COST ACCOUNTING AND FINANCIAL MANAGEMENT

For CA Professional Competence Examination

Third Edition

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Preface to the Third Edition

The third edition of *Cost Accounting and Financial Management*, like the earlier editions, caters exclusively to the requirements of **CA Professional Competence Examination (PCE)** of the Institute of Chartered Accountants of India. It covers the entire revised syllabus and is, accordingly, divided into **two sections titled Cost Accounting** and **Financial Management**.

In the light of the revised syllabus of the CA PCE, the following new features have been added in the third edition.

- New chapters:
  1. Reconciliation and Integration
  2. Marginal Costing and Full Costing
  3. Break-even Analysis
  4. Standard Costs
  5. Cost Variances Analysis
- Latest examination questions, updated till year 2007, with their solutions.
- Inclusion of Project Finance, Negotiation of Term Loans and Project Appraisal by Financial Institutions.
- Extension of Du-Pont Analysis.

The authors would like to place on record a word of appreciation for the excellent support from Mr Biju Kumar, Mr Tapas K Maji, Mr B L Dogra, Ms Anubha Srivastava, Mr Hemant Jha and Mr Manohar Lal of TMH for the speedy and excellent publication of the book.

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Preface to the First Edition

This book is designed exclusively for the requirements of the C.A. Professional Examination-II of the Institute of Chartered Accountants of India (ICAI). It covers the entire revised syllabus and is, accordingly, divided into two volumes titled Cost Accounting and Financial Management respectively. To cater to the special needs of the students, numerous problems and exercises have been solved in the text. They include most of the questions set at the various examinations conducted by the ICAI.

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Section One

Cost Accounting

Cost Accounting is devoted to a discussion of concepts, theories and techniques of cost ascertainment. It is divided into two parts: (i) Introduction and (ii) Product Costing/Cost Ascertainment.

Part one consists of two chapters. Chapter 1, which is devoted to an overview of cost accounting, discusses its objectives, relationships between cost accounting and financial accounting, and between cost accounting and management accounting; and also cost ascertainment, cost audit, cost reduction and, installation of costing system. The cost concepts related to managerial needs are examined in Chapter 2.

The subject matter covered in part two is the ascertainment of cost in different jobs, processes, activities, and so on. The chapters 3 to 6 dwell on the elements of costs, namely, Costing and Control of Materials (Chapter 3), Labour (Chapter 4), Factory Overheads and Activity Based Costing (Chapter 5), and Administrative, Selling and Distribution Overheads (Chapter 6).

Chapters 7 to 12 of this part examine the system and procedure of product costing in various situations: Chapter 7 (Job-order, Batch and Contract Costing); Chapter 8 (Process, Joint and By-product Costing); Chapter 9 (Unit/Single/Output Costing); and Chapter 10 (Reconciliation and Integration).

Part three consists of four chapters. While chapters 11 and 12 discuss Variable/Marginal Costing and Break-even Analysis respectively, Standard Costs and Costs Variances Analysis are covered in Chapters 13 and 14 respectively.

Part One

Introduction

This part provides an introduction to cost accounting as a background for a detailed account of its main features in the subsequent parts of this book. Chapter 1 describes the nature of cost accounting and discusses cost concepts and classifications. The framework of cost ascertainment and the installation of a costing system is also outlined. One of the important inputs in managerial decision-making is cost data. It also discusses the cost accounting records/rules and cost reduction framework. Chapter 2 describes the various concepts of costs related to various management needs.

1 Cost Accounting—An Overview

Introduction

The primary purpose of accounting is to provide financial information relating to an economic/ business activity. It is concerned with measuring, recording, and reporting financial information by the management to plan and control the activities of a business as well as by others who provide funds or who have various interests in the operations of an entity. The accounting system that provides the information to measure product costs and performance, and control the operations of a firm is called cost accounting. An overview of this system of accounting is the focus of this chapter, which is a background to a detailed account of its features in the subsequent chapters of this book. Section 1 of the chapter dwells on the nature of cost accounting in terms of its objectives, and the relationship between financial, cost and management accounting. The cost concepts and their classifications are briefly outlined in Section 2 to provide a conceptual foundation for the subject-matter covered subsequently. The framework of cost ascertainment/product costing is presented in Section 3. Section 4 describes cost audit and the related aspects of cost accounting records rules as well as cost audit report rules. While the considerations in the installation of a costing system in an organisation and cost reduction are highlighted in Sections 5 and 6 respectively, the last section summarises the main points.

NATURE OF COST ACCOUNTING

This section dwells on the nature of cost accounting. It is illustrated with reference to (i) Meaning and objectives of cost accounting and (ii) The relationship between cost, financial and management accounting.

Meaning and Objectives

Meaning Financial accounting results in reports to external parties on the status of assets, liabilities and equity; results of operations; changes in owner's equity and changes in the sources and uses of funds for

an accounting period. Cost data are/must be accumulated both for external financial accounting and internal management purposes. It accumulates, classifies and interprets information concerning the cost of materials, labour and other costs of manufacturing and marketing. Thus, it communicates financial information to management for planning, evaluating and controlling resources.

One of the primary concerns of financial accounting is the income determination. While calculating income, cost data are also used. Cost accounting provides an important input to financial accounting to the extent it provides cost data for determining income and financial position.

Thus, cost accounting is that part of accounting which identifies, defines, measures, reports and analyses the various elements of direct and indirect costs associated with manufacturing and providing goods/services. In the process of accumulating costs for inventory valuation and income determination, the needs of external users and management are fulfilled. It also provides management with an accurate, timely information for planning, controlling, and company operations.

Objectives The information needs of management and cost accounting objectives are closely related. The main objectives of cost accounting are: (i) Product costing (Cost ascertainment); (ii) Planning, performance evaluation and control and (iii) Decision making.

Product Costing Ascertainment of cost is one primary objective of cost accounting. The determination of total product cost and cost per unit are important for inventory valuation, product pricing and managerial decision making. Product costing covers the entire cycle of accumulating manufacturing and other costs and subsequently assigning them to work-in-process, finished goods, and so on.

Planning and Control The creation of useful cost data and information for planning and control by management is another important objective of cost accounting. The tools of managerial planning and control are budgeting and standard costing. The different plans/budgets are evaluated in relation to associated costs and benefits. The control technique compares the actual and budgeted performances. The variances between budgets and actuals are analysed by causes and, in that light, corrective actions are taken.

Decision Making Yet another objective of cost accounting is to provide information for both short- and long-term decisions. Decision-making primarily involves choice out of available alternatives.

Relationship Between Cost, Financial, and Management Accounting

Accounting is a system of collecting, summarising, analysing and reporting information about a business enterprise, in financial (monetary) terms. The business accounting system consists of three parts: (i) Financial accounting, (ii) Cost accounting, and (iii) Management accounting. The interrelationship between them is discussed below.

Financial and Cost Accounting: Similarities Financial accounting and cost accounting represent the two parts of the accounting information system of a business enterprise. These are similar on two counts. *Firstly*, operating information is used in the preparation of financial as well as cost accounts. If an enterprise has two completely different systems for collecting information for two purposes, it would involve, among other things, the incurrence of extra costs. The use of financial accounting information for cost accounting is, therefore, economical. This implies that financial accounting has a significant influence on cost accounting. *Secondly*, the considerations which make *Generally Accepted Accounting Principles* (GAAP) useful in financial accounting, are equally relevant in cost accounting also. For example, management cannot base its reporting system on non-verifiable, subjective estimates of profits because cost and revenue concepts in financial accounting are based on the idea of objectivity.

Differences Nevertheless, the two systems of accounting differ from each other in several respects. One basic difference between financial accounting and cost accounting relates to the structure or format of presenting information. Financial accounting has a single unified structure in the sense that the information relating to the operations of various enterprises is presented on a more or less uniform basis. It may be recalled that the end-products of financial accounting are the three financial statements: (i) Balance sheet, (ii) Profit and loss account/Income statement and (iii) Statement of changes in financial position. The preparation of various financial statements on the basis of a specified model implies that, while preparing accounts, all firms arrange the information in a uniform manner. *In other words, financial accounting has a unified structure*.

Why is the structure of financial accounting uniform? The primary objective of financial accounting is to provide information to outside parties, namely, shareholders, creditors, Government, the general public, and so on. These outside-users of the financial statements are interested in information from many different businesses. In order to enable an inter-firm comparison, there is a distinct need to present financial accountings on a uniform basis, and within a unified structure. The unified structure of financial accounts, therefore, facilitates communication between a business and the outside parties interested in it.

In contrast, cost accounting concerns itself with the accounting information that is useful to the management only. As this type of accounting is undertaken for internal use, its structure varies with the requirements and circumstances of each case. In other words, cost accounting is tailored to meet the needs of the management of a specific business, and therefore, it lacks a single unified structure. A related aspect is the impact of the GAAP on the preparation of the two types of accounting. Financial accounting is prepared in accordance with the GAAP. Accounting is the 'language of business', as it is the principal means by which information about a business is communicated to those interested in it. If, therefore, the information is to be communicated effectively and understood properly, it should be prepared in accordance with a mutually understood set of rules. These ground rules are referred to as GAAP. They represent laws or rules to be used as guideline in the preparation of financial accounts. In other words, GAAP provides a specified framework for the preparation of financial accounts which has evolved over the years and is based on experience, reason, usage, convention, and necessity. Thus, they ensure that financial accounts are prepared in accordance with certain norms and standards for better comprehension and reliability. On the other hand, cost accounting is for the exclusive use of the management of a firm. Outsiders do not need such accounts and have no access to them either. Therefore, there is a scope for flexibility in its preparation. It can be tailored to the specific needs of the management. The criterion for inclusion of any information in management accounting is the *utility*. In short, financial accounting, which essentially caters to the needs of outsiders, is prepared according to the norms set by the GAAP, whereas cost accounting, as an aid to managerial decision making, is dependent on, and largely influenced by, the internal requirements of the management.

The third difference between financial accounting and cost accounting relates to the need for preparing such accounts. The preparation of financial accounts is a statutory obligation. In fact, the corporate laws and regulations that govern the functioning of a corporate enterprise not only make it mandatory to prepare such accounts, but also lay down the model/format in which such accounts are to be prepared. The corporate laws also prescribe independent audit by professional auditors to ensure that the accounts reflect a *true and fair view* of the firms' affairs. Apart from this, tax regulations also require the maintenance of records by business establishments. In sharp contrast, cost accounting is entirely *optional*. It is prepared only if it is deemed useful to the management. There are no external compulsions for its preparation. The format, as also the items to be included, are exclusively dependent on the management's discretion.

The end-products of financial accounting are the three financial statements, namely, balance sheet, profit and loss account, and statement of changes in financial position. The balance sheet and the profit and loss

account report the financial position on a particular date, and the results of the operation of the firm during an accounting period respectively. The statement of changes in financial position reports the inflow and outflow of financial resources during a given period of time. These are essentially, records of what has happened in the past. Therefore, these are aptly called *historical accounts*. On the other hand, cost accounting does not record the financial history of an enterprise. Though past data is included in cost accounting, a major part of its contents is related to the future plans. It is, therefore, *future-oriented*. It aims at providing data for budgeting, planning, and so on. Thus, cost accounting lays more emphasis on the future.

Moreover, financial accounting relates to the business as a *whole*. While some firms do prepare financial accounts on a segmented basis for the main lines of business, the emphasis is on the entire business. Cost accounting focuses on parts of the business. In cost accounting the business is divided into different responsibility centres—cost, profit and investment. The term, responsibility centre, refers to the division of an enterprise into sections, departments, products, individual activities, and so on. In brief, financial accounting deals with the business as a whole, whereas cost accounting focuses on its different parts.

Finally, financial accounting and cost accounting also differ in relation to their ultimate objectives. Financial accounting is prepared to serve the purpose of external reporting. Therefore, from the viewpoint of the management, the purpose of financial accounting is accomplished when it is reflected in the three financial statements, that is, the balance sheet, profit and loss account, and statement of changes in financial position. In a way, it is an *end* in itself, whereas cost accounting is only a *means to an end*. In other words, cost accounting is designed to serve as an aid to managerial decision making. With the help of cost accounting, the management can discharge its planning, directing and controlling functions. In *planning*, the manager decides what actions should be taken to help the organisation achieve its goals. In *directing*, the manager oversees the conduct of day-to-day operations. And in *controlling*, steps are taken to ensure that the responsibility centres are operating in the best possible manner.

Cost and Management Accounting Cost accounting is that branch of the accounting information system which records, measures and reports information about costs. *A cost is a sacrifice of resources*. The costs are reflected in the accounting system by outlays of cash, promises to pay cash at a future date, and the expiration of the value of an asset. The primary purpose of cost accounting is cost ascertainment and its use in decision making and performance evaluation. A cost accounting system provides data for both financial accounting and management accounting. When costs are used by outsiders, such as shareholders or creditors, to evaluate the performance of the management and make investment decisions, they are said to be used for financial accounting purposes. On the other hand, when cost data are used inside the organisation to evaluate the performance of operations, activities, personnel, and so on, as the basis of decision making, they are said to be used for management accounting purposes. For instance, in a manufacturing business, the costs of products sold, and stock on hand, include the total expenditure on materials, labour, and all the other production costs. Each of these costs must first be measured, then accumulated and, finally, distributed to the work-in-process, finished goods and cost of goods sold. Consequently, the amount of profit reported by a manufacturing company depends on the *accuracy of its cost calculations*. Thus, cost accounting is useful for performance appraisal.

Cost accounting also helps in planning. Planning is a process of setting goals and allocating resources to achieve these goals. The expected financial outcome of planning is expressed in terms of budgets. A firms can increase its profits in two ways: (i) By increasing unit sale price/sales volume, and (ii) By reducing costs.

While the first cannot always be under the control of the management, the second falls well within the managerial domain. A detailed cost accounting system is an important requirement for a systematic cost control. For this reason, the management must understand the nature and behaviour of different elements of

cost, know when and where they are incurred, and who is responsible for them. The actual cost should be compared with the planned estimates. The differences between these should be analysed to identify the reasons for deviations, and corrective action should be taken to eliminate them. Thus, cost accounting is very useful to management for profit planning.

Cost accounting is also useful for the purpose of control. Control comprises managerial action to correct conditions that cause deviation between the actual and planned performance. Comparison between the actual and budgeted cost will highlight a poor or good performance, as well as the operations that have gone out of control and warrant corrective action. Thus, cost accounting provides the basis for cost/managerial control.

COST CONCEPT/DEFINITION, AND CLASSIFICATIONS*

This section presents the basic cost concepts, their definitions and classifications to provide a conceptual foundation for the subject matter to be covered in the remainder of this book.

Basic Cost Concept

Cost is defined as the 'value' of the sacrifice made to acquire goods/services, measured in monetary terms by the acquisition of assets or incurrence of liabilities at the time the benefits are acquired. At the time of acquisition, the cost incurred is for the present or future benefits. When these benefits are utilised, the costs become expense. An expense is defined as a cost that has given a benefit and is now *expired*. *Unexpired costs* that can give future benefits are classified as *assets*. Expenses are matched against revenues to determine net income/loss for a period. *Revenue* is defined as the price of products sold/services rendered.

Cost Classifications

Cost data/cost accounting information is routinely accessed by management for the purpose of (a) product costing, (b) performance evaluation and (c) managerial decision making. It consists of past revenues and costs necessary for product costing and performance evaluation, as well as projected revenues and costs necessary for managerial decision making. The cost data are classified into various categories according to:

- Elements of a product (product cost);
- Relationship to production;
- Relationship to volume;
- Ability to trace;
- Department where incurred;
- Functional areas/Activities performed;
- Period charged to income; and
- Relationship to planning, controlling and decision making.

Elements of a Product/Product Cost/Cost Elements This classification provides management with information necessary for product pricing and income measurement. The cost elements of a product (its integral components) are (i) Materials, (ii) Direct labour, and (iii) Factory overheads.

Materials These are the principal substances used in production and are transformed into finished goods by the addition of direct labour and factory overhead. The cost of materials may be divided into direct and indirect materials.

Direct Materials All materials (a) that can be identified with the production of a finished item/product, (b) that can be easily traced to the product and (c) that represent a major material cost of producing that product are called direct materials.

Indirect Materials These are materials involved in the production of a product that are not direct materials. These are included as a part of factory overhead.

Labour It is the physical/mental effort expended in the production of a product. Labour costs are divided into (a) direct and (b) indirect.

Direct Labour All labour directly involved in the production of a finished product (a) that can be easily traced to the product and (b) that represents a major labour cost of producing that product is known as direct labour.

Indirect Labour It is the labour involved in the production of a product that is not considered direct labour. It is included as part of factory overhead.

Factory Overhead It accumulates indirect materials, indirect labour, and all other indirect manufacturing costs which cannot be directly identified with any specific product. They can be further classified as fixed, variable, and mixed which are explained later.

Relationship to Production This classification is closely related to the cost elements of a product, namely, direct materials, direct labour and factory overhead, and the major objective of planning and control. Based on relationship to production, the two categories of costs are: (i) Prime costs and (ii) Conversion costs.

Prime Costs These are direct materials and direct labour. These are directly related to production.

Conversion Costs These are concerned with transforming direct material into finished goods. These include direct labour and factory overhead.

Relationship to Volume Costs vary with changes in volume of production. Understanding their behaviour is vital in almost all aspects of product costing, performance evaluation and managerial decision making. On the basis of relationship to volume, costs are classified as variable, fixed and mixed. These cost behaviour patterns are applicable *only* within the relevant range defined as that interval of activity within which the total fixed costs and per unit variable costs remain constant.

Variable Costs These costs are those in which the total cost are assumed to change in direct proportion to changes in volume/output within the relevant range, while the unit cost remains constant. Their implication for the management in planning and controlling of variable costs is that with all other factors held constant (for example, unit sale price and total fixed cost), each desired per unit expansion of productive activity triggers an incremental change in total variable costs equal to a constant amount per unit. As long as the unit sale price exceeds the unit variable cost, productive activity should be expanded. The variable costs are controlled by the departmental head responsible for incurring them.

Fixed Costs Such costs are those in which the total fixed costs remain constant over a relevant range of volume/output, while the unit fixed cost varies with output. Beyond the relevant range of output, fixed costs will vary. The higher management controls the volume of production and is, therefore, responsible for fixed costs. The implication for management in planning and controlling fixed cost is that with all other factors

such as unit sale price and variable cost remaining constant, productive activity should be expanded as far as possible, which will reduce the fixed costs per unit to its lowest level.

Mixed Costs These contain both fixed and variable characteristics over various relevant ranges of operation. These are of two types: (i) Semi-variable and (ii) Step.

Semi-variable Costs The fixed part of a semi-variable cost usually represents a minimum fee for making a particular item/service available. The variable portion is the cost charges for actually using the service. For example, most telephone service charges are made up of two elements: (i) A fixed charge for allowing to make/receive a call, (ii) Plus an additional variable charge for each call actually made. Other examples of such costs are truck rentals, equipment rentals and utilities.

Step Costs The fixed part of step costs changes abruptly at various levels of activity because these costs are acquired in indivisible portions. A typical example of such costs is supervisors' salary. If one supervisor is needed for every 20 workers, two supervisors would be required, if, for instance, 30 workers are employed. If two additional workers are hired, still only two supervisors would be needed. If the number, however, increases to 42, three supervisors would be required. A step cost is similar to a fixed cost within a very small relevant range. Another example of step costs is inspection cost. The nature of such cost is that it gives the appearance of increase in series of steps and, hence, the name step costs.

Although mixed costs are neither wholly fixed nor wholly variable in nature, these must ultimately be segregated into their fixed and variable components for planning and control purposes.

Ability to Trace From the viewpoint of ability to trace it to specific jobs/ departments/sales territories, and so on, cost may be (i) Direct, and (ii) Indirect.

Direct Costs These are costs that are traceable conveniently and wholly by management to specific items/areas. The examples of such costs are direct material and direct labour for a specific product.

Indirect Costs These are common to many items and cannot be traced to any one item /area. These are usually charged to items/areas on the basis of allocation techniques. For example, indirect manufacturing costs are allocated as a part of factory overhead.

Department Where Incurred A department-wise costing is helpful to management in controlling overhead cost and in income measurement. A department is a major functional division of a business. A manufacturing company has typically two departments: (i) Production and (ii) Service.

Production Departments These directly contribute to production of goods. These include departments in which conversion/production processes take place, including manual/machine operations directly performed on the goods manufactured.

Service Departments These are not directly related to production. These provide services for other departments. Their cost are usually allocated to production departments benefiting from the services. The examples of service departments are payroll, factory office, personnel, cafeteria, and security of factory.

Functional Areas Function-wise, costs are accumulated on the basis of activity performed. In case of a manufacturing company, cost classification by function relate to manufacturing, marketing, administrative, and financing.

Manufacturing Costs These are related to production of items and consists of direct materials, direct labour, and factory overhead costs.

Marketing Costs These are incurred in promoting products/service.

Administrative Costs These are incurred in directing, controlling, and operating a company. Such costs include salaries to management and workers.

Financing Costs These relate to acquiring funds for the operations of the company. These include interest on loans and cost of credit to customers.

Period Charged to Income Costs can also be classified on the basis of when they are charged to income/revenues. Such a classification helps management in (i) income measurement, (ii) preparation of financial statements and (iii) matching expenses to income properly in appropriate period. Based on period charged to income, cost are classified into product and period costs.

Product Costs These are directly/indirectly identifiable with the product and include direct materials, direct labour, and factory overhead. Upon completion of the product, they are inventoried (included in inventory) as they provide benefit/ income only after sale. The product costs are recorded as expense after sale of the product, known as cost of goods sold and are matched against income/revenue for the period in which the products are sold.

Period Costs These are not at all related to production. The examples of such costs are accountants' salary (administrative expense), depreciation on a salesmans' car (marketing expense) and interest on bonds (financing expense). Period costs are not inventoried but are charged to revenue immediately as there is no relationship between cost and revenue.

Relationship to Planning, Controlling and Decision Making The costs related to planning, controlling and decision-making are as follows.

Standard and Budgeted Costs The standard costs are those which should be incurred in a particular production process under normal conditions. A budget is a quantitative expression of objectives and a means of monitoring progress towards achievement of those objectives. Standard costing is usually concerned with per unit costs. It serves the same purpose as a budget. Budgets, however, usually provide forecasted activity on a total basis rather than on a unit cost basis. Both standard costs and budgets are used, first, to set standards/goals of performance and, second, to control actual performance through variance analysis in terms of the difference between the expected and actual.

Controllable and Non-controllable Costs The controllable costs are those which may be directly influenced by divisional managers in a given time period. Where, for instance, managers have authority to acquire and use, the cost may be considered controllable by them. On the other hand, non-controllable costs are those which are not directly administered/acquired and used at a given level of management.

Committed and Discretionary Fixed Costs A committed fixed cost arises from the necessity to have a basic organisational structure in terms of essential property, plan, equipment, personnel, and so on. It is long-term cost and cannot be reduced without adversely affecting the ability of the company to operate at a minimum level of productive capacity.

A discretionary fixed cost is a short-run cost and can be reduced to operate at any desired level of activity warranted by the committed fixed costs. It arises from decision for repairs and maintenance costs, advertising costs, training of personnel, and so on.

Relevant and Irrelevant Costs Relevant costs are expected future costs that differ among alternative courses of action. They may be eliminated if some activity is changed/dropped.

Irrelevant costs are not affected by management action. An example of irrelevant costs is sunk cost that is irrevocable such as depreciation. When confronted with a choice, they are not relevant and should not be considered for decision-making analysis.

However, relevancy is not an attribute of any particular cost. An identical cost may be relevant in one situation but irrelevant in another. Which costs are relevant and which are irrelevant would depend upon the specific facts of a given situation.

Differential Costs The difference between the costs associated with alternative courses of action on an item by item basis is differential cost. If the differential cost is increasing, it is called incremental cost; it is known as decremental cost when the differential cost is decreasing.

The differential cost is the key to a specific decision. Frequently, incremental costs equal variable costs. But in case of production beyond the relevant range, fixed cost would also increase along with variable cost. For decision-making in such special situation, incremental analysis should consider the differential both in fixed cost and variable cost.

Opportunity Costs When a decision to pursue one alternative is made, the benefits of other options are foregone. Benefits lost from rejecting the next best alternative are the opportunity costs of the chosen option.

Although opportunity costs are not shown in accounting records as they are not actually incurred, they are relevant costs for decision-making and must be considered in evaluating a proposed alternative.

Shut-down Costs These are those fixed costs which would be incurred even if there was no production. Examples of such costs are rent, storage costs, insurance, salary, and so on. In a seasonal industry, management has to decide whether to suspend operations or to remain open during the 'off-season'. In the short run, it is advantageous to remain open as long as sufficient sales can be generated to cover variable cost and contribute to the recovery of fixed costs.

COST ASCERTAINMENT/PRODUCT COSTING

An important objective of cost accounting is product costing. Cost ascertainment is the process of determining costs on the basis of actual data. The cost ascertainment involves: (i) Collection and classification of cost/expenditure according to cost elements; (ii) Its allocation /apportionment to cost centres/units; (iii) Choice of an appropriate method of costing; and (iv) Selection of an appropriate costing technique.

Elements of Cost

There are three broad elements of cost: direct material, direct labour, and overheads.

Direct Material The substance from which the product is made is known as material. All materials which become an integral part of the finished product and which can be conveniently assigned to specific physical units are direct material.

Direct Labour Human efforts, both physical and mental, used for conversion of materials into finished products is labour. Labour cost which can be wholly, conveniently identified with a specific physical unit of product is direct labour cost. Such costs are specifically and conveniently traceable to a specific product.

Overheads These include (i) Indirect material cost (ii) Indirect labour cost, and (iii) Indirect expenses.

Indirect Material Cost It is the cost of materials which cannot be conveniently assigned to a specific physical units of production. The examples of such a cost are consumable stores, oil and waste, and so on.

Indirect Labour Cost It cannot be conveniently traced to a specific unit of product/output. It includes, wages of storekeepers, foremen, time-keepers, directors fee, salary of salesmen, and so on.

Indirect Expenses The expenses which cannot be directly, conveniently and wholly allocated to specific cost units/centres are treated as indirect expenses. They consist of: (i) Factory/manufacturing/workers/ production expenses, (ii) Office and administrative expenses, and (iii) Selling and distribution expenses.

Indirect Manufacturing Expenses These are incurred in the factory. Included in these are expenses relating to production management, such as rent, rates and insurance of factory premises, power used in factory, depreciation of plant, machinery, and so on.

Office and Administrative Expenses These pertain to management of business and include office rent, lighting and heating, postage, telephone, fax and other charges, depreciation of office furnitures and equipments, legal charges, audit fee, and so on.

Selling and Distribution Charges These are incurred for marketing of products, dispatching goods solid, and so on and include (i) advertisement expenses, cost of preparing tenders, travelling expenses, bad debt collection charges, (ii) warehouse charges, packing and loading charges and carriage outwards, and so on.

The various elements of cost are depicted in Figures 1.1 and 1.2.

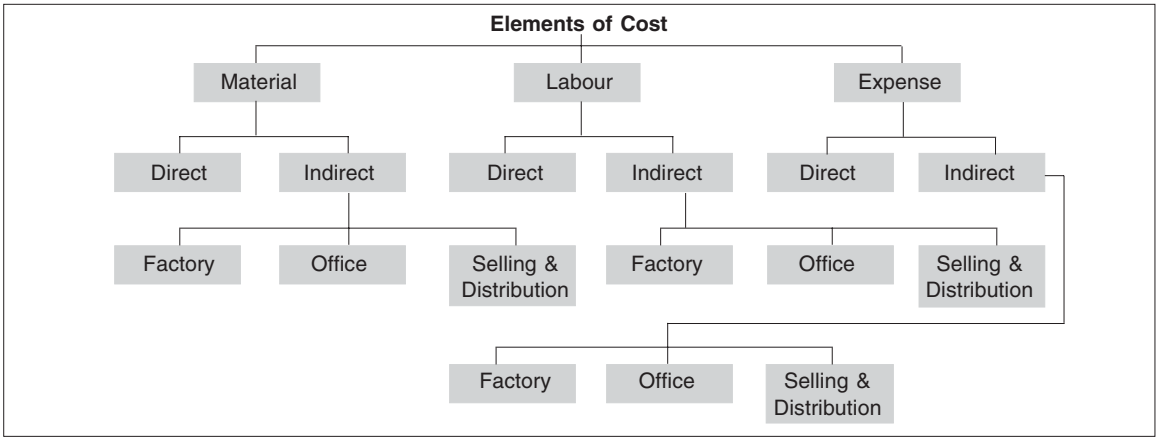

Figure 1.1 *Elements of Cost*

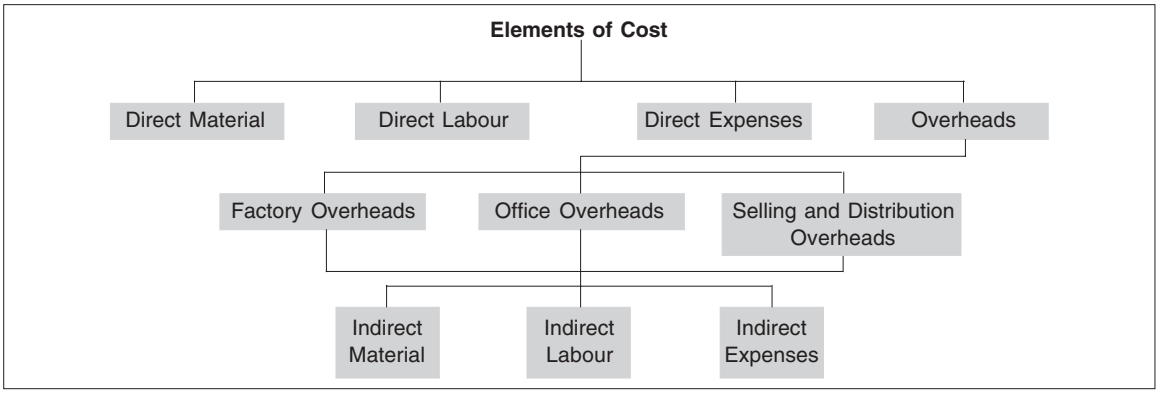

Figure 1.2 *Elements of Cost*

Cost Centres and Cost Units

The second element in cost ascertainment is allocation/apportionment of cost/expenses to cost centres/units.

Cost Centres While ascertaining cost, various cost elements are accumulated cost centre-wise. A cost centre means ''*a location, person, or item of equipment (or a group of these) for which costs may be ascertained and used for the purpose of cost control*''. It is an organisational segment/area of activity to accumulate costs. In other words, a cost centre refers to a convenient segment into which the organisation is appropriately divided for product costing. For instance, in a laundry, various activities such as collecting, sorting, marking and washing are performed. For purposes of cost accumulation, each of these activities may be treated as cost centre. All costs relating to particular activity (cost centre) would be separately accumulated to compute the cost of production of that cost centre. Cost centres can be classified into: (i) Productive, unproductive/service and mixed, (ii) Personal and impersonal, and (iii) Operation and process.

Productive, Unproductive/Service and Mixed Cost Centres A productive cost centre is actually engaged in manufacturing a product. An unproductive centre does not directly make products but provides essential service/aid to the productive centre and includes administration, repairs and maintenance, stores and drawing office. Mixed cost centres produce as well as provide services. A typical example of a mixed cost centre is a tool shop. The manufacture of dies and jigs in the tool shop for specific jobs/orders is illustrative of productive cost centre, while its repair service for the factory represents service cost centre.

Personal and Impersonal Cost Centres A personal cost centre consists of a person/group of persons, while an impersonal cost centre consists of a department, plant, item of equipment, location, or a group of these.

Operation and Process Cost Centres A cost centre which consists of machines and/or persons carrying out similar operations is known as operation cost centre. All machines/operators performing the same operation are combined into one cost centre to ascertain the cost of each operation irrespective of location in the factory. Process cost centre consists of a specific process/ a continuous sequence of operations. An example of such cost centres is chemical industry.

Cost Units The ascertainment of unit cost of production should be related to a unit of measurement. A cost unit is ''*a unit of quantity of product, service or time in relation to which costs may be ascertained/ expressed*.'' The cost units are not uniform. They differ from industry to industry. The examples of cost units for products in different industries are listed in Fig. 1.3.

Industry/Enterprise	*Cost Unit*	*Industry*	*Cost Unit*
1. Automobile	Number	13. Bicycle	Number
2. Brickworks	Per 1,000 bricks	14. Nuts and bolts	Per gross
3. Building	Per square foot	15. Brewery	Per dozen bottle
4. Cement	Per tonne	16. Ice cream	Per gallon
5. Cable	Per meter	17. Pharmaceuticals	Per 1,000 tablets
6. Transport	Tonne/passenger kilometre	18. Aircraft	Number
7. Gas	Cubic foot/meter	19. Confectionery	Per kilogramme
8. Power	Kilowatt hour	20. Timber	Per cubic foot
9. Paper	Ream	21. Steel	Per tonne
10. Taxtiles	Metres	22. Soft drinks	Per case of 24 bottles
11. Hospital	Per/bed/outpatient visit	23. Sugar	Tonnes/kilogramme
12. Road contractors	Per mile/kilometer	24. Oil	Tonnes/Kilogramme Gallon/litre

Figure 1.3 *Cost Units*

Costing Methods

As observed earlier, costing is the process and technique of ascertaining costs. Different methods can be applied to ascertain costs. The method to be used differ from industry to industry and according to nature of business. It primarily depends on the manufacturing process and the method of measuring the departmental and finished products. Basically, there are two methods of costing, namely, specific order costing or job/ terminal costing and operations/process/ period costing.

Specific Order/Job/Terminal Costing This category of basic costing methods is applicable where the work consists of separate jobs/batches/contracts as per specific orders and customer specifications and includes: (i) Job costing, (ii) Batch costing, and (iii) Contract costing.

Job Costing According to this method, costs are collected for each job/work/project separately. Where production is not repetitive, and consists of distinct jobs/ lots with which costs can be identified, job costing method is used. It is applicable to enterprises engaged in printing, machine tool manufacturing, foundaries and forging shops, general engineering workshops, house-building, and ship building. The cost unit is the specific job.

Batch Costing It is an extension of job costing. A batch consists of a number of similar products. The cost of a group of products constituting the batch and not the single item within the batch is ascertained. It is applicable for the production of nuts and bolts, medicines, biscuits, garments, and spare parts and components and so on. Each batch constitutes the cost unit.

Contract Costing A contract is a big job and is spread over a period of time. Contract costing is applicable to builders, civil engineering contractors, construction and mechanical engineering firms. The contract is the cost unit.

Operations/Process/Period Costing This basic method of costing is applicable where standardised products result from a sequence of repetitive and, more or less, continuous operations/processes to which costs are charged. The costs cannot be traced to specific units and are averaged for the number of units manufactured. This method includes: (i) Process costing, (ii) Unit/output costing, and (iii) Service/ operating costing.

Process Costing Where (i) production is continuous, (ii) manufacturing is carried on by distinct and well defined processes, (iii) the finished product of one process (stage) becomes the raw material of the subsequent process, (iv) different products with/without byproducts are produced simultaneously of the same process, and (v) products are exactly identical, the costing method is called process costing. Cost has to be computed (a) for each process and (b) for each unit at each process by averaging the total process cost. The industries in which this method is applicable are textiles, chemicals, paper, tanneries, paints, food, explosives, soaps, and so on.

Unit/Output/Single Costing Where a single item is produced and the final product is homogeneous, the costing method is known as unit/output/single costing. The per unit cost is computed by dividing the total cost by the number of units manufactured. Example of industries in which this method is applicable are brick making, collieries, flour mills, paper mills, cement manufacturing, oil drilling, and so on.

Operating Costing This method is suitable for enterprises/industries which provide services and do not manufacture any physical goods. Examples are transport undertakings, electricity companies, hospitals, hotels, railways, and so on. The cost units differ among these service organisations depending on the nature of service being provided. There is usually a composite cost unit such as tonne-passenger kilometer (transport undertakings), kilowatt-hour (power companies), patient-day (hospitals), and so on.

Costing Techniques/Types

The various costing methods outlined above can be used under different costing techniques. These techniques/types refer to the manner of ascertaining cost for cost control and decision-making purposes and include uniform costing, marginal costing, direct costing, absorption costing, historical costing, and standard costing.

Uniform Costing It is the use of standarised principles, practices and methods of cost accounting by several undertakings for a common control or comparison of costs. It includes methods of costing, accounting classification, methods of defining costs and charging depreciation, allocation/apportionment of overheads to cost centres/cost units, and so on.

Marginal Costing It is a technique of cost ascertainment in terms of marginal cost defined as those costs which arise due to a change in volume of production, that is, variable costs only. The fixed costs are accounted for in the profits of the period in which they arise. This technique is employed to ascertain the effect of change in volume/product mix and so on profit.

Direct Costing According to this technique, all direct costs consisting of all variable costs and some fixed costs are charged to products/operations/processes. The indirect costs are excluded and written off against the profit of the period in which they arise. In contrast to marginal costing, direct costing technique takes into account some portion of identifiable fixed cost also in addition to the variable cost.

Absorption Costing This technique charges all costs, that is, all variable as well as all fixed, to operations/products/processes.

Historical Costing It is a system of costing in which costs are determined after they have been incurred. It ascertains actual cost incurred in the past.

Standard Costing Standard costs are predetermined in conformity with the most efficient operation and use of resources. The standard costing technique compares actual cost with standard cost. The variances between them, if any, are analysed and, in the light of the analysis of the probable causes, remedial action are initiated by the management.

INSTALLATION OF A COST ACCOUNTING SYSTEM

A cost accounting system is a system of accounting that accumulates cost, ascertains cost of products/jobs, and prepares cost information reports using some produces and principles for recording cost data. This section briefly describes the installation of a costing system.

Features/Characteristics/Factors

The main characteristics of an ideal cost accounting system/factors having a bearing on the installation of such a system are as detailed below.

Suitability A costing system should be devised to suit the nature, conditions, requirements, manufacturing processes/methods, nature and number of products, and size of the company. It should serve the purpose of the company by supplying the necessary information for product costing, planning and control, and decision making.

Simplicity The system should be simple and amenable to easy understanding. The information should be presented in the right format at the right time to make it meaningful to users.

Flexibility The system should be flexible to accommodate changes in conditions and circumstances. It must be capable of expansion/contraction in consonance with emerging requirements.

Economical A costing system should be economical taking into account the requirements of the business in terms of cost benefit analysis. It should reflect the financial capacity of the business.

Comparability The information provided by the cost accounting system must be comparable with (i) past figures, (ii) figures of other concerns/industry as a whole and/or (iii) other departments. This would enable a more reliable basis of performance evaluation.

Timeliness The information must be timely to enable management take suitable action for cost control and decision making.

Organisational Set-up The system must correspond to the organisational set-up/authority to ensure accountability for costs incurred in various departments.

Uniformity All forms/proformas in the accounting system should be uniform in size and quality. Different forms should be in different colours to improve efficiency. Printed forms should be suitably designed for collection and dissemination of cost data. They should also contain instructions as to their use and disposal. The filling of forms should involve as little clerical work as possible.

Efficient Material Control System Materials constitute a significant proportion of total cost. An efficient system of materials control is a pre-requisite for an ideal cost accounting system. An appropriate method of pricing material issues also deserves consideration.

Adequate Wage Procedure A well-defined wage system helps control labour cost. There should be a well-defined wage procedure for time recording, preparation of wage sheets, and payment of wages.

Departmentalisation of Expenses To ascertain cost accurately, there should be a good system of collection/apportionment/absorption of overheads.

Reconciliation The cost and financial accounts should preferably be integrated. If not, the cost accounting system should be devised in a way to ensure easy reconciliation between them.

Duties and Responsibilities The duties and responsibilities of the cost accountant(s) should be clearly laid down.

External Factors Though the installation of the costing system depends primarily on internal factors and situation within the organisation, external factors may also have a bearing on the structure of the system. For instance, cost accounting rules applicable to manufacturing companies in India require certain cost information to be developed and submitted to the Government.

Steps/Procedures

The steps involved in installing a cost accounting system are listed below.

Objectives The objective to be achieved through the costing system should be laid down. If the objective is cost determination only, the system would be simple, but it would have to be elaborate to provide information for the objective of planning and control and managerial decision making.

Study of Existing Organisation/Routine This should be with reference, *inter alia*, to the following:

- Nature of business/operation/process carried;
- Extent of responsibility/authority of various functionaries:
- Factory layout with particular reference to the manufacturing departments;
- Treatment of wastage of materials;
- Time recording, computing and paying wages;
- System of issuing orders for production; and
- Fixed/semi-variable and variable overheads.

Structure of Cost Accounts A suitable system of cost accounting should be tailored to the manufacturing process. The structure of cost accounts should be in tune with the natural production line. The system should be designed in such a way that there is a gradual build up of the cost at each stage of production till completion stage.

Determination of Cost Rates This would entail a thorough study of factory conditions. Decisions would have to be made regarding (i) classification of costs into direct and indirect, (ii) grouping of indirect costs into production, selling and administration, (iii) treatment of wastes, (iv) method of pricing issues, (v) methods of recovering overheads, and (vi) calculation of overheads rates. A complete cost accounting code should be drawn up so that expenses can be quickly classified as to both source and cause.

Introduction of the System To ensure effective cooperation, before putting the system in place, its implications should be explained to all the functionaries. The system should be introduced gradually only by stages and the existing routines/practices should be utilised as far as possible.

Organisation of Cost Office The cost office should preferably be situated adjacent to the factory to avoid delays in routing out documents/clearing up discrepancies. The duties of the cost office fall into the following four categories.

Stores Accounts Posting of receipt of materials and issues of stores in stores ledger and preparing material abstracts.

Labour Accounting Evaluation of time sheets and job cards; preparing labour abstracts and preparation of payrolls.

Cost Accounts Posting of all cost accounts.

Cost Control Posting cost control accounts from data supplied from the above three sections; preparation of special statistical and other information for management for carrying out special investigation.

Relationship with other Departments The costing department should function independently, reporting directly to the top management. It should be structured to serve management at all levels. There should be a whole system of records and reports.

Authority and Responsibility These should be clearly defined to make the cost accounting successful.

COST REDUCTION

This Section discusses the relevant aspect of cost reduction in terms of its meaning/importance, comparison with cost control, cost control/reduction process, precautions in implementation of cost reduction programme, planning for, approaches to, cost reduction, and role of cost accountants in cost reduction/control.

Meaning and Importance

Meaning Cost reduction may be defined as an attempt to eliminate/reduce/bring down costs. It implies real and permanent reduction in the unit cost of goods manufactured/services rendered without impairing their suitability for the intended use. Cost reduction is the process of seeking ways to achieve a given result through improved design, better methods, new layout, incentive schemes, establishing new standards and so on. Cost reduction plan is a coordinated set of contingent actions to achieve the dual objective of reducing overall costs without corresponding loss of efficiency. The goal of cost reduction is achieved in two ways: (a) by reducing the cost per unit and (b) by increasing productivity. The steps for cost reduction include elimination of waste, improving operations, increasing productivity, search for cheap materials, improved standards of quality and other means to reduced costs. Thus defined, cost reduction has to be achieved using internal factors within the organization. The reduction of cost due to external factors such as reduction in taxes, Government subsidies/grants and so on are not relevant to cost reduction programme of an organization. Thus, cost reduction involves the improvement of the environment of the organization.

In contrast, cost control is essentially the prevention of waste within the exiting environment of an organization. The environment is made up of agreed operating methods for which budgets/standards have been set up. Cost control aims at controlling costs within specified limits with the help of budgets/standards. In operational terms, cost control is the process whereby actual results are compared with standards so that

waste can be measured and corrective action taken. It is a process of regulating action so as to keep the elements of cost within the set parameters. It results in the utilisation of the available resources economically.

In brief, cost reduction is a much wider concept than cost control. While the former deals with the methods by which the cost is reduced, the latter deals with the reporting/review of variances/divergences arising out of comparison between actual results and set of norms (standards/budgets). The following are the major differences between the two:

Cost Control	*Cost Reduction*
1. Cost control process involves (a) setting targets and standards, (b) ascertainment of actual performance, (c) comparison of actual performance with targets, (d) investigation of variances and (e) taking corrective action.	1. Cost reduction is not concerned with setting targets/standards and matching performance with standards. It is the final result in cost control process. It finds out the substitute/new ways (methods).
2. It aims at achieving standards, namely, cost targets.	2. It aims at improving standards and assumes existence of potential savings in standards. Necessary steps are for further modifications on the methods.
3. It follows a conservative procedure and lacks dynamic approach.	3. It is continuous, dynamic and innovative in nature looking always for measure/alternatives to reduce costs.
4. It is a preventive function	4. It is a corrective function.
5. Costs are optimised before being incurred	5. It is assumed that there is always scope for reducing incurred costs under controlled conditions.
6. It is generally applicable to items which are amenable to standards.	6. It is applicable to every activity of business.
7. It contains guidelines/directives of management as to how to do a thing.	7. It adds thinking and analysis to action at all levels of management.
8. The main stress is on the past/present behaviour of costs.	8. The emphasis is partly on present costs but largely on future costs.

Importance The advantages of cost control/reduction programmes are as listed below:

- Better utilisation of resources
- To prepare for a future competitive position
- Reasonable price for consumers
- Firm standing in the market
- Improved methods of production and use of the latest manufacturing techniques which have the effect of raising productivity and minimising cost.
- Improvement in the image of the company for long-term benefits.
- Improvement in the rate of return on investment (ROI)

Process

The process of cost control and cost reduction is briefly described below.

Cost Control The three steps involved in the cost control process are:

Establishment of Norms To exercise cost control, norms/targets/parameters/standards are established to serve as yardsticks to achieve the desired objectives. They are set on the basis of past behaviour or research/study.

Appraisal The actual results are compared with the set norms/targets/parameters. The deviations (variances) are analysed to ascertain the controllable/uncontrollable causes/factors for the variances.

Corrective Action/Measures After review of variances, remedial measures/revision of targets/norms/standards as required are taken.

Cost Reduction The cost reduction process involves the following sequence of steps, namely, analysis, examination, developing solutions and selecting a solution.

Analysis As a first step, every activity relating to factory, warehouse, office and so on is analysed into a number of separate steps. From the data collected, it is possible to draw a picture about the activity which enables it to be examined and improvements developed.

Examination Each activity is then examined in some detail on the basis of which it is classified into (i) vital, (ii) secondary/necessary and (iii) unnecessary. The activities which directly contribute to the achievement of objectives set previously are vital activities. They are obviously basic/fundamental components of subsequent improvements. The activities which are necessary to support/serve vital activities and lead to the achievement of the objectives indirectly constitute secondary activities. The activities which neither directly nor indirectly contribute to the realisation of the objectives are considered unnecessary. After identifying/classifying the activities, it should be considered whether they should be simplified/combined or eliminated. The elimination of the unnecessary activities/components would result in reduction in cost/savings. Considerable cost reduction can be achieved by combining activities in areas where they cannot be eliminated.

Developing Solutions The analysis and detailed examination of the activities/components would result in the emergence of alternative solutions. The evaluation process of a solution should match each alternative against the following requirements: (i) Does it achieve the objective in full? Is it practical? Does it fall within the constraints, if any, such as finance, time, physical/human resources and so on? Is it a better way of doing the job? Does it reduce cost, if so, by how much? Will it be acceptable to customers/employees/management? Will it stand the test of time?

Selection of a Solution The choice of a solution out of the alternatives would depend on a variety of factors including company policies, personal preferences, aesthetic appeal and other subjective criteria. For a rational choice, the advantage/disadvantages of various alternative solutions should be explained by the analyst to all concerned.

Precautions in Implementation of Cost Reduction Programme

Before implementation of the cost reduction programme, the following points should be given a careful consideration:

- It must be appropriate to the organization.
- Its introduction and implementation must be planned soundly.
- The success of cost reduction programme would depend upon the co-operation of all those involved, whether directly or indirectly. Its effects and results should be monitored regularly and closely.

- Resistance by employees.
- The mechanics and operation of such programmes must be communicated clearly and concisely to organisational members preferably in writing.
- Reluctance of the managers and workers should be recognised to change the patterns of their behaviour.
- Those required to operate a cost reduction programme must be convinced of the personal benefits to them.
- Monitoring and assessment system must be understood by all participants in the programme.
- There should not be any overlap between the cost reduction programme or double counting of reductions or savings.
- The success in one area is not severely hindering or damaging other aspects of the business or that success in one area is not being eroded by failure in another area.
- The cost reduction measures should not have any undesirable effects on external parties, for example, suppliers of raw material, buyers of finished products and so on.
- The programmes are within the letter and spirit of national or local legislation and regulations, for example, in the areas of health and safety standards.
- The degree of skill or efficiency of operational management has direct effects on costs.
- It must be recognised that even the most efficient business organisations incur unnecessary costs.
- The skill of the management is tested in identifying those unnecessary costs and acting to eliminate or reduce them.
- Generally, when the enterprise is facing difficulty in trying conditions, the attention of the managers should focus on costs; when conditions improve, there may be less inclination to control costs and their impacts. It must be recognised, cost reduction is a continuous process.
- It is vital that costs are examined and restrained at source.
- It must be appreciated that perfect scheme covering all enventualities will be both expensive and complicated to implement. This calls for realistic appreciation of the cost and benefits involved in any cost reduction programme.
- It must result in reduced unit costs.
- They may be limited to a small area of the business with the result that costs are reduced in one cost centre only to appear as an extra cost in another cost centre.
- Cost reduction campaigns are often introduced as a rushed, desperate measure instead of a carefully organised, well thought-out exercise.
- Cost reduction does not happen of its own accord, and managers must make positive decisions to reduce costs.

Planning for, Approaches to, Cost Reduction

There are two basic approaches to cost reduction: (i) crash programmes and (ii) planned programmes.

Crash Programmes To cut spending evils, if an organization is having problems with its profitability or cash flow, the management might decide on an immediate programme to reduce spending to a minimum. Some current projects might be adandoned, capital expenditures deferred, employees made redundant or new recruitment stopped and so on. The absence of careful planning might give such crash programmes the characteristics of panic measures and authoritarian solution from top management. Cost reduction measures might be too little, too late or misdirected. Poorly planned crash programmes to reduce costs might result in decisions which seriously reduce operational efficiency without the effects being immediately noticeable. Decisions by a company, for example, to reduce the size of its legal department, or

its internal audit or Organization and Methods (O & M) sections might cut staff costs in the short term but increase costs in the longer term.

Planned Programmes To reduce costs, many companies tend to introduce crash programmes for cost reduction in times of crisis and ignore the problem completely in times of prosperity. A far better approach is to introduce continual assessments of an organisation's entire products, production methods, services, internal administration systems and so on. The cost accountant will normally become involved when compiling report on the costs and benefits of schemes themselves. Cost reduction exercises are planned campaigns to cut expenditure. They should preferable be continuous, long-term campaigns, so that short-term cost reductions are not soon reversed and forgotten.

A planned programme of cost reduction begins with an assumption that some costs can be reduced significantly. The benefits of cost savings must be worthwhile, and should exceed the costs of achieving them. Areas for potential cost reduction should be investigated, and unnecessary costs identified. Cost reduction measures should be proposed, agreed, implemented and then monitored.

Some of the important cost reduction areas are listed below:

Product Improvement Product improvement and the efficiency level determine the cost incurred. The important factors in product improvement, *inter-alia,* are:

- Quality of product
- Unnecessary weight, material content, machine/labour operations
- Elimination of waste and losses and
- Proper designing of the product.

Production Method and Layout The production method/organisation and layout is an important area of cost reduction. A cost reduction programme may be applied in many vital activities relating to production/production planning such as:

- Materials control
- Labour control
- Production layout
- Systems analysis
- Time and motion study
- Work measurements
- Standardisation of methods
- Designing of tools
- Modernisation of equipment and machinery
- Use of incentive schemes and so on.

Marketing Areas The cost reduction areas relating to marketing are:

- Channels of distribution
- Sales promotion schemes
- Marketing research plans
- Territorial responsibilities
- Methods of remunerating sales men
- Advertising methods
- After sales service/cost
- Packaging methods

- Materials handling
- Transport arrangement and so on.

Administrative Areas The administrative functions/areas include personnel, purchase and general administration. The goal of cost reduction requires efficiency in administration, effective purchasing procedure and a fair personnel policy/scheme. Some of the important areas are investment planning, cash discount/policy, mechanised accounting, labour relations/welfare and so on.

Long-range and Short-range Cost Control and Cost Reduction Programmes

Long-range Programmes Long-range cost control and cost reduction programmes mainly arise due to huge capital expenditure designed towards a continual reduction in costs, depending upon better layout, relocation of plant, modernisation programmes, material handling and so on. They often operate as perspective plan during which all the aspects of business and the whole sphere of its operation would be covered.

Short-range Programmes Short range programmes may arise from the following considerations:

- A temporary fall in profits which has to be corrected promptly.
- An impending unfavourable competitive situation.
- Identification of certain products which competitors are selling at a lower price in the market.
- Adverse cost variance which calls for immediate action.
- Some operations which appear to be inefficient and provide opportunities for quick and substantial cost savings.
- Some operations or functions which appear to be costing too much.

Cost Accountants' Role in Cost Control and Cost Reduction

Cost Accountant's role in cost control and cost reduction is perhaps central to its role as a member of the management team. Indeed, for effective cost control, it may be necessary to spend more on the items which will reduce waste and scrap, improve quality, increase productivity or conserve energy. In any large organization, the points at which costs are incurred are usually numerous and relatively few line managers have the mechanism of collating and analysing all the costs they incur, with a view to implementing cost control measures. The cost accountant is uniquely placed in this respect and it usually falls on him to play a catalytic role in getting the management team to work together to achieve specific cost control objectives.

It is also upto the cost accountant to channelise the cost control and cost reduction efforts into areas which will give the greatest results. Without this direction, cost control and cost reduction can too often degenerate into symbolic actions like reusing envelops or downgrading the class of air travel, which generally have little impact on the overall cost structure but can substantially harm morale and motivation. It may be instructive to remember that high quality low cost manufacturers like the Japanese car companies are typically very liberal with expenses like company paid holidays and entertainment on business account. Their cost control measures are directed towards doing their jobs, work efficiently and productivity, not in poring down employee fringe benefits. It is important for the cost accountant to guide the cost reduction/control programmes into productive lines and not let it degenerate into morale damaging axing of petty expenditure.

SUMMARY

- Cost accounting is that part of accounting which identifies, defines, measures, reports and analyses the various elements of direct and indirect costs associated with manufacturing and providing goods/services. The main objectives of cost accounting are product costing/cost ascertainment, planning, performance evaluation, cost control, and decision making.
- Cost accounting, as a part of accounting system of a firm, although closely related to financial accounting, differs in important respects. The main points of distinction between them are: (i) Structure/format or presentation and the related aspects of the impact of GAPP on their preparation, (ii) Need for their preparation, (iii) Historical versus future orientation, (iv) Whole versus segment, and (v) Objectives.

  The cost data/cost accounting information is classified into various categories according to:
  - Elements of a product;
  - Relationship to production;
  - Relationship to volume;
  - Ability to trace;
  - Department where incurred;
  - Functional areas/activities performed;
  - Period charged to incomes; and
  - Relationship to planing, control and decision making.
- An important objective of cost accounting is product costing/cost ascertainment. Cost ascertainment is the process of determining costs on the basis of actual data. It involves: (i) Collection and classification of costs according to cost elements, (ii) Its allocation to cost centres/units, (iii) Choice of an appropriate method and costing technique.
- There are three broad elements of costs: direct material, direct labour, and overheads.
- A cost centre refers to a convenient segment into which the organisation is appropriately divided for product costing. The cost unit is a unit of quantity of product/service/time in relation to which costs may be ascertained/expressed.
- Different methods can be applied to ascertain costs according to the nature of industry/business. The various costing methods are: (i) Job costing, Batch costing and Contract costing, (ii) Process costing, (iii) Unit/output/single costing/operating costing.
- The cost accounting techniques refer to the manner of ascertaining costs and include uniform costing, marginal costing, direct costing, absorption costing, historical costing, and standard costing.
- The statutory cost audit is a system of audit introduced by the Government of India for the review, examination and appraisal of the cost accounting records and attendant information required to be maintained by the specified industries.
- Cost audit is to be conducted in India with regard to the provisions of the Companies Act, cost accounting record rules and the cost audit report rules. According to the cost accounting records rules, companies are required to maintain specified records relating to: (i) production, (ii) work-in-progress and finished goods, (iii) repairs and maintenance, (iv) utilities (steam, power and water), (v) raw materials and stores, (vi) wages and salaries, (vii) overheads, (viii) cost accounts/records/statements and (ix) sales. The rules framed by the Government prescribe (a) the form of the cost audit report and (b) the annexures to the cost audit report.
- The main elements of a sound costing system are suitability, simplicity, flexibility, comparability, timeliness, organisation set-up, uniformity, efficient control material system, adequate wage procedures, departmentalisation of expenses, reconciliation, and duties and responsibilities.

- The steps involved in installing a costing system include, laying down the objectives, study of existing organisation, structure of cost accounts, determination of cost rates, and the organisation of cost office.
- Cost reduction is an attempt to eliminate/reduce/bring down costs. It implies real/permanent reduction in the unit cost of goods manufactured/services rendered without impairing their suitability for the intended use. It involves the improvement of the environment of the organisation. In contrast, cost control is essentially the prevention of the waste within the existing environment. While cost control process involves three steps, namely, establishment of norms/standards/targets, appraisal/comparison of actual results with the norms and corrective action/measures, cost reduction process involves the following sequence of steps: (i) analysis of each activity, (ii) examination in details of each activity, (iii) develop solution and (iv) selection of a solution.

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* Polimeni, et al, *Cost Accounting*, 3rd Edition (McGraw-Hill, New York, 1991)

REVIEW QUESTIONS

RQ.1.1 What is cost accounting? Discus briefly its important objectives in a business firm.
RQ.1.2 State and explain the major differences between financial accounting and cost accounting.
RQ.1.3 Explain the importance of cost accounting as a managerial tool.
RQ.1.4 Enumerate the steps that you would take for installation of a costing system in an organisation. What are the essentials of an effective costing system?
RQ.1.5 ''Cost accounting is an unnecessary luxury for business establishments''. Do you agree with the statement? Discuss.
RQ.1.6 Examine the matters, which you will investigate, and the problems which you expect to face before installing a costing system in a manufacturing company.
RQ.1.7 How does cost accounting help in the planning and control of operations of a business enterprise?
RQ.1.8 Explain why is it necessary to devise different methods of costing for different industries and list the several methods employed.
RQ.1.9 A factory makes only one product in one quality and size. The owner says that his financial accounts easily give him the material, labour and other cost per unit. Write a brief letter to convince him that he still needs a costing system.
RQ.1.10 Define 'cost unit' and 'cost centre'. Also give a few suitable examples of each.
RQ.1.11 ''Costs may be classified in a variety of ways according to their name and information needs of management''. Explain and discuss this statement giving examples of classification required for different purposes.
RQ.1.12 ''A sound costing system must place the same emphasis on cost control as on cost ascertainment''. Comment on the statement.
RQ.1.13 You have been asked to install a costing system in a manufacturing business. Apart from technical costing problems, what practical difficulties would you expect to meet and how would you propose to obviate or overcome them?
RQ.1.14 Write a brief note on the meaning and objectives of cost audit.
RQ.1.15 Briefly explain the cost accounting record rules regarding the maintenance of statutory cost audit records under the Companies Act.
RQ.1.16 Discuss the main elements of the cost audit report rules, 2001.

EXAMINATION QUESTIONS

EQ.1.1 Define Cost Audit and state its purposes. (*CA—November, 2002*)
EQ.1.2 Distinguish between cost reduction and cost control. (*CA—November, 2002*)
EQ.1.3 State the essential pre-requisites for installation of uniform costing system in an industry. (*CA—November, 2002*)
EQ.1.4 What do you understand by the term cost centre? (*CA—November, 2002*)
EQ.1.5 Discuss the essential requisites for the installation of uniform costing system. (*CA—May, 2003*)
EQ.1.6 Distinguish between cost control and cost reduction. (*CA—May, 2003*)
EQ.1.7 Write short note on Conversion cost. (*CA—May, 2003*)
EQ.1.8 Distinguish between the Efficiency audit and proprietary audit. (*CA—May, 2003*)
EQ.1.9 Discuss the purpose of cost audit, and circumstances under which a cost audit is desirable. (*CA—November, 2003*)
EQ.1.10 Distinguish between cost control and cost reduction. (*CA—May, 2004*)
EQ.1.11 Discuss the essentials of a good cost accounting system. (*CA—May, 2004*)
EQ.1.12 Distinguish between the following:
(i) Cost control and cost reduction
(ii) Cost audit and statutory audit. (*CA—November, 2004*)
EQ.1.13 Discuss the essential requisites for the installation of uniform costing system. (*CA—May, 2005*)
EQ.1.14 Discuss the area of activity in respect of which cost accounting records are to be maintained. (*CA—May, 2005*)
EQ. 1.15 Discuss the essentials of a good cost accounting system. (*CA—November, 2005*)
EQ. 1.16 Distinguish between cost control and cost reduction. (*CA—November, 2006*)

2 Cost Concepts

INTRODUCTION

One of the important inputs in managerial decision-making is cost data. There is, however, no single concept of cost, which can cater to all management needs. The "*needs concept*" of cost depends on the conditions under which the costs are required to be measured and the purpose for which measurement is required. In other words, cost data which are relevant and useful in one situation may be quite irrelevant and useless in another. Developing the data on the required lines can be designated as "the concept of cost relevancy."[1] The concept implies the need of different sets of cost data for different objectives, purposes and situations. The object of the present chapter is to describe the various concepts of cost related to managerial needs. Management needs can be classified into four broad groups:

1. Income measurement
2. Profit planning
3. Costs control
4. Special situations requiring special decisions.

COST CONCEPTS RELATING TO INCOME MEASUREMENT

There are four cost concepts which pertain to income measurement. These are: (i) Product costs and Period costs; (ii) Absorbed costs and Unabsorbed costs; (iii) Expired costs and Unexpired costs; and (iv) Joint product costs and Separable costs.

Product Costs and Periods Costs

Product Costs The distinction between product costs and period costs assumes significance in the income determination process. In a variable costing system, only variable costs are recognised as product costs. The rationale is that it is only these costs which are affected by the production volume. If there is no production, there will be no material and direct labour cost (elements of variable costs) and, hence, no

production cost. Therefore, variable costs are often called product costs. Thus, production costs can be defined as *those costs, which can be identified with goods produced or purchased for resale*. They vary with production. Raw material and direct labour are the examples of product costs.

Period Costs In contrast, period costs are costs which vary with the passage of time and not with volume of production. Rent, insurance, salary of a works manager and general manager, and so on. will vary *pari passu* with the time period. For instance, factory rent may be paid per month. Every month, this sum is to be paid irrespective of the volume of production. Likewise, insurance instalment of a quarter is to be paid whether there is production or no production. Logically, therefore, they should be considered expenses of the year in which they have been incurred and not be carried forward to the next year as part of the inventory costs. In brief, period cost may be defined as *costs which are matched against the revenue of the current period*, that is, the sum of period costs is deducted as expenses from the revenue of the current period only.

Absorbed Costs and Unabsorbed Cost

The importance of this classification in the income determination process emanates from the fact that variable production costs are not the only true costs. Product costs should include some proportion of fixed costs. This can best be understood by an example. Let us assume that the management decides that product manufactured on an operator-controlled machine be henceforth manufactured on an automated process involving high cost machinery. Assume further, that as a result of the change in the production process, there will be no variation in material costs or variable manufacturing costs per unit. There will be a change only in direct labour cost which henceforth will become part of the fixed cost associated with the machine. According to the definition of product costs (as per variable costing), the cost of production will be reduced by the direct labour cost, simply because of a change in the method of manufacture. Certainly, this is not a logical viewpoint. Therefore, the argument that the benefits of fixed costs lapse with the passage of time and, hence, must be absorbed by the revenues of that period only to which they relate ignores the point that facilities represented by those costs are value-creating[2].

From the above it follows that fixed costs add value to the product and this value is well taken account of in determining the selling price. Therefore, such costs must be absorbed by the revenues of the period in which the products have been sold and not necessarily in the year in which they have been incurred. The fact that goods are held as inventories so that they can be sold in future further reinforces the above contention. Therefore, fixed costs are relevant and inventoriable. This argument is in line with another cost concept, namely, expired and unexpired cost.

Expired and Unexpired Cost

An expired cost is one which cannot contribute to the production of future revenues. In contrast, an unexpired cost is one which has the capacity of contributing to the production of revenue in the future. Inventory constitutes a good example of unexpired cost, as it can be sold in subsequent years and will influence total future revenues. These arguments, then, constitute the rationale of the concept of the absorbed and unabsorbed costs, the problem of allocating fixed costs notwithstanding. Fixed factory or production costs are related to capacity to produce. They are necessary to be spent to create infrastructure facilities so that the manufacturing process can set in. Therefore, they are as necessary costs of production as the variable costs. Accordingly, production should absorb fixed costs at a certain pre-fixed standard rate,

which normally is determined with reference to the budgeted fixed cost and the normal capacity to produce. Suppose that fixed costs are Rs 30,000 and the normal production is 15,000 units. The standard fixed overhead rate (SFOR) of recovery is Rs 2 per unit (Rs 30,000 ÷ 15,000 units). In other words, every unit of production absorbs Rs 2 of fixed costs. If the company produces 10,000 units, the total absorbed costs will be Rs 20,000 (10,000 units × Rs 2, SFOR). Obviously, Rs 10,000 constitutes unabsorbed costs (Rs 30,000, actual cost – Rs 20,000, absorbed costs). Thus, absorbed costs may be defined as those costs, which have been charged to production. Costs, which remain uncharged to production are referred to as unabsorbed costs. In contrast, overabsorbed costs represent the positive difference of fixed costs charged to production and actual fixed costs. Such a situation will arise if actual production is more than the normal production. In the above example, if the company produces 16,250 units, the costs charged to production will be Rs 32,500 (16,250 units × Rs 2, SFOR). The overabsorbed cost will be Rs 2,500 [Rs 30,000, actual fixed costs (AFC) – Rs 32,500 charged to production]. Figure 2.1 portrays these relationships.

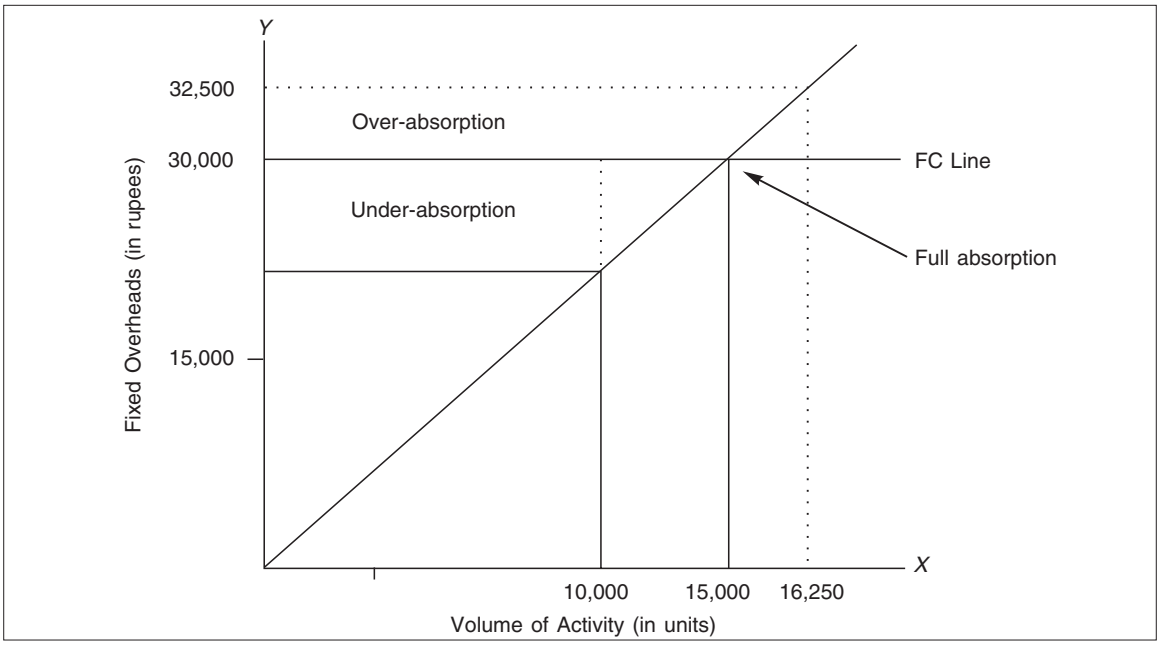

Figure 2.1 *Absorbed and Unabsorbed Costs*

Symbolically,

$$\text{Absorbed costs} = \text{Units produced} \times \text{SFOR} \quad (2.1)$$

$$\text{Unabsorbed costs} = [\text{AFC} - (\text{Units produced} \times \text{SFOR})] \quad (2.2)$$

$$\text{Overabsorbed costs} = [(\text{Units produced} \times \text{SFOR}) - \text{AFC}] \quad (2.3)$$

Joint Product Costs and Separable Costs

Joint product costs are the costs of a single process, or a series of processes that simultaneously produce two or more products of significant sales value. Such costs are not attributable to different individual products until after a certain stage of production known as the split-off point.[3]

Separable cost, in contrast, refers to any cost that can be attributed exclusively and wholly to a particular product, process, division or department.

The above cost concepts are helpful in the determination of the true costs of a particular segment of the business and, hence, the correct income.

COST CONCEPTS RELATING TO PROFIT PLANNING

Profit planning is concerned with taking a series of decisions where alternatives are available. Planning deals with the future. Therefore, future costs are relevant costs in the profit planning function. Cost volume profit relationship is an integral part of profit planning, that is, how the costs and profits vary with sales volume. The relevant cost concept are:

1. Fixed, Variable and Semi-variable/Mixed costs,
2. Future costs and Budgeted costs.

Although the fixed, variable and semi-variable/mixed costs are classified as cost concepts relevant to profit planning, they are basic cost concepts in the sense that they are amenable to wider application.

Fixed Costs

Fixed costs are costs associated with those inputs, which do not vary with changes in volume of output or activity within a specified range of activity or output (relevant range) for a given budget period. Fixed costs, thus, remain constant whether activity increases or decreases within a relevant range. For example, the rent of factory or office premises, property insurance, senior executives' salaries, lease payments, depreciation, and so on remain the same whether there is an increase or decrease in the volume of activity. However, fixed costs are not fixed for all times to come. Fixed cost, like any other cost, is subject to change over a period of time. For instance, rent may increase, property insurance rates may go up, executives' salaries may increase, and so on in the next period but these increases are not the result of an increase in the firm's output. In a way, therefore, the terminology "fixed cost" is not very appropriate; "non-variable" is a more appropriate name for these costs.

Since fixed costs are unaffected by volume changes, any increase in volume implies that the costs will be allocated to a greater number of units and as a result fixed cost per unit will become progressively smaller as volume increases. Conversely, when a smaller number of units is produced, the fixed costs per unit will become larger. Such a variation in unit fixed cost creates problems in product costing, the cost being dependent on the number of units produced. This aspect has been referred to as "troublesome fixed costs."[4] Table 2.1 illustrates the nature of fixed costs.

Table 2.1 *Production Volume and Fixed Costs*

Total fixed cost	*Production (in units)*	*Average fixed cost per unit*
Rs 10,000	1,000	Rs 10
10,000	2,000	5
10,000	5,000	2
10,000	10,000	1

Figure 2.2 portrays the relationship between volume and total fixed costs. The relationship between volume and fixed costs per unit is exhibited by Figure 2.3. While fixed cost remain constant at Rs 10,000 in total, cost per unit starts decreasing as the volume increases. Thus, there is an inverse relationship between production volume and fixed cost per unit (Figure 2.3). Hence, fixed costs are constant on an aggregative basis but are variable on a unit basis.

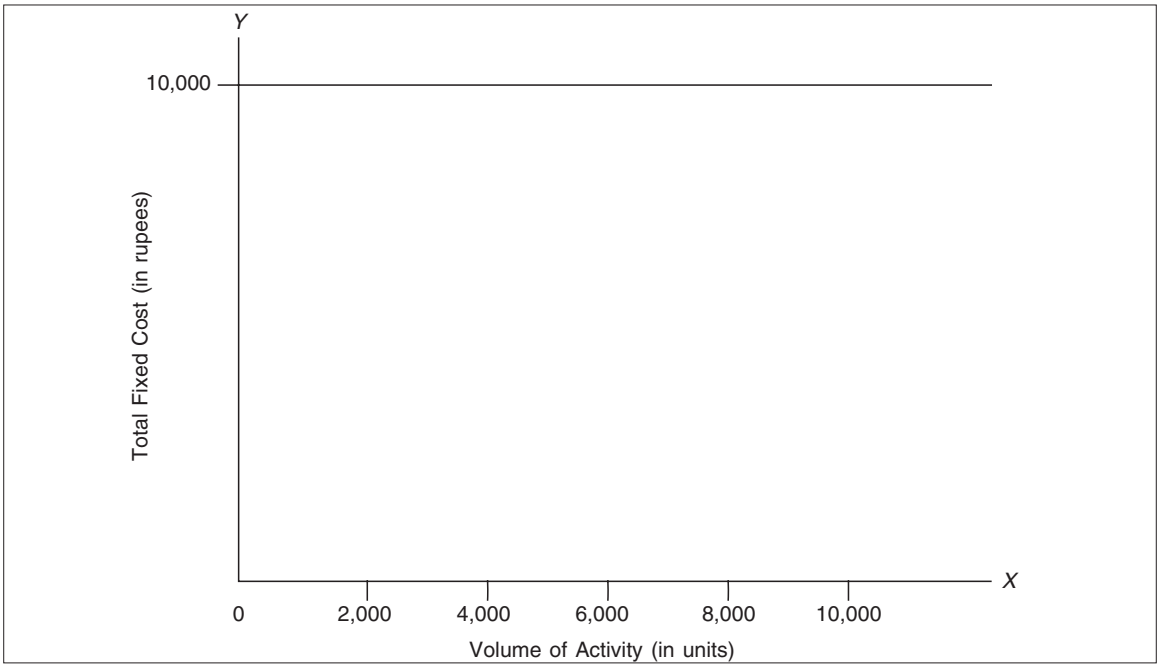

Figure 2.2 *Volume and Total Fixed Costs*

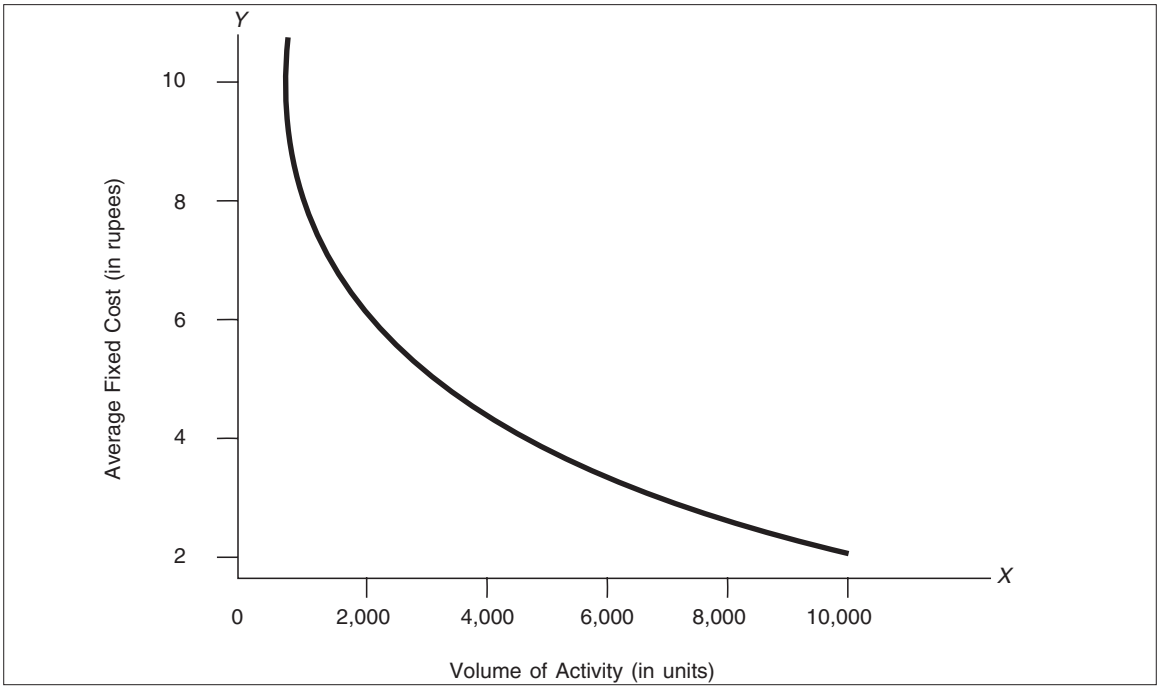

Figure 2.3 *Volume and Fixed Cost Per Unit*

As stated earlier, fixed costs will not change over a wide range of volume (the relevant range). They will fluctuate before and beyond that range. For example, prolonged strike or lockout may cause fixed costs to be reduced if executives or employees are laid off. Likewise, an expansion of activity beyond the present capacity will require purchase of new plant and equipment, engaging additional foremen and supervisors and, hence, additional fixed costs will result from these new inputs.[5] Such costs behaviour is shown in Figure 2.4. It is for this reason that fixed costs are sometimes called "capacity costs" as they measure the capacity for manufacturing, sales, administration and research. They reflect the capability for sustaining a planned volume of activity.[6]

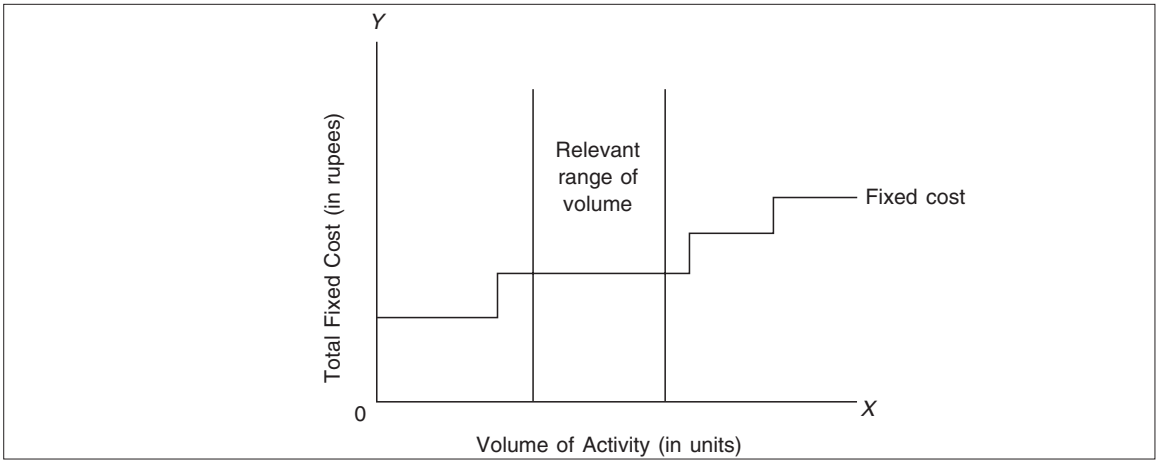

Figure 2.4 *Behaviour of Fixed Costs*

It is useful to sub-divide fixed costs into "committed" fixed costs and "discretionary" fixed costs from the point of view of profit planning and control.

Committed Fixed Costs Fixed costs caused by the purchase of capacity producing assets such as plant and equipment are called committed costs. These costs are on an increase in a growing firm as usually such a firm switches over to automatic plant operation from a manual one, resulting in higher expenditure on plant and equipment. Depreciation, rent, property taxes, salaries of key personnel, insurance, and so on are examples of committed fixed costs. These costs are known as committed fixed costs because the company has committed itself to incur such costs by making long range decisions which will extend several years into the future. Such costs cannot be reduced substantially without impairing the organisation's competence to meet long range goals. The committed fixed costs are the least responsive of the fixed costs, because they tend to be less affected by month-to-month and year-to-year decisions. For instance, once buildings are constructed and machinery is installed, little can be done in day-do-day operations to affect the total level of committed costs. From the point of view of the management, therefore, the stress should be to increase current utilisation of these facilities so as to augment income. It is for this reason that fixed costs are ignored for short-term decisions, that is, the management decides to sell a product at a price below the total cost but higher than variable cost. In such situations, the concept of the contribution margin as a decision-criterion becomes important. Contribution margin per unit is the difference between the selling price and the variable cost per unit.

Discretionary Fixed Costs These costs are also known as *programmed costs or managed costs*. The costs caused by management policy decisions to undertake activities such as research and development, training programmes for its employees, advertising and sales promotion, charitable and/or political donations, management consulting services, and so on, are called discretionary fixed costs. Such costs can be reduced substantially (and in extreme cases almost entirely) for a given year in difficult times at the discretion of management. For instance, the management may decide not go give any donations, may stop making advertisements in newspapers or other media and, thus, eliminate these costs.

The amount/size of discretionary fixed costs is decided by the top management at the beginning of the budget period, specifying the allocation for each of the expenditure items listed above. For example, the management may decide to allocate Rs 2 lakh for market research and development, Rs 1 lakh for sales promotion and advertising, and so on. These expenditures are allocated in the light of the long-term goals of the company. The advantages accruing from such expenditures cannot be expected in the same budget period in which they have been incurred. For example, even a technological break-through that could shorten production time appreciably would have no effect until it was properly tested, installed and checked—a process that would most likely extend into some future budgeted period.[7] Therefore, discretionary fixed costs are not subject to ordinary engineering input-output analysis which holds true for most other costs.[8]

Variable Costs

Costs that tend to vary in total in direct proportion or in a one-to-one relationship to changes in production activity, sales activity or some other measure of volume are referred to as variable costs within relevant range for a given budget period. Material costs, direct labour costs and supplies are examples of variable cost. The cost of these inputs increases/ decreases in proportion to increase/decrease in volume. It is so because these inputs are used in the exact quantities needed. Table 2.2 portrays relationship between material, labour and total variable costs and production volume.

Table 2.2 *Production Volume and Variable Costs*

Production (unit)	*Material costs*	*Labour costs*	*Total variable cost*
1	Rs 5	Rs 2	Rs 7
10	50	20	70
100	500	200	700
1,000	5,000	2,000	7,000

Table 2.2 shows that each change of one unit of product causes a change of Rs 7 of variable cost (Rs 5 materials and Rs 2 labour). As output increases, so do the variable costs increase in the same proportion. For instance, at 100 units production level, variable costs are Rs 700; at 1,000 units, such costs become Rs 7,000. Expressed mathematically, there is a linear relationship between volume and variable costs. Thus, total variable costs vary in direct proportion to volume and, consequently, are constant per unit of volume. Figures 2.5 and 2.6 illustrate this relationship. In view of their behaviour, variable costs are sometimes called "engineered costs". An engineered costs is any cost that has an explicit, specified, physical relationship with a selected measure of activity. Most variable costs are of this type. An "engineered" variable cost is said to exist when work measurement techniques (material standards with the help of production engineers, labour standards through time and motion study) have carefully established an optimum relationship between input and output.[9] Direct material and direct labour are a prime example of engineered costs. Like fixed costs, some of the variable costs are discretionary in nature, that is, they are dependent upon management policy. As an illustration, let us suppose that the management has pre-determined that *X* per cent

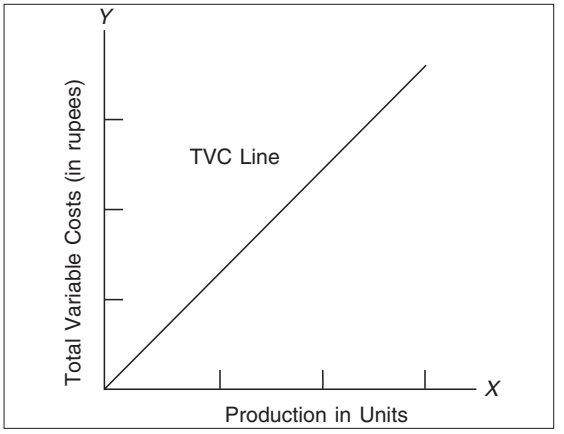

Figure 2.5 *Total Variable Cost*

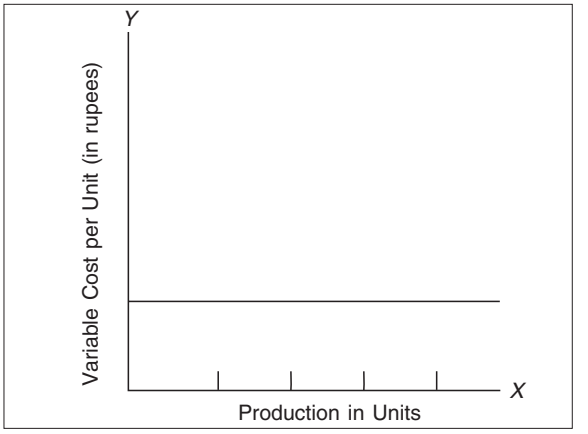

Figure 2.6 *Variable Cost per Unit*

of the sales revenue will be spent for items such as market research and advertising. These costs will, obviously, vary in direct proportion to the sales revenue but the reasons for variability are not the same as in case of direct materials or direct labour.

Semi-Variable Costs (Mixed Costs)

All costs which are neither perfectly variable nor absolutely fixed in relation to volume changes are called semi-variable costs. Semi-variable costs are also known as mixed costs as they consist both of fixed costs and variable costs. The fixed component of mixed costs represents the cost of providing capacity, whereas the variable component is caused by using the capacity. The first part is not affected by the changes in activity (and is thus like the fixed cost), while the latter part is influenced by the changes in activity (and is, thus, like the variable cost). Thus, semi-variable costs change in the same direction as volume but not in direct proportion thereto. Figure 2.7 exhibits such a relationship.

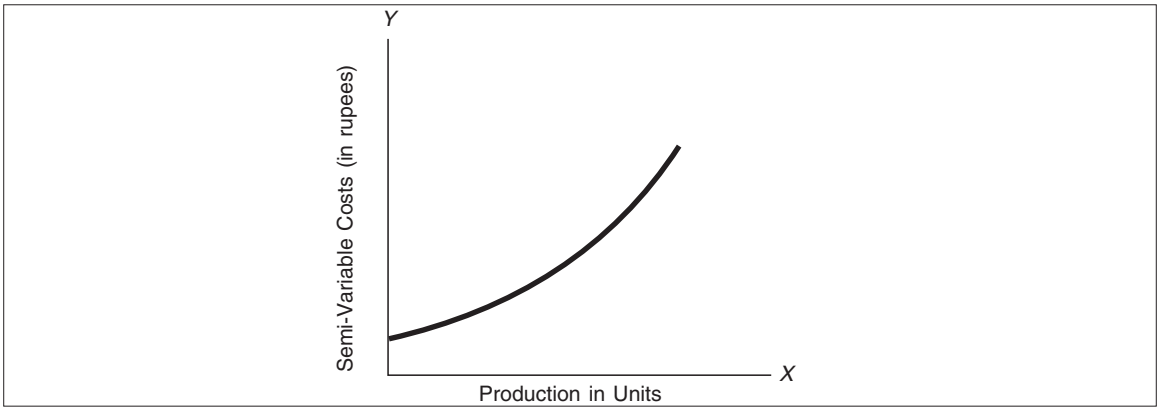

Figure 2.7 *Semi-Variable Costs*

Telephone, power, repairs and maintenance costs are some of the examples of mixed costs. For example, a telephone bill involves the twin elements of cost: fixed charge consisting of basic cost for telephone service (telephone rent) irrespective of the calls made; and variable charge consisting of actual number of telephone calls made. In the case of power expenses, meter rent is a fixed charge and power usage is a variable charge.

Ideally, semi-variable costs should be bifurcated into fixed and variable elements as the functions of profit planning, cost control and decision-making assume that costs are either variable or fixed.

Methods of Mixed Cost Segregation

There are four methods to bifurcate mixed costs:

1. Graphic Method (Scatter Diagram)
2. Two Point Method (High-Low Method)
3. Analytical Approach
4. Method of Least Squares.

Graphic Method The graphic method of dividing mixed costs into their fixed and variable components makes use of all relevant past data pertaining to cost-volume relationships. The data are plotted on a scatter graph, as shown in Figure 2.8, on the basis of Example 2.1. Each point on a chart represents cost for a particular month in relation to number of units produced. For instance, the point labelled March indicates that the repairs and maintenance expense of the machine is Rs 2,300 when 250 units are produced. The *X* axis represents the volume of production and the *Y* axis shows the amount of expenses. Then a line of "best fit" is drawn in such a way that the true average relationship between costs and volume can be established. While drawing the line, it should be borne in mind that the line includes as many points as possible so that it may be representative of the data. The positive intercept on the vertical axis represents fixed cost: the slope of the curve determines the variable element.

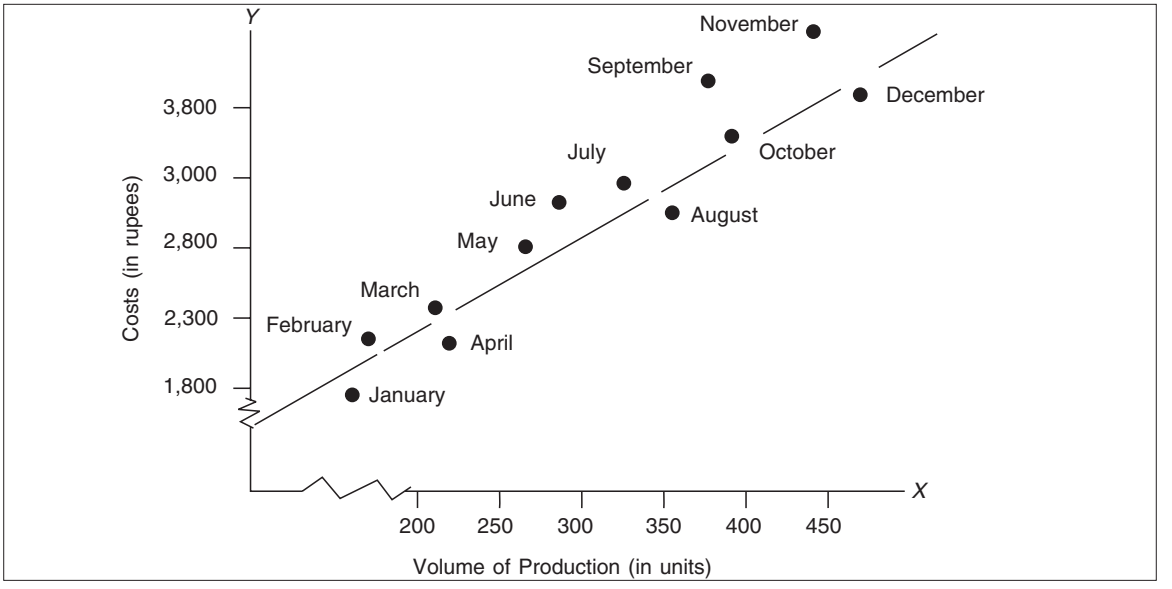

Figure 2.8 *Graphic Method of Segregation of Fixed Costs*

The problem with this method, however, is that two different persons will draw two different lines. Being so, this method is not scientific and objective.

EXAMPLE 2.1

The following is an extract of the cost data of Royal Industries Ltd month-wise for the previous year:

Month	*Production (units)*	*Repairs and maintenance costs*	*Month*	*Production (units)*	*Repairs and maintenance costs*
January	200	Rs 1,800	July	350	Rs 3,000
February	200	1,900	August	350	2,950
March	250	2,300	September	400	3,350
April	250	2,250	October	400	3,300
May	300	2,650	November	450	3,750
June	300	2,750	December	450	3,650

High-Low Method As the name suggests, this method makes use of two observations rather than all the observations for drawing the cost line. The two points chosen are: (i) The high cost point; and (ii) The low cost point corresponding to some specific volume (may be number of units produced as in Example 2.1 or any other measure of volume such as, labour-hours, machine-hours, telephone calls made, power consumed, and so on). Figure 2.9 shows the relationship on the basis of data contained in Example 2.1. The relevant data are plotted as follows.

The intercept on the vertical axis represents fixed cost and the slope of the cost line represents the variable element of the cost.

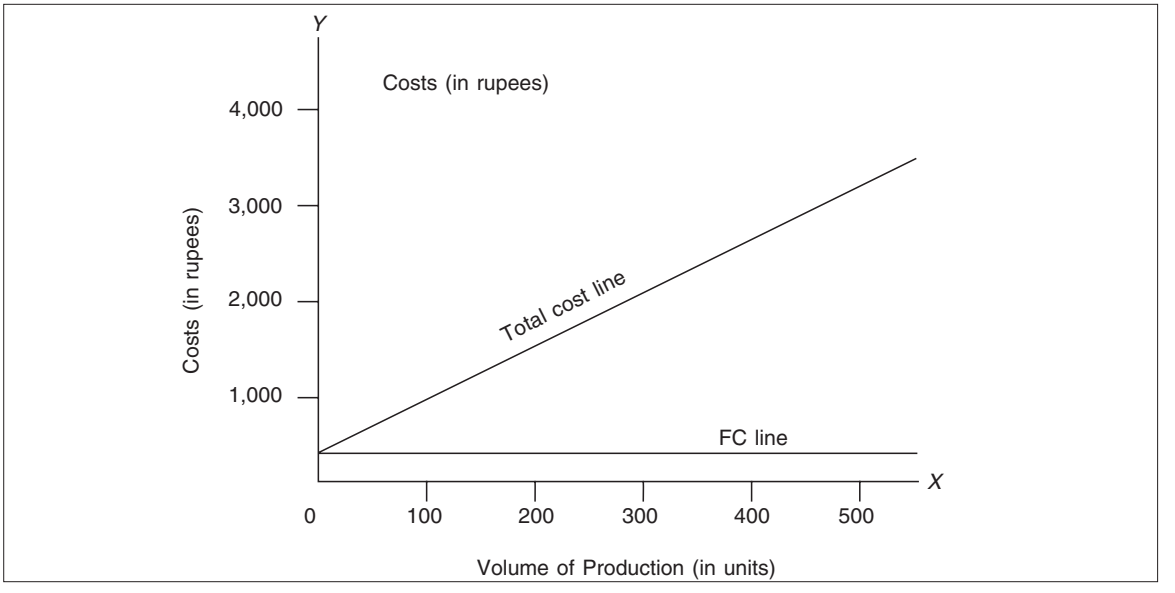

Figure 2.9 *High Low Method of Segregation of Fixed Costs*

Month	*Production (in units)*	*Costs*
January	200 (P_l) (lower production)	Rs 1,800 (Low cost point, C_L)
November	450 (P_H) (higher production)	3,750 (High cost point, C_H)

The algebraic method will yield identical results as shown below:

Variable rate = Difference in cost ($C_H - C_L$) ÷ Difference in production ($P_H - P_L$) = Rs 1,950 ÷ 250 units = Rs 7.8 per unit

Fixed overhead component at P_L = Rs 1,800 – (Rs 7.8 × 200) = Rs 240

P_H = Rs 3,750 – (Rs 7.8 × 450) = Rs 240

Thus, mixed cost = Rs 240 + Rs 7.8 X

In statistical terms, total cost (Y) is a function of (i) fixed element, a, and (ii) variable element, b, multiplied by number of units produced, X:

$$Y = a + bX$$

In Example, 2.1, the cost equation (flexible budget cost line)

$$Y = \text{Rs } 240 + \text{Rs } 7.8\ X$$

The high-low method is statistically not desirable as its results are based only on two extreme observations. Because of the danger of relying on extreme points, which may not be representative of normal situations, the high-low method is not recommended.[10] From the point of view of obtaining reliable and representative results, all data points should be used and not just two, as a basis of cost estimation. Therefore, the method is unscientific and inaccurate.

Analytical Method This method is also called the "degree of variability" technique because the genesis of this method lies in measuring the extent of variability of costs with volume. In other words, the technique is based on a careful analysis of each item to determine how far the cost varies with volume.[11] Some of the mixed cost may have a 40 per cent degree of variability while others may have only 20 per cent. The virtue of this method, apart from easy understanding, is that it closely examines each constituent of the mixed costs, and therefore, is likely to give most accurate figures of fixed and variable elements. But it may be emphasised again that this method also suffers from subjectivity in that the degree of variability associated with each part of semi-variable costs is to be determined by the accountant/some other person entrusted with the job. Obviously, two different persons will assign two different percentages to the degree of variability attached with an element of semi-variable cost. But then there is no accurate method of apportioning the mixed cost into fixed and variable components. One can only approximate. Such an analysis is of particular significance in making flexible budgets.

EXAMPLE 2.2

The analysis of factory overheads of Hypothetical Ltd reveals that on an average there is a 40 per cent degree of variability at 100 per cent level of activity. Budgeted mixed overheads are Rs 10,000. What would they be at 50, 70 and 90 per cent levels of activity?

SOLUTION

Variable overheads = (Budgeted mixed overheads × Degree of variability) = Rs 10,000 × 0.40 = Rs 4,000

Fixed overheads at 100 per cent capacity = (Rs 10,000 – Rs 4,000) = Rs 6,000

Variable overheads at 1 per cent capacity = Total variable overheads ÷ 100 = Rs 4,000 ÷ 100 = Rs 40

Flexible Budget (Overheads Costs)

	Level of capacity (per cent)		
	50	70	90
Fixed overheads	Rs 6,000	Rs 6,000	Rs 6,000
Variable overheads (level of capacity × Rs 40)	2,000	2,800	3,600
Total	8,000	8,800	9,600

Method of Least Squares This method is perhaps the most accurate and scientific to apportion mixed costs. The line is not plotted arbitrarily like the scatter diagram method. It is located by means of solving the two linear equations based on the formula for drawing a straight line regression equation. The basic equation is:

$$Y = a + bX \tag{2.4}$$

Where Y = Total cost
a = Fixed element of mixed cost
b = Variable cost to volume ratio
X = Any measure of volume (production, hours, and so on)

From Equation 2.4 follows the two simultaneous linear equations:

$$\Sigma Y = na + b\,\Sigma X \tag{2.5}$$

$$\Sigma XY = a\,\Sigma X + b\,\Sigma X^2 \tag{2.6}$$

EXAMPLE 2.3

ABC Ltd furnishes the following overhead cost behaviour of mixed cost for the first 6 months of the current year. You are required to segregate these costs into fixed and variable.

Month	*Units produced*	*Cost*		
	(X)	*(Y)*	*XY*	X^2
January	20	Rs 900	Rs 18,000	Rs 400
February	10	700	7,000	100
March	30	1,100	33,000	900
April	20	900	18,000	400
May	00	500	00	00
June	30	1,300	39,000	900
	110	5,400	1,15,000	2,700

SOLUTION

Substituting the values in Equations 2.5 and 2.6

$$5{,}400 = 6a + 110b \tag{1}$$

$$1{,}15{,}000 = 110a + 2{,}700b \tag{2}$$

Multiplying Equation 1 by 110 and 2 by 6, we have

$$5{,}94{,}000 = 660a + 12{,}100b$$

$$6{,}90{,}000 = 660a + 16{,}200b$$

Subtracting Equation 1 from Equation 2,

$$96{,}000 = 4{,}100b$$

$$\therefore \quad b = 23.41$$

Substituting b in Equation 1 we have $6a = 2{,}824.39$ or $a = 470.73$.
Thus, the least squares equation is

$$Y = 470.73 + 23.41\,X$$

The equation indicates that fixed costs are Rs 470.73, when volume X is zero and for each unit of production beyond zero costs will increase by Rs 23.41 (variable costs). The results of this equation can be used to estimate total costs for any volume within the relevant range. Figure 2.10 exhibits this relationship.

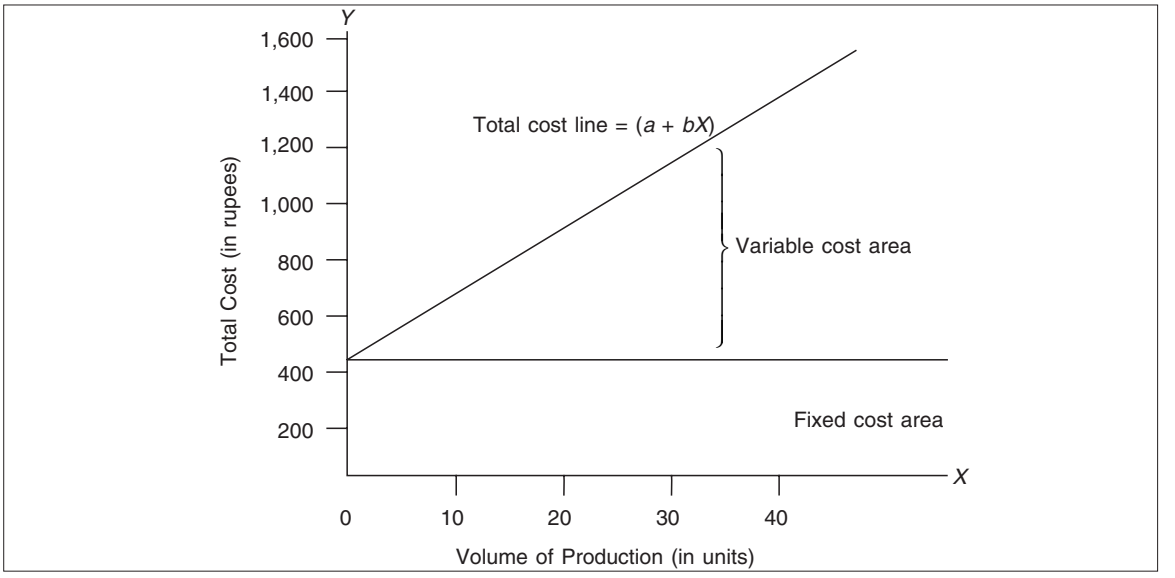

Figure 2.10 *Total Cost at Various Levels of Production*

This method is by far the best among the four methods of segregating mixed costs.

Future Costs

Future costs are relevant costs in the profit planning function of management. Those costs which are reasonably expected to be incurred at some future date as a result of a current decision are called future costs. Since they deal with a future period, they are estimated costs based on expectations, Such costs are of paramount importance to the management as they are the only costs over which it can exercise any control. In the case of historical costs, there can only be retrospection and nothing much can be done about them if they are more than the budgeted cost, for the simple reason that they have already been incurred. However, future costs can be planned for and planned to be reduced. If they are too high, resources can be planned to meet the high costs and efforts can be made, if possible, to reduce them. Thus, the measurement of future costs is critically associated with the active management functions of planning and control.[12]

Budgeted Costs

When an operating plan involving future costs is accepted, and incorporated formally in the budget for a specific period, such costs get converted to what may be referred to as budgeted costs. Budgeted costs are important elements in that they provide the basis for measuring the actual performance of different cost centres and, therefore, constitute an important input of responsibility accounting.

COST CONCEPTS FOR CONTROL

Once costs have been planned, the next step is to see that actual costs are in conformity with planned costs. It is in this context that management needs cost data so that responsibility for incurrence of cost can be identified. The cost concepts covered here are: (i) Responsibility cost; (ii) Controllable and non-controllable costs; and (iii) Direct and indirect costs.

Responsibility Costs

This concept is more popularly known as responsibility accounting. In a responsibility accounting system, costs are classified/identified/accumulated with the persons responsible for their incurrence commonly referred to as responsibility centres. The virtue of this manner of classifying cost data is that they not only indicate what costs have been incurred (actual costs) but also who is responsible for them so that responsibility can be localised in case actual costs exceed budgeted costs. In other words, the head of each responsibility centre is expected to prepare a budget of the costs over which he has control and the authority to incur, and he is expected to operate within the limits of this budget. This is by far the most important cost concept as far as the controlling of cost is concerned. The reason is that individuals in the organisation are held accountable only for those costs over which they have control and the authority to incur. In other words, they are not accountable for costs which they cannot control. For example, a foreman is not held liable for excess price paid by the purchase manager; he can be held liable only for the excessive usage of materials, if any. This gives rise to another concept of cost: controllable and non-controllable costs.

Controllable and Non-controllable Costs "An item of cost is controllable if the amount of cost incurred in (or assigned to) a responsibility centre is significantly influenced by the actions of the manager of the responsibility centre. Otherwise, it is non-controllable."[13]

The important characteristics of controllable costs are: (i) They are in relation to a particular responsibility centre (or the managerial area of responsibility involved); (ii) The head of the responsibility centre has *significant* influence but *not complete* influence on its controllability; (iii) They are relevant for the time period under review. For instance, the purchase manager has entered into a price contract, say for three months, with a supplier of raw materials used in production. Then price is not controllable by him for the relevant period of contract (three months) but is possibly controllable after the expiry of the contract period. Likewise, the sales manager may have entered into a contract for making advertisements for a certain period at an agreed amount.

The first characteristic indicates that the concept of controllable costs is a relative concept in the sense that when a company is viewed as a single entity, all costs are controllable at one level or another level of management. For instance, the top management may decide to close down one of the departments/divisions/segments of the business and, thus, reduce its cost to zero. The management may also decide to purchase a component from an outside supplier, hitherto manufactured by the company itself. These examples indicate

that costs are uncontrollable only at intermediate and lower levels of management. For instance, a departmental supervisor has no control over the fixed costs allocated to his department, a sales manager has no control over the price/cost at which goods have been transferred to his department by the production manager. Thus, allocated costs are not controllable by the responsibility centre to which the allocation is made.

Since all costs are controllable at the higher echelons of management, the management control system should focus on those costs which are controllable at lower/intermediate levels of management. It is important to stress here that cost controllability does not involve eliminating costs, but its endeavour is to keep them as close as possible to some desirable and reasonably attainable levels or standards.[14]

Direct and Indirect Costs The various items of cost in a responsibility centre may be classified as either direct or indirect. Those costs which can be identified logically and practically in their entirety to a particular department or a product are called direct costs. Those costs which are not practically identifiable exclusively and wholly to a particular product, division or segment are called indirect cost. Indirect costs are frequently called "common costs" as they are allocated between two or more products/ departments/divisions of a business. The salary of the chief executive who looks after the entire business, is an example of indirect cost. A divisional manager's salary is a direct cost if that division happens to be one specific responsibility centre. However, within divisions, if there are a number of products to be manufactured, then for each product unit (which is a separate responsibility centre), the divisional manager's salary will be the indirect cost. Thus, the distinction between a direct cost and an indirect cost depends upon the unit under consideration. If a cost can be directly and wholly traced to a particular responsibility centre under consideration, it is direct cost and if it is allocated to it from somewhere else in the organisation, it is an indirect cost.

This distinction is important as only direct costs are controllable costs for various responsibility centres. Indirect costs are not controllable.

COST CONCEPTS FOR DECISION-MAKING

Management is concerned with two types of decisions: (i) Long-range (capacity decisions) which cover a long time span and take into account the time value of money, (ii) Short-range or operating decisions cover a short span of time and, therefore, time value of money is not considered to be significant. Decisions involving production, output, pricing of special orders, addition or dropping of a product line, make or buy, processing further or sell, temporary shutdown and so on are examples of short-range decisions. To have correct decision, management requires estimates of all future benefits and costs concerning a particular decision. The relevant cost concepts affecting the latter type of decisions are: (i) Relevant and irrelevant costs; (ii) Incremental cost/differential cost; (iii) Out of pocket costs and sunk costs; (iv) Opportunity costs and imputed costs.

Relevant and Irrelevant Costs

Cost which is influenced by a decision is a relevant cost and, hence, is important for decision-makers. Cost which is not affected by a decision is irrelevant cost, that is, it will be the same regardless of the choice that is made. As a result, such a cost is of no relevance to decision-makers. Therefore, it should be ignored while taking decisions. Committed fixed costs are irrelevant costs. However, it should not be taken to mean that relevant costs are equivalent to variable costs. In situations where additional fixed costs are to be incurred as a result of a decision, fixed costs are as much the relevant costs as the variable costs are. As an illustration, if the company wants to make a component hitherto purchased from the outside suppliers, the relevant costs will be: (i) Cost of material and direct labour (variable cost) and (ii) Fixed costs (required for

creating new facilities so that the manufacturing process of making a component can start). Thus, relevant costs, truly speaking, are incremental costs, fixed and variable classification notwithstanding.

Incremental Cost/Differential Cost

This is by far the most important concept of cost in the decision-making process. Differential costs are the additional costs which will be incurred if management chooses one course of action as opposed to another. They are the extra, or incremental costs, caused by a particular decision.

A differential cost is the difference in cost between any two available, acceptable alternatives. This approach compares the two alternatives directly by looking at the differences between them.[15] The difference in cost between buying a component from outside and making it in the company is a differential cost, relevant for decision-making. Furthermore, differential costs always relate to a specific time period. What it implies is that with the passage of time and change of situation, the amount of differential costs will vary. It is a broader concept than variable cost as it also takes into account additional fixed costs caused by a management decision.

Out of Pocket Costs and Sunk Costs

A cost which requires current or future cash expenditures as a result of a decision is labelled as an out of pocket cost. In situations where funds/cash resources available are limited, such costs become very decisive in the decision-making process. In contrast, those costs which have already been incurred in the past and will not require current cash expenditure are called sunk costs.

Thus, the two cost concepts are the opposites of each other. In the case of the sunk cost a prior investment of cash resources has been made, while cash will be required currently or in the near future period in the cash of out of pocket costs.

Depreciation, depletion and amortisation of intangible assets (like preliminary expenses, cost of issue of shares and debentures) are some of the examples of sunk costs. Since sunk costs are the results of past commitments, they should be ignored/disregarded for purposes of decision-making. "*Do not cry over spilt milk*" should be the management's attitude towards such costs.

From the above it will be erroneous to infer that all variable costs are out of pocket costs and that all fixed costs are sunk costs. The chief executive's salary may be fixed but is very much an out of pocket cost as it requires current cash outlay. Similarly, in certain situations, variable costs may not be affected by the decision and, therefore, will be sunk costs. For example, assume that a company is considering a change in the manufacturing process with no change in production volume; the variable costs will remain unchanged and, therefore, will be labelled as sunk costs with respect to the decision. Consider the facts in Table 2.3.

Table 2.3 *Differential Cost*

	Present manufacturing process	*Proposed manufacturing process*
Direct material	Rs 2,00,000	Rs 2,00,000
Direct labour	3,00,000	3,00,000
Factory overheads	3,50,000	2,50,000
Total costs	8,50,000	7,50,000

The materials and labour costs are estimated at Rs 5,00,000 under both the manufacturing processes. They are sunk costs in this situation. The decrease of factory overheads in the proposed manufacturing process is the differential cost relevant for decision-making, though it is largely in the nature of a fixed cost.

The above illustration highlights the fact that variable costs are not always relevant costs and fixed costs are not always irrelevant costs from the points of view of decision-making. Included in the category of relevant costs for decision-making are all those costs which differ among the alternatives at hand. It is not significant whether the cost belongs to the fixed or variable category. Therefore, differential costs (incremental costs) are the only "material" costs for effective and efficient decision-making. It is this concept of differential costing, also known as incremental analysis, which is used for short-term non-recurring decision-making.

Opportunity Costs and Imputed Costs

Opportunity costs represent the benefits foregone by not choosing the second best alternative in favour of the best one. When we decide to follow one alternative, we are also deciding not to follow another. As a result, all the benefits that would have accrued are given up. To the extent they can be quantified/measured, they are opportunity costs of the decision and relevant costs for a decision. Assume that a company owns a building; it could be either used for business purposes or be rented to others. If a decision is taken to use the building, the amount of rent foregone constitutes the opportunity cost. Opportunity costs are associated only with feasible alternatives. The lost rent is an opportunity cost only if there are potential tenants willing to hire the building. Since they are hypothetical/theoretical costs, they are not entered in the accounting records. But the cost of the second best alternative must be taken into account before taking a decision.

Imputed costs are similar to the opportunity costs in that they are not recorded in the accounting books. However, they are hypothetical costs that must be taken into account if a correct decision is to be arrived at. Interest is the principal example of imputed costs.

SUMMARY

- From the viewpoint of managerial needs, cost concepts fall into four broad categories—income measurement, profit planning, cost control, and special situations.
- There are four cost concepts pertaining to income measurement. These are Product and period costs; Absorbed and unabsorbed costs; Expired and unexpired costs; and Joint and separable costs.
- Production costs are costs which can be identified with goods produced/purchased for resale. Period costs are costs which are matched against the revenue of the current period.
- Absorbed costs are costs which must be absorbed by the revenue of the period in which the products have been sold and not necessarily in the year in which they have been incurred.
- An expired cost is one which can not contribute to the production of future revenues. An unexpired cost has the capacity to contribute to the production of revenue in future, for example, inventory.
- Joint product costs are the costs of a single process/series of processes that simultaneously produce two or more products of significant sale value. Separable costs refer to any cost that can be attributed exclusively and wholly to a particular product/process/devision/department.
- The cost concepts relevant to profit planning are: (i) Fixed, variable and semi-variable/mixed costs, and (ii) Future and budgeted costs.
- Fixed (non-variable) costs do not change with changes in volume of output or activity within a specified range of activity/output (relevant range) for a given budget period. Fixed costs caused by the purchase of capacity producing assets such as plants are called committed fixed costs. The discretionary fixed (managed) costs are caused by management policy decision to undertake activities such as

research and development, training programme for employees, advertising and sales promotion and so on.

- Costs that tend to vary in total in direct proportion or in one-to-one relationship to changes in production/sales/some other measure of volume are variable costs.
- All costs which are neither perfectly variable nor absolutely fixed in relation to volume changes are called semi-variable (mixed) costs. They consist of both fixed costs and variable costs.
- The methods of segregating of mixed costs are the graphic method, the high-low method, the analytical method and the method of least squares.
- The concepts relating to cost control are Responsibility costs, Controllable and non-controllable costs, and Direct and indirect costs.
- Responsibility costs are costs which are classified/identified/accumulated with the person(s) responsible for their incurrence.
- An item of cost is controllable if the amount of cost incurred in (assigned to) a responsibility centre is significantly influenced by the actions of the manager of the responsibility centre. Otherwise, it is non-controllable.
- Those costs which can be identified logically and practically in their entirety to a particular department/product are called direct costs. Those costs which are not practically identifiable exclusively and wholly to a particular product/division/segment are called indirect (common) costs.
- The cost concepts affecting decision-making are Relevant and irrelevant costs, Differential costs, out-of-pocket costs and sunk costs, and Opportunity costs and imputed costs.
- Costs which are influenced by a decision are a relevant cost and cost which is not affected by a decision is irrelevant cost.
- Differential/incremental costs are the additional costs which would be incurred if the management chooses one course of action as opposed to another. They are incremental costs caused by a particular decision.
- A cost which requires a current/future cash expenditure as a result of a decision is an out of pocket cost. Costs which have already been incurred in the past are sunk costs.
- Opportunity cost represents the benefits foregone by not choosing the second best alternative in favour of the best one. Imputed costs are hypothetical costs that must be considered for correct decision, for example, interest cost.

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REVIEW QUESTIONS

RQ.2.1 (a) Are all fixed costs sunk costs? Explain.
(b) What are opportunity costs? Are opportunity costs relevant in decision-making? Give examples in support of your answer.

RQ.2.2 (a) "Certain costs are controllable and certain other costs are non-controllable." This is a meaningless statement unless we define what portion of the organisation is being discussed. Explain.
(b) Write short notes on controllable and uncontrollable costs.

RQ.2.3 What are the various methods by which you would split semi-variable costs in its fixed and variable elements?

RQ.2.4 (a) The classification of costs as controllable and non-controllable depends upon a point of reference. Explain.
(b) Direct costs and controllable costs are not necessarily the same. Comment.
(c) Why are sunk costs not relevant in decision-making?

RQ.2.5 (a) "All future costs are relevant." Do you agree? Why?
(b) "Fixed costs are really variable. The more you produce the less they become." Do you agree? Explain.

RQ.2.6 (a) "All controllable costs are direct costs. Not all direct costs are controllable." Explain with the help of suitable examples.
(b) Distinguish between (i) engineered, (ii) discretionary, and (iii) committed costs. Give suitable examples. Are all these costs controllable?

EXAMINATION QUESTIONS

EQ. 2.1 Write short notes on (i) sunk cost and (ii) opportunity cost. (*CA—May, 2003*)

EQ. 2.2 Distinguish between the controllable cost and uncontrollable costs. (*CA—May, 2003*)

EQ. 2.3 Discuss cost classification based on variability and controllability. (*CA—November, 2004*)

EQ. 2.4 Discuss cost classification based on variability and controllability. (*CA—November, 2004*)

EQ. 2.5 Distinguish between explicit and implicit cost. (*CA—May, 2005*)

EQ. 2.6 Explain the sunk cost. (*CA—May, 2005*)

EQ. 2.7 Distinguish between product cost and period cost. (*CA—May, 2006*)

EQ. 2.8 Distinguish between controllable costs and uncontrollable costs. (*CA—November, 2006*)

EQ. 2.9 Distinguish between period costs and discretionary costs. (*CA (PE-II)—May, 2007*)

Part Two

Product Costing Cost Accumulation/ Ascertainment

One major objective of cost accounting is cost ascertainment of goods and services. Part two of Volume I dwells on the systems and procedures of determination of cost. Chapters 3 to 6 describe the main elements of cost in terms of costing and control of materials, labour, factory overheads, and administrative, selling and distribution overheads respectively. Chapters 7 to 10 discuss the cost ascertainment in different situations. Chapter 7 deals with job, batch and contract costing system. The determination of product costs in process costing is explained in Chapter 8. Unit and operating cost accumulation methods are covered in Chapter 9. The reconciliation between financial and Cost accounts and Integration is elaborated in Chapter 10.

3 Costing and Control of Materials

Introduction

Raw materials constitute an essential element of production. After raw materials are purchased and temporarily placed in store, they are processed/transformed into finished goods. This chapter explores the costing and control of materials. Section 1 analyses the control of materials. The costing of materials is examined in Section 2. The main points are summarised in the last section.

CONTROL OF MATERIALS

Rigid control over materials are necessary not only to guard against theft, but also to minimise waste and misuse from causes such as excessive inventories, overissue, deterioration, spoilage, and obsolescence. There are certain prerequisites to an effective control system for materials:[1]

- Materials of the desired quantity will be available when needed;
- Materials will be purchased only when a need exists and in economical qualities;
- Purchases of materials will be made at most favourable prices;
- Vouchers for the payments of materials purchased will be approved only if the materials have been received in good condition;
- Materials will be protected against loss by proper physical control;
- Issue of materials will be properly authorised and accounted for; and
- All materials, at all times, will be charged, as the responsibility of some individual.

The control of materials, as an element of cost of production, is illustrated with reference to the purchase and issues procedures, inventory systems, and inventory control techniques.

Organisation for Control: Purchase and Issues Procedures

Control is achieved in part through an organisational structure that allows specialisation, and at the same time it defines authority, fixes responsibility and provides a system of checks and balances. To secure the advantage of specialisation, the function related to material acquisition (purchase) and handling, are usually subdivided. A centralised purchasing department is charged with the responsibility of planning orders for materials with reliable vendors at the right time and at the right price. A receiving department inspects incoming shipments/purchased goods and verifies the quantities received on orders. A stores department is held responsible for protecting materials against physical deterioration and ensuring that it is properly issued. Record-keeping is centralised in the accounting department where transactions are entered in the accounts only after documentary evidence has been supplied by other departments. Invoices are paid in the finance/credit department after approval by the accounting department. Checks and balances (that is, effective internal controls) are provided by making each department independent of the others.

Accounting for materials usually involves two activities: (i) Purchase of materials and (ii) Issue of materials.

Purchase of Materials Generally, there is a purchasing department whose function is to order/purchase materials and supplies for production. The purchase manager is responsible for ensuring that the items ordered: (a) Meet the quality standards, (b) Are acquired at the lowest price and (c) Are delivered on a timely basis. A typical purchase procedure involves three steps: (1) Purchase requisition, (2) Purchase order, and (3) Receipt of materials.

Purchase Requisition Purchase is initiated through a purchase requisition. It is a written request, sent to inform the purchasing department of a need for materials and supplies. The purchase requisition serves two purposes:

1. It notifies the purchasing department that a need exists for materials to start the purchase process in motion;
2. It fixes responsibility for the purchase request.

Although a purchase requisition is usually preprinted according to the specifications of a particular company, most forms include the requisition (serially numbered); name of the department/individual making the request; quantity of the items requested; identifying the catalogue number; description of the item; unit price; total price; shipping, handling, insurance and related costs; total cost of entire requisition; order date; required delivery date, and authorised signature. Figure 3.1 shows a purchase requisition.

Avon Company Ltd
Purchase Requisition

Number

Department/Individual making request.....

Order date.....Delivery date requested.....

Quantity	Catalogue number	Description	Unit price	Total
Approved by.....			Total cost	

Figure 3.1 *Purchase Requisition*

Two copies of purchase requisition are customarily made, the original going to the purchasing department (to place the order), and the copy remaining with the stores clerk who requested the purchase order (to keep track of orders placed).

Purchase Order After the requisition has been approved, the purchasing department places order. For routine purchases, the order is usually sent through established sources of supply; in other cases, the purchasing department may ask for bids or send out requests for quotations before placing the order. A purchase order is a written request to a supplier for specified goods at an agreed price. The request also stipulates terms of delivery and terms of payment. The purchase order authorises the supplier to deliver goods and submit a bill. To provide control over issuance of purchase orders, they are serially numbered. The items commonly included in a purchase ordered are: preprinted name and address of the company placing the order; purchase order number; name and address of supplier; order date; date delivery requested, delivery and payment terms; quantity of items ordered; catalogue number; description, unit and total price; shipping, handling, insurance and related costs; total cost of entire order; and authorised signature. Figure 3.2 shows a purchase order.

Avon Company Ltd
(full address)
Purchase Order

Number

Supplier..... Order date.....
Address..... Date delivery requested by .....
Delivery terms..... Payment terms.....

Quantity	Catalogue number	Description	Unit price	Total
Approved by.....			Total cost	

Figure 3.2 *Purchase Order*

The original order is sent to the supplier (to place the order). Copies of the purchase order usually go to the: (i) Accounting department (to be used in checking the supplier's invoice when a voucher is being prepared for payment, and for future recording in the purchase journal and the general and subsidiary ledgers); (ii) Receiving department (to alert them to expect a delivery), and (iii) Credit/finance department (for eventual payment within the discount period). A copy is retained by the purchasing department to maintain a file of all purchase orders issued.

Receiving Materials When the goods that were ordered are delivered, the receving department unpacks and counts them. In order to ensure that the goods delivered are actually counted, the copy of the purchase order sent to the receiving department does not show/deliberately omit the quantity ordered. The supplier sends a packing slip giving details of the goods supplied/shipped. To ensure that the goods are not damaged and that they meet the specifications of the purchase order and the packing list, they are checked by the receiving department. Quantities and condition on receipt of goods are noted by the receiving department on a Receiving Report as shown in Figure 3.3. The report includes the suppliers' name, purchase order number; date, delivery was received; quantity received; description of goods, discrepancies, if any, from the purchae order (or mention of damaged goods), and authorised signature. While the original report is kept with the receiving department, copies are sent to:

- Purchasing department, to indicate that the material was received, as well as to supply information about the goods received that might be useful in evaluating the suppliers'/vendors' performance in sending the materials on schedule;
- Credit/finance department, to be matched against the purchase order and the suppliers' bill. If the receiving report, purchase order and suppliers' bill tally, payment is authorised;
- Accounting department, to record in journal and ledger together with the related liability; and
- Stores, to infom that the goods have arrived.

Avon Company Ltd
Receiving Report

Number

Supplier.....
Purchase order number.....
Date received.....

Quantity	Catalogue number	Description	Unit price	Total
Authorised signature.....				

Figure 3.3 *Receiving Report*

In brief, for purposes of internal control over materials, the purchase order, receiving report, and the suppliers'/vendors' invoice should be matched/approved by an independent party. The accounting department should be responsible for checking and approving payment since they would not have a conflict of interest. Figure 3.4 illustrates the use of the three forms, namely purchase requisition, purchase order, and receiving reports together with the vendors' invoice.

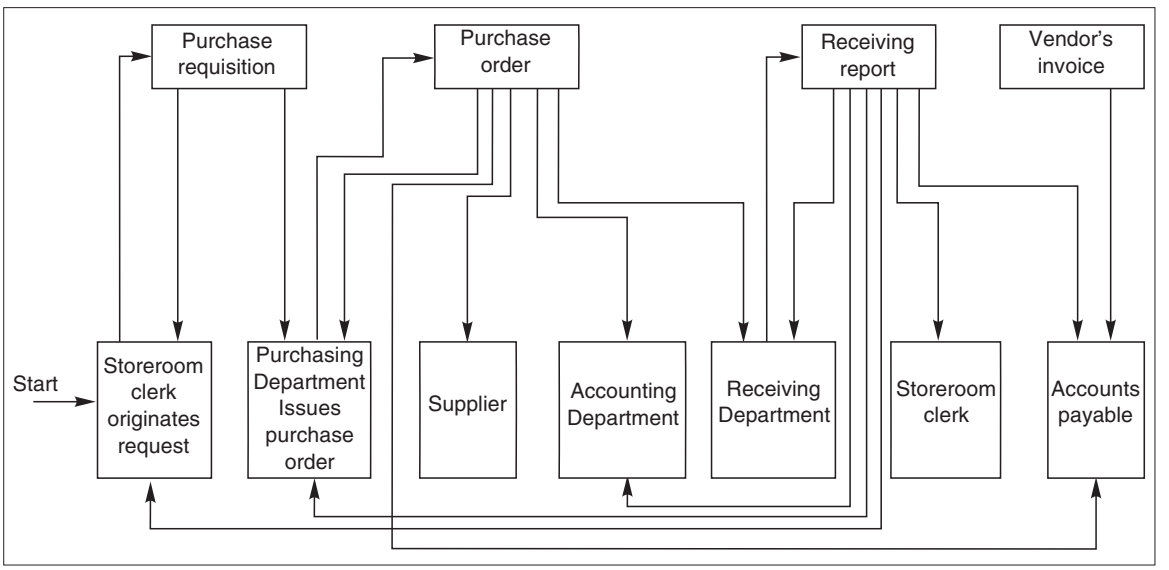


Figure 3.4 *Purchase Requisition, Purchase Order, Receiving Report and Vendors' Invoice*

Storing and Issuance of Materials Materials are transferred from the receiving department to the stores. The person in charge of the stores is responsible for proper storage, protection and issue of all materials. Efficient storing is another important step in materials control system. The basic accounting records of any inventory system are the documents required to authorise and record materials movements in/out of the store, namely, stocks/stores/materials ledger cards, bin cards and materials requisition note.

Stock/Stores/Materials Ledger Cards They show quantities on order, expected delivery dates and quantities reserved/required for work to be processed. They show the account number; description/type of material; location; unit measurement; minimum and maximum quantities to carry; details about the materials received; issue and balance. This is the basis of stock control as it is used to determine when additional stock needs to be acquired.

Bin Card This usually shows quantities of each type of material received, issued and on hand. It is placed in the bin/shelf or is hung over the almirah/rack otherwise known as bin. Separate bin cards are prepared for each item of stores. A bin card is shown in Figure 3.5.

Avon Company Ltd
Bin Card

Description.....
Stores ledger number.....
Minimum level.....

Bin card.....
Code number.....
Unit number.....

Date	Received		Issue		Balance quantity	Check
	Reference	Quantity	Reference	Quantity		

Figure 3.5 *Bin Card*

Materials Requisition Note/Form As an element of material control system, no materials can be issued from the store without proper authorisation by competent authority. The issurance of materials is authorised by means of a materials requisition form prepared by the production manager/departmental supervisor. It shows the job number/department requesting the goods; their quantity and description and the unit cost and total cost of the materials issued. Figure 3.6 shows a material requisition note/form.

Materials Requisition Form

Date requested	Approved by .....
Department requesting	Date issued .....
Requisition number	Issued to .....

Quantity	Description	Job number	Unit cost	Total

Figure 3.6 *Materials Requisition Note*

The note is prepared generally in triplicate. One copy is retained by the requesting department and two are sent to the stores. The signature of the recipient is obtained on both. The issue is recorded in the bin card and one copy is sent for accounting.

Materials Returned to Stores Materials requisitioned from store, and not needed, or found to be defective are returned to the stores. A returned material report is prepared, either by the person returning the material or by the incharge of the store upon receipt of the material. The original is used as a basis for crediting the accounts charged, while the duplicate copy is filed in the department returning the materials.

When summary of materials is prepared, the quantity and value of goods returned to the stores are deducted from the total materials issued. Similarly, the amount is deducted from the total amount charged to each department. Alternatively, returned materials may be recorded in the receipts section while putting a symbol/notation in red ink to indicate that it is not a receipt of new materials. The entry in red is helpful in insolating department consistently over requisitioning materials.

Some of the departments may prefer to use the excess materials on the next job instead of returning them to the store. A materials transfer note is prepared to transfer costs from one original job to the new job and also, the transfer is noted in the stock records.

System of Accounting for Materials Issued/Inventory Systems

Either the periodic inventory system or the perpetual inventory system may be used to account for materials issued to production and ending materials inventory.

Periodic Inventory System Under the periodic inventory system, the purchase of materials is recorded in Purchase of Raw Materials Account. The opening/beginning inventory, if any, is recorded in a separate Materials Inventory-Opening Account. The materials available for use during a period equal purchases plus opening inventory. A physical count is made of the materials on hand at the end of the period to arrive at the closing/ending materials inventory. The cost of materials for the period is determined as shown in Exhibit 3.1.

Exhibit 3.1 *Cost of Materials Issuesd*

Materials inventory-opening
+ Purchases
= Materials available for use
– Materials inventory-closing (based on physical count)
= Cost of materials issued

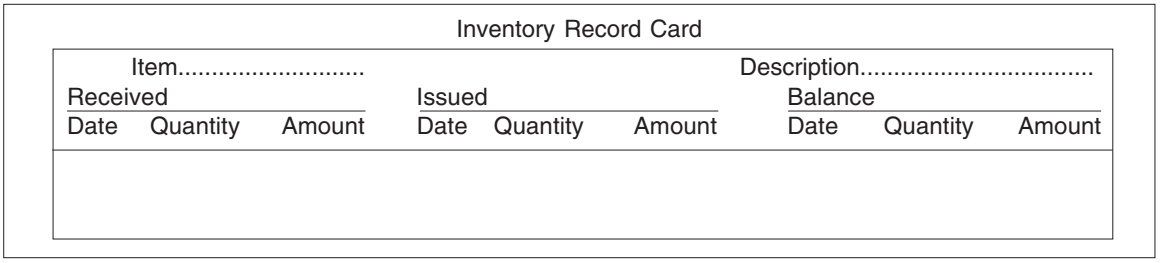
The entire book inventory is verified at a given date by an actual count of materials on hand. This physical inventory is usually taken near the end of the accounting year/period. This method provides for the recording of the purchases on a daily basis but does not provide for a continuous inventory-taking. Neither does it provide for a daily/continous computation of cost of goods sold. At the end of each accounting year, a physical count is made of the quantity of goods on hand, and the value of the inventory is determined by using an appropriate pricing method and attaching costs to units counted. It is assumed that goods not on hand at the end of the period have been sold. There is no system and accounting for shrinkage, losses, theft and wastage throughout the accounting period, and they can be discovered only at the end.

Perpetual Inventory System The purchase of materials is recorded under the perpetual inventory system in Materials Inventory Account rather than in a Purchase of Raw Materials Account. The opening/beginning materials inventory, if any, is also shown on the debit side of the Materials Inventory Account. The Materials Inventory Account is credited for the cost of materials issued, with a corresponding debit to Work-in-Process Inventory Account. The effect is that the cost of materials issued is charged to production at the time when the materials are issued and the balance in the Material Inventory Account shows the cost

of materials still available for use/issue. Therefore, both the cost of materials issued and the ending materials inventory can be directly ascertained after each transaction.

The perpetual inventory system is superior to the periodic inventory system. It provides better inventory/materials control and more information than the periodic inventory system. The recording and accounting of material cost is, therefore, illustrated below, using perpetual inventory system.

Recording/Accounting for Material Cost When a perpetual inventory system is used to account for materials inventory, a subsidiary ledger records card is maintained. Its total must equal the amount/balance in the Materials Inventory Control Account in the general ledger. The materials subsidiary ledger has a separate inventory record card for each item of inventory. Figure 3.7 shows an inventory record card. It shows the date, quantity and amount of materials received (debit) and issued (credit), and the resulting balance (debit).


Inventory Record Card

Item..... Description.....

Received			Issued			Balance		
Date	Quantity	Amount	Date	Quantity	Amount	Date	Quantity	Amount

Figure 3.7 *Inventory Record Card*

The use of perpetual inventory system also involves physical count of materials on hand, at least once a year, in order to check for possible loss or shrinkage due to theft or spoilage. If the physical count does not match with the balance in the inventory record cards, the book figures are adjusted upward/downward to reflected the actual count.

Journal Entries The purchase and issue of materials (direct as well indirect) are journalised as follows:

(i) When materials are purchased:
Direct Materials Inventory A/c Dr
To Cash/Accounts Payable (credit purchases)
Indirect Material Inventory A/c Dr
To Cash/Accounts Payable A/c (credit purchase)

(ii) Issue of direct materials for production:
Work-in-process Inventory A/c Dr
To Materials Inventory A/c

(iii) Issue of indirect materials for production:
Factory Overhead Control A/c Dr
To Materials Inventory A/c

Direct materials are debited to work-in-process inventory because they represent a major element of production cost and, therefore, require separate recognition to provide better control. On the other hand, indirect materials represent insignificant amounts and/or are not directly traceable to a product and are, therefore, charged to factory overhead control account. The factory overhead control account accumulates all indirect cost of production such as indirect materials, indirect labour, factory depreciation, and so on. Factory overheads are discussed in detail in Chapter 5.

EXAMPLE 3.1

The following data relate to wood pulp inventory of Premier Supply Company Ltd for the month of April.

April	1	Opening inventory, 10,000 kilos of wood pulp costing Rs 50 per kilo
	10	Purchases: 3,000 kilos @ Rs 55/Kilo
	16	Issued: 3,000 kilos
	26	Issued: 7,500 kilos
	28	Purchases: 4,000 kilos @ Rs 60/Kilo
	30	Issued: 3,500 kilos

All purchases are cash purchases. Journalise the above transactions under a perpetual inventory system. Also, compute the cost of materials issued and ending materials inventory. The company uses FIFO (first-in-first-out) method to value ending inventory.

SOLUTION

Journal Entries:

April	10	Materials inventory (3,000 × Rs 55)	Dr	Rs 1,65,000	
		To Cash			Rs 1,65,000
	16	Works-in-process inventory	Dr	1,50,000	
		To Materials inventory (3,000 × Rs 50)			1,50,000
	26	Work-in-process inventory	Dr	3,77,500	
		To Materials inventory [(7,000 × Rs 50) + (500 × Rs 55)]		3,77,500	
	28	Materials inventory (4,000 × Rs 60)	Dr	2,40,000	
		To Cash			2,40,000
	30	Work-in-process inventory	Dr	1,97,500	
		To Materials inventory [(2,500 × Rs 55) + (1,000 × Rs 60)]			1,97,500

Computation of Cost:

Materials Inventory A/c

April	1	To opening stock	Rs 5,00,000	April	16	By work-in process	Rs 1,50,000
	10	To cash	1,65,000		26	By work-in process	3,77,500
	28	To cash	2,40,000		30	By work-in process	1,97,500
					30	By balance c/d	1,80,000
			9,05,000				9,05,000

Work-in-Process A/c

April	16	To materials inventory	1,50,000
	26	To materials inventory	3,77,500
	30	To materials inventory	1,97,500
			7,25,000

Summary:

Cost of materials issued	Rs 7,25,000
Ending materials inventory	1,80,000

Adjustment for Discrepancies As observed earlier, physical count of materials under the perpetual inventory system may not tally with the inventory record cards (stores ledger). The discrepancy may result from: (a) Unavoidable reasons such as evaporation; absorption/moisture; temperature changes affecting the

volume of stock; shrinkage; deterioration in quality, for example, through rust; and loss due to breaking bulk or cutting up and (b) Avoidable reasons such as pilferage, unsuitable storage, careless handling, under and over issues, and materials unused but not returned to stores. The stores ledger records should be corrected to tally with the physical units in inventory irrespective of the reasons for inventory shortage. The following adjusting entries are made in different situations.

(a) When book inventory is more than the physical inventory and the shortage is normal:
Factory Overheads Control A/c Dr
To Stores Ledger Control A/c

(b) When the shortage in physical inventory is due to non-recording of inventory shortage:
Work-in-process Control A/c Dr
To Stores Ledger Control A/c
In both the above situations, in the stores ledger, an entry for both quantity and value is recorded in the Issue Column and a reduction is made in the Balance Column.

(c) In case of inventory gain, that is, when the stores ledger balance is less than the physical inventory (inventory overages), reverse adjusting entries of (a) and (b) above are passed. In the stores ledger, an entry for quantity and value both is recorded in the Received Column and addition is made in the Balance Column.

(d) The above adjustments are made when the inventory shortage/overage is normal and is expected in the normal course of business operations. If the loss is abnormal/due to unusual circumstances such as fire, theft, sabotage, the proper treatment is to transfer it to costing profit and loss account:
Costing Profit and Loss A/c Dr
To Stores Ledger Control A/c
Abnormal loss is considered a non-manufacturing loss, and is taken as a period charge against income of the current accounting period.

(e) If the discrepancies are slight, the balance of the stores ledger may be accepted for inventory verification and accounting purposes. No adjustment is required in such a situation.

Inventory Control Techniques

The important techniques covered here are: (i) ABC analysis, (ii) Economic order quantity (EOQ), (iii) Reorder-point and (iv) Safety stock.

ABC System: Classification Problem The first step in the inventory control process is classification of different types of inventories to determine the type and degree of control required for each. The ABC System is a widely-used classification technique to identify various items of inventory for purposes of inventory control. This technique is based on the assumption that a firm should not exercise the *same* degree of control on *all* items of inventory. It should rather keep more rigorous control on items that are: (1) Most costly, and/or (2) Slowest-turning, while items that are less expensive should be given less control effort.

On the basis of the cost involved, the various inventory items are, according to this system, categorised into three classes: A, B and C. The items included in group A involve the largest investment. Therefore, inventory control should be the most rigorous and intensive, and the most sophisticated inventory control techniques should be applied to these items. The C group consists of items of inventory which involve relatively small investments, although the number of items is fairly large. These items warrant the minimum attention. The B group stands midway. It deserves less attention than A but more than C. It can be controlled by employing less sophisticated techniques.

The task of inventory planning is to properly classify all the inventory items into one of these three categories. The typical breakdown of inventory items looks approximately as shown in Table 3.1.[2]

Table 3.1 *Inventory Breakdown between Number of Items and Inventory Value*

Group	*Number of items (per cent)*	*Inventory value (per cent)*
A	15	70
B	30	20
C	55	10
Total	100	100

Some points emerge from Table 3.8. While group A is the least important in terms of the number of items, it is by far the most important in terms of the investments involved. With only 15 per cent of the number, it accounts for as much as 70 per cent of the total value of inventory. The firm should direct most of its inventory control efforts to the items included in this group. The items comprising the B group account for 20 per cent of the investments in the inventory. They deserve less attention than A but more than C which involves only 10 per cent of the total value although, number-wise its share is as high as 55 per cent. The A B C analysis is illustrated in Example 3.2.

EXAMPLE 3.2

A firm has seven different items in its inventory. The average number of each of these items held, along with their unit costs, is listed below.

Items number	*Average number of units in inventory*	*Average cost per unit*
1	20,000	Rs 60.80
2	10,000	102.40
3	32,000	11.00
4	28,000	10.28
5	60,000	3.40
6	30,000	3.00
7	20,000	1.30

The firm wishes to introduce an A B C inventory system. Suggest a breakdown of the items into A, B and C classifications.

SOLUTION

The ABC analysis is presented in Table 3.2.

Table 3.2 *ABC Analysis*

Item *(1)*	*Units* *(2)*	*Per cent of Total* *(3)*		*Unit Cost* *(4)*	*Total Cost* *(5)*	*Per cent of Total* *(6)*	
1	20,000	10	15	Rs 60.80	Rs 12,16,000	Rs 38.00	70
2	10,000	5		102.40	10,24,000	32.00	
3	32,000	16	30	11.00	3,52,000	11.00	20
4	28,000	14		10.28	2,88,000	9.00	
5	60,000	30	55	3.40	2,04,000	6.38	10
6	30,000	15		3.00	90,000	2.80	
7	20,000	10		1.30	26,000	0.82	
Total	2,00,000	100	100		32,00,000	100.00	100

The A B C system of classification of various items of inventory for determining degree of inventory control effort is a very useful technique. It should, however, be used with caution. For example, an item of inventory may be very inexpensive. Under the A B C system, it would be classified into C category. But it may be very critical to the production process and may not be easily available. It, therefore, deserves the special attention of management. But in terms of the A B C framework, it would be included in the category which requires the least attention. This is a limitation of the A B C analysis.

Economic Order Quantity Model (EOQ): Order Quantity Problem After various inventory items are classified on the basis of the A B C analysis, the management becomes aware of the type of control that would be appropriate for each of the three categories of the inventory items. The A group of items warrant the maximum attention and the most rigorous control. A key inventory problem particularly in respect of group A items relate to the determination of the size or quantity in which inventory should be acquired. In other words, while purchasing raw materials or finished goods, the questions to be answered are: *How much inventory should be bought in one lot under one order on each replenishment? Should the quantity to be purchased be large or small? Or should the requirements of material during a given period (say six months or one year) be acquired in one lot or should it be acquired in instalments or in several small lots?* Such inventory problems are called order quantity problems.

The determination of the appropriate quantity to be purchased in each lot to replenish stock as a solution to the order quantity problem necessitates a resolution of conflicting goals. Buying in large quantities implies higher average inventory level, which will assure: (i) Smooth production/sale operations, and (ii) Lower ordering or set-up costs. But it will involve higher carrying costs. On the other hand, small orders would reduce the carrying costs of inventory by reducing the average inventory level but the ordering costs would increase, as also there is a likely interruption in operations due to stock-outs. A firm should place neither too large nor too small orders. On the basis of a trade-off between benefits derived from the availability of inventory and the cost of carrying that level of inventory, the appropriate or optimum level of the order to be placed should be determined. The optimum level of inventory is popularly referred to as the Economic Order Quantity (EOQ). It is also known as the Economic Lot Size. *The economic order quantity may be defined as that level of inventory order that minimises the total cost associated with inventory management*. Stated with reference to the cost perspectives, EOQ refers to the level of inventory at which the total cost of inventory comprising acquisition/ordering/set-up costs and carrying costs is the minimum.

For analysing the EOQ as an inventory management technique, several sophisticated and mathematical models are available.[3] These are, however, outside the scope of this book. We illustrate here the analysis of EOQ on the basis of a simple non-mathematical approach. Nevertheless, the main elements of the order quantity problem are covered by the analytical method followed here.

Assumptions The EOQ model, as a technique to determine the economic order quantity, illustrated by us, is based on three restrictive assumptions, namely:

(i) The firms knows with certainty the annual usage (consumption) of a particular item of inventory.
(ii) The rate at which the firm uses inventory is steady over time,
(iii) The orders placed to replenish inventory stocks are received at exactly the point in time when inventories reach zero.

In addition, it may also be assumed that ordering and carrying costs are constant over the range of possible inventory levels being considered.

Approaches The EOQ model can be illustrated: (i) By long/analytical approach or trial and error approach, and (ii) By the shortcut or simple mathematical approach.

Trial and Error Approach Given the total requirements of inventory during a given period of time depending upon the inventory planning horizon, a firm has different alternatives to purchase its inventories. For instance, it can buy its entire requirements in one single lot at the beginning of the inventory planning period. Alternatively, the inventories may be procured in small lots periodically, say, weekly, monthly, quarterly, six-monthly, and so on. If the purchases are made in one big lot, the firm's average inventory holdings would be relatively large, whereas, it would be relatively small in case of acquisition of inventory in small lots. The smaller the lot, the lower the average inventory and *vice-versa*. The high average inventory would involve high carrying costs. On the other hand, low inventory holdings are associated with high ordering cost. The trial and error or long analytical approach to determine EOQ uses different permutations and combinations of lots of inventory purchases so as to find out the least ordering and carrying cost combination. In other words, according to this approach, the carrying and acquisition costs for different sizes of orders to purchase inventories are computed, and the order-size with the lowest total cost (ordering plus carrying) of inventory is the economic order quantity. The mechanics of the computation of EOQ with the trial and error approach is illustrated in Example 3.3.

EXAMPLE 3.3

A firm's inventory planning period is one year. Its inventory requirement for this period is 1,600 units. Assume that its acquisition costs are Rs 50 per order. The carrying costs are expected to be Re 1 per unit per year for an item. The firm can procure inventories in various lots as follows: (i) 1,600 units, (ii) 800 units, (iii) 400 units, (iv) 200 units, and (v) 100 units. Which of these order quantities is the economic order quantity?

SOLUTION

The calculations of the inventory costs for the data in Example 3.3 for different order quantities are shown in Table 3.3.

Table 3.3 *Inventory Cost for Different Order Quantities*

1.	Size of order (units)	1,600	800	400	200	100
2.	Number of orders	1	2	4	8	16
3.	Cost per order	Rs 50	Rs 50	Rs 50	Rs 50	Rs 50
4.	Total ordering cost (2 × 3)	50	100	200	400	800
5.	Carrying cost per unit	1	1	1	1	1
6.	Average inventory (units)	800	400	200	100	50
7.	Total carrying cost (5 × 6)	800	400	200	100	50
8.	Total cost (4 + 7)	850	500	400	500	850

Working Notes

(i) Number of orders = Total inventory requirement/ Order size

(ii) Average inventory = Order size/2

It can be seen from Table 3.3 that the carrying and ordering costs taken together are the lowest for the order size of 400 units. This, therefore, is the economic order quantity.

The calculation of EOQ is further developed in Example 3.4.

EXAMPLE 3.4

The following details are available in respect of a firm:

1. Inventory requirement per year, 6,000 units
2. Cost per unit (other than carrying and ordering costs), Rs 5
3. Carrying costs per item for one year, Rs 1
4. Cost of placing each order, Rs 60
5. Alternative order size (units): 6,000, 3,000, 2,000, 1,200, 1,000, 600 and 200.

Determine the EOQ.

SOLUTION

The EOQ is determined in Table 3.4.

Table 3.4 *Determination of Economic Order Quantity*

1. Cost of items purchased each year	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000	Rs 30,000
2. Order size (units)	6,000	3,000	2,000	1,200	1,000	600	200
3. Number of orders	1	2	3	5	6	10	30
4. Average inventory (units)	3,000	1,500	1,000	600	500	300	100
5. Total carrying cost	3,000	1,500	1,000	600	500	300	100
6. Total ordering costs	60	120	180	300	360	600	1,800
7. Total cost (carrying plus ordering cost)	3,060	1,620	1,180	900	860	900	1,900

Clearly, the EOQ is 1,000 units.

Working Notes

(i) Total carrying costs = Average inventory × Carrying cost per unit

(ii) Total ordering costs = Number of orders × Cost per order

Mathematical (Short-cut) Approach The economic order quantity can, using a short-cut method, be calculated by the following equation:

$$EOQ = \sqrt{\frac{2\,AB}{C}} \tag{3.1}$$

Where A = Usage unit for the inventory planning period (total inventory requirement in units)

B = Ordering cost per buying order*

C = Carrying cost per unit

EXAMPLE 3.5

Using the facts in Example 3.3, find out the EOQ by applying the short-cut mathematical approach.

SOLUTION

$$EOQ = \sqrt{\frac{2 \times 1{,}600 \times 50}{1}} = 400 \text{ units}$$

Limitations While using the EOQ model, it should be noted that it suffers from shortcomings which arise mainly due to the restrictive nature of the assumptions on which it is based. The important limitations are:

1. The assumption of a constant consumption/usage and the instantaneous replenishment of inventory are of doubtful validity. As discussed subsequently, deliveries from suppliers may be slower than expected for reasons beyond control. It is also possible that there may be unusual and unexpected demand for the stocks. To meet such contingencies, firms have to make provision by keeping additional inventories which are known as safety stocks.
2. Another weakness of the EOQ model is that the assumption of a known annual demand for inventories is open to question. There is the likelihood of a discrepancy between the actual and the expected demand leading to a wrong estimate of the economic order quantity.
3. In addition to the above, there are some computational problems involved. For instance, Equation 3.1 may give the EOQ in fractional figures, say, 232.5 units. A more difficult situation may occur with the use of the model in that the number of orders to be may turn out to be a fraction.

Reorder Point: Order Point Problem The EOQ technique determines the size of an order to acquire inventory so as to minimise the carrying as well as the ordering` costs. In other words, the EOQ provides an answer to the question: How much inventory should be ordered in one lot? Another important question pertaining to efficient inventory management is: When should the order to procure inventory be placed? This aspect of inventory management is covered under the order point problem.

The reorder point is stated in terms of the level of inventory at which an order should be placed for replenishing the current stock of inventory. In other words, reorder point may be defined as that level of inventory when a fresh order should be placed with the suppliers for procuring additional inventory equal to the economic order quantity. Although some sophisticated reorder point formulae are available, they are outside the scope of this book We have, therefore, used a simple formula to calculate the reorder point. It is based on the following assumptions: (i) Constant daily usage of inventory and (ii) Fixed lead time. In other words, the formula assumes a condition of certainty.

$$\text{The reorder point} = \text{Lead time in days} \times \text{Average daily usage of inventory} \tag{3.2}$$

The term, "lead time" refers to the time normally taken in receiving the delivery of inventory after placing orders with the suppliers. It covers the time span from the point when a decision to place an order for the procurement of inventory is made to the actual receipt of the inventory by the firm. In other words, the lead time consists of the number of days required by the suppliers to receive and process the order as well as the number of days during which the goods will be in transit from the supplier. The lead time may also be called the procurement time of inventory.

The average usage means the quantity of inventory consumed daily. We can, therefore, define reorder point *as that inventory level which should be equal to the consumption during the lead time*.

EXAMPLE 3.6

Suppose the average consumption (daily usage) of inventory of a firm is 5,000 units. The number of days required to receive the delivery of inventory after placing the order (lead, that is, processing and transit time) is 15 days. The reorder point = 5,000 units × 15 days = 75,000 units. The implication is that the firm should place an order for replenishing the stock of inventory as soon as the level reaches 75,000 units. The size of the order would obviously be equal to the EOQ.

Safety Stock The economic order quantity and the reorder point, as inventory management techniques, have been explained so as to keep the discussion simple, on the assumption of certainty conditions. That is, we had assumed: (i) Constant/fixed usage/requirement of inventory and (ii) Instantaneous replenishment of inventory. The assumptions are, however, of questionable validity in real world situations, that is, under conditions of uncertainty. For instance, the demand for inventory is likely to fluctuate from time to

time. In particular, at certain points of time the demand may exceed the anticipated level. In other words, a discrepancy between the assumed (anticipated/expected) and the actual usage rate of inventory is likely to occur in practice. Similarly, the receipt of the inventory from the suppliers may be delayed beyond the expected lead time. The delay may result from factors beyond control such as strikes, floods, transportation, and other bottlenecks. Thus, a firm would come across situations in which the actual usage of inventory is higher than the anticipated level, and/or the delivery of the inventory from the suppliers is delayed. Another way of saying the same thing is that the demand for inventory cannot be anticipated with certainty, that is, the likely demand for inventory is uncertain.

The effect of increased usage and/or slower delivery would be shortage of inventory. That is, the firm would disrupt production schedule and alienate the customers. The firm would, therefore, be well advised to keep a sufficient safety margin by having additional inventory to guard against stock-out situations. Such stocks are called safety stocks. This would act as a buffer/cushion against a possible shortage of inventory caused by either increased usage or delayed delivery of inventory. The safety stock may, thus, be defined as *minimum additional inventory to serve as safety margin/buffer/cushion to meet unanticipated increase in usage resulting from unusually high demand and/or uncontrollable late receipt of incoming inventory*.

Figure 3.8 has been drawn to show clearly the interrelationship that exists among various concepts of inventory discussed so far. It serves the useful purpose of presenting an integrated picture at one place. In the Figure, inventory of 400 units is delivered on Day 0. The company has the policy of maintaining a safety stock of 200 units. With the receipt of 400 units inventory on Day 0, the inventory level reaches 600 units (the maximum level). With the withdrawal of raw material inventory from the store at the rate of 40 units per day, the balance of inventory stock declines to 360 units after 6 days [600 units – (40 units × 6 days)]. This level is the reorder point. If delivery is on time, the next replenishment point is reached at Day 10. On the 10th day the company has a maximum level of stock of 600 units. If, however, inventory is not received in time, the company has a safety stock of five days to fall back upon.

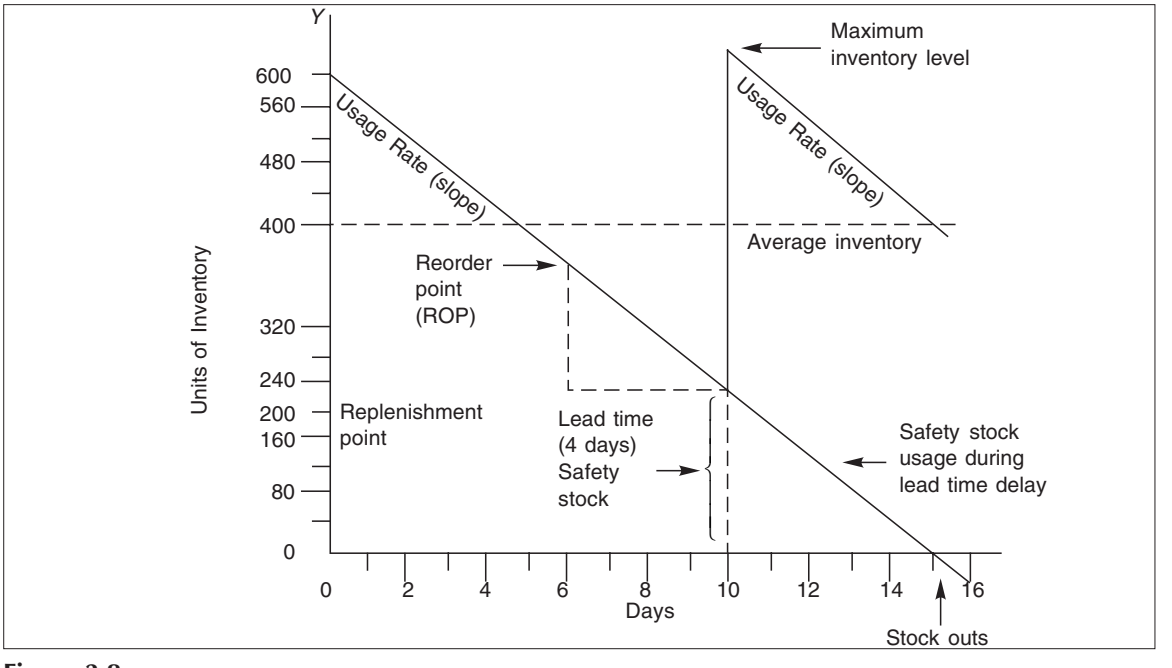


Figure 3.8

How can the decision-maker determine the safety stock? What is his responsibility? The safety stock involves two types of costs: (i) Stockout and (ii) Carrying costs. The job of the financial manager is to determine the appropriate level of safety stock on the basis of a trade-off between these two types of conflicting costs.

The term, 'stock-out-costs" refers to the cost associated with the shortage (stock-out) of inventory. It is, in fact, an opportunity cost in the sense that due to shortage of inventory the firm would be deprived of certain benefits. The denial of the benefits which would otherwise be available to the firm are the stock-out costs. The first, and the most obvious, of these costs is the loss of profits which the firm could have earned from increased sales if there was no shortage of inventory. Another category of stock-out costs is in terms of damage to relations with customers.[4] Since, due to shortage of inventory the firm would not be able to meet customer's requirements, the latter may turn to the firm's competitors. Of course, this type of cost cannot be easily and precisely quantified. The shortage of inventory may also disrupt the production schedule of the firm. The production process would grind to a halt, involving idle time.

The carrying costs are the costs associated with the maintenance of inventory. Since the firm is required to maintain additional inventory, in excess of the normal usage, additional carrying costs are involved.

The stock-out and the carrying costs are counterbalancing. The larger the safety stock, the larger the carrying costs and *vice versa*. Conversely, the larger the safety stock, the smaller the stock-out costs. In other words, if the firm minimises the carrying costs, the stock-out costs are likely to rise; on the other hand, attempt to minimise the stock-out costs imply increased carrying costs. The object of the financial managers should be to have the lowest total cost (carrying cost plus stock-out cost). The safety stock with the minimum carrying and stock-out costs is the economic (appropriate) level which financial managers should aim at. In brief, the appropriate level of the safety stock is determined by the trade-off between the stock-out and the carrying costs. We illustrate below, using a simple method,[5] the determination of the optimum (least cost) safety stock. Consider Example 3.7.

EXAMPLE 3.7

The experience of a firm of being out of stock is summarised below:

(A) *Stock-out (number of units)*	*Number of times*	
500	1	(1)
400	2	(2)
250	3	(3)
100	4	(4)
50	10	(10)
0	80	(80)
Total	100	(100)

Figures in brackets represent percentage of time the firm has been out of stock.

(B) Assume that the stock-out cost are Rs 40 per unit.

(C) The carrying cost of inventory per unit is Rs 20.

Determine the optimal level of stock-out inventory.

SOLUTION

Table 3.5 *Computation of Expected Stock-out Costs*

Safety stock level (units)	*Stock-out (units)*	*Stock-out costs (Rs 40 per unit)*	*Probability of stock-out*	*Expected stock-out cost [(3) × (4)]*	*Total expected stock-out cost*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
500	0	0	0	0	0
400	100	Rs 4,000	0.01	Rs 40	Rs 40
250	250	10,000	0.01	100	
	150	6,000	0.02	120	220
100	400	16,000	0.01	160	
	300	12,000	0.02	240	
	150	6,000	0.03	180	580
50	450	18,000	0.01	180	
	350	14,000	0.02	280	
	200	8,000	0.03	240	
	50	2,000	0.04	80	780
0	500	20,000	0.01	200	
	400	16,000	0.02	320	
	250	10,000	0.03	300	
	100	4,000	0.04	160	
	50	2,000	0.10	200	1,180

Working Notes

(i) The determination of the optimum safety stock involves dealing with uncertain demand. The first step, therefore, is to estimate the size of stock-out in terms of the shortage of inventory at different levels of safety stock as well as the probability of being out of stock.

Size of stock-out (units): The shortage of inventory at different levels of safety stock can be computed as follows:

(a) Assuming the firm's experience has been that it has been short of inventory by 500 units only once in 100 times. If, therefore, the level of safety stock is 500 units, it will never be short of inventory. It means that with 500 units of safety stock, the size of stock-out would be zero.

(b) When the firm has a safety stock of 400 units, it could be short by 100 units.

(c) Further, with 250 units of safety stock, the firm could be short by 250 units if the actual demand turns out to be 500 units greater than expected; 150 units short, if the demand turns out to be 400 units greater than the expected. Thus, the size of stock-out could be 250 units or 150 units depending upon the level of actual demand.

(d) It should be obvious that the size of stock-out increases with a decrease in the level of safety stock. The size of the stock-out for safety stock levels of 100 units, 50 units and 0 units can be computed on the lines of step (c) above.

The stock-out size at a different safety stock levels is computed in column (2) of Table 3.5.

Probability of stock-out: The probability of stock-out at different levels of safety stock can be computed as follows:

(a) If the safety stock of the firm is 500 units, there is no chance of the firm being out of stock. The probability of stock-out is, therefore, zero.

(b) When the safety stock is 400 units, there is 1 per cent chance that the firm will be short of inventory. The probability of stock-out is, therefore, 0.01.

(c) The probability of stock-out for other levels of safety stock is similarly computed in column 4 of Table 3.5.

(ii) After the determination of the size and probability of stock-out, the next step is the calculation of the stock-out cost. The stock-out cost can be found out by multiplying the stock-out by the stock-out cost per unit and the probability of stock-out cost.

When the stock-out is expected to be 100 units (safety stock being 400 units), the stock-out cost would be 100 × Rs 40 = Rs 4,000. But the probability of stock-out of this size is only 0.01. Therefore, the expected stock out cost would be Rs 4,000 × 0.01 = Rs 40. For other levels of safety stock, the stock-out cost can be similarly computed (column 5 of Table 3.5).

(iii) The next step is to compute the total expected stock-out costs (column 6 of Table 3.5).

(iv) Then, the carrying costs should be calculated. The carrying costs are equal to the safety stock multiplied by the carrying costs per unit (column 3 of Table 3.5).

(v) Finally, the carrying costs and the expected stock-out costs at each safety stock level should be added (column 4 of Table 3.5). The optimum safety stock would be that level of inventory at which the total of these two costs is the lowest. This is shown in Table 3.6.

Table 3.6 *Computation of Total Safety Stock Costs*

Safety stock level (units) *(1)*	*Expected stock-out costs** *(2)*	*Carrying costs (Rs 20 per unit)* *(3)*	*Total safety stock cost (2+3)* *(4)*
0	Rs 1,180	Rs 0	Rs 1,180
50	780	1,000	1,780
100	580	2,000	2,580
250	220	5,000	5,220
400	40	8,000	8,040
500	0	10,000	10,000

*From Table 3.5 column 6.

Thus, the optimum safety stock is zero unit.

COST OF INVENTORY AND COSTING METHODS

This section presents and evaluates the alternative practices and policies to measure the cost of inventory. We first discuss what is included in the cost of inventory. This is followed by a discussion of the inventory costing methods. In the light of the requirements of management, an evaluation of these methods is also presented.

Cost of Inventory

The cost of inventory may be said to be composed of two elements: (i) Inventory quantities determined on the basis of either physical count or perpetual inventory records and (ii) Unit cost. In other words, inventory value/cost can be found out by multiplying physical quantity of inventory by unit cost/cost per unit. The physical quantity can be determined from the cost accounting records. The term *unit* cost merits some elaboration.

In general, the basis of inventory valuation is the "lower of cost or market" or more appropriately "the lower of actual cost or replacement cost." Although replacement costs can be estimated for interim periods, and adjustments made later on to reflect the conditions at the close of the year, the market value can be known with certainty only at the close of the accounting period.

As regards the actual cost, there are several elements associated with it. They are: (i) Invoice cost, (ii) Freight charges and costs of buying, receiving and storing, and (iii) Discounts-trade/quantity as well as cash. In valuing inventory, management has to decide which of these should be included to determine the actual cost.

In theory, all the costs which are necessary to acquire the materials and to put them in a position where they are ready to be used should be considered in valuing inventory. It can, therefore, be argued on theoretical grounds that in addition to the invoice cost, the other two components are also relevant. In other words, the value of inventory should consist of invoice cost net of all discounts plus appropriate portions of the cost of freight, buying, receiving, and storing.

However, there are practical difficulties in computing unit cost on the basis of the theoretical ideal. For instance, appropriate portions of the cost of buying, receiving, and storing are exceedingly difficult to determine. Similar difficulties may sometimes be countered with identifying the relevant freight costs. On the contrary, the inclusion of discounts also does not seem to be very appropriate. The trade and quantity discounts exist for the purpose of defining the true invoice cost of the material. Cash discounts are considered as a reward for early payment (absence of such discounts may signify as penalty for late payment). The reward can be interpreted as income while the penalty can be interpreted as a loss rather than a part of unit cost.

Thus, items like freight, cost of storing, and discount are amenable to different treatments depending on facts and circumstances. However, whichever way they are treated, the firm should consistently follow the practice.

Methods of Inventory Costing/Pricing of Materials Issued

There are a number of generally accepted methods of determining the cost of inventories at the close of the accounting period. As already observed, our interest in discussing these methods is to identify a suitable method as a basis of inventory valuation. The selection of a suitable method assumes significance in view of the fact that it has a direct bearing on the cost of goods sold and consequently on profit. Therefore, the method should be selected in the light of the probable effects on profits over a period of years.[6] The discussion here of the methods to value inventory should, therefore, be viewed in this perspective.

First In First Out (FIFO) Method The calculation of inventory according to the FIFO method is illustrated in Table 3.7.

Table 3.7 *Inventory Valuation (FIFO Method)*

Date	*Receipts*			*Issues*			*Inventory*		
	Quantity (1)	*Cost (2)*	*Value (3)*	*Quantity (4)*	*Cost (5)*	*Value (6)*	*Quantity (7)*	*Cost (8)*	*Value (9)*
January									
1							10,000	Rs 2.10	Rs 21,000
9	1,000	Rs 2.21	Rs 2,210				11,000	—	23,210
12				2,000	Rs 2.10	Rs 4,200	9,000	—	19,010
27	1,000	2.31	2,310				10,000	—	21,320
February									
10				4,000	2.10	8,400	6,000		12,920
16	2,000	2.41	4,820				8,000	—	17,740
March									
3	2,000	2.41	4,820				10,000	—	22,560
17				4,000	2.10	8,400	6,000	—	14,160
29	4,000	2.29	9,160				10,000	—	23,320
April									
4	2,000	2.14	4,280				12,000	—	27,600
18				4,000	@	9,340	8,000	—	18,260
23	2,000	2.04	4,080				10,000	—	22,340
May									
12				1,000	2.40	2,400	9,000	—	19,940
24	3,000	2.00	6,000				12,000	—	25,940
June									
10				1,000	2.40	2,400	11,000	—	23,540
30	2,000	2.02	4,040				13,000	—	27,580
Total	19,000	2.19	41,700	16,000		35,140			

@ 1,000	2.21	2,210
1,000	2.31	2,310
2,000	2.41	4,820
4,000	—	9,340

The FIFO method of valuation of inventory is based on theassumption that the inventory is consumed in chronological order, that is, those received first are issued/consumed first and value fixed accordingly. It can be seen from Table 3.7 that with an opening inventory of 10,000 units at Rs 2.10, the first 10,000 units issued/consumed are charged to the cost of goods sold at this opening inventory rate (Rs 2.10). The April 18 issue or consignment of 4,000 units is costed on the basis of the first receipts of the year: January 9, 1,000 units at Rs 2.21, January 27,1,000 units at Rs 2.31, and February 16,2,000 units at Rs 2.41. The 1,000 each issued on May 12 and June 10 are costed on the basis of the 2,000 received on March 3. Therefore, the cost of the 13,000 inventory on June 30 is composed of the receipts of March 29, April 4 and 23, May 24 and June 30 and the value is the sum of the costs of these receipts.

Average Cost Method According to the average cost method, each purchase is added to inventory and an average cost determined. Materials are charged into cost of sales at this average until another lot is received, when a new average unit inventory cost is calculated. Using the basic data contained in Table 3.7, the average cost of inventroy is calculated in Table 3.8.

Table 3.8 *Inventory Valuation (Average Cost Method)*

Date	*Receipts*			*Issues*			*Inventory*		
	Quantity (1)	*Cost* (2)*	*Value (3)*	*Quantity (4)*	*Cost** (5)*	*Value (6)*	*Quantity (7)*	*Cost** (8)*	*Value (9)*
January									
1							10,000	Rs 2.10	Rs 21,000
9	1,000	Rs 2.21	Rs 2,210				11,000	2.11	23,210
12				2,000	Rs 2.11	Rs 4,220	9,000	2.11	18,990
27	1,000	2.31	2,310				10,000	2.13	21,300
February									
10				4,000	2.13	8,520	6,000	2.13	12,780
16	2,000	2.41	4,820				8,000	2.20	17,600
March									
3	2,000	2.40	4,800				10,000	2.24	22,400
17				4,000	2.24	8,960	6,000	2.24	13,440
29	4,000	2.29	9,160				10,000	2.26	22,600
April									
4	2,000	2.14	4,280				12,000	2.24	26,880
18				4,000	2.24	8,960	8,000	2.24	17,920
23	2,000	2.04	4,080				10,000	2.20	22,000
May									
12				1,000	2.20	2,200	9,000	2.20	19,800
24	3,000	2.00	6,000				12,000	2.15	25,800
June									
10				1,000	2.15	2,150	11,000	2.15	23,650
30	2,000	2.02	4,040				13,000	2.13	27,690
Total	19,000		41,700	16,000		35,010			

* Actual

** Average

Last In First Out (LIFO) Method As discussed above, under the FIFO as well as the average cost methods, it is possible to calculate the cost of sales each month, and at the same time determine a known inventory cost rate for the succeeding period(s). Under the LIFO method, on the other hand, the cost of goods sold and the value of closing inventory can be determined only after the final lot of the year has been received. This is because of the assumption underlying the valuation of inventory, according to this method. As the name LIFO suggests, the use of inventory is valued on the basis of the inverse sequence of receipts. The calculations of the value of inventory on the basis of this method are illustrated in Table 3.9.

Table 3.9 *Inventory Valuation (LIFO Method)*

	Quantity	*Cost*		*Value*
PART A				
Straight LIFO:				
Inventory (Janaury 1)	10,000	Rs 2.10	—	Rs 21,000
Receipts	19,000	—	—	41,700
Total	29,000	—	—	62,700

(*Contd.*)

(*Contd.*)

Inventory (June 30)		13,000			
Inventory (Janaury 1)	10,000	—	2.10	21,000	
Receipts (Janaury 9)	1,000	—	2.21	2,210	
(Janaury 27)	1,000	—	2.31	2,310	
(February 16)	1,000	—	2.41	2,410	
	13,000				27,930
Cost of inventory issued		16,000			34,770
PART B					
Additions at average cost:					
Inventory (January 1)		10,000	2,10		21,000
Receipts		19,000	2,19		41,700
Total		29,000			62,700
Inventory (June 30)		13,000			
Inventory (January 1)	10,000	—	2.10	21,000	
Added Inventory	3,000	—	2,19	6,585	
	13,000	—			27,585
Cost of inventory issued		16,000			35,115
PART C					
Additional at FIFO cost:					
Inventory (Janaury 1)	—	10,000	2.10		21,000
Receipts	—	19,000	—		41,700
Total —		29,000	—		62,700
Inventory (June 30)	—	13,000			
Inventory (January 1)	10,000	—	2.10	21,000	
Receipts (June 30)	2,000	—	2.02	4,040	
Receipts (May 24)	1,000	—	2.00	2,000	
	13,000	—	—	—	27,040
Cost of inventory issued		16,000			35,660

As can be seen from Table 3.9, LIFO method has three variations which are shown in parts A, B, and C respectively of the table. Under the first of these, namely, the straight LIFO method (Part A), the costs to addition to inventory in any year are the cost of the first equivalent quantity of purchases of the year. Under the second (Part B), the costs of the additions in taken at the average cost of the year. Under the third variations (Part C), the costs of the additions in any year are the costs of the last equivalent quantity or purchases in the year. In other words, additions to a LIFO inventory can be valued at FIFO cost, average cost, or LIFO cost.

However, regardless of the variation of the LIFO method used for costing additions to inventory in any one year, the years are on a straight LIFO basis regarding additions and reductions. Thus, the cost used for valuation in the first year in the LIFO method is the cost used for that quantity in every year so long as the quantity at the close of any year is not less than the original quantity. Cost of additions in a year as determined by the method selected (FIFO, Average, or LIFO for the year), is also used year after year so long as that quantity plus the original quantity remain on inventory. Reductions in inventory result in the elimination of the additions of the most recent year, and from there on back into the original quantity, if the inventory drops that far. Table 3.10 shows closing inventories for six years. As the quantities on hand at the close of the year increased in the first and second years, they were costed at the applicable rate for the respective year. In the third year, the reduciton in quantities removed the additions of the second year and 1,000 those of the first year. In the fourth year, quantities increased, and the increase was costed on the basis

of the cost of that year. In the fifth year, a substantial reduction in quantities took out the fourth and the first year's additions and 1,000 of the original quantity. LIFO costs of these passed out of the picture with this reduction, and in the sixth year the increase over the fifth year was costed on the basis of acquisitons in the sixth year.

Table 3.10 *Inventory Valuation (LIFO Method—6 Years)*

	Quantity	*Rate*	*Value*
Opening inventory at cost—first year'	10,000	Rs 2.10	Rs 21,000
Closing inventory:			
First year—opening inventory	10,000	2.10	21,000
First year's additions	3,000	2.31	6,930
Total	13,000	—	27,930
Second year—first year's opening	10,000	2.10	21,000
First year's additions	3,000	2.31	6,930
Second year's additions	2,000	2.20	4,400
Total	15,000	—	32,330
Third year—first year's opening	10,000	2.10	21,000
First year's additions	2,000	2.31	4,620
Total	12,000	—	25,620
Fourth year—first year's opening	10,000	2.10	21,000
First year's additions	2,000	2.31	4,620
Fourth year's additions	1,000	2.50	2,500
Total	13,000	—	28,120
Fifth year—remainder of first year's opening	9,000	2.10	18,900
Sixth year—remainder of first year's opening	9,000	2.10	18,900
Sixth year's additions	1,000	2.60	2,600
Total	10,000	—	21,500

Specific Identification/Actual Cost Method Under this method, the materials issued are priced at their actual cost which involves identification of each lot purchased. It is the simplest but also the most time-consuming method of determining cost of materials used and cost of the ending inventory. It entails keeping a record of the purchase price of each specific unit and the quantity of specific units used. Cost of material used is computed by multiplying the quantity used by the specific price of each material. In many cases, when materials are purchased, a tag showing the price is attached in order to identify them. This method may be usefully applied if purchase prices are fairly stable and material is readily identifiable.

Base Stock Prices Method The base stock refers to the minimum quantity of stock of materials that a firm has to maintain at all times. Under this method, it is assumed that the minimum stock which must always be carried is in the nature of fixed assets, and is never realised while the business continues. The minimum stock is carried at original cost of acquisition. The quantity of materials in excess of the base stock is available for production, while the base stock is used only in case of emergency. The excess is priced in conjunction with one of the other methods such as FIFO or LIFO. Thus, this method cannot be used idependently. Moreover, estimation of base stock may be difficult. It can be used in industries having relatively long processing period, and where the cost of finished product is largely made up of basic raw materials such as crude oil, hides and so on.

Standard Price Method This method of pricing issues is based on a standard price for a specified period. A standard price is fixed for each class of materials in advance after proper investigation. The method is suitable where standard costing is relevant. The difference between actual price and standad price is transferred to purchase price variance which reveals to what extent actual costs are different from standard material cost. This method is simple to operate and provides stability in costing system. However, standard price/cost does not often reflect actual/expected cost but only a notional cost/generalised target. The stock value does not show actual cost incurrence and, therefore, does not necessarily conform to acceptable principles of stock valuation.

Replacement/Market Price Method Under this method, materials are issued at the price at which they can be replaced, that is, at the market price prevailing on the date of issue. This method could be applied principally to materials purchased in advance for use in large quantities, in anticipation of economic/profitable use, or in such items of stores which are either obsolete or are lying unused for a long time in store. It reflects current cost of production and may be useful in such cases where quotations based on competitive market prices of materials are sent. However, it may be difficult to ascertain current price of each item of material at the time of issue. It is also not based on actual cost incurred and, therefore, may add confusion and complications in cost accounting.

Choice of a Method We now attempt to select an appropriate method. First, the implications of the different methods from the viewpoint of cost, and consequently their impact on profits, are analysed. The factors which are responsible for the differences among the methods in so far as their impact on cost flows and profits is concerned, are then ideitnfied. Finally, the suitability of the different methods to value inventory is examined. The Institute of Chartered Accountants of India issued in 1999 fresh accounting standad for inventory valuation. Our focus here is, therefore on the relative suitability of FIFO, LIFO, and Average methods.

Implications of Different Inventory Valuation Methods As stated earlier, inventory is, from the accounting point of view, included in the profit and loss account/income statement as cost of goods sold, and in the balance sheet as inventory on the assets side. The different methods of valuing inventory will have their impact on the flow of cost through the balance sheet into the profit and loss account. If, therefore, different methods to value inventory produce differing inventory values, they will also show differing amounts of cost of goods sold which will inevitably affect the profits. The implications of different methods of valuing inventory, in other words, is that depending upon the method selected, the amount of profit as shown by the profit and loss account will be different. From the viewpoint of income determination, thus, the choice of an appropriate method assumes significance. The impact of the various methods on profits through threir impact on the flow of cost for the data contained in Tables 3.7 through 3.10 is illustrated in Table 3.11.

Table 3.11 *Impact of Inventory Valuation on Cost Flows/Profits*

			LIFO with additions at		
	FIFO	*Average cost*	*LIFO*	*Average*	*FIFO*
Beginning inventory	Rs 21,000	Rs 21,000	Rs 21,000	Rs 21,000	Rs 21,000
Add: Receipts	41,700	41,700	41,700	41,700	41,700
Total	62,700	62,700	62,700	62,700	62,700
Deduct: Ending inventory	27,560	27,690	27,930	27,585	27,040
Materials put into process	35,140	35,010	34,770	35,115	35,660

It is clear from the table that each method produces a different figure for the transfer of raw materials to work-in-process. Ultimately, when the goods are sold, the varying methods of inventory valuation will have their impact on cost of goods sold and, thus, on profits.

Causes of Differences The exclusive reason for the difference in cost and profit according to the different inventory valuation methods is the changing purchase price or unit cost. If the purchase prices do not change at all or remain stable, all the inventory valuation methods will produce identical cost and profit figures. To elaborate, let us assume the following facts about the purchase of materials by a hypothetical firm.

Date of purchase	*Units acquired*	*Unit cost (stable price)*	*Unit cost (rising price)*	*Unit cost (falling price)*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
January 1	2	Rs 1	Rs 1.00	Rs 1.00
15	4	1	1.02	0.97
31	3	1	1.05	0.94

If the inventory on January 31 consists of two units, the inventory values and cost flows for each-inventory method, assuming no beginning inventory, are presented in Table 3.12.

Table 3.12 *Cost Flows Under Different Assumptions of Price Levels*

	FIFO	*Average*	*LIFO*
(C) *Stable price level*			
Ending inventory (2 units)	Rs 2.00	Rs 2.00	Rs 2.00
Materials put in process (7 units)	7.00	7.00	7.00
(B) *Rising price level*:			
Ending inventory (2 units)	2.10	2.05	2.00
Materials in process (7 units)	7.13	7.18	7.23
(C) *Falling price level*			
Ending inventory (2 units)	1.88	1.94	2.00
Materials in process (7 units)	6.82	6.76	6.70

The conclusions emerging from Table 3.12 are:

1. When prices are stable, all inventory valuation methods give the same figure of cost.
2. When prices are rising, the LIFO produces the highest cost flow and the lowest inventory. The FIFO has exactly the opposite effect.
3. When prices are falling, the LIFO method produces the lowest cost and the highest inventory. The impact of FIFO is exactly opposite.
4. Thus, the LIFO and the FIFO methods are extremes and the average methods falls in between.

Evaluation There is no one best method of inventory valuation. The three methods—FIFO, Average and LIFO—are suitable under different circumstances. As already observed, different methods affect the income determination (profit and loss account) and asset measurement (balance sheet). The discussion of the choice of a suitable method here is accordingly divided into two parts: The implications (i) On income determination and (ii) On asset measurement.

Income Determination

FIFO Method The FIFO method is based on an assumption regarding the physical flow of materials. As observed earlier, the implicit physical flow is the chronological order, that is, materials which are purchased/received first are consumed/issued/sold first. This assumption of the pattern of flow of materials closely approximates a theoretically sound method of inventory valuation, namely, *specific identification*. The term, "specific identification," means that the units in inventory should be identified with the specific unit costs to which they apply. The merit of the FIFO method is that the physical flow of materials match the flow of cost.[7]

LIFO Method The LIFO method cannot be justified on the basis of the physical flow of materials. The justification of this method is based on *cost flow*. Under conditions of changing prices, the LIFO method matches costs and revenues. Since the LIFO method assumes that the latest item in, is the first item out, the current cost of materials are matched with the current selling price/current revenues. *This matching of current costs with current revenues is the essence of the argument for the LIFO method.*

Average Method The average method is mid-way between FIFO and LIFO. The justification for the average method has two aspects. First, it differs from the FIFO and LIFO methods in respect of the physical flow of the materials. While the FIFO fits a first-in-first-out system and the LIFO fits a last-in-first-out (current cost) system, the average method fits a system, which has no specific pattern of physical flow. Therefore, where the units in inventory are identical, interchangeable and do not follow any specific pattern of physical flow, the average cost system would be appropriate. But such a situation is more imaginary than real. It provides no justification for the appropriateness of the average cost method. The second aspect is that it is a statistical technique. As an averaging technique, it can balance the effect of changes in purchase price on inventories and cost of materials put into prices, and ultimately in the cost of goods sold.

In brief, there is not one best method to value inventories. The method chosen should fit a particular situation. In case of a physical flow pattern, the FIFO method may be appropriate. The lack of a clearly identifiable physical flow pattern may justify the use of the Average method. The relevance of cost flows, as distinct from physical flows, particularly in periods of changing prices, would warrant the use of the LIFO method.

Asset Measurement We now highlight the effect of these methods on the inventory value to be shown in the balance sheet.

FIFO Method Under this method, as noted earlier, inventory is valued on the assumption of chronological cost flow. This implies that the unused/unsold inventory consists of the most recent purchases and, therefore, can be assumed to be valued at current cost. The value of inventory as shown in the balance sheet would reflect the *current cost*, if the FIFO method is used.

LIFO Method According to this method, obviously, the inventory figure would *not* appear in the balance sheet at the *current cost*. It will reflect rather the cost of raw materials purchased in the past year. Assuming rising prices, the inventory value based on the LIFO method would tend to be *undervalued* (Table 3.10). It can be seen from the table that inventory (not in physical terms but for purposes of costing) may consist of inventory purchased as early as six years or more. In that situation, the inventory figure included in the balance sheet would be actually the price paid on the purchase of inventory six years ago. In a period of rising prices, this value would naturally be grossly out of line with the currently prevailing price. This would

imply that the balance sheet will not reflect the current worth of the inventory. That the inventory value will not be correct is another way of saying that the balance sheet will present a distorted picture of the affairs of the firms.

A possible solution to correct the above distortion in the balance sheet implicit in the *under-valuation* of inventory with the LIFO method is a modified/adjusted LIFO method. According to the latter, inventory should be shown in the balance sheet in two parts: (i) As usual and (ii) The current cost should be shown in the *inner* column. To illustrate, the inventory data contained in Table 3.10 would appear in the balance sheet (sixth year) as follows:

Balance Sheet	
Inventory(Current cost, Rs 26,000)	Rs 21,500

The modified LIFO method will, thus, serve the needs of correct income determination as well as correct asset measurement. However, this is subject to a qualification, namely, the current year's purchases (units) should exceed the current year's consumption (units). If for reasons such as strike/lockouts, transportation problems, and so on, the current consumption exceeds the current purchases, profits will rise. The increase will depend upon the extent of liquidation of the previous years' inventory. This increase in profit is termed as *liquidation profit*,[8] which is equal to the difference between the current cost of the inventory and the cost of the inventory purchased in the past. The computation of liquidation profit on the basis of data from Table 3.5 is illustrated in Table 3.13 (assuming current cost at the end of the fifth year is Rs 250).

Table 3.13 *Liquidation Profit*

	Cost			*Units*	*Liquidation*
	Current	*Past/Old*	*Difference*		*Profit (3 × 4)*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
First year's opening inventory	Rs 2.60	Rs 2.10	Rs 0.50	1,000	Rs 500
First year's inventory	2.60	2.31	0.29	2,000	580
Fourth year's inventory	2.60	2.50	0.10	1,000	100
Total					1,180

The reporting of the liquidation profit separately from the operating profit would be found useful by management for a comparison of profits over a period of time. An additional advantage of such a policy would be that tax payment would be deferred by the firm, which will ultimately result in lower tax incidence due to time value of money.

SUMMARY

- Materials are the basic input that are transformed into finished goods in the production process. Materials costs based on relationship with finished goods, can be broken down into direct and indirect costs.
- Accounting for materials in a manufacturing company usually involves two activities: purchase of materials (requiring a purchase requisition, purchase order, and receiving report) and the issue of materials requiring a materials requisition form.
- Materials may be entered into accounting records under either the periodic or the perpetual system. The periodic system is relatively simple and does not maintain a continuous record of the large

volume of materials issued. In contrast, under the perpetual system, the cost of materials is determined as the material are placed in production.

- The first step in the inventory planning/control process is the classification of different types of inventory to determine the type and degree of control required for each. The ABC system is a widely-used classification technique for the purpose. On the basis of the cost involved, the various items are classified into three categories: (i) **A**, consisting of items with the largest investment, (ii) **C**, with relatively small investments, but fairly large number of items, and (iii) **B**, which stands mid-way between category A and C. Category A needs the most rigorous control, C requires minimum attention, and B deserves less attention than A but more than C.
- The second key inventory problem relates to determination of the size/quantity of inventory which would be acquired. This is the order quantity problem. The economic order quantity, or economic lot size (EOQ) is that level of inventory order which minimises the total cost associated with inventory management. Stated with reference to cost perspective, EOQ refers to the level of inventory at which the total cost of inventory comprising (i) order/setup cost, and (ii) carrying costs is the minimum.
  Symbolically,

$$\text{EOQ} = \sqrt{2\,\text{AB/C}}$$

  where A = Annual usage of inventory in units, B = Buying cost per order, C = Carrying cost per unit per year
- Yet another important question relating to inventory planning and control is: When should the order to procure inventory be placed? It is what is called the order point problem. The re-order point is that level of inventory when a fresh order should be placed with suppliers to procure additional inventory equal to the EOQ. It is that inventory level which is equal to the consumption during the lead time or procurement time.
  Re-order level = (Daily usage × Lead time) + Safety stock
  Minimum level = Re-order level – (Normal usage × Average delivery time)
  Maximum level = Reorder level – (Minimum usage × Maximum delivery time) + Re-order quantity
  Average stock level = Minimum level + (Re-order quantity)/2
  Danger level = (Average consumption per day × Lead time in days for emergency purchases)
- The safety stock are the minimum additional inventory which serve as a safety margin to meet an unanticipated increase in usage. This increase may be due to an usually high demand or because of uncontrollable late receipt of incoming inventory. The following steps are involved in determining the level of safety stocks:
  (i) The first step is to estimate the probability of being out of stock, as well as the size of stock-out in terms of the shortage of inventory at different levels of safety stock.
  (ii) After the determination of the size and probability of stock-out, the next step is the calculation of the stock-out cost. The stock-out cost can be found out by multiplying the stock-out by the cost per unit, and the probability of stock-out.
  (iii) Then, the carrying cost should be calculated. The carrying cost are equal to the safety stock multiplied by the carrying costs per unit.
  (iv) Finally, the carrying costs and the expected stock-out costs at each safety level should be added. The optimum safety stock would be that level of inventory at which the total of these two costs is the lowest.
- The proper costing of inventory is important from the point of view of the income determination and asset measurement. The important inventory costing methods are: FIFO, Weighted Average, LIFO

and Inflated Cost Method. The FIFO method *assumes* that the inventory is consumed in chronological order, that is, items received first are deemed to have been issued/consumed first and priced accordingly. The LIFO method is based on the *assumption* that the cost of inventory is computed on the basis of the inverse sequence of receipts. According to the Weighted Average Method, the weighted average price of purchases and inventory is taken as the basis for determining the cost of the inventory. The Inflated Cost Method takes into account normal material losses caused due to transportation, material handling and storage losses.

➔ The implication of different inventory costing method is: (i) When prices are stable, all inventory valuation methods give the same figure of cost, (ii) when prices are rising, the LIFO produces the highest cost flow and the lowest inventory, (iii) When prices are falling, the LIFO method produces the lowest cost and the highest inventory. The impact of FIFO is exactly opposite, and (iv) the LIFO and the FIFO methods are extremes and the weighted average method falls in between.

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SOLVED PROBLEMS

P.3.1 If the price of the material is Rs 15 per unit and the annual consumption is 4,000 units, the interest and storekeeping charges are 20 per cent of the value and the cost of placing of an order and receiving the goods is Rs 60, how much material should be ordered at one time?

SOLUTION

$$EOQ = \sqrt{\frac{2\,AB}{C}}$$

Where A = Annual usage of inventory (in units)
B = Ordering cost per buying order
C = Carrying cost per unit

$$\text{EOQ} = \sqrt{\frac{2 \times 4{,}000 \times 60}{3}} = 400 \text{ units.}$$

400 units should be ordered at one time.

Working Notes

$$\text{Total carrying cost} = \frac{4{,}000 \times \text{Rs } 15 \times 20}{100} = \text{Rs } 12{,}000$$

$$\text{Carrying cost per unit} = \frac{\text{Rs } 12{,}000}{4{,}000 \text{ units}} = \text{Rs } 3$$

P.3.2 Two components, A and B are used as follows:

Normal usage	:	50 units each per week
Minimum usage	:	25 units each per week
Maximum usage	:	75 units each per week
Re-order quantity	:	A: 300 units; B: 500 units
Re-order period	:	A: 4 to 6 weeks; B: 2 to 4 weeks

Calculate for each component: (a) Re-order level, (b) Minimum level, (c) Maximum level, and (d) Average stock level.

SOLUTION

(a) *Re-order level* = (Maximum usage × Maximum delivery time)

A = 75 × 6 weeks = 450 units

B = 75 × 4 weeks = 300 units

(b) *Minimum level* = Re-order level – (Normal usage × Average delivery time in weeks)

A = 450 units – (50 units × 5 weeks) = 200 units

B = 300 units – (50 units × 3 weeks) = 150 units

(c) *Maximum level* = Re-order level – (Minimum usage × Minimum delivery time) + Re-order quantity

A = 450 units – (25 × 4) + 300 units = 650 units

B = 300 units – (25 × 2) + 500 units = 750 units

(d) (i) Average stock level = Minimum level + (Re-order quantity)/2

A = 200 + (300)/2 = 350 units

B = 150 + (500/2) = 400 units

(ii) (Minimum level + Maximum level)/2

A = (200 + 650)/2 = 425 units

B = (150 + 500)/2 = 325 units

P.3.3 The following information pertaining to a firm are available:

Annual consumption	12,000 units (360 days)
Cost per unit	Re 1
Cost per order	12
Inventory carrying cost (%)	20
Lead time (maximum, normal and minimum) (days)	30-15-5
Daily consumption: (maximum, normal and minimum) (units)	45-33-15

Calculate inventory levels.

SOLUTION

(a) *Economic-order quantity* $= \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 12{,}000 \times \text{Rs } 12}{0.20}} = 1{,}200$ units

$$\text{Carrying cost per unit} = \left(\frac{\text{Rs } 12{,}000 \times 0.2}{12000 \text{ units}}\right) = \text{Rs } 0.20$$

(b) Re-order level = (Maximum usage × Maximum delivery time) = 45 units × 30 days = 1,350 units

(c) Minimum level = Re-order level – (Normal usage × Average delivery time in days)
= 1,350 units – (33 units × 15 days) = 855 units

(d) Maximum Level = Re-order level – (Minimum usage × Minimum delivery time) + Re-order quantity
= 1,350 units – (15 units × 5 days) + 1,200 units
= 1,350 units – 75 units + 1,200 units = 2,475 units

(e) (i) Average stock level = Minimum level + (Re-order quantity)/2 = 855 units + 600 = 1,455 units
(ii) (Minimum level + Maximum level)/2 = (855 units + 2,475 units)/2 = 1,665 units

P.3.4 Peekay Company Ltd has been buying a given item in lots of 1,200 units which is a six months' supply, the cost per unit is Rs 12, order cost is Rs 8 per order, and carrying cost is 25 per cent. You are required to calculate the savings per year by buying in economical lot quantities.

SOLUTION

EOQ = $\sqrt{2\,AB/C}\ \sqrt{(2 \times 2{,}400 \times 8)/3} = 114$ units

Total carrying cost = 2,400 × Rs 12 × 25/100 = Rs 7,200

Carrying cost per unit (C) = 7,200 ÷ 2,400 units = Rs 3

Savings due to EOQ:

	Present	*With EOQ*
1. Size of order (units)	1,200	114
2. Number of order	2	22
3. Cost per order	Rs 8	Rs 8
4. Total ordering cost (2 × 3)	16	176
5. Carrying cost per unit	3	3
6. Average inventory (units)	600 (1,200 ÷ 2)	57 (114 ÷ 2)
7. Total carrying cost (5 × 6)	1,800	171
8. Total cost (4 + 7)	1,816	347
Differential costs (savings)	Rs 1,469	

P.3.5 Ganges Pump Company Ltd. uses about 75,000 valves per year and the usage is fairly constant at 6,250 per month. The valve cost of Rs 1.50 per unit when bought in large quantities, and the carrying cost is estimated to be 20 per cent of average inventory investment on an annual basis. The cost to place an order and process the delivery is Rs 18.

It takes 45 days to receive delivery from the date of an order and a safety stock of 3,250 valves is desired.

You are required to determine: (i) The most economical order quantity and frequency of orders, (ii) The order point, and (iii) The most economical order quantity if the valves cost Rs 4.50 each instead of Rs 1.50 each.

SOLUTION

EOQ = $\sqrt{2\,AB/C} = \sqrt{(2 \times 75{,}000 \times 18)/0.30} = 3{,}000$ units

Working Notes

(i) *Total carrying cost* = (75,000 × Rs 1.50 × 20) ÷ 100 = Rs 22,500
Carrying cost per unit = Rs 22,500/75,000 = Rs 0.30 per unit

(ii) Order point (Lead time × normal usage during lead time) + safety stock
(1.5 months × 6,250 units per month) + 3,250 units = 12,625 units.

(iii) *EOQ when cost per valve is Rs 4.50:* = $\sqrt{2\,AB/C} = \sqrt{(2 \times 75{,}000 \times \text{Rs}\,18)/\text{Rs}\,0.90}$ =1,733 units
Total carrying cost = (75,000 × Rs 4.50 × 20) ÷ 100 = Rs 67,500
Carrying cost per unit = Rs 67,500/75,000 = Rs 0.90

P.3.6 Precision Engineering Factory Ltd consumes 50,000 units of a component per year. The ordering, receiving and handling cost are Rs 3 per order while the trucking costs are Rs 12 per order. Further details are as follows: deterioration and obsolescence cost, Rs 0.004 per unit per year; storage cost, Rs 1,000 per year for 50,000 units. Interest cost is Rs 0.06 per unit per year. Calculate the economic order quantity.

$$\text{EOQ} = \sqrt{2\,AB/C} = \sqrt{2 \times 50{,}000 \times 15/0.084} = 4{,}226 \text{ units}$$

Carrying cost per unit: Interest cost, Rs 0.060 + Deterioration and obsolescence cost, Rs 0.004 + Storage, Rs 0.020 (Rs 1,000/50,000) = Rs 0.084.

P.3.7 A customer has been ordering 5,000 special design metal columns at the rate of 1,000 per order during the past year. The production cost is Rs 12 a unit—Rs 8 for materials and labour and Rs 4 for overheads (fixed) cost. It costs Rs 1,500 to set up for one run of 1,000 columns, and inventory carrying cost is 20 per cent. Since this customers may buy at least 5,000 columns this year, the company would like to avoid making five different production runs. Find the most economic production run.

SOLUTION

Economic production run is given by the formula of EOQ in which B is setting up costs for one production run in place of buying cost per order. Accordingly economic production run = $\sqrt{(2 \times 50{,}000 \times 1{,}500)/\text{Rs}\,2.40} = 2{,}500$ units

P.3.8 Royal Industries Ltd manufacturers plastic lunch boxes in a moulding process. On an annual basis, the industry manufacturers 1,000 plastic lunch boxes at a cost of Rs 4 per unit. The industry's differential costs of carrying the item in the finished goods inventory are 20 per cent of the inventory value per year, and the set-up costs per production run is Rs 200. What is the optimum production-run?

SOLUTION

Optimum production = $\sqrt{2\,AB/C} = \sqrt{2 \times 1{,}000 \times \text{Rs}\,200/0.080} = 707$ units

P.3.9 M/s Tubes Ltd are the manufacturers of picture tubes for T.V. The following are the details of the operation during the current year:

Average monthly market demand (tubes)	2,000
Ordering cost (per order)	Rs 100
Inventory carrying cost (per cent per annum)	20
Cost of tubes (per tube)	500
Normal usage (tubes per week)	100
Minimum usage (tubes per week)	50
Maximum usage (tubes per week)	200
Lead time to supply (weeks)	6-8

Compute from the above:

1. Economic order quantity. If the supplier is willing to supply quarterly 1,500 units at a discount of 5 per cent, is it worth accepting?
2. Maximum level of stock

3. Minimum level of stock
4. Reorder level.

SOLUTION

1. *Economic order quantity*

Annual demand (A) = Normal usage per week × 52 weeks = 100 tubes × 52 = 5,200 tubes. Ordering cost per order (B) = Rs 100 per order

Inventory carrying cost per unit per annum(C) = Rs 500 × 0.20 = Rs 100 per unit per annum

$$EOQ = \sqrt{2\,AB/C} = \sqrt{(2 \times 5{,}200 \text{ units} \times \text{Rs } 100) \div \text{Rs } 100} = 102 \text{ tubes}$$

If supplier is willing to supply 1,500 units at a discount of 5 per cent:

Total cost (When order size is 1,500 units) = Cost of 5,200 units + Ordering cost + Carrying cost

$$= [5{,}200 \times (500 \times 0.95)) + [(5{,}200/1{,}500) \times \text{Rs } 100) + (\frac{1}{2} \times 1{,}500 \times 0.20 \times 475)]$$

= Rs 24, 70,000 + Rs 346.67 + Rs 71, 250 = Rs 25, 41,596.67

Total cost (when order size is 102 units) = (5,200 × 500) + (5,200/102 × Rs 100) + (1/2 × 102 × 0.20 × 500)
= Rs 26,00,000 + Rs 5,098.03 + Rs 5,100 = Rs 26, 10,198.03

Since the total cost under quarterly supply of 1,500 units with 5 per cent discount is lower than when order size is 102 units, the offer should be accepted. While accepting this offer, consideration of capital blocked on order size of 1,500 units per quarter has been ignored.

2. Maximum level of stock = Reorder level+Reorder quantity–(Minimum usage × Minimum reorder period)
= 1,600 units + 102 units – (50 units × 6 weeks) = 1,402 units
3. Maximum level of stock = Reorder level–(Normal usage × Average reorder period)
= 1,600 units–(100 units × 7 weeks) = 900 units
4. Reorder level = Maximum consumption × Maximum reorder period = 200 units × 8 weeks = 1,600 units.

P.3.10 Shriram Enterprises manufactures a special product "Zed." The following particulars were collected for the current year.

Monthly demand of Zed, 1000 units
Cost of placing an order, Rs 100
Annual carrying cost per unit, Rs 15
Normal usage, 50 units per week
Maximum usage, 75 units per week
Minimum usage, 25 units per week
Reorder period, 4 to 6 weeks

Compute from the above: (a) Reorder quantity, (b) Reorder level, (c) Minimum level, (d) Maximum level, and (e) Average stock level.

SOLUTION

(a) Reorder quantity/EOQ = $\sqrt{2AB/C} = \sqrt{2 \times 2{,}600^{*} \times \text{Rs } 100/\text{Rs } 15} = 187$ units

*Annual demand for input units of (1,000 × 12) 12,000 Zed = 52 weeks × Normal usage of inputs per week (52 × 50 units) = 2,600 units

(b) Reorder level = (Maximum usage × Maximum delivery time) = (75 units × 6 weeks) = 450 units

(c) Minimum level = Reorder level – (Normal usage × Average delivery time in weeks)
= 450 units – (50 units × 5 weeks) = 200 units

(d) Maximum level = Reorder level-(Minimum usage × Minimum delivery time) + Reorder quantity
= 450 units – (25 units × 4 weeks) + 187 units = 537 units.

(e) Average stock level = (Minimum level+Maximum level)/2 = (200 units + 537 units)/2 = 369 units

P.3.11 From the details given below, calculate: (a) Reordering level, (b) Minimum level, (c) Maximum level, and, (d) Danger level:

Reordering quantity is to be calculated on the basis of the following information:
Cost of placing a purchase order is Rs 20
Number of units to be purchased during the year is 5,000
Purchase price per unit inclusive of transportation cost is Rs 50.Annual cost of storage per unit is Rs 5.
Details of lead time: Average, 10 days; Maximum, 15 days; Minimum, 6 days. For emergency purchases, 4 days.
Rate of consumption: Average : 15 units per day; Maximum: 20 units per day.

SOLUTION

(a) Reordering level = Maximum usage × Maximum delivery time = 20 units × 15 days = 300 units
(b) Minimum level = Reorder level – (Normal usage × Average delivery time in days) = 300 units – (15 units × 10 days) = 150 units
(c) Maximum level = Reorder level – (Minimum usage × Minimum delivery time) + Reorder quantity = 300 units – (15 × 4 days) + 200 units* = 440 units.

*Reorder quantity = $\sqrt{2AB/C} = \sqrt{2 \times 5000 \times \text{Rs } 20/\text{Rs } 5}$ = 200 units

(d) Danger level = 15 units per day × Emergency purchase for 4 days = 60 units

P.3.12 The purchase department of an organisation has received an offer of quantity discounts on its order of materials as under:

Price per tonne	*Tonnes*
Rs 1,400	Less than 500
1,380	500 and less than 1,000
1,360	1,000 and less than 2,000
1,340	2,000 and less than 3,000
1,320	3,000 and above

The annual requirement of the material is 5,000 tonnes. The delivery cost per order is Rs 1,200 and the annual stock holding cost is estimated at 20 per cent of the average inventory.

The purchase department wants you to consider the following purchase options and advise which among them will be the most economical order quantity, presenting the information in a tabular form:

The purchase quantity options to be considered are: 400 tonnes, 500 tonnes, 1,000 tonnes, 2,000 tonnes, and 3,000 tonnes.

SOLUTION

Determination of Economic Order Quantity (EOQ)

1. Annual requirements (tonnes)	5,000	5,000	5,000	5,000	5,000
2. Order size (tonnes)	400	500	1,000	2,000	3,000
3. Number of orders (1 ÷ 2)*	12.5	10	5	2.5	1.67
4. Price per tonne (Rs)	1,400	1,380	1,360	1,340	1,320
5. Cost of inventory (1 × 4) (Rs lakh)	70	69	68	67	66
6. Ordering cost (Rs) (No. of orders × Rs 1,200)	15,000	12,000	6,000	3,000	2,004
7. Average inventory (tonnes)	200	250	500	1,000	1,500
8. Average inventory (Rs lakh)	2.8	3.45	6.8	13.4	19.8
9. Carrying cost (0.20 × Average inventory) (Rs lakh)	0.56	0.69	1.36	2.68	3.96
10. Total cost (5+6+9) (Rs lakh)	70.71	69.81	69.42	69.71	69.98

*Number of orders can be in fraction figure as per going concern concept.

Recommendation The purchase department is advised to have order size of 1,000 tonnes as at this order size total cost is minimum.

P.3.13 G. Ltd. produces a product which has a monthly demand of 4,000 units. The product requires a component X which is purchased at Rs 20. For every finished product, one unit of component is required. The ordering cost is Rs 120 per order and the holding cost is 10 per cent per annum.

You are required to calculate:

(i) Economic order quantity.
(ii) If the minimum lot size to be supplied is 4,000 units, what is the extra cost, the company has to incur?
(iii) What is the minimum carrying cost, the company has to incur?

SOLUTION

(i) *Determination of EOQ*

$$\text{EOQ} = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 48{,}000 \text{ units} \times \text{Rs } 120}{\text{Rs } 2}} = 2{,}400 \text{ units}$$

A = 4,000 units per month × 12 months = 48,000 units
C = Rs 20 cost per unit × 0.10 = Rs 2 per unit per annum

(i) *Determination of extra cost when lot size is 4,000 units*

Particulars	*Cost when lot size is*	
	4,000 units	*2,400 units*
1. Annual usage (units)	48,000	48,000
2. Size of order	4,000	2,400
3. Number of orders (1 ÷ 2)	12	20
4. Cost per order	Rs 120	Rs 120
5. Total ordering costs (3 × 4)	1,440	2,400
6. Carrying cost per unit per annum	2	2
7. Average inventory (size of order/2)	2,000	1,200
8. Total carrying cost (6 × 7)	4,000	2,400
9. Total costs (5 + 8)	5,400	4,800

Extra costs to be incurred is Rs 640 (Rs 5,440 – Rs 4,800), when the order size is 4,000 units.

(iii) *There is a positive relationship between the total carrying cost the firm incurs and the size of the average inventory it carries; this average size of inventory, in turn, is positively related to the size of order. In view of these facts, the minimum carrying costs, the firm is to incur is Rs 2,400 (corresponding to EOQ of 2,400 units and the average inventory level of 1,200 units)*

P.3.14 A company manufactures a product from a raw material, which is purchased at Rs 60 per kg. The company incurs a handling cost of Rs 360 plus freight of Rs 390 per order. The incremental carrying cost of inventory of raw material is Re 0.50 per kg. per month. In addition, the cost of working capital finance on the investment in inventory of raw material is Rs 9 per kg per annum. The annual production of the product is 1,00,000 units and 2.5 units are obtained from one kg of raw material.

Required:

(i) Calculate the economic order quantity of raw materials.
(ii) Advise, how frequently should orders for procurement be placed.
(iii) If the company proposes to rationalise placement of orders on quarterly basis, what percentage of discount in the price of raw materials should be negotiated?

SOLUTION

(i) $EOQ = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 40{,}000 \text{ kgs} \times \text{Rs } 750}{\text{Rs } 15}} = 2{,}000 \text{ kgs}$

Annual usage in kgs (A) = 1,00,000 units/2.5 units = 40,000 kgs
Ordering cost per order (B) = Rs 360 + Rs 390 = Rs 750
Carrying cost per kg per annum (C) = (Re 0.50 per kg per month ×12 months) + Rs 9 per kg cost of working capital finance per annum = Rs 15

(ii) *Frequency of placing an order in a year*

Annual usage (in kgs)	40,000
EOQ (in kgs)	2,000
Number of orders placed in a year (40,000 kgs/2,000 kgs)	20*

* Frequency of placing an order is 18 days (360 days/20)

(iii) *(a) Incremental total cost to be incurred when orders are placed on quarterly basis i.e., 10,000 kgs (40,000 annual usage/4 quarters)*

Particulars	*On EOQ Basis*	*On Quarterly Basis*
1. Annual usage (kgs)	40,000	40,000
2. Size of orders	2,000	10,000
3. Number of orders (1 ÷ 2)	20	4
4. Cost per order	Rs 750	Rs 750
5. Total orderings costs (3 × 4)	15,000	3,000
6. Carrying cost per unit	15	15
7. Average inventory (size of order/2) (kgs)	1,000	5,000
8. Total carrying cost (6 × 7)	15,000	75,000
9. Total cost (5 + 8)	30,000	78,000
Incremental costs (Rs 78,000 – Rs 30,000) per year = Rs 48,000		

(b) The firm should be able to earn discount of Rs. 48,000 on its total annual purchases of 40,000 kgs (40,000 kgs × Rs 60 per kg = Rs 24,00,000). The negotiated discount sum will be: (Rs 48,000/Rs 24,00,000) × 100 = 2 per cent.

P.3.15 The Complete Gardener is deciding on the economic order quantity for two brands of lawn fertilizer: Super Grow and Nature's Own. The following information is collected:

Particulars	*Fertilizer*	
	Super Grow	*Nature's Own*
Annual demand	2,000 Bags	1,280 Bags
Relevant ordering cost per purchase order	Rs 1,200	Rs 1,400
Annual relevant carrying cost per bag	480	560

Required:

(i) Compute EOQ for Super Grow and Nature's Own.
(ii) For the EOQ, what is the sum of the total annual relevant ordering costs and total annual relevant carrying costs for Super Grow and Nature's Own?
(iii) For the EOQ, Compute the number of deliveries per year for Super Grow and Nature's Own.

SOLUTION

(i) EOQ = $\sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 2,000 \times 1,200}{480}}$ = 100 bags (Super Grow)

$= \sqrt{\frac{2 \times 1,280 \times 1,400}{560}}$ = 80 bags (Nature's Own)

(ii) and (iii) Statement showing total relevant costs for Super Grow and Nature's Own Fertilizer

Particulars	*Super Grow*	*Nature's Own*
Annual demand (bags)	2,000	1,280
EOQ (bags)	100	80
Number of orders/deliveries	20	16
Multiplied by ordering cost per order	Rs 1,200	Rs 1,400
(a) Total ordering cost	24,000	22,400
Average inventory (1/2 × EOQ) of bags	50	40
Multiplied by carrying cost per bag	480	560
(b) Total carrying cost	24,000	22,400
(c) Total cost (a) + (b)	48,000	44,800

P.3.16 PQR Tubes Ltd are the manufactures of picture tubes for T.V. The following are the details of their operations during the current financial year:

Ordering cost (per order)	Rs 100
Inventory carrying cost (per annum)	20%
Cost of tubes (per tube)	Rs 500
Normal usage (tubes per week)	100
Minimum usage (tubes per week)	50
Maximum usage (tubes per week)	200
Lead time to supply (weeks)	6 – 8

Required:

(i) Economic order quantity. If the supplier is willing to supply quarterly 1,500 units at a discount of 5 per cent, is it worth accepting?
(ii) Re-order level
(iii) Maximum level of stock
(iv) Minimum level of stock

SOLUTION

(i) EOQ = $\sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 5,200 \text{ units} \times \text{Rs } 100}{\text{Rs } 100}}$ = 101.98 or 102 units

A = 100 tubes per week × 52 weeks = 5,200 units

C = Rs 500 per tube × 0.2 = Rs 100 per unit per year

(b) *Statement showing comparative total cost when order is placed on EOQ basis and when it is placed on quarterly basis, (supplying 1,500 units at 5 per cent discount)*

Particulars	*When order is placed on*	
	EOQ Basis	*1,500 units*
1. Annual requirement (units)	5,200	5,200
2. Order size (in units)	102	1,500
3. Number of order(1 ÷ 2)	50.98	3.47
4. Cost per order	Rs 100	Rs 100
5. Total ordering costs (3 × 4)	5,098	347
6. Cost per unit (tube)	500	475
7. Cost of tubes(1 × 6)	26,00,000	24,70,000
8. Average inventory (2/2) (units)	51	750
9. Carrying cost per unit per annum	100	95
10. Total carrying cost (8 × 9)	5,100	71,250
11. Total costs(5 + 7 + 10)	26,10,198	25,41,597

Since total costs are lower when discounts are offered, it is worth accepting to place order of 1,500 units on quarterly basis.

(ii) *Re-order Level*

Maximum ordering period (in weeks)× Maximum usage per week = 8 weeks×200 tubes = 1,600 tubes

(iii) *Maximum Level of Stock*

Re-order level + Re-order quantity - (Minimum usage, in weeks× Minimum lead time in weeks)

= 1,600 tubes + 102 tubes (50 tubes × 6 weeks) = 1,702 tubes – 300 tubes = 1402 tubes

(iv) *Minimum Level of Stock*

Re-order level—(Normal usage × Average lead time) = 1600 tubes – (100 tubes × 7 weeks) = 900 tubes

P.3.17 A Company has the option to procure a particular material from two sources:

Source I assures that defectives will not be more than 2 per cent of supplied quantity.

Source II does not give any assurance, but on the basis of past experience of supplies received from it, it is observed that defective percentage is 2.8 per cent.

The material is supplied in lots of 1,000 units. Source II supplies the lot at a price, which is lower by Rs 100 as compared to source 1. The defective units of material can be rectified for use at a cost of Rs 5 per unit.

You are required to find out which of the two sources is more economical.

SOLUTION

Statement showing comparative costs associated with two sources of material supplies

Particulars	*Material source I*	*Material source II*
1. Material supplied (in units)	1,000	1,000
2. Defective units (in percentage)	2	2.8
3. Total defective units (I × 2)	20	28
4. Rectification cost per unit	Rs 5	Rs 5
5. Total rectification (3 × 4)	100	140
6. Additional price paid in Source I	100	—
7. Total additional costs (5 + 6)	200	140

Material Source II is more economical as it entails lower costs. The company is advised to buy materials from Source II.

P.3.18 A factory uses 4,000 varieties of inventory. In terms of inventory holding and inventory usage, the following information is compiled.

Number of varieties of inventory	*Percentage*	*% value of inventory holding (average)*	*% of inventory usage (in end-product)*
3,875	96.875	20	5
110	2.750	30	10
15	0.375	50	85
4,000	100.00	100	100

Classify the items of inventory as per ABC analysis with reasons.

SOLUTION

(i) 15 number of varieties of inventory items should be classified as 'A' category (as per ABC analysis) as, while they constitute less than one per cent (0.375 per cent) of total number of inventory items handled by the store, their value is 50 per cent. Besides, these varieties (15) account for 85 per cent of total inventory usage (in end -product). Thus, this group is the most important.

(ii) 3,875 number of inventory items should be classified as 'C' category as they constitute 96.875 per cent of total varieties of inventory items handled by the store; such inventories account for only for 20 per cent of total value and 5 per cent of total inventory usage (in-end product). Thus, this group is the least important.

(iii) 10 number of inventory items should be classified as 'B' category as they occupy intermediate position between A category (15 items) and C category (3,875 items). These items (110) require more attention than C category items but less attention than A category items as per ABC analysis. In financial terms also, these items require 30 per cent investment (less than A category but more than C category) with 2.75 per cent of total number of varieties of inventory handled by store; such number is much higher for C category (96.875 per cent) and lower for A category (0.375 per cent).

P.3.19 From the following informations prepare a stores ledger account under FIFO method:

1-1-X6	Opening stock, 1,000 units at Rs 5 each
5-1-X6	Purchased, 900 units at Rs 6 each
10-1-X6	Issued, 1,200 units
12-1-X6	Purchased, 800 units at Rs 6.20 each
15-1-X6	Purchased, 300 units at Rs 6.40 each
19-1-X6	Issued, 400 units
22-1-X6	Issued, 600 units
27-1-X6	Purchased, 200 units at Rs 6.50 each
31-1-X6	Issued, 600 units

SOLUTION

Stores ledger (FIFO Method)

Date		*Receipts*			*Issues*			*Balance*		
		Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
January	1							1,000	Rs 5	5,000
	5	900	Rs 6	Rs 5,400				1,900	—	10,400

(*Contd.*)

(*Contd.*)

10				1,000	Rs 5	Rs 5,000			
				200	6	1,200	700	—	4,200
12	800	6.20	4,960				1,500		9,160
15	300	6.40	1,920				1,800		11,080
19				400	6	2,400	1,400		8,680
22				300	6	1,800			
				300	6.20	1,860	800		5,020
27	200	6.50	1,300				1,000		6,320
31				500	6.20	3,100			
				100	6.40	640	400		2,580

P.3.20 The following is a summary of receipts and issues of materials in a factory during January, current year:

January	1	Opening balance, 500 units @ Rs 25 per unit
	3	Issue, 70 units
	4	Issue, 100 units
	8	Issue, 80 units
	13	Received from supplier, 200 units @ Rs 24.50 per unit
	14	Returned to store, 15 units @ Rs 24 per unit
	16	Issue, 180 units
	20	Received from supplier, 240 units @ Rs 24.75 per unit
	24	Issue, 304 units
	25	Received from supplier, 320 units @ Rs 24.50 per unit
	26	Issue, 112 units
	27	Returned to store, 12 units @ Rs 24.50 per unit
	31	Received from supplier, 100 units @ Rs 25 per unit.

Work out on the basis of First-in-First-Out price at which materials are to be issued and the value of stock as on January, 31. The physical verification revealed that on January, 15 there was a shortage of 5 units and another of 8 units on January 28.

SOLUTION

Cost of inventory used and its valuation (FIFO method)

Date		*Receipts*			*Issues*			*Balance*		
		Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
January	1							500	Rs 25	Rs 12,500
	3				70	25	1,750	430	—	10,750
	4				100	25	2,500	330	—	8,250
	8				80	25	2,000	250	—	6,250
	13	200	Rs 24.5	Rs 4,900				450	—	11,150
	14	15[1]	24.0	360				465	—	11,510
	15				5[2]	25	125	460	—	11,385
	16				180	25	4,500	280	—	6,885
	20	240	24.75	5,940				520	—	12,825
	24									
					65	25	1,625			
					200	24.5	4,900			
					15	24.0	360			
					24	24.75	594	216	—	5,346

(*Contd.*)

(*Contd.*)

25	320	24.50	7,840			2,772	536	—	13,186
26				112	24.75	424	—	10,414	
27	12[1]	24.50	294				436	—	10,708
28				8[2]	24.75	198	428	—	10,510
31	100	25.0	2,500				528	—	13,010

1. Returned to stores; 2 Shortage (deemed to be an issue and priced accoridngly)
   Value of material on January 31, Rs 13,010.

P.3.21 Assume everything to be the same as provided in **P. 3.20**, work out on the basis of LIFO, the price at which materials are to be issued and the value of stock as on January 31.

SOLUTION

Cost of inventory used and its valuation (LIFO method)

Date		*Receipts*			*Issues*			*Balance*		
		Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
January	1							500	Rs 25	Rs 12,500
	3				70	25	Rs 1,750	430	—	10,750
	4				100	25	2,500	330	—	8,250
	8				80	25	2,000	250	—	6,250
	13	200	Rs 24.5	Rs 4,900				450	—	11,150
	14	15[1]	24.0	360				465	—	11,510
	15				5[2]	24	120	460	—	11,390
	16				10	24	240		—	
					170	24.5	4,165	280		6,985
	20	240	24.75	5,940				520	—	12,925
	24				240	24.75	5,940			
					30	24.50	735			
					34	25.00	850	216		5,400
	25	320	24.50	7,840				536	—	13,240
	26				112	24.50	2,744	424	—	10,496
	27	12[1]	24.50	294				436	—	10,790
	28				8[2]	24.50	196	428	—	10,594
	31	100	25.00	2,500				528	—	13,094

1. Returned to stores; 2 shortage
   Value of materials on January 31, Rs 13,094

P.3.22 The following are the transactions in respect of purchase and issue of components forming a part of an assembly of a product manufactured by a firm which required to update its cost of production, very often for bidding tenders and finalising cost plus contracts:

January	5	1,000 units purchased @ Rs 12 each
	11	Issued 2,000 units to production
February	1	1,500 units purchased @ Rs 13 each
	18	Issued 2,400 units to production
	26	Issued 1,000 units to production
March	8	1,000 units purchased @ Rs 14 each
	17	1,500 units purchased @ Rs 15 each
	28	2,000 units issued to production

Stock on January, 1 was 5,000 units valued at Rs 11 each. State the method you would adopt in pricing the issue of components, giving reasons. What value would you place on stocks as on March 31, which happens to be financial year-end?

SOLUTION

The LIFO method is ideal under conditions of rising prices (as is in the present question), as it matches current costs (higher costs) with current revenues, leading to correct income determination. Stores ledger, based on LIFO is given below.

Stores ledger (LIFO method)

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
January 1							5,000	Rs 11	Rs 55,000
5	1,000	12	Rs 12,000				6,000	—	67,000
11				1,000	12	Rs 12,000			
				1,000	11	11,000	4,000	—	44,000
							5,500		63,500
February 1	1,500	13	19,500						
18				1,500	13	19,500	3,100		34,100
				900	11	9,900	2,100		23,100
26				1,000	11	11,000			
March 8	1,000	14	14,000				3,100		37,100
17	1,500	15	22,500				4,600		59,600
28				1,500	15		22,500		
				500	14		7,000		30,100

Stock on March, 31 = Rs 30,100.

P.3.23 From the following details of store receipts and issues of material "Exe" in a manufacturing unit, prepare the store ledger using weighted average method of valuing the issues.

November	1	Opening stock, 2,000 units @ Rs 5 each
	3	Issued, 1,500 units to production
	4	Received, 4,500 units @ Rs 6 each
	8	Issued, 1,600 units to production
	9	Returned to stores, 100 units by production department (from the issues of November 3)
	16	Received, 2,400 units @ Rs 6.50 each
	19	Returned to supplier, 200 units out of the quantity received on November 4
	20	Received, 1,000 units @ Rs 7.00 each
	24	Issued to production, 2,100 units
	27	Received, 1,200 units @ Rs 7.50 each
	29	Issued to production, 2,800 units.

Note Use rates up to two decimal places.

SOLUTION

Stores ledger (weighted average method)

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
November 1							2,000	Rs 5	Rs 10,000
3				1,500	Rs 5	Rs 7,500	500	5	2,500
4	4,500	Rs 6	Rs 27,000	1,600	5.9	9,440	5,000	5.9	29,500
8							3,400	5.9	20,060
9	100[1]	5	500				3,500	5.87	20,560
16	2,400	6.50	15,600				5,900	6.13	36,160
19				200[2]	6.0	1,200	5,700	6.13	34,960
20	1,000	7.00	7,000				6,700	6.26	41,960
24				2,100	6.26	13,146	4,600	6.26	28,814
27	1,200		9,000				5,800	6.52	37,814
29		7.50		2,800	6.52	18,256	3,000	6.52	19,558

1. Returned to stores; 2. Returned to supplier.

P.3.24 The following information is provided by Sunrise Industries Ltd for the fortnight of April, current year in respect of material Exe:

Stock on April	1	100 units @ Rs 5 per unit
Purchases:		
	5	300 units @ Rs 6 per unit
	8	500 units @ Rs 7 per unit
	12	600 units @ Rs 8 per unit
Issues:		
	6	250 units
	10	400 units
	14	500 units

Required: (a) Calculate using FIFO and LIFO methods of pricing issues (i) the value of materials consumed during the period and (ii) the value of stock materials on April 15, current year; (b) Explain why the figures in (i) and (ii) in part (a) of this question are different under the two methods of pricing of materials issued/used. You need not draw up the stores ledgers.

SOLUTION

(a) *(i) Value of materials Exe consumed during April (FIFO basis)*

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
April 1							100	Rs 5	Rs 500
5	300	Rs 6	Rs 1,800				400	—	2,300
6				100	Rs 5	Rs 500			
				150	6	900	150	—	900
8	500	7	3,500				650	—	4,400
10				150	6	900			
				250	7	1,750	250		1,750
							850		6,550
12	600	8	4,800	250	7	1,750			
14				250	8	2,000	350		2,800

(ii) *Value of materials Exe consumed during April (LIFO basis)*

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
April 1							100	Rs 5	Rs 500
5	300	Rs 6	Rs 1,800				400	—	2,300
6				250	Rs 6	Rs 1,500	150	—	800
8	500	7	3,500				650		4,300
10				400	7	2,800	250		1,500
12	600	8	4,800				850		6,300
14				500	8	4,000	350		2,300

Cost of materials consumed	*FIFO*	*LIFO*
April 6	Rs 1,400	Rs 1,500
10	2,650	2,800
14	3,750	4,000
Total cost of materials used	7,800	8,300
Value of stock		
Balance, opening	Rs 500	Rs 500
Add purchases	10,100	10,100
Less value of materials consumed	(7,800)	(8,300)
Closing stock	2,800	2,300

(b) Cost of materials issued under LIFO method is higher by Rs 500 (Rs 8,300, LIFO-Rs 7,800, FIFO), therefore, value of stock in LIFO method is lower by Rs 500 (Rs 2,800–Rs 2,300).

P.3.25 The following transactions occur in the purchase and issue of a material.

January	2	Purchased, 4,000 units at Rs 4 per unit.
	20	Purchased, 500 units at Rs 5 per unit
February	5	Issued, 2,000 units
	10	Purchased, 6,000 units at Rs 6 per unit
	12	Issued, 4,000 units
March	2	Issued, 1,000 units
	5	Issued, 2,000 units
	15	Purchased, 4500 units at Rs 5.50 per unit
	20	Issued, 3,000 units

Prepare stores ledger account using (a) Simple Average Method, (b) Weighted Average Method.

SOLUTION

(a) *Stores ledger (simple average method)*

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
January 2	4,000	Rs 4	Rs 16,000				4,000	Rs 4	Rs 16,000
20	500	5	2,500				4,500	—	18,500
February 5				2,000	4.5[1]	9,000	2,500	—	9,500
10	6,000	6	36,000				8,500	—	45,500
12				4,000	5.0[2]	20,000	4,500	—	25,500
March 2				1,000	6.0[3]	6,000	3,500	—	19,500
5				2,000	6.0	12,000	1,500	—	7,500
15	4,500	5.50	24,750				6,000	—	32,250
20				3,000	5.75[4]	17,250	3,000	—	15,000

Note: (1) (Rs 4 + Rs 5)/2 = Rs 4.50; (2) (Rs 4 + Rs 5 + Rs 6)/3 = Rs 5; (3) Rs 6; (4) (Rs 6 + Rs 5.50)/2 = Rs 5.75

(b) *Stores ledger (weighted average method)*

Date	Receipts			Issues			Balance		
	Quantity	Rate	Amount	Quantity	Rate	Amount	Quantity	Rate	Amount
January 2	4000	Rs 4	Rs 16,000				4,000	Rs 4	Rs 16,000
20	500	5	2,500				4,500	4.11	18,500
February 5				2,000	Rs 4.11	Rs 8,220	2,500	4.11	10,280
10	6,000	6	36,000				8,500	5.44	46,280
12				4,000	5.44	21,760	4,500	5.45	24,520
March 2				1,000	5.45	5,450	3,500	5.45	19,070
5				2,000	5.45	10,900	1,500	5.45	8,170
15	4,500	5.50	24,750				6,000	5.49	32,920
20				3,000	5.49	16,470	3,000	5.49	16,470

P.3.26 The following information is extracted from the stores ledger:

Material X

Opening Stock	Nil
Purchases:	
January 1	100 @ Rs 1 per unit
20	100 @ Rs 2 per unit
Issues:	
22	60 for job W-16
23	60 for job W-17

Complete the receipts and issues valuation by adopting the First-in-first-out, Last-in-last-out and the Weighted Average Method.

SOLUTION

Stores ledger account (FIFO, LIFO, weighted average cost method)

Date	Receipts			Issues			Balance		
	Quantity	Rate	Amount	Quantity	Rate	Amount	Quantity	Rate	Amount
(a) FIFO									
January 1	100	Rs 1	Rs 100				100	Rs 1	Rs 100
20	100	2	200				200	—	300
22				60	Rs 1	Rs 60	140	—	240
23				40	1	40			
				20	2	40	80	—	160
(b) LIFO									
January 1	100	1	100				100	1	100
20	100	2	200				200	—	300
22				60	2	120	140	—	180
23				40	2	80			
				20	1	20	80		80
(c) Weighted Average Cost Method									
January 1	100	1	100				100	1	100
20	100	2	200				200	1.5	300
22				60	1.5	90	140	1.5	210
23				60	1.5	90	80	1.5	120

P.3.27 One parcel containing two vital components was received by a factory and the invoice relating to the same discloses the following:

I material, 500 kgs @ Rs 2 per kg	Rs 1,000.00
II material, 600 kgs @ Rs 1.60 per kg	960.00
Insurance	39.20
Sales tax	98.00
Freight, etc.	55.00

Transit loss of 10 units of material I and 6 units of material II was noted. However, no insurance claim could be made. Find the issue rate per unit of each material. If a provision for obsolescence of 10 per cent be made find the revised issue rates.

SOLUTION

Statement showing determination of issue price of materials

Particulars	*Material I*		*Material II*	
	Quantity (kgs)	*Amount*	*Quantity (kgs)*	*Amount*
Material	500	Rs 1,000	600	Rs 960
Insurance (apportioned in the ratio of value of materials		20		19.20
Sales tax (apportioned in the ratio of value of materials)		50		48.00
Freight (in proportion of quantity of materials)		25		30.00
	500	1,095	600	1,057.20
Less Transit loss (assumed to be normal)	10	—	6	—
Expected quantity available	490	1,095	594	1,057.20
(a) Issue price per kg		2.23		1.78
Revised rate on creating provision for obsolescence of 10%:				
Existing rate		2.23		1.78
Add 10% obsolescence		0.22		0.18
Revised rate		2.45		1.96

P.3.28 A manufacturer of Surat purchased three chemicals, A, B and C from Bombay. The invoice gave the following information:

Chemical A:	3,000 kgs @ Rs 4.20 per kg	Rs 12,600
Chemical B:	5,000 kgs @ Rs 3.80 per kg	19,000
Chemical C:	2,000 kgs @ Rs 4.75 per kg	9,500
Sales tax		2,055
Railway freight		1,000
Total cost		44,155

A shortage of 200 kgs in chemical A, of 280 kgs in chemical B and of 100 kgs in chemical C was noticed due to breakages. At Surat, the manufacturer paid octroi duty @ Rs 0.10 per kg. He also paid cartage, Rs 22 for chemical A, Rs 63.12 for chemical B and Rs 31.80 for chemical C. Calculate the stock rate that you would suggest for pricing issue of chemicals assuming a provision of 5 per cent towards further deterioration.

SOLUTION

Statement showing determination of issue price of materials

Particulars	*Chemical A*	*Chemical B*	*Chemical C*
Purchase price	Rs 12,600	Rs 19,000	Rs 9,500
Add sales tax (0.05[1] × purchase price)	630	950	475
Add railway freight (apportioned in the ratio of quantity, 3:5:2)	300	500	200
Add octroi @ Rs 0.10 per kg of material received	280	472	190
Add cartage charges	22	63.12	31.80
Total cost	13,832	20,985.12	10,396.80
Divided by expected quantity available for issue (kgs)	2,660	4,484	1,805
Issue price per kg	5.20	4.68	5.76

Working Notes

1. Sales tax = (Total sales tax/Total purchase price) × 100 = (Rs 2,055/Rs 41,100) × 100 = 5 per cent
2. Statement showing the quantity (kgs) of chemicals available for issue

Particulars	*Chemical A*	*Chemical B*	*Chemical C*
Quantity purchased	3,000	5,000	2,000
Less shortage*	200	280	100
Quantity received at store	2,800	4,720	1,900
Less provision for further loss (5 per cent)*	140	236	95
Quantity available for issue	2,660	4,484	1,805

*It is assumed that both shortages due to breakage and deterioration in quantity of materials are normal losses.

REVIEW QUESTIONS

RQ.3.1 Describe the functions and responsibilities of the purchasing department.

RQ.3.2 Identify the three forms commonly used to purchase goods. What items are usually included in them?

RQ.3.3 How is the cost of materials issued determined?

RQ.3.4 Write notes on:

(i) Periodic inventory system

(ii) Perpetual inventory system.

RQ.3.5 Compare LIFO with FIFO methods of inventory valuation

RQ.3.6 Explain with the help of a suitable example how current costs can be shown on both the income statement and the balance sheet under the LIFO inventory method.

RQ.3.7 "Management makes policy decision, at one time or another, regarding methods of inventory valuation. These decisions are important because they directly affect the way income will be computed." Discuss.

RQ.3.8 Explain and contrast the use of FIFO and LIFO methods of inventory pricing on income determination and asset valuation in a period of inflation. Illustrate your answer with respect to the following data:

January	1	Inventory	1,000 units at Rs 3 each
	31	Purchases	1,200 units at Rs 4 each
February	28	Purchases	1,100 units at Rs 5 each
March	28	Purchases	1,400 units at Rs 6 each
	31	Sales	4,000 units at Rs 8 each

RQ.3.9 "LIFO is acceptable, because it makes use of historical cost; replacement cost is not acceptable because it adjusts cost figures to a value that is not related to the amount paid for them." Examine this point of view for dealing with the problem of changes in the purchasing power of money. How would you match the cost of non-current assets with current revenue?

RQ.3.10 Purchases of a certain product during March are set out below:

March	1	100 units @ Rs 10.00
	12	100 units @ Rs 9.80
	15	50 units @ Rs 9.60
	20	100 units @ Rs 9.40

Units sold during the month were as follows: March 10, 80 units; March 14, 100 units; March 30, 90 units. There were no opening inventories.

You are required to determine the cost of goods sold for March under three different valuation methods: FIFO, LIFO, and Weighted average cost.

RQ.3.11 In what manner do the various methods of inventory valuation affect reporting profits? Which method of inventory valuation would you recommend in an inflationary situation?

RQ.3.12 What are the methods of pricing materials issues? When do you advocate pricing the issues at cost price based on Last-In-First-Out method?

RQ.3.13 What is meant by the ABC inventory control system? On what key premise is this system based? What are its limitations?

RQ.3.14 Define economic order quantity (EOQ). How can it be computed? What are the limitations of the EOQ model?

RQ.3.15 In connection with inventory ordering and control, certain terms are basic. Explain the meaning of each of the following:

1. Economic order quantity
2. Re-order point
3. Lead time
4. Safety stock

RQ.3.16 The particulars relating to the import of sealing ring made by ABC Ltd are given below:

(i) Sealing ring – 1,000 pieces invoiced £ 2 C.I.F. Bombay Port.
(ii) Customs duty was paid @ 100 per cent on invoice value (converted to Indian currency by adopting an exchange rate of Rs 70 per £).
(iii) Clearing charges – Rs 8,800 for the entire consignment, and
(iv) Freight charges – Rs 6,400 for transporting the consignment from Bombay Port to factory premises. It was found on inspection that 100 pieces of the above material were broken and, therefore, rejected. There is no scrap value for the rejected part. No refund for the broken material would be admissible as per the terms of contract. The management decided to treat 60 pieces as normal loss and the rest 40 pieces as abnormal loss. The entire quantity of 900 pieces was issued to production.

Calculate: (a) total cost of materials, and (b) unit cost of material issued to production. Also, state briefly how the value of 100 pieces rejected in inspection will be treated in costs.

SOLUTION

(a) Calculation of total cost of material

Sealing rings (1,000 × 2 × £70)	Rs 1,40,000
Customs duty (100 per cent of invoice price)	1,40,000
Clearing charges	8,800
Freight charges	6,400
Total cost of materials	2,95,200

(b) Calculation of Unit Cost of Material Issued to Production

Total cost of materials		Rs 2,95,200
Divided by normal output (units)		
Total units received	1,000	
Less normal loss	60	940
Unit cost of material		314.04

Normal loss is to be charged to cost of production; abnormal loss is to be transferred to costing profit and loss account. Accordingly,

Cost of material charged to production (900 units × Rs 314.04)	Rs 2,82,636
Cost of material charged to costing profit and loss A/c on account of abnormal loss (40 units × Rs 314.04)	12,562

RQ.3.17 A manufacturing organisation has imported four types of materials. The invoice reveals the following data:

Material	*Quantity*	*Rate US $ per kg*
A	1,000	1.50
B	2,000	1.25
C	1,500	2.00
D	3,000	1.00

Import duty, 23 per cent
Insurance, 2 per cent
Freight and clearing, Rs 30,000
Exchange rate, US$1 = Rs 40
50 per cent of the materials imported are issued to production center. While determining the value of closing stock, 5 per cent allowance is provided to cover up storage loss. Determine the value of closing stock of each type of materials.

SOLUTION

Determination of cost of materials

Particulars	*A*	*B*	*C*	*D*
Units imported (kgs)	1,000	2,000	1,500	3,000
Rate per kg. (US$)	1.50	1.25	2.00	1.00
Total value (US$)	1,500	2,500	3,000	3,000
Import duty (@ 23%)	345	575	690	690
Insurance (@ 2%)	30	50	60	60
Total cost (US$)	1,875	3,125	3,750	3,750
Total cost (Rs) (1$ = Rs 40)	75,000	1,25,000	1,50,000	1,50,000
Freight and clearing charges @ Rs 4 per kg	4,000	8,000	6,000	12,000
Total cost of imported material	79,000	1,33,000	1,56,000	1,62,000
Less: Issued to production (50%)	39,500	66,500	78,000	81,000
Closing stock	39,500	66,500	78,000	81,000
Less storage loss (5%)	1,975	3,325	3,900	4,050
Value of closing stock	37,525	63,175	74,100	76,950

RQ.3.18 After the annual stock-taking you come to know of some significant discrepancies between book stock and physical stock. You gather the following information:

Items	*Stock card (units)*	*Store ledger (units)*	*Physical check (units)*	*Cost/unit*
A	600	600	560	*Rs* 60
B	380	380	385	40
C	750	780	720	10

What action should be taken to record the information shown above, assuming discrepancies are to be treated as abnormal?

SOLUTION

Shortage is noted for items A and C.
Item A = 40 units × Rs 60 = Rs 2,400
Item C = 60 units × 10 = 600
The amount is to be transferred to costing profit and loss account. The journal entry will be:

Costing profit & loss A/c	Dr	Rs 3,000	
To Stores ledger control A/c			Rs 3,000

Excess is noted in respect of item B (5 units × Rs 40) = Rs 200
The abnormal gain is to be transferred to costing profit and loss A/c. The entry will be:

Stores ledger control A/c	Dr	Rs 200	
To Costing profit & loss A/c			Rs 200

RQ.3.19 From the following data, determine the EOQ.

(a) List price of product X is Rs 800 per gross.
(b) 40 per cent trade discount is allowed on list price on purchases in gross lots.
(c) Freight cost is Rs 20 per gross from the transport company to the factory premises.
(d) Annual usage or product X: 36 gross per year.
(e) Cost of placing an order is Rs 10, the cost of receiving an order is Rs 20.
(f) Carrying cost is 20 per cent of the effective purchase price of goods per year.
(g) Insurance and taxes are approximately 12 per cent of the net delivered cost of inventory.
   (i) Determine the total annual cost of inventory based on uniform order lot sizes of 1, 2, 3, 4, 5 and 6 gross of product X.
   (ii) Determine the minimum stock re-order point of product X, given the following: (a) working days: 240; (b) normal delivery time to receive an order: 20 working days from the date of purchase request is initiated; (c) safety stock: 1 gross.

SOLUTION

(i) EOQ (in gross lots) $= \sqrt{(2 \times 36 \times 30)/112} = 4.4$ or 4 gross (as purchases are allowed in gross lots). At 4 gross EOQ, total annual cost are minimum as shown in (ii) part.

Working Notes

Carrying cost per gross

B = Cost of placing an order	Rs10
Plus cost of receiving an order	20

(*Contd.*)

Total buying cost per order	30
C = List price per gross	800
Less 40 per cent trade discount	320
Net price	480
Plus freight cost per gross	20
Plus insurance and taxes (0.12 × Rs 500)	60
Effective purchase price per gross	560
Carrying cost per gross (0.20 × Rs 560)	112

(ii) *Statement showing total annual cost of inventory*

1	Size of quantity order (gross)	1	2	3	4	5	6
2	Number of orders	36	18	12	9	7.2	6
3	Cost per order (Rs)	30	30	30	30	30	30
4	Total order cost (2 × 3)	1,080	540	360	270	216	180
5	Carrying cost per gross (Rs)	112	112	112	112	112	112
6	Average inventory (size of order ÷ 2)	0.5	1	1.5	2	2.5	3
7	Total carrying cost (5 × 6)	56	112	168	224	280	336
8	Total annual cost (4 + 7)	1,136	652	528	494	496	516

(iii) Re-order level (minimum stock): Safety stock + (daily usage × lead time) = 1 gross + (36 gross/240 days) × 20 days = 4 gross.

RQ.3.20 Exe E. Limited has received an offer of quantity discounts on its order of materials as under:

Price per ton	*Tonnes*
Rs 1,200	Less than 500
1,180	500 and less than 1,000
1,160	1,000 and less than 2,000
1,140	2,000 and less than 3,000
1,120	3,000 and above

The annual requirement for the material is 5,000 tonnes. The ordering cost per order is Rs 1,200 and the stock holding cost is estimated at 20 per cent of material cost per annum. The purchase quantity options to be considered are: 400 tonnes, 500 tonnes, 1,000 tonnes, 2,000 tonnes and 3,000 tonnes. You are required to compute the most economical purchase level. What will be your answer to the above question, if there are no discounts offered and the price per ton is Rs 1,500.

SOLUTION

(a) *Determination of Economic Order Quantity (EOQ)*

1.	Annual requirements (tonnes)	5,000	5,000	5,000	5,000	5,000
2.	Order size (tonnes)	400	500	1,000	2,000	3,000
3.	Number of orders (1 ÷ 2)	12.5	10	5	2.5	1.67
4.	Price per tonne (Rs)	1,200	1,180	1,160	1,140	1,120
5.	Cost of inventory (in lakhs of Rs) (1 × 4)	60	59	58	57	56
6.	Ordering cost (Rs) (Rs 1,200 × number of orders)	15,000	12,000	6,000	3,000	2,004
7.	Average inventory (tonnes) (Order size/2)	200	250	500	1,000	1,500
8.	Average inventory (in lakh of Rs) (4 × 7)	2.4	2.95	5.8	11.4	16.8
9.	Carrying cost (in Rs lakh) (0.20 × Average inventory)	0.48	0.59	1.16	2.28	3.36
10.	Total cost (5+6+9) (in lakh of Rs)	60.63	59.71	59.22	59.31	59.38

Recommendation: The purchase department is advised to have order size of 1,000 tonnes as at this order size total cost is minimum.

(b) $EOQ = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 5,000 \times 1,200}{300}} = 200$ tonnes

C = Rs 1,500 × 0.20 = Rs 300

RQ.3.21 JP Limited manufacturers of a special product, follows the policy of EOQ for one of its components, The component's details are as follows:

Purchase price per component, Rs 200
Cost of an order, Rs 100
Annual cost of carrying one unit in inventory, 10 per cent of purchase price
Annual usage of components, 4,000

The company has been offered a discount of 2 per cent on the price of the component provided the lot size is 2,000 components at a time. You are required to (i) compute the EOQ, (ii) advise whether the quantity discount offer can be accepted (assume that the inventory carrying cost does not vary according to discount policy) and (iii) would your advise differ if the company is offered 5 per cent discount on a single order?

SOLUTION

(i) $EOQ = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 4,000 \times 100}{20}} = 200$ units

C = Rs 200 × 0.10 = Rs 20 per unit

(ii) Statement showing calculation whether to accept quantity discount of 2 per cent or not (order size 2,000 units)

(a) Total ordering and carrying cost:	
Ordering cost (Number of orders in a year × Rs 100 per order)	
(4,000 units annual usage/2,000 = 2 orders × Rs 100)	Rs 200
Carrying cost (1/2 × 2,000 units × Rs 20 per unit)	20,000
Total	20,200
(b) Existing cost:	
Ordering cost (4,000/200 EOQ = 20 orders × Rs 100)	2,000
Carrying cost (1/2 × 200 units × Rs 20 per unit)	2,000
Total	4,000
(c) Extra cost on account of placing order of 2,000 units	16,200
(d) Benefit in terms of trade discount of 2 per cent (4,000 units × Rs 200 per unit × 2/100)	16,000
(e) Additional cost if order is of 2,000 units (Rs 16,200 – Rs 16,000)	200

Recommendation: Quantity discount offer of 2 per cent should not be accepted.

(iii) Statement showing calculation whether to accept quantity discount of 5 per cent or not (order size, 4,000 units)

Ordering cost (1 order × Rs 100)	Rs 100
Carrying cost (1/2 × 4,000 units × Rs 20 per unit)	40,000
Total	40,100
Less existing cost	4,000
Extra cost for placing 4,000 units order	36,100
Benefit in terms of trade discount of 5 per cent (4,000 units × Rs 200 per unit × 5/100)	40,000
Net benefit (Rs 40,000 – Rs 36,100)	3,900

Recommendation: The company is advised to avail offer of 5 per cent trade discount.

RQ.3.22 ABC Ltd has several items of inventory. The average number of each of these as well as their unit costs is listed below:

Item	*Average inventory (units)*	*Average cost per unit*	*Item*	*Average inventory (units)*	*Average cost per unit*
1	4,000	Rs 1.96	11	1,800	Rs 25
2	200	10	12	130	2.70
3	440	2.40	13	4,400	9.50
4	2,000	16.80	14	3,200	2.60
5	20	165	15	1,920	2
6	300	6	16	800	1.20
7	160	76	17	3,400	2.20
8	3,000	3	18	2,400	10
9	1,200	1.90	19	120	21
10	6,000	0.50	20	320	4

The company wishes to adopt an ABC inventory system. How should the items be classified into A, B and C?

SOLUTION

ABC analysis

Item	*Units*	*Per cent of total*		*Unit cost*	*Total cost*	*Per cent of total*		*Classification*
11	1,800	5.02		Rs 25	Rs 45,000	21.27		
13	4,400	12.29		9.5	41,800	19.75		
4	2,000	5.58	29.59	16.8	33,600	15.88	68.24	A
18	2,400	6.7		10	24,000	11.34		
7	160	0.44		76	12,160	5.75		
8	3,000	8.37		3	9,000	4.25		
14	3,200	8.93	38.40	2.6	8,320	3.93	21.17	B
1	4,000	11.17		1.96	7,840	3.71		
17	3,400	9.49		2.2	7,480	3.53		
15	1,920	5.36		2	3,840	1.81		
5	20	0.05		165	3,300	1.56		
10	6,000	16.76		0.5	3,000	1.42		
19	120	0.33		21	2,520	1.19		
9	1,200	3.35		1.9	2,280	1.08		
2	200	0.56	31.95	10	2,000	0.94	10.56	C
6	300	0.83		6	1,800	0.85		
20	320	0.89		4	1,280	0.60		
3	440	1.23		2.4	1,056	0.50		
16	800	2.23		1.2	960	0.45		
12	130	0.36		2.7	351	0.16		
Total	35,810	100			2,11,587	100		

Note: Totals (100) may not tally due to rounding off.

RQ.3.23 The following information is available relating to the stock-out of a firm:

Stock-out (units)	*Number of times*
800	2
600	3
400	5
200	10
0	30
	50

The selling price of each unit is Rs 200. The carrying costs are Rs 19 per unit. The stock-out costs are Rs 50 per unit.

(i) If the firm wishes to never miss a sale, what should be its safety stock? What is the total cost associated with this level of safety stock? What are the associated costs with safety stock of 300, 200, 100 and 20 units, respectively?

(ii) What is the optimal safety stock level?

SOLUTION

(i) Computation of expected stock-out costs

Safety level	*Stock-out (units)*	*Stock-out costs (Rs 50 per unit)*	*Probability of stock-out*	*Expected stock-out cost at this level*	*Total expected stock-out costs*
800	0	0	0	0	0
600	200	Rs 10,000	0.04	Rs 400	Rs 400
400	400	20,000	0.04	800	
	200	10,000	0.06	600	1,400
200	600	30,000	0.04	1,200	
	400	20,000	0.06	1,200	3,400
	200	10,000	0.10	1,000	
0	800	40,000	0.04	1,600	
	600	30,000	0.06	1,800	
	400	20,000	0.10	2,000	7,400
	200	10,000	0.20	2,000	

(ii) Computation of total safety stock costs

Safety stock (units)	*Expected stock-out costs*	*Carrying cost (Rs 19 per unit)*	*Total safety stock cost*
0	Rs 7,400	0	Rs 7,400
200	3,400	Rs 3,800	7,200
400	1,400	7,600	9,000
600	400	11,400	11,800
800	0	15,200	15,200

(i) The safety stock should be 800 units if the firm never wishes to miss a sale. The total cost associated with this level of safety stock is Rs 15,200.

(ii) The optimal safety stock is 200 units.

RQ.3.24 The store ledger account for Material X in a manufacturing concern reveals the following data for the quarter ended September 30:

Date		*Receipts*		*Issues*	
		Quantity	*Price*	*Quantity*	*Price*
July 1	Balance b/d	1,600	Rs 2.00	—	—
9		3,000	2.20	—	—
13		—	—	1,200	Rs 2,556
August 5		—	—	900	1,917
17		3,600	2.40	—	—
24		—	—	1,800	4,122
September 11		2,500	2.50	—	—
27		—	—	2,100	4,971
29		—	—	700	1,656

Physical verification on September 30 revealed an actual stock of 3,800 units. You are required to:

(a) Indicate the method of pricing employed in the above.

(b) Complete the above account by making entries you would consider necessary including adjustments, if any, and giving explanations for such adjustments.

SOLUTION

(a) On observation of the pricing of issues in the problem, it is clear that weighted average rate method is adopted.

(b) *Stores ledger account (weighted average method)*

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
July 1	—	—	—	—	—	—	1,600	Rs 2.00	Rs 3,200
9	3,000	Rs 2.20	Rs 6,600	—	—	—	4,600	2.13	9,800
13	—	—	—	1,200	2.13	2,556	3,400	2.13	7,244
August 5	—	—	—	900	2.13	1,917	2,500	2.13	5,327
17	3,600	2.40	8,640	—	—	—	6,100	2.29	13,967
24	—	—	—	1,800	2.29	4,122	4,300	2.29	9,845
September 11	2,500	2.50	6,250	—	—	—	6,800	2.37	16,095
27	—	—	—	2,100	2.37	4,971	4,700	2.37	11,124
29	—	—	—	700	2.37	1,656	4,000	2.37	9,468
30	—	—	—	200	2.37[1]	473	3,800	2.37	8,994

Closing stock: 3,800 units @ Rs 2.37 = Rs 8,994

(1) Shortage of 200 units has been charged at the weighted average price of Rs 2.37 per unit.

RQ.3.25 From the following transactions extracted from the books of accounts of a manufacturing firm as on December 31, current year, determine (a) consumption value of raw materials in the month and (b) value of closing stock as on December 31 of the current year under the FIFO method of pricing issues.

December	*Particulars*	*Quantity (units)*	*Rate per unit*
1	Opening stock	300	Rs 9.70
3	Purchases	250	9.80
11	Issues	400	
15	Purchases	300	10.50
20	Issues	210	
25	Purchases	150	10.30
29	Issues	100	

SOLUTION

Cost of Inventory used and its valuation (FIFO Method)

Date	Receipts			Issues			Balance		
	Quantity	Rate	Amount	Quantity	Rate	Amount	Quantity	Rate	Amount
December 1							300	Rs 9.7	Rs 2,910
3	250	Rs 9.8	Rs 2,450				550	—	5,360
11				300	Rs 9.7	Rs 2,910			
				100	9.8	980	150	—	1,470
15	300	10.5	3,150				450	—	4,620
20				150	9.8	1,470			
				60	10.5	630	240	—	2,520
25	150	10.3	1,545				390		4,065
29				100	10.5	1,050	290		3,015

(a)Cost of inventory used in december

Date	Quantity	Amount
December 11	400	Rs 3,890
20	210	2,100
29	100	1,050
		7,040

RQ.3.26 A Ltd furnishes the following stores transactions for September of current year:

September 1	Opening balance, 25 units; value, Rs 162.50
4	Issues (Requisition 85), 8 units
6	Receipts from B and Co. (GNR 26), 50 units @ Rs 5.75 per unit
7	Issues (Requisition 97), 12 units
10	Returns to B and Co., 10 units
12	Issues (Requisition 10), 15 units
13	Issues (Requisition 110), 20 units
15	Receipts from M and Co. (GNR 33), 25 units @ Rs 6.10 per unit
17	Issues (Requisition 121). 10 units
19	Received replacement from B and Co. (GRN 38), 10 units
20	Returned from department material of B and Co. (MRR 4), 5 units
22	Transfer from Job 182 to Job 187 in department (MTR 6), 5 units
26	Issue (Requisition 146), 10 units
29	Transfer from Department A to Department B (MTR 10), 5 units
30	Shortage in stock-taking, 2 units

Write up the stores ledger under FIFO method and LIFO method.

SOLUTION

Stores ledger (FIFO method)

Date	Receipts			Issues			Balance		
	Quantity	Rate	Amount	Quantity	Rate	Amount	Quantity	Rate	Amount
September 1							25	Rs 6.5	Rs 162.5
4				8	Rs 6.50	Rs 52	17	—	110.5

(*Contd.*)

(*Contd.*)

6	50	Rs 5.75	Rs 287.50				67		398.0
7				12	6.50	78	55	—	320.0
10				10[1]	5.75	57.5	45	—	262.5
12				5	6.50	32.5			
				10	5.75	57.5	30	—	172.5
13				20	5.75	115.0	10	—	57.5
15	25	6.10	152.50				35	—	210.0
17				10	5.75	57.5	25	—	152.50
19	10	5.75[2]	57.50				35	—	210.00
20	5	5.75[3]	28.75				40		238.75
26				5[4]	5.75	28.75			
				5	6.10	30.50	30		179.50
30				2[5]	6.10	12.20	28		167.30

Note: (1) Returned to supplier; (2) Replacement from supplier (obviously at initial sale price of Rs 5.75 per unit; (3) Returned to stores; (4) The material received as replacement from vendor has been treated as a fresh supply and hence will be used after supplies purchased on September 15 are exhausted. Since, materials returned (5 units) on September 20 (from within) relate to purchases of September 6, these units have been priced at Rs 5.75 per unit; (5) Shortage (deemed to be am issue and priced accordingly); (6) The transfer from one job to another (September, 22) and from one department to another (September, 29) are book entries for adjusting the cost of respective jobs and, therefore, have not been taken into account in stores ledger account.

Stores ledger (LIFO method)

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
September 1							25	Rs 6.5	Rs 162.5
4				8	Rs 6.50	Rs 52	17	—	110.5
6	50	Rs 5.75	Rs 287.50				67	—	398
7				12	5.75	69	55		329
10				10	5.75	57.50	45		271.5
12				15	5.75	86.25	30		185.25
13				13	5.75	74.75			
				7	6.50	45.50	10		65
15	25	6.10	152.50				35		217.50
17				10	6.10	61.00	25		156.50
19	10	5.75	57.50				35		214
20	5	5.75	28.75				40		242.75
26				10	5.75	57.50	30		185.25
30				2	6.10	12.20	28[@]		173.05

@ Closing stock consists of

10 units @ Rs 6.50	=	Rs 65
5 units @ Rs 5.75	=	28.75
13 units @ Rs 6.10	=	79.30
		173.05

RQ.3.27 With help of the following information, prepare the store ledger based on the weighted average method of pricing issues.

September 1	Opening balance	24,000 kgs @ Rs 7.5 per kg
1	Purchased	44,000 kgs @ Rs 7.6 per kg
2	Issued	10,000 kgs
5	Issued	16,000 kgs
12	Issued	24,000 kgs
13	Purchased	10,000 kgs @ Rs 8 per kg
18	Issued	24,000 kgs
22	Purchased	50,000 kgs @ Rs 8 per kg
28	Issued	30,000 kgs
30	Issued	22,000 kgs

Note: Use rates up to two decimals.

Store ledger (weighted average method)

Date	*Receipts*			*Issues*			*Balance*		
	Quantity	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*	*Quantity*	*Rate*	*Amount*
September 1							24,000	Rs 7.5	Rs 1,80,000
1	44,000	Rs 7.6	Rs 3,34,400				68,000	7.56	5,14,400
2				10,000	Rs 7.56	Rs 75,600	58,000	7.56	4,38,800
5				16,000	7.56	1,20,960	42,000	7.56	3,17,840
12				24,000	7.56	1,81,440	18,000	7.56	1,36,400
13	10,000	8.0	80,000				28,000	7.73	2,16,400
18				24,000	7.73	1,85,520	4,000	7.73	30,880
22	50,000	8.0	4,00,000				54,000	7.98	4,30,880
28				30,000	7.98	2,39,378	24,000	7.98	1,91,502
30				22,000	7.98	1,75,560	2,000	7.97	15,942

EXAMINATION QUESTIONS

EQ. 3.1 Distinguish between (i) Re-order level and re-order quantity and (ii) Bin card and stores ledger (*CA—May, 2003*)

EQ. 3.2 Write short notes on any three of the following:

(i) Re-order quantity

(ii) Re-order level

(iii) Maximum stock level

(iv) Minimum stock level (*CA—November, 2003*)

EQ. 3.3 Discuss ABC analysis as a system of inventory control. (*CA—November, 2004*)

EQ. 3.4 Distinguish between Bin card and stores ledger. (*CA—November, 2004*)

EQ. 3.5 Discuss ABC analysis as a technique of invertory control. (*CA—November, 2006*)

EQ. 3.6 Disuss the use of perpetual inventory records and continuous stock verification, and its advantages. (*CA—November, 2006*)

EQ. 3.7 Write note on bin cards and stock control cards. (*CA (PE-II—May, 2007*)

EQ. 3.8 A company manufactures 5,000 units of a product per month. The cost of placing an order is Rs 100. The purchase price of the raw material is Rs 10 per kg. The re-order period is 4 to 8 weeks. The consumption of raw materials varies from 100 kgs to 450 kgs per week, the average consumption being 275 kgs. The carrying cost of inventory is 20 per cent per annum.

You are required to calculate:

(i) Re-order quantity

(ii) Re-order level

(iii) Maximum level
(iv) Minimum level
(v) Average stock level (*CA—November, 2002*)

SOLUTION

(i) Re-order quantity, i.e., economic order quantity = $\sqrt{\frac{2AB}{C}}$

$$EOQ = \sqrt{\frac{2 \times 14,300 \text{ Kgs} \times \text{Rs } 100}{\text{Rs } 2}} = 1,195.8 \text{ kgs or} = 1,196 \text{ kgs.}$$

A = Average consumption per week, 275 kgs × 52 weeks = 14,300 kgs.
C = Rs 10 × 20% = Rs 2 carrying cost per unit per annum

(ii) Re-order level = (Maximum usage × Maximum delivery time)
= 450 kgs per week × 8 weeks = 3,600 kgs.

(iii) Maximum level = Re-order level – (Minimum usage × Minimum delivery time) + Re-order quantity
= 3,600 kgs – (100 kgs × 4 weeks) + 1,196 kgs = 4,396 kgs.

(iv) Minimum level = Re-order level – (Normal usage x Average delivery time)
= 3,600 kgs – (275 kgs × 6 weeks) = 1,950 kgs.

(v) Average stock level = (Minimum level + Maximum level)/2
= (4,396 kgs + 1,950 kgs)/2 = 3,173 kgs.

EQ. 3.9 IPL Limited uses a small casting in one of its finished products. The castings are purchased from a foundry. IPL Limited purchases 54,000 castings per year at a cost of Rs 800 per casting.

The castings are used evenly throughout the year in the production process on a 360-day-per-year basis. The company estimates that it costs Rs 9,000 to place a single purchase order and about Rs 300 to carry one casting in inventory for a year. The high carrying costs result from the need to keep the castings in carefully controlled temperature and humidity conditions, and from the high cost of insurance.

Delivery from the foundry generally takes 6 days, but it can take as much as 10 days. The days of delivery time and percentage of their occurrence are shown in the following tabulation:

Delivery time (days)	6	7	8	9	10
Percentage of occurrence	75	10	5	5	5

Required: (i) Compute the economic order quantity (EOQ). (ii) Assume the company is willing to assume a 15 per cent risk of being out of stock. What would be the safety stock? The re-order point? (iii) Assume the company is willing to assume a 5 per cent risk of being out of stock. What would be the safety stock? The re-order point? (iv) Assume 5 per cent stock-out risk. What would be the total cost of ordering and carrying inventory for one year? (v) Refer to the original data. Assume that using process re-engineering the company reduces its cost of placing a purchase order to only Rs 600. In addition, the company estimates that when the waste and inefficiency caused by inventories are considered, the true cost of carrying a unit in stock is Rs 720 per year.

(a) Compute the new EOQ.
(b) How frequently would the company be placing an order, as compared to the old purchasing policy?

(*CA—May, 2004*)

SOLUTION

(i) *Computation of economic order quantity (EOQ):*

$$\text{EOQ} = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 54,000 \times \text{Rs } 9,000}{\text{Rs } 300}} = 1.800 \text{ castings}$$

(ii) *Safety stock:* (Assuming a 15 per cent risk of being out of stock)
Safety stock for one day = 54,000/360 days = 150 castings
Reorder point = Minimum stock level + Average consumption
= 150 + (6 × 150) = 1,050 castings

(iii) *Safety stocks:* (Assuming a 5 per cent risk of being out of stock)
Safety stock for three days = 150 × 3 days = 450 castings
Reorder point = 450 castings + 900 castings = 1,350 castings.

(iv) Total cost of ordering = (54,000/1,800) × Rs 9,000 = Rs 2,70,000
Total cost of carrying = (450 +1/2 × 1,800) × Rs 300 = Rs 4,05,000

(v) (a) Computation of new EOQ:

$$\text{EOQ} = \sqrt{\frac{2 \times 54,000 \times 600}{720}} = 300 \text{ castings}$$

(b) Under the new purchasing policy, the order will be placed more frequently. In fact, each order is to be placed after 2 days (1 year = 360 days). Under old purchasing policy each order was placed after 12 days.

EQ. 3.10 RST Limited has received an offer of quantity discount on its order of materials as under:

Price per tonne	*Tonnes number*
Rs 9,600	Less than 50
9,360	50 and less than 100
9,120	100 and less than 200
8,880	200 and less than 300
8,640	300 and above

The annual requirement for the material is 500 tonnes. The ordering cost per order is Rs 12,500 and the stock holding cost is estimated at 25 per cent of the material cost per annum.

Required: (i) Compute the most economical purchase level. (ii) Compute EOQ if there are no quantity discounts and the price per tonne is Rs 10,500. (*CA—November, 2004*)

SOLUTION

(1) Calculation of most economical purchase level:

	Total cost (3 + 4 + 5)	*Rs 50,04,250*	*48,63,500*	*47,36,000*	*46,93,250*	*46,64,875*
(1)	Order size (Q) (Units)	40	50	100	200	300
(2)	No. of orders (Units) [A/Q]	12.5	10	5	2.5	1.67
(3)	Cost of purchase (A) × Per unit cost	Rs 48,00,000 (500 × 9,600)	Rs 46,80,000 (500 × 9,360)	Rs 45,60,000 (500 × 9,120)	Rs 44,40,000 (500 × 8,880)	Rs43,20,000 (500 × 8,640)

(*Contd.*)

(*Contd.*)

(4) Ordering cost [(A/Q) x Rs 12,500]	1,56,250	1,25,000	62,500	31,250	20,875
(5) Carrying cost [(Q/2) x c x 25%]	48,000 [(40/2) x 9,600 x 0.25)	58,000 [(50/2) x 9,360 x 0.25)	1,14,000 [(100/2) x 9,120 x 0.25)	2,22,000 [(200/2) x 8,880 x 0.25]	3,24,000 [(300/2) x 8,640 x 0.25)]
Total cost (3 + 4 + 5)	Rs 50,04,250	Rs 48,63,500	Rs 47,36,500	Rs 46,93,250	Rs 46,64,875

Total cost is minimum (Rs 46,64,875) when the order size is 300 units. Hence, the most economical purchase level is 300 units.

(2) $\text{EOQ} = \sqrt{\frac{2AB}{C}} = \sqrt{\frac{2 \times 500 \times \text{Rs}\,12,500}{10,500 \times 0.25}} = 69 \text{ tonnes}$

EQ. 3.11 SK Enterprise manufactures a special product "ZE". The following particulars were collected for the year 2004:

Annual consumption	12,000 units (360 days)
Cost per unit	Re 1
Ordering cost	Rs 12 per order
Inventory carrying cost	24%
Normal lead time	15 days
Safety stock	30 days consumption

Required: (i) Re-order quantity (ii) Re-order level (iii) What should be the inventory level (ideally) immediately before the material order is received? (*CA—May, 2005*)

SOLUTION

(i) Re-order quantity/EOQ = $\sqrt{2AB/C} = \sqrt{(2 \times 12,000 \times \text{Rs}\,12) \div \text{Re}\,0.24} = 1,095$ units

Carrying cost per unit (c) = (12,000 units × 0.24)/12,000 units = Re 0.24 per unit

(ii) Re-order level = (Normal lead time × Daily consumption) + Safety stock
= (15 days × 33.33 units) + (30 days × 33.33 units) = 1,500 units

(iii) Minimum ideal level = Re-order level – (Normal usage per day × Average delivery time in days)
= 1,500 units – (33.33 units × 15 days) = 1,000 units

EQ. 3.12 PQR Ltd., manufactures a special product, which requires 'ZED'. The following particulars were collected for the year 2007–08:

(i)	Monthly demand of Zed	:	7,500 units
(ii)	Cost of placing an order	:	Rs 500
(iii)	Re-order period	:	5 to 8 weeks
(iv)	Cost per unit	:	Rs 60
(v)	Carrying cost % p.a.	:	10%
(vi)	Normal usage	:	500 units per week
(vii)	Minimum usage	:	250 units per week
(viii)	Maximum usage	:	750 units per week

Required: (i) Re-order quantity. (ii) Re-order level. (iii) Minimum stock level. (iv) Maximum stock level. (v) Average stock level. (*CA—November, 2006*)

SOLUTION

(i) Re-order quantity/EOQ = $\sqrt{2AB/C}$, Annual usage is 7,500 × 12 = 90,000.
Carryiing cost per unit is = Rs 60 × 10% = Rs 6, Buying cost per order is Rs 500.

$$\text{EOQ} = \sqrt{2 \times 90,000 \times 500/6} = \sqrt{1,50,00,000} = 3,873 \text{ units}$$

(ii) Re-order level = (Maximum usage × Maximum delivery time) = 750 units per week × 8 weeks = 6,000 units

(iii) Minimum stock level = Reorder level – (Normal usage × Average delivery time in weeks)
= 6,000 units – (500 units per week × 6.5 weeks) = 2,750 units

(iv) Maximum stock level = Reorder level + Reorder quantity – (Minimum usage × Minimum re-order period)
= (6,000 units + 3,873) – (250 units per week × 5 weeks) = 8,623 units

(v) Average stock level = (Minimum level + Maximum level)/2 = (2,750 units + 8,623)/2 = 5,687 units.

EQ. 3.13 The average annual consumption of a material is 18,250 units at a price of Rs 36.50 per unit. The storage cost is 20% on an average inventory and the cost of placing an order is Rs 50. How much quantity is to be purchased at a time? (*CA (PCC)—May, 2007*)

SOLUTION

$$EOQ = \sqrt{2AB/C} = \sqrt{(2 \times 18,250 \times \text{Rs}\,50/(\text{Rs}\,36.5 \times 0.2)}$$

$$= \sqrt{18,25,000/7.3 = 2,50,000} = 500 \text{ units}$$

4 Costing and Control of Labour

Introduction

Manufacturing is a process by which raw materials are converted into finished products. The two elements of conversion costs are direct labour, and factory overheads. If the manufacturing process is labour-intensive, labour costs constitute a significant component in the conversion process. This chapter explores the costing and control of labour. The costing and control of factory overheads follow in Chapter 5.

The compensation paid to the employees engaged in production related activities represents factory labour cost. The principal labour cost is *wages* paid to production workers made on hourly, daily, monthly, or price work basis. Included in labour costs are not only the regular earnings of the workers but also supplementary costs such as pensions, vocation and holiday pays, insurance benefits and other fringe benefit costs. Labour costs are direct or indirect.

Direct labour cost consists of the wages paid to labourers who work on a product directly, either manually or using a machine. It comprises wages which can be identified with, and allocated to, cost units. Direct labour, in other words, is the labour that: (i) Is directly involved in the production of a finished product, (ii) Can be easily traced to a product, and (iii) represents a major labour cost of manufacturing that product.[1] Examples are assembly-line workers, machine operators, moulders, samplers, and finishers.

Indirect labour is a factory labour which is not engaged in production. It is not directly traceable to a product. It cannot be allocated but can be apportioned to/absorbed by cost centres/units. Examples of indirect labour who are indirectly related to production are product designers, job supervisors, product inspectors, and so on. Indirect labour is included in factory overhead cost.

Section 1 illustrates accounting for labour. Some problems relating to accounting for labour and labour turnover are discussed in Sections 2 and 3 respectively. The efficiency rating procedures, namely, job evaluation and merit rating are briefly examined in Section 4. The main points are summarised in the last section.

ACCOUNTING FOR LABOUR

Accounting for labour by a manufacturing organisation usually involves three activities: (i) Time-keeping, (ii) Computation of total payroll (wages), and (iii) Allocation of total payroll costs.

Timekeeping

The timekeeping function involves two major activities in labour costing and control: (i) It accumulates the total number of hours worked by each worker so as to calculate his earnings and (ii) It determines how the labour - hours were spent so that proper distribution can be made in the cost records.

Timekeeping is usually centred in a separate time-keeping section of the personnel department. In small plants, however, timekeeping is mostly taken care of by each department head or, in some cases, by the workers themselves. The two source-documents commonly used in time keeping are: (a) Time or clock card and (b) Labour job ticket.

Time/Clock Card It is inserted in a time clock by the workers several times each day, that is: (i) Upon arrival, (ii) Going for lunch, (iii) Taking a break, and (iv) Leaving for the day. This provides a reliable source for computing and recording total payroll costs. Figure 4.1 shows a time card.

Time Card

Employee name..... Department.....
Employee/clock number..... Week.....
Shift.....

Day	Regular (time)				Overtime		Hours	
	In	Out	In	Out	In	Out	Regular	Overtime
						Total		

Figure 4.1 *Time/Clock Card*

Labour Job Tickets They are prepared daily by workers for each job worked on. They indicate the number of hours worked, a description of the work performed and the workers' wage rate (inserted by the payroll department). The total of the labour cost and hours for different jobs as shown on labour job tickets should equal the total labour cost and labour-hours for the period as shown on time cards. Figure 4.2 shows a labour job ticket.

Labour Job Ticket

Employee..... Nature of work.....
Shift..... Units completed.....
Job number..... Department.....
Date.....

Time started	Time stopped	Hours worked	Rate	Amount

Approved by.....

Figure 4.2 *Labour Job Payroll*

Computation of Total Payroll

The payroll department computes the total payroll including the gross amount earned and the net amount payable to employees after deduction of taxes and so on. It distributes the payroll and maintains records of employees' earnings, wage rate and job classification. The procedure is that the time cards are entered on the payroll sheet/summary. Figure 4.3 shows a payroll sheet. It forms the basis for the preparation of payroll vouchers authorising disbursements for the net amount payable to workers.

Payroll Sheet

Week.....

Employee	Hours worked	Rate	Gross pay	Deduction	Net pay

Figure 4.3 *Payroll Summary*

Allocation of Payroll Costs

On the basis of the time cards and job tickets, the cost accounting departments allocate the total payroll costs to individual jobs/departments/products. Alternatively, the payroll department itself prepares the allocation and sends it to cost accounting department for accounting in the form of appropriate journal entries. The total payroll cost must equal the sum of labour costs allocated to the individual jobs/departments/products.

Journal Entries to Record Labour Costs Payrolls are generally prepared weekly, fortnightly or monthly. Gross wages for an individual worker are determined by multiplying the hours shown on time cards by the hourly rate, plus any bonus or overtime. The payroll and related liabilities for deductions are journalised for each payroll period. The employee payroll expenses and payroll cost distribution are usually journalised at the end of the month. The basic journal entries to record factory labour costs are as follows:

(A) To record the payroll:		
Work-in-process Inventory (direct labour)	Dr	
Factory Overhead Control (indirect labour)	Dr	
To Payroll Payable		
(B) To record deductions and payment of payroll (wages):		
Payroll Payable	Dr	
To Employee Deductions Payable		
To Cash (to employees)		
(C) To record fringe benefits costs (pension, insurance, and so on):		
Factory Overhead Control	Dr	
To Employee Benefits Payable		

SPECIAL PROBLEMS RELATING TO ACCOUNTING FOR LABOUR

The accounting for labour involves special problems that are not encountered in the accounting for materials. The problem areas discussed in this section are:

- Workers/employees taxes
- Employer taxes and fringe benefits
- Shifts premiums
- Over time
- Idle time
- Minimum guaranteed wages and incentive plans.

Workers Taxes

Employers are required to deduct income taxes as well as social security payments, such as provident fund/pension contributions, which are remitted to government/social security organisations on a monthly/quarterly basis.

Fringe Benefit Costs

Employers are required to pay a matching contribution towards provident/pension funds of workers. They also bear the cost of workman's compensation insurance to provide funds to employees who are injured on the job.

EXAMPLE 4.1

Journalise the following payroll cost for the week ending April 15:

Factory payroll:		
Direct labour-Job 10	Rs 1,80,000	
Indirect labour	1,44,000	Rs 3,24,000
Other payroll:		
Salesmen's salaries	1,45,800	
Administrative salaries	70,200	2,16,000
Gross payroll		5,40,000
Social security contribution payable (employees contribution)		37,800
Social security contributions payable (employers contribution)		37,800
Income-tax deducted at source		1,35,000
Employees pension fund (paid by employer)		39,960

SOLUTION

Assuming all employers contribution and fringe benefits are recorded on a weekly basis, the following journal entries would be made on April 15:

(a)	To record the payroll:			
	Work-in-process Inventory—Job 10	Dr	Rs 1,80,000	
	Factory Overhead Control (indirect labour)	Dr	1,44,000	
	Selling Expenses Control	Dr	1,45,800	
	Administrative Expenses Control	Dr	70,020	
	To Payroll Payable			Rs 5,40,000
(b)	To record employee taxes and pay the payroll:			
	Payroll Payable	Dr	5,40,000	
	To Employee Income Taxes Payable			1,35,000
	To Employee Social Security Contribution Payable			37,800
	To Cash (to employees – residual balance)			3,67,200

(*Contd.*)

(c) To record employer contribution and fringe benefit costs:				
Factory Overhead Control (Rs 3,24,000 × 14.4 %*)	Dr	Rs 46,656		
Selling Expenses Control (Rs 1,45,800 × 14.4%)	Dr	20,995		
Administrative Expenses Control (Rs 70,200 × 14.4%)	Dr	10,109		
To Employer Social Security Contribution payable				Rs 37,800
To Employers Pension Fund				39,960
(d) To pay on a periodic basis all taxes/contribution and fringe benefit liabilities:				
Employee Income Taxes Payable				
Employee Social Security Contribution Payable				
Employer Social Security Contribution Payable				
Employer Pension Fund Contribution Payable				
To Cash				

* (Rs 37,800 + Rs 39,960)/Rs 5,40,000 = 14.4%

Shift Premiums

The shift premium/differential refers to the payment of higher hourly rates for working in less desirable evening/night shift(s). It is charged to factory overhead control rather than work-in-process, and spread over all units produced because they are not caused by specific units. If day shift rate is Rs 65 per hour and the night shift rate for the same job is Rs 70, for a worker working 50-hours week in the night shift, the entry would be:

Work-in-process Inventory (50 hours × Rs 65)	Dr	Rs 3,250	
Factory Overhead Control-Shift Premium (50 hours × Rs 5/hour)	Dr	250	
To Payroll Payable (50 hours × Rs 70/hour)			Rs 3,500

Overtime Premium

Regular earnings represent the total hours worked, including overtime hours multiplied by the regular pay rate. But a higher rate may be paid for overtime work. This is called overtime premium and represents the overtime hours multiplied by the premium rate. The premium rate is usually a fraction of the regular rate.

Accounting Treatment Depending on the underlying cause of overtime, overtime premium is treated in three ways when overtime results from: (i) Random scheduling of jobs, (ii) Requirements of a specific job, and (iii) Negligence or poor workmanship.

Random Scheduling of Jobs Overtime premium should be treated like shift premium and charged to factory overhead control. The entry to record overtime premium is:

Work-in-process Inventory—Job No. (Total hours worked × Normal hourly rate)	Dr	
Factory Overhead Control-Overtime Premium (Overtime hours × Overtime premium rate)	Dr	
To Payroll Payable		

Requirements of a Specific Job The overtime premium should be charged to the specific job that caused the overtime. If a rush order caused overtime for which the customer agrees to pay as a special service, the entry would be:

Work-in-process—Job No.	Dr	
To Payroll Payable		

Negligence/Poor Workmanship The overtime premium should be charged to as a loss and the entry would be:

Work-in-process Inventory—Job No.	Dr
Loss from Overtime Premium	Dr
To Payroll Payable	

The treatment accorded to overtime premium would determine action to be taken by management in planning and control of labour costs. The recording of loss, for example, would call for closer supervision/better on-the-job training.

Idle Time

When workers have no work to perform but are still paid for their time, idle time results. The accounting treatment from the point of view of labour cost control depends upon the reason for idle time. It could be normal or due to negligence/inefficiency.

If idle time is normal for the production process and is unavoidable, the cost of idle time is charged to factory overhead control and the entry is:

Work-in-process Inventory—Job No. (Hours worked × Rate per hour)	Dr
Factory Overhead Control-Idle Time (Hours × Hourly rate)	Dr
To Payroll Payable	

If idle time is caused by negligence/inefficiency, it is charged to a loss account and the entry would be:

Work-in-process Inventory	Dr
Loss from Idle Time	Dr
To Payroll Payable	

Minimum Guaranteed Wage and Incentive Plans

Under the piecework rate system of wage payment, employees earnings is equal to the number of units produced multiplied by the piecework rate. Several manufacturing organisations have a system of wage payment under which employees are paid a minimum guaranteed wage with a stipulation that they can earn more if they produce more. If the output multiplied by the piece rate results in an amount less than the guaranteed wage, the difference is charged to the factory overhead control; if the former exceeds the latter, it should be charged to the work-in-process inventory. Thus, under this system of wage payment, an average employee is expected to earn not only the minimum wage but a bonus as well. Employees who produce more than a specified number of units (piecework) receive a bonus.

The incentive (bonus) plans vary in format and application. They fall into two categories: (1) Differential piece rates schemes and (2) Premium bonus plans.

Differential Piece Rates Schemes Included in this category are (i) Taylor Differential Piece Rate System, (ii) Merrick Differential Piece Rate System, and (iii) Gantt Task and Bonus Plan.

Taylors Differential Piece Rate System Under this system, there are two price wage rates: a low rate for output below standard performance, and a higher rate applicable to workers whose production is above standard. The efficiency of a worker may be determined as a percentage of: (i) Time allowed for a job to the actual time taken or (ii) Actual output to standard output within a specified time. For example, if standard time allowed for a job is 15 hours, while the actual time taken is 20 hours, workers efficiency/performance is $(15 \times 100) \div 20 = 75$ per cent. Similarly, if standard output is 5 units per hour, and the actual output is 6

units per hour, efficiency = (6 × 100) ÷ 5 = 120 per cent. The merit of this system is that it provides a strong incentive to the efficient workers. The slow worker is penalised while the efficient worker is duly rewarded.

EXAMPLE 4.2

The standard production in Hypothetical Ltd is 20 units per hour. For the first week of April, a workers' record (working 8 hours per day) is as follows:

Monday	140 units	Wednesday	175 units
Tuesday	160 units	Thursday	180 units
Friday	200 units		

Compute the workers daily earnings. The effective hourly rate and the labour cost per unit under the Taylor Differential Piece Rate System with piece rates are as specified below: Rs 2 per unit below standard; Rs 2.40 at standard and upto 20 per cent above standard; and Rs 3 per unit when daily output exceeds 20 per cent above standard.

SOLUTION

Taylor Differential Piece Rate System

Days	*Standard output*	*Actual output*	*Efficiency (%)*	*Piece rate*			*Effective hourly rate*	*Cost per unit*
				Rs 2	*Rs 2.40*	*Rs 3*		
Monday	160	140	87.5	280	—	—	Rs 35.0	Rs 2
Tuesday	160	160	100.0	—	384	—	48.0	2.4
Wednesday	160	175	109.4	—	420		52.5	2.4
Thursday	160	180	112.5	—	432		54.0	2.4
Friday	160	200	125.0	—	—	600	75.0	3.0

EXAMPLE 4.3

Assuming the following facts, calculate the earnings of workers under Taylor Differential Piece Rate System:

- Standard time per piece; 20 minutes
- Normal rate per hour, Rs 9
- In a 9-hour day, A produces 25 units and B produces 30 units.
- Differential to be applied: 80 per cent of piece rate below standard and 120 per cent above standard.

SOLUTION

Efficiency of	A = 92.6 per cent = (25/27) × 100
	B = 111 per cent = (30/27) × 100
Piece rate of	A = 0.80 × Rs 3 = Rs 2.4
	B = 1.2 × Rs 3 = Rs 3.6
Earnings of	A = 25 × Rs 2.40 = Rs 60
	B = 30 × Rs 3.60 = Rs 108

Merrick Differential Piece Rate System This is a modification of/improvement over the Taylor Differential Piece Rate System. It uses three piece rates. Normal piece rates are paid when output is upto 83 per cent of the standard output; 110 per cent of normal piece rates are paid for output between 83 - 100 per cent; and 120 per cent is paid if the output exceeds 100 per cent. While it rewards efficient workers, it does not penalise less efficient workers as minimum upto 83 per cent could possibly be achievable by all workers.

EXAMPLE 4.4

From the under-mentioned facts, calculate the earnings of A, B and C under the Merrick Differential Piece Rate System:

- Normal piece rate (upto 83 per cent of high task output), Rs 10 per unit;
- High task, 40 units per week
- Output for the week: A, 32 units; B, 37 units; C, 42 units.

SOLUTION

Efficiency of A = (32 × 100) ÷ 40 = 80 per cent
B = (37 × 100) ÷ 40 = 92.5 per cent
C = (42 × 100) ÷ 40 = 105 per cent

Wages of A = 32 × Rs 10 = Rs 320
B = (37 × Rs 10 × 110) ÷ 100 = Rs 407
C = (42 × Rs 10 × 120) ÷ 100 = Rs 504

Gantt Task and Bonus Plan This system is a mixture of a guaranteed time rate with a bonus and piece rate plan using the differential principle. When output is below standard/high task (efficiency below 100 per cent), time rate is guaranteed. In case of output at standard level (100 per cent efficiency), bonus @ 20 per cent on time rate is payable, while higher price rate on whole output is paid if output exceeds standards. At the same time, it provides security/encouragement to less efficient workers.

EXAMPLE 4.5

Calculate the wages of A, B and C under the Gantt Task and Bonus Plan from the facts given below:

- Time rate, Rs 10 per hour for 40-hours week
- Standard production, 40 units per week
- Piece rate above standard output, Rs 12
- Weekly output: A, 32 units; B, 37 units; C, 42 units

SOLUTION

Wages: A = Rs 400 (40 × Rs 10): output below standard (32 units)
B = Rs 400 (40 × Rs 10): output below standard (37 units)
C = Rs 504 (42 × Rs 12): output above standard (42 units)

Premium Bonus Plans Under the time rate basis of wage payment, additional production beyond normal level benefits the employers, whereas, with piece rate system the benefit goes to the employees. Bonus plans are a mid-way in the sense that savings are shared between them. The plans included in premium bonus plans are Halsey Premium Plan, Halsey-Weir Plan, Rowan Plan, and Bedaux Point Plan.

Halsey Premium Plan Under this system, time rate is guaranteed and if a worker completes his jobs within/in more than standard time, he is paid the standard rate. But if the job is completed in less than the standard time, he is given wages for actual hours taken plus bonus equal to normally 50 per cent of the wages of the time saved; the remaining portion represents the share of the employer. The earning of a worker is computed according to Equation 4.1.

Workers earnings = (Time taken × Rate) + [0.50 × (Standard time – Time taken) × Rate] (4.2)

Halsey-Weir Premium Plan This plan is similar to the Halsey Plan with the only difference that the bonus/premium is usually applied on 33.33: 66.67 basis.

EXAMPLE 4.6

The standard time for Job Exe is 6 hours while the time given to complete the work is 10 hours. The wage rate is Rs 4 per hour. If the job is completed in 8 hours, compute the earnings per hour using Halsey Premium and Halsey-Weir Premium plans.

SOLUTION

Computation of Wages and Earnings per Hour

Halsey premium		*Halsey-Weir plan*	
Total wages	(8 × Rs 2) + 0.50 × (2 × Rs 2) = Rs 18		(8 × Rs 2) + 0.333 × (2 × Rs 2) = Rs 17.33
Earnings per hour	(Rs 18 ÷ 8) = 2.25		(Rs 17.33 ÷ 8) = 2.17

Rowan Plan This scheme is similar to the Halsey Plan in that a standard time is fixed for the completion of a job and bonus is paid in respect of the time saved. But a ceiling is applied to the size of the bonus. The bonus hours are computed as a proportion of the time taken, while time saved bears to the time allowed and is paid for at time rate.

The bonus = (Time taken ÷ Time allowed) × Time saved × Time rate (4.3)

The earnings are calculated according to Equation 4.4.

Earnings (Time taken × Rate per hour) + [(Standard time – Time taken) ÷ Standard time] × Time taken × Rate per hour (4.4)

EXAMPLE 4.7

From the undermentioned facts, calculate bonus, total earnings, and rate of earnings per hour under the Rowan plan:

- Time allowed, 6 hours
- Time taken, 4 hours
- Hourly rate, Rs 3

SOLUTION

Bonus = [(4/6) × 2 × Rs 3 = Rs 4*

Earnings = (4 × Rs 3) + Rs 4* or 4* [(6 – 4) ÷ 6] × 4 × Rs 3

Earnings per hour = Rs 16 ÷ 4 = Rs 4

Bedaux Point Plan Under this plan, a guaranteed hourly rate is paid until standard production is achieved, and a premium or additional wage is paid for units in excess of standard. Instead of being paid as piece rate, an hour's production is converted into points by dividing a standard hour's production in units into 60 minutes. A minute of standard time is termed as Bedaux Point (B), 60 units making one hour's work and the number of B points determined accordingly for each job. For instance, if 10 units are standard, each unit is 6 points (B). At standard performance, a worker produces a point per minute and for the first 60 points produced in an hour, he gets the hourly rate. For additional production, a bonus of 75 per cent of the rate is given to the workers; the remaining 25 per cent is paid to the supervisory staff and other indirect labour. Thus, under the Bedaux Point Plan, the guaranteed daily wage would apply for production upto standard. In excess of 60 points in an hour, bonus is paid equal to 75 per cent.

EAMPLE 4.8

From the information given below, compute bonus and total earnings according to Bedaux Point Plan:
Standard production for 8 hours daily = 100 (number)
Actual production for hours daily = 120 (number)
Hourly wage rate = Rs 3

SOLUTION

Standard points = $8 \times 60 = 480$ (B)
Actual points = $(120 \times 480) \div 100 = 576$ (B)
Points saved = $576 - 480 = 96 \times 0.75 = 72$
Bonus earned = $(72 \times \text{Rs } 3) \div 60 = \text{Rs } 3.60$
Total earnings = $(8 \times \text{Rs } 3) + \text{Rs } 3.60$ (bonus) = Rs 27.60

While incentive plans of wage payments are intended to improve labour performance/efficiency, their possible negative effects must be examined by management. They involve increased clerical cost due to additional record keeping. Moreover, quantity may become the main consideration to the detriment of quality of production. Therefore, incentive plans should be introduced only if increase in total payroll costs is offset by increase in production/sales, as well as reduction in labour cost per unit and/or labour-related costs per unit.

LABOUR TURNOVER

Labour turnover may be defined as the rate of change in the composition of the labour force in an organisation. It is the rate at which employees leave employment at a factory. Labour turnover has important implications for labour cost, efficiency and productivity. The objective should be to keep labour turnover at minimal.

Measurement of Labour Turnover

There are three methods to measure labour turnover: (i) Separation method, (ii) Flux/Separation-cum-replacement method, and (iii) Replacement/Net labour turnover method.

Separation Method Labour turnover is measured according to Equation 4.5.

Labour turnover = [(Employees leaving (number of separations) in a period ÷ Average number of workers employed)] × 100 (4.5)

Flux or Separation-cum-Replacement Method Labour turnover is measured according to Equation 4.6.

Labour turnover = [(Number of separations (employees leaving) + Number of replacements (new employees, excluding those recruited for expansion)] ÷ (Average number employed) × 100 (4.6)

Replacement/Net Labour Turnover Method Labour turnover is computed according to Equation 4.7.

Labour turnover = (Number of workers replaced in a period ÷ Average number employed) × 100 (4.7)

EXAMPLE 4.9

The information relating to the workforce of Premier Industries Ltd during the latest month is listed below:

- Number of workers in the beginning and end of the month 19,000 and 21,000 respectively;
- During the month workers discharged, 600 and left on their own, 200;
- During the month workers engaged, 2,000 out of which workers appointed against vacancies caused by separation, 400 and on account of expansion, the remaining 1,600.

Compute the monthly labour turnover rate and the equivalent annual rates under the three methods of labour turnover measurement.

SOLUTION

1. Separation Method:
   Labour turnover rate = (800 × 100) ÷ 20,000* = 4 per cent *(19,000 + 21,000) ÷ 2
   Equivalent annual turnover = (4 × 365 days) ÷ 30 days = 48.67 per cent
2. Flux Method:
   Labour turnover rate = (800 + 400) ÷ 20,000* = 6 per cent
   Equivalent annual rate = (6 × 365) ÷ 30 = 73 per cent
3. Replacement Method:
   Labour turnover rate = (400 × 100) ÷ 20,000* = 2 per cent
   Equivalent annual rate = (2 × 365) ÷ 30 = 24.33 per cent

Of the three, separation method is a better indicator of the labour turnover in a factory organisation.

Causes of Labour Turnover

The causes of labour turnover may be avoidable and unavoidable.

Avoidable Causes Such causes are avoidable in the sense that with suitable measures they can be eliminated. They include:

- Low wage rates and earnings
- Dissatisfaction with job/Unsatisfactory working conditions
- Unsatisfactory relationship with supervisors/fellow workers
- Lack of conveyance, accommodations, medical, educational, recreational and housing facilities
- Unfair methods of promotion/lack of promotional avenues
- Seasonal nature of job.

Unavoidable Causes They include

- Change for better jobs
- Retirement and death
- Domestic/family responsibilities/constraints
- Dismissal/discharge due to insubordination, negligence, inefficiency and
- Retrenchment/lay off.

Costs of Labour Turnover

The cost of labour turnover consists of two elements; preventive and replacements.

Preventive Costs This include all those costs which are incurred to keep the labour turnover rate as low as possible to prevent workers from leaving the organisation and keeping them satisfied. High preventive costs would result in low labour turnover. The preventive costs, *inter alia*, include costs of providing to workers/families:

- Medical, housing and recreational facilities
- Benefits like pension, gratuity and bonus
- Educational facilities to children of employees
- Good working conditions
- Other welfare facilities.

Replacement Costs These costs arise on account of labour turnover and consequent replacement of employees. They include costs which are incurred for recruitment/training of new workers as well as those which result from wastages, losses, lower production due to less competent and inexperienced new employees:

Personnel Department Expenses This is for recruitment/training new employees and loss of production time during training period.

Inefficiency of New Workers This has an adverse effect on production.

Delay in Recruitment of New Workers Recruitment of new workers is time-consuming, necessitating overtime payment to existing employees and the consequent burden on the organisation.

Cost of Abnormal Breakages This pertains to tools, equipments by new/inexperienced workers as well as machine break-down and the consequent interruption of production.

Cost of Spoilage and Defectives More spoilage/defectives are likely to occur due to mishandling/carelessness of new workers. The greater the spoilage/defectives, the larger is the production costs.

The replacement cost of labour turnover can be computed in two ways: (i) By separation and replacement method and (ii) By profit forgone method.

Separation and Replacement Method Under this method, the specific costs associated with separation (turnover) and replacements (recruitment/training) are accumulated. The separation costs include terminal pay, gratuity and other benefits. The replacement costs include costs associated with selection/training of new employees. Another relevant cost is the lost contribution in terms of sales less additional variable cost due to labour cost of lost hours due to replacement, and increase in material and variable overhead due to increase in potential sales.

EXAMPLE 4.10

From the information given below, calculate the cost of labour turnover, using separation and replacement method:

Income Statement for the Year Ended March 31, Current Year

Sales		Rs 4,00,000
Variable costs:		
Materials	Rs 1,00,000	
Direct labour	80,000	
Variable overheads	80,000	2,60,000
Contribution		1,40,000
Less fixed overheads		90,000
Profit before tax		50,000

The direct labour-hours worked during the period were 20,300 of which 500 hours pertained to new workers on training. Only 40 per cent of trainee's time was productive. As replacement of workers left was delayed for some time, 600 productive hours were lost.

The company incurred direct costs as a consequence of separation/replacements detailed below: Separation, Rs 4,000; Selection, Rs 6,000, and Training, Rs 10,000.

SOLUTION

Cost of Labour Turnover

Direct labour-hours worked		20,300
Less unproductive time of new workers (0.60 × 500)		300
Productive hours		20,000
Loss labour hours:		
Replacement	600	
Training	300	900
Unit sales per productive labour hour (Rs 4,00,000 ÷ 20,000)		Rs 20
(i) Loss of potential sales (900 hours × Rs 20)		18,000
Direct labour cost per hour worked (Rs 80,000 ÷ 20,300)		3.94
(ii) Increase in direct labour cost of lost hours due to replacement (600* hours × Rs 3.94)		2,364
* (300 hours already included while calculating hourly rate)		
(iii) Increase in material and variable overheads due to increase in potential sales (Rs 1,80,000 ÷ Rs 4,00,000) × Rs 18,000		8,100
(iv) Total increase in cost [(ii) + (iii)]		10,464
Contribution foregone [(i) – (iv)]		7,536
Add separation, selection and training costs (Rs 4,000 + Rs 6,000 + Rs 10,000)		20,000
Cost of labour turnover		27,536

Profit Forgone Method According to this method, the cost of labour turnover equals the profit foregone in terms of the difference between the actual profit for the period and the estimated profit that would have been earned had no labour turnover occurred. Alternatively, contribution lost due to labour turnover and costs incurred consequent on labour turnover equal profit foregone.

EXAMPLE 4.11

The sales of Premier Industries Ltd in the previous year aggregated Rs 1,66,06,600 and the P/V (profit - volume) ratio was 20 per cent. The actual hours worked was 4.45 lakh. The actual direct hours included

30,000 hours attributable to training of new recruits of which 50 per cent represented unproductive hours. As a result of delays in filling vacancies caused by labour turnover, 1,00,000 potentially productive hours were lost.

The cost associated with labour turnover were: (i) Settlement cost due to leaving, Rs 87,640; (ii) Recruitments cost, Rs 53,480; (iii) Selection costs, Rs 25,500, and (iv) Training costs, Rs 60,980.

Assuming the potential production loss consequent upon labour turnover could have been sold at the prevailing price, find the profit foregone in the previous year on account of labour turnover.

SOLUTION

Determination of Profit Foregone

Contribution foregone (working note)	Rs 7,72,400
Settlement cost	87,640
Recruitment cost	53,480
Selection cost	25,500
Training cost	60,980
Total	10,00,000

Working Note

Determination of contribution foregone:

Actual hours worked	4,45,000
Less unproductive hours (0.50 × 30,000)	15,000
Actual productive hours	4,30,000
Sales lost (Rs 1,66,06,600 ÷ 4,30,000 hours) × 1,00,000 hours	Rs 38,62,000
Contribution lost (Rs 38,62,000 × 0.20, P/V ratio)	7,72,400

Treatment of Labour Turnover Costs Labour turnover costs are usually treated as factory overhead. The preventive costs are distributed among different departments on the basis of workers in each department. The replacement costs are shared by the departments affected by the labour turnover on the basis of number of workers replaced.

Control of Labour Turnover Costs: Labour Turnover Report This report is prepared by the personnel department periodically with a view to minimising labour turnover costs by taking appropriate measures. It contains turnover statistics, turnover rate and reasons for turnover divided into avoidable and unavoidable. It shows whether workers are leaving through dissatisfaction or are being dismissed because of unsuitability/bad relations. A specimen of labour turnover report is given in Figure 4.4.

Labour Turnover Report Date.....

	Month	Cumulative since beginning of year	Last year
Number of employees			
Employees leaving			
Labour turnover (%)			
Reasons for leaving:			
Avoidable:			
.....			
.....			
.....			
Total			
Percentage			
Unavoidable:			
.....			
.....			
.....			
Total			
Percentage			
Number of replacements			
Percentages			

Figure 4.4 *Labour Turnover Report*

EFFICIENCY RATING PROCEDURES

This Section examines the two interrelated efficiency rating procedures, namely, job evaluation and merit rating.

Job Evaluation

Meaning Job evaluation is the systematic technique of analysis and assessment of jobs to ascertain their comparative labour/job worth. Every job has its own characteristics. Depending upon these, jobs demand varying degrees of qualifications, skill, experience and soon on the part of the operators performing them. For instance, some jobs may require physical ability, others may need a high degree of mental ability, yet others may need skill, experience and high educational qualification. Thus, job evaluation is the process of review, analysis and systematic classification of a job in accordance with its characteristics in terms of the varying factors it demands from the employees/workers. In other words, it grades all jobs with reference to their main characteristics so that the relative merit of each job in terms of work value/worth may be ascertained. Its focus is on the job and it has nothing to do with the rating of the employees.

Objectives/Importance/Uses The uses to which job evaluation may be put to, and the advantages acccruing from it, are specified below:

Fixation of Wage Structure The main aim/utility of job evaluation relates to fixation of a systematic, rational and equitable basis for differential wages/salaries in an organization. Fixation of wages on an impersonal basis, solely based on the job requirements, eliminates personal biases and errors. This results in simplified and balanced wage structure which are fair both for the employees as well as the employers. A related dimension is that anomalies in the wages of employees can be identified by comparing the actual wages *vis-a-vis* the job evaluation.

Help in Recruitment of New Workers The job evaluation technique generates useful information for recruitment of new workers. Since the exact requirement of each job is known, the personnel department can select only those workers who satisfy the requirements of the specific job. Likewise, promotions, transfers and so on can be made on a rational basis for different employees in the organisation.

Improvement of Labour Relations Job evaluation improves labour relations as it obviates scope for unfairness, favouritism, nepotism and so on.

Methods of Evaluation The job evaluation methods may be (i) qualitative or (ii) quantitative. The qualitative/non-qualitative methods include (1) job ranking method, and (2) job grading/grade description method. The quantitative method is primarily a point rating method.

Job Ranking Method According to this method, different jobs are evaluated and ranked on the basis of relative difficulty in performance and responsibilities. As a first step, all jobs are properly studied in terms of job requirements, qualification, responsibilities, hazards, working conditions and so on. On the basis of comparison of the job with the same components of another job, jobs are ranked in ascending/descending order. It is a method of informal arrangement of a hierarchy of jobs from the lowest to the highest or *vice versa.* After ranking, each job is put in ranked scale of jobs.

The ranking method of job evaluation is simple to use, easy to understand and less costly to operate. But it is less accurate. It could be usefully employed by small organisations only where jobs are few and well defined. Where jobs are complex in large organisations, the usefulness of this method would be rather limited.

Job Grading/Grade Description Method This method is a variant of the job ranking method. It is also an improvement over the ranking method. Under the job grading method, a predetermined/hypothetical scale/standard of job values is determined on the basis of education, experience, skill, responsibilities and so on and each job is placed in suitable grades/classes. The jobs within each grade are approximately of similar nature. The method is simple, less costly and administratively feasible. It attempts applying a rational basis for grading jobs. But like the ranking method, it is less accurate and is not suitable for large/complex organisations.

Point/Factor Ranking Method According to this method, each job is analysed in terms of job factors consisting of elements like basic skills and knowledge, mental and physical efforts, responsibilities, working conditions and so on. As a first step, depending upon its nature and the extent to which it requires the various factors for its performance, each job is assigned points/weightage. A job requiring a large number of these factors would rank high in the process of job evaluation compared to those requiring smaller number of these factors. Moreover, two dissimilar jobs may have the same gradation if each has the same number of points. An illustrative/list of characteristic which may be taken into account for job evaluation and hypothetical points allotted against each is summarised in Figure 4.5.

Basic Factors;		**Main Factors:**			
Background skill and knowledge	400	Education	100		
		Training	150		
		Experience	150	**Sub-factors:**	
				Education:	100
			400	Non-matriculate	10
				High School	20
				Intermediate	30
				Degree	40
					100
Skill and efforts	400	Mental:			
		Reasoning	100		
		Observation	60		
		Initiation	20		
		Physical:			
		Mascular	100		
		Stamina	100		
		Dexterity	20	Training:	75
			400		
Responsibilities	300	Degree of supervision	100		
		Responsibility for material	100		
		Safety for others	50		
		Confidential information	50		
			300		
Working condition	200	Hazard	60	**Physical:**	
		Risk and safety	80	Mascular:	
		Disagreeableness	60	High	50
			200	Medium	30
				Ordinary	20
		Total	1,300		100

Figure 4.5 *Job Characteristics/Factors*

The second step is to review the specification of a job, analyse it into various factors/characteristics and evaluate each job in terms of assigning points. This is illustrated below:

Job Factors

Job	*Background skill and knowledge*	*Skill and efforts required for job performance*	*Responsibility*	*Working conditions*	*Total point*
A	40	80	100	80	300
B	120	20	70	140	350
C	50	160	200	20	430
D	300	40	60	100	500
E	400	200	10	180	790

Finally, jobs are ranked in the order of points and are placed in a number of arbitrary grades for each of which wages scales/ranges of pay are fixed. The gradation/fixation of wages for the various grades are shown below:

Wages Scales/Grades

Points Value	*Grade*	*Pay Scale*
100-198	I	Rs 1,200-1,400
200-398	II	1,400-1,600
400-498	III	1,600-2,000
500-598	IV	2,000-2,400
600-898	V	2,400-2,760
900-1.098	VI	2.800-3,200
1,100-1,198	VII	3,200-4,000
1,200-1,300	VIII	4,000-4,800

This method is theoretically sound and objective but it is difficult to operate. The relative points/ weights of different job factors need to be developed very carefully and in an objective manner.

Merit Rating

Meaning As a systematic method of determining the relative worth of employees, merit rating is the comparative appraisal of the individual merits of an employee. It is a technique to rate an employees' performance through some norms/standards. The factors/characteristics that are considered in merit appraisal of the employees are:

- Quantity of work done
- Quality of work done
- Sense of responsibility
- Initiative
- Reliability and integrity
- knowledge, skill, experience and aptitude for work
- Cooperation and discipline
- Sense of judgement
- Attendance and punctuality and so on.

Each of these factors is assigned a point rating/value and each employee is rated according to the extent of the point value he possesses. The employees may be ranked individually in order of the points they score. Alternatively, they may be arranged in groups according to their common ratings. The individual/group rating may also be expressed as a ratio of the normal/standard rating.

Comparison With Job Evaluation While job evaluation is the process of analysis and classification of jobs according to their characteristics, merit rating refers to the evaluation of the merits of employees and their classification into groups on that basis. Merit rating differs from job evaluation in several respects. In the first place, job evaluation is the assessment of the relative worth of jobs in an organisations; merit rating in the assessment of the relative worth of an employee with respect to a job. In other words, while job evaluation rates jobs, merit rating rates employees on their jobs. Secondly, job evaluation helps in establishing a rational wage/salary structure. In contrast, merit rating provides a scientific basis for determining fair wages for each employee based on his ability/competence and performance. Finally, job evaluation simplifies wage/salaries administration by rationalising and bringing uniformity in the wage/salary rates. But merit rating helps in determining a fair rate of pay for different employees on the basis of their relative performance.

Objectives The main objectives of merit rating are the following:

- To find out the suitability of an employee for a particular job

- To assess an employee's merit for promotion, grant of increment, payment of reward for good work and so on.
- To serve as a basis for incentive payment and for simplification of wage structure and
- To analyse the employee's defects/bring out their strength and special abilities.

Shortcomings/Limitations Merit rating improves labour relations, reduces labour turnover and stimulates competition among employees and, thus, contributes to increased production, improved productivity and so on. Nevertheless, it suffers from certain limitations/shortcomings. Being a matter of mostly opinion/subjective, the rating may be erroneous and may result in unrest/dissatisfaction among the employees. Moreover, raters may be influenced by past ratings of an employee. This may vitiate their judgement. The employee(s) may have improved in course of time. Further, irrelevant factors may be given prominence by the raters. For example, raters may be highly influenced by one specific/strong good/adverse factor. If merit rating is inaccurate/unreliable/subjective, it may not serve the intended purpose.

SUMMARY

- Labour is the physical/mental effort expended in the production of a product. Labour costs can be broken down into direct and indirect, based on the employees' relationship with the finished product. Total labour costs are based on elements other than just gross wages. The additional costs include bonus payments, vacation pay, pension costs and other fringe benefits including employees contribution to health, life and other insurance.
- The accounting for labour in a manufacturing organisation generally involves three activities: timekeeping, computation of total payroll and allocation of payroll costs. Journal entries to record the payroll (wages) payments and associated liabilities for amounts withheld are made for each period.
- The accounting for labour involves special problems that are not encountered in the accounting for materials. They are: taxes and fringe benefit costs, shift premiums, overtime, idle time, and minimum guaranteed wage and incentive plans. The incentive/bonus plans vary in format and applications. They fall into two categories: differential price rate schemes and premium bonus plans. Included in the first category are (1) Taylor Differential Piece Rate (2) Merrick Differential Piece Rate, and (3) Gantt Task and Bonus Plan.
- Under the Taylor Differential Piece Rate System, there are two piece wage rates: a low rate for output below standard performance and a higher rate applicable to workers where production is above standard. The efficiency of a worker may be determined as a percentage of (i) time allowed for a job to the actual time taken or (ii) actual output to standard output within a specified time.
- Merrick Differential Piece Rate System is a modification of/improvement over the Taylor Differential Piece Rate System. It uses three piece rates. Normal piece rates are paid when output is upto 83 per cent of the standard output; 110 per cent of normal piece rates are paid for output between 83–100 per cent; 120 per cent is paid if the output exceeds 100 per cent.
- Gantt Task and Bonus Plan is a mixture of a guaranteed time rate with a bonus and piece rate plan using the differential plan when output is below standard (efficiency below 100 per cent), time rate is guaranteed. In case of output at standard level (100 per cent efficiency) bonus at the rate of 20 per cent on time rate is payable while a higher piece rate on the whole output is paid if output exceeds standard.
- Under the time rate basis of wage payment, additional production beyond normal level benefits the employer(s); with piece rate system, the benefit goes to the employee(s). Bonus plans are a mid-way in the sense that the savings are shared between them. These plans include (i) Halsey/Halsey-Weir Plan and (ii) Rowan Plan.

- Under the Halsey Premium Plan the earnings and bonus of a worker is computed as below:
  Earnings = (Time taken × rate) + [0.50 × (Standard time – Time taken) × Rate]
  Bonus = [0.50 × (Standard time – Time taken) × Rate]
- Halsey-Weir Premium Plan is similar to Halsey Plan with the difference that the bonus/premium is usually applied on 33.33 : 66.67 basis.
- According to the Rowan Plan earnings and bonus are computed as below:
  Workers earnings = (Time taken × Rate per hour) + [(Standard time – Time taken) ÷ Standard time] × Time taken × Rate Per hour
  Bonus = (Time taken ÷ Time allowed) × Time saved × Time rate
- Labour turnover is the rate at which employees leave employment. It has implications for labour cost. The objective should be to keep the labour turnover at minimal. Labour turnover can be measured in three ways: by Separation method, Flux method and Replacement method.
- According to the separation method, labour turnover = [Employees leaving (number of separations) in a period ÷ Average number of workers employed] × 100
- According to flux/separation-cum-replacement method, labour turnover = [(Number of employees leaving) + Number of employees joining/replacements against vacancies of those leaving (new employees) ÷ Average number employed)] × 100
- According to replacement/net labour turnover method, labour turnover = (Number of workers replaced in a period ÷ Average number employed) × 100
- The causes of labour turnover may be avoidable in the sense that with suitable measures they can be eliminated or unavoidable. The labour turnover cost consists of two elements, that is, preventive cost and replacement. The replacement can be computed in either of two ways: (i) Separation and replacement method and (ii) Profit forgone method.
- Under separation and replacement method, the specific costs associated with separation (turnover) and replacements (recruitment/training) are accumulated. The separation costs include terminal pay, gratuity and other benefits. The replacament costs include costs associated with selection/training of new employees. Another relevant cost is the lost contribution in terms of sales less additional variable cost due to labour cost of lost hours due to replacement, and increase in material and variable overhead costs due to increase in potential sales.
- According to profit foregone method, the cost of labour turnover equals the profit foregone in terms of the difference between the actual profit for the period and the estimated profit that would have been earned had no labour turnover occurred. Alternatively, contribution lost due to labour turnover and costs incurred consequent on labour turnover equal profit foregone.
- Labour turnover costs are usually treated as factory overhead. While the preventive costs are distributed among different departments, the replacements costs are shared by the department(s) affected by the labour turnover. The personnel department prepares a labour turnover report periodically to minimise turnover by taking appropriate measures.
- Job evaluation is the systematic technique of analysis and assessment of jobs to ascertain their comparative labour/job worth. It grades all jobs with reference to their main characteristics so that the relative merit of each job in terms of work value may be ascertained. Its focus is on jobs and it has nothing to do with the rating of the employees. The job evaluation methods are: (i) job ranking method, (ii) job grading/grade description method and (iii) point rating method.
- According to the job ranking method, different jobs are evaluated and ranked on the basis of relative difficulty in performance and responsibilities.
- Under the job grading method, a predetermined/hypothetical scale/standard of job value is determined on the basis of education, experience, skill, responsibilities and so on and each job is placed in suitable grade(s)/class(es).

- According to the point/factor ranking method, each job is analysed in terms of job factors consisting of elements like basic skills and knowledge, mental and physical efforts, responsibilities, working conditions and so on. Each job is assigned points/weightage.
- As a systematic method of determining the relative worth of employees, merit rating is the comparative appraisal of the individual merits of an employee. It rates an employees' performance through some norms/standards.

REFERENCES

1. Polimeni, Fabbozi and Adelberg, *op. cit*., p. 100.

SOLVED PROBLEMS

P. 4.1 Calculate the earnings of a worker under (1) Halsey Plan and (2) Rowan Plan from the following particulars: (i) Hourly rate of wages guaranteed, 50 paise per hour; (ii) Standard time for producing one dozen articles—3 hours; (iii) Actual time taken by the worker to produce 20 dozen articles—48 hours.

SOLUTION

Determination of earnings of a worker

(i) Halsey plan: (Hours worked × Rate per hour) + [(50% Time saved (Hours) × Rate per hour)] = (48 × Rs 0.50) + (0.5 × 12 × Rs 0.50) = Rs 27

(ii) Rowan plan: (Hours worked × Rate per hour) + (Time saved/Time allowed) × Time taken × Rate per hour) = (48 × Rs 0.50) + [(12/60) × 48 × Rs 0.50] = Rs 28.80.

P. 4.2 Calculate the earnings of A and B from the following particulars for a month and allocate the labour cost to each job X, Y and Z:

	A	*B*
Basic wages	Rs 100	Rs 160
Dearness allowance (%)	50	50
Contribution to provident fund (on basic wages) (%)	8	8
Contribution to employees' state insurance (on basic wages) (%)	2	2
Overtime (hours)	10	

The normal working hours for the month are 200. Overtime is paid at double the total of normal wages and dearness allowance. Employer's contribution and employees' contributions to state insurance and provident fund are at equal rates. The two workers were employed on jobs X, Y and Z in the following proportions:

	Jobs		
	X	*Y*	*Z*
Worker A (per cent)	40	30	30
Worker B (per cent)	50	20	30

Overtime was done on Job Y.

SOLUTION

Determination of earnings of workers A and B

Particulars	*A*	*B*
Basic wages	Rs 100	Rs 160
Dearness allowance (50 per cent)	50	80
Overtime wages	15 [1]	—
Gross wages	165	240
Less provident fund contribution (8 per cent of basic wages)	(8)	(12.8)
Less ESI contribution (2 per cent of basic wages)	(2)	(3.2)
Net wages paid	155	224

Determination of effective labour cost from employer's point of view

Particulars	*A*	*B*
Basic wages	Rs 100	Rs 160
Dearness allowance	50	80
Employer's contribution to provident fund (8 per cent) and ESI (2 per cent)	10	16
Total wages	160	256
Number of hours	200	200
Labour rate per hour	0.80	1.28

Statement showing allocation of wages to jobs X, Y and Z

Particulars	*X*	*Y*	*Z*
Worker A:			
Normal wages (4:3:3)	Rs 64	Rs 48	Rs 48
Overtime (for Job Y)	—	15	
Worker B:			
Normal wages (5:2:3)	128	51.20	76.80
Allocated wages	192	114.20	124.80

1. Determination of overtime wages: = 2 × (Basic wages + Dearness allowed)/ Normal working hours = 2 × Rs 150/200 = Rs 1.5 per hour 10 hours × Rs 1.5 = Rs 15

P. 4.3 During a week a worker produced 300 units, working for 48 hours. The hourly rate is Rs 4. The estimated time to produce a unit is 10 minutes. Under incentive scheme, 20 per cent additional time is allowed. Calculate his gross earnings under Halsey and Rowan Plans.

SOLUTION

Determination of earnings of a worker

(i) *Halsey Plan* : (Hours worked × Rate per hour) + (50% Time saved × Rate per hour)
: (48 hours × Rs 4) + [0.5 (60 hours[1] − 48 hours) × Rs 4]
: Rs 192 + (6 × Rs 4) = Rs 216

(1) Normal time allowed (10 minutes × 300 units) = 3,000 minutes
Plus 20 per cent additional time (0.2 × 3,000) = 600
Standard time allowed (60 hours) 3,600 minutes

(ii) *Rowan Plan* : (Hours worked × Rate per hour) + (Time saved/Time allowed) × Time taken × Rate per hour
: (48 Hours × Rs 4) + (12 Hours/60 Hours) × 48 Hours × Rs 4
: Rs 192 + (1/5 × 48 × Rs 4) = Rs 230.40

P. 4.4 A workman's wages for a guaranteed 44 hours week is Re 0.75 per hour. The estimated time to produce one article is 30 minutes and under an incentive plan, the time allowed is increased by 20 per cent.

During a week, a worker produced 100 articles. Calculate the wages under: (1) Time rate, (b) Rowan system and (c) Halsey system.

SOLUTION

Determination of earnings of a worker

(i) Time Rate	: (44 hours × Rs 0.75) = Rs 33
(ii) Rowan System	: (44 hours × Rs 0.75) + (16 hours/60 hours)[1] × 44 hours × Rs 0.75
	: Rs 33 + Rs 8.8 = Rs 41.80
(iii) Halsey Plan	: (44 hours × Rs 0.75) + (8 hours × Rs 0.75) = Rs 33 + Rs 6 = Rs 39

1	Normal time per article (minutes)	30
	Plus 20 per cent extra time allowed	6
	Standard time per article	36
	Standard time for 100 articles (60 hours)	3,600
	Time saved (60 hours – 44 hours worked) (hours)	16

P. 4.5 An employee working under a bonus scheme saves 10 hours in a job for which the standard time is 60 hours. Calculate the rate per hour worked and wages payable to him if incentive bonus of 10 per cen on the hourly rate is payable when standard time (namely, 100 per cent efficiency) is achieved, and a further incentive bonus of 1 per cent on hourly rate for each 1 per cent excess of that 100 per cent efficiency is payable. Assume that the normal rate of payment is Rs 5 per hour.

SOLUTION

Determination of total wages and effective rate per hour

Wages (50 hours × Rs 5)	Rs 250	
Plus bonus (0.10 × Rs 250)	25	
Plus incentive (1% for efficiency in excess of 100%)		
Efficiency (60 actual hours/50 standard hours) = 120%		
Plus incentive (120% – 100%) × 250	50	
Total wages	325	
Effective rate per hour (Rs 325/50 hours)		6.50

P. 4.6 Calculate the earnings of workers A, B and C under Straight Piece Rate System and Merrick's Multiple Piece Rate System from the following particulars:

Normal rate per hour	Rs 5.40
Standard time per unit	1 minute
Output per day is as follows:	
Worker A—390 units	
Worker B—450 units	
Worker C—600 units	
Working hours per day are 8.	

SOLUTION

Earnings of workers under straight piece rate system

Worker A = (390 units × Rs 0.09@) =	Rs 35.10
Worker B = (450 units × Rs 0.09@) =	40.50
Worker C = (600 units × Rs 0.09@) =	54.00

@ Rs 5.40/60 units = Rs 0.09

Earnings of workers under Merrick's Multiple Piece Rate System

Particulars/Workers	*A*	*B*	*C*
1. Actual output per day	390	450	600
2. Standard output per day (8 hours)	480	480	480
3. Efficiency level (1 ÷ 2) × 100 (%)	81.25	93.75	125
4. Revised wage rate per unit	Rs 0.09*	Rs 0.099**	Rs 0.108***
5. Earnings (1 × 4)	35.10	44.55	64.80

* Normal rate; ** 10 per cent above normal rate; *** 20 per cent above normal rate.

P. 4.7 A job can be executed either through workman A or B. A takes 32 hours to complete the job while B finishes it in 30 hours. The standard time to finish the job is 40 hours.

The hourly wage rate is same for both the workers. In addition, workman A is entitled to receive bonus according to Halsey Plan (50 per cent sharing) while B is paid bonus as per Rowan Plan. The works overheads are absorbed on the job at Rs 7.50 per labour-hour worked. The factory cost of the job comes to Rs 2,600 irrespective of the workman engaged. Find out the hourly wage rate and cost of raw materials input. Also, show cost against each element of cost included in factory cost.

SOLUTION

Statement of factory cost of jobs A and B

Particulars/Workman	*Job A*	*Job B*
Material cost	Rs X	Rs X
Wages (workmen)	36 Y	37.5 Y
Work overheads @ Rs 7.50 per hour worked	240	225
Factory cost	2,600	2,600
Standard time (hours)	40	40
Actual time taken (hours)	32	30
Time saved (hours)	8	10
Bonus	4 Y(1)	7.5Y(2)
Wages paid	32 Y	30 Y
Total wages paid	36 Y	37.5Y

1. Bonus for A under Halsey Plan: Time saved × 0.50 × Hourly rate = 8 × 0.50 × Rs Y = 4 Y
2. Bonus for B under Rowan Plan: (Time saved ÷ Standard time) × Time taken × Hourly rate) = (10 × 40) ÷ 30 × Rs Y = 7.5 Y

Now, from the above we can deduce that:

Rs X + Rs 36 Y + Rs 240 = Rs 2,600

Rs X + Rs 37.5 Y + Rs 225 = Rs 2,600

Solving above equations, we get:

X = Rs 2,000

Y = Rs 10 per hour.

Therefore, material cost (X) is Rs 2,000, and hourly wage rate (Y) is Rs 10 per hour.

P. 4.8 Supreme Industries Ltd recently adopted an incentive plan. Factory workers are paid at Rs 3.75 per unit with a guaranteed minimum wages of Rs 1,000 per week. Following is a report on employees' productivity for the week ending March, current year. All employees had worked the full 40-hour week. Weekly summary is as follows:

Workers' name	Units produced
A	240
B	275
C	250
D	280
E	220
F	300

Required (a) Compute each employee's gross wages per week, (b) What amount should be charged to work-in-process charged to factory overheads?

SOLUTION

(a) Statement showing determination of gross wages

Name	Units produced	Piece rate	Piecework earnings	Below minimum	Total earnings
A	240	Rs 3.75	Rs 900.00	Rs 100	Rs 1,000.00
B	275	3.75	1,031.25	—	1,031.25
C	250	3.75	937.50	62.50	1,000.00
D	280	3.75	1,050.00	—	1,050.00
E	220	3.75	825.00	175.00	1,000.00
F	300	3.75	1,125.00	—	1,125.00
			5,868.75	337.50	6,206.25

(b) Amount to be charged to work-in-process (WIP) inventory is Rs 5,868.75

(c) Amount to be charged to factory overheads is Rs 337.50.

P. 4.9 In an engineering concern, the employees are paid incentive bonus in addition to their normal wages at hourly rates. Incentive bonus is calculated in proportion of time taken to time allowed, of the time saved. The following details are made available in respect of employees X, Y and Z for a particular week:

	X	Y	Z
Normal wages (per hour)	Rs 4	Rs 5	Rs 6
Completed units of production	6,000	3,000	4,800
Time allowed per 100 units (hour)	0.8	1.5	1.0
Actual time taken (hours)	42	40	48

You are required to work out for each employee: (i) The amount of bonus earned, (ii) The total amount of wags received, and (iii) The total wages cost per 100 units of output.

SOLUTION

Statement showing the amount of bonus earned, wages received, and wages cost per 100 units of output

	X	Y	Z
Completed units of production	6,000	3,000	4,800
Time allowed for units produced	48	45	48
Actual time taken (hours)	42	40	48
Time saved (hours)	6	5	—
Normal wages (per hour)	Rs 4	Rs 5	Rs 6
Basic wages (Actual hours × Normal rate)	168	200	288
(i) Bonus earned (Time taken/Time allowed) × Time saved × Wage rate	21	22.22	—
(ii) Total wages cost	189	222.22	288
(iii) Wages cost per 100 units	3.15	7.41	6

P. 4.10 The time allowed for a job is 8 hours. The hourly rate is Rs 8. Prepare a statement showing: (i) The bonus earned, (ii) The total earnings of labour, and (iii) Hourly earnings under the Halsey System with 50 per cent bonus for time saved, and Rowan System for each hour saved respectively.

SOLUTION

Determination of bonus, total earnings of labour and hourly earnings as per halsey and rowan systems

				Bonus		Total earnings		Hourly earnings	
Time allowed (hours)	*Time taken (hours)*	*Time saved (hours)*	*Basic wages at Rs 8 per hour*	*Halsey System@*	*Rowan System@@*	*Halsey System (Col. 4 + Col. 5)*	*Rowan System (Col. 4 + Col. 6)*	*Halsey System (Col. 7 ÷ Col. 2)*	*Rowan System (Col. 8 ÷ Col. 2)*
1	2	3	4	5	6	7	8	9	10
8	8	Nil	Rs 64	—	—	Rs 64	Rs 64	Rs 8	Rs 8.0
8	7	1	56	Rs 4	Rs 7	60	63	8.57	9.0
8	6	2	48	8	12	56	60	9.33	10.0
8	5	3	40	12	15	52	55	10.40	11.0
8	4	4	32	16	16	48	48	12.00	12.0
8	3	5	24	20	15	44	39	14.67	13.0
8	2	6	16	24	12	40	28	20.0	14.0
8	1	7	8	28	7	36	15	36.0	15.0

@ Standard wage rate × 0.5 × Time saved

@@ Standard wage rate × (Time saved/Time allowed) × Time taken

P.4.11 A skilled worker in XYZ Ltd is paid a guaranteed wage rate of Rs 30 per hour. The standard time per unit for a particular product is 4 hours. P, a machineman, has been paid wages under the Rowan Incentive Plan and he had earned an effective hourly rate of Rs 37.50 on the manufacture of that particular product.

What could have been his total earnings and effective hourly rate, had he been put on Halsey Incentive Scheme (50 per cent)?

SOLUTION

(i) Total Earnings of Machineman, P as per Haley Incentive Scheme (50 per cent)
= (Time taken× Rate per hour) + [0.50 × (Standard time – Time taken) × Rate per hour
= (3 hours × Rs 30) + [0.5(4 Hours – 3 Hours) × Rs 30]
= Rs 90 + Rs 15 = Rs 105

(ii) *Effective Hourly Rate = Total earnings/Number of hours = Rs 105/3 = Rs 35*

Working Notes

Detemination of Time Taken by a Machineman

Earnings as per Rowan Incentive Plan are = (Time taken × Rate per hour) + [(Standard time – Time taken) ÷ Standard time] × Time taken × Rate per hour

Let time taken by x

Rs 37.50 = Rs 30x + [(4 – x) ÷ 4] × x Rs 30

Let both sides be divided be 1/x

$$= \text{Rs } 37.50 = \text{Rs } 30 + \left[\frac{4-x}{4}\right] \times \text{Rs } 30 = \text{Rs } 37.50 = \text{Rs } 30 + \left[\frac{\text{Rs } 120 - 30x}{4}\right]$$

Rs 7.5 = Rs 30 – 7.5 x

7.5x = Rs. 225 or x = Rs 22.5/7.5 = 3 hours

P.4.12. During audit of accounts of G. Company, your assistant found errors in the calculation of the wages of factory workers and he wants you to verify his work.

He has extracted the following information:

(i) The contract provides that the minimum wage for a worker is his base rate. It is also paid for downtime i.e. the machine is under repair or the worker is without work. The standard work week is 40 hours. For overtime production, workers are paid 150 per cent of base rates.

(ii) Straight Piece Work—The worker is paid at the rate of 20 paise per piece.

(iii) Percentage Bonus Plan—Standard quantities of production per hour are established by the engineering department. The worker's average hourly production, determined from his total hours worked and his production, is divided by the standard quantity of production to determine his efficiency ratio. The efficiency ratio is then applied to his base rate to determine his hourly earnings for the period.

(iv) Emerson Efficiency Plan - A minimum, wages is paid for production upto 66-2/3 per cent of standard output or efficiency. When the workers production exceeds 66-2/3 per cent of the standard output, he is paid bonus as per the following table:

Efficiency Level	*Bonus*
Upto $66\frac{2}{3}$ %	Nil
Above $66\frac{2}{3}$ % to 79%	10%
80%-99%	20
100%-125%	45

Your assistant has produced the following schedule pertaining to certain workers of a weekly pay roll:

Workers	*Wage incentive plan*	*Total hours*	*Down time (hours)*	*Units produced*	*Standard units*	*Base rate*	*Gross wages per book*
Rajesh	Straight piece work	40	5	400	—	Rs 1.80	Rs 85
Mohan*	Straight piece work	46	—	455	—	1.80	95
John	Straight piece work	44	—	425	—	1.80	85
Harish	Percentage bonus plan	40	4	250	200	2.20	120
Mahesh	Emerson	40	—	240	300	2.10	93
Anil	Emerson (40 hours production)	40	—	600	500	2.00	126

* Total hours of Mohan include 6 overtime hours.

Prepare a schedule showing whether the above computation of worker's wages are correct or not. Give details.

SOLUTION

Schedule showing correct computation of workers' wages

Name of the worker	*Wage incentive plan*	*Minimum wages*	*Gross wages payable as per incentive plan*	*Actual wages to be paid* (Wages paid as per book)*	
Rajesh	Straight piece basis	Rs 72[1]	Rs 80[2]	Rs 80	(Rs 85)
Mohan	Straight piece basis	88.20[3]	91[4]	91	(95)
John	Straight piece basis	82.80[5]	85[6]	85	(85)
Harish	Percentage bonus basis	88.00[7]	110[8]	110	(120)
Mahesh	Emerson efficiency plan	84.00[9]	100.8[10]	100.8	(93)
Anil	Emerson efficiency plan	80.00[11]	116.0[12]	116.0	(126)

*are equivalent to minimum wages or wages payable as per incentive plan, whichever is higher

1. Base rate (Rs 1.80 (x) 40 hours) = Rs 72
2. Units produced, 400 (x) Piece wage rate per unit, Re 0.20 = Rs 80
3. (Total normal hours per week × Rate per hour) + (Overtime hours × Rate per hour of overtime) = (40 × Rs 1.80) + (6 × Rs 2.70) = Rs 88.20
4. 455 units produced × Re 0.20 per unit = Rs 91
5. (40 Normal hours × Re 1.80) + (4 Overtime hours × Rs.2.70) = Rs 82.80
6. 425 units produced × Re 0.20 per unit = Rs 85
7. (40 hours × Rs 2.20) = Rs 88
8. Efficiency ratio = (units produced, 250/standard units 200) = 125 per cent. Hourly rate = Base rate per hour, Rs 2.20 × Efficiency ratio, 125% = Rs 2.75
   Wages payable = Rs 2.75 × 40 hours = Rs 110
9. (40 hours × Rs 2.10) = Rs 84
10. Efficiency ratio = 240 units/300 units = 80 per cent wages payable = Rs 84 + (20% of Rs 84) Rs 16.8 = Rs 100.8
11. (40 hours × Rs 2.00) = Rs 80
12. Efficiency ratio = 600 units/500 units = 120 per cent wages payable = Rs 80 + (45% of Rs. 80) Rs 36 = Rs 116

P.4.13. Calculate the earnings of workers A, B and C under Straight Piece Rate System and Merrick's Multiple Piece Rate System from the following particulars:

Normal rate per hour	Rs 5.40
Standard time per unit (minutes)	1
Output (units) per day is as follows:	
Worker A	390
Worker B	450
Worker C	600

Working hours per day are 8.

SOLUTION

Determination of wages under straight piece rate system

Worker	*(Output per day × Rate per unit)*	*Amount*
A	(390 Units × Re 0.09)[1]	Rs 35.10
B	(450 Units × Re 0.09)	40.50
C	(600 Units × Re 0.09)	54.00

1. Normal rate per hour Rs 5.40 ÷ Standard output per hour 60 = Re 0.09

(i) *Determination of wages under Merrick's Multiple Piece Rate System*

Worker	*Efficiency ratio (Actual production /Standard production i.e., 60 × 8 = 480 units) (%)*	*Rate per unit**	*Actual units produced*	*Wages payable*
A	(390/480) = 81.25	Re 0.09	390	Rs 35.10
B	(450/480) = 93.75	0.099	450	44.55
C	(600/480) = 125.00	0.108	600	64.80

*Normal piece rate is paid when output is upto 83 per cent of the standard output (and hence Re 0.09 per unit for worker A); 110 per cent of normal piece rate when output is between 83- 100 per cent (and hence Re 0.099 per unit for worker B); and 120 per cent is paid when output exceeds 100 per cent (and hence Re. 0.108 per unit for worker C).

P.4.14. From the following information, calculate labour turnover rate and labour flux rate:
Number of workers as on January 1 = 7,600
Number of workers on December 31 = 8,400
During the year, 80 workers left while 320 workers were discharged. 1,500 workers recruited during the year; of these 300 workers were recruited because of exits and the rest were recruited in accordance with expansion plans.

SOLUTION

(i) *Separation Method* = [(Number of workers leaving i.e., (left + discharged in a period) ÷ Average number of workers employed] × 100
= [(80 + 320)/ (7,600 + 8,400) ÷ 2] = 5 per cent

(ii) *Replacement Method* = (Number of workers replaced in a period) ÷ (Average number of workers employed) × 100
= (300/8,000) × 100 = 3.75 per cent

(iii) *Labour Flux Rate* = [(Number of workers leaving + Number of workers replaced excluding those who were recruited for expansion) ÷ (Average number of workers employed)] × 100
= [(400 + 300)/8000] × 100 = 8.75 per cent

P. 4.15 The cost accountant of Y Ltd has computed labour turnover rates for the quarter ended March 31, current year as 10 per cent, 5 per cent, and 3 per cent respectively under Flux Method. Replacement Method and Separation Method. If the number of workers replaced during that quarter is 30, find out the number of (1) workers recruited and joined and (2) workers left and discharged.

SOLUTION

Average number of workers on roll: Labour turnover rate (replacement method) = [Number of replacement ÷ Average number of workers on roll]
(N) × 100
0.05 = 30/N
Therefore, average number of workers on roll (N) is 600.

1. Labour turnover rate (Separation Method) = (Number of separation (s) ÷ Average number of workers on roll) × 100
   0.03 = S/600
   S = 18
   Therefore, number of workers left and discharged is 18.
2. Number of workers recruited and joined
   Labour turnover rate (Flux Method) = [Number of separation (S) + Number of replacement (R)] ÷ Average number of workers (N) × 100
   0.10 = (18 + R)/600
   R = 42

Therefore, workers recruited and joined are 42.

P. 4.16 The management of In and Out Limited are worried about their increasing labour turnover in the factory, and before analysing the causes and taking remedial steps, they want to have an idea of the profit forgone as a result of labor turnover in the last year.

Last year, sales amounted to Rs 83,03,300 and the profit-volume ratio was 20 per cent. The total number of actual hours worked by the direct labour force was 4.45 lakh. As a result of the delays by the Personnel Department in filling vacancies due to labour turnover, 1,00,000 potentially productive hours were lost. The actual direct labour-hours included 30,000 hours attributable to training new recruits, out of which half of the hours were unproductive.

The cost incurred consequent to labour turnover revealed on analysis the following:

Settlement costs due to leaving	Rs 43,820
Recruitment costs	26,740
Selection costs	12,750
Training costs	30,490

Assuming the potential production lost as a consequence of labour turnover could have been sold at prevailing prices, find the profit forgone last year on account of labour turnover.

SOLUTION

Statement showing profit foregone due to labour turnover last year

Settlement costs due to leaving	Rs 43,820
Recruitment costs	26,740
Selection costs	12,750
Training costs	30,490
Contribution lost due to lost sales	3,86,200
Total loss	5,00,000

Working Notes

(i) Direct labour-hours paid for	4,45,000
Less unproductive direct labour-hours	15,000
Actual direct labour-hours (productive)	4,30,000
Sales lost for 1,00,000 hours (Rs 83,03,300/4,30,000) × 1,00,000 hours	Rs 19,31,000
Contribution lost (Rs 19,31,000 × 0.20)	3,86,200

P. 4.17 The Managing Director of AII Found Limited is very much perturbed to see that labour turnover is increasing every year. Before taking an appropriate action, he desires to know the profit forgone on account of labour turnover. You are required to calculate the profit forgone on account of labour turnover from the following:

Income statement for the current year ended March, 31

Sales		Rs 2,00,000
Variable costs:		
Material	Rs 50,000	
Direct labour	40,000	
Variable overheads	40,000	1,30,000
Contribution		70,000
Less fixed overheads		20,000
Profit before taxes		50,000

The direct labour-hours worked in the concern during the period were 20,300, of which 500 hours pertained to the new workers on training. Only 40 per cent of the trainees time was productive. As replacement for the worker left was delayed for some time, 600 productive hours were lost.

The direct costs incurred by the company as a consequence of labour separation and replacement were as follows:

Separation costs	Rs 2,000
Selection costs	3,000
Training costs	5,000

SOLUTION

Statement showing determination of profit forgone due to labour turnover

Separation costs	Rs 2,000
Selection costs	3,000
Training costs	5,000
Contribution forgone	3,768
	13,768

Working Notes

(i) Direct labour hours paid for	20,300
Less unproductive time of new workers (0.6 × 500)	300
Productive hours	20,000
Total labour hours lost including 600 for replacement	900
Unit sales per productive labour-hour (Rs 2,00,000/20,000)	Rs 10
Loss of potential sales (900 hours × Rs 10)	9,000
Less variable costs:	
Material costs (Rs 50,000/Rs 2,00,000) × Rs 9,000	2,250
Variable overheads (Rs 40,000/Rs 2,00,000) × Rs 9,000	1,800
Increase in direct labour cost (600 hours) (Rs 40,000/20,300 hours)	1,182
Contribution foregone	3,768

REVIEW QUESTIONS

RQ.4.1 What are the costs included in total labour cost besides gross wages?
RQ.4.2 Explain timekeeping and book keeping and state the detailed records normally maintained under them.
RQ.4.3 What is idle time? How is it treated in costing of labour?
RQ.4.4 What is overtime premium? Discuss its treatment in cost accounting and suggest a procedure for its control.
RQ.4.5 What is labour turnover? How is it measured? What are its costs? How can they be reduced?
RQ.4.6 What are incentive plans? Describe the main types of incentives plans.
RQ.4.7 Explain and illustrate the differential price rate schemes type of incentive/bonus plans.
RQ.4.8 Write notes on the different types of premium bonus plans. Illustrate your answer with examples.
RQ.4.9 Management of a manufacturing unit is considering extensive modernisation of the factory through progressive mechanisation which would result in improved productivity and reduced strength. Through negotiations with the union, it was agreed that for every 1 per cent increase in productivity, workers would be paid 0.5 per cent incentive wages. It was also agreed that through voluntary retirement, the staff strength would be reduced to 300 from the present level of 400. The following further comparative data are available before and after the proposed mechanisation:

Particulars	*Before mechanisation*	*After mechanisation*
Number of articles produced per month	50,000	48,000
Fringe benefits	50 per cent of wages	
Wages paid per month	Rs 4,00,000	
Sales per month (value)	Rs 24,00,000	
P/V ratio	25 per cent	

Based on the above data, you are required to work out the annual financial implication of the proposal.

SOLUTION

Statement showing annual financial implication/profitability due to improved productivity

Particulars	*Amount*
(i) *Existing wages:*	
Annual wages (Rs 4,00,000 × 12 months)	Rs 48,00,000
Add fringe benefits (0.50 × Rs 48,00,000)	24,00,000
Total wages paid	72,00,000

(*Contd.*)

(*Contd.*)

(ii) *Wages after mechanisation (see working note 1)*	
Annual wages (Rs 3,00,000 × 12 months)	36,00,000
Add fringe benefits (0.50 × Rs 36,00,000)	18,00,000
Add incentive wages (0.14 × Rs 36,00,000)	5,04,000
Total wages paid	59,04,000
(iii) Savings in labour cost [(i) – (ii)]	12,96,000
(iv) Less contribution lost due to decrease in sales (2,000 units × Rs 12 contribution per unit[2] × 12 months)	2,88,000
(v) Increase in annual contribution [(iii) – (iv)]	10,08,000

Working Notes

(1) Improvement in productivity after mechanisation

Actual output (at the level of 300 workers) (units)	48,000
Less proportionate amount at the level of 300 workers (50,000 units/400 workers) × 300 workers given the existing productivity level	37,500
Increase in number of units produced per month	10,500
Improvement in productivity (percentage) (10,500 units/37,500 units) × 100	28
Incentive wages payable (0.5 per cent for every 1 per cent of improvement i.e., 28 × 0.5) (%)	14

(2) Selling price per unit (Rs 24,00,000/50,000 units)	Rs 48
Contribution per unit (Rs 48 × 0.25, P/V ratio)	12

RQ.4.10 The time taken for a particular operation for operator X in the Process Division of a manufacturing concern on three different counts was 24, 22 and 27 minutes while that of operator Y was 20, 23 and 26 minutes. It has been ascertained that the rating of 'X' is 70/60 and that of 'Y' is 55/60. Allowance for fatigue, personal needs are assumed at 15 per cent. Calculate, using the above information as a base, for that particular operation, (i) the standard time, and (ii) the time allowed under an incentive allowance of 30 per cent of standard time.

SOLUTION

(a) Statement showing determination of standard time required to Do a Job

Operator	*Counts*	*Time taken (minutes)*	*Rating*	*Normalised time (Time taken × Rating) (minutes)*
X	1	24	70/60	28.00
	2	22	70/60	25.67
	3	27	70/60	31.50
Y	1	20	55/60	18.33
	2	23	55/60	21.08
	3	26	55/60	23.84
Total time taken				148.42
Average time (148.42 minutes/6) (normalised)				24.74
Add 15% allowance for fatigue, personal needs etc. (0.15 × 24.74 minutes)				3.71
Standard time				28.45

(ii) Time allowed (minutes) to complete job

Standard time	28.45	
Plus incentive allowance @ 30%	8.53	
	36.98 = 37	

RQ.4.11 A worker is allowed to take 9 hours to complete a job on daily wages and 6 hours on a scheme of payment by results. His daily rate is Rs 7.5 per hour. The material cost is Rs 40 and the overheads are recovered at 150 per cent of the total direct wages. Calculate the factory cost of the product under (i) piece-work plan, (ii) Halsey Plan and (iii) Rowan Plan, assuming work is completed in 6 hours.

SOLUTION

Determination of wages under various wage plans

(i) Piece-Work Plan: Standard time allowed per job × Labour rate per hour = 6 hours × Rs 7.5 = Rs 45
(ii) Halsey Plan: (Hours worked ×rate per hour) + [0.50 × (Time saved in hours)] × Rate per hour = (6 × Rs 7.5) + (0.50 × 3 hours) × Rs 7.5 = Rs 56.25
(iii) Rowan Plan: (Hours worked × Rate per hour) + (Time saved in hours) × Time taken × Rate per hour = (6 × Rs 7.5) + (3 hours/6 hours) × 6 hours × Rs 7.5 = Rs 67.5

Statement showing factory cost

Particulars	*Piece work plan*	*Halsey plan*	*Rowan plan*
Materials cost	Rs 40	Rs 40	Rs 40
Direct wages	45	56.25	67.5
Prime cost	85	96.25	107.5
Add factory overheads (150% of wages)	67.5	84.38	101.25
Factory cost	152.5	180.63	208.75

RQ.4.12 Two workmen, Vishnu and Shiva, produce the same product using the same material. Their normal wage rate is also the same. Vishnu is paid bonus according to the Rowan system, while Shiva is paid bonus according to the Halsey system. The time allowed to make the product is 100 hours. Vishnu takes 60 hours while Shiva takes 80 hours to complete the product. The factory overhead rate is Rs 10 per man-hour actually worked. The factory cost for the product for Vishnu is Rs 7,280 and for Shiva it is Rs 7,600.

You are required: (a) to find the normal rate of wages; (b) to find the cost of materials; (c) to prepare a statement comparing the factory cost of the products as made by the two workmen.

SOLUTION

(a) and (b) *Determination of normal rate of wages and cost of materials of workers – Vishnu and Shiva*

Particulars	*Vishnu*	*Shiva*
(i) Materials cost (assumed to be)	X	X
(ii) Wages [Number of hours × Rate per hour, assumed to be Y]	60Y	80Y
(iii) Bonus (in addition to wages)		
— Vishnu's share is as per Rowan plan [(Time saved/Time allowed) × Time taken × Rate per hour = (40 hours/100 hours) × 60 hours × Y]	24Y	
— Shiva's share is as per Halsey plan [(50% Time saved, hours × Rate per hour) = (0.5 × 20 hours) × Y]		10 Y
(iv) Factory overheads (@ Rs 10 per hour)	Rs 600	Rs 800
Total factory cost (given)	7,280	7,600

Two equations are:
X + 84Y + Rs 600 = Rs 7,280
X + 90Y + Rs 800 = Rs 7,600
X + 84Y = Rs 6,680 (i)
X + 90Y = Rs 6,800 (ii)
Or 6Y = Rs 120, i.e. Y = Rs 20

Substituting the value of Y = 20 in equation (i), we have
X + (84 × Rs 20) = Rs 6,680
Or X = Rs 6,680 – Rs 1,680 = Rs 5,000
Thus: Y (wage rate per hour) = Rs 20
X (Total material cost) = Rs 5,000
(c) Statement showing factory cost of a product

Particulars	*Vishnu*	*Shiva*
Material cost	Rs 5,000	Rs 5,000
Direct wages @ Rs 20 per hour (Vishnu, 60 hours; Shiva 80, hours)	1,200	1,600
Bonus (Vishnu 24Y i.e., 24 × Rs 20) (Shiva 10Y i.e., 10 × Rs 20)	480	200
Factory overheads	600	800
Factory cost	7,280	7,600

RQ.4.13 Mr. A is working by employing 10 skilled workers. He is considering the introduction of some incentive scheme – either Halsey Scheme (with 50 per cent bonus) or Rowan Scheme – of wage payment for increasing the labour productivity to cope with the increased demand for the product. He feels that if the proposed incentive scheme could bring about an average 20 per cent increase over the present earnings of the workers, it could act as sufficient incentive for them to produce more and he has accordingly given this assurance to the workers. As a result of the assurance, the increase in productivity observed as revealed by the following figures for the current month:

Hourly rate of wages (guaranteed)	Rs 2
Average time for producing 1 piece by one worker at the previous performance (This may be taken as time allowed) (hours)	2
Number of working days in the month	25
Number of working hours per day for each worker	8
Actual production during the month (units)	1,250

Required:

(a) Calculate effective rate of earnings per hour under Halsey Scheme and Rowan Scheme.
(b) Calculate the savings to Mr A in terms of direct labour cost per piece under the schemes.
(c) Advise Mr A about the selection of the scheme to fulfill assurance.

SOLUTION

(a) Determination of effective rate of earnings

Halsey Scheme: (Hours worked in a month × Rate per hour) + [0.50 of time saved × Rate per hour] = (25 days × 8 hours per day × 10 workers = 2,000 hours × Rs 2 per hour) + [0.50 × (Time allowed 1,250 units × 2 hours = 2,500 hours – 2,000 hours, assumed) × Rs 2] = Rs 4,000 + Rs 500 = Rs 4,500
Effective earnings per hour (Rs 4,500/2,000 hours) = Rs 2.25

Rowan Scheme: (Hours worked in a month × Rate per hour) + $\left(\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Rate per hour}\right)$

= (2,000 hours × Rs 2) + $\left(\frac{500}{2{,}500} \times 2{,}000 \times \text{Rs } 2\right)$ = Rs4,000 + Rs 800 = Rs 4,800

Effective earnings per hour (Rs 4,800/2,000) = Rs 2.40

(b) Savings in direct labour cost per unit/piece

Halsey Scheme:	
Current production cost per unit (2 hours × Rs 2 per hour)	Rs 4.00
Less production cost under Halsey scheme (Rs 4,500/1,250 units)	3.60
Savings per unit	0.40
Rowan Scheme:	
Current production cost	4.00
Less production cost under Rowan scheme (Rs 4,800/1,250)	3.84
Savings per unit	0.16

(c) Mr. A has assured workers the increase in wages by 20 per cent (i.e., from present level of Rs 4,000 to Rs 4,800); this assurance can be fulfilled only under Rowan scheme as only under this scheme, the wage payable is Rs 4,800. The total wage amount under Halsey scheme is Rs 4,500 only (increase of 12.5 per cent only). Therefore, Mr A is advised to adopt Rowan scheme.

RQ.4.14 Following particulars have been extracted from the books of Supreme Engineers Ltd:

Time allowed for the job (hours)	15	15	15
Time taken (hours)	15	12	9

Bonus ratio for Halsey (per cent)	50
Rate per hour	Rs 2

(a) You are required to compute the quantum of wages under Halsey scheme and Rowan scheme. Which of these schemes would you like to introduce in this company if the time taken to complete the job is likely to reduce to 6 hours after three months?

(b) An alternative method of payment by results by a straight piecework rate for completion of the job in 7 hours is feasible. Would you like to switch over to this method of payment given further that hourly rate would be reckoned at Rs 1.50 for fixation of the piece rate? Please give reasons for your advice.

SOLUTION

Statement showing computation of total wages under Halsey scheme and Rowan scheme

Time (in hours)			*Rate per*	*Basic*	*Bonus*		*Total wages*	
Allowed	*Taken*	*Saved*	*hour*	*wages*	*Halsey*[1]	*Rowan*[2]	*Halsey*	*Rowan*
15	15	—	Rs 2	Rs 30	—	—	Rs 30	Rs 30
15	12	3	2	24	Rs 3	Rs 4.80	27	28.80
15	9	6	2	18	6	7.20	24	25.20
15	6	9	2	12	9	7.20	21	19.20

[1] (0.50 × hours saved × Rs 2)

[2] (Time saved/Time allowed) × Time taken × Rs 2

The company is advised to adopt Rowan scheme as it is more economical compared to Hasley plan, the respective total wages being Rs 19.20 and Rs 21 for the job, though, presently Halsey plan is more economical, total wages being lower, *vis-à-vis*, Rowan plan both at 12 hours and 9 hours).

The company is advised to opt for Rowan scheme. It will not be advisable to switchover to Rowan plan after three months; workers may resist it. Therefore, keeping in view the long-term perspective, it will be beneficial for the company to adopt Rowan incentive scheme.

(b) The wage payment under straight piece work system will be lower at Rs 10.50 (i.e., 7 hours × Rs 1.50 per hour) compared to Rowan plan (Rs 19.20 after 3 months and Rs 25.20 at present). However, it will require one hour extra. The company is advised to compute cost of overheads for one extra hour. In case per hour overhead cost is less than Rs 8.70 (Rs 19.20 – Rs 10.50), it will be advisable for the firm to prefer/adopt piece basis of wage payment to Rowan plan. The answer hinges on total overhead cost per hour.

RQ.4.15 A worker produced 200 units in a week's time. The guaranteed weekly wage payment for 45 hours is Rs 81. The expected time to produce one unit is 15 minutes which is raised further by 20 per cent under the incentive scheme. What will be the earnings per hour of that worker under Halsey (50 per cent sharing) and Rowan bonus schemes?

SOLUTION

Statement showing earnings per hour

Halsey Bonus Scheme: (Hours worked × Rate per hour) + (0.50 × Time saved × Rate per hour) = (45 hours × Rs 81/45 or Rs 1.80) + (0.50 × 15 hours[1] × Rs 1.80) = Rs 94.50
Earnings per hour (Rs 94.50/45 hours) = Rs 2.10

Rowan Bonus Scheme: (Hours worked × Rate per hour) + $\left(\frac{\text{Time saved}}{\text{Time allowed}}\right)$ × Time taken × Rate per hour

(45 hours × Rs 1.80) + (15 hours/60) × 45 hours × Rs 2.25
Earnings per hour (Rs 101.25/45 hours) = Rs 2.25

Working Note

Expected time to produce one unit (minutes)	15
Add 20% allowance under incentive scheme (15 minutes × 0.20)	3
Total time allowed per unit (hours)	18
Time allowed for 200 units (200 × 18/60) (hours)	60
Time taken	45
Time saved	15

RQ.4.16 From the following data provided to you find out the labour turnover rate by applying (a) Flux method, (b) Replacement method, and (c) Separation method.

*Number of workers on the payroll: A*t the beginning of the month, 500, At the end of the month, 600

During the month, 5 workers left, 20 persons were discharged and 75 workers were recruited. Of these, 10 workers were recruited in the vacancies of those leaving, while the rest were engaged for an expansion scheme.

SOLUTION

Determination of Labour Turnover Rate (LTR)

(a) Flux Method
LTR = [Number of separations + Number of joining/replacement against vacancies of those leaving] ÷ Average number of workers] × 100 = [(5 + 20 + 10 workers) ÷ 550] × 100 = 6.36 per cent

(b) Replacement Method
LTR = (Number of replacement/Average number of workers) × 100 = (10/550) × 100 = 1.82 per cent

(c) Separation Method
LTR = (Number of separation (s)/Average number of workers) × 100 = [(5 + 20)/550] × 100 = 4.55 per cent

RQ.4.17 Your organisation is experiencing a high labour turnover in recent years and management would like you to submit a report on the loss suffered by the Company due to such labour turnover. Following figures are available for your consideration:

Sales (Rs lakhs)	Rs 600
Direct materials	150
Direct labour (4,80,000 man-hours)	48
Other variable expenses	60
Fixed overheads	80

The direct man-hours include 9,000 man-hours spent on trainees and replacement, only 50 per cent of which were productive. Further, during the year, 12,000 man-hours of potential work could not be availed of because of delayed replacement. The cost incurred due to separations and replacements amounted to Rs 1 lakh.

On the basis of above data, prepare comparative statement showing actual profit *vis-à-vis* the profit which would have been realised had there been no labour turnover.

SOLUTION

Comparative statement showing actual profit vis-à-vis potential profits in absence of labour turnover

Particulars	*Actual profit*	*Potential profits*
Sales revenue	Rs 6,00,00,000	Rs 6,20,82,019[3]
Less costs:		
Direct materials (25% of sales)	1,50,00,000	1,55,20,505
Direct labour	48,00,000	49,20,000[4]
Other variable expenses (10% of sales)	60,00,000	62,08,202
Fixed overeheads	80,00,000	80,00,000
Separation and replacement costs	1,00,000	—
Profit	2,61,00,000	2,74,33,312
Loss of profit due to labour turnover (Rs 2,74,33,312 – Rs 2,61,00,000)	Rs 13,33,312	

Working Notes

(1) Hours lost due to labour turnover:	
Hours lost due to delayed replacement	12,000
Unproductive time lost due to training and replacement (0.50 × 9,000 hours)	4,500
Total hours lost	16,500
(2) Productive labour-hours:	
Direct labour-hours paid for	4,80,000
Less unproductive time of new workers (0.50 × 9,000 hours)	4,500
Total productive hours	4,75,500
(3) Potential sales revenue foregone due to unproductive hours as a result of labour turnover:	
Sales revenue at 4,75,500 productive hours	Rs 600,00,000
Sales foregone due to 16,500 unproductive labour hours (Rs 600 lakh/4,75,500 hours) × 16,500	20,82,019
Total sales revenue in absence of labour turnover	620,82,019
(4) Direct labour cost in absence of labour turnover	
Per hour direct labour cost (Rs 48,00,000/4,80,000 hours)	10
Cost of 12,000 man-hours (12,000 × Rs 10)	1,20,000
Direct labour cost (Rs 48,00,000, existing + Rs 1,20,000)	49,20,000

EXAMINATION QUESTIONS

EQ. 4.1 Discuss the accounting treatment of the Idle time and Over-time wages in cost-accounts (*CA—May, 2003*)

EQ. 4.2 What do you understand by labour turnover? How is it measured? (*CA—May, 2003*)

EQ. 4.3 Discuss two types of costs, which are associated with labour turnover. (*CA—November, 2003*)

EQ. 4.4 Discuss the three methods of calculating labour turnover. (*CA—November, 2004*)

EQ.4.5 Discuss the treatment of overtime premium in cost accounting. (*CA—November, 2004*)

EQ.4.6 Discuss the Gantt task and bonus system as a system of wage payment and incentives. (*CA—November, 2004*)

EQ.4.7 Under the Rowan Premium Bonus System, a less efficient worker can obtain same bonus as a highly efficient worker. Discuss with suitable examples. (*CA (PE II)—May, 2007*)

EQ.4.8 Enumerate the various methods of time booking. (*CA (PCE)—May, 2007*)

EQ.4.9 A company is undecided as to what kind of wage scheme should be introduced. The following particulars have been compiled in respect of three systems, which are under consideration of the management:

Particulars	*Workers*		
	A	*B*	*C*
Actual hours worked in a week	38	40	34
Hourly rate of wages	Rs 6	Rs 5	Rs 7.20
Production in units:			
Product P	21	—	60
Product Q	36	—	135
Product R	46	25	—
Standard time allowed per unit of each product is:			
	P	**Q**	**R**
Minutes	12	18	30

For the purpose of piece rate, each minute is valued at Rs 0.10.

You are required to calculate the wages of each worker under:

(i) Guaranteed hourly rates basis

(ii) Piece work earnings basis, but guaranteed 75 per cent of basic pay (guaranteed hourly rate) if his earnings are less than 50 per cent of basic pay.

(iii) Premium bonus where the worker receives bonus based on Rowan scheme.

(*CA—November, 2002*)

SOLUTION

(i) Computation of wagses of workers under guaranteed hourly rate basis

Particulars	*Workers*		
	A	*B*	*C*
1. Actual hours worked in a week	38	40	34
2. Multiply by hourly rate of wages	Rs 6	Rs 5	Rs 7.20
3. Guaranteed wages per week	Rs 228	Rs 200	Rs 244.8

(II.) Computation of wages of workers under piece work earnings basis

Product	*Piece rate per unit*	*Units produced by workers*			*Wages of workers*		
		A	*B*	*C*	*A*	*B*	*C*
1	*2*		*3*		*4 (2 × 3)*		
P	(12 minutes × Re 0.10) = Rs 1.20	21	—	60	Rs 25.20	—	Rs 72
Q	(18 minutes × Re 0.10) = 1.80	36	—	135	64.80	—	243
R	(30 minutes × Re 0.10) = 3.00	46	25	—	138.00	75	—
					228.00	150@	315

@ Since Rs 75 is less than 50% of basic pay (of Rs 200), he would be paid 75 per cent × Rs 200 = Rs 150.

(iii) Rowan scheme provides the following basis of computing bonus.
Bonus = (Time taken/Time allowed) × Time saved × Time rate

(a) Determination of time allowed to workers

Product	*Standard time allowed per unit (in minutes)*	*Units produced by workers*			*Total standard time allowed to workers*		
		A	*B*	*C*	*A*	*B*	*C*
P	12	21	—	60	252	—	720
Q	18	36	—	135	648	—	2,430
R	30	46	25	—	1,380	750	—
					2,280	750	3,150
					(In hours)38	12.5	52.5

(b) Determination of bonus payable under Rowan Scheme

Workers	*Time (in hours)*			*Wage rate per hour*	*Earnings*	*Bonus*	*Total earnings + bonus*
	Taken	*Allowed*	*Saved*				
A	38	38	—	Rs 6.00	Rs 228	—	Rs 228
B	40	12.5	NA	5.00	200	—	200
C	34	52.5	18.5	7.20	244.8	86.26[1]	331.06

1 = (34/52.5) × 18.5 × Rs 7.20 = Rs 86.26

EQ.4.10 ZED Ltd is working by employing 50 skilled workers. It is considering the introduction of incentive scheme-either Halsey scheme (with 50 per cent bonus) or Rowan scheme of wage payment for increasing the labour productivity to cope up the increasing demand for the product by 40 per cent. It is believed that proposed incentive scheme could bring about an average 20 per cent increase over the present earnings of the workers; it could act as sufficient incentive for them to produce more.

Because of assurance, the increase in productivity has been observed as revealed by the figures for the month of April, 2004.

Hourly rate of wages (guaranteed)	Rs 30
Average time for producing one unit by one worker at the previous performance (This may be taken as time allowed)	1.975 hours
Number of working days in the month	24
Number of working hours per day of each worker	8
Actual production during the month	6,120 units

Required: (i) Calculate the effective rate of earnings under the Halsey scheme and the Rowan scheme. (ii) Calculate the savings to the ZED Ltd in terms of direct labour cost per piece. (iii) Advise ZED Ltd about the selection of the scheme to fulfill their assurance. (*CA—May, 2004*)

SOLUTION

(i) Determination of effective rate of earnings

Halsey Scheme: (Hours worked in a month × Rate per hour) + (0.50 of time saved × Rate per hour)
= (24 days × 8 hours per day × 50 workers = 9,600 hours × Rs 30 per hour) + [0.50 × (Time allowed 6,120 units × 1.975 hours = 12,087 hours - 9,600 hours) × Rs 30)]
= Rs 2,88,000 + 37,305 = Rs 3,25,305

Effective earnings per hour = (Rs 3,25,305/9,600 hours) = Rs 33.89
Rowan Scheme: (Hours worked in a month × Rate per hour) + [(Time saved/Time allowed) × Time taken × Rate per hour]
= (9,600 hours × Rs 30) + [(2,487/12,087) × 9,600 × Rs 30]
= Rs 2,88,000 + Rs 59,258 = Rs 3,47,258
Effective earnings per hour (Rs 3,47,258/9,600) = Rs 36.17

(ii) Computation of savings in direct labour cost per unit/piece

Halsey Scheme:	
Current production cost per unit (1.975 hours x Rs 30 per hour)	Rs 59.25
Less production cost under Halsey scheme (Rs 3,25,305/6,120 units)	53.15
Savings per unit	6.10

Rowan Scheme:	
Current production cost	Rs 59.25
Less production cost under Rowan Scheme (Rs 3,47,258/6,120 units)	56.74
Savings per unit	2.51

(iii) Zed Ltd. has assured workers the increase in wages by 20 per cent (i.e. from present level of Rs 2,88,000 to 3,45,600); this assurance can be fulfilled only under Rowan scheme as only under this scheme, the wage payable is Rs 3,47,258. The total wage amount under Halsey scheme is Rs 3,25,305 only (increase of 13 per cent only). Therefore, Zed Ltd is advised to adopt Rowan scheme.

EQ.4.11 The existing incentive system of Alpha Limited is as under:

Normal working week	:	5 days of 8 hours each plus 3 late shifts of 3 hours each
Rate of payment	:	Day work : Rs. 160 per hour Late shift : Rs. 225 per hour
Average output per operator for 49-hours week i.e. including 3 late shifts.	:	120 articles

In order to increase output and eliminate overtime, it was decided to switch on to a system of payment by results. The following information is obtained :

Time-rate (as ususal)	:	Rs. 160 per hour
Basic time allowed for 15 articles	:	5 hours
Piece-work rate	:	Add 20% to basic piece-rate
Premium bonus	:	Add 50% to time.

Required: (i) Prepare a statement showing hours worked, weekly earnings, number of articles produced and labour cost per article for one operator under the following systems:

(a) Existing time-rate
(b) Straight piece-work
(c) Rowan system
(d) Hasely premium system

Assume that 135 articles are produced in a 40-hour week under straight piece work, Rowan Premium system,and Halsey premium system above and worker earns half the time saved under Halsey premium system.

(*CA—November, 2005*)

SOLUTION

Statement showing hours worked, weekly earnings, number of articles produced and labour cost per unit for an operator under various wage systems.

Wage system	*Hours worked*	*Weekly earnings*	*Number of articles produced*	*Labour cost per article (col 3 ÷ col. 4)*
1	*2*	*3*	*4*	*5*
Existing time rate[1]	49	Rs 8,425	120	Rs 70.21
Straight piece work[2]	40	8,640	135	64.00
Rowan system[3]	40	9,007.4	135	66.72
Halsey premium system[4]	40	8,600	135	63.70

1. (40 Hours × 160 per hour) + (9 Hours × Rs 225 per hour) = Rs 6,400 + 2,025 = 8,425
2. Piece work rate = Rs 160 + 20% of Rs 160 i.e., Rs 32 = Rs 192 wage amount per hour/3 articles required to be produced per hour (15 articles ÷ 5 hours) = Rs 64 per article. Weekly earnings = 135 articles × Rs 64 = Rs 8,640
3. (Time taken × Rate per hour) + [(Standard time – Time taken) ÷ standard time] × Time taken × Rate per hour
   (40 Hours × Rs 160) + [(67.5 Hours – 40 Hours)/67.5] × 40 Hours × Rs 160.
   Rs 6,400 + (27.5/67.5 × 40 × Rs 160) = Rs 6,400 + Rs 2,607.4 = Rs 9,007.4.
   Standard time allowed = Basic Time + 50% = 1 Hour for 3 units + 50% = 1.5 Hours for 3 units = 0.5 hour per unit.
   For 135 units, time allowed is 135 units × 0.5 = 67.5 hours.
4. (Time taken × Rate) + [0.5 × (Standard time – Time taken) × Rate]
   = (40 Hours × Rs 160) + [0.5 × (67.5 – 40) × Rs 160 = Rs 6,400 + 2,200] = Rs 8,600

EQ.4.12 Using Taylor's differential piece rate system, find the earnings of a worker, W form the following data:

Standard time per unit	12 minutes
Normal rate per hour (in a 8 hours day)	Rs 20
W produced	37 units

Differential to be applied: 83% of piece rate below standard and 120% above standard.

(*CA(PCC)—May, 2007*)

SOLUTION

Worker's efficiency is = Actual units produced/standard (expected) output in a specified time (8 hours in the present case) = 37 units/40 units (480 minutes ÷ 12) = 92.5 per cent
Normal piece rate = (Rs 20 × 8 Hours)/40 units = Rs 4
Since the worker's efficiency is 92.5 per cent, the applicable piece rate would be 83%.
Accordingly, earning piece rate is Rs 4 × 0.83 = Rs 3.32
Total earnings of worker = Rs 3.32 × 37 units produced = Rs 122.84

5 Costing and Control of Factory (Manufacturing) Overheads

Introduction

The previous two chapters discussed costing and control of direct material costs (Chapter 3) and direct labour costs (Chapter 4) that are incurred in manufacturing of products. The third element of production costs, namely, factory overheads is the subject matter of this chapter. Section 1 deals with determination of factory overheads. It also deals with determination of factory overheads application/absorption rate. The methods/procedure of allocating costs of service departments to production departments are discussed in Section 2. Section 3 explains the methods of absorption of factory overheads. Section 4 illustrates the treatment of the difference between actual factory overheads incurred and factory overheads absorbed, that is, under-absorption/over-absorption of factory overheads. Activity-based costing as a method of cost allocation is analysed in Section 5. The main points are summarised in the last section.

FACTORY OVERHEAD COSTS

Factory overhead costs refer to all indirect manufacturing costs which cannot be identified with particular orders or units of product. These costs include the following:

- Indirect materials and indirect labour.
- Factory rent, rates, lighting, power, and fuel.
- Depreciation on factory plant and equipments and factory building.
- Insurance, repairs and maintenance of factory plant and equipments and building.
- Storekeeping, toolroom costs.

Factory Overhead Application/Absorption Rate

Direct costs normally can be conveniently identified/allocated to specific jobs. Material requisitions and workers' time sheets provide sufficient indication where these costs are to be charged. The same is, however, not true for the indirect manufacturing costs as they are incurred for the factory as a whole. Being *common costs*, they are divided/shared/charged among various *cost centres* and/or *cost units*.

The procedure for allotting factory overheads to cost centres/objects/units cover cost allocation, cost apportionment, and overhead absorption. While the allotment of whole items of cost to cost centres or cost units is referred to as *cost allocation*, the allotment of common costs to two or more cost centres on the estimated basis of benefits received is known as cost *apportionment*. The allotment of factory overheads to cost units/objects by means of predetermined factory overhead application rate is called *overhead absorption*.

The factory overhead absorption rate can either be *actual* overhead rate or a *predetermined* overhead rate. Normally, a predetermined overhead rate is preferred, the reason being: (a) It is useful in 'bidding' cases to determine quotation prices; (b) It enables individual jobs to be costed immediately on their completion; and (c) Such a rate levels out the fluctuations which may be caused by variations in actual factory overhead costs and/or actual level of activity.

The two key factors to determine the factory overhead application rate for a period are: (a) To select a volume/level of production (more commonly referred to as capacity) to be used as a base for applying factory overheads to production (denominators) and (b) To budget factory overheads at the capacity selected (numerator).

Concepts of Capacity Choice of the capacity to be used as a base in applying factory overheads often raises a difficult question. The reason is that there are more than one basis of determining capacity. For instance, capacity can be based on the physical facilities that have been installed, or productive capacity that can be utilised (giving due allowance for unavoidable lost hours both in respect of machines and workers), or actual capacity used in relation to the expected sales volume. While one capacity level relates to the level of production (determined by engineers, with no regard to the expected sales volume) the other is the expected product sales. The choice (by and large *subjective* in nature) is to be made from one of the following four possibilities: (i) Maximum/Theoretical idle capacity, (ii) Practical capacity (iii) Normal/Long-term production capacity, and (iv) Expected/Short-term actual capacity.

Maximum or Theoretical Idle Capacity It refers to the volume of production that a particular production department or factory is capable of producing if the plant were in continuous operation at *peak efficiency at all times*. In other words, such a capacity base does not have any provision for either a lack of sales orders or interruptions in production (due to machine break-down, machine downtime for repairs and maintenance, set-up time, holidays, weekends, and so on). At this capacity level, the plant is assumed to function 24 hours a day, 7 days a week, 52 weeks a year without any interruptions, in order to yield the highest physical output possible, that is, 100 per cent of plant capacity.[1]

Practical Capacity Unlike theoretical capacity measure, practical capacity does not expect full utilisation of the plant; it makes due allowances for unavoidable idleness of workers and machinery caused by repairs and maintenance, machine set-up, fatigue, and time lost through vacations and holidays. However, this measure does not take into consideration plant and personnel made idle due to the lack of sales orders. In *operational* terms, it is the maximum capacity expected when the plant operates at *a planned level of efficiency*.

Normal or Long-run Productive Capacity Unlike practical capacity, normal capacity allows for idleness both of plant and personnel caused due to a lack of sales orders. Normally, capacity is equal to, or less than, practical production capacity depending upon the volume of expected sales. More often, normal capacity is less than practical capacity. Further, normal capacity is not based just on one year's sales; it is the average annual volume of production needed to meet ordinary and usual sales demand over a cycle of years long enough (say 5 years) to even out seasonal, cyclical, and other variations in customer demand.

Expected or Short-run Actual Capacity It is the volume of production required to meet the estimated/projected demand for the next period/year (that is in a single year only). Thus, expected actual capacity differs from normal capacity in the length of time to determine capacity base; this measure does not smoothen out cyclical variations in sales that are likely to occur over a period of time as it is guided by one year projections only. Such a measure may appeal to those firms which are interested more in short-term planning and control.

Example 5.1 illustrates these 4 concepts of capacity.

EXAMPLE 5.1

The Hypothetical Manufacturing Company Ltd wishes to determine various capacity levels both in terms of production units and machine-hours. One machine-hour produces 10 units of finished product. The production department in which the machine is located normally operates 6 days a week (except Sunday) on a single, eight-hour shift. The plant is closed for 10 working days each year for holidays.

Plant is closed for 200 hours each year for its repairs and maintenance. Normal sales demand averages 20,000 units a year over a 5-year period (extensive product changes are made every five years). The expected sales volume for the next year is 19,000 units. Show the machine-hours and production capacity at the four levels.

SOLUTION

Machine-hours and production capacity at 4 levels of capacity are shown in Table 5.1.

Table 5.1 *Capacity at Various Levels*

Details of computation		*Capacity*	
		Machine-hours	*Production units @ 10 units per hour*
1. Maximum capacity (365 days × 8 hours per day)		2,920	29,200
2. Practical capacity			
Maximum capacity (in hours)	2,920		
Less idle capacity:			
Sundays (52 days × 8 hours)	416		
Holidays (10 days × 8 hours)	80		
Plant maintenance	200	2,224	22,240
3. Normal capacity		2,000	20,000
4. Expected capacity		1,900	19,000

Table 5.1 shows that factory overhead applied rate will markedly vary among 4 capacity measures and thereby affect production costs, inventory costs, and profits. Therefore, it is important to select an appropriate capacity level to determine reliable and correct factory overhead application rate.

The first measure based on theoretical ideal/maximum capacity is more of academic significance rather than of practical relevance, as it is practically infeasible for plant to operate at such a capacity (for instance, in Example 5.1, it is not always possible for the firm to produce 29,200 units).

Likewise, practical capacity level suffers from lack of realism in that it focuses more on production than sales it can achieve. In practice, it is not a tenable assumption that the firm will produce without taking into account its sales level. However, this measure can be fruitfully applied if a manufacturing firm has captive market, that is, it can sell *all* it produces. But, in practice, this is rarely the case for the majority of the firms; most firms are expected to produce only as much as they can sell.

From the foregoing, it follows that sales projections are a vital factor in the planning process and must be considered while estimating production levels. For most manufacturing firms, either normal productive capacity or expected productive capacity is used to determine factory overhead application rate as both these bases explicitly recognise expected product sales.

Between the two, the normal long-run productive capacity base should be preferred. Such a measure, assuming all other factors remain constant, (i) Yields uniform product costs per unit across different time periods; (ii) Eliminates the possibility of manipulation of unit product cost by varying production levels intentionally. The latter situation is likely to arise in firms selling products which exhibit pronounced variations in their demand pattern across different time periods (over a cycle of years, say 5 years).

In sum, therefore, normal capacity level is conceptually correct measure to determine factory overhead application rate.

Budgeted Factory Overhead Costs Once the estimated level of production (capacity) has been decided, a manufacturing firm prepares a budget of expected production/factory overheads likely to be incurred in the next year. For estimating budgeted factory overheads, past historical cost data are normally taken as the base and adjustments are made for likely changes in prices/rates of various cost constituents of factory overheads. These overhead costs are classified based on their behaviour in relation to production into three categories: fixed, variable, and mixed costs; mixed costs, in turn, are segregated into fixed and variable.[2] Budgeted factory overheads are computed as shown in Format 5.1.

Format 5.1 *Determination of Budgeted Factory Overhead Costs*

Total budgeted fixed factory overheads	_____
Add variable factory overheads (Budgeted capacity level × Budgeted variable overhead rate)	_____
Total	_____

EXAMPLE 5.2

For Hypothetical Ltd in Example 5.1, assume further that the budgeted fixed overhead costs are estimated at Rs 6 lakh and variable overhead costs at Rs. 100 per unit as the basis of determining factory overhead application rate. Compute the factory overhead application rate.

SOLUTION

Table 5.2 *Determination of Factory Overhead Application Rate*

(a)	*Total budgeted fixed overheads*	
	Fixed overhead costs	Rs 6,00,000
	Variable overhead costs (2,000 hours × Rs. 100)	2,00,000
		8,00,000
(b)	Normal capacity (machine-hours)	2,000
(c)	(i) Factory overhead application rate (Rs. 8,00,000/2,000) per hour	400
	(ii) Factory overhead application rate (Rs. 8,00,000/20,000 units) per unit	40

COST ALLOCATION

When a company produces more than one product, it is important that the factory overhead costs (as determined above) are allocated to various production departments or cost centres. These departments, in turn, assign these costs to product(s) on some equitable basis. Thus, when multiple products are produced, a single factorywide factory overhead application rate is not appropriate for allocating factory overheads. On grounds of equity, the production departments receiving greater benefits should be charged a higher share of these overheads and *vice-versa*. This process of assigning direct and indirect manufacturing costs to various cost centres is referred to as *cost allocation*. Proper cost allocation is of crucial significance as wrong cost allocation can distort income determination, asset valuation, performance evaluation, and decision-making in a firm.

The cost allocation process is comprised of three basic activities.[3]

1. Accumulating the costs on the basis of department or division or product.
2. Identifying the cost objects or recipients of the allocated costs, say, a unit of product or a department.
3. Selecting a method for relating the costs so accumulated to the cost objects.

The third aspect is the most difficult as common costs cannot be directly associated with a single unit, or production department, or division. Some meaningful base needs to be developed to relate costs and cost objects.

While no allocation base can be hundred per cent foolproof (in terms of precision and accuracy), following bases are commonly used for allotting fixed overheads:

Labour-related Factory Overheads

(Say supervisor's salaries, canteen expenses) are usually allocated on the basis of number of employees, direct labour-hours, wages paid or similar other labour related criteria.

Machine-related Factory Overheads

(Say insurance, maintenance, depreciation) are normally allocated on the basis of machine-hours, current book value of machinery, number of machines, or similar other machine-related criteria.

Space-related Factory Overheads

(Say factory building rent and insurance, lighting, maintenance of building) are usually allocated on the basis of space occupied or similar other space-related criteria.

Service-related Costs

(Say materials handling, utility) are normally allocated on the basis of value, quantity, time and similar other service related criteria.

While the principle of cost allocation, in theory, appears to be easy, it is not so simple when it is put to practice. Methods used in practice are often somewhat arbitrary. As far as possible, each factory overhead cost item should be analysed on its own merit to arrive at the most suitable/equitable base.

Departmental Rates

It is common for manufacturing firms to have several departments that are involved either directly or indirectly in production. The discussion that follows dwells on determination of departmental rates related to factory overheads.

Direct Departmental Costs These are the costs which can be easily traced to specific departments. For instance, indirect materials used in production department (say X) can be traced through requisitions on store and can wholly be allocated to department X; likewise, indirect labour (foreman's and supervisor's salaries) wholly engaged in department X can be traced through payroll records; the same applies for depreciation on machines and plants exclusively used in the department X and annual maintenance contact payment for these machines.

Indirect Departmental Costs These are the costs which are common to more than one department and, hence, need to be shared/apportioned among the departments receiving benefits. Building occupancy costs (such as rent, maintenance and light); factory insurance premium, power charges for machine operations (where there are no separate metres for departments) are the major costs included in this category.

Charging Cost of Service Departments

It is a important to take into account costs incurred on service departments to compute factory overheads application rate of production departments.

A service department is a department which provides benefits to producing departments and/or service departments. For instance, maintenance department (responsible for the upkeep of the machinery and building), utility department (responsible for providing power and electricity for a factory), personnel department (responsible for keeping records of personnel employed), are the examples of service departments. Since the output of such service departments is not sold to outside customers, their costs must be covered by production departments, receiving their services.

Accordingly, apportioned service department costs to production departments (in which material conversion or production takes place) can be construed similar to indirect manufacturing costs. The following methods are used to apportion total budgeted costs of service department to production departments (also known as secondary distribution of factory overheads; allocation of indirect manufacturing costs like indirect labour and indirect materials to production departments is referred as primary distribution): (i) Direct method, (ii) Step method, (iii) Repeated distribution method, and (iv) Algebraic method.

Direct Method Total budgeted costs of service departments are apportioned between/among production departments only, ignoring any services provided by service departments to each other. This method is the most appropriate when there is virtually no provision of rendering services on reciprocal basis among the service departments. This method has the virtue of simplicity as far as its use in assigning costs to production departments is concerned.

Example 5.3 illustrates how total budgeted costs of five service departments in a manufacturing company are apportioned between its two production departments. It also shows the *modus operandi* of determining factory overhead application/absorption rate for each of the two production departments (after taking into account the share of service departments).

EXAMPLE 5.3

A manufacturing company has 5 service departments and 2 production departments. The total budgeted costs for the period for each department were as follows:

Service Departments:	
Building and grounds	Rs 1,00,000
Personnel	10,000
General factory and administration	2,60,900
Cafeteria	16,400
Storeroom	26,700

(*Contd.*)

(*Contd.*)

Production Departments:	
Machinery	3,47,000
Assembly	4,89,000

The following schedule was prepared to assist in allocating service department costs:

Department	*Direct labour-hours*	*Number of employees*	*Square feet*	*Total labour-hours*	*Number of requisitions*
Building and grounds	—	—	—	—	—
Personnel	—	—	2,000	—	—
General factory administration	—	35	7,000	—	—
Cafeteria	—	10	4,000	1,000	—
Storeroom	—	5	7,000	1,000	—
Machinery	5,000	50	30,000	8,000	2,000
Assembly	15,000	100	50,000	17,000	1,000
	20,000	200	1,00,000	27,000	3,000

The company management decided that the appropriate bases used by each service department would be the following:

Building and grounds	Square feet
Personnel department	Employees
General factory administration	Total labour-hours
Cafeteria	Employees
Storeroom	Requisitions

Direct labour-hours are used as the basis for computing the production dapartment's factory overhead application rates.

You are required to allocate the total budgeted costs of the service departments by using direct method. Also, determine the factory overhead absorption rates for the production departments.

SOLUTION

Table 5.3 *Determination of Factory Overhead Absorption Rates for Production Departments (Machinery and Assembly)*

Items	*Basis of charge*	*Service Departments*					*Production Departments*	
		Building and grounds	*Personnel*	*General factory administration*	*Cafeteria*	*Storeroom*	*Machinery*	*Assembly*
Budgeted costs	Allocation	Rs 1,00,000	Rs 10,000	Rs 2,60,900	Rs 16,400	Rs 26,700	Rs 3,47,000	Rs 4,89,000
Cost of service departments apportioned to production departments:								
Building and grounds	Square feet ratio (3:5)	(1,00,000)					37,500	62,500

(*Contd.*)

(*Contd.*)

Personnel	Employees (1:2)		(10,000)				3,333	6,667
General factory administration	Total labour-hours (8:17)			(2,60,900)			83,488	1,77,412
Cafeteria	Employees (1:2)				(16,400)		5,467	10,933
Storeroom	Requisitions (2:1)					(26,700)	17,800	8,900
Total cost		—	—	—	—	—	4,94,588	7,55,412
Direct labour-hours						5,000	15,000	
Factory overhead absorption rate (Total cost/Direct labour-hours)							98.92	50.36

Step Method In situations, when one service department renders services to another (that is reciprocity exists), the step method is more appropriate than the direct method. This method takes into consideration the *total/true* cost of each service department (and not partial) in assigning them to production departments.

The following is a list of steps used for the purpose of apportioning budgeted costs of service departments:[4]

(i) It is usual to apportion first the cost of that service department which renders services to the largest number of other service departments.

(ii) The budgeted costs of the service department that renders services to the next largest number of service departments are then apportioned. Obviously, any apportioned costs added to this service department from step 1 are included. The sum of budgeted service cost, so arrived at, is then apportioned among the remaining service departments (whose costs are yet to be assigned). The service department whose budgeted costs were apportioned as per the step 1 will not receive any cost share from the second department.

(iii) This sequence is continued, step-by-step, until all the budgeted service department costs have been apportioned to production departments.

Using the facts given in Example 5.3, cost apportionment of service departments as per Step method is shown in Table 5.4.

Table 5.4 *Determination of Factory Overhead Absorption Rates for Production Departments (Machinery and Assembly)*

Items	*Basis of charge*	*Service Departments*					*Production Departments*	
		Building and grounds	*Personnel*	*General factory administration*	*Cafeteria*	*Storeroom*	*Machinery*	*Assembly*
Budgeted costs	Allocation	Rs 1,00,000	Rs 10,000	Rs 2,60,900	Rs 16,400	Rs 26,700	Rs 3,47,000	Rs 4,89,000
Distribution of factory overheads of:								
Building and grounds	Square feet ratio	(1,00,000)	2,000	7,000	4,000	7,000	30,000	50,000
Personnel	Employees		(12,000)	2,100	600	300	3,000	6,000
General factory administration	Total labour-hours			(2,70,000)	10,000	10,000	80,000	1,70,000
Cafeteria	Employees				(31,000)	1,000	10,000	20,000
Storeroom	Requisition					(45,000)	30,000	15,000
Total cost		—	—	—	—	—	5,00,000	7,50,000

(*Contd.*)

(*Contd.*)

Direct labour-hours (DLH)	5,000	15,000
Factory overhead absorption rate (Total cost/DLH)	100	50

The allocation of 5 service departments (SD) is made in the following order: (a) Building and grounds (shared with 4 SD), (b) Personnel department (shared with 3 SD), (c) General factory administration (shared with 2 SD), (d) Cafeteria (with one SD), and (e) Service departments costs of storeroom is apportioned only with 2 production departments and not with any service department.

It may be noted that under direct method, budgeted costs of each of the five service departments were apportioned between 2 production departments only; service departments had not been apportioned any costs, at any stage.

Repeated Distribution Method The process of apportioning service departments overhead is continued until the figures of unapportioned sum(s) of service department(s) become negligible: The following steps are involved in its application:

(i) The first service department's (to be identified on the basis of the order in which their names are stated) budgeted costs are to be apportioned. As a result, the balance of the first service department becomes nil; its costs are apportioned among other departments (on the basis of their percentage share or some other base stated).

(ii) The budgeted costs of the second service department (consisting of original amount plus the apportioned sum from the first service department) is to be apportioned among other departments including the first service department.

(iii) This process continues for all the remaining/other service departments. The steps shown as per (i) to (iii) refer to the first phase.

(iv) The second phase of cycle starts once again with the first service department; it will consist only of apportioned amounts from other service departments. As a result, the total costs of service departments become less and less with each phase of apportionment.

(v) The process comes to an end when it is found that the residual sum (to be apportioned) has been either exhausted or has become virtually insignificant.

Consider Example 5.4.

EXAMPLE 5.4

A company has three production departments and two service departments. Distribution summary of overheads is as follows:

Production departments:	
A	Rs 13,600
B	14,700
C	12,800
Service departments:	
X	9,000
Y	3,000

The expenses of service departments are charged on a percentage basis, which is as follows:

Department	*A*	*B*	*C*	*X*	*Y*
X	40	30	20	—	10
Y	30	30	20	20	—

Apportion the cost of service departments by using the repeated distribution method.

SOLUTION

Table 5.5 *Apportionment of Cost of Service Departments to Production Departments*

Particulars	*Production departments*			*Service departments*	
	A	*B*	*C*	*X*	*Y*
Primary apportionment	Rs 13,600	Rs 14,700	Rs 12,800	Rs 9,000	Rs 3,000
Department X overheads apportioned in ratio of (4:3:2:1)	3,600	2,700	1,800	(9,000)	900
Department Y overheads (Rs 3,900) apportioned in the ratio of (3:3:2:2)	1,170	1,170	780	780	(3,900)
Department X overheads (Rs 780) apportioned in the ratio of 4:3:2:1	312	234	156	(780)	78
Department Y overheads (Rs 78) apportioned in the ratio of 3:3:2:2	23	23	16	16	(78)
Department X overheads (Rs 16) apportioned in the ratio of 4:3:2:1	6	5	3	(16)	2
Department Y overheads (Rs 2) apportioned in the ratio of 3:3:2:2	1	1	—	—	(2)
Total	18,712	18,833	15,555	—	—

Algebraic Method This method is the most appropriate of all the four methods when reciprocal services exist between service departments. It is also called the reciprocal services method as it takes into account cost flows in both directions between service departments that render services to each other. Typically, the service departments provide services to each other in most of the manufacturing firms in practice. This method provides conceptually the most correct budget cost estimates of service departments and their subsequent apportionment.

Example 5.5 illustrates its application.

EXAMPLE 5.5

Royal Industries Ltd has 2 service (SD) and 2 production departments (PD). It employs the algebraic method to allocate budgeted service department costs. The following information is available:

Department	*Budgeted costs*	*Services provided by*	
		Department A	*Department B*
Total costs:			
SD A	Rs 1,00,000	—	20 %
SD B	2,00,000	35 %	—

(*Contd.*)

(*Contd.*)

Factory overhead costs:			
PD_1	1,40,000	15	45
PD_2	60,000	50	35
	5,00,000	100 %	100 %
Direct labour-hours (DLH):			
PD_1	20,000		
PD_2	10,000		

From the above information, you are required to: (a) Allocate the service departments costs to production departments. Use algebraic equation method, (b) Compute factory overhead absorption rate, based on direct labour-hours.

SOLUTION

(a) Let X be the total overhead costs of SD A and Y be of SD B

X = Rs 1,00,000 + 0.20Y

Y = Rs 2,00,000 + 0.35X

Substituting,

X = Rs 1,00,000 + 0.20 × (Rs 2,00,000 + 0.35X) = Rs 1,00,000 + Rs 40,000 + 0.07X

= Rs 1,40,000/0.93 = Rs 1,50,538

Y = Rs 2,00,000 + 0.35 × (Rs 1,50,538) = Rs 2,52,688

Allocation of Overheads Among Production Departments

Items	*Production Departments*		*Total*
	P_1	P_2	
Direct overheads	Rs 1,40,000	Rs 60,000	Rs 2,00,000
SD A (15:50)	22,581	75,269	97,850
SD B (45:35)	1,13,709	88,441	2,02,150
Total	2,76,290	2,23,710	5,00,000

Working Notes

1. Total expenses of SD A	Rs 1,50,538
Less share of SD B (0.35 × Rs 1,50,538)	52,688
Amount to be divided between production departments	97,850
2. Total expenses of SD B	2,52,688
Less share of SD A (0.20 × Rs 2,52,688)	50,538
Amount to be divided between production departments	2,02,150

(b) *Factory Overhead Absorption Rate (based on DLH) for Production Departments*

For P_1 (Rs 2,76,290/20,000, DLH)	Rs 13.8145
For P_2 (Rs 2,23,710/10,000, DLH)	22.3710

ABSORPTION OF FACTORY OVERHEADS

If in production cost centre/department, all units produced are identical, the total factory overheads of production department could be shared equally among the units produced. For instance, if the total budgeted production department costs (inclusive of apportioned share from service departments) are Rs 1,50,000 per

month, budgeted production units are 15,000; factory overhead (predetermined) rate would be Rs 10 per unit.

However, when the units are not normally identical and different facilities are used in their production, if a unit rate were used, some units would be over-charged and others under-charged. This will cause wrong cost estimation of various products and, hence, incorrect income reporting of these products to the management. On the basis of income reporting, the management may like to encourage more profitable products (in terms of expansion) in future; it may be possible that these products, in effect, may not be more profitable as they have been charged lower share of factory overheads than their due. Further, the management may like to discontinue products (which appear to be less profitable or loss-incurring) due to overcharge of factory overheads.

Thus, it is imperative to have an equitable allotment of factory overheads to cost units. This allotment of factory overheads to cost units/cost objects is referred to as *absorption.* The absorption rate is usually expressed in terms of rupee(s) per unit of estimated activity base (called denominator activity).

There are no definitive rules for determining which base to use as the denominator activity. However, a close nexus between the denominator activity base and factory overhead costs should be ensured. This will facilitate determination of equitable and fair absorption rate. Besides, the method used should be simple and economical; as far as possible, denominator activity base ''must be a factor that is common to all jobs, has a high correlation with the incurrence of overhead costs, and is easy to measure."[5]

Some common bases for absorption of factory overhead are: (i) Units of production (ii) Direct materials cost, (iii) Direct labour cost (iv) Prime cost method (v) Direct labour-hours and (vi) Machine-hours.

Units of Production Method

Under this method, factory overheads are absorbed at a uniform rate for each unit produced. This method is suitable when a production department manufacturers only one type of product. The factory overhead absorption rate is computed using Equation 5.1.

$$\text{Estimated factory overhead costs} \div \text{Estimated units of production} \tag{5.1}$$

Direct Material Cost Method

This method is an appropriate basis of charging fixed overheads to production when overhead costs are closely related to direct materials cost. In an assembly area, where many of the costs correspond to the quantity of materials used, it may be equitable to assign factory overhead costs on the basis of direct materials costs. The overhead recovery rate (in terms of percentage of direct materials cost) is computed, using Equation 5.2.

$$(\text{Estimated factory overhead costs} \div \text{Estimated direct materials cost}) \times 100 \tag{5.2}$$

However, in practice, this method should not be normally followed (except in situation when factory overhead costs are significantly correlated to direct material costs) for the following reasons:

(a) While cost of materials is often subject to considerable fluctuations, factory overhead costs are not normally accompained by similar fluctuations.

(b) For firms using job costing, this method may give very distorted results. The mere fact that a job uses materials of a very expensive nature is no justification for the assumption that the factory overhead appropriate to that job will be proportionately heavier.[6]

(c) Overheads attributable to jobs tend to vary more in tune with time spent on them rather than on the value of materials used by them as most factory overheads, say, rent, rates insurance and salaries accrue on time basis. For this reason, time should be reckoned the key factor in charging factory overhead costs to production.

Direct Labour Costs Basis/Method

This method is suggested for the following reasons:

(a) There is built-in mechanism to consider time factor; it is reasonable to assume that the greater the direct labour costs attributed to a job, the longer is likely to be the time spent on that job.
(b) Labour rates are usually more stable than material prices.
(c) Variable factory overhead costs are likely to vary, to some extent, with the number of employees and, thus, with direct labour costs.

However, this method may not provide correct results in situations when different types of labour personnel (obviously subject to different wage rates) are used in different jobs. For instance, assume in Job A, skilled labour is used (which is paid at Rs 20 per hour); unskilled labour is used in Job B, paid @ Rs 10 per hour. As per this method, factory overheads will be charged twice in Job A compared to Job B, assuming both jobs use the same hours. Thus, the wages incurred on different jobs may not be necessarily in the same ratio as the hours spent and, hence, distortion in absorption of overheads. The question of overtime further compounds the problem.

(d) This method will also be inappropriate if the major share of factory overhead costs consists of depreciation, repairs and maintenance, and other machine-related costs. In such a situation, there is likely to be a little relationship between factory overhead costs and direct labour costs.

The factory overhead rate in terms of percentage of direct labour cost is computed, using Equation 5.3.

$$(\text{Estimated factory overhead costs} \div \text{Estimated direct labour costs}) \times 100 \tag{5.3}$$

Prime Cost Method

Since both direct materials and direct labour give rise to factory overheads, both these costs (prime cost) should be the basis to arrive at factory overhead absorption rate. Equation 5.4 provides the computation basis (in terms of percentage of prime cost).

$$(\text{Estimated factory overhead costs} \div \text{Estimated prime costs}) \times 100 \tag{5.4}$$

This method is an ideal in the most unlikely situation (or rare situation) when the same material and the same type of labour (drawing uniform wages) is engaged in production/jobs carried out by the manufacturing firms. Conversely, this method has the drawback of giving very distorted results if different types of materials as well as different types of labour is used in production/jobs.

Direct Labour-hours

This method is an appropriate absorption base when there is a direct relationship between factory overhead costs and direct labour-hours. It is likely to be so for businesses where most of the work is accomplished by labour. The results under this method are not distorted even when there is a marked difference among hourly wage rates as this method takes into account *hours* used on the job and not *the labour cost*. As stated earlier, factory overheads are likely to vary more in tune with time and not with labour cost; therefore this method is more logical than direct labour cost method. The factory overhead absorption rate per direct labour-hour is computed using Equation 5.5.

Estimated factory overhead costs ÷ Estimated direct labour-hours (5.5)

This method, however, will be inappropriate if factory overhead costs are primarily based on machine-related activity.

Machine-hour Rate

This method is the most ideal method of absorbing factory overheads of those production departments in which machinery represents the predominant factor of production, that is, where most of the work is done through machines. This generally occurs in those production departments which are largely automated; as a result, the major share of factory overhead costs consist of depreciation on plant and machinery installed/used in that department. Firms, providing computer services, normally charge their costs based on computer time used. The factory overhead absorption rate per machine-hour (MHR) is computed according to Equation 5.6.

Estimated factory overhead costs ÷ Estimated machine-hours (5.6)

Since most of the work is done through machines, machine-hour rate is normally adopted to absorb factory overheads.

In cases where production department has several machines (serving different needs), the factory overheads among different machines (each machine/block of machine constitutes a cost centre) should be apportioned on equitable basis. For instance, (i) rent and rates, lighting and heating costs can be apportioned on the basis of *effective* floor space occupied (that is, allowing for reasonable space to operate the machine; (ii) insurance may be apportioned on the basis of book value of machines; (iii) depreciation may be computed on the basis of effective cost of the machine and its effective useful life in hours; (iv) power costs should be charged on the basis of actual units consumed; (v) supervision costs are to be apportioned on the basis of the degree of supervision required by each machine. Similarly, other production department costs are to be apportioned on the most equitable basis. The estimated productive machine-hours should be based on effective hours for which the machine works. It should exclude time lost due to setting-up of the machine and its maintenance.

Further, total overheads related to machine should be segregated in two categories, normally: fixed costs (commonly called standing charges), and variable costs (referred to as machine expenses) for cost control purposes, as also for decision-making purposes. Included in machine expenses are depreciation, power, repairs and maintenance; standing charges include rent and rates, general lighting, insurance, and supervisor's salary.

Where the work performed by direct labour personnel is identifiable with a particular machine group, their direct wages should be included as part of the machine group cost. Thus production/job will be charged with a machine-hour rate which is inclusive of direct wages.[7] Such a rate is known as *comprehensive* machine-hour rate.

Examples 5.6 and 5.7 illustrate the computation of machine-hour rate and comprehensive machine-hour rate respectively.

EXAMPLE 5.6

Compute the machine-hour rate from the following data:

Cost of machine	Rs 3,00,000
Estimated scrap value after the expiry of its useful life (5 years)	50,000
Rent and rates for the shop per month	2,000
General lighting for the shop per month	1,500

(*Contd.*)

(*Contd.*)

Insurance premium for the machine per annum	4,800
Repairs and maintenance expenses per annum	5,000
Power consumption — 10 units per hour @ Rs 2 per unit	20
Estimated working hours per annum 2,200 (including setting-up time of 200 hours; no power is required during setting-up time)	
Shop supervisor's salary per month	6,000

The machine occupies one-fourth of the total area of the shop. The supervisor is expected to devote one-fifth of his time for supervising the machine.

Determine machine-hour rate.

SOLUTION

Determination of Machine-hour Rate

Particulars		*Rate per hour*
Standing charges:		
Rent and rates (Rs 2,000 per month × 12)/4	Rs 6,000	
General lighting (Rs 1,500 per month × 12)/4	4,500	
Insurance premium per annum	4,800	
Shop supervisor's salary (Rs 6,000 per month × 12)/5	14,400	
Total standing charges	29,700	
Productive working machine-hours (2,200 – 200, setting-up time)	2,000	
Standing charges per hour (Rs 29,700/2,000)		Rs 14.85
Machine expenses:*		
Repairs and maintenance expenses (Rs 5,000/2,000 hours)	2.5	
Depreciation [(Rs 3 lakh – Rs 0.5 lakh)/5years] ÷ 2,000 hours	25.0	
Power consumption per hour	20.0	47.50
Machine-hour rate per hour		62.35

*are in the nature of mixed and variable costs.

EXAMPLE 5.7

A machine costs Rs 9 lakh and is deemed to have a scrap value of 5 per cent at the end of its effective life (19 years). Ordinarily, the machine is expected to run for 2,400 hours per annum but it is estimated that 150 hours will be lost for normal repairs and maintenance and further 750 hours will be lost due to staggering. The other details in respect of machine shop are:

Wages, bonus and provident fund contribution of each of two operators (each operator is in charge of two machines) (per year)	Rs 60,000
Rent of the shop (per year)	30,000
General lighting of the shop (per month)	2,500
Insurance premium for one machine (per year)	8,000
Cost of repairs and maintenance per machine (per month)	2,500
Shop supervisor's salary (per month)	5,000
Power consumption of machine per hour 20 units @ Rs 2 per unit	
Other factory overheads attributable to the shop (per annum)	40,000

There are four identical machines in the shop. The supervisor is expected to devote one-fifth of time for supervising the machine. Compute a comprehensive machine-hour rate from the above details.

SOLUTION

Determination of Comprehensive Machine-hour Rate per Hour (per machine)

Particulars		*Amount per hour*
Standing charges per annum		
Rent and rates (Rs 30,000/4 machines)	Rs 7,500	
General lighting (Rs 2,500 × 12)/4 machines	7,500	
Insurance premium	8,000	
Supervisor's salary (Rs 5,000 × 12)/5	12,000	
Other factory overheads (Rs 40,000/4 machines)	10,000	
Total standing charges	45,000	
Standing charges per hour (Rs 45,000/1,500[1] machine-hours)		Rs 30
Machine charges per hour		
Wages, bonus and provident fund (Rs 60,000/2 machines) = Rs 30,000/1,500 machine-hours	20	
Repairs and maintenance (Rs 2,500 × 12)/1,500	20	
Power (20 units × Rs 2 per unit)	40	
Depreciation [(Rs 9 lakh – Rs 0.45 lakh)/19 years] ÷ 1,500	30	110
Machine-hour rate		140

Note: Productive machine – hours (2,400 – 150 – 750) = 1,500

There is no absorption method which is the best to charge factory overheads in all situations. Selection of the method that best serves a firm's needs can be made only after the factory overheads have been carefully analyzed and their incurrence has been observed to exhibit direct/close association with the method (say machine-hours, labour-hours, direct wage cost, direct material cost) chosen for absorption of factory overheads.

UNDERABSORPTION AND OVERABSORPTION OF FACTORY OVERHEADS

Once the factory overhead absorption/application rate has been determined, it is used as the basis to charge factory overhead costs to actual production. The rate is applied to production on an ongoing basis as goods are manufactured according to the method used (say, direct labour-hours, machine-hours, units produced). For instance, assume that factory overhead absorption rate is Rs 50 per machine-hour, using machine-hour as a base and that, 10,000 machine-hours were used, Rs 5,00,000 (10,000 machine-hours × Rs 50) of factory overheads will be charged to production. If the actual factory overheads are Rs 6,00,000, it implies they are underabsorbed/underapplied by Rs 1,00,000 (Rs 6,00,000 – Rs 5,00,000). Alternatively, if the actual factory overheads are Rs 4,50,000, it is the case of overabsorption/overapplied factory overheads by Rs 50,000 (Rs 5,00,000 – Rs 4,50,000).

The under-absorption and overabsorption of factory overheads are computed as per Equations 5.7 and 5.8.

Under-absorption of factory overheads = Actual factory overheads – Overheads charged to production (5.7)

Overabsorption of factory overheads = Overheads charged to production – Production overheads (5.8)

The difference between the actual factory overhead costs and absorbed factory overheads is referred to as overhead variance.[8] Overhead variances may be disposed of by following either of the two methods:

First, they may be treated as a period costs and, therefore, assigned to the income statement of current period. The adjustment is made through cost of goods sold account. Journal entries will be as follows:

Cost of Goods Sold A/c . . . . . Dr	
To Factory Overhead Control A/c	
(For charging under-absorbed factory overheads)	
Factory Overhead Control A/c . . . . . Dr	
To Cost of Goods Sold A/c	
(For adjusting over-absorbed factory overheads)	

This method is normally used when variance is insignificant in amount.

In the second method, it may be considered as the cost of production of the current period and the amount is pro-rated to work-in-process inventory, finished goods inventory, and cost of goods sold in proportion to the unadjusted factory overhead balance in each account. This method is normally used when the variance is significant in amount. The objective is to allocate the under-or overabsorbed factory overhead costs to those accounts which were distorted by using incorrect absorption rate and to bring their ending balances close to what they would have been if the correct application rate had been used. Journal entries would be as follows:

Work-in-process Inventory A/c . . . . . Dr	
Finished Goods Inventory A/c . . . . . Dr	
Cost of Goods Sold A/c . . . . . Dr	
To Factory Overhead Control A/c	
(For charging under-applied factory overheads)	
Factory Overhead Control A/c . . . . . Dr	
To Work-in-process Inventory A/c	
To Cost of Goods Sold A/c	
(For adjusting over-applied factory overheads)	

Apart from the magnitude of variance, the treatment would also depend on the nature of such variances. If the variance has been an outcome of abnormal factors/unusual events (say, defective planning), it should be considered as period costs and taken to current year's cost of goods sold account. On the contrary, if such a variance has been caused by errors in estimation (either of budgeted factory overhead or activity base), it should be pro-rated to work-in-process inventory, finished goods inventory and cost of goods sold.

EXAMPLE 5.8

In a manufacturing unit, factory overhead was recovered at a predetermined rate of Rs 25 per manday. The total factory overhead expenses incurred and the mandays actually worked were Rs 41.50 lakh and 1.5 lakh, respectively. Out of the 40,000 units produced during a period, 30,000 were sold.

On analysing the reasons, it was found that 60 per cent of the unabsorbed overheads were due to defective planning and the rest were attributable to increase in overhead costs.

How would unabsorbed overheads be treated in cost accounts?

SOLUTION

Determination of Unabsorbed Factory Overheads

Factory overhead expenses incurred	Rs 41,50,000
Less factory overheads absorbed (1,50,000 mandays × Rs 25 per manday)	37,50,000
Unabsorbed factory overheads	4,00,000

Treatment of Unabsorbed Factory Overheads:

(1) 60 per cent of unabsorbed overheads are attributed to defective planning. Being abnormal in nature, Rs 2,40,000 (0.60 × Rs 4 lakh) is charged to costing profit and loss account		Rs 2,40,000
(2) Rs 1,60,000 is to be pro-rated between cost of goods sold (30,000 units) and finished goods inventory (10,000 units):		
— Cost of goods sold (Rs 1,60,000 × 3/4)	Rs 1,20,000	
— Finished goods inventory (Rs 1,60,000 × 1/4)	40,000	1,60,000
		4,00,000

EXAMPLE 5.9

The XYZ Ltd has the following information relating to applied and actual factory overheads for the current month:

Factory overheads, incurred	Rs 1,52,500
Applied factory overheads	1,98,500

Applied factory overhead costs are in the following accounts:

Cost of goods sold	1,60,000
Ending work-in-process inventory	17,500
Ending finished goods inventory	21,000

You are required to allocate the under or overapplied factory overheads to relevant accounts and pass necessary journal entries at the month-end.

SOLUTION

Overapplied/Overabsorbed Factory Overheads:

Applied factory overheads	Rs 1,98,500
Less factory overheads incurred	1,52,500
	46,000
Over-absorbed factory overheads will be pro-rated in the following accounts:	
Cost of goods sold (Rs 1,60,000/Rs 1,98,500) × Rs 46,000	37,078
Ending work-in-process inventory (Rs 17,500/Rs1,98,500) × Rs 46,000	4,055
Ending finished goods inventory (Rs 21,000/Rs 1,98,500) × Rs 46,000	4,867
	46,000

Journal Entries:

Factory Overhead Applied A/c. . . . . .Dr	Rs 1,98,500	
To Over-applied Factory Overhead A/c		Rs 46,000
To Factory Overhead Control A/c		1,52,500
Overapplied Factory Overhead A/c. . . . . .Dr	46,000	
To Cost of Goods Sold A/c		37,078
To Ending Work-in-process Inventory A/c		4,055
To Ending Finished Goods Inventory A/c		4,867

ACTIVITY-BASED COSTING

The focus of traditional cost accounting is on product costing by tracing direct costs to the product and indirect costs are allocated through cost centres. While the direct costs are in proportion to the volume of

production, the indirect costs (i.e. production/administration/selling and distribution overheads) are apportioned to the individual products on the basis of methods such as machine-hour rate, labour-hour rate, percentage of direct cost and so on. These (normal) methods of apportionment are not accurate to prorate common costs of different functions to the product cost. In the first place, the overhead recovery basis is acceptable when valuing stocks for financial reporting but it is inappropriate for decision-making/typical product strategy decisions. Such decisions have implications for 3-5 years and over this period many fixed costs become variable. Secondly, the traditional fixed and variable cost split is often unrealistic since as business grows, they often become more complex. Moreover, due to difficulties in traditional costing system in collection, classification, allocation and recovery of overheads to individual products, decision by multi-product companies on pricing, product-mix and so on are based on distorted cost information. Further, the new manufacturing technology requires a feed-back of performance while production is still in progress rather than history but traditional cost accounting is confined merely to furnishing information at product level. Finally, there is also an urgent need to integrate activity measurement with financial measurement. The Activity- Based Costing (ABC) provides a solution to these inadequacies of the traditional methods of overhead absorption. It is briefly illustrated in this Section.

Meaning

The basic idea of ABC is that costs are grouped according to what drives/causes them to the incurred. These cost drivers are used as the absorption base. Cost drivers are defined as those activities/transactions that are significant determinants of costs. In other words, cost driver is an activity which generates cost. A cost driver is a structural determinant of cost- related activity. Since activities are presumed to cause costs, a link should be made between activities and products by assigning costs of activities to product based on an individual products' demand for each activity. Costs are grouped into pools according to the activities which drive them. For example, a cost pool may be of procurement of goods. All the costs associated procurement, namely, ordering, inspection, storing and so on, would be included in this cost pool and cost driver identified. The procurement cost per acquisition is then calculated. This provides a means to trace the cost of procurement to individual product. Thus, ABC technique focuses on different costs for different purposes and the identification of only those costs which are relevant to a particular decision.

An illustrative list of main activities and main cost drivers are listed below:

Main Activities	*Main Cost Driver*
Customer order processing	— Order value — Order source (new/old customer) — Order source (customer location)
Material planning/acquisition	— Number of material transactions — Volume of material receipts — Volume of material orders
Inspection	— Inspection plans — Number of problem suppliers — Gauge usage — Lack of good quality
Production control	— Engineering changes — Supplies performance — Number of parts operational — Make versus buy policy

(*Contd.*)

(*Contd.*)

	— Number of machine changes — Order board changes
Production	— Number to be supervised — Shift patterns — Industrial relations issues — Flow of product from assembly — Volume of service parts/kit packing
Maintenance	— Number of machine breakdowns — Maintenance schedule — Capital expenditure — Activity levels
Systems	— Number of systems operational — Number of systems devices — Adequacy of existing systems
Control quality	— Inspection plans
Financial accounting	— Number of accounting transactions — Numbers of times accounts produced — Volume of activity — Coordinated shipping process
Management accounting	— Accuracy of feeder systems — Management requirements — Corporate requirements — Activity levels
Personnel	— Recruitment activity — Industrial relations climate — Training requirements

Allocation of Overheads Under ABC

According to this new approach in costing to calculate product costs, costs are classified as (i) long-term variable costs (traditionally known as fixed costs) and (ii) short-term variable costs (traditionally known as variable costs). While the latter are volume related and change proportionally with the volume of production, the former vary in the long run but not necessarily instantaneously. For instance, production scheduling cost can be changed in the long-term by changing number of runs rather than number of units produced. In other words, simple traditional distinction between fixed and variable cost is not enough guide to provide quality of information to design a costing system.

The short-term variable costs should be identified to products on the basis of volume-related cost drivers such as direct labour-hour, direct material cost, machine-hour and so on. But they are inappropriate for tracing most long-term variable costs to products because they are driven by complexity and variety and not by volume and the key to understanding what causes (drives) overheads is the transactions undertaken by the support departments. They are (i) diversity (scope) related, (ii) events (decision) related and (iii) time-related.

Steps to Develop ABC

The ABC is the process of tracing costs first from resources to activities and then from activities to specific products. It focuses on different costs for different purposes and the identification of just those costs which

are relevant to a particular decision. It, however, does not replace the conventional cost accounting methods/theory; instead, it refines the conventional methods. The steps involved in cost refinement with the ABC are as follows:

Step 1: Identification of the Job/Product That Is The Chosen Cost Object A job-order of any size for one of the several products of the company.

Step 2: Identification of the Direct Costs for the Job For instance, the refined job costing system retains the existing (traditional cost based) two direct cost-categories, namely, (i) direct material and (ii) direct manufacturing labour.

Step 3: Identification of the Indirect-Cost Pools The refined system has five indirect cost pools representing individual activity areas of the company's manufacturing facility:

1. Materials Handing All the parts necessary for manufacturing the product chosen are combined into a kit.

2. Machine Insertion of Part Automated and semi-automated equipments insert components.

3. Manual Insertion of Ports Skilled workers insert those components that are not machine-inserted (because of their shape, weight, location and so on).

4. Wave Soldering All inserted parts are simultaneously soldered to ensure that they remain attached.

5. Quality Testing Test are made to check that all components are inserted and in the proper place and the final product performs to specifications.

Step 4: Selection of Cost-Allocation Base to Use in Allocating Each Indirect Cost Pool to the Job Based on cause and effect criterion, the cost allocation bases that are cost drivers are chosen. The chosen allocation bases are presented below for each activity area.

Activity Area	*Cost Driver Used as Cost Allocation Base*
1. Material handling	Parts
2. Machine insertion of parts	Machine–inserted parts
3. Manual insertion of parts	Manually–inserted parts
4. Wave soldering	Boards
5. Quality testing	Test time

Step 5: Develop the Rate Per Unit of Each Cost Allocation Base Used to Allocate Indirect Costs to Job For instance, consider the direct cost-area for the machine insertion parts. The budgeted total costs at this active area are Rs 40 lakh while the budgeted number of machine inserted parts on boards is 80 lakh. The budgeted indirect cost allocation rate for the machine insertion parts activity area is Rs 0.50 per insertion (Rs 40,00,000 ÷ 80,00,000, insertions). A similar procedure can be used to compute the budgeted indirect cost allocation rates in each activity area.

Step 6: Assign the Costs to the Costs Object by Adding All Direct Costs and Indirect Costs

The cost allocation with ABC is illustrated in Example 5.10.

EXAMPLE 5.10

The hypothetical Instruments Ltd assembles and tests a number of electronic instrument products including printed-circuit boards. Every board has various parts (diodes, capacitors and integrated circuits) inserted on it.

It is currently producing two products - Board X and Board Y, using the same equipment and similar processes. An extract of production and cost data for these products in one period is given below.

(a) Direct manufacturing costs

	Board X	*Board Y*
Direct materials	Rs 6,000	Rs 2,800
Direct manufacturing labour	320	560

(b) Indirect manufacturing costs:

- Procurement (purchasing) support (overheads): allocated to products on the basis of 50 per cent of their direct material costs
- Production support (overheads): allocated to products on the basis of 700 per cent of their direct manufacturing labour costs

(c) Budgeted indirect cost allocation rates in each activity area:

Activit area	*Indirect cost allocation rate*
1. Materials handling	Rs 20 per part
2. Machinery insertion of parts	Rs 5 per insertion
3. Manual insertion of parts	Rs 40 per insertion
4. Wave soldering	Rs 500 per board
5. Quality testing	Rs 500 per test-hour

(d) Relative use of resources of the activity areas:

Activity area	*Board X*	*Board Y*
Material handling[@@]	81 parts	121 parts
Machine insertion of parts	70 insertions	90 insertions
Manual insertion of parts	10 insertions	30 insertions
Wave soldering	1 board	1 board
Quality testing	1.5 hours	6.5 hour

[@@]The number of parts includes the raw printed circuit board (counted as one part) plus the number of component parts to be inserted on the board.

Required Calculate the products costs of the Hypothetical Instruments Ltd. with (a) traditional costing system and (b) activity -based costing. Comment on their relative suitability for decision-making.

SOLUTION

(a) Manufacturing Product Costs with Traditional Costing System

	Board X	*Board Y*
Direct manufacturing costs:		
Direct materials	Rs 6,000	Rs 2,800
Direct manufacturing labour	320	560
	6,320	3,360
Indirect manufacturing costs		
Procurements/purchase overheads (support) (50% of direct material cost)	3,160	1,680
Production overheads (support) (700% of direct manufacturing labour cost)	2,240	3,920
	5,400	5,600
Total manufacturing costs	10,720	8,960

(b) Product Costs with Activity- Based Costing

	Board X	*Board y*
Direct manufacturing costs:		
Direct materials	Rs 6,000	Rs 2,800
Direct manufacturing labour	320	560
	6,320	3,360
Indirect manufacturing costs		
Material handling [(X, 81 parts; Y 121 parts) × Rs 20]	1,620	2,420
Machine insertion of parts [(X, 70 insertions; Y, 90 insertions) × Rs 5]	350	450
Manual insertion of parts [(X, 10 insertions; Y, 30 insertions) × Rs 40]	400	1,200
Wave soldering[(X, 1 board; Y, 1 board) × Rs 500]	500	500
Quality testing [(X, 1.5 hours; Y, 6.5 hours) × Rs 500]	750	3,250
	3,620	7,820
Total manufacturing costs	9,940	11,180

Thus, the ABC system results in the following product costs:

	Board X	*Board Y*
Direct job costs	Rs 6,320	Rs 3,360
Indirect job costs	3,620	7,820
Total job costs	9,940	11,180

Comment: Different factors were causing/driving costs in individual activity areas but the traditional costing system did not provide information about those differences. The numbers with this system are of limited use or even a detriment in decision- making. The costing system tended to "overcost" the intensely competitive high- volume product, X by loading too much of the indirect manufacturing costs on high-volume products and too little on low- volume products.

The ABC system is a more refined costing system and reports cost numbers that better measure the way jobs/products/customers and so on differently use resources of the company. Moreover, it points to opportunities for cost reductions. For instance, ABC reveals three reasons why Board X costs less: (i) it has fewer parts, (ii) it has a higher percentage of total insertions made by machines which are cheaper than insertions

made manually, and (iii) it requires less test time. Finally, cost reduction efforts are better focussed using the ABC system. The five activity areas have different cost drivers. The cost reduction targets can be set that relate to reductions in the costs per driver unit of each activity area. For example, the manager of the material handling area could have a performance target related to reducing the Rs 20 per part handled rate. Each of the indirect cost-allocation bases in the ABC systems is a non-financial number such as parts, hours and so on. Controlling such physical items is often the most fundamental way to manage costs. The ABC system ensure that cost accounting information is not merely a by-product of external financial reporting/ accounting system. While it provides a more accurate basis for computing product costs, its greatest benefit is that it is a mechanism for managing costs. It has the greatest potential in the area of cost management and resource planning rather than product costing.

EXAMPLE 5.11

The Instrumentation Ltd manufactures two products, X and Y, using the same equipment and similar processes. An extract of the production data for these products in one period is given below:

Particulars	*Product X*	*Product Y*
Quantity produced (units)	10,000	14,000
Direct labour-hours per unit	2	4
Machine-hours per unit	6	2
Setups in the period	20	80
Orders handled	30	120

The details of overheads costs ae:

- Relating to machine activity Rs 8,80,000
- Relating to production run set-ups 80,000
- Relating to handling of orders 1,80,000

Required: Calculate the production overheads to be absorbed by one unit of each of the products using (i) the traditional costing approach using the direct labour-hour rate to absorb overheads and (ii) the activity-based costing approach, using suitable cost drivers to trace overheads to products.

SOLUTION

(a) Direct Labour-hours (DLHs) Using Traditional Costing

Product X (10,000 units × 2 hours)	20,000
Product Y (14,000 units × 4 hours)	56,000
	76,000

Overhead absorption rate (Rs 11,40,000 ÷ 76,000, DLHs) = Rs 15 per hour

Overheads absorbed:

Product X (2 hours × Rs 15) = Rs 30 per unit

Product Y (4 hours × Rs 15) = Rs 60 per unit

(b) Machine-hours (MHs) Using Activity-Based Costing

Product X (10,000 units × 6 hours)	60,000
Product Y (14,000 units × 2 hours)	28,000
	88,000

Machine-hours driven costs (Rs 8,80,000 ÷ 88,000, MHs) = Rs 10 per machine-hour
Set-up driven costs (Rs 80,000 ÷ 100, set-ups) = Rs 800 per set-up
Order-driven costs (Rs 1,80,000 ÷ 150, orders) = Rs 1,200 per order
Computation of overhead costs

Particulars	*Products*			
	Products X		*Product Y*	
Machine-driven costs	(60,000 hours × Rs 10)	Rs 6,00,000	(28,000 × Rs 10)	Rs 2,80,000
Set-up costs	(20 × Rs 800)	16,000	(80 × Rs 800)	64,000
Order handling costs	(30 × Rs 1,200)	36,000	(120 × Rs 1,200)	1,44,000
		6,52,000		4,88,000
Overhead cost per unit	(Rs 6,52,000 ÷ 10,000 units)	65.2	(Rs 4,88,000 ÷ 14,000 units)	34.85

Thus, it is clear from the computation that product Y absorbs an unrealistic amount of overhead using direct labour-hour basis under the traditional costing basis. In the case of the activity-based costing, overhead absorption should be based on the basis of the activities drive the costs, namely, (i) machine-hours, (ii) number of production run set ups and (iii) number of orders handled for each product.

SUMMARY

- Factory overheads represent all indirect manufacturing costs. Unlike direct costs, these costs cannot be conveniently and wholly charged to product cost centres. All of the factory overhead costs find their way into production costs through a somewhat difficult method of allocations and apportionments and reallocations and reapportionments. Allotment of common costs/factory overheads to cost centres/cost objects/cost units is often made on a somewhat arbitrary basis. Cost allocation procedures are costly as they use the time of cost accountants and decision-makers. Therefore, cost allocation should be justified on the basis of cost-benefit considerations. Yet, cost allocation is necessary to determine the true cost of products, particularly in the case of multi-product firms.
- Costing and control of factory overheads involves (i) Determination of factory overheads application role, (ii) Allocation of overheads, (iii) Absorption of overheads and (iv) Under/over absorption of overheads.
- Factory overheads costs are normally allocated at a predetermined factory overhead application rate. It is determined dividing budgeted factory overhead costs (consisting of fixed costs, variable costs and mixed costs) for the coming period/year by capacity level. Among four capacity measures, normal capacity and expected capacity levels (theoretical capacity, practical capacity), normal capacity (based on long-run productive capacity) is considered as the best denominator measure.
- Cost common to more than one department are to be allocated among the production departments receiving benefits, and service department costs are to be distributed among producing departments. Cost incurred in service departments are apportioned by (i) Direct method, (ii) Step method, (iii) Repeated dstribution method, and (iv) Algebraic method, among production departments as part of factory overhead costs.
- According to direct method, total budgeted costs of service departments are apportioned between/among production departments, ignoring any services provided by service departments to each other.
- In situations when one service department renders services to another (that is reciprocity exits), the step method is more appropriate than the direct method. This method takes into consideration the *total/true* cost of each service department (and not partial) in assigning them to production departments.

The following is a list of steps used for the purpose of apportioning budgeted costs of service departments.

(i) It is usual to apportion first the cost of that service department which renders services to the largest number of other service departments.

(ii) The budgeted costs of the service department that renders services to the next largest number of service departments are then apportioned. Obviously, any apportioned costs added to this service department from step 1 are included. The sum of budgeted service cost, so arrived at, is then apportioned to note that the service department (whose costs are yet to be assigned). It is important to note that the service department whose budgeted costs were apportioned as per the step 1 will not receive any cost share from the second department.

(iii) This sequence is continued, step-by-step, until all the budgeted service department costs have been apportioned departments.

➔ The process of apportioning service departments overhead according to repeated distribution method is continued until the figures of unapportioned sum(s) of service department(s) become negligible: The following steps are involved in its application:

(i) The first service department's (to be identified on the basis of the order in which their names are stated) budgeted costs are to be apportioned. As a result, the balance of the first service department becomes nil; its costs are apportioned among other departments (on the basis of their percentage share or some other stated base).

(ii) The budgeted costs of the second service department (consisting of original amount plus the apportioned sum from the first service department) is to be apportioned among other departments including the first service department.

(iii) This process continues for all the remaining/other service departments. The steps shown as per (i) to (iii) refer to the first phase.

(iv) The second phase of cycle starts once again with the first service department; it will consist only of apportioned amounts from other service departments. As a result, the total costs of service departments becomes less and less with each phase of apportionment.

(v) The process comes to an end when it is found that the residual sum (to be apportioned) has been either exhausted or has become virtually insignificant.

➔ The algebraic method is the most appropriate of all the four methods when reciprocal services exist between service departments. This method is also called the reciprocal services method as it takes into account cost flows in both directions between service departments that render services to each other. This is typical for the service departments to provide services to each other in most of the manufacturing firms in practice. This method provides conceptually the most correct budget cost estimates of service departments and their subsequent apportionment.

➔ Factory overheads of production departments (inclusive of appropriate apportioned share from other services departments) are to be applied to production/jobs. Some common bases of absorption of factory overheads are: (i) Units of production, (ii) Direct materials cost, (iii) Direct labour cost, (iv) Prime cost method, (v) Direct labour-hours, and (vi) Machine-hours.

➔ According to units of production method, the factory overhead absorption rate = Estimated/bugeted factory overhead costs ÷ Estimated/budgeted units of production

➔ According to the direct material cost method, the overhead recovery rate in terms of percentage of direct material cost = (Estimated/budgeted factory overhead cost/Estimated direct material cost) × 100

➔ The factory overhead rate according to direct labour cost method = (Estimated factory overhead cost/ Estimated direct labour cost) × 100

- According to prime cost method the factory overhead rate = (Estimated factory overhead cost/Estimated prime cost) × 100
- The factory overhead absorpation rate per direct labour hour = Estimated factory overhead costs ÷ Estimated direct labour-hours
- According to the machine-hour rate, the factory overhead absorption rate per machine-hour (MHR) = Estimated factory overhead costs ÷ Estimated machine-hours
- Since most of the work is done through machines, machine-hour rate is normally adopted to absorb factory overheads.
- In cases where prodution department has several machine (serving different needs), the factory overheads among different machines (each machine/block of machine constitutes a cost centre) should be apportioned on equitable basis. For instance, (i) rent and rates, lighting and heating costs can be apportioned on the basis of *effective* floor space occupied (that is, allowing for reasonable space to operate the machine); (ii) insurance may be apportioned on the basis of book value of machines; (iii) depreciation may be computed on the basis of effective cost of the machine and its effective useful life in hours; (iv) power costs should be charged on the basis of actual units consumed; (v) supervision costs are to be apportioned on the basis of the degree of supervision required by each machine. Similarly, other production departments costs are to be apportioned on the most equitable basis. The estimated productive machine-hours should be based on effective hours for which the machine works. It should exclude time lost due to setting-up of the machine and its maintenance.
- Further, total overheads related to machine should be normally segregated in two categories: fixed costs (commonly called standing charges), and variable costs (referred to as machine expenses) for cost control purposes, as also for decision-making purposes. Included in machine expenses are depreciation, power, repairs and maintenance; standing charges include rent and rates, general lighting, insurance, and supervisor's salary.
- Where the work performed by direct labour personnel is identifiable with a particular machine group, their direct wages should be included as part of the machine group cost. Thus production/job will be charged with a machine-hour rate which is inclusive of direct wages. Such a rate is known as *comprehensive* machine-hour rate.
- Direct labour-hour rate (where factory overhead costs consist primarily of labour activity) and machine-hour rate (where indirect manufacturing costs predominantly comprise of machine-related activity) are the two suitable methods. Further, for cost control and decision-making purposes, factory overhead absorption rate should be computed separately both for fixed costs and variable costs.
- When predetermined factory overhead applied rate is used as the basis of absorption of indirect manufacturing costs, it is seldom that the total factory overhead costs applied to production (or jobs) in a given period are equal to the total factory overhead costs incurred in that period. When the absorbed factory overheads exceed the actual, it is a situation of overabsorption; under-absorption results when the actual factory overhead costs exceed the factory overheads charged to production. At the end of accounting period, if the over/under-applied overhead balance is insignificant, it is normally closed by transferring to cost of goods sold; if it is being sizeable, it is pro-rated to work-in-process inventory, finished goods inventory and cost of goods sold.
- The activity-based costing (ABC) is an alternative method of overhead absorption. Here, costs are grouped according to what drives/causes them to be incurred. These cost drivers are used as the absorption basis. Cost driver is an activity which generates cost. A link is established between activities and products by assigning costs of activities to product(s) based on an individual products' demand for each activity. Costs are grouped into pools according to the activities which drive them. A cost pool of procurement of goods, for example, would include all costs associated with procurement, namely, ordering, inspection, storing and so on and cost driver identified. The acquisition cost is then calculated.

➔ The ABC is a more refined costing system and reports cost numbers that better measure the way tools/ products differently use resources of the company. It also points to opportunities for cost reproduction. The cost reduction targets can be set that relate to reduction in the costs per driver unit of each activity area. It ensures that cost accounting information is not merely a by-product of external financial reporting/accounting system. While it provides a more accurate basis for computing product costs, its greatest benefit is that it is a mechanism for managing costs. Its has the greatest potential in area of cost management and resource planning rather than product costing.

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8. For details of overhead variances, please refer to Chapter 16 of this book.

SOLVED PROBLEMS

P.5.1 Atlas Engineering Limited accepts a variety of jobs which require both manual and machine operations. The budgeted profit and loss account for the current period is as follows: (Rs in lakh)

Sales		75
Cost:		
Direct materials	10	
Direct labour	5	
Prime cost	15	
Production overheads	30	
Production cost	45	
Administrative, selling and distribution overheads	15	60
Profit		15

Other budgeted data:

Labour-hours for the period	25,000
Machine-hours for the period	15,000
Number of jobs for the period	300

An enquiry has been received recently from a customer and the production department has prepared the following estimate of the prime cost required for the job.

Direct material	Rs 2,500
Direct labour	2,000
Prime cost	4,500
Labour-hours required	80
Machine-hours required	50

You are required to:

(a) Calculate by different methods, six overhead absorption rates for absorption of production overhead and comment on the suitability of each.

(b) Calculate the production overhead cost of the order based on each of the above rates.

(c) Give your recommendation to the company.

SOLUTION

(a) Statement showing determination of production overhead rate under various methods of absorption.

Method of absorption	*Production overhead absorption rate*
1. Percentage of direct material cost (Rs 30 lakh/Rs 10 lakh) × 100	300 per cent (3 times) of direct material cost
2. Percentage of direct labour cost (Rs 30 lakh/Rs 5 lakh) × 100	600 per cent (6 times) of direct labour cost
3. Percentage of prime cost (Rs 30 lakh/Rs 15 lakh) × 100	200 per cent (twice) of prime cost
4. Machine-hour rate (Rs 30 lakh/15,000 hours)	Rs 200 per machine-hour
5. Direct labour-hour rate (Rs 30 lakh/25,000 hours)	Rs 120 per labour-hour
6. Production unit method (Rs 30 lakh/300 Jobs)	Rs 10,000 per job

(b) *Statement showing determination of production overhead cost of a job under various methods of absorption.*

Method	*Production overhead cost*
1. Percentage of direct material cost	Rs 2500 × 3 = Rs 7,500
2. Percentage of direct labour cost	Rs 2,000 × 6 = Rs 12,000
3. Percentage of prime cost	Rs 4,500 × 2 = Rs 9,000
4. Machine-hour rate	50 hours × Rs 200 = Rs 10,000
5. Direct labour-hour rate	80 hours × Rs 120 = Rs 9,600
6. Production unit method	1 × Rs 10,000 = Rs 10,000

(c) ***Recommendation*** The company is advised to apply machine-hour rate to compute production overhead cost as mechanisation is high.

P.5.2 A company's production costs for the current ending March 31 are given below:

Item	*Production departments*			*Service departments*			*Total*
	P_1	P_2	P_3	*Office*	*Stores*	*Workshop*	
Direct wages	Rs 20,000	Rs 25,000	Rs 30,000	—	—	—	Rs 75,000
Direct materials	30,000	35,000	45,000	—	—	—	1,10,000
Indirect materials	2,000	3,000	3,000	Rs 1,000	Rs 2,000	Rs 2,000	13,000
Indirect wages	3,000	3,000	4,000	10,000	10,000	5,000	35,000
Area (sq. metres)	200	250	300	150	100	250	1,250
Book value of machinery	30,000	35,000	25,000	—	—	15,000	1,05,000
Total horse power (H.P.) of machines	15	20	25	—	—	5	65
Machine-hours worked	10,000	20,000	15,000	—	—	5,000	50,000

The other expenses are as follows:

Rent	Rs 12,500
Insurance	1,050
Depreciation (per cent of value of machinery)	15
Power	3,800
Light	1,250

You are required to prepare an overhead analysis sheet for the departments showing clearly the basis of apportionment where necessary.

SOLUTION

Overhead analysis sheet

Item	*Basis*	*Production departments*			*Service departments*			*Total*
		P_1	P_2	P_3	*Office*	*Stores*	*Workshop*	
Indirect materials	Allocation	Rs 2,000	Rs 3,000	Rs 3,000	Rs 1,000	Rs 2,000	Rs 2,000	Rs 13,000
Indirect wages	Allocation	3,000	3,000	4,000	10,000	10,000	5,000	35,000
Rent	Area	2,000	2,500	3,000	1,500	1,000	2,500	12,500
Insurance	Value of machine	300	350	250	—	—	150	1,050
Depreciation	Value of machine	4,500	5,250	3,750	—	—	2,250	15,750
Power	Horse power	877	1,169	1,462	—	—	292	3,800
Light	Area	200	250	300	150	100	250	1,250
Total		12,877	15,519	15,762	12,650	13,100	12,442	82,350
office overheads	Direct wages	3,373	4,217	5,060	(12,650)	—	—	—
Stores overheads	Direct materials	3,573	4,168	5,359	—	(13,100)	—	—
Workshop overheads	Machine-hours	2,765	5,530	4,147	—		(12,442)	—
Total overheads		22,588	29,434	30,328	—	—	—	82,350

P.5.3 Deccan Manufacturing Limited has three departments which are regarded as production departments. Service department's costs are distributed to these production departments using the "Step Ladder Method" of distribution. Estimates of factory overhead costs to be incurred by each department in the forthcoming year are as follows. Data required for distribution is also shown against each department.

Department	*Factory overheads*	*Direct labour-hours*	*Number of employees*	*Area in square metres*
Production				
X	Rs 1,93,000	4,000	100	3,000
Y	64,000	3,000	125	1,500
Z	83,000	4,000	85	1,500

(*Contd.*)

(*Contd.*)

Service				
P	45,000	1,000	10	500
Q	75,000	5,000	50	1,500
R	1,05,000	6,000	40	1,000
S	30,000	3,000	50	1,000

The overhead costs of the 4 service departments are distributed in the same order, namely, P,Q,R and S respectively on the following basis:

Departments	Basis
P	Number of employees
Q	Direct labour-hours
R	Area in square metres
S	Direct labour-hours

You are required to: (a) Prepare a schedule showing the distribution of overhead costs of the four service departments to the three production departments; and (b) Calculate the overhead recovery rate per direct labour-hour for each of the three production departments.

SOLUTION

(a) *Statement showing distribution of factory overhead costs of service department among production departments as per step ladder method*

Particulars	*Service departments*				*Production departments*		
	P	*Q*	*R*	*S*	*X*	*Y*	*Z*
Factory overhead costs	Rs 45,000	Rs 75,000	Rs 1,05,000	Rs 30,000	Rs 1,93,000	Rs 64,000	Rs 83,000
Distribution of factory overhead of Department P (in the ratio of number of employees)	(45,000)	5,000	4,000	5,000	10,000	12,500	8,500
Distribution of factory overhead of Department Q, Rs 80,000 (in the ratio of direct labour-hours)	—	(80,000)	24,000	12,000	16,000	12,000	16,000
Distribution of factory overheads of Department R, Rs 1,33,000 (in the ratio of area used)	—	—	(1,33,000)	19,000	57,000	28,500	28,500
Distribution of factory overheads of Department S, Rs 66,000 (in the ratio of direct labour-hours)	—	—	—	(66,000)	24,000	18,000	24,000
Total cost					3,00,000	1,35,000	1,60,000
(b) Divided by direct labour-hours					4,000	3,000	4,000
Overhead recovery rate per hour (Total cost/DLH)					75	45	40

P.5.4 Modern Machines Limited has three production departments (A, B and C) and two service departments (D and E). From the following figures extracted from the records of the company, calculate the overhead rate per labour-hour of production departments:

Indirect materials	Rs 15,000
Indirect wages	10,000
Depreciation on machinery	25,000
Depreciation on buildings	5,000
Rent, rates and taxes	10,000
Electric power for machinery	15,000
Electric power for lighting	500
General expenses	15,000

Items	*Total*	*A*	*B*	*C*	*D*	*E*
Drect materials (Rs)	60,000	20,000	10,000	19,000	6,000	5,000
Direct wages (Rs)	40,000	15,000	15,000	4,000	2,000	4,000
Value of machinery (Rs)	2,50,000	60,000	1,00,000	40,000	25,000	25,000
Floor area (sq. feet)	50,000	15,000	10,000	10,000	5,000	10,000
Horse power of machines	150	50	60	30	5	5
Number of light points	50	15	10	10	5	10
General expenses	15,000	5,000	5,000	2,000	1,000	2,000

The expenses of service departments D and E are to be apportioned as follows:

	A	*B*	*C*	*D*	*E*
Department D (%)	40	20	30	—	10
Department E (%)	30	30	40	—	—

SOLUTION

Determination of departmental overhead rates of production

Item	*Basis of charge*	*Total*	*Production departments*			*Service departments*	
			A	*B*	*C*	*D*	*E*
Direct materials	Allocation	Rs 11,000	—	—	—	Rs 6,000	Rs 5,000
Direct wages	Allocation	6,000	—	—	—	2,000	4,000
Indirect materials	Direct materials usage ratio	15,000	Rs 5,000	Rs 2,500	4,750	1,500	1,250
Indirect wages	Direct wages usage ratio[1]	10,000	3,750	3,750	1,000	500	1,000
Depreciation (machinery)	Value of machinery	25,000	6,000	10,000	4,000	2,500	2,500
Depreciation (building)	Floor area	5,000	1,500	1,000	1,000	500	1,000
Rent, rates and taxes	Floor area	10,000	3,000	2,000	2,000	1,000	2,000
Electric power (machinery)	Horse power	15,000	5,000	6,000	3,000	500	500
Electric power (lighting)	Light points	500	150	100	100	50	100
General expenses	Labour-hours	15,000	5,000	5,000	2,000	1,000	2,000
Total		1,12,500	29,400	30,350	17,850	15,550	19,350

(*Contd.*)

(*Contd.*)

Cost of service Department D apportioned		6,220	3,110	4,665	(15,550)	1,555
Cost of service Department E apportioned	—	6,272	6,271	8,362	—	(20,905)
Total overheads	1,12,500	41,892	39,731	30,877	—	—
Labour-hours	—	5,000	5,000	2,000	—	—
Overhead rate per direct labour-hour		8.378	7.946	15.439	—	—

1 May also be based on the basis of direct labour-hours.

P.5.5 A factory is having three production departments: A, B and C, and two service departments, namely, Boiler House (BH) and Pump Room (PR). The Boiler House is to depend upon the Pump Room for supply of water and Pump Room, in turn, is dependent on the Boiler House for supply of power for driving the pump. The expenses incurred by the production departments during a period are: A, Rs 8,00,000; B, Rs 7,00,000; and C, Rs 5,00,000. The expenses for Boiler House are Rs 2,34,000 and the Pump Room are Rs 3,00,000.

The expenses of the Boiler House and Pump Room are apportioned to the production departments on the following basis:

	A	*B*	*C*	*B.H.*	*P.R.*
Expenses of Boiler House (%)	20	40	30	—	10
Expenses of Pump Room (%)	40	20	20	20	—

Show clearly as to how the expenses of Boiler House and Pump Room would be apportioned to A, B and C departments. Use algebraic equation method.

SOLUTION

Let X be total overhead costs of Boiler House, and

Y be total overhead costs of Pump Room

X = Rs 2,34,000 + 0.2Y

Y = Rs 3,00,000 + 0.1X

Or, X = Rs 2,34,000 + 0.2 × (Rs 3,00,000 + 0.1X) = Rs 2,34,000 + Rs 60,000 + 0.02 X = Rs 2,94,000/0.98
= Rs 3,00,000

Y = Rs 3,00,000 + 0.1 × (Rs 3,00,000) = Rs 3,30,000

Allocation of overheads among production departments

Particulars	*Production departments*			*Total*
	A	*B*	*C*	
Direct overheads	Rs 8,00,000	Rs 7,00,000	Rs 5,00,000	Rs 20,00,000
Boiler House (2:4:3)	60,000	1,20,000	90,000	2,70,000 [1]
Pump Room (4:2:2)	1,32,000	66,000	66,000	2,64,000 [2]
Total	9,92,000	8,86,000	6,56,000	25,34,000

Working Notes

1. Total expenses of Boiler House	Rs 3,00,000
Less share of Pump Room (0.10 × Rs 3,00,000)	30,000
Amount to be apportioned among production departments	2,70,000

2. Total expenses of Pump Room	3,30,000
Less share of Boiler House (0.20 × Rs 3,30,000)	66,000
Amount to be apportioned among production departments	2,64,000

P.5.6 A factory has three production departments (P_1, P_2 and P_3) and two service departments (S_1 and S_2). Budgeted overheads for the next year have been allocated/apportioned by the cost department among the five departments. The secondary distribution of service department overheads is pending and the following details are given to you:

Department	*Overheads apportioned/allocated*	*Estimated level of activity*
P_1	Rs 48,000	5,000 labour-hours
P_2	1,12,000	12,000 machine-hours
P_3	52,000	6,000 labour-hours
Apportionment of service department costs		
S_1	16,000	P_1 (20 per cent), P_2, (40 per cent), P_3 (20 per cent), S_2 (20 per cent)
S_2	24,000	P_1 (10 per cent), P_2 (60 per cent), P_3 (20 per cent), S_1 (10 per cent)

Calculate the overhead rate of each production department after completing the distribution of service department costs.

SOLUTION

Let, X be total overhead costs of S1
Y be total overhead costs of S2

We get simultaneous equations,

X = Rs 16,000 + 0.1Y

Y = Rs 24,000 + 0.2X

Or, X = Rs 16,000 + 0.10 × (Rs 24,000 + 0.2 X) or 0.98 X = Rs 18,400

X = Rs 18,775

Y = Rs 24,000 + 0.20 (Rs 18,775) = Rs 27,755

Allocation of overheads among production departments

Particulars	*Production departments*		
	P_1	P_2	P_3
Direct overheads	Rs 48,000	Rs 1,12,000	52,000
Allocation of overheads			
Department S_1 (Rs 18,775)	3,755 (0.20)	7,510 (0.40)	3,755 (0.20)
Department S_2 (Rs 27,755)	2,776 (0.10)	16,653 (0.60)	5,551 (0.20)
Total cost	54,531	1,36,163	61,306
Estimated capacity	5,000 (labour-hours)	12,000 (machine-hours)	6,000 (labour-hours)
Overhead cost per hour	Rs 10.91	Rs 11.35	Rs 10.22

P.5.7 A machine was purchased on January 1, in the current year. The following information relate to the machine:

Cost of machine	Rs 40,000
Estimated life	15 years of 1,800 hours per year
Estimated scrap value	Rs 2,500
Estimated repairs for whole life	Rs 10,500
Power consumed per hour	15 units @ 0.07 per unit
Insurance	0.75% per month
Consumable stores	Rs 25 per month

The machine is installed in a department whose monthly rent is Rs 500 and this machine occupies 1/5 of the area. Total monthly lighting expenses is Rs 40 for 10 light points, of which 3 relate to the machine. A supervisor with monthly salary of Rs 500, devotes 1/4 of his time to this machine. Calculate machine hour rate.

SOLUTION

Determination of machine-hour rate

Standing charges:	Per year	Per hour
Insurance (0.75% per month × 12 × Rs 40,000)	Rs 3,600	
Rent (Rs 500 per month × 12 months × 1/5)	1,200	
Lighting charges (Rs 4 per point per month × 12 months × 3 points)	144	
Supervisor's salary (Rs 500 per month × 12 months × 1/4)	1,500	
Total standing charges	6,444	
Standing charges per hour (Rs 6,444/1,800 hours)		3.58
Machine expenses:		
Depreciation per hour (Rs 40,000 – Rs 2,500)/15 years = Rs 2,500/1,800		1.389
Consumable stores (Rs 25 per month × 12 months)/1,800		0.167
Power consumed (15 units × Rs 0.07)		1.050
Repairs (Rs 10,500/15 years) = Rs 700/1,800		0.389
Machine-hour rate per hour		6.575

P.5.8 A machine was purchased on April 1 in the current year for Rs 5 lakh. The total cost of all machinery inclusive of the new machine was Rs 75 lakh. The following particulars are further available:

Expected life of machine, 10 years
Scrap value at the end of 10 years, Rs 5,000
Repairs and maintenance for the machine during the year, Rs 2,000
Expected number of working hours of machine per year, 4,000
Insurance premium annually for all the machines, Rs 4,500
Electricity consumption for the machine per hour (@ Rs 2 per unit), 25 units
Area occupied by the machine, 100 sq. feet
Area occupied by other machines, 1,500 sq. feet
Rent per month of the department, Rs 800
Lighting charges for 20 points for the whole department, out of which 3 points are for the machine, Rs 120 per month.

Compute the machine-hour rate for the new machine on the basis of the data given above

SOLUTION

Computation of machine-hour rate of new machine

	Per annum	*Per hour*
Standing charges:		
Insurance premium (Rs 4,500 × Rs 5 lakh)/Rs 75 lakh	Rs 300	
Rent (Rs 9,600 per year × 100 sq. feet)/1,600 sq. feet	600	
Lighting charges (Rs 1,440 per year × 3 points)/20 points	216	
Total standing charges	1,116	
Standing charges per hour (Rs 1,116 ÷ 4,000 hours)		Rs 0.279
Machines expenses:		
Depreciation per hour (Rs 5 lakh – Rs 5,000)/40,000 hours		12.375
Power charges (25 units × Rs 2)		50.000
Repairs and maintenance (Rs 2,000/4,000 hours)		0.500
Machine-hour rate		63.154

P.5.9 X Ltd, having fifteen different types of automatic machines furnishes information as under for current year.

(i) Overhead expenses: Factory rent, Rs 96,000 (floor area 80,000 sq. ft.); Heat and gas, Rs 45,000, and Supervision, Rs 1,20,000.
(ii) Wages of the operator are Rs 48 per day of 8 hours. He attends to one machine when it is under set-up and two machines while they are under operation.
(i) Cost of machine Rs 45,000; Life of machine, 10 years, and scrap value at the end of its life, Rs 5,000.
(ii) Annual expenses on special equipment attached to the machine are estimated at Rs 3,000.
(iii) Estimated operation time of the machine is 3,600 hours while set-up time is 400 hours per annum.
(iv) The machine occupies 5,000 sq. ft. floor area.
(v) Power costs Rs 2 per hour while machine is in operation.

Find out the comprehensive machine-hour rate of machine B. Also find out machine costs to be absorbed in respect of use of machine B on the following two work orders:

	Work order 31	*Work order 32*
Machine set-up time (hours)	10	20
Machine operation time (hours)	90	180

SOLUTION

Statement showing comprehensive machine-hour rate of machine B of X Ltd

Particulars	*Amount*	
Standing charges:		
Factory rent (Rs 96,000/80,000 sq. ft.) × 5,000 sq. ft.	Rs 6,000	
Heat and gas (Rs 45,000/15 machines)	3,000	
Supervision (Rs 1,20,000/15 machines)	8,000	
Depreciation [(Rs 45,000 – Rs 5,000)/10 years]	4,000	
Annual expenses on special equipment	3,000	
Total	24,000	
Machine-hours	4,000	
Fixed cost per hour	6	
	Set up rate per hour	*Operation rate per hour*
Fixed cost	Rs 6	Rs 6
Power	—	2
Wages	6	3
Comprehensive machine-hour rate	12	11

Statement of machines B costs to be absorbed on the two work orders

Particulars	*Work order 31*			*Work order 32*		
	Hours	*Rate*	*Amount*	*Hours*	*Rate*	*Amount*
Set up time cost	10	Rs 12	Rs 120	20	Rs 12	Rs 240
Operation time cost	90	11	990	180	11	1,980
Total cost			1,110			2,220

P.5.10 A machine shop cost centre contains 6 machines of equivalent capacities. Three operators are employed on each machine: one at Rs 10 per hour and two at Rs 5 per hour each. The factory works a 40-hour week which includes 4 hours for setup time. The work is jointly done by the operators. The operators are paid fully for the 40 hours. In addition, they are paid a bonus of 10 per cent on productive time. Costs are reported for this company on the basis of 13 four-week periods.

The company for the purposes of computing machine-hour rate includes direct wages of the operators and also recoups the factory overheads allocated to the machines. The following details of factory overheads applicable to the cost centre are available:

1. Setup time as described above.
2. Depreciation, 10 per cent per annum on original cost on each machine (original cost of each machine is Rs 13,000)
3. Maintenance and repairs per week per machine is Rs 250
4. Consumable stores per week per machine is Rs 360
5. Power, 20 units per hour per machine at Rs 2.00 per unit
6. Apportionment to the cost centre:

Rent per annum	Rs 14,400
Heat and light per annum	54,000
Foreman's salary	72,000
Total expenses for 6 machines	1,40,400

From the above, you are required to compute: (a) The cost of running one machine for a 4-week period and (b) The machine-hour rate.

SOLUTION

(a) *Determination of cost of running one machine for a 4-week period.*

Standing charges:		
Rent per annum (Rs 14,400/6 machines)	Rs 2,400	
Heat and light per annum (Rs 54,000/6)	9,000	
Foreman's salary per annum (Rs 72,000/6)	12,000	
Total expenses for one machine per annum	23,400	
Expenses for a 4-week period (Rs 23,400/13)		Rs 1,800
Wages for a 4-week period		3,488 [1]
Total standing charges		5,288
Machine expenses		
Depreciation (Rs 13,000 × 0.10 × 1/13)		100
Repairs an maintenance (Rs 250 × 4 weeks)		1,000
Consumable stores (Rs 360 × 4 weeks)		1,440
Power (144 Hours × 20 units × Rs 2 per unit)		5,760 [2]
Total machine expenses		8,300
Total cost (Rs 5,288 + Rs 8,300)		13,588

(b) *Machine-hour rate* = Rs 13,588/144 productive hours = Rs 94.36

Working Notes

(1) Determination of wages:

Hours for 4 weeks	160
Rate per hour [(1 operator × Rs 10) + (2 operators × Rs 5)]	Rs 20
Wages per week (160 × Rs 20)	3,200
Add bonus for productive time (36 hours per week × 4 weeks × Rs 20 per hour) × 0.1	288
	Rs 3,488

It is assumed that no power is used during setup time of the machine.

P.5.11 A machine shop has 8 identical drilling machines manned by 6 operators. The machines cannot be worked without an operator wholly engaged on it. The original cost of all these 8 machines, works out to Rs 8 lakh. These particulars are furnished for a 6-month period:

Normal available hours per month	208
Absenteeism with pay (hours)	18
Leave with pay (hours)	20
Normal idle time unavoidable (hours)	10

(*Contd.*)

(*Contd.*)

Average rate of wages per day of 8 hours	Rs 20
Production bonus estimated (per cent on wages)	15
Value of power consumed	8,050
Supervision and indirect labour	3,300
Lighting and electricity	1,200

These particulars are for a year:
Repairs and maintenance including consumables, 3 per cent on value of machines Insurance, Rs 40,000
Depreciation, 10 per cent on original cost
Other sundry works expenses, Rs 12,000
General management expenses allocated, Rs 54,530
You are required to work out a comprehensive machine-hour rate.

SOLUTION

Determination of comprehensive machine-hour rate of machine shop

		Amount (6 months)
Standing charges:		
Supervision and indirect labour	Rs 3,300	
Lighting and electricity	1,200	
Insurance	20,000	
Other sundry works expenses	6,000	
General management expenses	27,265	Rs 57,765
Machine charges:		
Power	8,050	
Repairs and maintenance including consumables (0.03 × Rs 8 lakh × 0.5 year)	12,000	
Depreciation (.10 × Rs 8 lakh × 0.5 year)	40,000	
Operators wages	17,100 [1]	
Production bonus (0.15 × Rs 17,100)	2,565	79,715
Total		1,37,480
Machine-hour rate (Rs 1,37,480/5,760 hours[2])		23.87

Working Notes

1. Determination of wages payable to operators:

Normal available hours per month	208
Less absenteeism hours per month (without pay)	18
Number of hours for which wages are to be paid	190
Wages paid for 6 operators for 6 months @ Rs 2.50 per hour (Rs 20/8 hours) = 190 hours × Rs 2.5 × 6 months × 6 operators)	Rs 17,100

2. Determination of machine-hours available for work (for 6 months):

Normal available hours per operator (per month)	208
Less absenteeism hours	18
Less leave hours	20
Less normal idle time hours	10
Effective hours available per operator per month	160
Total effective hours for 6 operators for 6 months (160 × 6 × 6)	5,760

P.5.12 Gemini Enterprise Ltd undertakes three different jobs: A, B, and C. All of them require the use of a special machine and also the use of computer. The computer is hired and the hire charges work out to be Rs 4,20,000 per annum. The expenses regarding the machine are estimated as follows:

Rent for the quarter	Rs 17,500
Depreciation per annum	2,00,000
Indirect charges per annum	1,50,000

During the first month of operation, the following details were taken from the job register:

Job	*A*	*B*	*C*
Number of hours the machine was used			
(a) Without the use of the computer	600	900	—
(b) With the use of computer	400	600	1,000

You are required to compute the machine-hour rate (a) for the firm as a whole for the month when the computer was used and when the computer was not used, (b) for the individual jobs: A,B and C.

SOLUTION

(a) *Determination of machine-hour rate when the computer was not used:*

Total overheads of machine per month:	
Rent (Rs 17,500/3 months) per month	Rs 5,833
Depreciation (Rs 2,00,000/12 months) per month	16,667
Indirect charges (Rs 1,50,000/12 months) per month	12,500
	35,000
Total machine-hours in a month:	
Without the use of computer	1,500
With the use of computer	2,000
	3,500
Machine-hour rate (without use of computer) Rs 35,000/3,500 hours)	10
When computer is used:	
Machine-hour rate per hour (determined above)	10
Add computer charges per hour(Rs 4,20,000/12 months) = Rs 35,000 per month/2,000 hours	17.50
	27.50

(b) *Determination of Machine-hour Rate (MHR) for jobs A, B and C*

Particulars	*Jobs*					
	A		*B*		*C*	
	Hours	*Amount*	*Hours*	*Amount*	*Hours*	*Amount*
MHR, without computer @ Rs 10 per hour	600	Rs 6,000	900	Rs 9,000	—	—
MHR with use of computer @ Rs 27.50 per hour	400	11,000	600	16,500	1,000	Rs 27,500
Total	1,000	17,000	1,500	25,500	1,000	27,500
MHR		17		17		27.50

P. 5.13 In a machine shop, the machine-hour rate is worked out at the beginning of a year on the basis of a 13-week period which is equal to three calendar months. The following estimates for operating a machine are relevant.

Total working hours available per week	48
Maintenance time included in the above	2
Setting up time included in the above	2

(*Contd.*)

(*Contd.*)

Cost details:	
Operator's wages per month	Rs 3,250
Supervisor's salary per month	7,500
Written down value of machine (depreciation at 12 per cent)	1,80,000
Repairs and maintenance per annum	16,000
Consumable stores per annum	30,000
Rent, rates and taxes (for the quarter apportioned)	4,826

Power consumed is 15 units per hour @ Rs 2 per unit. Power is required for productive hours only. Setting-up time is part of productive time but no power is required for setting-up jobs.

The operator and supervisor are permanent. Repairs and maintenance and consumable stores are variable.

You are required to:

(a) Work out the machine-hour rate

(b) Work out the rate for quoting to the outside party for utilising the idle capacity in the machine shop assuming a profit of 20 per cent above variable cost.

SOLUTION

(a) *Determination of machine-hour rate*

Standing charges:			
Operator's wages (Rs 3,250 × 3 months)		Rs 9,750	
Supervisors' salary (Rs 7,500 × 3 months)		22,500	
Rent, rates and taxes		4,826	
Total standing fixed charges		37,076	
Standing charges per hour (Rs 37,076/598 productive hours, that is, 46 hours × 13 weeks)			Rs 62
Variable cost per hour:			
Power (15 units × Rs 2 per unit × 44/46 hours)	Rs 28.70		
Repairs and maintenance (Rs 4,000/598)	6.69		
Consumable stores (Rs 7,500/598)	12.54		
Depreciation [(Rs 1,80,000 × 0.12)/4] ÷ 598 hours	9.03		56.96
Machine-hour rate			118.96

(b) *Determination of quotation price:*

Variable cost per machine-hour	Rs 56.96
Add 20 per cent profit	11.39
Quotation price	68.35

Assumption Depreciation is treated as machine charges and, hence, is more close to variable cost category.

P.5.14 The budgeted working conditions for a cost centre are as follows:

Normal working week, 40 hours
Number of machines, 10
Normal weekly loss of hours on maintenance, and so on, 5 hours per machine
Estimated annual factory overheads, Rs 5,04,000
Estimated direct wages rate, Rs 10 per hour
Number of weeks worked per year, 48

Actual results in respect of a 4 week period are:

Factory overheads incurred, Rs 58,000
Wages incurred, Rs 16,400
Machine-hours produced, 2,000

You are required to calculate: (a) The overhead rate per machine-hour and (b) The amount of under or over-absorption of both factory overheads and wages.

SOLUTION

(a) Machine-hour rate = Rs 5,04,000/16,800[1] hours = Rs 30
(b) *Determination of overheads under-or overabsorbed:*

Factory overheads incurred	Rs 58,000
Overheads absorbed (2,000 hours × Rs 30)	60,000
Overheads overabsorbed (Rs 60,000 – Rs 58,000)	2,000

Determination of Wages Under or Overabsorbed:

Wages incurred	Rs 16,400
Wages absorbed (10 machines × 40 hours per week × 4 weeks × Rs 10 per hour)	16,000
Wages underabsorbed (Rs 16,400 – Rs 16,000)	400

Working Notes

(1) Normal working hours per year for 10 machines (40 hours × 10 machines × 48 weeks)	19,200
Less hours lost due to maintenance in a year (5 hours × 10 machines × 48 weeks)	2,400
	16,800

P.5.15 In a factory, overheads of a particular department are recovered on the basis of Rs 5 per machine-hour. The total expenses incurred and the actual machine-hours for the department for the month of August were Rs 80,000 and 10,000 respectively. Of the amount of Rs 80,000, Rs 15,000 became payable due to an award of the Labour Court and Rs 5,000 was in respect of expenses of the previous year booked in the current month (August). Actual production was 40,000 units, of which 30,000 units were sold. On analysing the reasons, it was found that 60 per cent of the under-absorbed overhead was due to defective planning and the rest was attributed to normal cost increase. How would you threat the under-absorbed overhead in the cost accounts?

SOLUTION

Determination of underabsorbed overhead expenses

Total expenses incurred in August	Rs 80,000
Less amount paid as per Labour Court award (assumed to be abnormal expense)	15,000
Less expenses paid related to previous year	5,000
Overhead expenses relating to current month	60,000
Less overheads recovered (10,000 machine-hours × Rs 5)	50,000
Underabsorbed factory overheads	10,000

Treatment of underabsorbed overheads in cost accounts
1. 60 per cent of underabsorbed factory overheads (Rs 10,000) is attributed to defective planning.
Being abnormal in nature, the amount of Rs 6,000 is to be charged to costing profit and loss account
2. Balance 40 per cent of underabsorbed factory overheads is prorated between cost of sales (30,000 units) and finished goods inventory (10,000 units).
Accordingly, Rs 4,000 is distribution between the two as follows:

Cost of sales	Rs 3,000	
Finished goods	1,000	4,000
		10,000

P.5.16 ABC Ltd manufactures a single product and absorbs the production overheads at a predetermined rate of Rs.10 per machine-hour.

At the end of current financial year, it has been found that actual production overheads incurred were Rs 6,00,000. It included Rs 45,000 on account of 'written off' obsolete stores and Rs 30,000 being the wages paid for the strike period under an award.

The production and sales data for the current year is as under:

Production:	
Finished goods (units)	20,000
Work-in-progress (50% complete in all respects) (units)	8,000
Sales:	
Finished goods (units)	18,000

The actual machine-hours worked during the period were 48,000. It has been found that one-third of the under-absorption of production overheads was due to lack of production planning and the rest was attributable to normal increase in costs.

You are required to:

(i) Calculate the amount of under-absorption of production overheads during the current year; and

(ii) Show the accounting treatment of under-absorption of production overheads.

SOLUTION

(i) Determination of unabsorbed production overheads

Production overhead expenses incurred (gross)		Rs 6,00,000
Less "written off" obsolete stores	Rs 45,000	
Less wages paid for the strike period	30,000	75,000
Net relevant production overheads expenses		5,25,000
Less production overheads absorbed (48,000 machine-hours × Rs. 10 per machine-hour)		4,80,000
Unabsorbed production overheads		45,000

(ii) *Treatment of unabsorbed production overheads:*

(1) One-third of unabsorbed overheads are attributed to lack of production planning. Being abnormal in nature Rs. 15,000 (Rs. 45,000 × 1/3) is charged to costing profit and loss account

Rs 15,000

(2) The balance sum of Rs. 30,000 is to be pro-rated among Cost of goods sold (18,000 units), work-in-progress(4,000 units i.e., 8,000 units × 50 per cent completion) and finished goods inventory 2,000 units) as follows:

Cost of goods sold (Rs. 30,000 × 18/24)	Rs 22,500	
Work-in-progress (Rs. 30,000 × 4/24)	5,000	
Finished goods inventory (Rs. 30,000 × 2/24)	2,500	30,000
		45,000

Journal entry will be as follows:

Cost of goods sold A/c	…….. Dr	Rs 22,500	
Work-in-progress A/c	…….. Dr	5,000	
Finished goods inventory A/c	…….. Dr	2,500	
To Factory overhead control A/c			Rs 30,000

REVIEW QUESTIONS

RQ.5.1 What do you understand by fixed overheads? Why are they called 'burdens'?

RQ.5.2 What factors would you consider before formulation of overhead recovery rate?

RQ.5.3 What two key factors determine the factory overhead application rate for a period? Why are these factors important?

RQ.5.4 What do you understand by classification, allocation, apportionment, and absorption in relation to overhead expenses? Explain with examples.

RQ.5.5 What do you understand by the terms production department and service department? Explain the rationale for allocating the service department costs to production departments. Using your own figures, illustrate how the expenses are absorbed over the production department? Consider at least three service departments that are to be absorbed by production departments.

RQ.5.6 (a) Distinguish between cost allocation, cost apportionment and cost absorption, (b) Explain in brief various methods for apportionment of service department's cost over production departments.

RQ.5.7 Describe how costs are allocated under the direct method, the step method, and the algebraic method.

RQ.5.8 What are the requisites of a good method of absorption of factory overheads?

RQ.5.9 What information is necessary to calculate machine-hour rate for overhead absorption? State the conditions in which this method is most effective.

RQ.5.10 What are the five bases commonly used to compute the factory overhead absorption rate and when is each one appropriate to use?

RQ.5.11 What is meant by absorbed overhead? Under what circumstances will a difference arise between absorbed and actual overheads? How would you dispose of the balance?

RQ.5.12 What is meant by under/overabsorption of factory overheads? How will you account for them in cost accounts? Does it bear any impact while submitting quotations?

RQ.5.13 The cost accountant of a newly formed company was asked to establish a predetermined rate for applying overhead to the job moving through a single manufacturing shop and to check results periodically. After consulting various departments, he collated the following estimated data for the current year:

Direct labour-hours	*Estimated (1,44,000)*	*Actuals (1,21,500)*
Factory supervision	Rs 50,000	Rs 51,000
Indirect labour	1,15,000	99,000
Inspection	70,000	73,000
Maintenance	35,000	39,000
Indirect material	25,000	20,000
Heat, light and power	20,000	18,000
Depreciation	35,000	35,000
Miscellaneous factory overheads	10,000	3,000

At the end of current year, the first year of operations, the actual results were recorded against each item above. You are required to:

(a) Compute the predetermined overhead rate, based on direct labour-hours; also compute the incurred overhead rate;

(b) Determine the under or over-applied overhead for the year.

SOLUTION

(a) *Determination of predetermined and actual overhead rates (based on direct labour-hours)*

Particulars	*Overheads*	
	Estimated	*Actual*
Factory supervision	Rs 50,000	Rs 51,000
Indirect labour	1,15,000	99,000
Inspection	70,000	73,000
Maintenance	35,000	39,000
Indirect material	25,000	20,000
Heat, light and power	20,000	18,000
Depreciation	35,000	35,000
Miscellaneous factory overheads	10,000	3,000
Total overheads costs	Rs 3,60,000	Rs 3,38,000
Divided by direct labour hours (hours)	÷ 1,44,000	÷ 1,21,500
Labour hour rate	2.5	2.782

(b) *Determination of unabsorbed overheads*

Actual overheads incurred	Rs 3,38,000
Less overheads absorbed/recovered (Actual direct labour hours, 1,21,500 (×) Direct labour-hour rate, Rs 2.50)	3,03,750
Unabsorbed factory overheads	34,250

RQ.5.14 A company has three production cost centres A, B and C and two service cost centres X and Y. Costs allocated to service centres are required to be apportioned to the production centres to find out cost of production of different products.

It is found that benefit of service cost centres is also received by each other along with the production cost centres. Overhead costs as allocated to the five cost centres and estimates of benefit of service cost centres received by each of them are as under:

Cost centres	*Overhead costs as allocated*	*Estimates of benefits received from service centres (%)*	
		X	*Y*
A	Rs 80,000	20	20
B	40,000	30	25
C	20,000	40	50
X	20,000	—	5
Y	10,000	10	—

Required: Work out final overhead costs of each of the production departments including reapportioned cost of service centres using (a) continuous distribution method and (b) simultaneous equation method.

SOLUTION

(a) *Apportionment of cost of service centres (X and Y) to production centres (A, B and C) as per continuous distribution method*

Particulars	*Production Centres*			*Service Centres*	
	A	*B*	*C*	*X*	*Y*
Primary apportionment	Rs 80,000	Rs 40,000	Rs 20,000	Rs 20,000	Rs 10,000
Centre X overheads apportioned in ratio of (2:3:4:1)	4,000	6,000	8,000	(20,000)	2,000

(*Contd.*)

(*Contd.*)

Centre Y overheads (Rs12,000) apportioned in ratio of (4:5:10:1)	2,400	3,000	6,000	600	(12,000)
X overheads (Rs 600) apportioned in ratio of (2:3:4:1)	120	180	240	(600)	60
Centre Y overheads (Rs 60) apportioned in ratio of (4:5:10:1)	12	15	30	3	(60)
Centre X overheads (Rs 3) apportioned in ratio of (2:3:4:1)	1	1	1	(3)	—
Total	86,533	49,196	34,271	—	—

(b) *Simultaneous equation method*

Let X be the total overhead costs of service Department X and Y be of service Department Y

X = Rs 20,000 + 0.05Y (1)

Y = Rs 10,000 + 0.10X (2)

Substituting equation (2) in equation 1

X = Rs 20,000 + 0.05 (Rs 10,000 + 0.10X)

X = Rs 20,000 + Rs 500 + 0.005X

X – 0.005X = Rs 20,500 or 0.995X = Rs 20,500

X = (Rs 20,500/0.995) = Rs 20,603

Y = Rs 10,000 + 0.10 (Rs 20,603)

Y = Rs 12,060

Allocation of overheads of service centres (X and Y) among production centres (A, B and C) as per simultaneous equation method

Particulars	*Production centres*		
	A	*B*	*C*
Primary apportionment	Rs 80,000	Rs 40,000	Rs 20,000
Share of service centres X (Rs 18,543[1] apportioned in ratio of (2:3:4))	4,121	6,181	8,241
Share of service centre Y (Rs 11,457[2] apportioned in ratio of (20:25:50))	2,412	3,015	6,030
Total	86,533	49,196	34,271

Working Notes

1. Total expenses of service centres X	Rs 20,603
Less share of service centre Y (0.10 × Rs 20,603)	2,060
Amount to be apportioned among production centres	18,543
2. Total expenses of service centre Y	12,060
Less share of service centre X (0.05 × Rs 12,060)	603
Amount to be apportioned among production centres	11,457

RQ.5.15 XYZ Ltd has three production departments (P, Q and R) and two service departments (X and Y). The following data relate to these departments:

Particulars	*P*	*Q*	*R*	*X*	*Y*
Direct wages	Rs 3,000	Rs 2,000	Rs 3,000	Rs 1,500	Rs 195
Worked hours	3,070	4,475	2,419	—	—
Value of machine	60,000	80,000	1,00,000	5,000	5,000

(*Contd.*)

(*Contd.*)

HP of machines	60	30	50	10	—
Light points	10	15	20	10	5
Floor space (square feet)	2,000	2,500	3,000	2,000	500

Additional information	
RentRs	5,000
Lighting	600
Power	1,500
Indirect wages	1,939
Depreciation on machines	10,000
Sundries	9,695

Determine overhead recovery rate per hour for production departments, if X's expenses are distributed to P, Q, R and Y in the ratio of 2 : 3 : 4 : 1 and Y's expenses are distributed in the ratio of 4 : 2 : 3 : 1 to P, Q, R and X respectively.

SOLUTION

Determination of departmental overhead recovery rates per hour of production departments (P, Q and R)

Item	*Basis of charge*	*Total*	*Production departments*			*Service departments*	
			P	*Q*	*R*	*X*	*Y*
Direct wages	Allocation	Rs 1,695	—	—	—	Rs 1,500	Rs 195
Rent	Floor space	5,000	Rs 1,000	Rs 1,250	Rs 1,500	1,000	250
Lighting	Light points	600	100	150	200	100	50
Power	Horse power	1,500	600	300	500	100	—
Indirect wages	Direct wages	1,939	600	400	600	300	39
Depreciation	Value of machine	10,000	2,400	3,200	4,000	200	200
Sundries	Direct wages	9,695	3,000	2,000	3,000	1,500	195
Primary distribution (Total)		30,429	7,700	7,300	9,800	4,700	929
Secondary distribution (using continuous distribution method)							
Department X overheads apportioned in ratio of 2:3:4:1 (Rs 1,399)			940	1,410	1,880	(4,700)	470
Department Y overheads/apportioned in ratio of 4:2:3:1			560	280	420	139	(1,399)
Department X overheads (Rs 139) apportioned in the ratio of 2:3:4:1			28	42	55	(139)	14
Department Y overheads (Rs 14) apportioned in the ratio of 4:2:3:1			6	3	5	—	(14)
Total overheads			Rs 9,234	Rs 9,035	Rs 12,160	—	—
Divided by worked hours			3,070	4,475	2,419		
Overhead recovery rate			3.01	2.02	5.03		

RQ.5.16 Following particulars have been extracted from the books of Reliable Company:

Indirect materials	
Shop Number 1	Rs 12,000
Shop Number 2	18,000

(*Contd.*)

(*Contd.*)

Shop Number 3	6,000	
Tool Room	3,600	
Stores	4,800	
Factory Office	1,800	Rs 46,200
Indirect wages		
Shop Number 1	12,600	
Shop Number 2	17,600	
Shop Number 3	16,000	
Tool Room	11,100	
Stores	4,500	
Factory office	6,600	68,400
Factory rent		30,000
Insurance		6,000
Depreciation (10%)		30,000
Power		27,000
Light and heat		12,000
Total		2,19,600

Further information regarding the operations are given below:

Departments	*Area (square meter)*	*Book value of machinery*	*Effective H.P.*	*Direct labour*		*Machine-hours*
				Hours	*Cost*	
Production						
Shop 1	1,000	Rs 75,000	90	3,00,000	Rs 90,000	1,60,000
Shop 2	750	1,35,000	90	3,00,000	60,000	2,40,000
Shop 3	1,500	30,000	—	2,00,000	50,000	—
Service						
Tool room	500	45,000	20	—	50,000	—
Stores	750	7,500	—	—	—	—
Factory office	500	7,500	—	—	—	—
	5,000	3,00,000	200	8,00,000	2,50,000	4,00,000

You are required to prepare an Overhead Analysis Sheet for the departments of Reliable Company for the year showing the basis of apportionment.

SOLUTION

Overhead analysis sheet (Step method[1])

Particulars	*Basis of apportionment*	*Total*	*Production departments*			*Service departments*		
			Shop 1	*Shop 2*	*Shop 3*	*Tool room*	*Stores*	*Factory office*
Indirect materials	Direct allocation	Rs 46,200	Rs 12,000	Rs 18,000	Rs 6,000	Rs 3,600	Rs 4,800	Rs 1,800
Indirect wages	Direct allocation	68,400	12,600	17,600	16,000	11,100	4,500	6,600
Factory rent	Area (sq. meters)	30,000	6,000	4,500	9,000	3,000	4,500	3,000
Insurance	Book value of machines	6,000	1,500	2,700	600	900	150	150
Depreciation	10% of value of machines	30,000	7,500	13,500	3,000	4,500	750	750
Power	Effective H.P.	27,000	12,150	12,150	—	2,700	—	—
Light and heat	Area (square meters)	12,000	2,400	1,800	3,600	1,200	1,800	1,200
Total		2,19,600	54,150	70,250	38,200	27,000	16,500	13,500

(*Contd.*)

(*Contd.*)

Redistribution of service departments overheads to production departents[2]:							
Factory office	Direct labour cost	4,860	3,240	2,700	2,700	—	(13,500)
Stores	Indirect materials	5,000	7,500	2,500	1,500	(16,500)	—
Tool room (Rs 31,200)	Book value of machinery	9,750	17,550	3,900	(31,200)	—	—
Total cost		73,760	98,540	47,300	—	—	—

1. Repeated distribution method and Algebraic method cannot be used in view of non-availability of requisite data required for their use.
2. As per step method, it is usual to apportion first the cost of that service department which renders services to the largest number of other service departments. It is assumed that Factory office (service department) renders services to the largest number of departments, followed by Stores and Tool room.

RQ.5.17 A company has two production departments and two service departments the data relating to a period are as under:

	Production Departments		*Service Departments*	
	PD_1	*PD_2*	*SD_1*	*SD_2*
Direct Materials	Rs 80,000	Rs 40,000	Rs 10,000	Rs 20,000
Direct Wages	95,000	50,000	20,000	10,000
Overheads	80,000	50,000	30,000	20,000
Power requirement at normal capacity operations (Kwh)	20,000	35,000	12,500	17,500
Actual Power consumption during the period (Kwh)	13,000	23,000	10,250	10,000

The power requirement of these departments are met by a power generation plant. The said plant incurred an expenditure, which is not included above, of Rs 1,21,875 out of which a sum of Rs 84,375 was variable and the rest fixed.

After apportionment of power generation plant costs to the four departments, the service department overheads are to be redistributed on the following bases:

	PD_1	*PD_2*	*SD_1*	*SD_2*
SD_1	50 per cent	40 per cent	—	10 per cent
SD_2	60 per cent	20 per cent	20 per cent	—

You are required to:

(i) Apportion the power generation plant costs to the four departments.
(ii) Re-apportion service department cost to production departments.
(iii) Calculate the overhead rates per direct labour hour of production departments, given that the direct wage rates of PD_1 and PD_2 are Rs 5 and Rs 4 per hour respectively.

SOLUTION

(i) *Statement showing apportionment of costs related to power generation plant among four departments*

Particulars	*Basis*	*Total*	*Departments*			
			PD_1	*PD_2*	*SD_1*	*SD_2*
Indirect costs:						
Fixed costs	Normal capacity	Rs 37,500[1]	Rs 8,824	Rs 15,441	Rs 5,515	Rs 7,720
Variable costs	Actual power consumption	84,375	19,500	34,500	15,375	15,000
Total (a)		1,21,875	28,324	49,941	20,890	22,720

(*Contd.*)

(*Contd.*)

Direct costs:						
Direct materials	Given	Rs 30,000	—	—	Rs 10,000	Rs 20,000
Direct wages	Given	30,000	—	—	20,000	10,000
Overheads	Given	1,80,000	80,000	50,000	30,000	20,000
Total (b)		2,40,000	80,000	50,000	60,000	50,000
Total costs (a) + (b)		3,61,875	1,08,324	99,941	80,890	72,720

[1](Rs 1,21,875 – Rs 84,375, variable costs) = Rs 37,500, fixed costs

(ii) *Statement showing Re-apportionment of service department costs to production departments (repeated distribution method)*

Particulars	*Total*	*Production departments*		*Service departments*	
		PD_1	*PD_2*	*SD_1*	*SD_2*
Primary apportionment as given in (i)	Rs 3,61,875	Rs 1,08,324	Rs 99,941	Rs 80,890	Rs 72,720
SD_1 overheads apportioned in ratio of 5:4:1	80,890	40,445	32,356	(80,890)	8,089
SD_2 overheads (Rs 80,809) apportioned in ratio of 6:2:2	80,809	48,485	16,162	16,162	(80,809)
SD_1 overheads (Rs 16,162) apportioned in ratio of 5:4:1	16,162	8,081	6,465	(16,162)	1,616
SD_2 overheads (Rs 1,616) apportioned in ratio of 6:2:2	1,616	970	323	323	(1,616)
SD_1 overheads (Rs 323) apportioned in ratio of 5:4:1	323	162	129	(323)	32
SD_2 overheads (Rs 32) apportioned in ratio of 6:2:2	32	19.2	6.4	6.4	(32)
SD_1 overheads Rs 6.4 apportioned in ratio of 5:4:1	6.4	3.2	2.6	(6.4)	0.6
SD_2 overheads (Rs 0.6) apportioned in ratio of 6:2:2	0.6	0.4	0.2	Negligible	(0.6)
	—	2,06,489.80	1,55,385.2	—	—

(iii) *Determination of overhead rates per direct labour-hour of production departments*

Particulars	*Production departments*	
	PD1	*PD2*
Overheads (as per statement ii)	Rs 2,06,489.80	Rs 1,55,385.2
Direct labour-hours	19,000[2]	12,500[3]
Overhead rate per direct labour-hour	Rs 10.87	Rs 12.43

[2] Rs 95,000 Direct wages/Rs 5 Direct wage rate per hour = 19,000 Direct labour-hours

[3] Rs 50,000/Rs 4 = 12,500 Direct labour-hours.

RQ.5.18 A manufacturing unit has added a new machine to its fleet of five existing machines. The total cost of purchase and installation of the machine is Rs 7,50,000. The machine has an estimated life of 15 years and is expected to realise Rs 30,000 as scrap at the end of its working-life.

Other relevant data are as follows:

(i) Budgeted working-hours is 2,400 based on 8 hours per day for 300 days. This includes 400 hours for plant maintenance.

(ii) Power used by the machine is 15 units per hour at a cost of Rs 2 per unit. No current is drawn during maintenance.

(iii) The machine requires special oil for heating which is replaced once in every month at a cost of Rs 2,500 on each occasion.
(iv) Estimated cost of maintenance of the machine is Rs 500 per week of 6 working days.
(v) 3 operators control the operations of the entire battery of six machines and the average wages per person amounts to Rs 450 per week *plus* 40 per cent fringe benefits.
(vi) Departmental and general works overheads allocated to the operation during the last year was Rs 60,000. During the current year, it is estimated that there will be an increase of 12.5 per cent of this amount. No incremental overhead is envisaged for the installation of the new machine.

You are required to compute the machine-hour rate for recovery of the running cost of the machine.

SOLUTION

Computation of machine-hour rate

Particulars		*Per annum*	*Per hour*
Standing charges:			
Operator's wages (for 6 machines) (Rs 450 per week × 3 operators × 300/6 weeks)	Rs 67,500		
Add fringe benefits (0.40 × Rs 67,500)	27,000	Rs 94,500	
Departmental and general work overheads (Rs 60,000 + 12.5 per cent)		67,500	
Total standing charges per year for 6 machines		1,62,000	
Standing charges per machine (Rs 1,62,000/6)		27,000	
Standing charges per machine-hour (Rs 27,000/2,000 effective productive hours i.e., 2,400 – 400 maintenance hours)			Rs 13.5
Machine charges:			
Depreciation per hour (Rs 7,50,000 – Rs 30,000) ÷ (15 years × 2,000 hours)			24
Power charges per hour (15 units × Rs 2)			30
Special oil used per hour (Rs 2,500 × 12 months)/2,000 hours			15
Maintenance per hour (Rs 500 × 50 weeks)/2,000 hours			12.5
Machine-hour rate			95

RQ.5.19 The following data pertains to the machine shop of an engineering company, relating to the current year. The machine shop has 3 cost centres A, B and C, each having 3 distinct set of machines.

Particulars	*A*	*B*	*C*	*Total*
Number of workers	400	400	800	1,600
Number of machine-hours	50,000	50,000	60,000	1,60,000
Percentage of HP	40	25	35	100
Value of assets	Rs 20,00,000	Rs 35,00,000	Rs 30,00,000	Rs 85,00,000
Direct wages	16,00,000	20,00,000	24,00,000	60,00,000
Indirect wages				18,00,000
Supervisory salaries				7,00,000
Depreciation				8,50,000
Insurance				4,25,000
Electricity charges				12,00,000
Welfare expenses				9,00,000
Office and other expenses				16,00,000

Work out a composite machine-hour rate for each of the cost centres, showing the basis of apportionment of expenses amongst the cost centres.

SOLUTION

Computation of composite machine-hour rate

Particulars	*Basis of apportionment*	*Total*	*Cost centres (in Rs lakh)*		
			A	*B*	*C*
Direct wages	Actual	Rs 60	Rs 16	Rs 20	Rs 24
Indirect wages	Direct wages (4:5:6)	18	4.8	6.0	7.2
Supervisor's salaries	Number of workers (1:1:2)	7	1.75	1.75	3.5
Insurance	Value of assets (4:7:6)	4.25	1.00	1.75	1.5
Depreciation	Value of assets (4:7:6)	8.5	2.00	3.50	3.0
Electricity charges	Percentage of HP (40:25:35)	12.00	4.80	3.00	4.2
Welfare expenses	Number of workers (1:1:2)	9.00	2.25	2.25	4.5
Office and other expenses	Machine-hours (5:5:6)	16.00	5.00	5.00	6.0
Total expenses		134.75	37.60	43.25	53.90
Divided by number of machine-hours (in lakh)		1.60	0.50	0.50	0.60
Machine-hour rate		—	75.20	86.5	89.83

RQ.5.20 A manufacturing unit produces electronic circuits at the rate of 6 pieces an hour. The unit works in single shift of 8 hours during a six-day week and remains closed for 18 days a year, on account of holidays. Average idle hours per month is 20 for cleaning and maintenance of equipments. Against an average annual output of 12,000 pieces during last ten years, the actual output achieved during the year was 10,800 pieces. The fixed overheads for the year amounted to Rs 5,40,000.

You are required to calculate the idle capacity costs on the assumption that overhead recovery rates are based on maximum capacity, practical capacity, normal capacity and actual capacity utilisation respectively.

SOLUTION

Statement showing computation of capacity at various levels

Details of computation		*Hours*
1. Maximum capacity (single shift basis)(365 days × 8 hours per day)		2,920
2. Practical capacity		
Maximum capacity (in hours)	2,920	
Less idle capacity:		
Sundays (52 days × 8 hours)	416	
Holidays (18 days × 8 hours)	144	
Maintenance (12 months × 20 hours)	240	2,120
3. Normal capacity		
Average annual output (in units)	12,000	
Divided by 6 units per hour	÷ 6	2,000
4. Actual capacity (10,800 units/6 units)		1,800

Statement showing idle capacity hours at various levels

Particulars	*Capacity base*	*Capacity utilised*	*Idle capacity*
Maximum (hours)	2,920	1,800	1,120
Practical (hours)	2,120	1,800	320
Normal (hours)	2,000	1,800	200
Actual (hours)	1,800	1,800	—

Statement showing idle capacity costs at varoius levels

Capacity	*Machine-hour rate (MHR)*	*Idle capacity (hours)*	*Idle capacity cost (MHR × Idle capacity hours)*
Maximum	Rs 184.93[1]	1,120	Rs 2,07,121.60
Practical	254.72[2]	320	81,510.40
Normal	270.00[3]	200	54,000.00
Actual	300.00[4]	—	—

[1](Rs 5,40,000 fixed overheads/2,920 hours) = Rs 184.93
[2](Rs 5,40,000/2,120) = Rs 254.72
[3](Rs 5,40,00/2,000) = Rs 270
[4](Rs 5,40,000/1,800) = Rs 300

RQ.5.21 In a manufacturing concern, the pre-determined rate of overhead recovery is Rs 40 per machine-hour. During the year, total factory overhead amounted to Rs 88,96,000 and machine-hours actually worked were 1,86,500 only.

Actual production and sales during the year were 1,20,000 units and 1,05,000 units respectively. The production shop had 36,000 unfinished units and based on technical estimates these were considered as 50 per cent complete.

Analysis of the data revealed that 37.5 per cent of the unabsorbed overheads were attributable to initial inaccuracies in the planning and the balance was due to rising price levels.

Show the treatment of unabsorbed overheads in cost accounts.

SOLUTION

Determination of unabsorbed factory overheads

Actual factory overheads incurred	Rs 88,96,000
Less factory overheads absorbed (1,86,500 machine-hours × Rs 40)	74,60,000
Under-absorption of factory overheads	14,36,000

Analysis of under-absorbed factory overheads

Cause of under-absorption	*Percentage*	*Amount*
Initial inaccuracies (planning)	37.5	Rs 5,38,500[1]
Rising price level	62.5	8,97,500[2]

[1](Rs 14,36,000 × 0.375) = Rs 5,38,500
[2](Rs 14,36,000 × 0.625) = Rs 8,97,500

Treatment of under-absorbed factory overheads: The under-absorbed factory overheads caused due to initial inaccuracies in planning (being abnormal in nature) are to be charged to costing profit and loss account. In contrast, under-absorbed factory overheads due to rising price levels (being uncontrollable in nature) is to be adjusted among cost of sales, work-in-process and finished goods closing stock (in proportion to the number of units).

Statement Showing Adjustment of Under-Absorbed Factory Overheads.

Particulars	*Number of units (1)*	*Percentage (2)*	*Amount [Rs 8,97,500 × (2)]*
Cost of sales	1,05,000	76.09	Rs 6,82,908
Work-in-process (0.50 × 36,000)	18,000	13.04	1,17,034
Closing stock of finished units	15,000	10.87	97,558
Total	1,38,000	100.00	8,97,500

Journal Entry:

Cost of sales A/c	Dr	Rs 6,82,908	
Work-in-Progress Inventory A/c	Dr	1,17,034	
Finished Goods Inventory A/c	Dr	97,558	
Costing Profit & Loss A/c	Dr	5,38,500	
To Factory Overhead Control A/c			Rs 14,36,000

RQ.5.22 In a manufacturing unit, overhead was recovered at a pre-determined rate of Rs 20 per labour-hour. The total factory overhead incurred and the labour-hours actually worked were Rs 45,00,000 and 2,00,000 labour-hours respectively. During this period, 30,000 units were sold. At the end of the period, 5,000 units were held in stock while there was no opening stock of finished goods. Similarly, though there was no stock of uncompleted units at the beginning of the period, at the end of the period there were 10,000 uncompleted units which may be reckoned at 50 per cent complete.

On analysing the reasons, it was found that 60 per cent of the unabsorbed over-heads were due to defective planning and rest were attributable to increase in overhead costs.

How would unabsorbed overheads be treated in cost accounts?

SOLUTION

Determination of un-absorbed factory overheads

Actual factory overheads incurred	Rs 45,00,000
Less factory overheads absorbed (2,00,000 labour-hours × Rs 20)	40,00,000
Under-absorbed factory overheads	5,00,000

Analysis of under-absorbed factory overheads

Cause of under-absorption	*Percentage*	*Amount*
Defective planning	60	Rs 3,00,000[1]
Increase in overhead costs (100-60)	40	2,00,000[2]

[1] (Rs 5,00,000 × 0.60) = Rs 3,00,000
[2] (Rs 5,00,000 × 0.40) = Rs 2,00,000

Treatment of under-absorbed factory overheads: The under-absorbed factory overheads caused due to defective planning (being abnormal) is to be charged to costing profit and loss account. In contrast, under-absorbed factory overheads (of Rs 2,00,000) is caused due to rise in overhead costs (largely uncontrollable in nature). This amount should be prorated among cost of sales, work-in-progress and closing stock of finished goods.

Statement showing adjustment of under-absorbed factory overheads

Particulars	*Number of units (1)*	*Percentage(2)*	*Amount [Rs 2,00,000 × (2)]*
Cost of sales		75	Rs 1,50,000
Work-in-progress (10,000 × 0.50)	5,000	12.5	25,000
Finished goods inventory	40,000	12.5	25,000
		100.00	2,00,000

Journal entry:

Cost of sales A/c	Dr	Rs 1,50,000	
Work-in-Progress Inventory A/c	Dr	25,000	
Finished Goods Inventory A/c	Dr	25,000	
Costing Profit & Loss A/c	Dr	3,00,000	
To Factory Overhead Control A/c			Rs 5,00,000

RQ.5.23 From the following particulars calculate labour cost per hour:

(a) Basic salary, Rs 20 per working day
(b) Dearness allowance per month, 50 paise per every point over 100 cost of living index (current cost of living index is 700 points)
(c) Leave salary, 10 per cent of [(a) + (b)]
(d) Employer's contribution to provident fund, 8 per cent of [(a) + (b) + (c)]
(e) Employer's contribution to State Insurance, 2.5 per cent of [(a) + (b) + (c)]
(f) Expenditure on amenities to labour, Rs 100 per head per month
(g) Number of working days in a month, 25 days of 8 hours each.

SOLUTION

Computation of labour-hour rate

Particulars	*Per hour*
Basic salary (Rs 20/8 hours)	Rs 2.5
Dearness allowance (600 points × Re 0.50)/(25 days × 8 hours)	1.5
Leave salary (Rs 2.5 + Rs 1.5) × 0.10	0.4
Employer's contribution to provident fund (Rs 4.4 × 0.08)	0.35
Employer's contribution to state insurance (Rs 4.4 × 0.025)	0.11
Amenities to labour (Rs 100/(25 days × 8 hours))	0.50
Labour-hour rate	5.36

RQ.5.24 The Hypothetical Ltd manufactures a variety of prestige board room chairs. Its job-costing system is designed using an activity-based approach. There are two direct cost categories consisting of direct materiels and direct manufacturing labour and three indirect costs pools representing three activity areas at the plant:

Manufacturing activity area	*Budgeted costs*	*Cost driver used as allocation base*	*Cost allocation rate*
Material handling	2,00,000	Parts	Rs 0.25
Cutting	21,60,000	Parts	2.50
Assembly	20,00,000	Direct manufacturing labour-hours	25.00

Two styles of chairs were produced in March: Executive chair and Chairman chair. Their quantities, direct material costs and other data for March are as follows:

Type of chair	*Units produced*	*Direct material costs*	*Number of parts*	*Direct manufacturing labour-hours*
Executive	5,000	Rs 6,00,000	1,00,000	7,500
Chairman	100	25,000	3,500	500

The direct manufacturing labour rate is Rs 20 per hour. Assuming no beginning/ending inventory,

(a) Compute the total manufacturing costs and units costs of the two types of chairs.

SOLUTION

(a) *Manufacturing costs with activity-based costing*

	Executive chair	*Chairman chair*
Direct manufacturing costs:		
Direct material costs	Rs 6,00,000	Rs 25,000

(*Contd.*)

(*Contd.*)

Direct manufacturing labour [(Executive chair, 7,500 labour-hours, Chairman chair, 500 labour-hours) × Rs 20]	1,50,000	10,000
	7,50,000	35,000
Indirect manufacturing costs:		
Material handling [(Executive chair, 1,00,000 parts; Chairman chair, 3,500 parts) × Rs 0.25]	25,000	875
Cutting [(Executive chair, 1,00,000 parts; Chairman chair, 3,500 parts) × Rs 2.50]	2,50,000	8,750
Assembly [(Executive chair, direct manufacturing labour hours, 7,500; Chairman chair, direct manufacturing labour-hours, 500) × Rs 25]	1,87,500	12,500
	4,62,500	22,125
Total manufacturing costs	12,12,500	57,125

RQ.5.25 The Hypothetical Ltd has production facility specialising in jobs for the aircraft components market. The traditional costing system has two direct-cost categories, namely, direct materials and direct manufacturing labour and a single indirect cost pool, that is, manufacturing overhead allocated on the basis of direct labour-hours. The indirect cost allocation rate would have been Rs 115 direct manufacturing labour-hour.

The company has now decided to replace the single indirect cost pool with five indirect cost pools, representing five activity areas each with its own supervising and budget responsibility. The relevant data are as follows:

Activity area	*Cost driver used as an allocation base*	*Cost allocation rate*
Material handling	Parts	Rs 0.40
Lathe work	Turns	0.20
Milling	Machine-hours	20.00
Grinding	Parts	0.80
Testing	Units tested	15.00

Two representative jobs processed under the new system of the facility at the most recent period had the following features:

Particulars	*Job 101*	*Job 102*
Direct material costs per job	Rs 9,700	Rs 59,900
Direct manufacturing labour cost per job	750	11,250
Direct manufacturing labour-hours per job	25	375
Parts per job	500	2,000
Turns per job	20,000	60,000
Machine-hours per job	150	1,050
Units per job	10	200

Required:

(a) Compute the per unit manufacturing costs of each job under the traditional job-costing system.

(b) Compute the per unit manufacturing costs of each job under the activity-based job costing systems

SOLUTION

(a) *Manufacturing costs with traditional job costing system*

	Job 101	*Job 102*
Direct manufacturing costs per job:		
Direct materials per job	Rs 9,700	Rs 59,900
Direct manufacturing labour per job	750	11,250
	10,450	71,150
Indirect manufacturing costs per job:		
(Job 101, 25 labour-hours; Job 102, 375 labour-hours) × Rs 115	2,875	43,125
Total manufacturing costs per job	13,325	1,14,275

(b) *Manufacturing costs with activity-based costing system*

	Job 101	*Job 102*
Direct manufacturing costs per job:		
Direct materials per job	Rs 9,700	Rs 59,900
Direct manufacturing labour per job	750	11,250
	10,450	71,150
Indirect manufacturing costs:		
Materials handling [(Job 101, 500 parts; Job 102, 2,000 parts) × Re 0.40]	200	800
Lathe work [(Job 101, 20,000 turns; Job 102, 60,000 turns) × Re 0.20]	4,000	12,000
Milling [(Job 101,150 machine-hours; Job 102, 1050 machine-hours) × Rs 20]	3,000	21,000
Grinding [(Job 101, 500 parts; Job 102, 2,000 parts) × Re 0.80]	400	1,600
Testing [(Job 101, 10 units; Job 102, 200 units) × Rs 15]	150	3,000
	7,750	38,400
Total manufacturing costs	18,200	1,09,550

EXAMINATION QUESTIONS

EQ. 5.1 Explain what do you mean by chargeable expenses and state its treatment in cost accounts. (*CA—November, 2002*)

EQ. 5.2 Discuss the different stages in the activity-based costing. (*CA—November, 2003*)

EQ. 5.3 Discuss the treatment of under-absorbed and over-absorbed factory overheads in cost accounting. (*CA—May, 2004*)

EQ. 5.4 Discuss the essentials of a good cost accounting system. (5) Discuss the treatment of under-absorbed and over-absorbed factory overheads in cost accounting. (*CA—May, 2004*)

EQ. 5.5 Discuss the step method and reciprocal service method of secondary distribution of overheads. (*CA—November, 2004*)

EQ. 5.6 Explain the single and multiple overhead rate (*CA—May, 2005*)

EQ. 5.7 A company manufacturing two products furnishes the following data for a year:

Product	*Annual output (Units)*	*Total machine-hours*	*Total number of purchase orders*	*Total number of set-ups*
A	5,000	20,000	160	20
B	60,000	1,20,000	384	44

The annual overheads are as under:

Volume related activity costs	Rs 5,50,000
Set-up related costs	8,20,000
Purchase related costs	6,18,000

You are required to calculate the cost per unit of each Product A and B based on:

(i) Traditional method of charging overheads

(ii) Activity based costing method.

(*CA—November, 2002*)

SOLUTION

(i) *Statement showing cost per unit products. (A and B based on traditional method of charging overheads)*

Total annual overheads (Rs 5,50,000 + 8,20,000 + 6,18,000)	Rs 19,88,000
Total machine-hours	1,40,000
Machine-hour rate (Rs 19,88,000/1,40,000 hours)	Rs 14.2

Particulars	*Products*	
	A	*B*
Annual output (units)	5,000	60,000
Total machine-hours	20,000	1,20,000
Overhead cost	Rs 2,84,000*	Rs 17,04,000**
Overhead cost per unit	Rs 56.80@	Rs 28.40@@

* (20,000 x Rs 14.20) ** (1,20,000 x Rs 14.20)

@ (Rs 2,84,000/5,000 units) @@ (Rs 17,04,000/60,000 units)

(ii) *Statement showing cost per unit products (A and B based on activity based costing method)*

Machine-hour rate (Rs 5,50,000/1,40,000 hours)	Rs 3.93
Cost of one set-up (Rs 820,000/64 set-ups)	12,812.50
Cost of a purchase order (Rs 6,18,000/544 orders)	1,136.03

Particulars	*Products*	
	Product A	*Product B*
Total machine-hours	20,000.00	1,20,000.00
Cost related to volume activities	Rs 78,600.00@	4,71,600.00@@
Cost related to purchases	Rs 1,81,764.80*	Rs 4,36,235.52**
Cost related to set-ups	2,56,250.00$	Rs 5,63,750.00$$
Total costs	5,16,614.80	14,71,585.52
Annual output units	(÷) 5,000.00	(÷) 60,000.00
Cost per unit	Rs 103.32	Rs 24.53

@ (20,000 hours × Rs 3.93) @@ (1,20,000 hours × Rs 3.93)

* (160 orders × Rs 1,136.03) ** (384 orders × Rs 1,136.03)

$ (20 set-ups × Rs 12,812.50) $$ (44 set-ups × Rs 12,812.50)

EQ. 5.8 Family Store wants information about the profitability of individual product lines: soft drinks, fresh produce and packaged food. Family store provides the following data for the year 2002-03 for each product line:

	Soft drinks	*Fresh produce*	*Packaged food*
Revenues	Rs 7,93,500	Rs 21,00,600	Rs 12,09,000
Cost of goods sold	6,00,000	15,00,000	9,00,000
Cost of bottles returned	12,000	0	0
Number of purchase orders placed	360	840	360
Number of deliveries received	300	2,190	660
Hours of shelf-stocking time	540	5,400	2,700
Items sold	1,26,000	11,04,000	3,06,000

Family Store also provides the following information for the year 2002-2003:

Activity	*Description of activity*	*Total cost*	*Cost-allocation base*
Bottles returns	Returning of empty bottles	Rs 12,000	Direct tracing to soft drink line
Ordering	Placing of orders for purchases	1,56,000	1,560 purchase orders
Delivery	Physical delivery and receipt of goods	2,52,000	3,150 deliveries
Shelf-stocking	Stocking of goods on store shelves and on-going restocking	1,72,800	8,640 hours of shelf-stocking time
Customer support	Assistance provided to customers including checkout	3,07,200	15,36,000 items sold

Required:

(i) Family Store currently allocates support cost (all costs other than cost of goods sold) to product lines on the basis of cost of goods sold of each product line. Calculate the operating income and operating income as a % of revenues for each product line. (ii)If Family Store allocates support costs (all costs other than cost of goods sold) to product lines using an activity-based costing system, calculate the operating income and operating income as a % of revenues for each product line. (iii) Comment on your answers in requirements (i) and (ii). (*CA—May, 2003*)

SOLUTION

(i) Statement showing operating income and operating income as a percentage of revenues for 3 products of Family Store

Particulars	*Soft drinks*	*Fresh produce*	*Packaged foods*	*Total*
Revenues	Rs 7,93,500	Rs 21,00,600	Rs 12,09,000	Rs 41,04,000
Cost of goods sold (COGS)	6,00,000	15,00,000	9,00,000	30,00,000
Support cost (30% ofCOGS)	1,80,000	4,50,000	2,70,000	9,00,000
Total cost	7,80,000	19,50,000	11,70,000	39,00,000
Operating income	13,500	1,50,600	39,900	2,04,000
Operating income as a % of revenue	1.70%	7.17%	3.30%	4.97%

Working Notes

1. Total support cost:

Bottle returns	Rs 12,000
Ordering	1,56,000
Delivery	2,52,000
Shelf stocking	1,72,800
Customer support	3,07,200
Total support costs	9,00,000

2. Percentage of support cost to cost of goods sold (COGS)
   = (Rs 9,00,000/30,00,000) × 100 = 30%

(ii) Statement showing operating income and operating income as a percentage of revenues for 3 products of Family Store

Particulars	*Soft drinks*	*Fresh produce*	*Packaged foods*	*Total*
Revenues	Rs 7,93,500	Rs 21,00,600	Rs 12,09,900	Rs 41,04,000
Cost of goods sold	6,00,000	15,00,000	9,00,000	30,00,000
Cost of bottles returned	12,000	—	—	12,000
Ordering cost [360:840:360]	36,000	84,000	36,000	1,56,000
Delivery cost [300:2,190:660]	24,000	1,75,200	52,800	2,52,000
Shelf stoking cost [540:5,400:2,700]	10,800	1,08,000	54,000	1,72,800
Customer support cost [1,26,000:11,04,000:3,06,000]	25,200	2,20,800	61,200	3,07,200
Total cost	7,08,000	20,88,000	11,04,000	39,00,000
Operating income	85,500	12,600	1,05,900	2,04,000
Operating income as % of revenues	10.78%	0.60%	8.75%	4.97%

Working Note

Computation of cost for each cost activity:

Activity	*Total cost*	*Cost allocation base*	*Cost activity rate*
(1)	*(2)*	*(3)*	*(4)*
Ordering	Rs 1,56,000	1,560 purchase orders	Rs 100 per purchase order
Delivery	2,52,000	3,150 deliveries	80 per delivery
Shelf-stocking	1,72,800	8,640 hours	20 per stocking hours
Customer support	3,07,200	15,36,000 items sold	0.20 per items sold

(iii) Comment: The operating income margins are more credible and authentic under the ABC costing system *vis-à-vis* the traditional costing system. The reason is that the ABC method provides more equitable basis of allocation of costs among user units.

EQ. 5.9 PQR Ltd. has its own power plant, which has two users, Cutting department and Welding department. When the plans were prepared for the power plant, top management decided that its practical capacity should be 1,50,000 machine-hours. Annual budgeted practical capacity fixed costs are Rs 9,00,000 and budgeted variable costs are Rs 4 per machine-hour. The following data are available:

	Cutting	*Welding department*	*Total department*
Actual usage in 2002-03 (machine-hours)	60,000	40,000	1,00,000
Practical capacity for each department (machine-hours)	90,000	60,000	1,50,000

Required:

(i) Allocate the power plant's cost to the cutting and the welding department using a single rate method in which the budgeted rate is calculated using practical capacity and costs are allocated based on actual usage. (ii) Allocate the power plant's cost to the cutting and welding departments, using the dual-rate method in which fixed costs are allocated

based on practical capacity and variable costs are allocated based on actual usage. (iii) Allocate the power plant's cost to the cutting and welding departments using the dual-rate method in which the fixed-cost rate is calculated using practical capacity, but fixed costs are allocated to the cutting welding department based on actual usage. Variable costs are allocated based on actual usage. (iv) Comment on your results in requirements (i), (ii) and (iii).

(*CA—May, 2003*)

SOLUTION

(i) Statement showing power plant's cost allocation to the cutting and welding departments sing single rate method

Particulars	*Cutting department*	*Welding department*	*Total*
Power plant's cost allocation by using actual usage [Working notes 1 and 2]	Rs 6,00,000 [60,000 hours × Rs 10]	Rs 4,00,000 [40,000 hours × Rs 10]	Rs 10,00,000

Working Notes

1. *Fixed cost per machine-hour*

Fixed costs	Rs 9,00,000
Machine-hours	1,50,000
Fixed cost per machine-hour [Rs 9,00,000/1,50,000]	Rs 6

2. *Budgeted rate per machine-hour*

Fixed cost per machine-hour + budgeted variable cost per machine-hour (Rs 6 + Rs 4)	Rs 10

(ii) Statement showing power plant's cost allocation to the cutting and welding departments using dual rate method

Particulars	*Cutting department*	*Welding department*	*Total*
Fixed cost	Rs 5,40,000	Rs 3,60,000	Rs 9,00,000
Allocated on practical capacity to each department (90,000 hours: 60,000 hours)	(9,00,000 × 3)/5	(9,00,000 × 2)/5	
Variable cost based on actual usage of machine-hours (60,000 hours: 40,000 hours)	2,40,000 (60,000 hours × Rs 4)	1,60,000 (40,000 hours × Rs 4)	4,00,000
	7,80,000	5,20,000	13,00,000

(iii) Statement showing power plant's cost allocation to cutting and welding departments' using dual rate method

Particulars	*Cutting department*	*Welding department*	*Total*
Fixed cost: Allocation of fixed cost on actual usage basis (60,000:40,000)	Rs 3,60,000 (60,000 hours × Rs 6)	Rs 2,40,000 (40,000 hours × Rs 6)	Rs 6,00,000
Variable cost (based on actual usage)	2,40,000 (60,000 hours × Rs 4)	1,60,000 (40,000 hours × Rs 4)	4,00,000
	6,00,000	4,00,000	10,00,000

(iv) Comments: Whereas under (ii) method, the entire fixed costs (of Rs 9,00,000) are allocated to the cutting and welding departments, the fixed costs allocated under (i) and (iii) methods are only of Rs 6,00,000. In operational terms, the under-absorbed fixed costs (reflecting unused capacity) are highlighted under (i) and (iii) methods, while such cost are not identified under (ii) method.

EQ. 5.10 Alpha limited has decided to analyse the profitability of its five new customers. It buys bottled water at Rs 90 per case and sells to retail customers at a list price of Rs 108 per case. The data pertaining to five customers are:

	Customers				
	A	*B*	*C*	*D*	*E*
Cases sold	4,680	19,688	1,36,90	71,550	8,775
List selling price	Rs 108	108	108	108	108
Actual selling price	108	106.20	99	104.40	97.20
Number of purchase orders	15	25	30	25	30
Number of customer visits	2	3	6	2	3
Number of deliveries	10	30	60	40	20
Kilometers travelled per delivery	20	6	5	10	30
Number of expedited deliveries	0	0	0	0	1

Its five activities and their cost drivers are:

Activity	*Cost driver rate*
Order taking	Rs 750 per purchase order
Customer visits	Rs 600 per customer visit
Deliveries	Rs 5.75 per delivery km travelled
Product handling	Rs 3.75 per case sold
Expedited deliveries	Rs 2,250 per expedited delivery

Required:

(i) Compute the customer-level operating income of each of five retail customers now being examined (A,B,C,D and E). Comment on the results. (ii) What insights are gained by reporting both the list selling price and the actual selling price for each customer? (iii) What factors should Alpha Limited consider in deciding whether to drop one or more of five customers?

(*CA—November, 2003*)

SOLUTION

(i) Statement showing operating income of customers A to E

Particular	Customers				
	A	*B*	*C*	*D*	*E*
Cases sold	4,680	19,688	1,36,800	71,550	8,775
Revenues (at listed price)	Rs 5,05,440	Rs 21,26,304	Rs 1,47,74,400	Rs 77,27,400	Rs 9,47,700
Less costs:					
Cost of goods sold (cases sold x Rs 90)	4,21,200	17,71,920	1,23,12,000	64,39,500	7,89,750
Discount	—	35,438 (19,688 × Rs 1.80)	12,31,200 (1,36,800 × Rs 9)	2,57,580 (71,550 × Rs 3.60)	94,770 (8,775 × Rs 10.80)
Order taking costs (No. of purchase orders × Rs 750)	11,250	18,750	22,500	18,750	22,500

(*Contd.*)

(*Contd.*)

Customer visits costs:					
(No. of customer visits × Rs 600)	1,200	1,800	3,600	1,200	1,800
Delivery vehicles travel costs					
(Rs 5.75 per km)	1,150	1,035	1,725	2,300	3,450
Product handling costs					
(cases sold × Rs 3.75)	17,550	73,830	5,13,000	2,68,313	32,906
Cost of expediting deliveries	—	—	—	—	2,250
Operating income	53,090	2,23,531	6,90,375	7,39,757	274

Comment: Although the number of cases sold is maximum in the case of customer C, the most profitable customer is D. The primary reason is that customer C gets 2.5 times discount *vis-à-vis* customer D, the respective discount rates being Rs 9 per case and Rs 3.60. Further, customer E is the least profitable as he gets the maximum discount of Rs 10.80 per case, places orders more frequently, requires more customer visits as well as more traveling costs compared to other customers.

(ii) Insights gained by reporting the two sets of prices, i.e., the listed selling price (LSP) and the actual selling price (ASP) for each customer

The difference between the LSP and the ASP represents discount. The discount amount offered to customers enables Alpha Limited to examine whether the discount offered to various customers has bearing on the sales made to them. In general, the expectation is the higher is the amount of discount, the higher is the likely sales volume. The relevant data showing the relationship between the two is contained in the following table:

Discount per case	*Sales volume in cases (customer)*
Rs 0.00	4,680 (Customer A)
1.80	19,688 (Customer B)
3.60	71,550 (Customer D)
9.00	1,36,800 (Customer C)
10.80	8,775 (Customer E)

There is direct relationship between discount amount and sales, except in the case of customer E. There is need to examine (a) the reason for higher discount (of Rs 10.80) in the case of customer E and (b) whether it will be profitable to offer discount to customer A also.

(iii) Factors to be considered in dropping one or more customers

Since there is profit from each customer, the decision of dropping the customers should be the last option/resort. The major factors to be considered are: (a) To determine the projected profitability in respect of each customer. In particular, the company should examine profitability in respect of customers E (the least profitable) and A (low profitable). (b) There is need to segregate cost data into avoidable costs and unavoidable costs. Based on such data, profitability for each customer should be determined. (c) The company should explore to ascertain whether it is possible to have more profits by offering different discount rate structure to different customers (in particular between customers C and D).

EQ. 5.11 E-books is an online book retailer. The company has four departments. The two sales departments are corporate sales and consumer sales. The two support-departments are Administrative (Human resources, Accounting), and Information systems. Each of the sales departments conducts merchandising and marketing operations independently. The following data are available for October, 2003:

Departments	*Revenues*	*Number of employees*	*Processing time used (in minutes)*
Corporate sales	Rs 16,67,750	42	2,400
Consumer sales	8,33,875	28	2,000
Administrative	—	14	400
Information systems	—	21	1,400

Cost incurred in each of four departments for October, 2003 are as follows:

Corporate sales	Rs 12,97,751
Consumer sales	6,36,818
Administrative	94,510
(Information systems)	3,04,720

The company uses number of employees as a basis to allocate administrative costs and processing time as a basis to allocate information systems costs.

Required:

(i) Allocate the support department costs to the sales departments using the direct method. (ii) Rank the support departments based on percentage of their services rendered to other support departments. Use this ranking to allocate support costs based on the step-down allocation method. (iii) How could you have ranked the support departments differently? (iv) Allocate the support department costs to two sales departments using the reciprocal allocation method. (*CA—November, 2003*)

SOLUTION

(i) Statement showing the allocation of support department costs to the sales departments (using direct method)

Particulars	*Basis of allocation*	*Sales department*		*Support department*	
		Corporate sales	*Consumer sales*	*Administrative*	*Information systems*
Cost incurred	No. of employees	Rs 12,97,751	Rs 6,36,818	Rs 94,510	Rs 3,04,720
Administrative cost	(6:4)	56,706	37,804	(94,510)	—
Information systems cost	Processing time (6:5)	1,66,211	1,38,509	—	(3,04,720)
		15,20,668	8,13,131	—	—

(ii) Ranking of support departments based on percentage of their services rendered to other support departments

(a) Administrative support department provides 23.077 per cent [21/(42 + 28 + 21) × 100] of its services to information systems support department. Thus, 23.077 per cent of Rs 94,510 = Rs 21,810.

(b) Information system support department provides [400/(2,400 + 2,000 + 400) × 100] 8.33 per cent of its services to administration support department. Thus 8.33 per cent of Rs 3,04,720 = Rs 25,383.

Statement showing allocation of support costs (using step-down allocation method)

Particulars	*Basis of allocation*	*Support department*		*Sales department*	
		Administrative	*Information systems*	*Corporate sales*	*Consumer sales*
Cost		Rs 94,510	Rs 3,04,720	Rs 12,97,751	Rs 6,36,818
Reallocation of administrative department cost	No. of employees (6:4:3)	(94,510)	21,810	43,620	29,080
			3,26,530		
Reallocation of information system department cost	Processing time (6:5)	—	(3,26,530)	1,78,107	1,48,423
				15,19,478	8,14,321

(iii) An alternative ranking is based on the rupee amount (figures obtained under requirement (ii) of services rendered to other service departments. This approach would use the following sequence of ranking:

— Allocation of information systems overheads as first (Rs 25,383 provided to administrative department)

— Allocated administrative overheads as second (Rs 21,810 provided to information systems).

(iv) *Statement showing allocation of support department costs to the sales departments (using reciprocal allocation method)*

Particulars	*Sales department*	
	Corporate sales	*Consumer sales*
Costs	Rs 12,97,751	Rs 6,36,818
Reallocation of cost of administrative department (46.16% and 30.77% of Rs 1,22,243)	56,427	37,614
Reallocation of cost of information systems department (50% and 41.67% of Rs 3,32,922)	1,66,461	1,38,729
	15,20,639	8,13,161

Working Notes

(i) *Percentage of services provided by service department between themselves and sales departments.*

Particulars	*Service departments*		*Sales departments*	
	Administrative	*Information system*	*Corporate sales*	*Consumer sales*
Administrative	—	23.07%	46.16%	30.77%
Information systems	8.33%	—	50%	41.67%

(ii) *Determination of total cost of support department: (using simultaneous equation method)*

Let X and Y be the total costs of support departments Administrative overheads and Information systems respectively.

X = Rs 94,510 + 0.0833Y

Y = Rs 3,04,720 + 0.2307X

Or X = Rs 94,510 + 0.0833 (Rs 3,04,720 + 0.2307X)

Or X = Rs 94,510 + Rs 25,383 + 0.01922X

Or X -0.01922 X = Rs 1,19,893

Or 0.98078X = Rs 1,19,893

X = Rs 1,19,893/0.98078 = Rs 1,22,243

Y = Rs 3,04,720 + 0.2307 (Rs 1,22,243)

Y = Rs 3,04,720 + 28,202 = Rs 3,32,922

EQ. 5.12 RST Ltd. specialises in the distribution of pharmaceutical products. It buys from the pharmaceutical companies and resells to each of the three different markets:

(i) General supermarket chains

(ii) Drugstore chains

(iii) Chemist shops

The following data for the month of April, 2004 in respect of RST Ltd has been reported:

	General supermarket chains	*Drugstore chains*	*Chemist shops*
Average revenue per delivery	Rs 84,975	Rs 28,875	Rs 5,445
Average cost of goods sold per delivery	82,500	27,500	4,950
Number of deliveries	330	825	2,750

In the past, RST Limited has used gross margin percentage to evaluate the relative profitability of its distribution channels.

The company plans to use activity-based costing for analysing the profitability of its distribution channels. The activity analysis of RST Limited is as under:

Activity area	*Cost driver*
Customer purchase order processing	Purchase orders by customers
Line-item ordering	Line-items per purchase order
Store delivery	Store deliveries
Cartons dispatched to stores	Cartons dispatched to a store per delivery
Shelf-stocking at customer store	Hours of shelf-stocking

The April, 2004 operating costs (other than cost of goods sold) of RST Limited are Rs 8,27,970. These operating costs are assigned to five activity areas. The cost in each area and the quantity of the cost allocation basis used in that area for April, 2004 are as follows:

Activity area	*Total costs in April, 2004*	*Total unit of cost allocation base used in April, 2004*
Customer purchase order processing	Rs 2,20,000	5,500 orders
Line-item ordering	1,75,560	58,520 line items
Store delivery	1,95,250	3,905 store deliveries
Cartons dispatched to store	2,09,000	2,09,000 cartons
Shelf-stocking at customer store	28,160	1,760 hours

Other data for April, 2004 include the following:

	General supermarket chains	*Drugstore chains*	*Chemist shops*
Total number of orders	385	990	4,125
Average number of line items per order	14	12	10
Total number of store deliveries	330	825	2,750
Average number of cartons shipped per store delivery	300	80	16
Average number of hours of shelf-stocking per store delivery	3	0.6	0.1

Required:

(a) (i) Compute for April, 2004 gross-margin percentage for each of its three distribution channels and compute RST limited's operating income. (ii) Compute the April, 2004 rate per unit of the cost-allocation base for each of the five activity areas. (iii) Compute the operating income of each distribution channel in April, 2004 using the activity-based costing information. Comment on the results. What new insights are available with activity-based cost information? (iv) Describe four challenges one would face in assigning the total April, 2004 operating costs of Rs 8,27,970 to five activity areas.

(*CA—May, 2004*)

SOLUTION

a(i) Statement showing operating income and gross margin percentage of three distribution channels of RST Limited

Particulars	*General super market chains*	*Drugstore chains*	*Chemist shops*	*Total*
Revenues	Rs 2,80,41,750 (330 × Rs 84,975)	Rs 2,38,21,875 (825 × Rs 28,875)	Rs 1,49,73,750 (2,750 × Rs 5,445)	Rs 6,68,37,375
Less cost of goods sold	2,72,25,000 (330 × Rs 82,500)	2,26,87,500 (825 × Rs 27,500)	1,36,12,500 (2,750 × Rs 4,950)	6,35,25,000
Gross margin	8,16,750	11,34,375	13,61,250	33,12,375
Less operating costs				8,27,970
Operating income				24,84,405
Gross margin (%)	2.91	4.76	9.09	4.96
Operating income (%)				3.72

(ii) Computation of rate per unit of cost allocation for five activity areas for April 2004.

1. Customer purchase order processing (Rs 2,20,000/5,500 orders)	Rs 40 per order
2. Line-item ordering (Rs 1,75,560/58,520 line items)	3 per line item order
3. Store delivery (Rs 1,95,250/3,905 store deliveries)	50 per delivery
4. Cartons dispatched (Rs 2,09,000/2,09,000 dispatches)	1 per dispatch
5. Shelf-stocking at customer store (Rs 28,160/1,760 hours)	16 per hour

(iii) Statement showing operating income statement of distribution channels in April 2004 (using activity based costing information)

Particulars	*General supermarket chains*	*Drugstore chains*	*Chemist shops*
Gross margin	Rs 8,16,750	Rs 11,34,375	Rs 13,61,250
Less operating costs:			
Customer purchase order processing	15,400 (Rs 40 × 385 orders)	39,600 (Rs 40 × 990 orders)	1,65,000 (Rs 40 × 4,125 orders)
Line-item ordering	16,170 (Rs 3 × 14 × 385 orders)	35,640 (Rs 3 × 12 × 990 orders)	1,23,750 (Rs 3 × 10 × 4,125 orders)
Store delivery	16,500 (Rs 50 × 330 deliveries)	41,250 (Rs 50 × 825 deliveries)	1,37,500 (Rs 50 × 2,750 deliveries)
Cartons dispatched	99,000 (Re 1 × 300 cartons × 330 deliveries)	66,000 (Re 1 × 80 cartons × 825 deliveries)	44,000 (Re 1 × 16 cartons × 2,750 deliveries)
Shelf-stocking	15,840 (Rs 16 × 330 deliveries × 3 Activity hours)	7,920 (Rs 16 × 825 deliveries × 0.6 Activity hours)	4,400 (Rs 16 × 2,750 deliveries × 0.1 Activity hours)
Operating income	6,53,840	9,43,965	8,86,600
Operating income(%)	2.33	3.96	5.92

Comments: The activity based costing technique focuses on different costs for different purposes and identifies only those costs which are relevant to a particular decision.

It highlights the distribution channel, namely, chemist shops use larger amount of RST Ltd's resources per rupee of revenue earned *vis-à-vis* the other two distribution channels. Ratio of operating costs to revenues for 3 channels is as follows:

General supermarket chains	0.58%
Drugstore chains	0.80%
Chemist shops	3.17%

(iv) Challenges faced in assigning total operating cost of Rs 8,27,970

— Selection of an appropriate cost-allocation base.
— To develop a reliable data base for the choosen cost base.
— Developing the rate per unit of each cost allocation base.
— Behavioural factors.

EQ. 5.13 MST Limited has collected the following data for its two activities. It calculates activity cost rates based on cost driver capacity.

Activity	*Cost driver*	*Capacity*	*Cost*
Power	Kilowatt hours	50,000 hours	Kilowatt Rs 2,00,000
Quality inspections	Numbers of inspections	10,000 inspections	Rs 3,00,000

The company makes three products, M, S and T. For the year ended March 31, 2004, the following consumption of cost drivers was reported:

Product	*Kilowatt-hours*	*Quality inspections*
M	10,000	3,500
S	20,000	2,500
T	15,000	3,000

Required:

(i) Compute the costs allocated to each product from each activity. (ii) Calculate the cost of unused capacity for each activity. (*CA—May, 2004*)

SOLUTION

(i) Statement showing cost allocation to each product from each activity:

Product	*Power*		*Quality inspections*	
M	(10,000 hours × Rs 4)	Rs 40,000	(3,500 inspections × Rs 30)	Rs 1,05,000
S	(20,000 hours × Rs 4)	80,000	(2,500 inspections × Rs 30)	75,000
T	(15,000 hours × Rs 4)	60,000	(3,000 inspections × Rs 30)	90,000
		1,80,000		2,70,000

Working Note

Computation of rate per unit of cost driver:
Power (Rs 2,00,000/50,000 hours) = Rs 4 per hour
Quality inspection (Rs 3,00,000/10,000 inspections) = Rs 30 per inspection
(ii) Cost computation of unused capacity for each activity

Power (Rs 2,00,000 – Rs 1,80,000)	Rs 20,000
Quality inspections (Rs 3,00,000 – Rs 2,70,000)	30,000
Total cost of unused capacity	50,000

EQ. 5.14 MNP Suits is a ready-to-wear suit manufacturer. It has four customers: two wholesale-channel customers and two retail-channel customers. *MNP Suits has developed the following activity-based costing system:*

Activity	*Cost driver*	*Rate in 2004*
Order processing	Number of purchase orders	Rs 1,225 per order
Sales visits	Number of customer visits	Rs 7,150 per visit
Delivery-regular	Number of regular deliveries	Rs 1,500 per delivery
Delivery-rushed	Number of rushed deliveries	Rs 4,250 per delivery

List selling price per suit is Rs 1,000 and average cost per suit is Rs 550. The CEO of MNP Suit wants to evaluate the profitability of each of the four customers in 2003 to explore opportunities for increasing profitability of his company in 2004. The following data are available for 2003:

Item	*Wholesale customers*		*Retail customers*	
	W	*H*	*R*	*T*
Total number of orders	44	62	212	250
Total number of sales visits	8	12	22	20
Regular deliveries	41	48	166	190
Rush deliveries	3	14	46	60
Average number of suits per order	400	200	30	25
Average selling price per suit	Rs 700	Rs 800	Rs 850	Rs 900

Required:

(i) Calculate the customer-level operating income in 2003 (ii) What do you recommend to CEO of MNP Suits to do to increase the company's operating income in 2004? (iii) Assume MNP Suits' distribution channel costs are Rs 17,50,000 for its wholesale customers and Rs 10,50,000 for the retail customers. Also, assume that its corporate sustaining costs are Rs 12,50,000. Prepare income statement of MNP Suits for 2003. (*CA—November, 2004*)

SOLUTION

(i) Statement showing computation of customer-level operating income in 2003

Item	*Wholesale customers*		*Retail customers*	
	W	*H*	*R*	*T*
Revenues at list price	Rs 1,76,00,000	Rs 1,24,00,000	Rs 63,60,000	Rs 62,50,000
	(44 × 400 × 1,000)	(62 × 200 × 1,000)	(212 × 30 × 1,000)	(250 × 25 × 1,000)
Less discount	52,80,000	24,80,000	9,54,000	6,25,000
	(44 × 400 × 300)	(62 × 200 × 200)	(212 × 30 × 150)	(250 × 25 × 100)
Revenues at actual prices	1,23,20,000	99,20,000	54,06,000	56,25,000
Less cost of goods sold	96,80,000	68,20,000	34,98,000	34,37,500
	(44 × 400 × 550)	(62 × 200 × 550)	(212 × 30 × 550)	(250 × 25 × 550)
Gross margin	26,40,000	31,00,000	19,08,000	21,87,500
Customer level operating costs:				
Order processing (44,62,212,250) × (Rs 1,225)	53,900	75,950	2,59,700	3,06,250
Sales visits (8,12,22,20) × (Rs 7,150)	57,200	85,800	1,57,300	1,43,000

(*Contd.*)

(*Contd.*)

Delivery regular (41,48,166,190) × (Rs 1,500)	61,500	72,000	2,49,000	2,85,000
Delivery rushed (3,14,46,60) × (Rs 4,250)	12,750	59,500	1,95,500	2,55,000
Customer-level operating income	24,54,650	28,06,750	10,46,500	11,98,250
Customer level operating income as percentage on revenues at actual prices	19.92	28.29	19.35	21.30

(ii) The activity based costing (ABC) system is a more refined costing system and reports cost that better measure the way jobs/products/customers use resources of the company.

The ABC cost system reveals areas where R and T. (retail customers) cause more costs to the company. The identified areas are high number of orders, high number of customer visits and high number of rushed deliveries

The CEO needs to explore the possibility whether this high level of activity can be reduced without reducing customer revenues.

(iii) Income statement of MNP Suits for 2003

Particulars	*Wholesale customer*	*Retail customers*	*Total*
Operating income	Rs 52,61,400	Rs 22,44,750	Rs 75,06,150
Less distribution channel cost	17,50,000	10,50,000	28,00,00
Distribution channel level operating income	35,11,400	11,94,750	47,06,150
Less corporate sustaining costs			12,50,000
Operating income			34,56,150

EQ. 5.15 From the details furnished below you are required to compute a comprehensive machine-hour rate:

Original purchase price of the machine (subject to depreciation at 10% per annum on original cost)	Rs 3,24,000
Normal working hours for the month (The machine works to only 75% of capacity)	200 hours
Wages of machineman	Rs 125 per day (of 8 hours)
Wages for a helper (machine attendent)	Rs 75 per day (of 8 hours)
Power cost for the month for the time worked	Rs 15,000
Supervision charges apportioned for the machine centre for the month	Rs 3,000
Electricity and lighting for the month	Rs 7,500
Repairs and maintenance (machine) including consumable stores per month	Rs 17,500
Insurance of plant and building (apportioned) for the year	Rs 16,250
Other general expenses per annum	Rs 27,500

The workers are paid a fixed Dearness allowance of Rs 1,575 per month. Production bonus payable to workers in terms of an award is equal to 33.33% of basic wages and dearness allowance. Add 10% of the basic wage and dearness allowance against leave wages and holidays with pay to arrive at a comprehensive labour-wage for debit to production.

(*CA—November, 2005*)

SOLUTION

Determination of comprehensive machine hour rate per hour

Particulars		*Amount per hour*
Standing charges per month		
Supervision charges	Rs 3,000	
Insurance of plant and building (Rs 16,250/12)	1,354	
Other general expenses (Rs 27,500/12)	2,292	
Electricity and lighting	7,500	
Total standing charges	14,146	
Standing changes per hour (Rs 14,146/150 hours*)		Rs 94.30
Machine charges per month		
Depreciation (Rs 3,24,000 × 0.10)/12	2,700	
Wages of machineman (1)	6,737	
Wages of machine attendent (1)	4,945	
Power cost	15,000	
Repairs and maintenance (including consumables)	17,500	
Total machine charges	46,882	
Machine charges per hour (Rs 46,882/150 hours)		312.55
Comprehensive machine hour rate		406.85

*200 hours × 0.75 = 150 hours

(1) Wages per month of machineman and machine attendent

Particulars	*Mechineman*	*Attendent*
Wages for 200 hours (25 days)	Rs 3,125 (Rs 125 × 25)	Rs 1,875 (Rs 75 × 25)
Dearness allowance	1,575	1,575
	4,700	3,450
Production bonus (33.33%)	1,567	1,150
	6,267	4,600
Leave wages (10% of wages + DA)	470	345
Total wages per month	6,737	4,945

EQ.5.16 RST Ltd. has two production departments: Machining and Finishing. There are three service departments: Human Resource (HR), Maintenance and Design. The budgeted costs in these service departments are as follows:

	HR	*Maintenance*	*Design*
Variable	Rs 1,00,000	1,60,000	1,00,000
Fixed	4,00,000	3,00,000	6,00,000
Total	5,00,000	4,60,000	7,00,000

The usage of these Service Department's output during the year just completed is as follows:
Provision of service output (in hours of service).

	Providers of Service		
Users of Service	*HR*	*Maintenance*	*Design*
HR	—	—	—
Maintenance	500	—	—
Design	500	500	—
Machining	4,000	3,500	4,500
Finishing	5,000	4,000	1,500
Total	10,000	8,000	6,000

Required: (i) Use the direct method to re-apportion RST Ltd.'s service department cost to its production departments. (ii) Determine the proper sequence to use in re-apportioning the firm's service department cost by step-down method. (iii) Use the step-down method to re-apportion the firm's service department cost. (*CA—November, 2006*)

SOLUTION

(i) *Statement showing distribution of overhead costs of service departments between production departments as per direct method.*

Particulars	*Production departments*		*Service departments*		
	Machining	*Finishing*	*HR*	*Maintenance*	*Design*
Overheads of service departments (given)			Rs 5,00,000	Rs 4,60,000	Rs 7,00,000
Distribution of overheads:					
HR department in the ratio of 4 : 5	Rs 2,22,222	Rs 2,77,778	(5,00,000)	—	—
Maintenance department in the ratio of 7 : 8	2,14,667	2,45,333	—	(4,60,000)	—
Design department in the ratio of 3 : 1	5,25,000	1,75,000	—	—	(7,00,000)
	9,61,889	6,98,111	—	—	—

(ii) The proper sequence to use in re-apportioning the firm's service department cost by step-down method is (1) HR, (2) Maintenance and (3) Design, respectively.

(iii) *Statement showing distribution of overhead costs of service departments between production departments as per step-down method.*

Particulars	*Service departments*			*Production departments*	
	HR	*Maintenance*	*Design*	*Machining*	*Finishing*
Overheads of service departments	Rs 5,00,000	Rs 4,60,000	Rs 7,00,000		
Overheads of HR in ratio 1 : 1 : 8 : 10	(5,00,000)	25,000	25,000	2,00,000	2,50,000
Overheads of maintenance in ratio of 1 : 7 : 8	—	(4,85,000)	30,312	2,12,188	2,42,500
Overheads of design in ratio of 3 : 1	—	—	(7,55,312)	5,66,484	1,88,828
	—	—	—	9,78,672	6,81,328

EQ.5.17 A company has three production departments (M_1, M_2 and A_1) and three service departments one of which Engineering service department, servicing the M_1 and M_2 only. The relevant informations are as follows:

	Product X	*Product* Y
M_1	10 Machine hours	6 Machine hours
M_2	4 Machine hours	14 Machine hours
A_1	14 Direct labour hours	18 Direct labour hours

The annual budgeted overhead cost for the year are

	Indirect Wages	*Consumable Supplies*
M_1	Rs 46,520	Rs 12,600
M_2	41,340	18,200
A_1	16,220	4,200
Stores	8,200	2,800
Engineering service	5,340	4,200
General services	7,520	3,200

— Depreciation of machinery	Rs 39,600	
— Insurance of machinery	7,200	
— Insurance of building	3,240	(Total building insurance cost for M_1 is one third of annual premium)
— Power	6,480	
— Light	5,400	
— Rent	12,675	(The general service deptt. is located in a building owned by the company. It is valued at Rs 6,000 and is charged into cost at notional value of 8% per annum. This cost is additional to the rent shown above)

— The value of issues of materials to the production departments are in the same proportion as shown above for the consumable supplies.

The following data are also available:

Department	*Book value Machinery (Rs)*	*Area (Sq. ft.)*	*Effective H.P. hours %*	*Production direct labour hours*	*Capacity machine hours*
M_1	1,20,000	5,000	50	2,00,000	40,000
M_2	90,000	6,000	35	1,50,000	50,000
A_1	30,000	8,000	05	3,00,000	
Stores	12,000	2,000	—		
Engg. service	36,000	2,500	10		
General service	12,000	1,500	—		

Required: (i) Prepare a overhead analysis sheet, showing the bases of apportionment of overhead to departments. (ii) Allocate service department overheads to production department ignoring the apportionment of service department costs among service departments. (iii) Calculate suitable overhead absorption rate for the production departments. (iv) Calculate the overheads to be absorbed by two products *X* and *Y*.

(*CA (PCE)—May, 2007*)

SOLUTION

(i) Statement showing apportionment of overheads

(Rs)

Items	*Basis of Apportionment*	*Total Amount*	*Production Departments*			*Service Departments*		
			M_1	M_2	A_1	*Store service*	*Engineering service*	*General service*
Indirect wages	Allocation is given	1,25,140	46,520	41,340	16,220	8,200	5,340	7,520
Consumable stores	Allocation is given	45,200	12,600	18,200	4,200	2,800	4,200	3,200
Depreciation	Value of machine	39,600	15,840	11,880	3,960	1,584	4,752	1,584
Insurance of Machine	Value of machine	7,200	2,880	2,160	720	288	864	288
Insurance of Building	1/3 to M_1; Balance on area basis	3,240	1,080	648	864	216	270	162
Power	HP hours %	6,480	3,240	2,268	324	—	648	—
Light	Area	5,400	1,080	1,296	1,728	432	540	324
Rent	Area	12,675	2,535	3,042	4,056	1,014	1,268	760
Rent of general service	Direct 8% of 6,000	480	—	—	—	—	—	480
Total		2,45,415	85,775	80,834	32,072	14,534	17,882	14,318

(ii) Statement showing allocation of service departments overheads

Service Deptt.	*Basis of Apportionment*		*Production Departments*			*Service Departments*		
			M_1	M_2	A_1	*Store Service*	*Engineering Service*	*General Service*
Store	Ratio of consumable value (126 : 182 : 42)		Rs 5,232	Rs 7,558	Rs 1,744	(Rs 14,534)	—	—
Engineering service	Machine hours Ratio of M_1 and M_2 (4 : 5)		7,948	9,934	—	—	(17,882)	—
General service	Labour hours Basis 20 : 15 : 30		4,406	3,304	6,608	—	—	(14,318)
Production Department allocated in (i)			85,775	80,834	32,072			
Total		2,45,415	1,03,361	1,01,630	40,424			

(iii) Statement showing overhead absorption rate

Particulars	M_1	M_2	A_1
Total overhead allocated	Rs 1,03,361	Rs 1,01,630	Rs 40,424
Machine hours (MH)	40,000	50,000	—
Labour hours (LH)	—	—	3,00,000
Rate per MH	2.584	2.033	
Rate per Direct LH	—	—	0.135

(iv) Statement showing overhead absorption for Products *X* and *Y*

Machine Deptt.	*Absorption Rate*	*Product X*		*Product Y*	
		Hours	*Amount*	*Hours*	*Amount*
M_1	Rs 2.584	10	Rs 25.84	6	Rs 15.50
M_2	2.033	4	8.13	14	28.46
A_1	0.135	14	0.54	18	2.43
			34.51		46.39

6 Costing and Control of Administrative, Selling and Distribution Overheads

Introduction

The previous chapter has illustrated the costing and control of factory (manufacturing) overheads. Though the control techniques used in manufacturing costs/overheads are by and large applicable to non-manufacturing costs/overheads, due to difficulty in cost-benefit analysis as the benefits are not easily measurable, such overheads require accounting and control treatment different from that of the factory overheads. The non-manufacturing overheads fall into two groups: (i) Administrative costs and (ii) Selling and distribution costs. Sections 1 and 2 respectively discuss the costing and control of these two categories of non-manufacturing costs. While treatment of some special/problem items of cost is described in Section 3, the main points are summarised in Section 4.

ADMINISTRATIVE OVERHEADS/COSTS

This section discusses the meaning/nature, accounting, and control of administration overheads.

Meaning and Nature

The administrative overheads are those costs which are incurred for formulating policy to be followed, directing the organisation in a manner that these policies are effectively carried out, and controlling its operations. They are, in other words, incurred for planning, general management and control of organisation. They have, therefore, some special features which distinguish them from other overheads, namely, factory/manufacturing and selling and distribution. In most cases, the amount of such costs is relatively small. Moreover, due to the nature of most of the items of expenses, it is difficult to fix suitable norms/standards

for comparison with the actual costs. Such overheads are, therefore, not susceptible to the same degree of control as are other overheads. The methods of absorption of administrative overheads in product costing are, in addition, mostly arbitrary as a result of which it is not possible to have an accurate/equitable cost ascertainment. They, however, do not show wide fluctuations as they are not related to output/sales.

Depending on the organisational structure, two types of administrative costs are typically incurred in a large manufacturing organisation: (i) Those incurred within the plant/factory in terms of provision of staff and other administrative support to the factory. The associated costs are controllable at the factory level; (ii) Those incurred centrally in the head office and allocated to various plants on an equitable basis. The associated costs are controllable at the head office level.

The administrative overheads include, inter alia, the following costs items:

- **Indirect material:** (i) Printing and stationery used in office and (ii) Other office supplies.
- **Indirect labour:** (i) Salary and allowances/fee of office and administrative staff including Board of Directors, Managing Director, Chairman, accounting and secretarial staff; (ii)Salary/allowances/fee of legal advisor/public relations officer and staff, and internal and statutory auditors.
- **Indirect expenses:** (i) Office rent, rates, and insurance; (ii) Office lighting, heating, and cleaning; (iii) Depreciation and repairs of office building, furniture and fittings; (iv) Legal charges; (v) Bank charges; (vi) Trade subscriptions and donations and (vii) Miscellaneous office expenses.

Accounting for Administrative Overheads

The procedures for the primary accounting and analysis of administrative overheads, namely, classification, allocation and departmentalisation follow the same patterns as in the case of factory overheads described in the preceding chapter. In brief, as a first step, they are classified according to the nature and purpose of cost. Each type of cost is allotted a separate Control Account Number for this purpose. A control account, namely, Administrative Overhead Control Account, is opened in the cost books to record the total administrative overheads incurred in an accounting period. The next step, similar to the procedure adopted for factory overhead, is to departmentalise the cost. These administrative departments serve as cost centres for the purpose of collection and control of these overheads. A typical list of such departments is given in Exhibit 6.1.

EXHIBIT 6.1 *Departmentalisation of Administrative Overheads*

1. Accounts Department	4. Legal Department
2. Factory Estate Department	5. Personnel Departmen
3. General Office	6. Secretarial Department

The expenses that can be identified with specific departments are allocated directly. Those that cannot be so identified are apportioned to the various departments on a suitable basis in a manner similar to that for manufacturing overheads.

Accounting Methods There are three methods of accounting of administrative overheads: (i) Transfer to costing profit and loss account; (ii) Apportionment to manufacturing, selling and distribution divisions/functions, and (iii) Addition as a separate item of cost.

Transfer to Costing Profit and Loss Account According to this method, administrative overheads are treated as period costs to be excluded from product costs for two reasons: (i) They are mainly fixed costs which do not vary with production/sales and (ii) There is no equitable basis to charge them to other

products/divisions/functions/departments. The accounting treatment is simple. At the end of the accounting period, as a step in closing the books, Profit and Loss Account is debited and the Administrative Overhead Control Accounts credited. However, non-inclusion of administrative overheads results in understatement of product costs.

Apportionment to Manufacturing and Selling, and Distribution Divisions This method recognises only two basic functions of a manufacturing organisation, namely, (i) manufacturing and (ii) selling and distribution. As administrative overheads are incurred for manufacturing as well as selling and distribution, these suitably are apportioned between production and selling and distribution expenses. As a result, they lose their identity and are merged with manufacturing and selling and distribution costs.

The expenses apportioned to manufacturing and selling and distribution overheads respectively are treated in the same way as other items of such overheads. Each item is first allocated to service cost and production centres. The cost of the service centre is then apportioned to the production cost centres and ultimately absorbed in cost units. These overheads incurred are debited to Administrative Overhead Control Account. On apportionment, the amount pertaining to manufacturing is transferred to Works/Manufacturing/Factory Overhead Control Account/Work-in-Process Account, and those pertaining to selling and distribution are debited to Selling and Distribution Control Account.

The main problem with this method of accounting of administrative overheads is the selection of a suitable/equitable basis for their apportionment. As the nature of the various items of these overheads is different from each other, each item is analysed separately for the purpose. Some of the items can be allocated directly on the basis of the amount spent. In the case of most items, however, equitable bases have to be adopted for apportionment of each item of expenditure. The bases adopted for apportionment of factory overheads would be useful here also. An illustrative list of items and the basis of their apportionment is given in Exhibit 6.2.

EXHIBIT 6.2 *Apportionment of Administrative Overheads*

Item/Expense	*Basis of Apportionment*
1. Office rent and rates	Floor area
2. Depreciation of office building	Floor area or capital value
3. Legal expenses	Number of employees
4. Personnel department expenses	Number of employee
5. Filing	Number of items handled
6. Typing	Number of letters typed
7. Invoicing	Number of invoices
8. Correspondence	Number of letters drafted

Addition as a Separate Item of Cost Under this method, administrative overhead is added as a separate cost element to the cost units sold. It is apportioned to the cost of product/goods sold on the basis of an equitable administrative overhead rate much in the same way as is done for the determination of factory overhead rate. Depending upon the suitability and equitability under the given circumstances, the administrative overhead rate can be computed using one of the following bases: (i) Sales value/quantity; (ii) Cost of sales/selling cost; (iii) Works/manufacturing cost; (iv) Conversion costs; (v) Production units, and (vi) Gross profit.

Control of Administrative Overheads

As administrative overheads typically relate to the general and financial management of an organisation, their major portion represents policy costs that are mostly fixed in nature and, therefore, largely non-controllable. Moreover, fixation of norm/standard to measure the effectiveness of such costs is beset with serious difficulties, coupled with the fact that the amount involved is rather small. The introduction and operation of a control system is difficult as well as not very worthwhile. Nonetheless, the normal methods of controlling costs may, with suitable adjustments, be applied to such costs as well, as explained below.

Comparison with Past Performance The administrative overheads allocated to various administrative/service departments/cost centres may be compared periodically with the corresponding expenditure in a previous period. The effectiveness of this method would depend upon the level of activity during the period of comparison. Alternatively, the cost of a department may be compared with the cost of similar services from outside. Similarly, the administrative overhead absorption rate my also be compared over a period of time and the relative efficiency of a department would be reflected in the extent of under/over absorption.

Budgetary Control The technique of budgetary control can be used and periodic comparison with actuals would reveal relative efficiency.

Standard Costing Although standards cannot be set with the same degree of precision as in case of manufacturing costs, standards for certain types of administrative work with standard units of measurement can be established. The examples of such types of work are clerical, typing, posting, filing and billing, and so on. The standard costing techniques, however, cannot be applied to fixed administrative costs such as depreciation of office buildings/machines/equipments, and so on. They may be included in a separate fixed cost budget for the information of the top management.

SELLING AND DISTRIBUTION OVERHEADS

This section discusses the nature of selling and distribution oveheads, their accounting treatment, and control, and the related aspect of analysis of sales.

Nature

Although the selling and distribution functions are separate but as *after-production costs*, there is overlapping between the two. They are, therefore, dealt with together for accounting and control purposes. As most of the items of such costs are not identifiable with specific products, they are in the nature of indirect costs/overheads.

Selling Overheads Selling overheads/costs include the costs incurred in selling to existing customers/retaining customers and in promoting sales to potential customers. They consist of the following items.

Direct Selling Costs Such costs are incurred for soliciting/obtaining orders, market research, and supply of goods to customers. They are paid to sales executives/staff/office.

Advertising and Sales Promotion Costs The major items of expenditure are:

- Advertising;
- Sales promotion: exhibitions, displays, posters, films, distribution of samples and free gifts/diaries/calendars

Credit and Collection Costs These include expenses relating to collection of receivables and bad debts.

Financial and General Administration Costs Included in this category are (i) royalty on sales, (ii) discounts and allowances, (iii) sales invoicing, and (iv) accounts.

Distribution Overheads Distribution overheads begin when a order has been obtained, and generally end when goods are to be despatched. They include the following.

Transportation Costs Such costs consist of expenditure on different modes of transport, comprising salary of staff, maintenance/depreciation/insurance of vehicles, demurrage and wharfage and dispatch of goods, and so on.

Warehousing and Storage Costs The main items of such costs are the cost of storage such as warehouse rent, salary of warehouse staff, warehouse office expenses, depreciation, and insurance.

Financial and General Administration The distribution expenses covered under this head are (i) cost of carrying stock and (ii) financial/cost accounting costs, and so on.

Accounting of Selling and Distribution Overheads

The accounting of selling and distribution overheads involves three-stage analysis: (i) By nature/object, (ii) By function/cost centre, and (iii) By product/cost units.

Analysis by Nature/Object The selling and distribution costs are analysed according to the nature/object of different items of such costs. An illustrative list of such cost items nature-wise includes: (i) advertising, (ii) commission/remuneration, (iii) customs excise/duty, (iv) depreciation, (v) discounts and allowances, (vi) fees, (vii) freight, (viii) heating, (ix) insurance, (x) lighting/power (xi) materials and consumable stores/supplies, (xii) packing, (xiii) postage, (xiv) rent, (xv) repairs, (xvi) services, and so on. Like the manufacturing costs, selling and distribution overheads may be fixed, variable, and semi-variable.

Functional Analysis The functional analysis of selling and distribution costs is similar to departmentalisation and apportionment of manufacturing overheads to cost centres. The main operational functions with reference to such costs my be further classified into (i) direct selling, (ii) advertising and sales promotion, (iii) transportation, (iv) warehousing and storage, (v) credit and collection, (vi) financial, (vii) general administration, (viii) warranty claims, and (ix) miscellaneous. The functional analysis can be extended to locations, namely, territories/sales offices/customers/salesmen. Each function and location constitutes a cost centre for accounting and control of selling and distribution costs. Such costs are allocated to functions/locations to which they relate, for example, freight charges, packing materials, remuneration of salesmen, postage and stationery, and so on. The items/expenses which cannot be allocated may be apportioned on some suitable basis. An illustrative list of bases for such apportionment is given in Exhibit 6.3.

EXHIBIT 6.3 *Apportionment of Selling and Distribution overheads*

Expense item	*Basis*
1. Advertising	Sales vale/physical units
2. Credit control	Number of orders
3. Depreciation	Value of assets
4. Insurance	Property value
5. Rent	Floor space
6. Warehousing	Sales volume
7. Transport	Weight/number of packages/distance carried

Analysis by Products/Groups of Products Selling and distribution costs can also be analysed by products/groups of products, for example, products A and B and location-wise, that is, Territory/Zone 1 (East), 2 (South), 3 (West), and 4 (North). This type of analysis is somewhat similar to absorption of manufacturing overheads to cost units. Such an analysis can also be made for a group of products based on some common factors such as prices, sales order, and salesmen. There are two other related methods of analysis of such overheads, namely, by channels of distribution/methods of sale and by customers.

Apportionment of Functional Costs The direct functional costs are allocated to cost units. The indirect functional costs which cannot be allocated directly are apportioned to cost units on the basis of following methods: (i) Rate per article based on number/other physical unit of the product (i.e. advertisement, transportation and warehousing expenses); (ii) Percentage of turnover (i.e. direct selling costs, general administration/finance cost); (iii) Percentage of cash collected (bad debts and credit collection expenses); (iv) Percentage of works cost (e.g. fixed selling and distribution costs); (v) Percentage of stock of finished goods; (vi) Number of orders; (vi) Number of invoices, and (viii) Percentage of value added (i.e. total sales less cost of materials). Each item of such expenses should be analysed and allocated to different products (cost centres) on the basis of services rendered.

EXAMPLE 6.1

Following data is available relating to ABC Ltd. for a certain month:

	Territory I	*Territory II*	*Territory III*
Selling expenses	Rs 7,600	Rs 4,200	Rs 6,240
Distribution costs	4,000	1,800	2,000
Number of units sold	16,000	6,000	10,000
Sales	76,000	28,000	52,000

The company adopts sales basis and quantity basis for application of selling and distribution costs respectively. Compute (a) the territory-wise overhead recovery rates separately for selling and distribution costs and (b) the amount of selling and distribution costs chargeable to a consignment of 2,000 units of a product, sold in each territory at Rs 4.50 per unit.

SOLUTION

(a) *Statement Showing Determination of Overhead Recovery Rates for Selling and Distribution Costs*

(i) *Selling cost recovery rate:* (Selling expenses/Sales) × 100
Territory I (Rs 7,600/Rs 76,000) × 100 = 10 per cent of sales
Territory II (Rs 4,200/Rs 28,000) × 100 = 15 per cent of sales
Territory III (Rs 6,240/Rs 52,000) × 100 = 12 per cent of sales

(ii) *Distribution cost recovery rate per unit sold:* (Distribution costs/Number of units sold)
Territory I (Rs4,000/16,000 units) = Re 0.25 per unit sold
Territory II (Rs 1,800/6,000 units) = 0.30
Territory III (Rs 2,000/10,000 units) = 0.20

(b) *Statement Showing Determination of Selling and Distribution Costs Charged to Consignment of 2,000 units*

Particulars	*Territory I*	*Territory II*	*Territory III*
Number of units sold	2,000	2,000	2,000
Sales revenue	Rs 9,000	Rs 9,000	Rs 9,000
Selling cost	900	1,350	1,080
Distribution cost	500	600	400
Total cost	1,400	1,950	1,480

EXAMPLE 6.2

The Hypothetical Ltd. is making a study of the relative profitability of two products—A and B. In addition to direct costs, indirect selling and distribution costs to be allocated between the two products are as under:

Insurance charge for inventory (finished)	Rs 78,000
Storage costs	1,40,000
Packing and forwarding charges	7,20,000
Salesman salaries	8,50,000
Invoicing costs	4,50,000

Other details are:

	Product A	*Product B*
Selling price per unit	Rs 500	Rs 1,000
Cost per unit (exclusive of indirect selling and distribution cost)	300	600
Annuals sales (in units)	10,000	8,000
Average inventory (in units)	1,000	800
Number of invoices	2,500	2,000

One unit of product A requires a storage space twice as much as product B. The cost to pack and forward is the same for both the products. The salesmen are paid salary plus commission @ 5 per cent on sales and equal amount of efforts are put forth on the sales of each of the products.

Required: (i) Set up a schedule sharing the apportionment of the indirect selling and distribution costs between the two products, (ii) Prepare a statement sharing the relative profitability of two products.

SOLUTION

(i) *Schedule Showing Apportionment of Indirect Selling and Distribution Costs Between Products A and B*

Particulars	*Basis of apportionment*	*Products*		
		A	*B*	*Total*
Insurance charges	Value of average inventory (Rs 500 × 1,000): (Rs 1,000 × 800) = 5:8	Rs 30,000	Rs 48,000	Rs 78,000
Storage costs	Storage space occupied by inventory (1000 × 2): (800 × 1) = 20:8	1,00,000	40,000	1.40,000

(*Contd.*)

(*Contd.*)

Packing and forwarding	Annual sales (units) = 10:8	4,00,000	3,20,000	7,20,000
Salesmen's salaries	Efforts of salesmen (1:1)	4,25,000	4,25,000	8,50,000
Salesmen's commission	Sales value (Rs 500 × 1,000) : (Rs 1,000 × 800)	2,50,000	4,00,000	6,50,000
Invoicing costs	Number of invoices (2500:2000) = 5:4	2,50,000	2,00,000	4,50,00
Total cost		14,55,000	14,33,000	28,88,000

(ii) *Statement Showing Relative Profitability of Two Products—A and B*

Particulars	*Product A*	*Product B*
Annual sales revenue	Rs 50,00,000	Rs 80,00,000
Loss cost of goods sold	30,00,000	48,00,000
Gross profit	20,00,000	32,00,000
Less indirect selling and distribution costs	14,55,000	14,33,000
Profit	5,45,000	17,67,000
Profit as percentage of sales	10.9	22.09

Control of Selling and Distribution Overheads

The control of selling and distribution costs is comparatively difficult due to the special nature of such costs. The incidence of such costs is dependent upon various external factors such as distance of market, sales terms and extent of competition, and so on. The problems associated with their control are: (i) Absence of control over customers/competitors; (ii) Lack of proper definition of capacity of a sales organisation; (iii) Absence of control/direct supervision over staff/representatives employed outside, necessitating the use of incentive plans of remuneration for them; (iv) Fixation of market prices without reference to cost of production; (v) Difficulty in obtaining data regarding market operations; and (vi) Difficulty in accurately determining the market capacity. Most of the items of selling and distribution overheads are in the nature of policy/discretionary costs which are largely uncontrollable at lower levels of management. Nevertheless, control of such costs may be effected by comparison with past performance (actual) or with the help of budgets and standards like the administrative and factory overheads.

A contributory factor to effective planning and control is the analysis of sales.

Sales Analysis Sales may be analysed in a number of ways and according to market segments. The methods of analysis according to different market segments and the purpose served by each are discussed below.

Salesmen-wise The turnover by each salesman is ascertained for comparison of (a) actual sales with past/budgeted sales/sales quota or inter-salesmen comparison for corrective action, and (b) sales volume *vis-à-vis* selling costs for control of cost and fixing up commission/bonus payable to salesmen.

Performance Evaluation of Salesmen As much of the success of marketing strategy of a company depends on the efficiency of its salesmen including selling agents/offices, their performance evaluation is an important element in sales analysis. Such evaluation is made on the basis of performance in relation to one/more standards/targets specified below:

- Sales turnover
- Gross profit/contribution on sales

- Percentage of sales quota achieved
- Number/volume of new business obtained/lost
- Number of calls made.

Sales Territory The analysis of sales by territory enables (i) comparison with budgets/potential sales, (ii) determination of each territory's contribution to net profits, (iii) control of selling and distribution costs through correlation with sales volume, (iv) assessment of the extent of penetration of competitors, and so on.

Product/Product Lines-wise The usefulness of such analysis is based on (i) ascertainment of profit of each product/product line and comparison with past data for control purposes, (ii) product planning in terms of choice of product mix based on profitability, (iii) ascertainment of sales trends for each product, and (iv) control of selling and distribution costs in relation to sales volume of each product.

Customer-wise This analysis of sales is useful to:

- Ascertain profit by each type of customer,
- Maintain a reasonable balance between the types of customers and the extent of discount allowed to each
- Ascertain by type of customers the potential for future sales
- Determine their preferences in respect of quality/type of products.

Distribution Channel-wise Sales Such analysis is useful to ascertain profits of various channels of distribution and to assess their relative viability. The distribution channels refer to the series of middlemen/intermediary agencies through whom the products of a manufacturer reach the consumers. They include wholesalers, retailers, selling agents, commission agents, distributors, and so on. The choice of a channel of distribution is related to improvement in sales and provision of more effective customer service. Each distribution system produces different level of sales/profits and incurs different distribution costs. The main objective of evaluation of distribution alternatives is to determine/select the one which would bring in the highest sales/profits through the least cost. The evaluation process is based on a consideration of the relationship between sales value and the related costs for each alternative.

By Size of Order The analysis of sales on the basis of size of orders would enable comparison of cost of handling and transportation with the sales volume of various sizes as well as decision regarding trade discount for sales of various sizes.

Unit Price-wise This analysis of sales provides information relating to price trends which may be useful in the formulation of a price policy for products.

Period-wise A comparison of sales over a period of time would reveal trends, periodic/cyclical movements, seasonal/fluctuating characteristics of the product and assist in formulating sales policy on long-term basis.

TREATMENT OF SPECIAL ITEMS OF COST

The treatment of some illustrative items of cost in cost accounting is discussed in this section. The treatment depends upon the nature and purpose of the cost item and the circumstances of each case and management policies.

Research and Development Cost

There is a lack of agreement regarding the treatment of such costs in cost accounting due to the nature of such costs. In the first place, such costs are in the nature of pre-production costs and there is a considerable time lag between the incidence of expenditure and realisation of return/profit. Secondly, there is no immediate production. Such cost is so small that it is difficult to charge them to products.

Accounting The research and development costs can be charged/recovered according to the following three methods.

Charge to Cost of the Current Period on Revenue Basis According to this method, research and development (R&D) costs are regarded as a function of production and are charged to cost of goods sold by direct allocation to specific products, or treated as overhead costs to be recovered through the general overhead rate. The arguments in support of this approach are: (i) All such expenses do not result in new processes/saleable products, (ii) Some of the R&D projects may result in failure, (iii) Such expenses are incurred simply to maintain the present competitive position, (iv) It is difficult to assess the period over which the acquired know-how/knowledge may be spread over, (v) It is advantageous in those cases where future sales may drop once the novelty wears off and competition sets in, and (vi) In certain cases, the effect of these costs on future revenues may be doubtful.

Capitalisation According to this method, R&D costs should be capitalised so that they are amortised on a long-term basis. This approach is suitable (i) when R&D cost is incurred for a specific product/process and there is little or no production during the current period and (ii) if the benefits are to be derived in subsequent periods on a long-term basis.

Deferment In case, it is considered desirable to recover the R&D cost over a short period of 2-3 years, it may be treated as deferred cost. The cost is treated as a fictitious asset and carried over in the balance sheet for amortisation in the subsequent years. This method is a compromise between an immediate charge to revenue (first method) and the long-term capitalisation (second method).

Methods of Accounting in Specific Situations The methods of accounting in specific situations are discussed below:

General/Basic Research Costs Such costs are not linked with any particular product/equipment/method. The results of such research are also uncertain/indefinite as to when they would be available or may not be available at all. They are treated as items of overhead with reference to the area in which the research falls. For example, the R&D cost on products/methods of production is treated as factory overhead while that on marketing research as selling and distribution overhead. A fixed amount for R&D cost may be provided against which the actual expenditure is set off.

Cost of Applied Research/Development Such R&D costs are allocated to products for which they are incurred or treated as pre-production costs. If the amount is large and benefits would accrue in future years, they may be treated as deferred revenue expenditure and prorated to future production. They may be partly charged to the current production and partly treated as deferred expenditure if incurred for an improvement of existing products/methods of production. The R&D costs incurred for increasing capacity/production capability of assets are capitalised.

Cost of Unsuccessful Research and Development If such expenditure is normal and is provided for in the budget, it is written-off to profit and loss account.

Cost of Research and Development on Behalf of a Customer Such a cost is either treated as overhead cost or directly charged to the customer's job as it can be identified with him.

Cost of Research and Development for Existing Products If the R&D is carried out to reduce waste, correct defects and improve quality of existing products, the R&D cost is charged to current production. It is treated as manufacturing overhead if incurred for improving production capabilities and as selling and distribution overhead if incurred for increasing sales volume. The cost of incomplete R&D projects is carried over to the next year as work-in-progress.

Interest on Capital

The interest on capital is defined with reference to its treatment in cost accounting to include interest on (i) borrowed capital, namely, loans, debentures, bank borrowings and (ii) own capital. While the former is actually paid and involves cash outflows, the later is only a notional item of cost. There is a difference of opinion as regards treatment of interest on capital as an item of cost; there are arguments both for an against its inclusion in cost accounting.

Arguments for inclusion: The arguments in support of treating interest on capital as an item of cost are given below:

- Capital, like labour, is an important factor of production, and like wages, interest on capital is an element of cost.
- The comparison of operations, different processes and assessment of true profit without due consideration of interest factor may yield unreliable conclusions.
- Interest considers time factor as it is computed on the basis of an important consideration in production, namely, time element.
- Where articles of different values are produced and the capital invested in each product line differs considerably, interest is an important factor.
- The cost of carrying inventory can be accurately assessed by including interest.

Arguments against inclusion: The arguments against treating interest on capital as an item of cost are as follows:

- As profit is reward for capital, interest on capital should not be charged to cost.
- Interest is an item of pure finance. It is in no way connected with cost of manufacture and should be met out of profits.
- Difficulty in determining the rate of interest and the capital employed introduces an element of approximation in costs, requiring adjustment from time to time. It not only creates unnecessary complications but also results in increased clerical costs.
- Interest inflates the values of work-in-process and finished stock, and if not paid, distorts the profits by inclusion of unrealised income.

Since notional interest on owned capital is not payable, it cannot be said to constitute an element of cost. The interest on borrowed capital too is not a part of cost of production/sales, and as a pure finance item, is an appropriation of profit.

Rent for owned Premises

The rent paid on hired/leased buildings is an essential item of cost of production. Similarly, the rent not paid for owned premises should also be included as an item of cost because (i) being akin to depreciation, it should be similarly treated in cost accounting, (ii) it facilitates correct cost comparison, and (iii) inter-firm

comparison of cost of production of companies having owned premises with those having lease-hold/rented factories is facilitated.

Advertisement/Sales Promotion Costs

The treatment of advertisement/sales promotion costs in cost accounting is given below.

- If the advertisement relates to all the products of an organisation, it is treated as selling and distribution overhead and recovered from/apportioned to the cost of goods sold.
- The cost of advertisement for individual products is treated as an item of selling overheads and allocated directly to the product/department.
- In case of huge advertisement costs which would yield benefits over a period of time, it should be treated as deferred expenditure and apportioned/prorated to current and future production and sales.
- If the advertisement is of permanent nature such as permanent neon signs/hoarding sites, the cost should be capitalised and its depreciation charged to selling overheads.
- Advertisements which are not a part of sales promotion such as for staff recruitments, opening of new offices/branches, notices in respect of closure of share transfer books, meeting of shareholders, and so on are treated as administrative overheads.

Bad Debts

As an item of financial loss, bad debts should be excluded from cost accounts.

Packing Costs

The treatment of packing costs depend on its type. The cost of ordinary/prime packing which is necessary for protection and convenient handling of the product, such as tooth paste tube, is included in the manufacturing/prime cost. If packing is required to facilitate transport of goods from the factory to the consumers (e.g. boxes and containers), its cost is treated as a part of selling and distribution overheads. The cost of special packing to customer specification is charged to specific job. The cost of fancy packing to attract customers is treated as selling and distribution overhead. The packing costs which cannot be directly allocated should be suitably apportioned to prime cost and selling and distribution overheads, and the various products on equitable basis.

Blueprints and Designs

The blueprints are copies of drawings in respect of products/customers' orders. Their cost for immediate use is charged to the specific product/order. The cost of blueprints for standard/regular products is depreciated over the period of their life.

The design function includes (i) originating and developing new products, (ii) improving/developing the existing product lines in tune with technology and customers' habits (iii) specifying and communicating standards of quality, (iv) interpreting the product in the form of product identification and/or materials/parts lists, and (v) preparing drawings/plans to define and interpret each component for manufacture. Depending on the purpose, the cost of design may be charged to a specific order from a customer or apportioned as part of R&D costs and treated as deferred expenditure.

SUMMARY

- The non-manufacturing overheads consist of administrative and selling and distribution costs. The administrative costs are incurred for policy formulation, direction, organisation and control of operations of an organisation.
- Their special features are that their amount is relatively small, fixation of standards for them is difficult and their absorption in product costing is arbitrary. There are three methods of accounting of administrative overheads: (i) transfer to costing profit and loss account, (ii) apportionment to manufacturing, selling and distribution functions, and (iii) addition as a separate item of cost.
- Though the introduction and operation of a control system is both difficult as well as not very useful, the normal methods of controlling cost, namely, comparison with past record, budgeting control and standard costing, may with suitable adjustments, be applied to such cost as well.
- Although the selling and distribution functions are separate but as after-production costs, there is overlapping between the two. These are, therefore, dealt with together for costing and control purposes. The selling overheads are incurred for selling to existing customers/retaining customers and for promoting sales to potential customers.
- The distribution overheads begin when an order is obtained and generally ends when goods are despatched. The accounting of selling and distribution overheads involves three-stage analysis: (i) by nature, (ii) by function, and (iii) by product. The control of such costs is comparatively difficult due to their special nature.
- An important factor in their control is sales analysis. Sales may be analysed in a number of ways and according to market segments. The methods of analysis are:
  - — By salesmen
  - — By product
  - — By distribution channel
  - — By period.
  - — By territories
  - — By customer
  - — By size of order

SOLVED PROBLEMS

P.6.1 A company is producing three types of products A, B and C. The sales territory of the company is divided into three areas X, Y and Z. The estimated sales for the year are as under:

Product	*Territories*		
	X	*Y*	*Z*
A	Rs 50,000	Rs 20,000	—
B	30,000	—	Rs 80,000
C	—	70,000	40,000

Budgeted advertising cost is as under:

Product	*Territories*			
	X	*Y*	*Z*	*Total*
Local cost	Rs 3,200	Rs 4,500	Rs 4,200	Rs 11,900
Common cost				5,800

You are required to prepare the statement showing cost (per cent on sales) for each product and territory.

SOLUTION

Statement showing determination of product-wise advertising cost

Particulars of Cost	*Products*			*Total*
	Product A	*Product B*	*Product C*	
Local cost:				
Territory X[1]	Rs 2,000	Rs 1,200	—	Rs 3,200
Territory Y[2]	1,000	—	3,500	4,500
Territory Z[3]	—	2,800	1,400	4,200
Common cost: (apportioned as % of sales)[4]	1,400	2,200	2,200	5,800
Total apportioned cost	4,400	6,200	7,100	17,700
Sales	70,000	1,10,000	1,10,000	2,90,000
Per cent on sales	6.29	5.64	6.45	6.10

Statement showing determination of territory-wise advertising cost

Particulars	*Territory X*	*Territory Y*	*Territory Z*	*Total*
Local cost (direct allocation)	Rs 3,200	Rs 4,500	Rs 4,200	Rs 11,900
Common cost (apportionment as % of sales, territory-wise)[5]	1,600	1,800	2,400	5,800
Total apportioned costs	4,800	6,300	6,600	17,700
Total sales	80,000	90,000	1,20,000	2,90,000
Per cent on sales	6.00	7.00	5.50	6.10

Working Notes

Local/territory costs are apportioned to products on the basis of their sales value.

1. Local cost of territory X (Rs 3,200) has been apportioned in the ratio of 5 : 3, i.e.
   Product A (Rs 3,200 × 5/8) = Rs 2,000
   Product B (Rs 3,200 × 3/8) = 1,200
2. Local cost of territory Y is apportioned in the ratio of 2 : 7:
   Product A (Rs 4,500 × 2/9) = Rs 1,000 Product C (Rs 4,500 (7/9) = 3,500
3. Costs of Territory Z are apportioned in the ratio of 8 : 4:
   Product B (Rs 4,200 × 8/12) = Rs 2,800
   Product C (Rs 4,200 × 4/12) = 1,400
4. (Rs 5,800/Rs 2,90,000) × Rs 70,000 = Rs 1,400 (Product A)
   (Rs 5,800/Rs 2,90,000) × Rs 1,10,000 = 2,200 (Product B)
   (Rs 5,800/Rs 2,90,000) × Rs 1,10,000 = 2,200 (Product C)
5. Rs 5,800 common costs are apportioned in territories X, Y, Z in proportion of sales made in each of these territories, i.e. (8 : 9 : 12)
   (Rs 5,800/Rs 2,90,000) × Rs 80,000 = Rs 1,600 (Territory X)
   (Rs 5,800/Rs 2,90,000) × Rs 90,000 = Rs 1,800 (Territory Y)
   (Rs 5,800/Rs 2,90,000) × Rs 1,20,000 = Rs 2,400 (Territory Z)

P.6.2 XYZ Ltd., having an extensive marketing network throughout the country, sells its products throughout four zonal sales offices, namely, A, B, C and D. The budgeted expenditure for the year are given below:

Sales manager's salary			Rs 1,20,000
Expenses relating to sales manager's office			80,000
Travelling salesmen's salaries			3,20,000
Travelling expenses			36,000
Advertisements			30,000
Godown rent: Zone	A	Rs 15,000	
	B	25,200	
	C	9,800	
	D	18,000	68,000
Insurance on inventories			20,000
Commision on sales @ 5% on sales			6,00,000

The following further particulars are also available:

Zone	*Sales (Rs lakh)*	*Number of salesmen*	*Total mileage covered*	*Allocation of advertisement (%)*	*Average stock in Rs lakh*
A	36	5	6,000	30	6
B	48	6	14,000	30	8
C	16	2	4,500	20	4
D	20	3	5,500	20	2

Based on the above details, compute zone-wise selling overheads, as a percentage to sales.

SOLUTION

Statement showing determination of zone-wise selling overhead rates

Particulars	*Basis of apportionment*	*Zones*				*Total*
		A	*B*	*C*	*D*	
Sales manager salary	Sales ratio	Rs 36,000	Rs 48,000	Rs 16,000	Rs 20,000	Rs 1,20,000
Office expenses of sales	Sales ratio	24,000	32,000	10,667	13,333	80,000
Travelling salesman's salaries	No. of salesmen	1,00,000	1,20,000	40,000	60,000	3,20,000
Travelling expenses	Mileage covered	7,200	16,800	5,400	6,600	36,000
Advertisement	(3 : 3 : 2 : 2)	9,000	9,000	6,000	6,000	30,000
Godown rentActual	15,000	25,200	9,800	18,000	68,000	
Insurance (stock)	(6 : 8 : 4 : 2)	6,000	8,000	4,000	2,000	20,000
Commission	(5% of sales)	1,80,000	2,40,000	80,000	1,00,000	6,00,000
Total overheads		3,77,200	4,99,000	1,71,867	2,25,933	12,74,000
Sales revenue		36,00,000	48,00,000	16,00,000	20,00,000	1,20,00,000
Selling overheads as % of sales		10.48	10.40	10.74	11.30	10.62

P.6.3 A manufacturing concern sells its sale product in three sizes of packages—small, medium, and large—each package containing one, two and three dozen units of the product respectively. Sales for the year were:

	Number of packages sold	*Sales rate*
Small size	20,000	Rs 1
Medium size	5,00,000	1.50
Large size	5,00,000	2

The factory cost was 3 paise per unit of product and the administration overhead was added at 2% of sales. The following selling and distribution expenses were incurred:

Advertising:	
Small	Rs 3,000
Medium	60,000
Large	1,50,000
Packages:	
Small	500
Medium	50,000
Large	50,000
General advertising (as % of sales)	1
Commission (as % of sales)	10
Sales office expenses (as % of sales)	2
Travelling expenses:	
Small	100
Medium	8,000
Large	3,000

Prepare a comparative income statement for each size of package.

SOLUTION

Income statement, package-wise

Particulars	*Packages*		
	Small	*Medium*	*Large*
Number of units	Rs 2,40,000	Rs 120,00,000	Rs 180,00,000
Sales revenue	20,000	7,50,000	10,00,000
Factory cost (Re 0.03 per unit)	7,200	3,60,000	5,40,000
Administration overheads	400	15,000	20,000
Advertising	3,000	60,000	1,50,000
Packaging expenses	500	50,000	50,000
General advertising	200	7,500	10,000
Commission	2,000	75,000	1,00,000
Sales office expenses	400	15,000	20,000
Traveling expenses	100	8,000	3,000
Total cost of sales	13,800	5,90,500	8,93,000
Profit (Sales-Cost of sales)	6,200	1,59,500	1,07,000

REVIEW QUESTIONS

RQ.6.1 Explain the term administrative overheads and briefly discuss three methods of treatment thereof in cost accounts.

RQ.6.2 What, according to you, are the steps to be followed in controlling administrative overheads?

RQ.6.3 What problems are encountered in applying administrative costs partly to the manufacturing and partly to the selling department of a business firm?

RQ.6.4 What are non-manufacturing costs? Give a few examples of such costs.

RQ.6.5 What are selling and distribution overheads? Give four examples of such costs. How can such costs be controlled?

RQ.6.6 Distinguish between selling costs and distribution costs. What is the relevance of such a distinction?

RQ.6.7 For purposes of product costing, explain how would you allocate or apportion each of the following items of overhead:

(a) Traveler's salaries, commissions and expenses
(b) After-sales services costs
(c) Warehousing costs
(d) Market research costs

RQ.6.8 Discuss the various methods of treatment of research ad development costs in cost accounts.

RQ.6.9 ''Interest on capital employed and depreciation are the factors which cannot be disregarded by management.'' Comment.

RQ.6.10 What are the arguments for and against inclusion of interest on capital in cost accounts?

RQ.6.11 How would you deal with the following items in the cost accounts of a manufacturing concern?

(a) Research and development cost
(b) Packing expenses
(c) Sales promotion expenses
(d) Director's fees and salaries
(e) Bad debts

RQ.6.12 A company is making a study of the relative profitability of the two products A and B. In addition to direct costs, indirect selling and distribution costs to be allocated between the two products are as under:

Insurance charges for inventory (finished)	Rs 78,000
Storage costs	1,40,000
Packing and forwarding charges	7,20,000
Salesmen salaries	8,50,000
Invoicing costs	4,50,000

Other details are:

	Product A	*Product B*
Selling price per unit	Rs 500	Rs 1,000
Cost per unit (exclusive of indirect selling and distribution costs)	300	600
Annual sales in units	10,000	8,000
Average inventory (units)	1,000	800
Number of invoices	2,500	2,000

One unit of product A requires a storage space twice as much as product B. The cost to pack and forward one unit is the same for both the products. Sales men are paid salary *plus* commission @ 5 per cent on sales and equal amount of efforts are put forth on the sales of each of the products.

Required:

(i) Set up a schedule showing the apportionment of the indirect selling and distribution costs between the two products.

(ii) Prepare a statement showing the relative profitability of the two products.

SOLUTION

(i) *Statement showing apportionment of indirect selling and distribution costs between products A and B*

Particulars	*Basis of apportionment*	*Total*	*Products*	
			A	*B*
Insurance charges for finished inventory	Cost of average inventory (30:48)[1]	Rs 78,000	Rs 30,000	Rs 48,000
Storage costs	Storage space (5:2)[2]	1,40,000	1,00,000	40,000
Packing and forwarding charges	Annual sales in units	7,20,000	4,00,000	3,20,000
Salesmen salaries	Efforts (equal)	8,50,000	4,25,000	4,25,000
Salesmen commission	Annual sales (5:8)[3]	6,50,000	2,50,000	4,00,000
Invoicing costs	Number of invoices	4,50,000	2,50,000	2,00,000
		28,88,000	14,55,000	14,33,000

	Product A	*Product B*
(1) *Cost of average inventory*		
Average inventory (units)	1,000	800
(×) Cost per unit	× Rs 300	× Rs 600
Total cost	Rs 3,00,000	Rs 4,80,000
(2) *Storage space*		
Average inventory (units)	1,000	800
(×) Storage space ratio (2:1)	2	1
Total effective storage space	2,000	800
(3) *Salesmen commission*		
Selling price per unit	Rs 500	Rs 1,000
(×) Annual sales in units	(×) 10,000	(×) 8,000
(×) Commission (0.05)	(×) Re 0.05	(×) Re 0.05
Total salesmen commission	Rs 2,50,000	Rs 4,00,000

(ii) *Statement showing relative profitability of product A and product B*

Particulars	*Product A*	*Product B*
Selling price per unit	Rs 500	Rs 1,000
Cost per unit	300	600
Annual sales (in units)	10,000	8,000
Total sales revenue	Rs 50,00,000	Rs 80,00,000
Less total cost of goods sold	30,00,000	48,00,000
Less indirect selling and distribution costs	14,55,000	14,33,000
Net profit	5,45,000	17,67,000
Net profit ratio (Net profit as percentage to sales)	10.9	22.09

RQ.6.13 Marketing Division of company wishes to discontinue the sale of one of the products in view of unprofitable operations. Following details are available with regard to turnover, costs and activity for the current year ending 31st March.

	Products			
	P	*Q*	*R*	*S*
Sales turnover	Rs 6,00,000	Rs 10,00,000	Rs 5,00,000	Rs 9,00,000
Cost of sales	3,50,000	8,00,000	3,70,000	4,80,000
Storage area (square meters)	40,000	60,000	70,000	30,000
Number of cartons sold	2,00,000	3,00,000	1,50,000	3,50,000
Number of bills raised	1,00,000	1,20,000	80,000	1,00,000

Overhead costs and basis of apportionment are:

Fixed expenses

		Basis of apportionment
Administrative wages and salaries	Rs 1,00,000	Number of bills raised
Salesmen's salaries and expenses	1,20,000	Sales turnover
Rent and insurance	60,000	Storage area
Depreciation	20,000	Number of cartons

Variable costs

Commission	4 per cent of sales
Packing materials and wages	Re 0.50 per carton
Stationery	Re 0.20 per bill

Based on the above data you are required to

(i) prepare a statement showing summary of Selling and Distribution Costs to the products, and

(ii) prepare a Profit and Loss Statement showing contribution and profit or loss on sale of each of the products to enable the marketing department take an appropriate decision on discontinuance of the sale of a product.

SOLUTION

(i) *Statement showing summary of selling and distribution costs to products*

Particulars	*Basis of apportionment*	*Total*	*Products*			
			P	*Q*	*R*	*S*
Fixed Costs:						
Administrative wages and salaries	Number of bills raised	Rs 1,00,000	Rs 25,000	Rs 30,000	Rs 20,000	Rs 25,000
Salesmen's salaries and expenses	Sales turnover	1,20,000	24,000	40,000	20,000	36,000
Rent and insurance	Storage area	60,000	12,000	18,000	21,000	9,000
Depreciation	Number of cartons	20,000	4,000	6,000	3,000	7,000
Total (a)		3,00,000	65,000	94,000	64,000	77,000
Variable costs:						
Commission	4 % of sales	Rs 1,20,000	24,000	40,000	20,000	36,000
Packing materials and wages	Re 0.50 per carton	5,00,000	1,00,000	1,50,000	75,000	1,75,000
Stationery	Re 0.20 per bill	80,000	20,000	24,000	16,000	20,000
Total (b)		7,00,000	1,44,000	2,14,000	1,11,000	2,31,000
Total selling and distribution costs		10,00,000	2,09,000	3,08,000	1,75,000	3,08,000

(ii) Contribution based income statement (product-wise)

Particulars	*Total*	*Products*			
		P	*Q*	*R*	*S*
Sales revenue	Rs 30,00,000	Rs 6,00,000	Rs 10,00,000	Rs 5,00,000	Rs 9,00,000
Less variable costs:					
Cost of sales	20,00,000	3,50,000	8,00,000	3,70,000	4,80,000
Other variable selling and distribution overheads	7,00,000	1,44,000	2,14,000	1,11,000	2,31,000
Total contribution	3,00,000	1,06,000	(14,000)	19,000	1,89,000
Less fixed selling and distribution overheads	3,00,000	65,000	94,000	64,000	77,000
Profit/(Loss)	Nil	41,000	(1,08,000)	(45,000)	1,12,000

Note: It is suggested that product Q may be discontinued.

EXAMINATION QUESTIONS

EQ. 6.1 Discuss the treatment of research and development expenditures in cost accounting. (*CA—May, 2005*)

EQ. 6.2 Discuss the accounting of selling and distribution overheads. (*CA—May, 2006*)

7 Job-order, Batch and Contract Costing

Introduction

This chapter describes and illustrates the systems of job/order, batch and contract costing. It is accordingly divided into three sections. Section 1 is devoted to job costing. The two subsequent sections describe and illustrate batch and contract costing respectively. The main points are summarised in the last section.

JOB/ORDER COSTING

This section illustrates job costing as a method of cost accumulation. As the system of costing depends upon the operating environment/production procedure, we first outline the nature of job costing in terms of the situations/manufacturing processes in which such a costing method is appropriate. This is followed by the cost accounting cycle for jobs. The cost recording procedure under job costing is dependent on whether the firm maintains both the general and factory ledgers or only the general ledger. The cost accumulation in job costing is illustrated here in both situations.

Nature and Suitability

As the name implies, job-order costing refers to a costing system that determines the production cost of individual orders/jobs. Under this system, costs are assigned to, and accumulated for, each job. Such a system of cost accumulation is related to the flow of production in which a firm has to work on a job in pursuance of an order received from a customer. The order may be for a single item or a number of identical items manufactured as a group, that is, a batch. For instance, a book publishing company prints each of its published books in separate batches. Thus, the job-order cost system refers to the procedures to accumulate costs when work is performed pursuant to an order, and when products are manufactured or services rendered to meet individual customers' specifications.

The essence of job costing is that as all jobs/orders are not necessarily alike, they do not pass through the same manufacturing process. In other words, since each job requires varying amounts of materials and labour and different levels of skills or attention, the cost of one job would differ from another. Thus, the cost should be recorded separately for each job. Therefore, the job-order costing system traces costs with individual production orders/jobs. In other words, in the case of certain manufacturing processes/situations, whether dealing with a product or service, is the relative uniqueness of the work (specific identity) performed for each job/client/order. Therefore, in this system of costing, each job or batch is regarded as a cost unit from the viewpoint of cost accumulation. Thus, the distinguishing feature of job-order costing is the ability to identify costs with a specific project/job/order or group of units.[1]

It follows from the above that job-order costing is, in general, appropriate in situations when each job (work) is unique, easily identifiable, and can serve as a cost objective.[2] Such a system can be appropriately applied to accumulate costs in the following situations:

1. Auto-repair shops, where each repair job requ ires varying amounts of material and labour. The mechanic will charge the cost of any replaced parts and the number of labour-hours spent in repairing.
2. Automobile assembly, where each car includes a variety of different options.
3. Printing shops, where each print order requires a different type of paper, ink, design and so on.
4. Foundries, where special parts are to be manufactured as per order.
5. Hospitals, where the costs of services provided to each patient are billed separately.
6. Contractors, shipbuilders and motion picture companies.
7. Machine shops, tool shops and design engineers.
8. Public accounting firms and other similar professions, where each audit, tax return, or management services engagement needs varying amounts of professional time and attention.
9. Furniture making firms, where they may produce a batch of similar chairs, tables, sofas, and so on. Each batch may be treated as a job.

Cost Accounting Cycle/Job Cost Sheet

This section discusses the work flow and cost recording procedure in job costing. The backbone of the job costing system is the *job cost sheet*.

On receipt of an order by a firm employing job costing, a job cost sheet is prepared. Every job order is given a specific number. For identification, a job cost sheet bearing the alloted number is maintained for each job put into production. General information in respect of the job order is recorded at the top of the job sheet. As regards specific information, the job cost sheet enumerates the appropriate inputs required in three basic categories: direct material, direct labour and overhead to carry out the order. Depending on data requirements for planning, controlling costs and evaluating performance, additional information such as labour-hours, machine-hours, quantity and quality of the materials to be used may also be recorded in the job sheet. Besides, it also contains information regarding the quantum and quality of the final output and the date by which the supply is to be made; it may also provide reference of the customer. In some job cost situations, the job sheet follows the job physically through the production process, serving not only to accumulate costs, but also providing the appropriate routing for the job.[3] The labour and materials used by each production department on the job are recorded on the job sheet. A reference of the overhead criterion such as, direct material, direct labour, machine-hour rate or labour-hour rate used is also recorded on the job sheet. On completion of the work in one department, the goods are transferred to the next relevant department along with the job sheet. This process is repeated till the job is completed. At the final stage, the job sheet contains all the materials, labour and overhead costs that were incurred on each job, as the work on an

order progresses through various stages of production. As a result, profit earned or loss suffered on the job can be easily determined. The job sheet also provides room for comparing the actual total costs with estimated costs. The reasons for variance in these costs are determined so as to prevent their future occurrence. All this information is vital to the management for evaluating employee performance and controlling the costs. Thus, the job cost sheet constitutes the backbone of the job-order system. In fact, it is a vital document for subsequent accounting records. The format of the cost sheet varies from firm to firm depending on their individual requirements. Exhibit 7.1 is the commonly used cost-sheet format. Columns may be added or deleted as circumstances warrant.

EXHIBIT 7.1 *Job Cost Sheet*

Job No.

Customer name _____ Date started _____
and address _____ Date promised _____
Description _____ Date finished _____
Quantity _____ Special remarks, if any _____

	Materials			*Labour*			*Overheads*		
	Quantity	Rate	Amount	Hours	Rate	Amount	Hours	Rate	Amount
Department 1									
Department 2									
Department 3									

Cost Summary

	Materials	*Labour*	*Overheads*	*Total*	
				Actual	*Estimate*
Department 1					
Department 2					
Department 3					
Job order price					
Profit (Loss)					

Discrepancies between actual and estimated costs are explained below:
1.
2.
3.

Recording Job Costs in Accounts

The accounting system of recording job costs will depend on whether the general ledger records all cost transactions or a special ledger called factory ledger is *separately* maintained for the purpose. It is ideal/ preferable if the cost accountant is concerned with recording the costs in respect of the use of material and labour closer to the scene of production operations in the factory ledger, and the financial accountant is concerned with paying the bills and the records are maintained in the general ledger. Such a system of record keeping also rules out duplication of clerical effort.

The *modus operandi* is that a factory ledger account is opened in the general ledger to substitute for the accounts, which have been recorded in the factory ledger. Likewise, a general ledger account is provided in the factory ledger. Such cost recording can be said to be on a *self-balancing basis* as the general ledger and the factory ledger are independent of each other. The balances in these accounts are kept equal at all times. When an entry is made in the factory ledger accounts at the general office, it is offsetted by an entry made in the general ledger account at the factory office. In view of the usefulness of keeping a separate cost record in the factory ledger, it is commended for adoption. The accounting procedure to be adopted if both the factory and general ledgers are maintained is explained first. The accounting procedure when no separate ledger is kept and all transactions are recorded in a general ledger is illustrated subsequently. We have first explained the procedure relating to the: (i) Accounting for materials, (ii) Accounting for labour, (iii) Accounting for overheads, and (iv) Accounting for completed jobs. A comprehensive illustration follows the theoretical discussion.

Accounting for Materials Certain raw materials may be purchased to cater to the specifications of particular jobs. Typically, more basic materials of common use on a number of jobs are acquired and held in the materials inventory. For each type of raw material held by the manufacturing firm, a separate materials ledger card is prepared which indicates the quantity and cost of materials held for future use. When the materials are needed for a job, the job supervisor or any other authorised person, requisitions them through a *materials requisition slip/form* which forms the basis for the entry transferring materials from materials inventory (materials and supplies) account to the concerned job account. This form identifies the job order number and lists the type and quantity of materials drawn from the inventory. Any material not used in the job for which it was requisitioned would be returned. The relevant accounting entries in the factory and general ledgers to record the (i) purchase, (ii) issue, and (iii) return of materials would be as follows:

Factory ledger:

1. Debit materials inventory/materials and supplies A/c, and Credit general ledger.
2. Debit work-in-process A/c, and Credit materials inventory/materials and supplies A/c.
3. Reversal of entry (2)

General ledger:

1. Debit factory ledger, and Credit accounts payable/cash or bank.
2. No entry
3. No entry

Materials inventory is also used for indirect materials and supplies. Often, it is not worthwhile to assign the costs of these materials directly to the jobs in which they are used, as their value is insignificant compared to the total cost of the job. Hence, they are charged to the indirect manufacturing overhead account *(indirect manufacturing costs control account).* The journal entry for the acquisition of indirect materials is the same as that for the purchase of direct materials in both sets of ledgers. However, the issue of such materials to production is considered as an addition to indirect manufacturing cost and is charged to the manufacturing overhead cost control account. Subsequently, indirect material costs are allocated to jobs on the basis of some predetermined rate of absorption of indirect overheads

Accounting for Labour In job-order costing, direct labour costs are payments for the services of employees directly engaged in manufacturing activities on jobs in progress—for example, wages paid to machinists, drill press operators, welders, and assemblers.

It is usual for manufacturing firms to pay wages to production workers on the basis of time; moreover, they are also usually provided with *a job time card* on which they record the number of hours spent on each

job on a working day. The direct labour cost of any job is ascertained by the product of the number of hours spent on that job and the worker's hourly wage rate. In determining true hourly wage rate, calculations should not be limited to only the wage amount paid to him, but should also include the employer's contribution to the provident fund, pension and insurance plans, and other fringe benefits that are paid to him by the firm.

It is important to recognise here the element of indirect labour cost in the aggregate payments made to production workers. Indirect labour includes the costs of supervisors, foremen, maintenance, security and time keeping personnel; it also includes the costs of idle time, machine setup time, rework time and overtime wages paid to direct labourers. The justification in including overtime premium in indirect overhead is the fact that overtime is the result of overall activity. If the overall level of activity were lower, the job worked on during overtime hours would be worked on during regular hours. Accordingly, overtime premiums are allocated to all jobs through the overhead account.[4] However, if overtime premium accrues on account of a ''*rush*'' job where the customer is willing to pay for shorter than normal delivery time, the premium amount can be charged directly to a specific job.

The following journal entries would be recorded in respect of the labour cost:

Factory ledger:

Debit work-in-process A/c (for direct labour) and Debit factory overhead control (A/c (for indirect labour) and *Credit general ledger*.

General ledger:

Debit factory ledger A/c, and Credit wages payable A/c /cash or bank.

Accounting for Manufacturing Overheads Unlike direct material and labour costs which can wholly and exclusively be identified with specific jobs, costs relating to manufacturing overheads cannot be conveniently traced to a particular job as overhead costs are indirect in nature and pertain to the factory or organisation as a whole. In other words, they are not caused by a specific job. Nevertheless, each job requires the services of indirect overheads. This gives rise to the need for charging each job with its fair share of indirect overheads to determine its true cost.

Manufacturing overheads can be charged to various jobs either at the actual overhead rate or a *predetermined* overhead rate. The merits of a predetermined overhead rate are: (a) It is useful in 'bidding' cases to determine the tender/quotation price; (b) It enables individual jobs to be costed as soon as they are completed and, thus, helps in providing more rapid product cost information to the management; and (c) Such a rate levels out the fluctuations which may be caused by variations in actual overhead costs and actual activity. For these reasons, manufacturing overheads are often applied to jobs at a predetermined overhead rate:

$$\text{Predetermined overhead rate} = \text{Budgeted manufacturing overheads/Budgeted activity} \quad (7.1)$$

For estimating budgeted manufacturing overheads, past historical cost data are taken as the base and adjustments are made for likely changes in prices/rates of various elements of overheads. The overheads are segregated into two categories: variable (for example, power and heating, indirect materials, repairs and maintenance) and fixed (for example, insurance, rent, property taxes, work manager's salary). Thus,

$$\text{Budgeted manufacturing overheads} = [\text{Total budgeted fixed overheads} + \text{Budgeted variable overhead rate}] \times \text{Budgeted activity} \quad (7.2)$$

The budgeted activity measure "must be a factor that is common to all jobs, has a high correlation with the incurrence of overhead costs, and is easy to measure.[5] Where most of the work is done by machines, the machine-hour rate is often used to charge indirect overheads to jobs. The labour-hour rate or direct labour cost is useful in situations where most of the work is accomplished by labour.

Like manufacturing overheads, one reasonable way of estimating budgeted activity can be to make adjustments in the previous year's activity level on the basis of the management's expectation for the coming year.
Consider Example 7.1.

EXAMPLE 7.1 *(Determining Predetermined Overheads Rate)*

Hypothetical Ltd employs job-order costing. It uses an annual predetermined rate for applying manufacturing overheads to jobs. The company furnishes you with the following information regarding its overheads for the coming year at normal activity: Fixed overheads, Rs 4,00,000; and Variable overheads, Rs 3,00,000.

The estimates of the direct labour cost, direct labour hours and machine-hours at normal activity along with a set of correlation coefficients between overheads and various measures of activity, as compiled from past records, are also given:

	Normal level of activity	*Correlation coefficient with overheads*
Direct labour cost	Rs 10,00,000	0.7
Direct labour hours	2,00,000	0.8
Machine hours	1,00,000	0.6

Determine the predetermined (i) fixed, (ii) variable, and (iii) total overhead rates.

SOLUTION

Predetermined overhead rates should be based on direct labour-hours (DLH):

(i) Predetermined fixed overhead rate = Rs 4,00,000 ÷ 2,00,000 = Rs 2
(ii) Predetermined variable overhead rate = Rs 3,00,000 ÷ 2,00,000 = Rs 1.50
(iii) Total predetermined overhead rate = Rs 7,00,000 ÷ 2,00,000 = Rs 3.50

Further assume that Hypothetical Ltd during the first quarter received an invitation from a regular customer to bid on a job. The job was estimated to require Rs 1,00,000 of direct materials and the following: Direct labour cost, Rs 50,000; Direct labour-hours, 15,000; and Machine-hours, 5,000

Determine the bid price the company should quote assuming its normal practice of charging 20 per cent on factory cost to cover other administrative overheads and profit. Assume further that the company uses a predetermined factory overhead rate to assign factory overheads to jobs.

SOLUTION

Job Cost Sheet to Determine the Bid Price

Particulars	*Amount*
Direct materials	Rs 1,00,000
Direct labour cost	50,000
Prime cost	1,50,000
Add factory overheads (15,000 direct labour-hours @ Rs 3.5 per hour)	52,500
Factory cost	2,02,500
Add 20 per cent for administrative overheads and profit	40,500
Bid price	2,43,000

Over-applied or Under-applied Manufacturing Overheads When predetermined overhead rate is used as the basis of absorption of overheads, it is seldom that the total overhead costs applied to jobs in a given period are equal to the total overhead costs of that period. When the applied overhead exceeds the actual, it is referred to as over-applied/absorbed overhead. It is known as under-applied/absorbed in case the applied is less than the actual. The difference between the actual and applied manufacturing overhead costs is designated as the *variance*.

Suppose in Example 7.1, the company's actual overheads were Rs 1,80,000 and total direct labour-hours used were 45,000 in the first quarter. The applied overheads would amount to Rs 1,57,500 [45,000 DLH × Rs 3.50 (Total predetermined overhead rate per hour)]; overhead is under-applied by Rs 22,500 (Rs 1,80,000 – Rs 1,57,500).

Disposition of Variance Overhead variances may be disposed of by following either of the two methods: (i) They may be assigned to the income statement of the current period by charging the entire amount to the cost of goods sold account; or (ii) They may be considered as the cost of production of the current period and accordingly may be pro-rated to work-in-process, finished goods and cost of goods sold. The treatment would depend on the nature of such variance.

If the variance has been an outcome of unusual events of the current period, it should be charged to the cost of goods sold. But if such a variance has been caused by errors in estimation or fundamental changes in cost structure, it should be pro-rated over work-in-process, finished goods and cost of goods sold. For the firm in Example 7.1, consider the following additional information:

Job No.	*Direct costs*	*Overheads charged In quarter*	*Status of job at the end of the quarter*
50	Rs 2,20,000	Rs 72,000	Cost of goods sold
51	1,80,000	45,000	Finished goods in inventory
52	1,30,000	40,500	Work-in-process inventory
	5,30,000	1,57,500	

Show the process of adjusting under-applied overheads.

SOLUTION

Manufacturing/Factory Overhead Adjustment

Account	*Over-charged in quarter*	*Percentage of overhead applied in quarter*	*Under-applied overheads (Rs 22,500) × (percentage)*	*Total costs assigned to jobs after adjustment*
Cost of goods sold	Rs 72,000	45.7	Rs 10,282.50	Rs 82,282.50
Finished goods inventory	45,000	28.6	6,435.00	51,435.00
Work-in-process inventory	40,500	25.7	5,782.50	46,282.50
	1,57,500	100.00	22,500.00	1,80,000.00

The following journal entries would be required to give effect to manufacturing overheads.

Factory ledger

1. Debit Factory Overhead Control A/c, and Credit General Ledger
   (For indirect manufacturing costs incurred).
2. Debit Work-in-Process/Individual Jobs A/c, and Credit Factory Overhead Control A/c
   (For charging indirect overheads to jobs).
3. Debit Cost of Goods Sold A/c, and Credit Factory Overhead Control A/c
   (For charging under-applied overheads to cost of goods sold account under first method).
   Entry number (3) would be reversed in the case of over-applied overheads.
4. Debit Work-in-Process/Individual Jobs
   Debit Finished Goods inventory
   Debit Cost of Goods Sold, and
   Credit Factory Overhead Control A/c
   (For charging under-applied overheads under pro-rating method).
   Entries (3) and (4) would be reversed in the case of over-applied overheads.

General ledger

1. Debit Factory Ledger A/c, and Credit Various Credits (Accounts Payable), Credit Accumulated Depreciation, and so on.
   (For indirect manufacturing costs incurred).

For subsequent transactions no entry is required in the general ledger as these transactions do not affect the general ledger accounts.

Accounting for Completed Jobs Normally, in a job costing system when work on a job is completed, it would be available for delivery to a customer. At the time of completion, all work-in-process account balances pertaining to that job are transferred directly to cost of goods sold account. In case, production is made in anticipation of future sale, relevant costs from work-in-process will be transferred to the finished goods inventory account. The journal entries in the factory ledger would be as follows:

1. *Production is as per order*
   Debit Cost of Goods Sold A/c, and
   Credit Work-in-process A/c
   (Transfer of cost on completion of the job).
2. *Production is for future sale*
   (a) Debit Finished Goods Inventory A/c, and
   Credit Work-in-process A/c
   (b) *At the time of sale*
   Debit Costs of Goods Sold A/c, and
   Credit finished goods inventory.

Accounting for Non-Manufacturing Costs Costs such as sales commissions, freight and delivery charges, can sometimes be related directly to particular jobs. Since these costs are incurred subsequent to the completion of the job, they cannot be classified as the cost of production. They should be separately shown as the direct costs of selling, distributing, and servicing particular jobs in job cost sheets which can be modified to add non-manufacturing costs. This information is useful in estimating future job costs and in bidding on prices.

We now illustrate the cost recording procedure in job costing with a comprehensive example.

EXAMPLE 7.2 *(Job Costing System: Factory Ledger and General Ledger Method)*

Jay Engineering Company Ltd uses a job-order cost system. The following is a summary of its operations during January:

1. Purchases of raw materials and supplies, Rs 37,500.
2. Materials and supplies were requisitioned and issued as follows:
   Direct materials:

Job No.	101	Rs 6,000	
	102	9,000	
	103	1,400	Rs 16,400
Indirect materials			400

3. Factory payroll sent to the general office for payment was distributed as follows:
   Direct labour:

Job No.	101	Rs 5,400	
	102	6,000	
	103	600	
			Rs 12,000
Indirect labour			4,000

4. Indirect miscellaneous manufacturing costs incurred, Rs 5,200.
5. Indirect manufacturing costs were applied using a rate of 70 per cent of direct labour cost.
6. Job No. 101 (100 units) and Job No. 102 (50 units) were completed and transferred to finished goods.
7. Goods despatched to customers were as follows: From Job No. 101, 50 units; From Job No. 102, 100 units.

Prepare the required ledger accounts to record the above transactions in the factory ledger.

SOLUTION

Job Ledger

	Job No. 101	*Job No. 102*	*Job No. 103*
Raw materials and supplies	Rs 6,000	Rs 9,000	Rs 1,400
Direct labour	5,400	6,000	600
Indirect manufacturing costs applied	3,780	4,200	420
	15,180	19,200	2,420

Factory Ledger Accounts

Raw Materials and Supplies A/c

To general ledger (purchase of inventory)	Rs 37,500	By work-in-process	Rs 16,400
		By factory overhead control A/c	400

Work-in-Process A/c

To raw materials and supplies	Rs 16,400	By finished goods (cost of Job Nos. 101 and 102	Rs 34,380
To general ledger (direct labour payment)	12,000		
To factory overhead control (applied A/c)	8,400		

Finished Goods Inventory A/c

To work-in-process	Rs 34,380	By cost of goods sold (Rs 7,590 + Rs 12,800)	Rs 20,390

Cost of Goods Sold A/c

To finished goods inventory	Rs 20,390

Factory Overhead Control A/c

To raw materials and supplies	Rs 400
To general ledger (indirect labour payment)	4,000
To general ledger (miscellaneous expenses)	5,200

Factory Overhead Control Applied A/c

By work-in-process	Rs 8,400

General Ledger Accounts

By raw materials and supplies	Rs 37,500
By work-in-process	12,000
By factory overhead control A/c	4,000
By factory overhead control A/c	5,200

Note Ledger accounts are not balanced as the transactions pertain to only a month's period.

General Ledger Accounts

Factory Ledger (A/c)

To accounts payable	Rs 37,500
To wages payable	16,000
To miscellaneous credits	5,200

Accounts Payable A/c*

By factory ledger A/c	Rs 37,500

Wages Payable A/c*

By factory ledger A/c	Rs 16,000

Miscellaneous Credits A/c*

By factory ledger A/c	Rs 5,200

*Debits in these accounts would be made when payments are made.

The above cost recording procedure is valid when a *separate* factory ledger is maintained. We now enumerate the accounting system when the general ledger records *all* transactions and no separate factory ledger is maintained. A comprehensive illustration (Example 7.3) demonstrates the actual recording procedure.

EXAMPLE 7.3 *(Job Order Costing: General Ledger Method)*

The following transactions occurred at the Small Machine Manufacturing Company Ltd:

1. Issued Rs 1,000 in supplies from the materials inventory.
2. Purchased materials worth Rs 20,000.

3. Purchased materials costing Rs 15,800 on cash basis.
4. Paid for the materials purchased.
5. Issued materials worth Rs 17,000 to the production department.
6. Incurred wages of Rs 42,000 which were debited to a temporary account called the wages payable account. Of this amount, Rs 8,000 was withheld for taxes; the balance was paid in cash to the employees.
7. Analysis of the wage accounts reveals that 60 per cent was direct labour, 30 per cent indirect manufacturing labour and 10 per cent administrative and selling costs.
8. Paid cash for utilities, power, equipment maintenance, and other miscellaneous items for the manufacturing plant. The total amount was Rs 21,600.
9. Applied overhead on the basis of 175 per cent of direct labour costs.
10. Depreciation on plant and equipment is to be charged at Rs 10,500.
11. The following balances appeared in the accounts of company:

	Opening	*Closing*
Materials inventory	Rs 37,050	—
Work-in-process inventory	8,250	—
Finished goods inventory	41,500	Rs 33,200
Cost of goods sold		65,850

You are required to prepare T accounts to show the costs during the period.

SOLUTION

Ledger Accounts

Materials Inventory A/c

To balance b/d	Rs 37,050	By factory overhead control A/c	Rs 1,000
To accounts payable	20,000	By work-in-process inventory	17,000
To cash (purchases)	15,800	By balance c/d	54,850
	72,850		72,850
To balance b/d	54,850		

Work-in-Process Inventory A/c

To balance b/d	Rs 8,250	By finished goods inventory A/c	Rs 57,550
To raw materials inventory	17,000	By balance c/d	37,000
To factory overhead control A/c	44,100		
To wages control A/c (Rs 42,000 × 0.60)	25,200		
	94,550		94,550
To balance b/d	37,000		

Finished Goods Inventory A/c

To balance b/d	Rs 41,500	By cost of goods sold	Rs 65,850
To work-in-process inventory (balancing figure)	57,550	By balance c/d	33,200
To balance b/d	33,200		
	99,050		99,050

Factory Overhead Control A/c

To raw materials inventory	Rs 1,000	By work-in-process A/c	Rs 44,100
To wages control A/c	12,600	(Rs 25,200 × 1.75)	
(Rs 42,000 × 0.30)		By factory-overhead control applied A/c	1,600
To cash (for various overheads)	21,600	(under-absorbed)	
To accumulated depreciation to pant	10,500		
	45,700		45,700

Apart from the manufacturing firms, service organisations such as engineering, consulting and accounting, firms can also usefully apply the job-order costing system. The job-order costing procedure is basically the same in both service and manufacturing organisations, except that the former do not make use of any direct materials. Instead of having an indirect manufacturing overhead account, service firms can have the title of service overhead account, to represent and accumulate costs in respect of indirect materials, indirect labour and other overheads.

Evaluation

Job order costing is useful in the following ways:

1. Job costing data can be utilised for estimating the production costs of specific jobs or lots of production. If, for example, a customer places an order with the firm to manufacture a sepcific type of product that has unique characteristics different from the other products manufactured by the company, a job-order cost system should be utilized to accumulate the production costs associated with this product. In other words, job costing system provides the basis for determining the 'bidding' price for similar jobs that will be considered in the future.
2. Estimates of future job costs serve not only as a basis for bidding and price setting but also as a standard for measuring efficiency and evaluating the performance through comparisons with the actual costs incurred. Since under this system, all costs such as direct materials, direct labour and other expenses which can be traced directly to particular or specific jobs must be forecast as separate identifiable amounts, subsequent comparisons between actual job costs incurred and estimated job costs can be made on an item-by-item basis. This process helps the management in assigning responsibilities for variance in costs to different responsibility centres that worked on the job. Thus, this process assists the management in discharging its control function.
3. From the point of view of accounting also, the system is easy to operate as the costs are recorded order or job-wise.
4. Finally, job cost sheets which are the focal point of job order system can be utilised by the management to segregate jobs on the basis of contributions/profits made by them. This information, in turn, will help the management in deciding which types of jobs should be accorded priority.

The only drawback visualised in the system is that it requires detailed record-keeping for each of the jobs, and, therefore, may prove to be more expensive to use.

BATCH COSTING

This section illustrates batch costing, as a system of cost accumulation. As mentioned earlier, batch costing is a variant of job costing. It is a natural type of system to be utliised in situations when a firm manufactures products in readily identifiable batches or definite lots.

The I.C.M.A. London has defined batch costing as ''that form of specific order costing which applies where similar articles are manufactured in batches either for sale or for use within the company''. In most cases, this costing is similar to job-costing. "A batch is a cost unit which consists of a group of similar articles, which maintain its identity throughout one or more stages of production:" In such a system, each batch can serve as a cost objective for identification of costs as each job is a cost objective in the job-order costing system. Hence, the cost recording procedure in the batch costing system is similar to that of the job costing system.

For identification purposes, each batch is required to be numbered in batch costing as each job is numbered in the job costing system. Similarly, direct material, direct labour and any other direct costs which can be traced directly to a specific batch are charged to it and indirect manufacturing overheads are applied at the predetermined rate. Thus, the normal principles of job-order costing system apply to batch costing also. However, there are some points of distinction between the two.

The unique feature which distinguishes job costing from batch costing is that, while in the former production is tailored to meet the customers' specifications, in the latter, in general, goods are produced to inventory them for future sale to customers. The situations in which batch costing might gainfully be applied include, furniture making, small tool making, manufacture of fabric, clothing and toys, as well as certain food processing undertakings.

The determination of batch/quantity to be produced in each job is another salient feature which distinguishes it from job costing. The determination of the appropriate size of the batch produced necessitates a resolution of conflicting goals. Production in large quantities implies lower *setting-up* costs as such costs are normally fixed per batch. Thus, the unit cost falls with an increase in size of the batch. But an increase in size of the batch produced would involve higher carrying costs of holding inventory in stock. These costs include the cost of storage, risk of pilferage, spoilage and obsolescence and loss interest on the investment blocked in inventories. Therefore, the size of batch produced should neither be too small nor too large. On the basis of a trade-off between benefits derived from setting-up costs and the costs of carrying the inventory, an appropriate production level of the batch should be determined. Stated with reference to the cost perspective, the economic batch quantity (EBQ), can be determined by Equation 7.3. This is similar to the method of determining the economic order quantity (EOQ):

$$EBQ = \sqrt{2\,AS/C} \tag{7.3}$$

Where A = annual requirements of the product
S = setting-up costs per batch
C = carrying cost per unit of inventory per annum

EXAMPLE 7.4

The following details are available in respect of a small tool manufacturing firm:

Annual estimated demand per year (units)	1,600
Cost of production per unit	Rs 5
Carrying costs per unit for one year	1
Setting up cost per batch	50

Determine EBQ.

SOLUTION

Using Equation 7.3,

$$\text{EBQ} = \sqrt{\frac{2 \times 1,600 \times \text{Rs } 50}{\text{Rs } 1}} = 400 \text{ units}$$

CONTRACT COSTING

Contract costing is also a variant of job costing. It is a specialized costing system, which applies to construction works. This section outlines and illustrates contract costing. It first discusses the cost accumulation process in contracts, which are completed in one accounting year. It is followed by a discussion of determination of profit on incomplete contracts. *Cost plus* contracts are covered in the last part.

Contract Accounts

A separate account is kept for each individual *contract* for the purpose of cost accumulation and profit determination. Each contract account constitutes the *cost unit* as well as the *cost centre*. Generally, under other costing systems, cost is allocated first to the cost centre (may be a department or process) and then to the individual jobs (cost units). The nature of contract work is such that most of the costs (material, labour and overheads) are directly traceable to the contract. All direct costs are debited to the contract account; indirect/overhead costs relating to the overall administration and other central services are apportioned to each contract on some predetermined equitable basis. On completion of the contract, the contract price is credited to the contract account; excess credit and excess debit respectively represent profit and loss from the contract. Exhibit 7.2 summarises the contract account when the contract is complete within an accounting year.

EXHIBIT 7.2 *Proforma Contract Account*

Particulars	*Amount*	*Particulars*	*Amount*
To materials (direct)		By materials returned to store	
To materials (issued from the store)		By materials transferred to another contract site	
To wages and salaries		By materials sold	
To sub-contract payments[1]		By abnormal loss (theft of materials, loss of plant due to fire, and so on.)	
To other direct expenses[2]			
To indirect expenses (apportioned share of overhead)		By closing stock of materials	
To plant and equipment (purchase price/book value)		By plant and equipment (closing balance)	
To profit and loss A/c (surplus)		By profit and loss A/c (deficiency)	

[1]Payment for specialised character jobs such as lifts, steel work, heating installation, and so on.
[2]Include architects' and consultants' fees, hire charges of plant and equipment, and insurance of contract site, and so on.

Profit Determination on Incomplete Contracts

The determination of profit in case of contracts which are not completed in one accounting year is an important aspect of contract accounting.

The actual profits will be known only on completion of the contract, but a contractor would be interested in determining the profits periodically to even out fluctuations in the profits of the firm. When a part/proportion of profits is not taken into account each year, the contractor's annual accounts may show low profits (or even a loss) for each year in which no major contract(s) is/are completed and exceptionally high profits in any year in which a large contract(s) is/are completed. Thus, there would be wide fluctuations in the contractor's annual profits making inter-year profits incomparable. The profits to be accounted for in different years will depend on the following considerations:

1. No profit is accounted for in the early stages of the contract. Conventionally, a contract is deemed to be in early stages if less that one-fourth of the job has been completed. In other words, no profit should be considered unless one-fourth of the contract is complete. However, if any loss is anticipated, it should always be provided for.
2. Profit should be considered on only that part of the work which is certified by the contractee's architect and no profit should be reckoned on work completed but not certified.
3. Adequate provision should be made for contingencies likely to affect the completion of the work. For instance, conventionally, one-third of the expected profits are taken into account if the contract, as certified by the architect, is between one-fourth and one-half complete, and two-thirds are considered when the job is half or more than half complete.
4. The profit to be considered should be in the proportion which the cash received from the contractee bears to the amount of certified work.

   Based on the foregoing conventions, the determination of profit on incomplete contracts to be credited to profit and loss account can be summarised as follows:

   (a) When work certified is 25 per cent or more but less than 50 per cent of the total contract

$$\text{Estimated (notional) profit} \times \frac{1}{3} \times \frac{\text{Cash received}}{\text{Work certified}} \tag{7.4}$$

   (b) When work certified is 50 per cent or more

$$\text{Estimated (notional) profit} \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}} \tag{7.5}$$

   The difference between the estimated and transferred profits represents the *reserve for future contingencies* left in the contract account to be carried forward to the following year(s).
5. To show the *pari passu* relationships between work certified and the amount of profit to be transferred to the current year's profit and loss account, the estimated profit can be computed on the basis of Equation 7.6. However, this equation should be applied when at least 25 per cent of the work is complete.

$$\text{Estimated profit} \times \frac{\text{Work certified}}{\text{Contract price}} \times \frac{\text{Cash received}}{\text{Work certified}}$$

$$\text{Estimated profit} \times \frac{\text{Cash received}}{\text{Contract price}} \tag{7.6}$$

Estimated Profit

When a contract is nearing completion, the contractor would be in a better position to estimate future profits with a greater degree of accuracy. Since the contract has reached on advanced stage, he would find himself in a position where he can estimate the likely future costs to be incurred to get the contract completed and a margin for contingencies. These costs can be added to the costs already incurred on the contract. The *total*

cost so arrived at can be deducted from the contract price to arrive at the profit figure. Even in this case, the profit to be carried to the profit and loss account is generally required to be adjusted both for future contingencies and the cash received:

$$\text{Estimated total profit} \times \frac{\text{Value of work certified}}{\text{Contract price}} \times \frac{\text{Cash received}}{\text{Work certified}} \tag{7.7}$$

$$\text{Estimated profit} \times \frac{\text{Value of work certified}}{\text{Contract price}} \tag{7.8*}$$

*When cash position is satisfactory.

$$\text{Estimated total profit means: [Contract price} - \text{Costs already incurred} + \text{Estimated future costs} + \text{Margin for contingencies]} \tag{7.9}$$

In case of non-availability of information about work certified, profit

$$= \text{Estimated total profit} \times \frac{\text{Cost of work to date}}{\text{Estimated total cost}} \tag{7.10}$$

Exhibits 7.3 provides the format of contract account, Exhibit 7.4 presents information in the balance sheet and Exhibit 7.5 the contractee account.

EXHIBIT 7.3 *Proforma Contract Account*

(When the Work is in Process)	
To materials (direct)	By materials returned to store
To materials (ex-store)	By materials transferred to contract sit (specify number)
To wages and salaries	
To sub-contract payments	By materials sold
To other direct expenses	By abnormal loss
To plant (purchased)	By closing stock of materials
To profit and loss A/c (transfer part of realised profits)	By closing value of plant
	By work-in-progress
To reserve for future contingencies	Certified
	Uncertified
(When the Work is Completed)	
To work-in-progress (opening)	By reserve for future contingencies
Work certified	By materials returned
Work uncertified	By plant returned
To plant	By any other item to be credited
Opening balance	By contractee (with the contract price)
Purchase	
To other items of expenses	
To profit and loss A/c (profit)	

EXHIBIT 7.4 *Skeleton Balance Sheet*

Liabilities	*Assets*
Profit and loss A/c [will include profit on contract) (specify the contract number)]	Work-in-progress
	Work certified
Less loss on contract (specify the contract number)	Work uncertified

(*Contd.*)

(*Contd.*)

Sundry creditors	Less reserve for contigencies
Wages accrued	Less contractee (payment received)
Direct expenses accrued	Materials in hand
Any other expenses(specify)	Materials at site

EXHIBIT 7.5 *Contract A/c*

To balance c/d	By bank (amount received)
	By balance b/d

Cost Plus Contracts

Cost plus contracts are the contracts in which the contractor is reimbursed not only the costs incurred by him in executing the contract, but also, remunerated a stipulated profit for rendering his services. The stipulated profit may either be a fixed amount decided in advance or determined subsequently with reference to certain percentage of costs to be incurred by him. The latter approach is more commonly employed as such contacts are generally undertaken when the cost of a contract cannot be computed with a reasonable degree of accuracy at the time of undertaking the job. A few examples of such contracts are construction of a newly designed building, aircraft, ship, machine; or any urgent construction work; or work which is spread over a long period of time during which the expected prices of basic inputs are liable to fluctuate, that is, contracts which require a significant part of materials to be imported from other countries at foreign exchange rates likely to be subject to considerable fluctuations.

Cost plus contracts are useful from both the points of view of the contractor/manufacturer and contractee/customer. The manufacturer is assured of recovering all his costs and is, therefore, protected against possible losses which may arise due to upward revision of material prices, wages and other items of cost. In other words, there is a built-in *escalation clause* to protect his interests in such contracts. They are equally beneficial to the clients, especially those who are particular about the quality of work and cost is not a problem for them. However, such contracts are not without drawbacks. For instance, there is no incentive for the contractor to economize specially in terms of the costs incurred. For a reduction in costs implies less remuneration for him, if his share is based on the percentage of costs, which is most likely in such contracts.

To overcome these problems, the following principles may be followed:

1. Certain broad limits regarding the type of materials to be used and the prices to be paid for them should be agreed upon in advance.
2. Likewise, rates of allowable wastage and spoilage should also be agreed upon at the time of undertaking the contract. By such agreements, the client will not be penalised for inefficiencies of the contractor in terms of abnormal wastage, high costs of material and so on.
3. Again, the broad limits of the category of labour force and the rate which is payable for each category should be laid down specifically in advance. As far as possible, the agreement should provide that overtime payments will normally not be allowed without the sanction and approval of the contractee.
4. After completion of the contract, the mode of valuation of the plant, which had been specially purchased for the contract, should be decided in advance. Likewise, depreciation rates of existing plants should be predetermined. The basis of overhead charges should also be outlined to avoid controversy later on.

In a nutshell, there is an obvious need for establishing clear-cut parameters for every probable item of cost as part of the agreement between the contractor and the contractee at the contract initiation stage. Above all, the agreement should provide for a fair return to the contractor so that his interest and motivation in the contract are sustained.

SUMMARY

- In this chapter we have discussed the determination of cost of a job defined as the work done in pursuance of an order from a customer for the supply of a specific type of product to suit his needs. The job costing system is applicable in the case of a single item or batch. It is also applicable both to manufacturing and service activities.
- In this system of costing, each job is regarded as a cost unit as each job is different from the other. Such a system of cost accumulation is applicable to firms such as auto repair shops, printing shops, foundaries, hospitals, machine/tool shops, design engineers, accounting firms, furniture-making firms and so on.
- The procedure of determining cost according to this method is to trace/attach costs of the specific job by means of a cost sheet set up for each job. Direct materials and direct labour costs are traced directly to the specific jobs; indirect manufacturing costs are applied to jobs by means of a predetermined overhead application rate. The pre-determined rate = Budgeted overheads ÷ Budgeted/normal activity.
- At the end of the accounting period, there will be an over or under-applied overhead balance. If this balance is insignificant in nature, it is usually closed to the cost of goods sold, but significant amounts may need to be *pro-rated* to appropriate accounts, that is, work-in-process, finished goods and cost of goods sold. The procedure of recording cost depends on whether a firm maintains only a general ledger or whether it records transactions in a general as well as a factory ledger.
- A variant of job costing is contract costing. The cost accumulation in this system of costing is done through a contract account. The difference between the contract price and various direct and indirect costs incurred in completing the contract is the profit or loss.
- In the case of contracts which extend beyond one accounting year, account is to be taken of profit on a *notional* basis, as the actual profit will be known only after the completion of the contract. The variables having a bearing on the determination of profit on incomplete contracts are (i) the extent of the completion of work, (ii) the extent of work certified by the architect, and (iii) cash received from the contractee. Conventionally, no credit is taken for profit unless the contract is complete to the extent of 25 per cent. The difference between the profit estimated and transferred represents reserves for future contingencies. The amount of profit to be accounted for in different situations is computed as given below:

  (i) *When the work certified is 25 per cent or more but less than 50 per cent of the total contract*

$$\text{Estimated (notional) profit} \times \frac{1}{3} \times \frac{\text{Cash received}}{\text{Work certified}}$$

  (ii) *When the work certified is 50 per cent or more*

$$\text{Estimated (notional) profit} \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}}$$

  (iii) *When the contract work is nearing completion*

$$\text{Estimated total profit} \times \frac{\text{Value of work certified}}{\text{Contract price}} \times \frac{\text{Cash received}}{\text{Work certified}}$$

  The estimated total profit = Contract price – (Costs already incurred + Estimated future costs + Margin of contingencies)

REFERENCES

1. Morse, W.J., *Cost Accounting*, (Addison-Wesley Publishing Co., Massachusetts), 1978, p. 55.
2. Chatfield, M. and Weilson, D., *Cost Accounting*, (Harcourt Brance Joyanvich, New York), 1983, p. 115.
3. Moriarity, S. and Allen, C.P. *Cost Accounting*, (Harper and Row Publishers, New York), p. 516.
4. Morse, W.J., *op. cit*., p. 58.
5. *Ibid*., p. 66.

SOLVED PROBLEMS

P. 7.1 The normal expenses attributable to machine No. III and the normal hours for which the machine is expected to be utilized in the current year are indicated below:

Fixed		Rs 2,000
Variable:		
Power	Rs 1,500	
Repairs	900	
Lubricants	600	3,000
		5,000
Predetermined normal hours of working:		
To make ready	200	
Running on jobs	800	
Total	1,000	
From the data furnished below, compute the cost of job No. 8237:		
Materials consumed (10 units of Rs 5 per unit)		Rs 50
Direct labour cost:		
To make ready: 2 machine-hours at Re 1		2
Running on job: 8 machine-hours at Re 1		8
		60

Note: Whenever a job is to be put on the machine, the machine is cleaned, any tools or jigs already on the machine are removed, and new tools and so on. suitable for the particular job are fitted before commissioning the machine for the job and the time involved is to be charged to the job as 'Make ready' time.

SOLUTION

Job Cost Sheet

Customer name ..... Job No. 8237 .....
Description and quantity ..... Date started .....
Special remarks ..... Date promised .....
(Machine III is used on job) ..... Date finished .....

Particulars	*Rate*	*Hours/units*	*Amount*
Materials (Requisition No....)	Rs 5	10	Rs 50
Wages: (To make ready)	1	2	2
(Running on job)	1	8	8
Prime cost			60
Factory overheads:			
To make ready	2	2	4
Running on job (see working note)	5.75	8	46
Cost of production			110

Working Notes

Determination of factory overheads: Total normal machine-hours are 1,000; of which setting-up time (to make ready) is 200 hours. Fixed expenses will be pro-rated on the basis of 1,000 hours and variable expenses on the basis of 800 hours the machine worked. The rates, so determined would be:

Fixed overhead rate to make ready (Rs 2,000, total expenses ÷ 1,000)	Rs 2.00
Variable (Rs 3,000, total expenses ÷ 800)	3.75
Overhead rate to make ready	2.00
Overhead rate for running time would be the sum of the two rates, (Rs 2 + Rs 3.75)	5.75

P. 7.2 The Rathi Engineering Company Ltd manufactures special-purpose small machines to order. In the beginning of the year, there were two jobs in process, namely, Job No. 100 and Job No. 101. The following costs were applied to these jobs in the previous year:

	Job 100	*Job 101*
Direct materials	Rs 25,000	Rs 40,000
Direct labour	20,000	15,000
Overheads	22,200	16,650
	67,200	71,650

During January of the current year, the following transactions took place:

1. Raw materials costing Rs 2,00,000 were purchased on account.
2. Supplies costing Rs 40,000 were purchased for cash.
3. Jobs 102, 103 and 104 were started and the following costs applied to them:

	Job 102	*Job 103*	*Job 104*
Direct materials	Rs 15,000	Rs 50,000	Rs 35,000
Direct labour	25,000	30,000	20,000

4. Jobs 100 and 101 were completed; additional direct labour costs incurred on them were Rs 10,000 and Rs 20,000 respectively.
5. Wages paid to production employees during January totalled Rs 1,25,000, of which accrued wages of the previous year were Rs 25,000; wages payable at the end of the current month were Rs 20,000.
6. Depreciation for the month totalled Rs 50,000.
7. Utilities bills totalling Rs 60,000 were received for the January operations.
8. Supplies costing Rs 10,000 were used.
9. Miscellaneous overhead expenses totalled Rs 12,000 for January.

   Actual overhead is applied for individual jobs at the end of each month using a rate based on actual direct-labour costs. You are required to

   (a) Determine the overhead rate for the month of January.
   (b) Pass the necessary journal entries for each of the transactions that book place during January.
   (c) Specify all subsidiary records affected by each transaction.
   (d) Determine the amount of profit earned on Jobs 100 and 101, assuming job prices of Rs 1,10,000 and Rs 1,70,000 respectively.
   (e) Prepare a statement of cost of goods manufactured.

SOLUTION

(a) Determination of overhead rate (January)

Indirect labour:			
Wages paid		Rs 1,25,000	
Less wages outstanding of previous year		(25,000)	
Add wages outstanding of current month		20,000	
		1,20,000	
Less direct labour			
Job 100	Rs 10,000		
101	20,000		
102	25,000		
103	30,000		
104	20,000	(1,05,000)	Rs 15,000
Depreciation			50,000
Utilities			60,000
Supplies			10,000
Miscellaneous overhead			12,000
Total overheads			1,47,000
Actual direct labour cost			1,05,000
Overhead rate (Rs 1,47,00 0 ÷ Rs 1,05,000) × 100 (per cent)			140

(b) and (c) Subsidiary records affected by the fransactions are shown along with journal entry.

Particulars		*Dr Amount*	*Cr Amount*
Stores control A/c	Dr	Rs 2,00,000	
To accounts payable			Rs 2,00,000
(Inventory ledger cards, payable ledger)			
Supplies inventory A/c	Dr	40,000	
To bank			40,000
(Supplies inventory may have separate records and accordingly subsidiary ledgers would be affected)			
Work-in-process A/c	Dr	1,00,000	
To stores control			1,00,000
(Job cost sheets and inventory ledger cards)			
Factory overhead control A/c	Dr	15,000	
(individual labour)			
Work-in-process	Dr	1,05,000	
To wages payable			1,20,000
(Overhead ledger cards, job cost sheets and payable ledger)			
Wages payable A/c	Dr	1,25,000	
To bank/cash			
(Payables ledger)			1,25,000
Factory overhead control A/c	Dr	1,32,000	
To accumulated depreciation			50,000
To accounts payable (utilities)			60,000

(*Contd.*)

(*Contd.*)

To supplies inventory			10,000
To sundry accounts			12,000
(overheads ledger *cards payables ledger and fixed assets ledger)*			
Accounts payable (utilities)	Dr	50,000	
To bank/cash			50,000
(Accounts payable ledger)			
Work-in-process A/c	Dr	1,47,000	
To factory overhead control			1,47,000
(Job cost sheets and overhead ledger cards)			
Finished stock inventory	Dr	2,10,850	
To work-in-process			2,10,850

(d) Job cost sheet (for jobs 100 and 101)

Particulars	*Job 100*	*Job 101*
Opening work-in-process		
Direct materials	Rs 25,000	Rs 40,000
Direct labour	20,000	15,000
Overhead	22,200	16,650
	67,200	71,650
Add current month cost		
Direct labour	10,000	20,000
Overhead (140 per cent)	14,000	28,000
Total cost	91,200	1,19,650
Profit (balancing figure)	18,800	50,350
Job prices	1,10,000	1,70,000

(e) Statement of cost of goods manufactured for the month of January

Particulars		*Amount*
Direct materials		Rs 1,00,000
Direct labour		1,05,000
Prime cost		2,05,000
Add factory overheads		
Indirect labour	Rs 15,000	
Depreciation	50,000	
Utilities	60,000	
Supplies	10,000	
Miscellaneous overheads	12,000	1,47,000
Gross factory cost		3,52,000
Add work-in-process (opening)		
Job 100	67,200	
Job 101	71,650	1,38,850
Less closing work-in-process		
Job 102 (Rs 15,000 + Rs 25,000 + Rs 35,000)	75,000	
Job 103 (Rs 50,000 + Rs 30,000 + Rs 42,000)	1,22,000	
Job 104 (Rs 35,000 + Rs 20,000 + Rs 28,000)	83,000	(2,80,000)
Cost of goods manufactured		2,10,850

P.7.3 The Philips Company Ltd produces gramophone records and has several different recording companies as clients. Since each order is separately identifiable, a job order accounting system is in use. Two departments are utilized, and the following overhead budget data at normal activity are available for the whole current year as well as the actual overhead cost for the first month (January):

	Overhead budget for the current year at normal level of activity	*Actual overheads(January)*
Department X		
Fixed	Rs 7,20,000	Rs 66,000
Variable	6,00,000	63,000
Department Y		
Fixed	10,80,000	87,000
Variable	9,00,000	51,000

During January, 2 jobs were in production (209 and 210). The following is a summary of some of the data from their respective job cost sheets.

	Job 209		*Job 210*	
	Departments		*Departments*	
	X	Y	X	Y
Direct labour	Rs 1,08,000	Rs 15,000	Rs 36,000	Rs 42,000
Direct labour-hours	24,000	3,000	6,000	9,000
Machine-hours	4,800	24,000	3,000	12,000

The estimates of the departments' direct-labour cost, direct labour-hours, and machine-hours at normal activity are also provided in the following table, along with a set of correlation coefficients between overheads and the various measure of activity that have been compiled from past production and cost data.

	Department X		*Department* Y	
	Normal level of activity	*Correlation co-efficient with overheads*	*Normal level of activity*	*Correlation co-efficient with overheads*
Direct labour cost	Rs 15,00,000	0.8	Rs 7,20,000	0.6
Direct labour-hours	3,00,000	0.9	1,50,000	0.8
Machine-hours	90,000	0.5	6,00,000	0.9

During January, the company received an invitation from a regular customer to bid on a job which, if won, would be executed in February. The job was estimated to require Rs 1,50,000 of materials and to involve:

	Department X	*Department* Y
Direct labour cost	Rs 75,000	Rs 33,000
Direct labour-hours	15,000	6,000
Machine-hours	3,000	21,000

How much overhead would you include in the bid? Estimate the bid price, the company should quote, assuming the company's normal practice of charging 20 per cent on cost price as profit.

SOLUTION

Job cost sheet to determine the tender price

Particulars	*Amount*		*Amount*
Direct materials			Rs 1,50,000
Direct labour cost:			
Department X	Rs 75,000		
Department Y	33,000		1,08,000
Prime cost			2,58,000
Add overhead costs			
Department X:			
Fixed (15,000 × Rs 2.40)	36,000		
Variable (15,000 × Rs 2)	30,000	Rs 66,000	
Department Y:			
Fixed (21,000 × Rs 1.80)	37,800		
Variable (21,000 × Rs 1.50)	31,500	69,300	1,35,300
Factory cost			3,93,300
Add estimated profit @ 20 per cent on cost			78,660
Bid price			4,71,960

Working Notes

Determination of overhead rates:

Department X [Direct labour hours (DLH) has been taken as basis as there is the highest correlation between DLH and overhead incurred]

Fixed = Rs 7,20,000 ÷ 3,00,000 DLH = Rs 2.40

Variable = Rs 6,00,000 ÷ 3,00,000 DLH = Rs 2.00

Department Y [Machine-hour rate (MHR) has been taken as the basis as there is the highest correlation between MHR and overhead]:

Fixed = Rs 10,80,000 ÷ 6,00,000 = Rs 1.80

Variable = Rs 9,00,000 ÷ 6,00,000 = Rs 1.50

P.7.4 A jobbing factory has undertaken to supply 200 pieces of a component per month for the ensuing 6 months. Every month a batch order is opened against which materials and labour-hours are booked at actuals; overheads are levied at a per/labour hour rate. The selling price contracted for is Rs 8 per piece. From the following data, present the cost and profit per piece of each batch order and overall position of the order for 1,200 pieces:

Months	*Batch output*	*Material cost*	*Direct wages*	*Direct labour-hours*
January	210	Rs 650	Rs 120	240
February	200	640	140	280
March	220	680	150	280
April	180	630	140	270
May	200	700	150	300
June	220	720	160	320

The other details are:

Month	*Chargeable expenses*	*Direct labour-hours*
January	Rs 12,000	Rs 4,800
February	10,560	4,400
March	12,000	5,000
April	10,580	4,600
May	13,000	5,000
June	12,000	4,800

SOLUTION

Batch cost sheet for six months (January to June)

Month	*Material*	*Cost of production*			*Batch output (units)*	*Cost per unit (5 × 6)*	*Selling price per unit*	*Profit (loss) per unit*
		Direct wages	*Overheads**	*Total*				
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
January	Rs 650	Rs 120	Rs 600	Rs 1,370	Rs 210	Rs 6.52	Rs 8	Rs 1.48
February	640	140	672	1,452	200	7.26	8	0.74
March	680	150	672	1,502	220	6.83	8	1.17
April	630	140	621	1,391	180	7.73	8	0.27
May	700	150	780	1,630	200	8.15	8	(0.15)
June	720	160	800	1,680	220	7.64	8	0.36
	4,020	860	4,145	9,025	1,230			

*Overheads = (Direct labour-hours × Labour-hour rate)

Labour-hour rate = (Chargeable expenses ÷ Direct labour-hours)

Overall position of the order of 1,200 units

Sale revenue (1,200 × Rs 8)		Rs 9,600
Less cost of production	$\left[\frac{\text{Rs } 9,025}{1,230} \times 1,200\right]$	8,805
Profit		795

P.7.5 The following is the trial balance of Premier Construction Company Ltd engaged in the execution of Contract 747 for the year ending March 31 of the current year:

	Dr Amount	*Cr Amount*
Amount received (contractor's account)		Rs 3,00,000
Buildings	Rs 1,60,000	
Creditors		72,000
Bank balance	35,000	
Capital account		5,00,000
Materials	2,00,000	
Wages	1,80,000	
Expenses	47,000	
Plant	2,50,000	
Total	8,72,000	8,72,000

The work on Contract 747 had commenced on April 1 of the current year. Materials costing Rs 1,70,000 were sent to the site of the contract but those costing Rs 6,000 were destroyed in an accident. Wages amounting to Rs 1,80,000 were paid during the year. Plant costing Rs 50,000 was used on the contract all through the year. Plant with a cost of Rs 2,00,000 was used from April 1 to December 31 and was then returned to the stores. Materials of the cost of Rs 4,000 were at site on March 31.

The contract was for Rs 6,00,000 and the work certified was 80 per cent of the total contract work at the end of the year. Uncertified work was estimated at Rs 15,000 on March 31. Expenses are charged to contract at 25 per cent of wages. Plant is to be depreciated at 10 per cent for the entire year.

Prepare Contract 747 account for the current year ending March 31 and make out the balance sheet as on that date in the books of Premier Construction Company Ltd Also prepare contractee's account.

SOLUTION

Contract A/c (747) for the year ending March 31

	Dr Amount		*Cr Amount*
To materials	Rs 1,70,000	By profit and loss A/c(abnormal	
To wages	1,80,000	loss due to materials destroyed	Rs 6,000
To plant (Rs 50,000 + Rs 2,00,000)	2,50,000	in an accident)	
To expenses allocated to		By plant at site (Rs 50,000 –	
contract (0.25 × Rs 1,80,000)	45,000	Rs 5,000, depreciation	
To profit c/d	90,000	@ 10 per cent for the full year)	45,000
		By plant returned to store	
		(Rs 2,00,000 – Rs 15,000, depre-	
		ciation @ 10 per cent for 9 months)	1,85,000
		By materials at site	4,000
		By *work-in-process:*	
		Work certified (0.80 × Rs 6,00,000)	4,80,000
		Work uncertified	15,000
	7,35,000		7,35,000
To profit and loss A/c[1]	37,500	By profit b/d	90,000
To reserve for unforeseen			
contingencies[2]	52,500		
	90,000		90,000

[1]Determination of profit (to be transferred to profit and loss account)

$$\text{Estimated profit} \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}}$$

$$\text{or Rs } 90{,}000 \times \frac{2}{3} \times \frac{\text{Rs } 3{,}00{,}000}{\text{Rs } 4{,}80{,}000} = \text{Rs } 37{,}500$$

[2]Reserve for unforeseen contingencies = Rs 90,000 – Rs 37,500 = Rs 52,500

General Profit and Loss Account

To abnormal loss	Rs 6,000	By contract A/c (747)	Rs 37,500
To absorbed expenses			
(Rs 47,000 – Rs 45,000)	2,000		
To depreciation on plant (Rs 2,00,000			
for 3 months @ 10 per cent)	5,000		
To net profit	24,500		
	37,500		37,500

Contractee's Account

To balance c/d	3,00,000	By bank	3,00,000
		By balance b/d	3,00,000

Balance Sheet as on at March 31

Liabilities	*Amount*	*Assets*		*Amount*
Capital	Rs 5,00,000	Buildings		Rs 1,60,000
Profit and loss A/c	24,500	Plant in store		
Creditors	72,000	(Rs 2,00,000 – Rs 20,000)		1,80,000
		Plant at site (Rs 50,000 – Rs 5,000)		45,000
		Materials in store		
		(Rs 2,00,000 – Rs1,70,000)		30,000
		Materials at site		4,000
		Work-in-process:		
		Work certified	Rs 4,80,000	
		Work uncertified	15,000	
		Less reserve for unforeseen contingencies	(52,500)	
		Less cash received from contractee	(3,00,000)	1,42,500
		Bank balance		35,000
	5,96,500			5,96,500

P. 7.6 The following information relates to a building contract for Rs 30,00,000.

	Year 1	*Year 2*
Materials issued	Rs 9,00,000	Rs 2,52,000
Direct wages	6,90,000	3,15,000
Direct expenses	66,000	30,000
Indirect expenses	18,000	4,200
Work certified	22,50,000	30,00,000
Work uncertified	24,000	–
Materials at site	15,000	21,000
Plant issued	42,000	6,000
Cash received from contractee	18,00,000	30,00,000

The value of the plant at the end of years 1 and 2 was Rs 21,000 and Rs 15,000 respectively.
Prepare: (i) The contract account; (ii) The contractee account; and (iii) Show how the various relevant figures would appear in the assets side of the balance sheet.

SOLUTION

Contract A/c for the end of year 1

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To materials	Rs 9,00,000	By materials at site	Rs 15,000
To direct wages	6,90,000	By plant at site	21,000
To direct expenses	66,000	By work-in-progress	
To indirect expenses	18,000	Work certified	22,50,000
To plant	42,000	Work uncertified	24,000
To profit c/d	5,94,000		
	23,10,000		23,10,000

(*Contd.*)

(*Contd.*)

To profit and loss account (Rs 5,94,000 × 2/3 × Rs 18,00,000) ÷ Rs 22,50,000	3,16,800	By profit b/d	5,94,000
To reserve for unforeseen contingencies	2,77,200		
	5,94,000		5,94,000

Contract account for the end of year 2

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To work-in-progress b/d	Rs 22,74,000	By reserve for unforeseen contingencies	Rs 2,77,200
To materials at site	15,000	By materials at site	21,000
To plant at site	21,000	By plant at site	15,000
To materials	2,52,000	By contractee's A/c	30,00,000
To direct wages	3,15,000		
To direct expenses	30,000		
To indirect expenses	4,200		
To plant issued	6,000		
To profit and loss A/c	3,96,000		
	33,13,200		33,13,200

Contractee's account

Year end 1	To balance c/d	18,00,000	Year end 1	By bank	18,00,000
		18,00,000			18,00,000
Year end 2	To contract A/c	30,00,000	Beginning year 2	By balance b/d	18,00,000
			Year end 2	By bank (balance received)	12,00,000
		30,00,000			30,00,000

Balance sheet (skeleton) as at the end of year 1

Liabilities	*Amount*	*Assets*		*Amount*
		Materials at site		Rs 15,000
		Plant at site		21,000
		Work-in-process:		
		Work certified	Rs 22,50,000	
		Work uncertified	24,000	
		Less reserve for unforeseen contingencies	(2,77,200)	
		Less cash received	(18,00,000)	1,96,800

Balance sheet as at the end of year 2

		Materials at site	Rs 21,000
		Plant at site	15,000

P.7.7 As on March 31, of the current year, Rs 4,89,000 has been expended upon a contract and certificates of value of work certified have been received to date of the value of Rs 6,00,000. The cost of work uncertified on the date was estimated at Rs 15,000. Upto the end of the previous year, profit of Rs 30,000 had been taken on the contract. It is estimated that the contract will take a further 4 months to complete and that it will necessitate an additional expenditure of Rs 1,00,000. The total estimated expenditure upon the contract is to include a provision of 5 per cent for contingen-

cies. The contract price is Rs 7,20,000 and Rs 5,40,000 has been received in cash to date. Determine the amount of profit to be credited to profit and loss account.

SOLUTION

Computation of profit

Particulars	*Amount*
Total expenditure upto March 31	Rs 4,89,000
Add additional estimated expenditure	1,00,000
	5,89,000
Add provision for contingencies (5 per cent on total estimated expenditure $\frac{5}{95} \times$ Rs 5,89,000)	31,000
Total estimated expenditure on contract	6,20,000
Contract price	7,20,000
Estimated total profit (Rs 7,20,000 – Rs 6,20,000)	1,00,000
Cumulative profit to be taken to profit and loss account $\left(\text{Rs } 1{,}00{,}000 \times \frac{\text{Rs } 6{,}00{,}000}{\text{Rs } 7{,}20{,}000} \times \frac{\text{Rs } 5{,}40{,}000}{\text{Rs } 6{,}00{,}000}\right)$	75,000
Less already credited to the profit and loss account of the previous year	30,000
Profit to be credited to current year profit and loss account	45,000

P.7.8 A contractor enters into a contract to construct a building for Rs 8,00,000. Work began in April of the current year and it is estimated that the contract will take 16 months to complete. Work is proceeding on schedule and the costs charged to the contract at the end of the current year are as follows:

Material used	Rs 2,00,000
Materials returned	10,000
Wages	2,60,000
Plant hire and other expenses	65,000
Establishment charges	50,000

Additional information

Materials at site	Rs 5,000
Work certified upto date	6,50,000
Cash received on account	6,00,000
Work not certified	15,000

It is estimated that the following further expenditure will be incurred to complete the work:

Materials	Rs 15,000
Labour	20,000
Sub-contractors	50,000
Plant hire and other expenses	15,000
Establishment charges	10,000

Prepare the contract account indicating the amount to be credited to the profit and loss account of the current year, assuming provision for contingencies amounting to 5 per cent of the total cost is to be made and the contractor's cash position is satisfactory.

SOLUTION

Contract account for the year ending March 31

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To materials	Rs 2,00,000	By materials returned	Rs 10,000
To wages	2,60,000	By materials at site	5,000
To plant hire and other expenses	65,000	By *work-in-process*	
To establishment expenses	50,000	Work certified	6,50,000
To profit c/d	1,05,000	Work uncertified	15,000
	6,80,000		6,80,000
Profit and loss account	72,698	By profit b/d	1,05,000
To reserve for contingencies	32,302		
	1,05,000		1,05,000

Computation of estimated profit

Expenditure upto March 31			Rs 5,60,000
Add estimated expenditure to complete the contract:			
Materials at site	Rs 5,000		
Add required	15,000	Rs 20,000	
Labour		20,000	
Sub-contractors		50,000	
Plant hire and other expenses		15,000	
Establishment charges		10,000	1,15,000
			6,75,000
Add provision for contingencies (5 × Rs 6,75,000) ÷ 95			35,526
Total estimated cost			7,10,526
Contract price			8,00,000
Estimated profit			89,474

Proportion of profit to be carried to current year profit and loss account = (Rs 89,474 × Rs 6,50,000) ÷ Rs 8,00,000 = Rs 72,698

P.7.9 Kapoor Engineering Company Ltd undertakes a long-term contract which involves the fabrication of pre-stressed concrete blocks and the erection of the same on consumer's site.

The following information is supplied regarding the contract which is incomplete on March 31 of the current year:

Fabrication costs to date:		
Direct materials		Rs 2,80,000
Direct Labour		90,000
Overheads		75,000
		4,45,000
Erection costs to date		15,000
Total cost incurred		4,60,000
Contract price		8,19,000
Cash received on account		6,00,000
Technical estimate of work completed to date:		
Fabrication		
Direct price	80 per cent	
Direct labour and overheads	75 per cent	
Erection	25 per cent	

You are required to prepare a statement for submission to the management indicating:

1. The estimated profit on the completion of the contract, and
2. The estimated profit-to-date on the contract.

SOLUTION

1. *Statement showing estimated profit to be carried to profit and loss account for the current year ended March 31*

Expenditure upto March 31:		
Direct materials	Rs 2,80,000	
Direct labour	90,000	
Overheads	75,000	
Erection costs to date	15,000	Rs 4,60,000
Add estimated expenditure to complete the contract::		
Direct materials (Rs 2,80,000 × 20) ÷ 80	70,000	
Direct labour and overheads (Rs 1,65,000 × 25) ÷ 75	55,000	
Erection cost (Rs 15,000 × 75) ÷ 25	45,000	1,70,000
Total estimated cost		6,30,000
Contract price		8,19,000
Estimated profit		1,89,000

2. Proportion of profit to be carried to current year's profit and loss account:

$$\text{Estimated total profit} \times \frac{\text{Cost of work to date}}{\text{Estimated total cost}} = \text{Rs}\,1{,}89{,}000 \times \left(\frac{\text{Rs}\,4{,}60{,}000}{\text{Rs}\,6{,}30{,}000}\right) = \text{Rs}\,1{,}38{,}000$$

P.7.10 M/s Bhagwandas Associates undertook a contract for Rs 15,00,000 on an arrangement that 80 per cent of the value of the work done, as certified by the architect of the contractee, should be paid for immediately and that the remaining 20 per cent be retained until the contract was completed.

In year 1, the amounts expended were: Materials, Rs 1,80,000; Wages, Rs 1,70,000; Carriage, Rs 6,000; Cartage, Rs 1,000; Sundry expenses, Rs 3,000. The work was certified for Rs 3,75,000 and 80 per cent of this was paid as agreed.

In year 2, the amounts expended were: Materials, Rs 2,20,000; Wages, Rs 2,30,000; Carriage, Rs 23,000; Cartage, Rs 2,000; Sundry expenses, Rs 4,000. Three-fourths of the contract was certified as done by March 31, and 80 per cent of this was received accordingly. The value of unused stock and work-in-process uncertified was ascertained at Rs 20,000.

In year 3, the amounts expended were: Materials, Rs 1,26,000; Wages, Rs 1,70,000; Cartage, Rs 6,000; Sundry expenses, Rs 3,000 and on September 30, the whole contract was completed. Show how the contract account and also the contractee's account would appear in each of these years in the books of the contactor, assuming that the balance due to him was paid on completion of the contract.

SOLUTION

Contract account for the year ending 1

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To materials	Rs 1,80,000	By work-in-process	
To wages	1,70,000	Work certified	Rs 3,75,000
To carriage	6,000		
To cartage	1,000		
To sundry expenses	3,000		
To profit c/d	15,000		
	3,75,000		3,75,000

(*Contd.*)

(*Contd.*)

To profit and loss account (Rs 15,000 × 1 × 80) ÷ (3 × 100)	4,000	By profit b/d	15,000
To reserve for unforeseen contingencies	11,000		
	15,000		15,000

Contract account for the year ending 2

To work-in-process	Rs 3,75,000	By reserve for unforeseen contingencies	Rs 11,000
To materials	2,20,000		
To carriage	23,000	By *work-in-process*	
To wage	2,30,000	Work certified	
To cartage	2,000	(3 × Rs 15,00,000) ÷ 4	11,25,000
To sundry expenses	4,000	Work uncertified	20,000
To profit c/d	3,02,000		
	11,56,000		11,56,000
To profit and loss A/c (Rs 3,02,000 × 2 × 80) ÷ (3 × 100)	1,61,067	By profit b/d	3,02,000
To reserve for unforeseen contingencies	1,40,933		
	3,02,000		3,02,000

Contract account for the year ending 3

To work-in-process b/d	Rs 11,45,000	By reserve for unforeseen contingencies	Rs 1,40,000
To materials	1,26,000	By contractee's A/c	15,00,000
To wages	1,70,000		
To cartage	6,000		
To sundry expenses	3,000		
To profit and loss A/c	1,90,933		
	16,40,933		16,40,933

Contractee's account

Year end 1	To balance c/d	Rs 3,00,000	Year end 1	By bank A/c	Rs 3,00,000
		3,00,000			3,00,000
Year end 2	To balance c/d	9,00,000	Year 2 beginning	By balance c/d	3,00,000
			Year 2 end	By bank	6,00,000
		9,00,000			9,00,000
Year end 3	To contract A/c	15,00,000	Year 3 beginning	By balance b/d	9,00,000
			Year 3 end	By bank (balance received)	6,00,000
		15,00,000			15,00,000

P.7.11 The following particulars are obtained from the books of Vinak Construction Limited as on March 31 of the current year:

Plant and equipment at cost	Rs 4,90,000
Vehicles at cost	2,00,000

Details of contract which remain uncompleted as on March 31:

	Contract numbers		
	V. 20	V. 24	V. 25
Estimated final sales value	8,00,000	5,60,000	16,00,00
Estimated final cost	6,40,000	7,00,000	12,00,000
Wages	2,40,000	2,00,000	1,20,000
Materials	1,00,000	1,10,000	44,000
Overheads (excluding depreciation)	1,44,000	1,46,000	58,000
Total costs to date	4,84,000	4,56,000	2,22,000
Value certified by architects	7,20,000	4,20,000	2,40,000
Progress payments received	5,00,000	3,20,000	2,00,000

Depreciation of plant and equipment and vehicles should be charged at 20 per cent to the three contracts in proportion to work certified. You are required to prepare statements to show contract-wise and over-all:

(i) profit/loss to be taken to the profit and loss account for the year ended March 31.

(ii) work-in-process as would appear in the balance sheet as March 31.

SOLUTION

Statement of profit/loss to be taken to profit and loss A/c for the year ending March 31

	Contract numbers			
	V. 20	*V. 24*	*V. 25*	*Total*
(A) 1. Estimated final contract price	Rs 8,00,000	Rs 5,60,000	Rs 16,00,000	—
2. Work certified by architects	7,20,000	4,20,000	2,40,000	—
3. Percentage of completion [(2) as per cent (1)]	90	75	15	—
(B) 1. Estimated final contract price	8,00,000	5,60,000	16,00,000	—
2. *Less* estimated final costs	6,40,000	7,00,000	12,00,000	—
3. Estimated profit (loss)	1,60,000	(1,40,000)	4,00,000	—
(C) 1. Work certified	7,20,000	4,20,000	2,40,000	13,80,000
2. *Less cost incurred:*				
Wages	2,40,000	2,00,000	1,20,000	5,60,000
Materials	1,00,000	1,10,000	44,000	2,54,000
Overheads (excluding depreciation)	1,44,000	1,46,000	58,000	3,48,000
Depreciation (working note 1)	72,000	42,000	24,000	1,38,000
Notional profit (loss) [(1)-(2)]	1,64,000	(78,000)	(6,000)	80,000
Profit/(loss) to be taken to profit and loss A/c	1,00,000	(1,40,000)@	(6,000)	(46,000)
Reserve for future contingencies	64,000	62,000	—	1,26,000

@Rs 7,00,000, estimated financial cost – Rs 5,60,000, estimated sales value.

Statement of work-in-process as would appear in the balance sheet as on March 31

	V. 20	*V. 24*	*V. 25*	*Total*
Work certified	Rs 7,20,000	Rs 4,20,000	Rs 2,40,000	Rs 13,80,000
Less reserve for future contingenies	64,000	62,000	—	1,26,000
Less payments received	5,00,000	3,20,000	2,00,000	10,20,000
Work-in-process	1,56,000	38,000	40,000	2,34,000

Working Notes

1. Total depreciation [0.20 × (Rs 4,90,000 + Rs 2,00,000)] = Rs 1,38,000
   Depreciation is apportioned to three contracts in proportion to work certified: Rs 7,20,000; Rs 4,20,000; and Rs 2,40,000:

   Contract V. 20: $\frac{\text{Rs } 7,20,000}{\text{Rs } 13,80,000} \times \text{Rs } 1,38,000 = \text{Rs } 72,000$

   Contract V. 24: $\frac{\text{Rs } 4,20,000}{\text{Rs } 13,80,000} \times \text{Rs } 1,38,000 = \text{Rs } 42,000$

   Contract V. 25: $\frac{\text{Rs } 2,40,000}{\text{Rs } 13,80,000} \times \text{Rs } 1,38,000 = \text{Rs } 24,000$

2. Profit to be estimated: Estimated total cost $\times \frac{\text{Value of work certified}}{\text{Contract price}} \times \frac{\text{Cash received}}{\text{Work certified}}$

   $\text{Rs } 1,60,000 \times \frac{\text{Rs } 7,20,000}{\text{Rs } 8,00,000} \times \frac{\text{Rs } 5,00,000}{\text{Rs } 7,20,000} = \text{Rs } 1,00,000$

3. Loss transferred:

Contract	Amount
V. 24	Rs 1,40,000
V. 25	6,000

P.7.12 Compute a conservative estimate of profit on contract (which has been 80 per cent complete) from the following particulars. Illustrate your methods of computing the profit.

Total expenditure to date	Rs 1,70,000
Estimated further expenditure to complete the contract (including contingencies)	34,000
Contract price	3,06,000
Work certified	2,00,000
Work not certified	17,000
Cash received	1,63,200

SOLUTION

Methods of computing the conservative estimates of profit (80 per cent contract complete):

(i) (Estimated profit × Work certified) ÷ Contract price =(Rs 1,02,000 × Rs 2,00,000) ÷ Rs 3,06,000 = Rs 66,667

(ii) (Estimated profit × Work certified × Cash received) ÷ (Contract price × Work certified) = (Rs 1,02,000 × Rs 2,00,000) × Rs 1,63,200) ÷ (Rs 3,06,000 × Rs 2,00,000) = Rs 54,400

(iii) (Notional profit × Work certified) ÷ Contract price = (Rs 47,000 × Rs 2,00,000) (Rs 3,06,000 = Rs 30,719

(iv) (Notional profit × Cash received × 2/3) ÷ Work certified = (Rs 47,000 × Rs 1,63,200 × 2/3) ÷ Rs 2,00,000) = Rs 25,568

Working Notes

1. *Notional profit*

Value of work certified	Rs 2,00,000
Less: cost of work certified (Total expenditure till date – Work not certified) (Rs 1,70,000 – 17,000)	1,53,000
	47,000

2. *Estimated profit*

Contract price		*3,06,000*
Less total expenditure till date	Rs 1,70,000	
Estimated further expenditure to complete the contract	34,000	2,04,000
		1,02,000

P.7.13 Deluxe limited undertook a contract for Rs 5,00,000 on July 1, year 1. On June 30, year 2, when accounts were closed, the following details about the contract were gathered:

Materials purchases	Rs 1,00,000
Wages paid	45,000
General expenses	10,000
Plant purchased	50,000
Materials on hand (June 30, year 2)	25,000
Wages accrued (June 30, year 2)	5,000
Work certified	2,00,000
Cash received	1,50,000
Work uncertified	15,000
Depreciation of plant	5,000

The above contract contained an escalation clause which read as follows:

"In the event of prices of materials and rates of wages increasing by more than 5 per cent, the contract price will be increased accordingly by 25 per cent of the rise in the cost of materials and wages beyond 5 per cent in each case."

It was found that since the date of signing the agreement, the prices of the materials and wage rates increased by 25 per cent. The value of the work certified does not take into account the effect of the above clause.

Prepare the contract account. Workings should form part of the answer.

SOLUTION

Contract account of deluxe Ltd. for the year ending June 30, year 2

To materials	Rs 1,00,000	By work-in progress:	
To wages paid and accrued (Rs 45,000 + Rs 5,000)	50,000	Work certified	Rs 2,00,000
		Work uncertified	15,000
To general expenses	10,000	By contract escalation[1]	5,000
To depreciation on plant	5,000	By materials in hand	25,000
To profit and loss a/c[2]	20,000		
To work-in-process reserve	60,000		
	2,45,000		2,45,000

Working Notes

(a) *Contract escalation charges*

	Total increase		*Upto 5 per cent*		*Beyond 5 per cent*
1 Materials	(Rs 75,000 × 25÷125) =	Rs 15,000	(Rs 75,000 × 5 ÷ 125) =	Rs 3000	Rs 12,000
2 Wages	(Rs 50,000 × 25÷125) =	10,000	(Rs 50,000 × 5 ÷ 125) =	2,000	8,000
		25,000		5,000	20,000

Therefore, increase in contract price = 0.25 × Rs 20,000 = Rs 5,000.

(b) Since more than 25 per cent but less than 50 per cent of contract has been completed, one-third of the notional profit as reduced by proportion of cash received is transferred to P&L A/c: Notional profit × 1/3 × Cash received/Work certified = Rs 80,000 × 1/3 × (Rs 1,50,000/Rs 2,00,000) = Rs 20,000

P.7.14 A contractor commenced a building contract on October 1, year 1. The contract price is Rs 4,40,000. The following data pertaining to the contract for the year 2 has been compiled from his books and is as under:

April 1, year 2 beginning	Work-in-progress not certified	Rs 55,000
	Materials at site	2,000
Year 2-during	Expenses incurred	
	Materials issued	1,12,000
	Wages paid	1,08,000
	Hire of plant	20,000
	Other expenses	34,000
Year 2-end	Materials at site	4,000
	Work-in-progress: Not certified	8,000
	Work-in-progress: Certified	4,05,000

The cash received represents 80 per cent of work certified. It has been estimated that further costs to complete the contract will be Rs 23,000 including the materials at site as on March 31, year-2. You are required to determine the profit on the contract for the year 2 on prudent basis, which has to be credited to P/L A/c.

SOLUTION

Contract A/c for the year 2 ending March 31

Particulars	*Dr. Amount*	*Particulars*		*Cr. Amount*
Opening balances:		By materials at site		Rs 4,000
To Work-in-progress (not certified)	Rs 55,000	By work-in-progress:		
To Materials at site	2,000	work certified	Rs 4,05,000	
To Materials	1,12,000	work uncertified	8,000	4,13,000
To Wages	1,08,000			
To Hire charges of plant	20,000			
To Other expenses	34,000			
To Profit c/d	86,000			
	4,17,000			4,17,000
To Profit & loss A/c	66,273[1]	By profit b/d		86,000
To Reserve for unforeseen contingencies	19,727			
	86,000			86,000

Working Note

(1) Estimated profit

Total expenditure up to March 31, year 2 (Rs 3,31,000 – Rs 4,000 Materials at site)	Rs 3,27,000
Add further cost of completing contract	23,000
Total estimated expenditure on contract	3,50,000
Contract price	4,40,000
Estimated total profit	90,000

Profit to be carried to profit & loss A/c:
[Estimated total profit × (Value of work certified / Contract price) × (Cash received / Work certified)]
[Rs 90,000 × (Rs 4,05,000/Rs 4,40,000) × (Rs 3,24,000*/Rs 4,05,000) = Rs 66,273]
*0.8 × Rs 4,05,000 = Rs 3,24,000

P.7.15 Paramount Engineers are engaged in construction and erection of a bridge under a long-term contract. The cost incurred upto March 31 of current year was as under: (Rs in Lakh)

Fabrication	
Direct materials	280
Direct labour	100
Overheads	60
	440
Erection costs to date	110
	550

The contract price is Rs 11 crore and the cash received on account till March 31 was Rs 6 crore.

A technical estimate of the contract indicates the following degree of completion of Fabrication: Direct material – 70 per cent, Direct labour and Overheads 60 per cent and Erection 40 per cent.

You are required to estimate the profit that could be taken to Profit and Loss against this partly completed contract as at March 31 in the current year.

SOLUTION

Statement Showing Estimated Profit to be Carried to Profit and Loss Account for the Current Year Ended March 31. (Amount in Rs lakh)

Expenditure upto March 31:		
Direct materials	Rs 280	
Direct labour	100	
Overheads	60	
Erection costs to date	110	Rs 550
Add estimated expenditure to complete the contract:		
Direct materials (Rs 280 lakh × 30) ÷ 70	Rs 120.00	
Direct labour (Rs 100 lakh × 40) ÷ 60	66.67	
Overheads (Rs 60 lakh × 40) ÷ 60	40.00	
Erection costs (Rs 110 × 60) ÷ 40	165.00	391.67
Total estimated costs		941.67
Estimated Profit		158.33
Contract price		1,100.00

Proportion of profit to be carried to current year P&L A/c:

Estimated total profit × Cost of work to date / Estimated total cost = (Rs 158.33 lakh x Rs 550 lakh)/Rs 941.67 lakh = Rs 92.48 lakh

REVIEW QUESTIONS

RQ.7.1 What are the characteristics of companies that are likely to be using job order cost system? Specify five concrete situations when use of job order cost system is most appropriate.

RQ.7.2 What is a job-cost sheet? Prepare a comprehensive job-cost sheet of a firm having two departments.

RQ.7.3 Enumerate, in brief, the cost recording procedure in a job-order cost system. Illustrate your answer with examples.

RQ.7.4 Why is it difficult to identify manufacturing overheads with products manufactured? Also, state the difference between the manufacturing overheads control account and manufacturing overhead applied account.

RQ.7.5 How is job costing in service organisations different from job costing in manufacturing organisations?

RQ.7.6 Explain the meaning of batch costing. How does such a costing differ from job costing?

RQ.7.7 A firm is engaged in manufacturing jobs of long duration. Examine the detailed procedure suitable for costing purposes.

RQ.7.8 Discuss the method of ascertaining profit on the following contracts: (i) When the contract is completed, (ii) When the contract is not complete, and (iii) When the contract is nearing completion.

RQ.7.9 Indicate how would you deal with the following items:

1. Plant and machinery purchased and used on contract work.
2. Amounts received from contractee.
3. Materials lying unused at site.

RQ.7.101. Discuss the implications of cost-plus contracts from the view point of (a) manufacturer, (b) customer.

2. What is the relevance of the escalation clause if provided in a contract?

RQ.7.11 A Ltd employs a job-order costing system. The factory expenses incurred in the month of March of the current year (as shown by the factory overhead control account) are as follows:

Cutting shop	Rs 36,250
Assembly shop	4,755
Spraying shop	670
Finishing shop	7,900

Overheads have been debited to jobs as follows:

Cutting—Rs 1.30 per machine-hour for 22,000 hours.
Assembly—140 per cent of direct labour cost. Direct labour cost is Rs 3,300.
Spraying—Re 0.60 per piece for 925 pieces.
Finishing—Re 0.75 per direct labour-hour for 11,000 hours.

All expenses are charged to a factory overhead control account and are transferred from this account at the end of each month to the departmental overhead account.

You are required to (a) record the necessary journal entries for factory overheads incurred and absorbed and (b) state the amount of over- or under-absorption of overheads in each department. Assume that the company maintains both factory ledger and general ledger.

SOLUTION

Journal Entries

Particulars		*Dr. Amount*	*Cr. Amount*
1. Factory Ledger:			
(i) Factory overhead control A/c	Dr	Rs 49,575	
To General ledger			Rs 49,575
(Indirect manufacturing costs incurred)			
(ii) Cutting shop A/c (22,000 × Rs 1.30)	Dr	28,600	
Assembly shop A/c (1.40 × Rs 3,300)	Dr	4,620	
Spraying shop A/c (925 × Re 0.60)	Dr	555	
Finishing shop A/c (11,000 × Re 0.75)	Dr	8,250	
To Factory overhead control A/c			42,025
(Absorption of indirect overheads from various jobs)			
(iii) Cost of goods sold A/c	Dr	7,550	
To Factory overhead control A/c			7,550
(Charging under-absorbed overheads to cost of goods sold A/c)			
2. General Ledger:			
Factory ledger A/c	Dr	49,575	
To Cash/Suppliers' A/c			49,575
(Indirect manufacturing costs incurred)			

Statements of Absorption of Overheads

Department	*Cost incurred*	*Amount absorbed*	*Over-absorption (under-absorption)*
Cutting shop	Rs 36,250	Rs 28,600	Rs (7,650)
Assembly shop	4,755	4,620	(135)
Spraying shop	670	555	(115)
Finishing shop	7,900	8,250	350
	49,575	42,025	(7,550)

RQ.7.12 A factory can produce 60,000 units per annum at its optimum capacity. The estimated unit costs of production are as under:

Direct material	Rs 3
Direct labour	2
Indirect expenses	
Fixed (per annum)	1,50,000
Variable (per unit)	5
Semi-variable per annum up to 50 per cent capacity and an extra Rs 10,000 for every 25 per cent increase in capacity or part thereof.	50,000

The factory produces only against orders (and not for stock). The production programme of the factory is as indicated below. The management desires to ensure a profit of Rs 1,00,000 for the year. Work out the average selling price at which each unit should be quoted.

First 3 months of the year : 50 per cent of the capacity
Remaining 9 months : 80 per cent of the capacity
Ignore selling and administration overheads.

SOLUTION

Statement of cost and profit to determine selling price

	First 3 months	*Next 9 months*	*Total for the year*
Units produced (see working note)	7,500	36,000	43,500
Direct material @ Rs 3 per unit	Rs 22,500	Rs 1,08,000	Rs 1,30,500
Direct labour @ Rs 2 per unit	15,000	72,000	87,000
Prime Cost	37,500	1,80,000	2,17,500
Add indirect overheads:			
Fixed Rs 1,50,000 per year (allocated on the basis of time)	37,500	1,12,500	1,50,000
Variable @ Rs 5 per unit	37,500	1,80,000	2,17,500
Semi-variable: (working note)	12,500	52,500	65,000
Cost of Production	1,25,000	5,25,000	6,50,000
Add desired profit			1,00,000
Sales Price			7,50,000
Average Selling Price (Sales revenue ÷ Units produced)			17.24

Working Note

Units produced

(i) *First 3 months of the year*

Production per month at 100 per cent capacity (60,000 ÷ 12 months) 5,000

	Production at 50 per cent capacity		2,500
	Production for 3 months (2,500 × 3)		7,500
(ii)	*Next 9 months of the year*		
	Production at 80 per cent capacity (5,000 × 0.80) per month		4,000
	Production for 9 months (4,000 × 9)		36,000
(iii)	*Total production for the year* [(i) + (ii)]		43,500
Semi-variable expenses			
(i)	For first 3 months (Rs 50,000 × 1/4)		Rs 12,500
(ii)	For next 9 months: up to 50 per cent capacity	Rs 50,000	
	Add Rs 10,000 for every 25 per cent or part increase in capacity (30%)	20,000	
		70,000 × 9/12	52,500
			65,000

RQ.7.13 A job shop commenced its operations on January 1 of the current year. During the first quarter, the following transactions took place:

(i) Materials costing Rs 40,000 were pruchased on account.
(ii) Materials purchased were placed in process.
(iii) A total of 2,000 direct labour-hours were charged to individual jobs at the rate of Rs 5 per hour.
(iv) The fixed manufacturing overhead totalled Rs 16,000.
(v) The variable manufacturing overhead totalled Rs 4,000.
(vi) Only job 10, with mateiral charges of 4,000, direct labour charges of Rs 2,000, and applied overhead rate, was in process at the end of the period.

Additional information:

(i) The firm uses an actual job-order cost system.
(ii) The variable manufacturing overhead is a function of direct labour-hours.
(iii) All overheads are allocated to individual jobs on the basis of a single rate based on direct labour-hours.

You are required to record journal entries for the current quarter assuming only general ledger is maintained.

SOLUTION

Journal entries

Particulars		*Dr. Amount*	*Cr. Amount*
(i) Stores control A/c	Dr	Rs 40,000	
To Accounts payable			Rs 40,000
(ii) Work-in-process A/c	Dr	40,000	
To Stores control A/c			40,000
(iii) Work-in-process A/c	Dr	10,000	
To Wages payable/bank			10,000
(iv) Factory overhead control A/c	Dr	20,000	
To Sundry accounts			20,000
(v) Finished goods inventory A/c	Dr	60,000	
To work-in-process			60,000

Working Note

Determination of amount to be transferred to finished goods inventory:

Total costs placed in process

Direct materials	Rs 40,000
Direct labour	10,000

Fixed overheads	16,000	
Variable overheads	4,000	Rs 70,000
Less closing work-in-process (Job 10)		
Direct materials	4,000	
Direct labour	2,000	
Overheads (400 direct labour-hours × Rs 10 per hour)	4,000[@]	10,000
Cost of goods completed and transferred		60,000

[@]Direct labour-hours = Rs 2,000 ÷ Rs 5 (labour hour-rate) = 400

Overhead rate per hour = Rs 20,000 ÷ 2,000 = Rs 10

RQ.7.14 Messers Anand Associates commenced work on a particular contract on April 1 of the current year. The following information is available from their costing records on December 31:

Materials sent to site	Rs 43,000
Foreman's salary	12,620
Wages paid	1,00,220

A machine costing Rs 30,000 remained in use on site for 1/5th of the year. Its working life was estimated at 5 years and scrap value at Rs 2,000. A supervisor is paid Rs 2,000 per month and had devoted one-half of his time on the contract.

All other expenses were Rs 14,000. The materials at site were Rs 2,500. The contract price was Rs 4,00,000. On December 31, 2/3rd of the contract was complete. However, the architect gave certificate only for Rs 2,00,000 on which 80 per cent was paid. Prepare the contract account.

SOLUTION

Contract A/c for the year ending December 31

To Materials	Rs 43,000	By Materials at site		Rs 2,500
To Wages paid	1,00,220	By *Work-in-progress*		
To Foreman's salary	12,620	Work certified	Rs 2,00,000	
To Depreciation on machine (Rs 28,000 × 1/5 × 1/5)	1,120	Work uncertified	44,365	2,44,365
To Miscellaneous expenses	14,000			
To Supervisor's salary (Rs 1,000 × 9 months)	9,000			
To Profit c/d	66,905			
	2,46,865			2,46,865
To Profit & loss A/c (Rs 66,905 × 2/3 × 8/10)	35,683	By Profit b/d		66,905
To Reserve for unforeseen contingencies	31,222			
	66,905			66,905

Working Notes

Determination of cost of work uncertified

1. Expenditure on completing 2/3rd contract	Rs 1,77,460
2. Therefore, total estimated cost of the full contract = $\left(\frac{\text{Rs } 1,77,460 \times 3}{2}\right)$	2,66,190
3. Work certified as percentage of total contract	50
4. Cost of work certified (Rs 2,66,190 × 0.50)	1,33,095
5. Cost of work uncertified [(1) – (4)]	44,365

RQ.7.15 A building contractor, having undertaken construction work at a contract price of Rs 5,00,000 begins the execution of the work on January 1. The following are the particulars of the contract upto December 31:

Machinery installed at site	Rs 30,000
Materials sent to site	1,70,698
Wages paid at site	1,48,750
Direct expenses	6,334
Overhead charges allocated	8,252
Materials returned from site	1,098
Work certified by the architect	3,90,000
Cash received	3,60,000
Cost of work not certified yet	9,000
Materials in hand as at December 31	3,766
Wages outstanding on December 31	5,380
Value of machinery as at December 31	22,000

Prepare the contract account and the contractee account.

SOLUTION

Contract A/c for the year ending December 31

Particulars		*Dr. Amount*	*Particulars*		*Cr. Amount*
To Machinery		Rs 30,000[@]	By Materials returned		Rs 1,098
To Materials		1,70,698	By Machinery		22,000[@]
To Wages	Rs 1,48,750				
Add accrued	5,380	1,54,130	By Materials at site		3,766
To Direct expenses		6,334	By *Work-in-progress:*		
To Overhead charges		8,252	Work certified	Rs 3,90,000	
To Profit c/d		56,450	Work uncertified	9,000	3,99,000
		4,25,864			4,25,864
To Profit & loss A/c		34,738[1]	By Profit b/d		56,450
To Reserve for unforeseen contingencies		21,712			
		56,450			56,450

Contractee A/c

To Balance c/d	3,60,000	By Bank	3,60,000
		By Balance b/d	3,60,000

[@]Instead of showing machinery on both the sides of contract account, depreciation of Rs 8,000 on machinery may be shown on its debit side.

[1]Determination of profit:

$$\text{Estimated profit} \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}} = (\text{Rs } 56{,}450 \times 2 \times \text{Rs } 3{,}60{,}000) \div (3 \times \text{Rs } 3{,}90{,}000) = \text{Rs } 34{,}738$$

RQ.7.16 A building contractor took a contract for the construction of a certain building on January 1. The contract price was agreed upon at Rs 16,00,000. The contractor made the following expenditure during the year.

Direct materials purchased	Rs 40,000
Materials issued from stores	60,000
Direct labour	60,000
Plant	1,60,000

(*Contd.*)

(*Contd.*)

Direct expenses	40,000
Additional information:	
Value of plant on December 31	1,20,000
Stock of materials at site on December 31	20,000
Materials returned to stores	4,000
Work certified by the architect	3,00,000
Cash received from contractee	2,80,000
Cost of work not yet certified	16,000

From the above information, prepare a contract account for the year. Also, show the amount of work-in-process which will be shown in the balance sheet of the contractor.

SOLUTION

Contract A/c for the year ending December 31

Particulars		*Dr. Amount*	*Particulars*		*Cr. Amount*
To Direct materials:			By Materials returned to stores		Rs 4,000
Purchased	Rs 40,000		By Plant		1,20,000
Issued from stores	60,000	Rs 1,00,000			
To Direct labour		60,000	By materials at site		20,000
To Plant		1,60,000	By *Work-in-progress:*		
To Direct expenses		40,000	Work certified	Rs 3,00,000	
To Profit c/d		1,00,000	Work uncertified	16,000	3,16,000
		4,60,000			4,60,000
To Reserve for unforeseen contingencies		1,00,000	By Profit b/d		1,00,000

Balance sheet (skeleton) as at December 31

Liabilities	*Amount*	*Assets*		*Amount*
		Work-in-progress:		
		Work certified	Rs 3,00,000	
		Work uncertified	16,000	
			3,16,000	
		Less sum received from contractee	2,80,000	
		Less reserve for unforeseen contingencies	1,00,000	Rs (64,000)

RQ.7.17 The Continental Construction Company Ltd. is engaged in two contracts, A and B during the current year. The following information relates to these contracts, which were started on January 1 and July 1, respectively.

	Contracts	
	A	*B*
Contract price	Rs 3,00,000	Rs 4,00,000
Direct materials issued	55,000	40,000
Materials returned to store	500	1,000
Direct labour payments	48,000	32,000

(*Contd.*)

(*Contd.*)

Wages accrued, December 31	2,000	2,500
Plant installed (at cost)	30,000	45,000
Establishment charges	25,000	15,000
Direct expenses	15,000	10,000
Direct expenses accrued, December 31	1,000	500
Work certified by architect	1,60,000	80,000
Cost of work not yet certified	10,000	15,000
Materials on site, December 31	5,500	4,000
Cash received from contractees	1,50,000	60,000
Depreciation of plant per annum (%)	$33\ ^1/_3$	10

Show the accounts for these contracts and the contractees.

SOLUTION

Contracts A/c (A and B) for the year ending December 31

Particulars	*Dr. Amount*		*Particulars*	*Cr. Amount*	
	A	*B*		*A*	*B*
To Direct material	Rs 55,000	Rs 40,000	By Materials returned	Rs 500	Rs 1,000
To Direct labour	48,000	32,000	By Plant less depreciation	20,000	40,500
To Wages accrued	2,000	2,500	By Materials at site	5,500	4,000
To Plant	30,000	45,000	By *Work-in-progress:*		
To Establishment charges	25,000	15,000	Work certified	1,60,000	80,000
To Direct expenses	15,000	10,000	Work uncertified	10,000	15,000
To Direct expenses accrued	1,000	500	By Profit & loss A/c (Loss transferred)	—	4,500
To Profit c/d	20,000	—			
	1,96,000	1,45,000		1,96,000	1,45,000
			By Profit b/d	20,000	—
To Profit & loss A/c (Rs 20,000 × 2/3 × 15/16)	12,500				
To Reserve for unforeseen contingencies	7,500				
	20,000	—		20,000	—

Contractee A/c

To Balance c/d	1,50,000	60,000	By Bank	1,50,000	60,000
			By Balance b/d	1,50,000	60,000

RQ.7.18 A public works contractor secured a contract at a price of Rs 5,00,000. Work began on July 1 and the contract ledger account showed the following items debited up to March 31, in the following year:

Materials	Rs 90,000
Wages	1,05,000
Direct charges	5,000
Plant	16,000

(*Contd.*)

(*Contd.*)

The measurement at March 31, reads as follows:		
Total work done certified to date		2,40,000
Total work done for last measurement		2,10,000
Total work done for month		30,000
Less retention money (10%)		3,000
Material on site	Rs 5,000	27,000
Less 20%	1,000	4,000
		31,000

Prepare a proforma account for the contract showing the profit earned to date, accompanied by the note on the basis of which you arrive at the amount which may be carried to profit & loss A/c. Allow for depreciation on the plant at 10 per cent per annum.

SOLUTION

Contract A/c for the year ending March 31

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Materials	Rs 90,000	By Materials on site	Rs 4,000*
To Wages	1,05,000	By *Work-in-progress:*	
To Direct charges	5,000	Work certified	2,40,000
To Depreciation on plant for 9 months (Rs 16,000 × 9/12 × 10/100)	1,200		
To Profit c/d	42,800		
	2,44,000		2,44,000
To Profit & loss A/c (Rs 42,800 × 1/3 × 9/10)	12,840	By Profit b/d	42,800
To Reserve for unforeseen contingencies	29,960		
	42,800		42,800

*20 per cent loss on materials is considered normal loss.

RQ.7.19 An expenditure of Rs 1,94,000 has been incurred on a contract till March 31, of the current year. The value of work certified is Rs 2,20,000. The cost of work done but not yet certified is Rs 6,000. It is estimated that the contract will be completed by June 30 of the current year and an additional expenditure of Rs 40,000 will have to be incurred to complete the contract. The total estimated expenditure on the contract is to include a provision of $2^1/_2$ per cent for contingencies. The contract price is Rs 2,80,000 and Rs 2,00,000 has been realised in cash up to March 31. Calculate the proportion of profit to be taken to the profit & loss A/c as on March 31.

SOLUTION

Estimated profit

Total expenditure up to March 31	Rs 1,94,000
Add provision for estimated expenditure	40,000
	2,34,000
Add provision for contingencies ($2^1/_2$% on total contract, i.e. 2.5/97.5 × 2,34,000)	6,000
Total estimated expenditure on contract	2,40,000
Contract price	2,80,000
Estimated total profit	40,000

Profit to be carried to profit & loss A/c:

$$\text{Estimated total profit} \times \frac{\text{Value of work certified}}{\text{Contract price}} \times \frac{\text{Cash received}}{\text{Work certified}} = (\text{Rs } 40{,}000 \times \text{Rs } 2{,}20{,}000 \times \text{Rs } 2{,}00{,}000) \div (\text{Rs } 2{,}80{,}000 \times \text{Rs } 2{,}20{,}000) = \text{Rs } 28{,}571$$

RQ.7.20 The following is the trial balance of Cosmos Construction Ltd. engaged in the execution of Contract 303, for the current year ending December 31:

	Debit	*Credit*
Contractee's account—75 per cent of work certified		Rs 3,60,000
Accumulated depreciation		50,000
Creditors		12,000
Buildings	Rs 2,00,000	
Bank balance	45,000	
Share capital		5,00,000
Materials	2,00,000	
Wages	1,80,000	
Expenses	47,000	
Plant	2,50,000	
	9,22,000	9,22,000

The work had commenced on January 1.

Materials costing Rs 1,70,000 were sent to the site of the contract but those costing Rs 6,000 were destroyed in an accident. Plant costing Rs 50,000 was used on the contract throughout the year. Plant with a cost of Rs 2 lakh was used from January 1 to September 30 and was then returned to the stores.

The contract was for Rs 6,00,000 and the contractee paid 75 per cent of the work certified. The cost of work uncertified was estimated to be Rs 15,000 on December 31, on which date materials costing Rs 4,000 were at the site of the contract.

Overheads are charged to the contract at 25 per cent of wages. Plant is to be depreciated at 10 per cent according to the straight line method for the entire year.

Prepare Contract 303 account for the current year ending December 31, and make out the balance sheet of Cosmos Construction Ltd. as on that date.

SOLUTION

Contract (303) A/c for the year ending December 31

Particulars		*Dr. Amount*	*Particulars*		*Cr. Amount*
To Materials		Rs 1,70,000	By Materials destroyed in accident (abnormal loss)		Rs 6,000
To Depreciation on plant:s			By Materials at site		4,000
(Rs 50,000 × 0.10)	Rs 5,000		By *Work-in-progress:*		
(Rs 2,00,000 × 0.10 × 9/12)	15,000	20,000	Work certified	Rs 4,80,000	
To Wages		1,80,000	Work uncertified	15,000	4,95,000
To Expenses (Rs 1,80,000 × 1/4)		45,000			
To Profit c/d		90,000			
		5,05,000			5,05,000
To Profit & loss A/c (Rs 90,000 × 2/3 × 75/100)		45,000	By Profit b/d		90,000
To Reserve for unforeseen contingencies		45,000			
		90,000			90,000

General Profit and Loss A/c

To Abnormal loss	6,000	By Contract (303) A/c	45,000
To Unabsorbed expenses (Rs 47,000 – Rs 45,000)	2,000		
To Depreciation on plant for 3 months (Rs 2,00,000 × 0.10 × 3/12)	5,000		
To Net profit	32,000		
	45,000		45,000

Balance Sheet as at December 31

Liabilities	*Amount*	*Assets*		*Amount*
Share capital	Rs 5,00,000	Plant	Rs 2,50,000	
Profit and loss A/c	32,000	(Accumulated depreciation)	(75,000)	
Creditors	12,000	Buildings	2,00,000	
		Bank balance		45,000
		Work-in-progress:		
		Work certified	Rs 4,80,000	
		Work uncertified	15,000	
		Less cash received from contractee	3,60,000	
		Less reserve for unforeseen contingencies	45,000	90,000
		Materials at site		4,000
		Materials in store (Rs 2,00,000 – Rs 1,70,000)		30,000
	5,44,000			5,44,000

EXAMINATION QUESTIONS

EQ.7.1 Discuss the process of estimating profit/loss on incomplete contracts. (*CA—November, 2003*)
EQ.7.2 Distinguish between the Job costing and batch costing. (*CA—November, 2004*)
EQ.7.3 Distinguish between the Job costing and contract costing. (*CA—May, 2005*)
EQ.7.4 Distinguish between job costing and batch costing. (*CA—May, 2006*)
EQ.7.5 Discuss briefly the principles to be followed while taking credit for profit on incomplete contracts. (*CA—November, 2006*)

EQ.7.6 Explain the following:
(i) Notional profit in contract costing.
(ii) Economic batch quantity in batch costing. (*CA (PE-II)—May, 2007*)

EQ. 7.7 A construction company undertook a contract at an estimated price of Rs 108 lakh, which includes a budgeted profit of Rs 18 lakh. The relevant data for the year ended 31.3.2002 are as under:

	(Rs in '000)
Materials issued to site	5,000
Direct wages paid	3,800
Plant hired	700
Site office costs	270
Materials returned from site	100
Direct expenses	500
Work certified	10,000
Progress payments received	7,200

A special plant was purchased specifically for this contract at Rs 8,00,000 and after use on this contract till the end of 31.2.2002, it was valued at Rs 5,00,000. The cost of materials at site at the end of the year was estimated at Rs 18,00,000. Direct wages accrued as on 31.3.2002 was Rs 1,10,000.

Required:

Prepare the contract account for the year ended 31st March, 2002 and compute the profit to be taken to the profit and loss account. (*CA—November, 2002*)

SOLUTION

Contract A/c for the year ending March 31, 2002

Particulars		*Dr. Amount*	*Particulars*	*Cr. Amount*
To Materials issued to site		Rs 50,00,000	By Materials at site	Rs 18,00,000
To Direct wages paid	Rs 38,00,000		By Material returned	1,00,000
Add accrued	1,10,000	39,10,000	By Work-in-progress:	
To Hiring charges of plant		7,00,000	Work certified	1,00,00,000
To Site office costs		2,70,000		
To Direct expenses		5,00,000		
To Depreciation of special plant (Rs 8,00,000 – Rs 5,00,000)		3,00,000		
To Profit c/d		12,20,000		
		1,19,00,000		1,19,00,000
To Profit & loss A/c		12,00,000[1]	By Profit b/d	12,20,000
To Reserve for unforeseen contingencies		20,000		
		12,20,000		12,20,000

Working Notes

(1) Since the work certified (Rs 100 lakh/Rs 108 lakh) is more than 90 per cent of the total contract, the profit amount to be taken in profit & loss account can be determined by using the following formula (based on the pari-passu relationship between the work certified and contract price).

Budgeted estimated profit (given) × (Work certified/ Contract price) × (Cash received/Work certified)

= Rs 18,00,000 × (Rs 1,00,00,000/Rs 1,08,00,000) × (Rs 72,00,000/Rs 1,00,00,000) = Rs 12,00,000

(2) Due to non-availability of data with respect to work uncertified and likely future costs to be incurred to get the contract completed, budgeted estimated profit figures of Rs 18 lakh is taken as the basis of determining profit instead of Rs 12,20,000.

EQ.7.8 In the current quarter, a company has undertaken two jobs. The data relating to these jobs are as under:

	Job 1102	*Job 1108*
Selling price	Rs 1,07,325	Rs 1,57,920
Profit as percentage on cost	8	12
Direct materials	37,500	54,000
Direct wages	30,000	42,000

It is the policy of the company to charge factory overheads as percentage on direct wages and selling and administration overheads as percentage on factory cost. The company has received a new order for manufacturing of a similar job. The estimate of direct materials and direct wages relating to the new order are Rs 64,000 and Rs 50,000 respectively. A profit of 20 per cent on sales is required.

You are required to compute:

(i) The rates of factory overheads and selling and administration overheads to be charged;

(ii) The selling price of the new order. (*CA—November, 2002*)

SOLUTION

(i) Computation of factory overheads and selling and administration overhead rates:

Jobs cost sheet

	Job 1102	*Job 1108*
Direct materials	Rs 37,500	Rs 54,000
Direct wages	30,000	42,000
Prime cost	67,500	96,000
Add factory overheads	30,000F	42,000F
Factory cost	(67,500 + 30,000F)	(96,000 + 42,000F)
Add selling and administration overheads	(67,500 + 30,000F)S	(96,000 + 42,000F)S
Total cost	[67,500 + 30,000F] [1 + S]	[96,000 + 42,000F] [1 + S)]
Total cost of Job 1102 when 8% is profit on cost	Rs 1,07,325/100) × 108	Rs 99,375
Total cost of Job 1108 when 12% is profit on cost	(Rs 1,57,920/112) × 100	Rs 1,41,000

Let factory overheads = F% of direct wages and selling and administration overheads = S% of factory cost

We have the following equations

$$(67{,}500 + 30{,}000\,F)(1 + S) = 99{,}375$$

$$(96{,}000 + 42{,}000\,F)(1 + S) = 1{,}41{,}000$$

Or $67{,}500 + 30{,}000\,F + 67{,}500\,S + 30{,}000\,FS = 99{,}375$

$96{,}000 + 12{,}000\,F + 96{,}000\,S + 42{,}000\,FS = 1{,}41{,}000$

Or $30{,}000\,F + 67{,}500\,S + 30{,}000\,FS = 31{,}875$ (1)

$42{,}000\,F + 96{,}000\,S + 42{,}000\,FS = 45{,}000$ (2)

Divide equation (1) and (2) by 3,000

$$(10F + 22.5S + 10FS = 10.625) \times 14 \quad (3)$$

$$(14F + 32S + 14FS = 15) \times 10 \quad (4)$$

Subtracting equation (4) from equation (3)

$$(315S - 320S) = (148.75 - 150)$$

$$-5S = -1.25$$

$$S = 1.25/5 = 0.25, \text{ i.e. (25 per cent)}$$

Substituting S in equation (4)

$$14\,F + 32(0.25) + 14\,(0.25)F = 15$$

$$17.5\,F = 7$$

$$F = 7/17.5 = 0.40, \text{ (40 per cent)}$$

(ii) Selling price of new order:

Direct materials	Rs 64,000
Direct wages	50,000
Prime cost	1,14,000
Factory overheads (40% × Rs 50,000)	20,000
Factory cost	1,34,000
Selling and administration overheads (25% × Rs 1,34,000)	33,500
Total cost	1,67,500
Selling price of the new order = (Rs 1,67,500/80) × 100	2,09,375

EQ.7.9 Brock Construction Ltd. commenced a contract on November 1, 2003. The total contract was for Rs 39,37,500. It was decided to estimate the total profit on the contract and to take to the credit of profit and loss account that proportion of estimated profit on cash basis, which work completed bore to the total contract. Actual expenditure for the period November 1, 2004 to March 31, 2005 are given below:

	November 1, 2003 to October 31, 2004 (Actuals)	*November 1, 2004 to March 31, 2005(Estimated)*
Materials issued	Rs 6,75,000	Rs 12,37,500
Labour: Paid	4,50,000	5,62,500
Prepaid	25,000	—
Outstanding	—	2,500
Plant purchased	3,75,000	—
Expenses: Paid	2,00,000	3,50,000
Outstanding	50,000	25,000
Plant returns to store	75,000	3,00,000
(historical cost)	(on March 31, 2004)	(on March 31, 2005)
Work certified	20,00,000	Full
Work uncertified	75,000	
Cash received	17,50,000	
Materials at site	75,000	37,500

The plant is subject to annual depreciation @ 33-1/3 per cent on written down value method. The contract is likely to be completed on March 31, 2005.

Required:

Prepare the contract account. Determine the profit on the contract for the year November, 2003 to October, 2004 on prudent basis, which has to be credited to profit and loss account. (*CA—November, 2004*)

SOLUTION

Contract A/c for the year ending October 31, 2004

Particulars		*Amount*	*Particulars*		*Amount*
To materials issued		Rs 6,75,000	By plant returned to store on 31/03/04:		
To labour paid	Rs 4,50,000		Cost	Rs 75,000	
Less prepaid	25,000	4,25,000	Less depreciation (1/3)	10,417	Rs 64,583
To plant purchased		3,75,000	By work-In-Process		
To expenses paid	2,00,000		Certified	20,00,000	
Add outstanding	50,000	2,50,000	Uncertified	75,000	20,75,000
To notional profit c/d		6,89,583	By plant at site on 31/10/04:		
			Cost	Rs 3,00,000	
			Less depreciation (1/3)	1,00,000	2,00,000
			By materials at site		75,000
		24,14,583			24,14,583
To profit & Loss A/c			By notional profit b/d		6,89,583
Rs 2,34,305 × (17,50,000/20,00,000) × (20,00,000/39,37,500) (working note 1)		1,04,136			
To work-in-progress		5,85,447			
		6,89,583			6,89,583

(1) Working Note

Contract A/c for computing estimated profit (1 November 2003 to March 31, 2005)

Particulars	*Amount*	*Particulars*		*Amount*
To materials issued		By materials at site		Rs 37,500
(Rs 6,75,000 + Rs 12,37,500)	Rs 19,12,500	By plant returned to stores on		
To labour (paid and outstanding)		31/3/04		64,583
(Rs 4,25,000 + Rs 5,87,500		By plant returned to stores on		
+ Rs 2,500)	10,15,000	31/3/05:		
To plant purchased	3,75,000	Cost	Rs 3,00,000	
To expenses (Rs 2,50,000 + 3,25,000)	5,75,000	Less depreciation	1,00,000	
To estimated profit	2,34,305	Less depreciation of		
		5 months	27,778	1,72,222
		By contractee		39,37,500
	41,11,805			41,11,805

EQ.7.10 Reliable Construction Ltd. commenced a contract on April 1, 2007. The total contract was for Rs 49,21,875. It was decided to estimate the total profit on the contract and to take to the credit of P/L A/c that proportion of estimated profit on cash basis, which work completed bore to total contract. Actual expenditure for the period April 1, 2007 to March 31, 2008 and estimated expenditure for April 1, 2008 to September 30, 2008 are given below:

Particulars	*April 1, 2007 to March 31, 2008 (Actuals)*	*April 1, 2008 to September 30, 2008 (Estimated)*
Materials issued	Rs 7,76,250	Rs 12,99,375
Labour : Paid	5,17,500	6,18,750
: Prepaid	37,500	—
: Outstanding	12,500	5,750
Plant purchased	4,00,000	—
Expenses : Paid	2,25,000	3,75,000
: Outstanding	25,000	10,000
: Prepaid	15,000	—
Plant returns to store (historical cost)	1,00,000	3,00,000
	(On September 30, 2007)	(On September 30, 2008)
Work certified	22,50,000	Full
Work uncertified	25,000	—
Cash received	18,75,000	—
Materials at site	82,500	42,500

The plant is subject to annual depreciation @ 25% on written down value method. The contract is likely to be completed on September 30, 2008.

Required: Prepare the contract A/c. Determine the profit on the contract for the year 2007–08 on prudent basis, which has to be credited to P/L A/c. (*CA—May, 2006*)

SOLUTION

Contract account for the year ending March 31, 2008

Particulars		*Dr. Amount*	*Particulars*		*Cr. Amount*
To Materials issued		Rs 7,76,250	By plant (returned to		
To Wages	Rs 5,17,500		store, Rs 1,00,000 –		
Add outstanding	12,500		Rs 12,500 depreciation)		Rs 87,500
Less prepaid	(37,500)	4,92,500	By Materials at site		82,500
To Plant (purchased)		4,00,000	By Plant at site	Rs 3,00,000	
To Expenses	2,25,000		Less depreciation	75,000	2,25,000
Add outstanding	25,000		By Work-in-progress:		
Less prepaid	(15,000)	2,35,000	Work certified	22,50,000	
To profit and			Work uncertified	25,000	22,75,000
loss account		3,89,000			
To Reserve for unforeseen contingencies (balancing figure)		3,77,250			
		26,70,000			26,70,000

Computation of estimated profit

Expenditure upto March 31, 2008			Rs 15,08,750
Add estimated expenditure to complete the contract:			
Materials at site	Rs 82,500		
Add materials issued	12,99,375		
Less materials unused	(42,500)	Rs 13,39,375	
Wages paid	6,18,750		
Add payable	5,750		
Add prepaid (from previous year)	37,500		
Less paid for previous year	(12,500)	6,49,500	
Depreciation on plant (opening balance) (Rs 2,25,000 × 0.25 × 1/2 year)		28,125	
Expenses paid	Rs 3,75,000		
Add outstanding	10,000		
Add prepaid from previous year	15,000		
Less outstanding of previous year	(25,000)	3,75,000	23,92,000
Total estimated cost			39,00,750
Contract price			49,21,875
Estimated profit			10,21,125

Proportion of profit to be carried to profit & loss account = Estimated profit × (Work certified/contract price) × (Cash received/work certified)

= Rs 10,21,125 × (Rs 22,50,000/Rs 49,21,875) × (Rs 18,75,000/Rs 22,50,000)

= Rs 3,89,000

EQ.7.11 Sound Builders Ltd. commenced a contract on April 1, 2007. The total contract was for Rs 5,00,000. Actual expenditure for the period April 1, 2007 to March 31, 2008 and estimated expenditure for April 1, 2008 to December 31, 2008 are given below:

Particulars	*2007–08 (Actual)*	*2008–09 (9 months) (Estimated)*
Materials issued	Rs 90,000	85,750
Labour : Paid	75,000	87,325
Outstanding at the end	6,250	8,300
Plant	25,000	—
Sundry Expenses : Paid	7,250	6,875
Prepaid at the end	625	—
Establishment charges	14,625	—

A part of the material was unsuitable and was sold for Rs 18,125 (Cost being Rs 15,000) and a part of plant was scrapped and disposed off for Rs 2,875. The value of plant at site on 31 March, 2008 was Rs 7,750 and the value of materials at site was Rs 4,250. Cash received on account to date was Rs 1,75,000, representing 80% of the work certified. The cost of work uncertified was valued at Rs 27,375.

The contractor estimated further expenditure that would be incurred in completion of the contract:

- The contract would be completed by 31st December, 2008.
- A further sum of Rs 31,250 would have to be spent on the plant and the residual value of the plant on the completion of the contract would be Rs 3,750.
- Establishment charges would cost the same amount per month as in the previous year.
- Rs 10,800 would be sufficient to provide for contingencies.

Required: Prepare contract account and calculate estimated total profit on this contract. Profit transferrable to profit and loss account is to be calculated by reducing estimated profit in proportion to work certified and contract price.

(*CA (PCE)—May, 2007*)

SOLUTION

Contract account for the year ending March 31, 2008.

Particulars		*Dr. Amount*	*Particulars*	*Cr. Amount*
To Materials issued		Rs 90,000	By Materials (sold)	Rs 18,125
To Wages	Rs 75,000		By Plant (sale proceeds of	
Add outstanding	6,250	81,250	plant scrapped)	2,875
To Plant		25,000	By Plant at site	7,750
To Sundry expenses	Rs 7,250		By Materials at site	4,250
Less prepaid	625	6,625	By Work-in-process:	
To Establishment charges		14,625	Work certified (Rs 1,75,000/0.8)	2,18,750
To Materials (profit on			Work uncertified	27,375
sale of materials T/F to				
Profit and loss account)		3,125		
To Profit and loss account		29,960		
To Reserve for unforeseen				
contigencies (balancing figure)		28,540		
		2,79,125		2,79,125

Computation of estimated profit

Expenditure upto March 31, 2008			Rs 1,87,625
Add estimated expenditure to complete the contract:			
Materials at site	Rs 4,250		
Add materials issued	85,750	Rs 90,000	
Wages paid	87,325		
Add payable	8,300		
Less paid for 2007–8	(6,250)	89,375	
Sundry expenses	6,875		
Add prepaid in 2007–08	625	7,500	
Establishment charges (Rs 14,625 × 9/12)		10,969	
Plant at site	7,750		
Add overhauling expenses of plant	31,250		
Less closing value	(3,750)	35,250	2,33,094
			4,20,719
Add provision for contingencies			10,800
Total estimated cost			4,31,519
Contract price			5,00,000
Estimated profit			68,481

Proportion of profit to be carried to current year profit and loss account = (Rs 68,481 × Work certified/contract price). (Rs 68,481 × Rs 2,18,750/Rs 5,00,000) = Rs 29,960.

8 Process, Joint and By-product Costing

Introduction

The purpose of this chapter is to discuss and illustrate process costing—a system of costing applicable to organisations whose products pass through different processes. Section 1 examines the nature of process costing in terms of its comparison with job costing and the types of organisations for which it is suitable. The accounting procedure involved in computing the cost under this system of costing is illustrated in Section 2 with reference to: (a) Completed units, (b) Partially completed/incomplete units, (c) Spoilage, and (d) Inter-process profits. Sections 3 and 4 deal respectively with the related aspects of joint products and by-products. The costing for selling at split-off point or processing further is discussed in Section 5. The major points are summarised in the last section.

NATURE AND SUITABILITY

The process costing system refers to the procedure of determining the average unit cost in situations in which the product passes through more than one stage of the manufacturing process. In other words, it is used when identical units are produced through an on-going series of uniform production steps. The process costing system, as a cost accumulation procedure, can be applied when: (i) The output is homogeneous, that is, the units produced are alike in all respects, (ii) Production is continuous, (iii) Production precedes sales, and (iv) There is feasibility of segmentation of the manufacturing operations into clearly identifiable processes or departments. In view of these features, process costing is appropriate for industries such as chemicals, food processing, breweries, petroleum refining, glass, metal manufacturing, steel making, paper, and so on.

The process costing system can be distinguished from the job costing system in several respects. In the first place, in job costing, jobs receive varying degrees of skill and attention from each production department

or operation; in process costing, units of output produced receive identical attention from each production department or operation. Secondly, the job-order cost system identifies costs essentially with a specific job, while the process cost system identifies costs with units of work performed during a period of time. Thirdly, in job costing, unit costs are determined continuously as each job is completed, whereas in process costing, unit costs are determined periodically. Fourthly, in job costing, production is for a specific order to meet an individual customer's specifications; therefore, sales normally precede production. In process costing, production is for building up inventories for future sales and, therefore, production precedes sales. Further, the materials needed for jobs would depend on the receipt of specific job-order, and therefore, the materials inventory/stock held is small/minimum in job costing. In process costing, the materials needed for output are known and, hence, the materials inventory kept on hand tends to be higher *vis-à-vis* job costing. In addition, in job costing most of the costs are directly traceable to the jobs and, therefore, a major part of the total costs normally consists of direct costs; overheads form a relatively low proportion of these costs. In process costing, automation/mechanisation is feasible to a greater extent entailing higher overhead costs, but in job costing production runs are relatively short since the number of units produced each time depends on specific orders received. In marked contrast, in process costing, production being on a mass scale, production runs are long and often continuous. Finally, job cost sheets for each job are the backbone of the job/order costing system. Cost-of-production reports for each production process, department or operation constitute the focal points of the process costing system.

The foregoing differences notwithstanding, job and process costing systems are not mutually exclusive, that is, a firm need not limit itself to the adoption of either of the two systems. For, the same firm can use both the methods to serve cost information needs. For instance, automobile manufacturing firms may employ job costing in their engineering departments and process costing in their main assembly lines. Similarly, heavy equipment manufacturing firms often use job costing to determine the total cost of a large machine but the costs of mass produced machine components like switches, valves, and so on, are first determined by the process cost method.

COST ACCUMULATION IN PROCESS COSTING

The process cost system accumulates production costs according to departments or processes. Each department/process constitutes a *responsibility centre* from the point of view of cost control and performance evaluation through techniques such as standard costing, responsibility accounting, budgeting, and so on, It provides unit cost measures that are helpful in establishing selling price particularly when the firm employs ‘cost plus’ or some other type of cost-based product pricing.

Process costing assumes a sequential flow of costs from one process to another as units of output pass through a number of specified production processes. That is, the units leave the first process and take their costs with them to the second process, the units leave the second process and take their costs with them to the third process, and this process continues till the last process, when output is finally completed. Each process performs part of the total operation and transfers its ‘finished’ output to the next process, in which it is the input/raw material for further processing. The finished product of the last process is transferred to the finished goods inventory. Thus, the cost becomes cumulative as production moves along, the final process determining the total cost.

In process costing, a work-in-process account (process account) is set up for each production process, and the material, labour and indirect manufacturing overhead costs are recorded as the work progresses. Direct materials and direct labour costs are assigned to the respective process accounts using materials

requisition forms and payroll records. Likewise, indirect manufacturing overhead costs are often allocated to the units of each process on the basis of a predetermined departmental overhead application rate.

The procedure to determine the cost under process costing will depend on the stage of completion of the product in each process. From the point of view of the level of completion, a product may be fully or partially complete. During the production process, some units may be wasted. Moreover, the output of one process may be transferred at cost price or market/inflated price. We, therefore, elaborate the computation of unit costs in each of these situations in the discussions that follow.

Completed Units

Example 8.1 shows the calculation of costs when units are fully complete.

EXAMPLE 8.1

A product passes through two processes, A and B. During the month ended June 30, 1,500 units were produced. The detailed cost break-up is as follows:

	Process A	*Process B*
Direct materials	Rs 90,000	Rs 75,000
Direct labour	75,000	1,50,000
Direct expenses	15,000	18,000

Indirect overhead costs during the period were Rs 60,000 apportioned to the processes on the basis of direct labour cost. No work-in-progress existed at the beginning and end of the period.

Prepare relevant process accounts.

SOLUTION

Process A Account

To direct materials	Rs 90,000	By cost of output transferred	
To direct labour	75,000	to process B	Rs 2,00,000
To direct expenses	15,000		
To indirect overheads (Rs 60,000 × 1/3)	20,000		
	2,00,000		2,00,000

Process B Account

To process A (cost transferred)	Rs 2,00,000	By cost of output transferred	
To direct material	75,000	to finished goods inventory	Rs 4,83,000
To direct labour	1,50,000		
To direct expenses	18,000		
To indirect overheads (Rs 60,000 × 2/3)	40,000		
	4,83,000		4,83,000

Finished Goods Inventory

To process B (cost of output)	4,83,000

Incomplete Units

Given the nature of the production process, some units may remain incomplete at the time of accounting for the total cost of production. In such a situation, some units are complete while others are incomplete/partially complete. For the purpose of cost accumulation, the units of production are to be converted into comparable units. They are referred to as *equivalent units*. For instance, 100 units of inventory estimated to be 40 per cent complete are considered equivalent to 40 completed units. Therefore, for cost determination purposes, 100 partially completed units will be considered equal to 40 units of equivalent production. Symbolically:

$$\text{Equivalent units} = \text{Actual number of partially completed units} \times \text{Stage of completion} \quad (8.1)$$

The computation of equivalent units is illustrated in Examples 8.2 and 8.3, assuming that the stage of completion is uniform in respect of all items of cost and it is different in respect of raw materials and conversion costs (labour and overheads) respectively.

EXAMPLE 8.2

From the following information of ABC Manufacturers Limited, prepare a statement of equivalent units.

Opening inventory: Partially completed units (40 per cent complete)	600
Units introduced during the period	10,000
Closing inventory (partially completed units: 70 per cent complete)	2,000

SOLUTION

Statement of Equivalent Units

1. Work necessary to complete opening inventory (600 × 0.60)	360
2. Work necessary to start and finish units introduced during the current year (10,000 – 2,000 partially completed units)	8,000
3. Work performed on closing inventory (2,000 × 0.70)	1,400
Total number of equivalent units	9,760

EXAMPLE 8.3

From the following production record of XYZ Manufacturing Company Ltd, prepare a statement of equivalent units:

Units in process-opening		2,000
Stage of completion (%):	material	100
	labour	60
	overheads	50
New units introduced		20,000
Units completed		18,000
Units in process-closing		4,000
Stage of completion (%):	material	100
	labour	50
	overheads	40

SOLUTION

Table 8.1 *Statement of Equivalent Units*

Input	*Particulars*	*Number of units (completed or otherwise)*	*Work performed during the current period [stage of completion (per cent)]*			*Equivalent produced units: input units × stage completion in respect of*		
			Material	*Labour*	*Over-heads*	*Material*	*Labour*	*Over-heads*
Opening inventory 2,000 units	Work expended on opening inventories (100 per cent stage of completion)	2,000	Nil	40	50	—	800	1,000
+ 20,000 units introduced during the current period	Units started and completed during the current period (18,000 total units completed inventory)	16,000	100	100	100	16,000	16,000	16,000
	Closing inventory (work-in-process)	4,000	100	50	40	4,000	2,000	1,600
22,000		22,000				20,000	18,800	18,600

Process Accounts/Production Cost Report

Under the process costing system, the cost of production can be shown in form of production cost reports and/or process cost accounts.

Production Cost Report The cost of production report forms the backbone of the process cost records. It provides the summary of the production activity and costs of each process or department. On the basis of information regarding production activity in the report, it is possible to determine the number of equivalent units processed, unit costs per equivalent unit, and the quantity and cost of ending work-in-process inventories and of units completed and transferred to subsequent processing departments/finished goods inventory account. Cost of production report provides production and cost information, generally, in the following sequence of steps for a given period:

1. It accounts for physical flow of *all* units irrespective of their stage of completion during the period under reference.
2. It shows the computation of *equivalent* units of materials, labour and overheads; often the last two items are clubbed together and shown under the head of conversion costs.
3. It provides information for the total costs to be accounted for, consisting of the cost of opening work-in-process plus the costs of material, labour and factory overhead that were assigned to these units during the current period.
4. It shows very explicitly the procedure of determining the cost per equivalent unit of output processed.
5. Finally, it indicates the manner of allocating the cost of processing to ending work-in-process and to units completed and transferred.

The total cost of production of each process is split into: (i) Cost of output and (ii) Closing inventory. The distribution between these two elements would depend on the method of valuation of work-in-process (closing inventory), namely, weighted average method and first-in-first-out (FIFO) method.

Weighted Average Cost Method Under this method, total costs in process are divided by *equivalent* units produced by the process to ascertain the cost per equivalent unit. Total cost in process is the sum of

the current production costs and the costs of opening work-in-process. Total equivalent units produced by the process are determined by adding units completed during the current period and equivalent units of work performed on opening and closing inventories.

FIFO Method Unlike the weighted average cost method, this method is based on the assumption that units in process at the beginning of the period are the first to be completed and accordingly the first costs incurred in the current period should be attached to the units of the opening work-in-process inventory. Therefore, under this method, the cost of the units that are completed from the opening inventory is separated from the cost of the units that have been introduced and completed during the current period. As a result, under the FIFO method, closing work-in-process inventory is based on the cost pertaining to the current period only *vis-à-vis* average cost under the weighted average cost method.

Exhibits 8.1 and 8.2 show the process accounts prepared as per the weighted average cost and FIFO methods respectively.

EXHIBIT 8.1 *Process Account (Weighted Average Cost Method)*

To work-in-process (opening inventory)	By cost of completed units transferred to next process/finished goods inventory A/c
To current costs	By closing work-in-process
Material	
Labour	
Overheads	
To closing work-in-process inventory to be carried to the next period	

EXHIBIT 8.2 *Process Account (FIFO Method)*

To work-in-process opening inventory during the current period (units partially completed in earlier period)	By units completed 1. Units started in earlier period and completed during the current period
To current costs	2. Units started and completed during the current period
1. To complete opening inventory units	3. Units started but not completed during the current period
2. To work initiated on new units in the current period in this process:	
(a) Some of which are completed and transferred	
(b) Some of which are not yet completed and carried as opening inventory for next period	
To closing work-in-process inventory to be carried forward to the next period	

The effect of the two methods of valuation is that a larger share of the total cost will be allocated to the closing inventory according to the FIFO method, whereas with the weighted average cost method the current output will be charged at a relatively higher amount. Example 8.4 illustrates the process costs using both these methods.

EXAMPLE 8.4

For the firm in Example 8.3, assume the following:

Cost of 2,000 units in process (opening):	
Materials	Rs 6,000
Labour	3,600
Overheads	2,400
Processing costs during the current period	
Materials	69,900
Labour	56,560
Overheads	58,360

Prepare a cost of production report for the current period using (a) weighted average, and (b) FIFO costing methods.

SOLUTION

Cost of Production Report of Process A (Weighted average cost method)

Flow of completed or partially completed units:				
Opening	2,000			
Introduced	20,000			
Total in process	22,000			
Less completed	18,000			
In process	4,000			
Equivalent units in process:				
		Conversion costs		
	Material	*Labour*	*Overhead*	
Units completed	18,000	18,000	18,000	
Equivalent units in ending inventory	4,000	2,000	1,600	
	22,000	20,000	19,600	
Total cost to be accounted for:				
	Material	*Labour*	*Overheads*	*Total*
Work-in-process (opening)	Rs 6,000	Rs 3,600	Rs 2,400	Rs 12,000
Current costs	69,900	56,560	58,360	1,84,820
Total cost in process	75,900	60,160	60,760	1,96,820
Equivalent units (EU) in process	22,000	20,000	19,600	—
Cost per equivalent unit in process (Total cost ÷ EU)	3.45	3.008	3.1	9.558
Costs accounted for:				
Transferred to finished goods inventory (18,000 × Rs 9.558)				1,72,044
Work-in-process (closing inventory)				
Materials (4,000 × 100 per cent × Rs 3.45)		Rs 13,800		
Labour (4,000 × 0.50 × Rs 3.008)		6,016		
Overheads (4,000 × 0.40 × Rs 3.1)		4,960		24,776
Total costs accounted for				1,96,820

Cost of Production Report of Process A (FIFO method)

Flow of completed or partially completed units:				
Opening	2,000			
Introduced	20,000			
Total in process	22,000			
Less completed	18,000			
In process	4,000			
Equivalent units manufactured:				
		Conversion costs		
	Material	*Labour*	*Overheads*	
Units completed	18,000	18,000	18,000	
Equivalent units in ending inventory	4,000	2,000	1,600	
Equivalent units in process	22,000	20,000	19,600	
Less equivalent units in opening inventory	2,000	1,200	1,000	
Equivalent units manufactured	20,000	18,800	18,600	
Total costs to account for:				
	Material	*Labour*	*Overheads*	*Total*
Opening work-in-process	—	—	—	Rs 12,000
Current costs	Rs 69,900	Rs 56,560	Rs 58,360	1,84,820
Total costs in process				1,96,820
Equivalent units manufactured	20,000	18,800	18,600	—
Cost per equivalent unit manufactured	3.495	3.0085	3.1376	9.6411
Costs accounted for:				
Transferred to finished goods inventory				
First batch:				
Work-in-process opening inventory		Rs 12,000		
Add conversion costs:				
Labour (2,000 × 0.40 × Rs 3.0085)		2,406.8		
Overheads (2,000 × 0.50 × Rs 3.1376)		3,137.6		Rs 17,544.4
Second batch:				
Started and completed (16,000 × Rs 9.6411)				1,54,257.6
Work-in-process (closing):				
Materials (4,000 × 100 per cent × Rs 3.495)		13,980		
Labour (4,000 × 0.50 × Rs 3.0085)		6,017		
Overheads (4,000 × 0.40 × Rs 3.1376)		5,020.16		25,017.16
				1,96,819.16

Comparison For comparison of the two costing methods, summary results of important items are listed below:

	FIFO		*Weighted average cost*
(A) Cost of output transferred from			
(i) Opening inventory	Rs 17,544.40		Rs 1,72,044
(ii) Current production	1,54,257.60	Rs 1,71,802	
(B) Closing work-in-process		25,017.16	24,776
		1,96,819.16	1,96,820

Spoilage

In the case of firms whose output passes through several stages, some wastage/spoilage of units takes place for a variety of reasons, such as breakdown of machines, use of substandard material, poor workmanship,

evaporation, shrinkage, and so on. The effect of wastage is that the actual units produced are less than the units introduced initially.

The treatment of spoiled units depends on the nature of the spoilage/wastage/loss. The wastage may be normal or abnormal. *Normal loss* may be defined as the loss of units which is an inherent part of the production process caused by natural or unavoidable causes such as milling, drying, breaking, weighing, evaporating, processing, loading, unloading, and so on. Any loss in excess of the normal spoilage is called *abnormal loss*. It is a controllable loss. It involves consumption of resources without accruing corresponding benefits to the firm. On the other hand, if the number of units actually lost are less than the number of units normally expected to get lost, the difference would represent an abnormal gain/effectiveness.

Normal spoilage forms part of the product cost. Since it is inherent in the production process, it occurs even under efficient operating conditions. Therefore, the cost of production of spoiled units is recovered from the good units. Abnormal loss is treated as a period cost and is written off as a loss of the period in which it occurs. It is relevant for determining the process cost. Likewise, abnormal gain is transferred to the profit and loss account of the period.

It is likely that the wasted units (normal as well as abnormal) may have salvage value. The sale proceeds of the units in normal waste would reduce the cost of production. The loss on abnormal wastage charged against the costing profit and loss account will be lower to the extent of the revenue received from their sale.

The unit cost with normal spoilage and with salvage value is computed as per Equation 8.2 and the amount of loss on account of abnormal spoilage to be transferred to profit and loss account is determined as in Equation 8.3.

$$\text{Cost per unit} = (\text{Total process cost-Salvage value of normal spoilage}) \div (\text{Total units introduced-Normal loss in units}) \quad (8.2)$$

$$\text{Abnormal loss} = [\text{Abnormal loss in units} \times \text{Unit production cost}] - \text{Salvage value of abnormal spoilage} \quad (8.3)$$

The treatment of spoilage is illustrated in Example 8.5.

EXAMPLE 8.5

Six hundred kgs of material was charged to process I at the rate of Rs 4 per kg. The direct labour accounted for Rs 200 and the other departmental expenses amounted to Rs 760. The normal loss is 10 per cent of input. During the period, the actual production was 500 kgs and 100 kgs was scrap. Assuming that the scrap is saleable at Rs 2 per kg, prepare a ledger account of process I, showing the values of normal and abnormal losses.

SOLUTION

Process I Account

Particulars	*Units (kgs)*	*Amount*	*Particulars*	*Units (kgs)*	*Amount*
To materials	600	Rs 2,400	By normal loss (600 × 0.10)	60	Rs 120
To wages		200	By abnormal loss	40	240
To departmental expenses			By process II (500 units		
		760	transferred at Rs 6 each)	500	3,000
	600	3,360		600	3,360

Working Notes

Cost per unit = (Rs 3,360 - Rs 120)/ 540 units = Rs 6

Amount of abnormal loss

Units introduced	600
Less normal loss (10 per cent)	60
Normal output expected	540
Less actual output achieved	500
Abnormal loss (units)	40
(×) Cost per unit	Rs 6
Total loss	240
Less sale value of scrap (40 × Rs 2)	80
Total	160

We now take comprehensive examples (8.6 to 8.10) to illustrate the preparation of process accounts under different situations.

EXAMPLE 8.6 *(Closing Work-in-Process with Process Loss or Gain)*

AB Ltd is engaged in the process engineering industry. During the month of April, 2,000 units were introduced in process X, the normal loss was estimated at 5 per cent of input. At the end of the month, 1,400 units had been produced and transferred to process Y; 460 units were incomplete and 140 units had to be scrapped during the process. The incomplete units had reached the following stages of completion: Material, 75 per cent; Labour, 50 per cent; Overhead, 50 per cent.

Further information on process X:

Cost of the 2,000 units	Rs 58,000
Additional direct material	14,400
Direct labour	33,400
Direct overhead	16,700

Scrapped units realised Rs 10 each.

Prepare a statement of equivalent production, statement of cost, statement of apportionment of cost and process × account.

SOLUTION

Statement of Equivalent Production

Input	*Particulars*	*Number of units (completed or otherwise)*	*Stage completion (per cent)*			*Equivalent units (units × stage of completion)*		
			Material	*Labour*	*Over-heads*	*Material*	*Labour*	*Over-heads*
2,000	Units introduced		100	100	100	1,400	1,400	1,400
	Units produced	1,400						
	Normal loss (0.5 × 2,000)	100	—	—	—	—	—	—-
	Abnormal loss (140 units – 100, normal)	40	100	100	100	40	40	40
	Closing inventory	460	75	50	50	345	230	230
		2,000				1,785	1,670	1,670

Statement of Cost

Particulars	*Total cost*	*Equivalent production(units)*	*Cost per unit*
Materials			
Cost of units introduced	Rs 58,000		
Additional direct material	14,400		
	72,400		
Less sale proceeds of scrap material (100 units × Rs 10)	1,000		
	71,400	1,785	Rs 40
Direct labour	33,400	1,670	20
Direct overheads	16,700	1,670	10
	1,21,500		70

Statement of Apportionment of Cost

Particulars	*Element of cost*	*Equivalent production*	*Cost per unit*	*Cost*	*Total cost*
Finished production	Material	1,400	Rs 40	Rs 56,000	
	Labour	1,400	20	28,000	
	Overhead	1,400	10	14,000	Rs 98,000
Abnormal loss	Material	40	40	1,600	
	Labour	40	20	800	
	Overhead	40	10	400	2,800
Work-in-process	Material	345	40	13,800	
	Labour	230	20	4,600	
	Overhead	230	10	2,300	20,700
					1,21,500

Process X Account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To raw material	2,000	Rs 58,000	By normal loss	100	Rs 1,000
To other direct materials		14,400	By abnormal loss	40	2,800
To direct labour		33,400	By process Y (transferred @ Rs 70)	1,400	98,000
To direct overheads		16,700	By work-in-process	460	20,700
	2,000	1,22,500		2,000	1,22,500

EXAMPLE 8.7 *(Opening and Closing Work-in-Process with Process Loss/Gains)*

The finished output of a factory passes through two processes, the entire material being introduced at the beginning of the first process. From the following production and cost data relating to the first process, work out the value of closing inventory and the value of materials transferred to the second process. Also prepare process I account.

Process I: Opening stock, 10,000 units at Rs 50,000

Stage of completion of opening inventory: Materials, 100 per cent; Labour, 60 per cent; Overheads; 50 per cent.

Units introduced during the process: 50,000 units at Rs 1,44,000; Direct labour, Rs 81,000; Overheads, Rs 80,000.
Units transferred to next process, 38,000
Spoilage during the process (units), 7,000
Stage of completion of closing inventory, 15,000 units: Material, 100 per cent; Labour, 50 per cent; Overheads, 40 per cent.
Normal loss, 10 per cent of input.
Sale value of spoilage, Rs 2 per unit.

SOLUTION

Statement of Cost

Particulars	*Total cost*	*Equivalent production (units)*	*Cost per unit*
Materials	Rs 1,44,000		
Less sale value of normal scrap (6,000 × Rs 2)	12,000		
	1,32,000	44,000	Rs 3
Direct labour	81,000	40,500	2
Overheads	80,000	40,000	2
	2,93,000		7

Statement of Equivalent Production

Input units	*Particulars*	*Number of units (completed or otherwise)*	*Stage completion (per cent)*			*Equivalent units (units × stage of completion)*		
			Material	*Labour*	*Over-heads*	*Material*	*Labour*	*Over-heads*
10,000	Opening stock (100 per cent stage of completion)	10,000	Nil	40	50	—	4,000	5,000
50,000	Units started and completed (38,000 – 10,000, opening inventory)	28,000	100	100	100	28,000	28,000	28,000
	Normal loss (0.10 × 60,000)	6,000	—	—	—	—	—	—-
	Abnormal loss (7,000-6,000)	1,000	100	100	100	1,000	1,000	1,000
	Closing work-in-process	15,000	100	50	40	15,000	7,500	6,000
60,000		60,000				44,000	40,500	40,000

Note: FIFO method of cost flow has been assumed.

Statement of Apportionment of Cost

Particulars	*Element of cost*	*Equivalent production*	*Cost per unit*	*Total cost*	
Opening inventory (combined)	—	—	—	Rs 50,000	—-
	Material	—	—	—	—-
	Labour	4,000	Rs 2	8,000	
	Overheads	5,000	2	10,000	Rs 68,000
Units introduced and completed	Material	28,000	3	84,000	
	Labour	28,000	2	56,000	
	Overheads	28,000	2	56,000	1,96,000
Abnormal loss	Material	1,000	3	3,000	
	Labour	1,000	2	2,000	
	Overheads	1,000	2	2,000	7,000
Closing work-in-process	Material	15,000	3	45,000	
	Labour	7,500	2	15,000	
	Overheads	6,000	2	12,000	72,000

Process I Account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To opening work-in-process	10,000	Rs 50,000	By normal loss	6,000	12,000
			By abnormal loss	1,000	7,000
To direct material costs	50,000	1,44,000	By process II (Rs 68,000 + Rs 1,96,000)	38,000	2,64,000
To direct labour		81,000			
To overheads		80,000	By work-in-process	15,000	72,000
	60,000	3,55,000		60,000	3,55,000

EXAMPLE 8.8 *(Determination of Abnormal Loss When Units are Scrapped and Spoiled Units are at Different Stages of Completion)*

In **Example 8.7**, assume the stages of completion in respect of 7,000 spoiled units are as follows: Material, 100 per cent; Labour, 50 per cent; Overheads, 60 per cent.
Determine the abnormal loss.

SOLUTION

Determination of Abnormal Loss

Cost element	*Number of units*	*Stage of completion (per cent)*	*Equivalent units*	*Cost per unit*	*Total cost*
Material	1,000	100	1,000	Rs 3.000	Rs 3,000.00
Labour	1,000	50	500	2.025	1,012.50
Overheads	1,000	60	600	2.020	1,212.00
					5,224.50

Material cost	(Rs 1,32,000 ÷ 44,000)	=	Rs 3.00 per unit
Labour cost	(Rs 81,000 ÷ 40,000)	=	2.025 per unit
Overhead costs	(Rs 80,000 ÷ 39,600)	=	2.02 per unit

EXAMPLE 8.9 *(Abnormal Loss and Abnormal Gain with no Work-in-process Inventory)*

XYZ Chemical Ltd processes a range of products including a detergent, 'Washo', which passes through 3 processes before completion and transfer to the finished goods warehouse. During April, data relating to this product were as follows:

	Process I	*Process II*	*Process III*	*Total*
Basic raw material (10,000 units)	Rs 6,000	—	—	Rs 6,000
Direct raw material added in process	8,500	9,500	5,500	23,500
Direct wages	4,000	6,000	12,000	22,000
Direct expenses	1,200	930	1,340	3,470
Production overhead				16,500
Output (units)	9,200	8,700	7,900	
Normal loss in process of input (per cent)	10	5	10	
Scrap value loss per unit	0.20	0.50	1	

The production overhead is absorbed as a percentage of direct wages. There was no stock at the start or at the end of any process.

You are required to prepare the following accounts: (i) Process I; (ii) Process II; (iii) Process III; (iv) Abnormal loss; and (v) Abnormal gain.

SOLUTION

Process I Account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To raw materials	10,000	Rs 6,000	By normal loss (0.10 × 10,000)	1,000	Rs 200
To other direct raw materials		8,500	By process II (transferred @ Rs 2.50 per unit:		
To direct wages		4,000	Rs 22,500 ÷ 9,000)	9,200	23,000
To direct expenses		1,200			
To manufacturing overheads [0.75 × (Rs 16,500 ÷ Rs 22,000) of wages]		3,000			
To abnormal gain (9,200 – 9,000, normal output)	200	500			
	10,200	23,200		10,200	23,200

Process II Account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To output transferred from process I	9,200	Rs 23,000	By normal loss (0.05 × 9,200)	460	Rs 230
To direct raw materials		9,500	By process III (transferred @ Rs 5: Rs 43,700 ÷ 8,740)	8,700	43,500
To direct wages		6,000	By abnormal loss (8,740 normal output – 8,700)	40	200
To direct expenses		930			
To manufacturing overheads (0.75 × Rs 6,000)		4,500			
	9,200	43,930		9,200	43,930

Process III Account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To output transferred from process II	8,700	Rs 43,500	By normal loss (8,700 × 0.10)	870	Rs 870
To direct material		5,500	By finished stock A/c (final output transferred @ Rs 9 per unit)	7,900	71,100
To direct wages		12,000			
To direct expenses		1,340			
To manufactured overhead (0.75 × Rs 12,000)		9,000			
To abnormal gain (7,900 – 7,830, normal output)	70	630			
	8,770	71,970		8,770	71,970

Abnormal Loss Account

To process II	40	200	By sale proceeds of scrap @ Rs 0.50 per unit	40	20
			By profit @ loss A/c (loss transferred)		180
	40	200		40	200

Abnormal Gain Account

To normal loss			By process I A/c	200	500
Process I	200	40	By process III A/c	70	630
Process II	70	70			
To profit and loss account (profit transferred)		1,020			
	270	1,130		270	1,130

EXAMPLE 8.10 *(Intermediate Process Output is Partially Sold and Partially Transferred)*

A chemical company processes a patent material used in buildings. The material is produced in three consecutive grades: soft, medium and hard. The details of its operations are as follows:

	Process I	*Process II*	*Process III*
Raw material used (tonnes)	1,000		
Cost per tonne	Rs 200		
Total manufacturing expenses	87,500	Rs 39,500	Rs 10,710
Weight lost (per cent of input of the process)	5	10	20
Scrap (Sale price Rs 50 per tonne) (tonnes)	50	30	51
Sale price per tonne	350	500	800

Management expenses were Rs 7,500 and selling expenses, Rs 5,000. Two-thirds of the output of process I and one-half of the output of process II is passed on to the next process and the balance is sold. The entire output of process III is sold.

Prepare relevant process accounts.

SOLUTION

Process I Account

Particulars	*Tonnes*	*Amount*	*Particulars*	*Tonnes*	*Amount*
To direct raw materials	1,000	Rs 2,00,000	By weight lost	50	—
To manufacturing expenses		87,500	By scrap sales	50	Rs 2,500
To profit		10,000	By sales (900 × 1/3)	300	1,05,000
			By Process II	600	
			(Rs 2,85,000 × 2/3)	—	1,90,000
	1,000	2,97,500		1,000	2,97,500

Process II Account

Particulars	*Tonnes*	*Amount*	*Particulars*	*Tonnes*	*Amount*
To process I			By weight lost	60	—-
(transferred from)	600	Rs 1,90,000	By scrap sales	30	Rs 1,500
To manufacturing expenses		39,500	By sales (510 × 1/2)	255	1,27,500
To profit		13,500	By process III (transferred)		
			(Rs 2,28,000 × 1/2)	255	1,14,000
	600	2,43,000		600	2,43,000

Process III Account

Particulars	*Tonnes*	*Amount*	*Particulars*	*Tonnes*	*Amount*
To process II			By weight loss	51	—
(transferred from)	255	Rs 1,14,000	By scrap sales	51	Rs 2,550
To manufacturing expenses		10,710	By sales	153	1,22,400
To profit		240			
	255	1,24,950		255	1,24,950

Statement of Profit

Profit from			
Process	I	Rs 10,000	
	II	13,500	
	III	240	
Total			Rs 23,740
Less: management expenses		7,500	
selling expenses		5,000	12,500
Net profit			11,240

Note: Weight lost as well as scrap material is assumed to be normal loss.

Inter-Process Profits

The transfer of the output of one process to another can either be at the cost or at the market/inflated price. The cost basis of inter-process transfer of output has a serious limitation in that the efficiency or inefficiency of one process is passed on to the next. The market price basis overcomes this weakness.

The efficiency of process operations can be judged by comparing the value of output of a process with the price which would be paid for purchasing material from the market. If the market price is lower, the process operations are clearly not efficient. Conversely, if the market price is higher, efficiency of the process operations should be recognised in terms of profits contributed by the process equal to the excess of market price over its cost. Naturally, for true comparison of efficiency of, say, process II, the output of process I should be transferred at market price and not at the cost price. '*Market/inflated price transfer formula*' has an additional advantage in that the final process account is not artificially distorted by inclusion of a figure of profit which has, in fact, accrued throughout the sequence of prior processes. Each process is, thus, made to stand by itself. The determination of the true cost of each process independent of others is of utmost significance particularly for those process industries where there are clear-cut possibilities of getting the intermediate supplies form the market. Therefore, the '*economy cost*' of performing such operations should be determined. For these reasons, inter-process transfer should be at the current market value or by the addition of an arbitrary percentage to cost. Such transfers would involve inter-process profits.

One important consequence of inflated transfer price (for inter-processes output) would be on valuation of closing stock. The inter-processes profit should be deducted from the closing inventory to show the inventory at cost price. This is illustrated in Examples 8.11 and 8.12.

EXAMPLE 8.11 *(Inter-Process Profits)*

A product passes through three processes, A, B, and C. The output of process A and B is charged to the next process at a price calculated to give a profit of 16.67 per cent on transfer price while the output of process C is charged to the finished stock account at a profit of 13.33 per cent on the transfer price. From the following particulars, prepare the process cost accounts and calculate the amount of reserve that should be made in respect of the stock in hand.

	Process A	*Process B*	*Process C*
Materials and labour	Rs 7,000	Rs 2,800	Rs 4,800
Closing stock	2,000	2,800	2,000

There was no stock in hand at the beginning of the period. The closing stocks are valued at prime cost in each process.

SOLUTION

Process A Account

Particulars	*Amount*	*Particulars*	*Amount*
To materials and labour	Rs 7,000	By closing stock	Rs 2,000
To profit (Rs 6,000 × 0.1667)	1,000	By process B (Rs 5,000 × 120/100)	6,000
	8,000		8,000

Process B Account

Particulars	*Amount*	*Particulars*	*Amount*
To process A	Rs 6,000	By closing stock	Rs 2,800
To material and labour	2,800	By process C (Rs 6,000 × 120/100)	7,200
To profit (Rs 7,200 × 0.1667)	1,200		
	10,000		10,000

Process C Account

Particulars	*Amount*	*Particulars*	*Amount*
To process B	Rs 7,200	By closing stock	Rs 2,000
To materials and labour	4,800	By finished goods (10,000 × 115.38/100)	11,538
To profit (Rs 11,538 × 0.1333)	1,538		
	13,538		13,538

Working Notes

1. Profit of 16.67 per cent on transfer means 20 per cent on cost price.
2. Likewise, profit of 13.33 per cent on transfer price means 15.38 per cent on cost.
3. Provision for unrealised profit:
   Process A: Nil
   Process B: (Rs 1,000 × 2,800)/8,800 = Rs 318
   Process C: Closing stock of process C of Rs 2,000 is made up of respective cost proportions of C: B, that is, 2:3 (Rs 4,800: Rs 7,200).
   Process C's share is = Rs 2,000 × 2/5 = Rs 800
   Process B's share is = Rs 2,000 × 3/5 = Rs 1,200
   Profit included in Rs 1,200 (process B's cost) is = Rs 1200 × 20/120 = Rs 200 (i)
   Profit included in Rs 1,000. This includes part of process A's costs: Rs 1,000 × 60/88= Rs 682.
   Rs 682 includes profit element of = Rs 682 × 20/120 = Rs 113 (ii)
   Total profit included in process C = Rs 313 (200 + 113) (i + ii)

Statement of Profit

Process A		Rs 1,000
Process B	Rs 1,200	
Less provision for unrealised profit	318	882
Process C	1,538	
Less provision for unrealised profit	313	1,225
Profit realised		3,107

Alternatively

Process A Account

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
To materials and labour	Rs 7,000	Rs 7,000	—	By closing stock	Rs 2,000	Rs 2,000	—
To profit (Rs 5,000 $\times \frac{50}{3} \times \frac{3}{250}$)	1,000	—	Rs 1,000	By process B (transferred)	6,000	5,000	Rs 1,000
	8,000	7,000	1,000		8,000	7,000	1,000

Process B Account

	Total	*Cost*	*Profit*		*Total*	*Cost*	*Profit*
To process A	Rs 6,000	Rs 5,000	Rs 1,000	By Closing stock (2,800 × 1,000)			
To materials and labour	2,800	2,800	—	÷ 8,800	Rs 2,800	Rs 2,482	Rs 318
To profit and loss A/c				By process C (transferred)	7,200	5,318	1,882
(Rs 6,000 × (50 × 3) ÷ (3 × 250))	1,200	—	1,200				
	10,000	7,800	2,200		10,000	7,800	2,200

Process C Account

To process B	Rs 7,200	Rs 5,318	Rs 1,882	By closing stock	Rs 2,000	Rs 1,687	Rs 313
To materials and labour	4,800	4,800	—	By finished goods A/c (at 115.38 per cent of cost)	11,538	8,431	3,107
To profit and loss A/c (0.1333 × Rs 11,538)	1,538	—	1,538				
	13,538	10,118	3,420		13,538	10,118	3,420

EXAMPLE 8.12 *(Inter-Process Profit When Opening Inventory of Processes is Given)*

A Ltd makes a product which passes through two processes before it is completed and transferred to finished stock. The following data related to the month of December:

Particulars	*Process I*	*Process II*	*Finished stock*
Opening stock	Rs 7,500	Rs 9,000	Rs 22,500
Direct materials	15,000	15,750	
Direct wages	11,200	11,250	
Factory overheads	10,500	4,500	
Closing stock	3,700	4,500	11,250
Inter-process profit included in opening stock		1,500	8,250

Output of process I is transferred to process II at 25 per cent profit on the transfer price. Output of process II is transferred to finished stock at 20 per cent profit on the transfer price. Stocks in process are valued at prime cost. Finished stock is valued at the price at which it is received from process II. Sales during the period were Rs 1,40,000.

Prepare process cost account and finished goods account showing the profit element at each stage.

SOLUTION

Process I Account

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
To opening stock	Rs 7,500	Rs 7,500	—	By process II (Rs 40,500			
To direct materials	15,000	15,000	—	× 133.33/100)	Rs 54,000	Rs 40,500	Rs 13,500
To direct wages	11,200	11,200					
Less closing stock	(3,700)	(3,700)					
Prime cost	30,000	30,000					
To factory overheads/ process cost	10,500	10,500					
Process cost	40,500	40,500					
To profit & loss A/c(0.25 × Rs 54,000)	13,500		Rs 13,500				
	54,000	40,500	13,500		54,000	40,500	13,500

Process II Account

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
To opening stock	Rs 9,000	Rs 7,500	Rs 1,500	By finished stock (Rs 90,000			
To process I (transferred from)	54,000	40,500	13,500	× 125/100)	Rs 1,12,500	Rs 75,750	Rs 36,750
To direct materials	15,750	15,750	—				
To direct wages	11,250	11,250	—				
Less closing stock	(4,500)	(3,750)	(750)				
Prime cost	85,500	71,250	14,250				
To factory overheads	4,500	4,500					
Process cost	90,000	75,750	—				
To profit & loss A/c	22,500	—	22,500				
	1,12,500	75,750	36,750		1,12,500	75,750	36,750

Finished Stock Account

To opening stock	Rs 22,500	Rs 14,250	Rs 8,250	By closing stock	Rs 11,250	Rs 7,500	Rs 3,750
To Process II (transferred from)	1,12,500	75,750	36,750	By sales	1,40,000	82,500	57,500
To profit & loss A/c (profit transferred)	16,250	—	16,250				
	1,51,250	90,000	61,250		1,51,250	90,000	61,250

Working Notes

1. If Rs 90,000 prime cost includes Rs 15,000 profit, then Rs 4,500 closing stock would include: Rs 15,000 × Rs 4,500)/Rs 90,000 = Rs 750
2. *Statement of Profit*

Particulars		*Amount*
Process I:		Rs 13,500
Process II:	Rs 22,500	
Adjustment: provision for unrealised profit		
Add for opening stock	1,500	
Less for closing stock	750	23,250
Finished stock account	16,250	
Adjustment of provision for unrealised profit		
Add for opening stock	8,250	
Less for closing stock	3,750	20,750
		57,500

3. If Rs 1,35,000 includes Rs 45,000 profit, then Rs 11,250 closing stock would include: (Rs 45,000 × Rs 11,250) ÷ Rs 1,35,000 = Rs 3,750

The process accounts prepared in columnar form are more informative and useful as they provide classified information regarding cost and profit. This information shows inter-process profits included in the value of output (stock) transferred from one process to another, while such profits are to be computed separately in non-columnar form of process accounts.

JOINT PRODUCTS

Joint products are a feature of industries which process natural raw materials such as petroleum, chemicals, dairy products, wood products, mining and extractive industries. Two or more products produced simultaneously from a common set of inputs through a single manufacturing process (joint process), are called joint products.

Since joint products are the result of the use of some common items of cost, these items of cost are known as common/joint costs. The joint/multiple products resulting from common costs can be either sold at this stage of production or they can be processed further. Therefore, this stage of the joint production process is known as the *split-off point. Split-off point* is that stage in the manufacturing process where the joint products are separately identifiable. Prior to the point of split-off/ separation, products are not subject to identification nor are the costs. Therefore, production costs incurred prior to the split-off point are called *joint costs*, and those incurred after the split-off point are called *separable costs*. Being so, separable costs

can be directly traced to specific products and, therefore, do not entail any problem of cost allocation while the same is not true of joint costs.

Allocation of Joint Costs

The critical problem in accounting for joint products is that of allocating common process costs among the separate/multiple outputs that emerge from the joint process. The allocation method used will determine the amount of common processing cost allocated to each of the joint outputs. The commonly-used methods for allocating joint processing costs include:

1. Physical quantities method/Unit method.
2. Relative sales value method/Net realisable value method.
3. Net realisable value less normal profit method.
4. Weighted averages cost method.

Physical Quantities Method/Unit Method Under this method, the total costs (material, labour and overhead) incurred in the joint production process are allocated to various products in proportion to the physical measurement of the output. The physical measure might be volume, weight, surface area or any other common measure of the physical characteristics. Thus, under this method, the common attribute is aggregated and the joint costs are allocated on the basis of each product's relative share of it. This is illustrated in Example 8.13.

EXAMPLE 8.13 *(Allocation of Joint Costs Under Unit Method)*

Royal Industries Ltd manufactures products X, Y and Z by processing a specific raw material in Department 1. The production process is such that every 1,100 kgs of raw materials that is put into Department 1 yields 400 kgs of X, 250 kgs of Y and 350 kgs of Z. The total cost of processing a batch of 1,100 kgs of raw materials through Department 1 is Rs 22,000. Allocate the joint costs to the three products using the physical quantity method.

SOLUTION

Joint Cost Allocation Using Unit Method

Product	*Output (kgs)*	*Rates (per cent)*	*Allocated joint cost*	*Cost per unit*
X	400	40	Rs 8,800	Rs 22
Y	250	25	5,500	22
Z	350	35	7,700	22
	1,000	100	22,000	22

This method results in identical unit costs for each product. Identical benefits exist only if the products are homogeneous. It will, therefore, provide a satisfactory basis of allocating joint cost if the different products are homogeneous and their sale prices are relatively close to each other. Otherwise, it may lead to misleading results in that there will be wide divergence in the gross margin of the different products as shown in Table 8.2.

Table 8.2 *Gross Margin of Different Products*

	Product X	*Product Y*	*Product Z*
Sales price	Rs 33	Rs 44	Rs 66
Less cost of production	22	22	22
Cross margin	11	22	44
Gross margin percentage	33.33	50	66.67

Relative Sales Value/Net Realisable Value (NRV) Method As per this method, joint costs are *prorated* among multiple products on the basis of the market value of the products manufactured. This method is based on the premise that if a product has a higher sale price, it costs more to produce and, hence, the market value basis to allocate join costs.

If the joint products can be sold at the split-off point, sales price measure can *directly and conveniently* be applied for joint costs allocation. In case the products are not readily marketable at the split-off point, but require further processing, it is necessary to estimate the sales value at the split-off-point. This is usually estimated by taking the sale value after further processing and deducting the additional processing costs.

Net realisable value = Sales value after further process - Further processing cost (8.4)

From the facts in **Example 8.13 and Table 8.2** and assuming all products are sold at the split-off point, joint cost allocation under the relative sale value method would be, as shown in Table 8.3.

Table 8.3 *Joint Cost Allocation Using Sales Value Method*

Product	*Output (kgs)*	*Market price*	*Market value*	*Rates*	*Allocated joint cost*	*Cost per unit*
X	400	Rs 33	Rs 13,200	132/473	Rs 6,140	Rs 15.35
Y	250	44	11,000	110/473	5,116	20.46
Z	350	66	23,100	231/473	10,744	30.70
	1,000		47,300		22,000	22.00

Thus, the costs per unit are in proportion to the sale prices. The relative sale price method generates the same margin percentage (53.48 per cent) for all products. Thus, this approach implies a matching of input costs with revenues generated by each output.

In practice, however, it may so happen that the joint products may not be in a condition to be sold at the split-off point; they may need further processing to become marketable. In such cases, a hypothetical sales value needs to be estimated at the split-off point to allocate joint costs. The resulting hypothetical sales value/net realisable value is used for joint cost allocation in the same way as actual market value at the split-off point. Assuming that for the firm in Example 8.13, the additional processing for products X, Y and Z is done in departments 2, 3 and 4 respectively. Following are the costs incurred in these departments to process the batch of 1,100 kgs of materials:

Product	*Output (kgs)*	*Department*	*Further processing/ separable cost*	*Unit cost*
X	400	2	Rs 6,000	Rs 15
Y	250	3	4,500	18
Z	350	4	7,000	20

Assuming no change in market price, joint costs of Royal Industries Ltd would be allocated as shown in Table 8.4.

Table 8.4 *Allocation of Joint Costs [Net Realisable Value (NRV) Method]*

Product	*Output (kgs)*	*Market price*	*Market value*	*Separable cost*	*Net realisable value*	*Rates*	*Allocated joint costs*	*Joint cost per unit*
X	400	Rs 33	Rs 13,200	Rs 6,000	Rs 7,200	72/298	Rs 5,315	Rs 13.28
Y	250	44	11,000	4,500	6,500	65/298	4,799	19.19
Z	350	66	23,100	7,000	16,100	161/298	11,886	33.96
	1,000		47,300	17,500	29,800		22,000	22.00

The gross margin rates for each product according to this method are shown in Table 8.5.

Table 8.5 *Gross Margin Rates*

	Product X	*Product Y*	*Product Z*
Sales price	Rs 33.00	Rs 44.00	Rs 66.00
Less cost of production:			
Joint cost	13.28	19.19	33.96
Separable cost	15.00	18.00	20.00
	28.28	37.19	53.96
Gross margin	4.72	6.81	12.04
Gross margin rate (percentage)	14.3	15.5	18.21

The NRV method is based on the assumption that the processing costs incurred subsequent to the split-off point contribute nothing to profit; the increase in the product's sales value is equal to the separable costs. This supposition is fundamentally wrong as it implies that the firm would be willing to process its products further even if they do not contribute to profits. This is not likely to be true in practice for manufacturing firms. Therefore, it may be more logical to argue that profit is earned over the entire span of production rather than just during the joint span. Thus, this method of allocating joint costs ignores the profits from further processing of the product beyond the split-off point.

Net Realisable Value Less Normal Profit Method This method is based on the fundamental axiom that profits are earned on total cost incurred, and not on joint costs only. The following are the steps required to apply this method:

(i) Determine the ratio of the total production cost (joint and separable) to total final market value. This ratio is an average cost ratio per rupee of sales.
(ii) Subtract the average cost ratio form 100 per cent to find an average/normal profit ratio.
(iii) Finally, subtract the sum of the separable costs and normal profit from the market value. The amount so arrived at would be allocated joint costs corresponding to each product. Table 8.6 shows the cost allocation.

Table 8.6 *Joint Cost Allocation Using NRV Less Normal Profit Method*

Product	*Output (kgs)*	*Market value*	*Normal profit*	*Separable costs*	*Joint cost allocation*	*Joint cost per unit*
X	400	Rs 13,200	Rs 2,177	Rs 6,000	Rs 5,023	Rs 12.557
Y	250	11,000	1,814	4,500	4,686	22.744
Z	350	23,100	3,809	7,000	12,291	35.117
	1,000	47,300	7,800	17,500	22,000	

Working Notes

Normal profit ratio = 100 per cent – [Total costs – (Joint + Separable) × 100] ÷ Total market value = 100 per cent – [(Rs 22,000 + Rs 17,500) × 100 ÷ Rs 47,300, 83.5 per cent = 16.5 per cent]

It may be noted that gross profit margin is uniform (16.5 per cent) for all the products as per this method which may not be a desirable characteristic. Therefore, this method should again not be taken as a perfect measure of allocating joint costs but, certainly, it is one, which is logically superior to others discussed so far.

Weighted Average Method Where the products are heterogeneous, the weighted average method can provide a reasonable basis for allocating joint costs. This method is theoretically superior to the physical quantity method as this method, by assigning different weights to different products, recognises some significant characteristics of the output. As the weight factors can reflect the varying amounts of time required to process the units, the difficulty of the processing procedure, the amount of material and labour used and other significant factors, there would be a positive correlation between these factors and the assigned value of weights. The sale price is one of the widely-used weight factors in practice.

According to this method, the volume of output for each product is multiplied by a weight that reflects the collective differences among the products. In order to have reliable results from the method, weights should be assigned after giving due and careful consideration to all the relevant characteristics of the product.

Continuing with the example of Royal Industries Ltd, assume that the following are the weights assigned to products X, Y and Z after taking into consideration a variety of factors: X, 1; Y, 2; Z, 4. Using the weighted average method, the joint costs are allocated in Table 8.7.

Table 8.7 *Joint Cost Allocation Using Weighted Average Method*

Product	*Output (kgs)*	*Weight*	*Weighted output*	*Ratio*	*Allocated joint cost*	*Cost per unit*
X	400	1	400	4/23	Rs 3,826	Rs 9.56
Y	250	2	500	5/23	4,783	19.13
Z	350	4	1,400	14/23	13,391	38.26
	1,000		2,300		22,000	

Thus, according to this method, joint cost per unit is in direct proportion to the weights assigned to various products. The major limitation of the method is the problem of establishment of the weights. These weights are frequently the result of individual judgement and, therefore, may not be objective. In all fairness, this method would be an ideal one if weights could be objectively determined.

BY-PRODUCTS

A by-product is incidental to the process of manufacturing the main/joint products. It is an output whose value does not contribute materially to the revenues of the firm. Its amount, relative to the value of the main product, is small. Chemical residues, sawdust and shavings, and slag are typical by-products of the chemicals, timber and steel processing industries respectively. By-products differ from scrap. For instance, scrap is sold as it is while by-products may have to undergo additional processing before sale. Moreover, it may so happen that the disposal of scrap may involve some expenses instead of yielding any revenue, whereas a by-product always generates some revenue.

The accounting treatment of by-products will depend on whether the by-product is sold at the split-off point or processed further. The former is discussed here while the latter is covered in the next section. The two most commonly used methods of accounting for by-products are: (1) Miscellaneous income method, and (2) Net realisable value method (NRV).

Miscellaneous Income Method

Under this method, sales revenue contributed by the by-products is considered as miscellaneous income of the firm. All costs are assigned to only the main products and not to the by-products. This method is considered as the most appropriate when the value of the by-product is uncertain or so trivial that it is not likely to have any significant/noticeable effect on inventory or profit.

Net Realisable Value Method

In case the value of a by-product is large enough to have a significant effect on inventory or profits, the by-product should be valued at its net realisable value/sale value. This treatment would cause *reduction in the cost of production of the main products*. The cost of the joint process is assigned to the joint products as well as to by-products. Therefore, the cost of production of the main output would be lower by the proportionate charge to the by-product. There are two variants of this method: (i) Recognisation of no profit on the sale of by-products (ii) Recognition of some normal profit.

Recognisation of No Profit on the Sale of By-products As per this variant, the sale price of the by-product would be considered to consist of two elements, namely, (i) Production cost assigned to it out of joint costs, and (ii) Selling and distribution cost. Accordingly, the share of joint costs allocated to by-products would be:

Sale price of by-products – Selling and distribution cost of by-products = Joint process cost allocated to by-products (8.6)

Recognisation of Some Normal Profit on the Sale of By-products A second variant is to recognise some normal profit from the sales of by-products. Accordingly, the sale price of by-product would be considered consisting of three elements, namely, (i) Production cost (share of joint costs) allocated to it; (ii) Selling and distribution cost; and (iii) Normal profit. The share of joint costs allocated to by-products would be determined as follows (Equation 8.7).

Sale price of by-products – Normal profit – Selling and distribution cost of by-products (8.7)

EXAMPLE 8.14

For the facts contained in **Example 8.13**, let as assume further that joint production process also yields by-product (70 kgs) in addition to three main products X, Y, Z. Its selling price is Rs 2 per kg and selling costs are Rs 0.50 per kg. Determine the share of joint costs (i) if firm does not recognize profit on the sale of its by-product; and (ii) if it recognizes 10 per cent profit on such sales.

SOLUTION

Share of Joint Costs

(i) When no profits are recognized:	
Sales revenue (70 kgs × Rs 2)	Rs140
Less selling costs (70 kgs × Rs. 0.50)	35
Share of joint costs (70 kgs × Rs 1.50)	105
(ii) When 10 per cent profits are recognised:	
Sales revenue (70 kgs × Rs 2)	140
Less normal profit (Rs 140 × 0.10)	14
Less selling costs (70 kgs × Rs 0.50)	35
Share of joint costs (70 kgs × Rs 1.30)	91

SELL NOW (AT SPLIT-OFF POINT) OR PROCESS FURTHER

As mentioned in the preceding section, a joint product can be sold at the split-off point or processed further and sold later as a completed production unit. This section explains the accounting for the sale or further processing of the main products as well as the by-products. This exercise will be helpful to the management in arriving at a decision, whether the product should be sold at the split-off point or processed further. From the point of view of managerial decision-making, incremental costs of further processing should be compared with the incremental revenue. This aspect is comprehensively elaborated in a subsequent chapter dealing with short-term decisions.

Main Products Requiring Further Processing

Examples 8.15 and 8.16 illustrate the application of process costing to the main products.

EXAMPLE 8.15 *(Sell Now or Process Further: Single Product)*

A B C Ltd manufactures a single product which it sells to firms which process it further before sale. The normal quarterly operating volume for the company is 50,000 units produced and sold. The relevant cost data are as follows:

Selling price		Rs 10.00
Less standard costs:		
Direct materials	Rs 3.00	
Direct labour	1.50	
Variable manufacturing overheads	1.00	
Fixed manufacturing overheads (Rs 25,000 per quarter)	0.50	
Variable selling overheads	1.00	
Fixed selling expenses (Rs 12,500 per quarter)	0.25	7.25
Standard profit per unit		2.75

The company's management is considering the possibility of further processing the product and selling it directly to the customers. The management estimates that the product can be sold @ Rs 14 per unit after further processing. The following are the estimates of the *additional* (*per unit/ quarter*) costs of processing 50,000 units:

Direct labour	Rs 1.00
Variable manufacturing overheads	0.50
Variable selling costs	0.20
Additional fixed manufacturing overheads (per quarter)	10,000
Additional sales expenses (per quarter)	5,000

You are required to compute the cost (i) without, and (ii) with further processing. Is further processing advisable?

SOLUTION

Cost Comparison: Incremental Analysis

Particulars	*Without further processing*		*With further processing*		*Difference from further processing*	
	Per unit	*Total*	*Per unit*	*Total*	*Per unit*	*Total*
Sales	Rs 10.00	Rs 5,00,000	Rs 14.00	Rs 7,00,000	Rs 4.00	Rs 2,00,000
Less variables costs:						
Direct material	3.00	1,50,000	3.00	1,50,000	0.00	
Direct labour	1.50	75,000	2.50	1,25,000	1.00	50,000
Manufacturing overheads	1.00	50,000	1.50	75,000	0.50	25,000
Selling overheads	1.00	50,000	1.20	60,000	0.20	10,000
Total	6.50	3,25,000	8.20	4,10,000	1.70	85,000
Contribution	3.50	1,75,000	5.80	2,90,000	2.30	1,15,000
Less separable identifiable fixed costs:						
Manufacturing		—		10,000		10,000
Sales		—		5,000		5,000
Product margin		1,75,000		2,75,000		1,00,000
Less common fixed costs:						
Manufacturing		25,000		25,000		—
Sales		12,500		12,500		—
Net income		1,37,500		2,37,500		1,00,000

Since further processing would result in a greater product margin and net income, the new proposal is acceptable.

EXAMPLE 8.16 *(Sell or Process Further: Multiple Products)*

XYZ Ltd produces three products, A, B and C. One type of a raw material is used for all these products. Raw material enters the process in department 1 of the factory. Department 1 separates material for products A, B and C. During the last quarter, Rs 4,00,000 of material was issued to Department 1. Other direct costs of operating Department 1 were Rs 2,00,000. The output of products A, B and C from Department 1 was: A, 10,000 units; B, 5,000 units; C, 2,000 units.

Products A, B and C can be sold after being processed from Department 1 (split-off point) at prices of Rs 60, Rs 30 and Rs 20 respectively. After the split off, product A could be processed further in Department 2. With additional processing, product A can be sold at Rs 70 per unit. After the split-off, product B could be processed further in Department 3 for Rs 30,000 additional cost, and will fetch Rs 35 per unit after processing. Product C is not suitable for further processing and has to be sold at the point of split-off. What action should be management take?

SOLUTION

Sell or Process Further: Decision Analysis

Particulars	*Product A*			*Product B*		
	Sell now	*Process further*	*Difference from further processing*	*Sell now*	*Process further*	*Dfferences from further processing*
Sales	Rs 6,00,000	Rs 7,00,000	Rs 1,00,000	Rs 1,50,000	Rs 1,75,000	Rs 25,000
Less separable costs	—	50,000	50,000	—	30,000	30,000
Joint cost of Rs 6,00,000 from Department 1	Irrelevant as costs not affected by the decision					
Contribution (decrease)	Rs 6,00,000	6,50,000	50,000	1,50,000	1,45,000	(5,000)

Thus, it is profitable to process product A further because it yields an incremental profit of Rs 50,000, (additional revenue being Rs 1,00,000 and additional cost, Rs 50,000). The decision is based on the assumption that there is no other opportunity cost for using the facilities of Departments 2 and 3.

By-Products Processed Further

There are several methods of accounting for costs of further processing: (i) Recognition of no profit on sale of by-products; (ii) Recognition of normal profit on by-products; and (iii) Separate cost records for by-products.

Recognition of No Profit on Sale of By-products Method Under this method, share of joint costs allocated to by-products would be determined by subtracting both selling and further processing costs from the sale price of by-products.

Sale price of by-products – Further processing cost beyond split-off point – Selling cost = Joint costs (8.8)

Recognition of Normal Profit on Sale of By-Products/Reversal Cost Method The share of joint costs assigned to by-products is given by Equation 8.9.

Sale-price-Further processing cost beyond shift off point-Selling cost-Estimated normal profit. (8.9)

This method is also known as the reversal cost/replacement/opportunity cost method and is most appropriate when by-products are used/utilised in the firm itself as material for manufacturing/processing some other products. Under this method, by-products are valued at the price which would have been paid by the firm in making outside purchases for these products.

Separate Cost Record for By-products This method is most appropriate in situations when the joint manufacturing process yields by-products which are relatively of high value and/or of large quantity; they also require further processing after separation from the joint manufacturing process. In such situations, the by-products cease to be by-products; they become as significant as the main products. Accordingly, they must normally be treated as main products and the cost allocated on some equitable and rational basis.

EXAMPLE 8.17 *(Reversal Cost Method)*

In manufacturing the main product, Hypothetical Ltd processes the incidental waste into two products, A and B. From the following data relating to the products, you are required to prepare a comparative profit and loss statement showing the individual costs and other details. The total costs upto separation point were Rs 3,10,400.

	Main product	*By-product A*	*By-product B*
Sales	Rs 8,00,000	Rs 64,000	Rs 96,000
Costs after separation	80,000	12,800	14,400
Estimated net profit (per cent to sales value)		20	30
Estimated selling expenses (as per cent to sales value)	20	10	15

SOLUTION

Statement Showing Allocation of Joint Costs

Particulars	*By-product A*	*By-product B*
Sales	Rs 64,000	Rs 96,000
Less: estimated net profit on sale (20 per cent, A; and 30 per cent, B)	12,800	28,800
estimated selling expenses (10 per cent, A, and 15 per cent, B)	6,400	14,400
separable costs	12,800	14,400
Share of joint costs allocated	32,000	38,400

Share of main products in joint costs, therefore, would be: Rs 3,10,400 – (Rs 32,000 + Rs 38,400) = Rs 2,40,000.

Comparative Profit and Loss Account

Particulars	*Main product*	*By-product A*	*By-product B*
Sales revenue	Rs 8,00,000	Rs 64,000	Rs 96,000
Less cost of production:			
Joints costs	2,40,000	32,000	38,400
Separable costs	80,000	12,800	14,400
Gross profit	4,80,000	19,200	43,200
Less selling expenses	1,60,000	6,400	14,400
Net profit	3,20,000	12,800	28,800

SUMMARY

- The process costing system measures the cost of products under conditions of continuous production, sequential processing and homogeneous output. The procedure under such a system of costing essentially involves averaging the total costs of a process or a department. It is used in industries such as chemicals, food processing, breweries, petroleum refining, paper, glass, metal manufacturing and so on.

- The procedure to determine the cost will depend on, firstly, the stage of completion of the product, in each process, secondly, the extent of wastage, spoilage of units in the process and, thirdly, the inter-process profits.
- In cases where some units are complete, while others are incomplete or partially complete, for the purpose of cost accumulation, the partially completed units are to be converted into comparable equivalent units. Equivalent units = [Actual number of partially completed units × Stage of completion]
- The cost of production is shown in the form of a production cost report and/or process cost account. The total cost of production of each process is split into the cost of output and the closing inventory/work-in-process. The distribution between these two elements depends on the method of valuation of work-in-process, namely, weighted average method and first-in-first-out (FIFO) method.
- The spoilage of units under process costing may take place due to a variety of reasons, like use of sub-standard material, poor workmanship, evaporation, shrinkage, break-down of machines, and so on. The effect of spoilage is that the number of actual units produced is less than the units introduced initially. The spoilage or wastage may be normal or abnormal. The unit cost with normal spoilage

$$= \left(\frac{\text{Total process costs} - \text{Salvage value of normal spoilage}}{\text{Total units introduced} - \text{Normal loss in units}} \right)$$

- Abnormal loss = [(Abnormal loss in units × Unit production cost) – Salvage value of abnormal spoilage]
- The transfer of output of one process to the other can either be at cost or the inflated/market price. Transfers at the latter price involve inter-process profits. These profits should be deducted from closing inventory to determine true profits.
- Two or more products produced simultaneously from a common set of inputs through a single manufacturing (joint) process are called joint products. The joint products can be sold either at the stage of production (split-off point) itself or they can be processed further. The costs incurred before the split-off point are called joint/common/inseparable costs and the costs incurred beyond that point are known as separable costs. The crucial factor in accounting for joint products is the allocation of joint costs among the joint/multiple products from the joint process.
- The commonly used methods of allocating joint process costs are: (i) Physical quantities method/unit method, (ii) Relative sales value method/net realisable value method, (iii) Net realisable value less normal profit method, and (iv) Weighted average cost method.
- Under the physical quantities method, the total joint costs are allocated to the joint products in proportion to the physical measurement of output.
- In the net realisable value method, joint costs are pro-rated on the basis of the market value of the joint products.
- The net realisable value less normal profit method differs from the net realisable value method to the extent the joint costs less normal profits are pro-rated.
- Where the joint products are heterogeneous, the weighted average cost method provides a reasonable basis for allocating the joint costs.
- A by-product is incidental to the process of manufacturing the main/joint product. The accounting treatment depends on whether the by-product is sold at the split-off point or is processed further. The two most commonly-used methods of accounting for by-products are: (i) Miscellaneous income method, and (ii) Net realisable value method, *(NRV)*.
- Under the miscellaneous income method, the income generated by the by-products is treated as a miscellaneous income and all the associated costs are charged to the main product.

- According to the NRV method, the by-product is valued at its net realisable value and the joint costs are pro-rated between the main product and the by-product. Joint process cost allocated to by-product = (Sale price of by-products – Selling and distribution costs of by-products)
- A variation of this is to recognise some normal profit from the sale of by-products.
- Joint cost allocated to by-products = (Sale price of by-products – Normal profit – Selling and distribution costs of by-product)

SOLVED PROBLEMS

P.8.1 The product of ABC Ltd passes through three distinct processes for completion. From past experience, it is ascertained that normal wastage in each process is as under:

Process	*Wastage (%)*	*Sale value of wastage per unit*
A	2	Rs 0.25
B	4	0.50
C	2.5	0.60

The expenses were as follows:

	Process A	*Process B*	*Process C*
Materials	Rs 12,000	Rs 10,000	Rs 9,000
Direct labour	16,000	5,000	4,900
Manufacturing expenses	2,000	3,400	3,590
Other factory expenses	3,500	2,005	2,004

4,000 units were initially introduced in process at a cost of Rs 13,560. The output of each process was as under: A, 3,850 units; B, 3,600 units; and C, 3,500 units.

Prepare process accounts and also work out the sale price per unit of finished stock so as to realise 20 per cent profit on selling price.

SOLUTION

Process A account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To units introduced	4,000	Rs 13,560	By normal wastage	80	Rs 20
To materials		12,000	By abnormal wastage@	70	840
To direct labour		16,000	Rs 12 per unit		
To manufacturing expenses		2,000	By process B (output		
To other factory expenses		3,500	transferred @ Rs 12		
			per unit, Rs 47,040 ÷		
			3,920, normal output)	3,850	46,200
	4,000	47,060		4,000	47,060

Process B account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To process A (transferred from)	3,850	Rs 46,200	By normal wastage	154	Rs 77
To materials		10,000	By abnormal loss @		
To direct labour		5,000	Rs 18 per unit	96	1,728

(*Contd.*)

(*Contd.*)

To manufacturing expenses		3,400	By process C (output	3,600	64,800
To other factory expenses		2,005	transferred @ Rs 18 per unit, Rs 66,528÷ 3,696, normal output)		
	3,850	66,605		3,850	66,605

Process C account

To process B (transferred from)	3,600	Rs 64,800	By normal wastage	90	Rs 54
			By abnormal loss		
To materials		9,000	@ Rs 24 per unit	10	240
To direct labour		4,900	By finished stock	3,500	84,000
To manufacturing expenses		3,590	(output transferred @		
To other factory expenses		2,004	Rs 24 per unit,		
			Rs 84,240 ÷ 3,510 units)		
	3,600	84,294		3,600	84,294

Selling price per unit = Rs 30 (Rs 24 + Rs 6, profit)

P.8.2 A product passes through two consecutive processes having relative standard output of 80 per cent and 90 per cent of inputs. In addition, standard yield is obtained by giving scrap allowances of 10 per cent and 5 per cent of outputs of process I and II respectively. Scraps of each process are sold at Rs 1,000 per tonne.

There was no work-in-process at any stage, all materials were issued in process I as follows and all scraps arising from the processes were sold, except closing stock of 10 tonnes (opening stock was nil).

Material issued: 'A'; 100 tonnes @ Rs 2,000 per tonne; 'B'; 400 tonnes @ Rs 1,500 per tonne; and 'C'; 500 tonnes @ Rs 1,200 per tonne.

The actual outputs and scraps were 85-per cent and 8 per cent in process I and 80 per cent and 10 per cent in process II. Assume that there was no price variance.

You are required to find out the standard cost and actual cost per tonne of a product.

SOLUTION

(a) *Value of materials used*

Type of materials	*Quantity (tonnes)*	*Rate*	*Amount*
A	100	Rs 2,000	Rs 2,00,000
B	400	1,500	6,00,000
C	500	1,200	6,00,000
	1,000		14,00,000

(b) *Statement of production—standard and actual*

Particulars	*Standard*		*Actual*	
	Percentage	*Quantity (tonnes)*	*Percentage*	*Quantity (tonnes)*
(i) Process I				
Input in process I	100	1,000	100	1,000
Output of process I	80	800	85	850
Less scrap	10	80	8	68
Finished output of process transferred to process II		720		782

(*Contd.*)

(*Contd.*)

(ii) Process II				
Inputs to process II	100	720	100	782
Output of process II	90	648	80	625.60
Less scrap	5	32.40	10	62.56
Finished output (yield) of process II		615.60		563.04

(c) *Cost of finished product per tonne*

	Standard	Actual
Value of materials used	Rs 14,00,000	Rs 14,00,000
Less scrap sale value		
Standard: (102.4 tonnes @ Rs 1,000)		
Less closing stock of 10 tonnes @ Rs 1,000	10,000	
102.4 tonnes sold @ Rs 1,000 per tonne	1,02,400**	
Actual: (120.56 tonnes@ Rs 1,000)		
Less closing stock of 10 tonnes @ Rs 1,000		10,000
120.56 tonnes sold @ 1,000 per tonne		1,20,560***
Net cost	12,87,600	12,69,440
Finished output in tonnes	615.60	563.04
Cost of finished output per tonne	2,092	2,255

** (Process I 80 tonnes + Process II 32.4 tonnes-closing stock 10 tonnes) = 1,02,400

*** (Process I 68 tonnes + Process II 62.56 tonnes-closing stock 10 tonnes) = 1,20,560

P.8.3 The Regal Company Ltd produces a product that goes through three processing centres for mixing, moulding and finishing. During January, the following activity took place in the mixing process centre.

	Materials		*Processing*	
	Kgs	*Percentage completed*	*Kgs*	*Percentage completed*
Opening stock	500	90	500	50
Weight of raw material issued to producing centre	9,000	—	9,000	—
Completed during the period and transferred to moulding	9,300	—	9,300	—
Closing stock	200	40	200	10

The following costs were collected from the mixing processing centre during the month: Materials, Rs 4,46,500; Processing costs, Rs 8,16,300 and Total, Rs 12,62,800.

You are required to compute:

(a) Output for January, (in equivalent units of production) in the mixing centre;

(b) Unit cost for the mixing processing centre; and

(c) Material input cost per kg for the material transferred from the mixing centre to the moulding centre.

SOLUTION

(a) *Statement of equivalent production (mixing centre)*

Input	*Particulars*	*Output(kgs) completed or otherwise*	*Stage of completion (per cent)*		*Equivalent units produced*	
			Material	*Processing*	*Materials*	*Processing*
500 kgs + 9,000 kgs introduced during the year	(I) Work expended on opening inventories	500	10	50	50	250
	(ii) kgs input started and completed during the current period (9,000-200)	8,800	100	100	8,800	8,800
	(iii) Closing inventory	200	40	10	80	20
9,500	(Work-in-process)	9,500			8,930	9,070

(b) *Determination of unit costs for mixing centre*

	Materials	Processing
1. Costs to be accounted for	Rs 4,46,500	Rs 8,16,300
2. Equivalent units produced	8,930	9,070
3. Equivalent unit cost per kg (1) ÷ (2)	50	90

(c) Total material input cost per kg of material transferred from mixing centre to the moulding centre = Rs 140 per kg (Rs 50 + Rs 90).

P.8.4 S.M. Limited furnishes you the following information relating to process B for the month of October:

1. Opening work-in-process, Nil
2. Units introduced, 10,000 units @ Rs 3 per unit
3. *Expenses debited to the process*
   Direct materials, Rs 14,650
   Labour, Rs 21,148
   Overheads, Rs 42,000
4. Normal loss in process, 1 per cent of input
5. Closing work-in-process, 350 units
   Degree of completion
   Material, 100 per cent
   Labour and overheads, 50 per cent
6. Finished output, 9,500 units
7. Degree of completion of abnormal loss:
   Material, 100 per cent
   Labour and overheads, 80 per cent
8. Units scrapped as normal loss were sold at Rs 1 per unit.
9. All the units of abnormal loss were sold at Rs 2.50 per unit.

Prepare: (a) Statement of equivalent production, (b) Statement of cost, (c) Process B account, and (d) Abnormal loss account.

SOLUTION

(a) *Statement of equivalent production in process B*

Input	*Particulars*	*Units completed or otherwise*	*Stage of completion (per cent)*		*Equivalent units*	
			Material	*Conversion cost*	*Material*	*Conversion cost*
10,000	Units introduced					
	Units produced	9,500	100	100	9,500	9,500
	Normal loss (10,000 × 0.01)	100	—	—	—	—
	Abnormal loss (150 units – 100 normal)	50	100	80	50	40
	Work-in-process	350	100	50	350	175
10,000		10,000			9,900	9,715

(b) *Statement of cost*

Particulars	*Total cost*	*Equivalent production in units*	*Cost per unit*
Cost of units introduced	Rs 30,000		
Additional direct materials	14,650		
	44,650		
Less sale proceeds of normal loss units (100 units × Rs 1)	100		
Total material cost	44,550	9,900	Rs 4.5
Conversion costs			
Direct labour	21,148		
Overheads	42,000		
Total conversion costs	63,148	9,715	6.5
Total cost	1,07,698		11.00
Value of work-in-process			
Material (350 units × Rs 4.50)		Rs 1,575.00	
Conversion costs (175 units × Rs 6.50)		1,137.50	
		2,712.50	
Value of abnormal loss			
Materials (50 units × Rs 4.50)		225	
Conversion costs (40 units × Rs 6.50)		260	
		485	

(c) *Process B account*

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To materials	10,000	Rs 30,000	By normal loss	100	Rs 100
To direct materials		14,650	By abnormal loss	50	485
To labour		21,148	By finished stock		
To overheads		42,000	@ Rs 11 per unit	9,500	1,04,500
			By work-in-process inventory	350	2,713
	10,000	1,07,798		10,000	1,07,798

(d) *Abnormal loss account*

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To process B	50	Rs 485	By sales	50	Rs 125
			By costing profit and loss A/c	—	360
	50	485		50	485

P.8.5 A company within the food industry mixes ingredients in two different processes to produce one product. The output of process I becomes the input of process II and the output of process II is transferred to the packing department. From the information given below, you are required to open accounts for process I, process II, abnormal loss and packing department and to record the transactions for the week ended May.

Process I	
Input:	
Material A	6,000 kgs at Rs 0.50 per kg
Material B	4,000 kgs at Re 1 per kg
Mixing labour	430 hours at Rs 2 per kg
Normal loss	5 per cent of weight input, disposed of at Rs 0.16 per kg
Output	9,200 kgs
Process II	
Input:	
Material C	6,000 kgs at Rs 1.25 per kg
Material D	4,200 kgs at Rs 0.75 per kg
Flavouring essence	Rs 330
Mixing labour	370 hours at Rs 2 per hour
Normal waste	5 per cent of weight input with no disposal value
Output	18,000 kgs

No work-in-process at the beginning of the week but 1,000 kgs in process at the end of the week and estimated to be only 50 per cent complete so far as labour and overheads were concerned.

Overhead of Rs 3,200 incurred by the two processes to be absorbed on the basis of mixing labour-hours.

SOLUTION

Process I account

Particulars	*Quantity*	*Amount*	*Particulars*	*Quantity*	*Amount*
To material A	6,000	Rs 3,000	By normal loss	500	Rs 80
To material B	4,000	4,000	By abnormal loss	300	300
To mixing labour (430 hour @ Rs 2 per hour)		860	By transfer to process II @ Re 1 per kg	9,200	9,200
To overhead (@ Rs 4 per hour)		1,720			
	10,000	9,580		10,000	9,580

Process II account

To Process I	9,200	Rs 9,200	By normal waste	1,000	
To material C	6,600	8,250	By work-in-process	1,000	Rs 1,160
To material D	4,200	3,150	By packing department	18,000	21,960

(*Contd.*)

(*Contd.*)

To flavouring essence		300			
To mixing labour		740			
To overhead		1,480			
	20,000	23,120		20,000	23,120

Abnormal Loss Account

To process A/c	300	Rs 300	By sale	300	Rs 48
			By balance to P/L A/c		252
	300	300		300	300

Packing Department Account

To Process II	18,000	Rs 21,960	By balance c/d	Rs 21,960
		21,960		21,960

Working Notes

(i) *Statement of equivalent production (process II)*

Input	*Particulars*	*Units completed or otherwise*	*Stage of completion*		*Equivalent units produced*	
			Material	*Conversion cost*	*Material*	*Conversion cost*
9,200 kgs (output from process I)	Kgs output completed	18,000	100	100	18,000	18,000
+ 10,800 kgs introduced during process II	Normal loss (0.05 × 20,000 kgs)	1,000	—	—	—	—
	Work-in-process	1,000	100	50	1,000	500
20,000		20,000			19,000	18,500

(ii) *Statement of cost*

Particulars	*Total cost*	*Equivalent production (kg)*	*Cost per unit/kg*
Materials transferred from Process I	Rs 9,200		
Add current process costs:			
Material C	8,250		
Material D	3,150		
Flavouring essence	300		
Total material cost	20,900	19,000	Rs 1.10
Conversion cost			
Mixing labour	740		
Overhead	1,480		
	2,220	18,500	0.12

(iii) *Statement of apportionment of cost*

Particulars	*Element of cost*	*Equivalent production*	*Cost per kg*	*Cost*	*Total*
Finished input	Material	18,000	Rs 1.10	Rs 19,800	
	Conversion costs	18,000	0.12	2,160	Rs 21,960
Work-in-process	Material	1,000	1.10	1,100	
	Conversion costs	500	0.12	60	1,160
					23,120

(iv) *Determination of overhead absorption rate* = Rs 3,200 (Total labour-hours (430 + 370) = Rs 4 per labour-hour
(v) *Cost per kg of output* = (Rs 9,580 – Rs 80) ÷ 9,500 = Re 1

P.8.6 Product B passes through two processes before it is completed and transferred to finished stock. The following data are available for the month of March of the current year:

	Process I	*Process II*
Opening stock (at prime cost)	Rs 5,000	Rs 8,000
Direct materials	40,000	12,000
Direct labour	35,000	40,000
Production overheads	20,000	24,000
Closing stock (at prime cost)	10,000	4,000

Output of processes are transferred to the next ones at the following transfer prices:

Process I—@ 25 per cent on the transfer price to Process I

Process II—@ 25 per cent on the transfer price to finished stock.

Finished stocks are valued at the price at which they are received from Process II, and are as follows: Opening stock, Rs 20,000; Closing stock, Rs 30,000. Sales for the month amounted to Rs 3,00,000. Provision for internal process profits as on March 1 were as follows:

Included in work-in-process of Process II, Rs 1,500; Included in finished stock, Rs 6,500

Calculate: (a) Process costs, (b) Gross profit, and (c) Write up the provision for inter-process profit account.

SOLUTION

(a) *Process I account*

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
To opening stock	Rs 5,000	Rs 5,000	—	By Process III			
To direct materials	40,000	40,000	—	(output transferred			
To direct labour	35,000	35,000	—	at $1331\frac{1}{3}$% of cost			
Less closing stock	(10,000)	(10,000)	—	(Rs 90,000 ×			
Prime cost	70,000	70,000	—	$133\frac{1}{3}$%)	Rs 1,20,000	Rs 90,000	Rs 30,000
To factory overheads	20,000	20,000					
Process costs	90,000	90,000					
To profit and loss A/c (profit at 25% on transfer price or							
$331\frac{1}{3}$ % on cost)	30,000	—	30,000				
	1,20,000	90,000	30,000		1,20,000	90,000	30,000

Process II account

To opening stock	8,000	6,500	1,500	By finished stock A/c			
To Process I				(output transferred)	2,50,000	1,69,200	80,800
(transferred from)	1,20,000	90,000	30,000				
To direct materials	12,000	12,000	—				
To direct labour	40,000	40,000	—				
Less closing stock@	(4,000)	(3,300)	(700)				
Prime cost	1,76,000	1,45,200	30,800				
To factory overheads	24,000	24,000	—				
Process cost	2,00,000	1,69,200	30,800				

(*Contd.*)

(*Contd.*)

To profit and loss A/c (profit at 20% on transfer price or 25% on cost)	50,000	—	50,000			
	2,50,000	1,69,200	80,800	2,50,000	1,69,200	80,800

@Cost of closing stock is worked out proportionately: (Rs 1,48,500 × Rs 4,000) ÷ Rs 1,80,000 = Rs 3,300
Profit = Rs 4,000 – Rs 3,300, cost = Rs 700

Finished stock account

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
To balance b/d	Rs 20,000	Rs 13,500	Rs 6,500	By closing stock	Rs 30,000	Rs 20,300@	Rs 9,700
To Process I (transferred from)	2,50,000	1,69,200	80,800	By sales	3,00,000	1,62,400	1,37,600
To profit and loss A/c (profit transferred)	60,000	—	60,000				
	3,30,000	1,82,700	1,47,300		3,30,000	1,82,700	1,47,300

@Cost of closing stock = (Rs 1,82,700 × Rs 30,000) ÷ Rs 2,70,000 = Rs 20,300

(b) and (c) Statement of profit

Process I		Rs 30,000
Process II	Rs 50,000	
Adjustment of provision for unrealised profit		
Add on opening stock	1,500	
Less on closing stock	(700)	50,800
Finished stock account	60,000	
Adjustment of provision for unrealised profit		
Add on opening stock	6,500	
Less on closing stock	(9,700)	56,800
		1,37,600

P.8.7 The Food Specialists Ltd has two cost centres: (i) Cooking and (ii) Mix-pack. Material is added at the beginning of production in each cost centre, and labour is added equally during production in each cost centre. The FIFO method is used in the Cooking department and the weighted average method in the Mix-pack department.
The following information is available for the month of January:

	Cooking	*Mix-Pack*
Work-in-process opening, January 1		
Materials	Rs 4,980	Rs 570
Labour	500	300
Overhead	400	240
Prior department cost	—	2,130
Current month's cost		
Materials	1,98,000	76,380
Labour	50,250	80,000
Overhead	40,200	64,000

Inventory and production records show that Cooking had 500 litres, 40 per cent processed in the beginning of the month and 400 litres, 50 per cent processed at the end of the month; Mix-pack had 300 litres, 50 per cent processed in the beginning of the month and 400 litres, 30 per cent processed at the end of the month.

Production reports for the month show that 'Cooking' started 20,000 litres into production and completed and transferred 20,100 litres to Mix-pack; Mix-pack completed and transferred 20,000 one-litre containers of the finished product to the warehouse.

You are required to prepare a process cost report for the Cooking department as well as for Mix-pack department. Also prepare relevant process accounts.

SOLUTION

Production cost report of cooking centre for the month of January (FIFO basis)

1.	*Units schedule*		
	Opening inventory (40 per cent)		500
	Add introduced during the month		20,000
	Total		20,500
	Less closing work-in-process inventory (50 per cent)		400
	Units completed and transferred		20,100
2.	*Cost to be accounted for*		
	Opening inventory (Rs 4,980 + Rs 500 + Rs 400)		Rs 5,880
	Materials		1,98,000
	Conversion costs:		
	Labour	Rs 50,250	
	Overhead	40,200	90,450
			2,94,330
3.	*Equivalent units and unit cost*		
		Material	*Conversion cost*
	Opening inventory	Nil	300
	Units introduced and completed(20,000 – 400)	19,600	19,600
	Closing inventory	400	200
	Equivalent units produced	20,000	20,100
	Costs	Rs 1,98,000	Rs 90,450
	Cost per unit	9.90	4.50
4.	*Accounting for total costs transferred to Mix-pack*		
	Opening inventory	Rs 5,880	
	Costs to complete (300 × Rs 4.50)	1,350	Rs 7,230
	Started and completed 19,600 × (Rs 9.90 + Rs 4.50)		2,82,240
	Closing work-in-process inventory		
	Materials (400 × Rs 9.90)	3,960	
	Conversion costs (200 × Rs 4.50)	900	4,860
	Total costs accounted for		2,94,330

Cooking process account

Particulars	*Unit (litres)*	*Amount*	*Particulars*	*Unit (litres)*	*Amount*
To opening inventory	500	Rs 5,880	By Mix-pack	20,100	Rs 2,89,470
To material	20,000	1,98,000	By closing work-in-process	400	4,860
To labour		50,250			
To overheads		40,200			
	20,500	2,94,330		20,500	2,94,330

Cost of production report of mix-pack department for the month of January (weighted average cost basis)

1. *Units schedule*

Opening inventory (50 per cent)	300
Add units transferred from Cooking centre	20,100
Total	20,400
Less closing work-in-process inventory	400
Units completed and transferred	20,000

2. *Cost to be accounted for*

	Cooking centre	*Mix-pack*		*Total costs*
		Material	*Conversion costs*	
Opening inventory	Rs 2,130	Rs 570	Rs 540	Rs 3,240
Current period costs	2,89,470	76,380	1,44,000	5,09,850
	2,91,600	76,950	1,44,540	5,13,090

3. *Equivalent units and unit cost*

	Cooking centre	*Mix-pack*	
		Material	*Conversion costs*
Units completed	20,000	20,000	20,000
Plus closing work-in-process	400	400	120
	20,400	20,400	20,120
Cost per equivalent unit	Rs 14.2941	Rs 3.772	Rs 7.184

4. *Accounting for total costs*

Transferred to finished goods inventory [20,000 × Rs 25.2501 (Rs 14.2941 + Rs 3.772 + Rs 7.184)]		Rs 5,05,002
Work-in-process (closing)		
Cooking centre (400 × Rs 14.294)	Rs 5,717.60	
Material (400 × Rs 3.772)	1,508.80	
Conversion costs (120 × Rs 7.184)	862.08	8,088.48
Total costs accounted for		5,13,090.48

Mix-pack process account

Particulars	*Unit (litres)*	*Amount*	*Particulars*	*Unit (litres)*	*Amount*
To opening work-in -process inventory	300	Rs 3,240	By finished goods inventory account (transferred to)	20,000	Rs 5,05,002
To cooking process A/c (transferred from)	20,100	2,89,470	By work-in-process	400	8,088
To materials		76,380			
To labour		80,000			
To overheads		64,000			
	20,400	5,13,090		20,400	5,13,090

P.8.8 Following information is available regarding process A for the month of February, related to the current year.

Production record:

Units in process as on February 1 (All materials used, 25 per cent complete for labour and overheads)	4,000
New units introduced	16,000
Units completed	14,000
Units in process as on February 28 (All materials used, 33-1/3 per cent complete for labour and overheads)	6,000

(*Contd.*)

(*Contd.*)

Cost records:	
Work-in-process as on February 1	
Materials	Rs 6,000
Labour	1,000
Overheads	1,000
	8,000
Cost during the month	
Materials	25,600
Labour	15,000
Overheads	15,000
	55,600

Presuming that average method of inventory is used, prepare:

(i) Statement of equivalent production.
(ii) Statement showing cost for each element
(iii) Statement of apportionment of cost.
(iv) Process cost account for process A.

SOLUTION

(i) Statement of equivalent production (average cost method)

Flow of completed or partially completed units:	
Opening (at the beginning of month)	4,000
Introduced during the month	16,000
Total in process	20,000
Less units completed	14,000
Units in process	6,000

Particulars	*Number of units completed or otherwise*	*Stage of completion (per cent)*			*Equivalent units*		
		Materials	*Labour*	*Overheads*	*Materials*	*Labour*	*Overheads*
Units completed	14,000	100	100	100	14,000	14,000	14,000
Units in process	6,000	100	$33\frac{1}{3}$	$33\frac{1}{3}$	6,000	2,000	2,000
					20,000	16,000	16,000

(ii) Statement showing cost for each element

Particulars	*Materials*	*Labour*	*Overheads*	*Total*
Opening work-in-process	Rs 6,000	Rs 1,000	Rs 1,000	Rs 8,000
Cost incurred during February	25,600	15,000	15,000	55,600
Total cost	31,600	16,000	16,000	63,600
Equivalent units	20,000	16,000	16,000	—
Cost per equivalent unit	Rs 1.58	Re 1	Re 1	Rs 3.58

(iii) Statement of apportionment of cost

Particulars	*Element of cost*	*Equivalent production (in units)*	*Cost per unit*	*Total cost*	
Finished production	Materials	14,000	Rs 1.58	Rs 22,120	
	Labour	14,000	1.00	14,000	
	Overheads	14,000	1.00	14,000	Rs 50,120
Work-in-process	Materials	6,000	1.58	Rs 9,480	
	Labour	2,000	1.00	2,000	
	Overheads	2,000	1.00	2,000	13,480
					63,600

(iv) *Process A account*

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Opening Work-in-process	4,000	Rs 8,000	By Completed units	14,000	Rs 50,120
To Materials	16,000	25,600	By Closing work-in-process	6,000	13,480
To Labour		15,000			
To Overheads		15,000			
	20,000	63,600		20,000	63,600

P.8.9 The following information is given in respect of Process 3 for the month of January, current year.

Opening stock – 2,000 units made-up of:
- Direct materials-I Rs 12,350
- Direct materials-II 13,200
- Direct labour 17,500
- Overheads 11,000

Transferred from Process 2: 20,000 units @ Rs 6 per unit.
Transferred to Process 4: 17,000 units
Expenditure incurred in Process 3:
- Direct materials 30,000
- Direct labour 60,000
- Overheads 60,000

Scrap: 1,000 units – Direct materials, 100 per cent; Direct labour, 60 per cent; Overheads, 40 per cent
Normal loss: 10 per cent of production.
Scrapped units realised: Rs 4 per unit
Closing Stock: 4,000 units – Degree of completion: Direct materials, 80 per cent, Direct labour, 60 per cent and Overheads, 40 per cent

Prepare Process 3 Account using average price method, alongwith necessary supporting statements.

SOLUTION

Statement of equivalent production (average cost method)

Particulars	*Total units to be accounted for*	*Stage of completion(%)*				*Equivalent units*			
		Materials		*Labour*	*Over -heads*	*Materials*		*Labour*	*Over -heads*
		I	*II*			*I*	*II*		
Units completed	17,000	100	100	100	100	17,000	17,000	17,000	17,000
Normal loss (10%) (2,000 units + 20,000 units – 4,000 units)	1,800	—	—	—	—	—	—	—	—

(*Contd.*)

(*Contd.*)

Closing stock (work-in-process)	4,000	100	80	60	40	4,000	3,200	2,400	1,600
Abnormal gain (balancing figure)	(800)*	100	100	100	100	(800)	(800)	(800)	(800)
Total	22,000	—	—	—	—	20,200	19,400	18,600	17,800

* 22,800 – 22,000 (total units to be accounted for i.e., 2,000 opening stock units + 20,000 transferred from Process No. 2). It may be noted that units completed include units due to abnormal gain also.

Statement of cost

Particulars	*Total cost*	*Equivalent units*	*Equivalent per unit cost*
Direct materials-I:			
Opening stock	Rs 12,350		
Add cost of 20,000 units transferred form process 2@ Rs 6 per unit	1,20,000		
	1,32,350		
Less scrap value of normal loss units (1,800 x Rs 4)	7,200		
	1,25,150	20,200	Rs 6.2
Direct materials-II:			
Opening stock	Rs 13,200		
Introduced in process 3	30,000		
	43,200	19,400	2.2268
Direct labour:			
Included in opening stock	17,500		
Costs incurred as per process 3	60,000		
	77,500	18,600	4.1667
Overheads:			
Included in opening stock	11,000		
Costs incurred as per process 3	60,000		
	71,000	17,800	3.9888
Total cost per unit			16.5778

Statement showing apportionment of costs

Cost of completed units	(17,000 units × Rs 16.5778)		Rs 2,81,822.60
Valuation of abnormal gain	(800 units × Rs 16.5778)		13,262.24
Valuation of closing stock (Work-in-process):			
Direct materials I	(4000 Units × Rs 6.1955)	Rs 24,782	
Direct Materials II	(3,200 Units × 2.2268)	7,125.76	
Direct Labour	(2,400 Units × 4.1667)	10,000.08	
Overheads	(1,600 Units × 3.9888)	6,382.08	48,289.92

Process 3 account

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To opening work-in-process	2,000	Rs 54,050	By Normal loss	1,800	Rs 7,200
To Process 2	20,000	1,20,000	By Finished goods	17,000	2,81,822
To Direct materials II		30,000	By Closing work-in-process	4,000	48,290
To Direct labour		60,000			
To Overheads		60,000			
To Abnormal gain	800	13,262			
	22,800	3,37,312		22,800	3,37,312

P.8.10 A factory producing P also produces a by-product Q which is further processed into a finished product. The joint cost of manufacture is given below: Material, Rs 5,000; Labour, Rs 3,000; and Overheads, Rs 2,000.
Subsequent costs are as under:

	P	Q
Material	Rs 3,000	Rs 1,500
Labour	1,400	1,000
Overheads	600	500
	5,000	3,000

Selling prices are: P, Rs 16,000; Q, Rs 8,000.
Estimated profits on selling prices are 25 per cent for P and 20 per cent for Q.

Assume that selling and distribution expenses are in proportion of sales price.

Show how you would apportion joint costs of manufacture, and prepare a statement showing cost of production of P and Q.

SOLUTION

Apportionment of joint costs

Particulars	*P*	*Q*
Selling price	Rs 16,000	Rs 8,000
Less profits @ 25 per cent (P) and 20 per cent (Q) on selling price	4,000	1,600
Less selling and distribution expenses (2:1)	267	133
Cost of production	11,733	6,267
Less separable costs subsequent to split-off point	5,000	3,000
Share of joint costs (6,733: 3,267 for P and Q)	6,733	3,267

Statement showing cost of production of P and Q

Elements of cost	*Joint costs*		*Separable costs*		*Total cost*	
	P	*Q*	*P*	*Q*	*P*	*Q*
Materials	Rs 3,367	Rs 1,633	Rs 3,000	Rs 1,500	Rs 6,367	Rs 3,133
Labour	2,020	980	1,400	1,000	3,420	1,980
Overheads	1,346	654	600	500	1,946	1,154
	6,733	3,267	5,000	3,000	11,733	6,267

Working Notes

Determination of selling and distribution expenses

Sales revenue (P and Q)		Rs 24,000
Less profit (P and Q)		5,600
Cost of sales		18,400
Less cost of production		
Joint costs	Rs 10,000	
Separable costs [Rs 5,000 (P) + Rs 3,000 (Q)]	8,000	18,000
Selling and distribution expenses		400

P.8.11 X Ltd manufactures product A which yields two by-products, B and C. In a period the amount spent upto the point of separation was Rs 20,600. Subsequent expenses were:

	A	*B*	*C*
Materials	Rs 300	Rs 200	Rs 250
Direct wages	400	300	200
Overhead	300	270	180
	1,000	770	630

Gross sales value of products A, B and C was Rs 15,000, Rs 10,000, and Rs 5,000 respectively. It was estimated that the net profit as a percentage of sales in case of products B and C would be 25 per cent and 20 per cent respectively. Ascertain the profit earned on A.

SOLUTION

Statement showing the allocation of joint costs between products B and C (NRV less normal profit method)

Products	*Sales value*	*Profit*	*Separable costs*	*NRV/Joint costs*
B	Rs 10,000	Rs 2,500	Rs 770	Rs 6,730
C	5,000	1,000	630	3,370

Joint cost to be allocated to A would be: Rs 20,600 – (Rs 6,730 + Rs 3,370) = Rs 10,500

Statement showing profit earned by product A

Sales revenue			Rs 15,000
Less cost of production			
Joint cost		Rs 10,500	
Separable costs:			
Material	Rs 300		
Direct wages	400		
Overheads	300	1,000	11,500
Profit			3,500

P.8.12 From the following information, find the profit made by each product apportioning joint costs on sales-value basis:

Joint costs		
Direct material		Rs 1,26,000
Power		25,000
Petrol, oil, lubricants		5,000
Labour		7,500
Other charges		4,100
		1,67,600
	Product X	*Product Y*
Selling costs	Rs 20,000	Rs 80,000
Sales	1,52,000	1,68,000

SOLUTION

Statement showing profit after apportionment of joint costs

Particulars	*Product X*	*Product Y*	*Total*
Sales	Rs 1,52,000	Rs 1,68,000	Rs 3,20,000
Less cost of production (In the ratio of sales: 19:21)			
Direct material	59,850	66,150	1,26,000
Power	11,875	13,125	25,000
Petrol, oil, lubricants	2,375	2,625	5,000
Labour	3,562.50	3,937.50	7,500
Other charges	1,947.50	2,152.50	4,100
Gross profit	72,390	80,010	1,52,400
Less selling costs	20,000	80,000	1,00,000
Profit	52,390	10	52,400

P.8.13 XYZ Chemicals Manufacturing Company Ltd buys a particular raw material at Rs 4 per litre. At the end of the processing in department 1, this raw material splits-off into products, X, Y and Z. Product X is sold at the split-off point, with no further processing. Products Y and Z require further processing before they can be sold. Product Y is processed in department 2, and product Z is processed in department 3. Following is a summary of costs and other related data for the end of the current year.

	Department		
	1	2	3
Cost of raw material	Rs 2,40,000	—	—
Direct labour	35,000	Rs 2,25,000	Rs 3,25,000
Manufacturing overhead	24,000	1,05,000	2,25,000
	Products		
	X	Y	Z
Litres sold	10,000	15,000	22,500
Closing inventory	5,000	—	7,500
Sales	Rs 1,50,000	Rs 4,80,000	Rs 7,50,000
Sale price per litre	15	32	25

There were no opening and closing inventories of basic raw materials at the beginning as well as at the end of the year. All finished goods inventory of litres was complete as to processing. The company uses the relative sales value method of allocating joint costs.

You are required to prepare: (i) Schedule showing the allocation of joint cost; (ii) Cost of sales of each product, the cost of each ending inventory; and (iii) A comparative statement of profit.

SOLUTION

(i) *Schedule showing allocation of joint cost*

Product	*Output (litres)*	*Market price*	*Total market price*	*Separable costs*	*Net realisable value*	*Joint cost*	*Total cost*	*Cost per unit*
X	15,000	Rs 15	Rs 2,25,000	—	Rs 2,25,000	Rs 1,17,000	Rs 1,17,000	Rs 7.8
Y	15,000	32	4,80,000	Rs 3,30,000	1,50,000	78,000	4,08,000	27.2
Z	30,000	25	7,50,000	5,50,000	2,00,000	1,04,000	6,54,000	21.8
				8,80,000		2,99,000	11,79,000	

Joint cost = [Rs 2,40,000 + Rs 35,000 + Rs 24,000] = Rs 2,99,000 of Department 1 allocated in the ratio of 9:6:8 among products X, Y, and Z respectively.

(iii) *Schedule showing cost of sales and ending inventory of each product*

Product	*Cost per unit*	*Units sold (litres)*	*Cost of sales*	*Inventory units (litres)*	*Inventory cost*
X	Rs 7.8	Rs 10,000	Rs 78,000	5,000	Rs 39,000
Y	27.2	15,000	4,08,000	—	—
Z	21.8	22,500	4,90,500	7,500	1,63,500

(iii) *Comparative statement of profit*

Particulars	*Product X*	*Product Y*	*Product Z*
(a) Sales revenue	Rs 1,50,000	Rs 4,80,000	Rs 5,62,500
Less cost of sales			
Production cost			
(i) Joint cost	1,17,000	78,000	1,04,000
(ii) Separable cost	—	3,30,000	5,50,000
Total cost	1,17,000	4,08,000	6,54,000
Less closing inventory	39,000	—	1,63,500
(b) Cost of goods sold	78,000	4,08,000	4,90,500
(c) Gross profit [(a) – (b)]	72,000	72,000	72,000

P.8.14 The ABC Ltd makes three products from one common input. Process I is the joint process and every 100 kgs of input yields: 60 kgs of product A; 30 kgs of product B; and 5 kgs of product C and the remaining 5 kgs is a waste product with no market value.

Product A requires further processing in process II at an average cost of Rs 10 per kg. It is then sold at Rs 100 per kg. Product B is sold at split-off point at Rs 50 per kg. Product C after further processing in process III (at Rs 2.5 per kg), is sold at Rs 5 per kg. The selling expenses associated with C are negligible, and the company desires the cost of product C to be such as to earn a profit of 10 per cent on sales.

During the current period, 1,00,000 kgs of input was processed through process I (assume no inventories), and the total operating costs in Process I were Rs 51,85,000.

You are required: (i) To determine the amount of Process I cost assigned to by-product C; (ii) To determine the amount of joint costs to be assigned to A and B using the relative sales value approach; (iii) To determine the amount of joint costs to be assigned to A and B, using the net realisable value less normal profit approach.

SOLUTION

(i) *Determination of cost of by-product C*

Sales revenue (Rs 5 × 5,000 kgs, that is, 1,00,000 kgs × 0.5)	Rs 25,000
Less separable costs in Process III (Rs 2.5 × 5,000 kgs)	12,500
Less profit [10 per cent of selling price (0.10 × Rs 25,000)]	2,500
Cost of Process I (joint costs) assigned to product C	10,000

(ii) *Statement showing allocation of joint cost between products A and B (relative sales value approach)*

Product	*Output (kgs)*	*Sales price*	*Total market value*	*Separable costs*	*NRV*	*Joint cost*
A	60,000	Rs 100	Rs 60,00,000	Rs 6,00,000	Rs 54,00,000	Rs 40,50,000
B	30,000	50	15,00,000	—	15,00,000	11,25,000
			75,00,000		69,00,000	51,75,000

(iii) *Statement showing the allocation of joint cost between products A and B (NRV less normal profit approach)*

Product	*Market value*	*Normal profit*	*Separable cost*	*NRV*	*Joint cost*
A	Rs 60,00,000	Rs 13,80,000	Rs 6,00,000	Rs 40,20,000	Rs 40,20,000
B	15,00,000	3,45,000	—	11,55,000	11,55,000

Normal profit ratio = 100 per cent – (Rs 51,75,000+Rs 6,00,000) ÷ Rs 75,00,000 = 100 –77 = 23 per cent

P.8.15 The XYZ Chemical Company Ltd produces chemicals X and Y from material Z. 10 litres of raw material Z yield 8 litres of X and 2 litres of Y as a result of processing it in department I. Product X requires furhter processing in

department II and then is sold at Rs 150 per litre. Product Y is sold at the split-off point for Rs 112.50 per litre. The following additional data are available for the current period.

Department I	
Inventory (in litres)	100
Percentage completion of conversion costs	50
Cost of material Z added in current period (1,100 litres)	Rs 22,000
Conversion costs in current period	31,500
Department II	
Inventory (in litres)	200
Percentage completion of conversion costs	25
Conversion costs in current period	Rs 52,000
Finished goods inventories	
Product X	100
Product Y	50

Prepare a statement apportioning the joint costs of Department I between Products X and Y using the net realisable value less normal profit method.

SOLUTION

Department I

Total cost (Rs 22,000 + Rs 31,500)		Rs 53,500
Less cost of closing inventory (work-in-process):		
Material cost (100 litres × Rs 20)	Rs 2,000	
Conversion cost [100 × 0.50 × Rs 31.500 ÷ 1,050)]	1,500	3,500
Cost to be allocated between products X and Y		50,000

Working Notes

(i) 1,050 are equivalent units: (1,000, completed units + 100 units, work in process × 0.50 complete).

(ii) Litres produced, 1,000
Product X (0.80 × 1,000) = 800 litres
Product Y (0.20 × 1,000) = 200 litres

Department II (product X)

Equivalent units started and finished (800 litres from Department I - 200 litres, closing inventory)	600
Add closing equivalent units inventory (200 × 0.25)	50
Equivalent units produced	650
Conversion costs	Rs 52,000
Cost per equivalent unit (Rs 52,000 ÷ 650)	80

Statement apportioning joint cost of department I between products X and Y (NRV less normal profit method)

Product	*Output (litres)*	*Selling price*	*Total market value*	*Normal profit*	*Separable costs*	*Joint costs*
X	800	Rs 150	Rs 1,20,000	Rs 24,000	Rs 64,000	Rs 32,000
Y	200	112.50	22,500	4,500	—	18,000

Normal profit rate = 100 –[Rs 50,000 + (Rs 80 × 800)] ÷ Rs 1,42,500 = 100 – 80 = 20 per cent

Separable costs for completed 800 units @ Rs 80 per equivalent unit = (Rs 80 × 800) = Rs 64,000.

P.8.16 The Jayna Watch Company Ltd manufactures wall clocks and watches on an assembly-line basis. The April 1 work-in-process inventory consisted of 2,000 watches that were complete as to material and 50 per cent complete as to labour and overheads. Costs in process on April 1 were: Material, Rs 50,000; Conversion, Rs 1,30,000. 20,000 units

were started during the month and 19,000 units were completed. The closing inventory was complete as to material and one-third complete as to conversion. Costs placed in process during April were:

Material (20,000 units)	Rs 6,10,000
Labour (10,000 hours)	4,00,000
Variable overheads	25,000
Fixed overheads	9,45,000
	19,80,000

Prepare a cost-of-production report using FIFO process costing.

SOLUTION

Cost of production report (FIFO Basis) for the month of april

(i) *Units schedule*

Opening inventory	2,000
Add introduced during the month	20,000
Total	22,000
Less closing work-in-process inventory	(3,000)
Units completed	19,000

(ii) *Cost to be accounted for*

	Materials	*Conversion costs*	*Total*
Work-in-process opening inventory	—	—	Rs 1,80,000
Current costs	Rs 6,10,000	Rs 13,70,000	19,80,000
Total costs in process	6,10,000	13,70,000	21,60,000
Equivalent units manufactured	÷ 20,000	÷ 19,000	
Cost per equivalent unit	30.50	72.105	102.605

(iii) *Equivalent units*

	Material	*Conversion cost*
Units completed	19,000	19,000
Plus equivalent units in closing inventory	3,000	1,000
Less equivalent units in opening inventory	2,000	1,000
Equivalent units manufactured	20,000	19,000

(iv) *Accounting for total costs*

Transferred to finished goods inventory:		
First batch		
Opening inventory	Rs 1,80,000	
Costs to complete (1,000 × Rs 72.105)	72,105	
	2,52,105	
Second batch		
Started and completed (17,000 × Rs 102.605)	17,44,285	Rs 19,96,390
Work-in-process (closing)		
Materials (3,000 × Rs 30.50)	91,500	
Conversion costs (1,000 × Rs 72.105)	72,105	1,63,605
Total costs accounted for		21,59,995

P.8.17 X Ltd is in the food processing industry. In one of its processes, three joint products are manufactured. Traditionally, the company apportions costs incurred upto the joint products' pre-separation point on the basis of weight of output of the product.

You are required to prepare statements for the management to express:

(a) The profit or loss of each product as ascertained, using weight basis of apportioning pre-separation joint cost.

(b) The optimal contribution which could be obtained from the manufacture of these products.

The following process data for December are given. Costs incurred upto separation point are Rs 96,000.

	Product A	*Product B*	*Product C*
Cost incurred after separation point	Rs 20,000	Rs 12,000	Rs 8,000
Selling price per tonne:			
Completed product	500	800	600
Estimated, if sold at separation point	250	700	450
Output (tonnes)	100	60	80

The cost of any unused capacity after the separation point should be ignored.

SOLUTION

Comparative profit and loss account for products, A,B and C

Particulars	*Products*			*Total*
	A	*B*	*C*	
Sales revenue	Rs 50,000	Rs 48,000	Rs 48,000	Rs 1,46,000
Less cost of production:				
Joint costs (allocated in of proportion output 10:6:8)	40,000	24,000	32,000	96,000
Separable costs	20,000	12,000	8,000	40,000
Profit/(loss)	(10,000)	12,000	8,000	10,000

(b) In order to ascertain whether the firm is following a sound policy regarding processing all products beyond the split-off point, we should adopt the incremental analysis which compares incremental revenue from further processing with incremental costs (separable costs) incurred by the firm.

Particulars	*Product A*	*Product B*	*Product C*
(i) Number of units (tonnes)	100	60	80
(ii) Incremental revenue from further processing per unit	Rs 250	Rs 100	Rs 150
(iii) Total incremental revenue (i) × (ii)	25,000	6,000	12,000
(iv) Incremental cost from further processing	20,000	12,000	8,000
(v) Incremental profit/loss [(iii) – (iv)]	5,000	(6,000)	4,000

The incremental analysis suggests that products A and C should be processed further beyond the split-off point as they yield positive contributions. Product B should be sold at split-off point because further processing cost is more than the incremental revenue it fetches. Accordingly, contributions would be maximum and optimal when products A and C are processed further and product B is sold at the split-off point. This is shown in the following statement:

Statement Showing Optimal Contribution

Particulars	*Product A*	*Product B*	*Product C*	*Total*
Sales revenue	Rs 50,000	Rs 42,000	Rs 48,000	Rs 1,40,000
Less variable costs for further processing	20,000	—	8,000	28,000
Contribution	30,000	42,000	40,000	1,12,000
Less joint costs		Not required		96,000
Profit				16,000

P.8.18 Two products P and Q are obtained in a crude form and require processing at a cost of Rs 5 for P and Rs 4 for Q per unit before sale. Assuming a net margin of 25 per cent on cost, their sale prices are fixed at Rs 13.75 and Rs 8.75 per unit respectively. During the period, the joint cost was Rs 88,000 and the outputs were: P, 8,000 units; Q, 6,000 units. Ascertain the joint cost per unit

SOLUTION

Statement for ascertaining joint cost per unit

Product	*P*	*Q*
Output (units)	*8,000*	*6,000*
Selling price per unit	Rs 13.75	8.75
Less, profit margin @ 25 per cent on cost or 20 per cent on sales	(2.75)	(1.75)
	11	7
Less post split off cost	(5)	(4)
Pre-split off net joint cost per unit	6	3
Share in joint cost of units of P and Q can be obtained by apportioning in ratio of 8:3[1]	64,000	24,000
Joint cost per unit	8[@]	4[@@]

[@](Rs 64,000/8000 units) [@@](Rs 24,000/6,000 units)

Working Notes

1. *Calculation of ratio of apportionment of joint cost*

Products	*P*		*Q*
Units	8,000		6,000
Pre-split off net joint cost per unit	Rs 6		Rs 3
Total output cost	48,000		18,000
Ratio	8	:	3

P.8.19 The following data relate to process Q:

(i)	Opening work-in-process (units)		4,000
	Degree of completion (%):		
	Materials	100	Rs 24,000
	Labour	60	14,400
	Overheads	60	7,200
(ii)	Received during the month of April, current year from process P:		
	40,000 units		Rs 1,71,000
(iii)	Expenses incurred in process Q during the month:		
	Materials		Rs 79,000
	Labour		1,38,230
	Overheads		69,120
(iv)	Closing work-in-process (units)		3,000
	Degree of completion (%):		
	Materials		100
	Labour and overheads		50
(v)	Units scrapped (units)		4,000
	Degree of completion (%):		
	Materials		100
	Labour and overheads		80
(vi)	Normal loss: 5 per cent of current input.		
(vii)	Spoiled goods realised Rs 1.50 each on sale.		
(viii)	Completed units are transferred to warehouse.		

Required Prepare: (i) Equivalent units statement, (ii) Statement of cost per equivalent unit and total costs, (iii) Process Q Account, (iv) Any other account necessary.

SOLUTION

(i) *Equivalent units statement (using FIFO method)*

Units introduced	*Particulars*	*Units produced*	*Equivalent Production*					
			Materials		*Labour*		*Overheads*	
			Percentage completion	*Units*	*Percentage completion*	*Units*	*Percentage completion*	*Units*
4,000	Opening work-in-progress units, completed and transferred to warehouse	4,000	—	—	40	1,600	40	1,600
40,000	Units introduced, completed and transferred to warehouse	33,000	100	33,000	100	33,000	100	33,000
	Normal loss	2,000	—	—	—	—	—	—
	Closing work-in-progress	3,000	100	3,000	50	1,500	50	1,500
	Abnormal loss	2,000	100	2,000	80	1,600	80	1,600
44,000		44,000		38,000		37,700		37,700

(ii) *Statement of cost*

Particulars	*Total cost*	*Equivalent production (in units)*	*Cost per unit*
Materials			
Cost of units introduced	Rs 1,71,000		
Additional direct material	79,000		
	2,50,000		
Less sale proceeds of scrap material (2,000 units × Rs 1.5)	3,000		
	2,47,000	38,000	Rs 6.50
Direct labour	1,38,230	37,700	3.67
Overheads	69,120	37,700	1.83
	4,54,350		12.00

Statement of apportionment of cost

Particulars	*Element of cost*	*Equivalent production*	*Cost per unit*	*Cost*	*Total cost*
Opening inventory (combined)	—	—	—	Rs 45,600	—
	Material	—	—	—	—
	Labour	1,600	Rs 3.67	5,872	
	Overheads	1,600	1.83	2,928	Rs 54,400

(*Contd.*)

(*Contd.*)

Finished production	Material	33,000	6.50	2,14,500	
	Labour	33,000	3.67	1,21,110	
	Overheads	33,000	1.83	60,390	3,96,000
Abnormal loss	Material	2,000	6.50	13,000	
	Labour	1,600	3.67	5,872	
	Overheads	1,600	1.83	2,928	21,800
Work-in-progress (WIP)	Material	3,000	6.50	19,500	
	Labour	1,500	3.67	5,505	
	Overheads	1,500	1.83	2,745	27,750

(iii) *Process Q account*

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To opening W.I.P.	4,000	Rs 45,600	*By normal loss @ Rs 1.5*	2,000	Rs 3,000
To units received from Process P	40,000	1,71,000	*By completed units** (Rs 54,400 + Rs 3,96,000)	37,000	4,50,400
To expenses incurred					
Material		79,000	By abnormal loss*	2,000	21,800
Labour		1,38,230	By closing W.I.P.*	3,000	27,750
Overheads		69,120			
	44,000	5,02,950		44,000	5,02,950

*Calculated in answer (ii)

(iv) *Abnormal loss account*

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To process Q A/c	2,000	Rs 21,800	By sale @ Rs 1.5	2,000	Rs 3,000
			By transfer to profit and loss a/c		18,800
	2,000	21,800		2,000	21,800

P.8.20 A company purchases raw materials worth Rs 11.04 lakh and processes them into four products P, Q, R and S, which have a unit sale price of Rs 3, Rs 9, Rs 16, and Rs 60, respectively at split-off point, as they could be sold as such to other processors. However, during year, the company decided to further process and sell products P, Q and S, while product R would be sold at split-off point to other processes. The processing of raw materials into the four products cost Rs 28 lakh to the company. The other data for the year were as under (amount in Rs lakh):

Product	*Output (units)*	*Sales*	*Additional processing (variable) cost after split-off*
P	10,00,000	46.00	12.00
Q	20,000	4.00	2.40
R	10,000	1.60	—
S	18,000	12.00	0.40

You are required to work out the company's annual income If the joint costs are allocated amongst the four products on the basis of 'net realisable value' at split-off point, what would be the compan's annual income?

SOLUTION

Statement showing annual income for four products (Rs in lakh):

Products	*Sales*	*Joint cost (working note 1)*	*Additional processing cost after split-off*	*Total cost (3+4)*	*Net income (2–5)*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
P	46.00	27.20	12.00	39.20	6.80
Q	4.00	1.28	2.40	3.68	0.32
R	1.60	1.28	—	1.28	0.32
S	12.00	9.28	0.40	9.68	2.32
Total	63.60	39.04	14.80	53.84	9.76

Working Note

1. Statement showing allocation of joint cost amongst the products P, Q, R and S (under net realisable values at split-off point method) (Rs in lakh)

Products	*Sales value*	*Less additional processing cost*	*Net realisation value beyond split-off point*	*Computation*	*Joint costs*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
P	46.00	12.00	34.00	$\frac{39.04 \times 34.00}{48.80}$	27.20
Q	4.00	2.40	1.60	$\frac{39.04 \times 1.60}{48.80}$	1.28
R	1.60	—	1.60	$\frac{39.04 \times 1.60}{48.80}$	1.28
S	12.00	0.40	11.60	$\frac{39.04 \times 11.60}{48.80}$	9.28
Total:	63.60	14.80	48.80		39.04

P.8.21 The Sunshine Oil Company purchases crude vegetable oil. It does refining of the same. The refining process results in four products at the split-off point: M,N,O and P.

Product O is fully processed at the split-off point. Product M,N and P can be individually further refined into 'Super M', 'Super N' and 'Super p'. In the most recent month (October), related to current year the output (in gallons) at split-off point was:

Product M	3,00,000
Product N	1,00,000
Product O	50,000
Product P	50,000

The joint cost of purchasing the crude vegetable oil and processing it were Rs 40,00,000.

Sunshine had no beginning or ending inventories. Sales of Product O in October were Rs 20,00,000. Total output of products M, N and P was further refined and then sold. Data related to October are as follows:

Particulars	*Further processing costs to make Super Products*	*Sales*
'Super M'	Rs 80,00,000	Rs 1,20,00,000
'Super N'	32,00,000	40,00,000
'Super P'	36,00,000	48,00,000

Sunshine had the option of selling products M, N and P at the split-off point. This alternative would have yielded the following sales for October:

Product M	Rs 20,00,000
Product N	12,00,000
Product P	28,00,000

You are required to answer:

(i) How would the joint cost of Rs. 40,00,000 be allocated between each product under each of the following methods (a) sales value at split-off: (b) physical output (gallons): and (c) estimated net realizable value?

(ii) Could Sunshine have increased its October operating profits by making different decisions about the further refining of product M, N or P? Show the effect of any change you recommend on operating profits.

SOLUTION

(i) (a) Joint cost allocation using sales value at split-off method

Products *(1)*	*Sales value at split-off point* *(2)*	*Basis of joint cost allocation* *(3)*	*Joint cost allocated (Col 3 × Rs 40 lakh)* *(4)*
M	Rs 20,00,000	20/80	Rs 10,00,000
N	12,00,000	12/80	6,00,000
O	20,00,000	20/80	10,00,000
P	28,00,000	28/80	14,00,000
	80,00,000		40,00,000

* assumed sales value at split-off point.

(b) Joint cost allocation using physical output method

Products *(1)*	*Output (gallons)* *(2)*	*Basis of joint cost allocation* *(3)*	*Joint cost allocated (Col 3 × Rs 40 lakh)* *(4)*
M	Rs 3,00,000	3/5	Rs 24,00,000
N	1,00,000	1/5	8,00,000
O	50,000	1/10	4,00,000
P	50,000	1/10	4,00,000
	5,00,000		40,00,000

(c) Joint cost allocation using estimated net realisable value method

Products (1)	*Sales value after further processing* (2)	*Further processing costs* (3)	*Net realisable value (Col.2 - Col. 3)* (4)	*Basis of joint cost allocation* (5)	*Joint cost allocated (Col. 5 x 40 lakh)* (6)
M	Rs 1,20,00,000	Rs 80,00,000	Rs 40,00,000	40/80	Rs 20,00,000
N	40,00,000	32,00,000	8,00,000	8/80	4,00,000
O	—	—	20,00,000	20/80	10,00,000
P	48,00,000	36,00,000	12,00,000	12/80	6,00,000
			80,00,000		40,00,000

(ii) Sell or process further: decision analysis

Particulars	*Products*		
	M	*N*	*P*
Sales value after further processing	Rs 1,20,00,000	Rs 40,00,000	Rs 48,00,000
Less sales value before further processing	20,00,000	12,00,000	28,00,000
Incremental sales revenue	1,00,00,000	28,00,000	20,00,000
Less further processing costs	80,00,000	32,00,000	36,00,000
Incremental profit (loss) from further processing	20,00,000	(4,00,000)	(16,00,000)

Sunshine would have increased profits by Rs 20 lakh if it had processed Product M further; further processing of products N and P would have caused losses.

P.8.22 Two products P and Q are obtained in a crude form and require further processing at a cost of Rs 5 for P and Rs 4 for Q per unit before sale. Assuming a net margin of 25 per cent on cost, their sale prices are fixed at Rs 13.75 and Rs 8.75 per unit respectively. During the period, the joint cost was Rs. 88,000 and the outputs were: P, 8,000 units; Q, 6,000 units

Ascertain the joint cost per unit.

SOLUTION

Statement showing allocation of joint costs

Particulars	*Products*	
	P	*Q*
Selling price per unit	Rs 13.75	Rs 8.75
Less estimated net profit (25 per cent on cost or 20 per cent on sales)	2.75	1.75
Less separable post split-off cost	5.00	4.00
Pre-split/joint cost per unit	6.00	3.00
Multiplied by output (in units)	8,000	6,000
Joint costs are to be shared between products P and Q in the ratio of 48000: 18,000 i.e., 8:3 respectively	48,000	18,000
Share of joint costs (P: Rs 88,000 × 8/11 and Q: Rs 88,000 × 3/11	64,000	24,000

REVIEW QUESTIONS

RQ.8.1 Specify the production situations that are more suitable to the process costing system.

RQ.8.2 Distinguish between process costing and job costing. Why is cost accumulation easier under the process costing system than under the job costing system?

RQ.8.3 Specify the important elements of a production report.

RQ.8.4 Explain clearly the difference between scrap, by-products, and joint products. Give the cost accounting treatment for each.

RQ.8.5 What is meant by 'equivalent units?' Discuss its importance in valuing work-in-process.

RQ.8.6 Explain normal and abnormal wastage and state how they should be dealt with in process cost accounts.

RQ.8.7 Under what circumstances are identical results obtained under weighted average and FIFO process costing?

RQ.8.8 Compare the weighted average method with the FIFO method in calculating unit costs.

RQ.8.9 An accountant has described cost allocations to joint products as a "necessary evil"? Comment.

RQ.8.10 Define joint products and by-products. Explain the various methods available for apportionment of joint costs to joint products.

RQ.8.11 What is meant by the split-off point? What is its significance in product costing?

RQ.8.12 When is the sales value method preferable to the quantity method as a means of allocating joint costs?

In many manufacturing processes, waste products and by-products are produced. What problems do these present in costing the main product and how are they overcome?

RQ.8.13 A manufacturer can sell part of the output of process 1 as it is or process it further in process 2. What cost are relevant in a decision to sell it as it is or to process it further? What costs are irrelevant?

RQ.8.14 What are inter-process profits? How are such profits taken into account while valuing closing stock from the point of view of the balance sheet? Do you subscribe to the view that the output of one process should be transferred to another at a profit?

RQ.8.15 A product passes through two processes, A and B. The output of A passes on to B and that of B becomes the finished product. From the following information, prepare the process accounts:

	Process A	*Process B*
Materials consumed	Rs 24,000	Rs 12,000
Direct labour	28,000	16,000
Manufacturing expenses	8,010	8,000
Input in process A (units)	20,000	
Input in process A	20,000	
Output (units)	18,000	16,600
Normal wastage of input (%)	5	10
Value of normal wastage per 100 units	16	20

SOLUTION

Process accounts

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
		Process A A/c			
To Raw materials	20,000	Rs 24,000	By Normal wastage	1,000	Rs 160
To Direct labour		28,000	By Abnormal loss	1,000	3,150

(*Contd.*)

(*Contd.*)

To Manufacturing expenses		8,010	By Process B A/c (transferred @ Rs 3.15 per unit)	18,000	56,700
	20,000	60,010		20,000	60,010
			Process B A/c		
To Process A (output transferred from)	18,000	56,700	By Normal wastage	1,800	360
To Material consumed		12,000	By Finished stock A/c (final output transferred @ Rs 5.7 per unit)	16,600	94,620
To Direct labour		16,000			
To Manufacturing expenses		8,000			
To Abnormal gain (@ Rs 5.7 per unit)	400	2,280			
	18,400	94,980		18,400	94,980
			Abnormal Loss A/c		
To Process A A/c	1,000	3,150	By Sale proceeds (@ Re. 0.16 each unit)	1,000	160
			By Profit & loss A/c (loss transferred)	—	2,990
	1,000	3,150		1,000	3,150
			Abnormal Gain A/c		
To Normal wastage	400	80	By Process B	400	2,280
To Profit & loss A/c (profit transferred to)	—	2,200		—	—
	400	2,280		400	2,280

RQ.8.16 The product of a manufacturing concern passes through two processes, A and B before reaching the finished stock. It is estimated that in each process, normally 5 per cent of the total weight is lost; 10 per cent becomes scrap which from processes A and B realises Rs 80 and Rs 200, respectively.
The following are the other details:

	Process A	*Process B*
Material (tons)	1,000	70
Cost of material (per ton)	Rs 125	Rs 200
Wages	28,000	10,000
Manufacturing expenses	8,000	5,250
Output (tons)	830	780

Prepare the process accounts showing cost per ton of each process. There is no stock or work-in-process.

SOLUTION

Process accounts

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
		Process A A/c			
To Material	1,000	Rs 1,25,000	By Loss in weight	50	—
To Wages		28,000	By Normal loss	100	Rs 8,000
To Manufacturing expenses		8,000	By Abnormal loss	20	3,600
			By Process B (@ Rs 180 per ton)	830	1,49,400
	1,000	1,61,000		1,000	1,61,000
		Process B A/c			
To Process A (output transferred from)	830	1,49,400	By Loss in weight	45	—
			By Normal loss	90	18,000
To Materials	70	14,000	By Finished stock A/c (output		
To Labour		10,000	transferred @ Rs 210 per ton)	780	1,63,800
To Overheads		5,250			
To Abnormal gain	15	3,150			
	915	1,81,800		915	1,81,800

RQ.8.17 In a chemical engineering factory, a product has to pass through three different stages before it is ready for sale. From the information given below, work out the selling price of the product if the management decides to have a mark-up of 25 per cent over its works cost.

Stage of production	*I*	*II*	*III*
Input of raw material @ Rs 4 per kg	1,00,000		
Normal loss in input of each stage (%)	5	5	5
Delivered to next process (kgs)	90,000	80,000	—
Total direct labour cost (Rs)	14,000	15,000	30,000
Variable overheads as per cent on direct labour	150	120	100
Fixed overheads as per cent on direct labour	250	140	200
Finished stocks held back at the stage	4,000	4,000	—

For the purposes of this exercise, abnormal loss, if any, may be charged to the respective stages since output of each stage can also be diverted to other process for manufacturing other chemicals.

SOLUTION

Stage accounts

Particulars	*Kgs*	*Amount*	*Particulars*	*Kgs*	*Amount*
		Stage I A/c			
To Material	1,00,000	Rs 4,00,000	By Normal loss (5%)	5,000	—
To Direct labour cost	—	14,000	By Normal loss	1,000	—
To Variable overheads	—	21,000	By Stage II (@ Rs 5 per kg)	90,000	Rs 4,50,000
To Fixed overheads	—	35,000	By Balance c/d	4,000	20,000
	1,00,000	4,70,000		1,00,000	4,70,000

(*Contd.*)

(*Contd.*)

Stage II A/c

To Stage I (transferred from)	90,000	4,50,000	By Normal loss (5%)	4,500	—
To Direct labour cost		15,000	By Abnormal loss	1,500	—
To Variable overheads		18,000	By Stage III (@ Rs 6 per kg)	80,000	4,80,000
To Fixed overheads		21,000	By Balance c/d	4,000	24,000
	90,000	5,04,000		90,000	5,04,000

Stage III A/c

To Stage II (transferred from)	80,000	4,80,000	By Normal loss (5%)	4,000	—
To Direct labour cost	—	30,000	By Finished stock	76,000	6,00,000
To Variable overheads		30,000			
To Fixed overheads		60,000			
	80,000	6,00,000		80,000	6,00,000

Determination of selling price:

Work cost of stage III	Rs 6,00,000
Add 25% profit margin	1,50,000
Selling price of actual output	7,50,000

RQ.8.18 From the following data prepare process accounts for a single product:

	Process I	*Process II*
(i) Period: December of the current year		
(ii) Work-in-process at the beginning	Nil	Nil
(iii) *Cost incurred in the period*		
Direct materials	Rs 60,000	—
Labour	12,000	Rs 16,000
Factory overheads	24,000	20,000
(iv) *Units of production*		
Received in process	40,000	36,000
Completed and transferred	36,000	32,000
Remaining in process at the end of the period	2,000	2,500
Loss-in-process (normal loss)	2,000	1,500

(v) *Production remaining in process should be valued at:*
Material, 100 per cent
Labour and overheads, 50 per cent

SOLUTION

Process accounts

Process I A/c

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Direct materials	40,000	Rs 60,000	By Normal loss	2,000	—
To Direct wages		12,000	By Process II (balancing figure)	36,000	Rs 91,870
To Factory overheads		24,000	By Work-in-process: (see working note)	2,000	4,130
	40,000	96,000		40,000	96,000

(*Contd.*)

(*Contd.*)

Process II A/c

To Process I A/c	36,000	91,870	By Normal loss	1,500	—
To Direct wages		16,000	By Finished stock		
To Factory overheads		20,000	(balancing figure)	32,000	1,19,870
			By Work-in-process: (see working note)	2,500	8,000
	36,000	1,27,870		36,000	1,27,870

Working Notes

Statement of equivalent production

Input	*Particulars*	*Units*	*Stage of completion(%)*		*Equivalent units*	
			Materials	*Conversion cost*	*Materials*	*Conversion cost*
	Process I					
40,000	Units introduced					
	Units completed	36,000	100	100	36,000	36,000
	Normal loss	2,000	—	—	—	—
	Closing work-in-process	2,000	100	50	2,000	1,000
40,000		40,000			38,000	37,000
	Process II					
36,000	Units introduced					
	Units completed	32,000	100	100	32,000	32,000
	Normal loss	1,500	—	—	—	—
	Closing work-in-process	2,500	100	50	2,500	1,250
36,000		36,000			34,500	33,250

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per equivalent unit*
Process I			
Materials	Rs 60,000	38,000	Rs 1.58
Conversion costs	36,000	37,000	0.97
Process II			
Materials	91,870	34,500	2.66
Conversion costs	36,000	33,250	1.08

RQ.8.19 The following information is available from the records of a company engaged in manufacturing a single product.

Opening work-in-process	Quantity (units)	16,000
	Material	Rs 1,48,000
	Wages	33,000
	Overhead	29,000
Added during the year	Quantity (units)	69,000
	Material	5,62,000
	Labour	1,67,000
	Overhead	1,51,000

(*Contd.*)

(*Contd.*)

Finished during the year	Quantity (units)	56,000
Closing work-in-progress	Quantity (units)	24,000
	Material: 100% complete	
	Labour and overhead: 1/3 complete	

Tabulate the production and cost figures to give quantities, units values and total value for completed output and value of each element of cost for closing work-in-progress. Weighted average method of valuation may be used.

SOLUTION

Cost of production report (weighted average cost method)

Flow of completed or partially completed units (quantity schedule):	
Opening	16,000
Introduced	69,000
Total in process	85,000
Less completed	56,000
Less work-in-process	24,000
Lost units	5,000

Note: It is assumed that the lost units correspond to normal loss and the firm has a policy of recovering total costs from the good units produced.

Equivalent units in process

	Material	*Labour*	*Overhead*
Units completed	56,000	56,000	56,000
Add equivalent units in ending inventory	24,000	8,000	8,000
	80,000	64,000	64,000

Total costs to be accounted for:

	Material	*Labour*	*Overhead*	*Total*
Opening work-in-process	Rs 1,48,000	Rs 33,000	Rs 29,000	Rs 2,10,000
Current costs	5,62,000	1,67,000	1,51,000	8,80,000
Total costs in process	7,10,000	2,00,000	1,80,000	10,90,000
Divided by equivalent units in process	÷ 80,000	÷ 64,000	÷ 64,000	
Cost per equivalent unit	Rs 8.875	Rs 3.125	Rs 2.812	Rs 14.812
Costs accounted for:				
Transferred to finished stock (56,000 × Rs 14.812)				Rs 8,29,472
Work-in-process (closing inventory):				
Material (24,000 × 1.00 × Rs 8.875)			Rs 2,13,000	
Labour (24,000 × 1/3 × Rs 3.125)			25,000	
Overhead (24,000 × 1/3 × Rs 2.812)			22,496	2,60,496
				10,89,968

RQ.8.20 The following information is available for process IV of Mysore Machineries Ltd. for the month of March:

Opening stock: 4,800 units at Rs 16,560	
Degree of completion (%):	
Material	70
Labour	60
Overheads	60
Transfer from process III: 30,600 units at Rs 30,600	
Transfer to process V: 27,600 units	
Direct material added in process IV: Rs 13,440	
Direct labour added in process IV: Rs 39,420	
Production overheads incurred, Rs 52,560	
Units scrapped: 2,400	
Degree of completion (%):	
Material	100
Labour	70
Overheads	70
Closing stock (units)	5,400
Degree of completion (%)	
Material	60
Labour	40
Overheads	40

There was a normal loss of 10 per cent of production in the process. Units scrapped realised Re. 1 per unit.
From the above information, prepare the

(i) Statement of equivalent production,
(ii) Cost of equivalent unit for each element of the cost, the loss, the work-in-process etc.,
(iii) Process accounts using the FIFO method.

SOLUTION

Statement of equivalent production (process IV)

Input (Units)	*Particulars*	*Units*	*Stage of completion (%)*				*Equivalent units produced*			
			Material 1	*Material 2*	*Labour*	*Over-heads*	*Material 1*	*Material 2*	*Labour*	*Over-heads*
4,800	Opening stock	4,800	–	30	40	40	–	1,440	1,920	1,920
30,600	Units introduced									
	Units introduced and completed during the period	22,800	100	100	100	100	22,800	22,800	22,800	22,800
	Normal loss [0.10 × (4,800 + 30,600 – 5,400 units)]	3,000	–	–	–	–	–	–	–	–
	Abnormal gain	(600)	–	–	–	–	(600)	(600)	(600)	(600)
	Work-in-process (closing inventory)	5,400	100	60	40	40	5,400	3,240	2,160	2,160
35,400		35,400					27,600	26,880	26,280	26,280

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per unit*
Material 1:			
Transferred from previous process	Rs 30,600		
Less value of normal scrap (3,000 × Re 1)	3,000		
	27,600	27,600	Rs 1.00
Material 2 (added in the process)	13,440	26,880	0.50
Labour	39,420	26,280	1.50
Production overheads	52,560	26,280	2.00
	1,33,020		5.00

(i) *Cost incurred to complete work-in-process units*				
Material 1		Nil		
Material 2	(1,440 × Re 0.50)	Rs 720		
Labour	(1,920 × Rs 1.50)	2,880		
Overheads	(1,920 × Rs 2.00)	3,840	Rs 7,440	
(ii) *Units introduced and completed during the current period* (27,600 units @ Rs 5)			1,38,000	
(iii) *Closing work-in-process:*				
Material 1	(5,400 × Re 1)		5,400	
Material 2	(3,240 × Re 0.5)		1,620	
Labour	(2,160 × Rs 1.5)		3,240	
Overheads	(2,160 × Rs 2.0)		4,320	14,580

Process IV a/c (FIFO method)

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Work-in-process (opening inventory)	4,800	Rs 16,560	By Normal loss	3,000	Rs 3,000
To Current costs:			*By Units completed:*		
Transferred from Process III	30,600	30,600	(i) Started earlier and completed during the		
Material		13,440	current period		
Direct wages		39,420	(Rs 16,560 + Rs 7,440)	4,800	24,000
Production overheads		52,560	(ii) Started and comp-		
Abnormal gain	600	3,000	leted during the current		
			period @ Rs 5 per unit	22,800	1,14,000
			Units started but not yet completed (work-in-		
			process)	5,400	14,580
	36,000	155,580		36,000	1,55,580

RQ.8.21 From the following details, prepare statement of equivalent production and statement of cost. Also, find the value of (a) output transferred, and (b) closing work-in-progress, applying average method of valuation of the process stock.

Opening work-in-process (units)		2,000
Material (100 % complete)	Rs 7,500	
Labour (60% complete	3,000	
Overheads (70% complete)	8,000	
Units introduced		8,000

There are 2,000 units in process and the stage of completion (%) is estimated to be:

Material	100
Labour	50
Overheads	50

8,000 units are transferred to the next process. The process costs for the period are:

Material	Rs 1,00,000
Labour	78,000
Overheads	39,000

SOLUTION

Statement of equivalent production

Input	*Particulars*	*Units*	*Stage of completion (%)*		
			Material	*Labour*	*Overheads*
2,000	Opening stock				
8,000	Units introduced				
	Units completed and transferred to next process	8,000	8,000 (100)	8000 (100)	8000 (100)
	Work-in-process (closing)	2,000	2,000 (100)	1,000 (50)	1,000 (50)
10,000		10,000	10,000	9,000	9,000

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per equivalent unit*
Materials:			
Opening stock	Rs 7,500		
Added during the process	1,00,000		
	1,07,500	10,000	Rs 10.75
Labour:			
Included in opening stock	3,000		
Added during the process	78,000		
	81,000	9,000	9.00
Overheads:			
Included in opening stock	8,000		
Added during the process	39,000		
	47,000	9,000	5.222
			24.972

Process account (weighted average cost method)

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Work-in-progress (opening inventory)	2,000	Rs 18,500	By Cost of completed units transferred to next process @ Rs 24.97	8,000	Rs 1,99,778
To Material	8,000	1,00,000			
To Labour		78,000	By Work-in-progress	2,000	35,722[@]
To Overheads		39,000			
	10,000	2,35,500		10,000	2,35,500

@ Material (2,000 × Rs 10.75)	Rs 21,500
Labour (1,000 × Rs 9.00)	9,002
Overheads (1,000 × Rs 5.222)	5,222
	35,722

RQ.8.22 A manufacturing company makes a product using two processes. For the month of June, the information recorded for the second process is: A work-in-progress balance of 400 units brought forward from May was valued at Rs 5,760. During June, 17,040 units were transferred from the first to the second process at a cost of Rs 1,32,320. Costs incurred by the second process were:

Direct material issued	Rs 64,288
Direct wages	31,696
Overheads	15,848

The transfer of finished goods to the stock was 15,120 units. Number of units scrapped during the period was 880; 1,440 units were in work-in-progress at the end of the month.

There was a normal loss of 5 per cent of production. Units scrapped were sold at Rs 3 each. The particulars relating to degree of completion are as follows:

	Degree of completion (%)		
	Opening stock	*Closing stock*	*Scrap*
Direct material	70	80	100
Direct wages	50	60	80
overheads 50	60	80	

Prepare the necessary accounts.

SOLUTION

Statement of equivalent production (second process)

Input (units)	*Particulars*	*Units*	*Stage of completion (%)*				*Equivalent units produced*			
			Material 1	*Material 2*	*Labour*	*Over-heads*	*Material 1*	*Material 2*	*Labour*	*Over-heads*
400	Opening stock	400	—	30	50	50	—	120	200	200
17,040	Units introduced and completed/ transferred to next process	14,720	100	100	100	100	14,720	14,720	14,720	14,720
	Normal loss [0.05 × (400 + 17,040 – 1,440)]	800	—	—	—	—	—	—	—	—
	Abnormal loss	80	100	100	80	80	80	80	64	64
	Work-in-progress (closing inventory)	1,440	100	80	60	60	1,440	1,152	864	864
17,440		17,440					16,240	16,072	15,848	15,848

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per unit*
Material 1:			
Transferred from previous process	Rs 1,32,320		
Less value of normal scrap (800 × Rs 3)	2,400		
	1,29,920	16,240	Rs 8
Material 2 (added in the process)	64,288	16,072	4
Labour	31,696	15,848	2
Overheads	15,848	15,848	1
	2,41,752		15

(i) *Cost incurred to complete opening work-in-process units*		
Material 1	Rs Nil	
Material 2 (120 × Rs 4)	480	
Labour (200 × Rs 2)	400	
Overheads (200 × Re 1)	200	Rs 1,080
(ii) *Units introduced and completed during the current period*		
Cost: 14,720 units × Rs 15	2,20,800	
(iii) *Abnormal loss:*		
Material 1 (80 × Rs 8)	640	
Material 2 (80 × Rs 4)	320	
Labour (64 × Rs 2)	128	
Overhead (64 × Re 1)	64	1,152
(iv) *Closing work-in-process:*		
Material 1 (1,440 × Rs 8)	11,520	
Material 2 (1,152 × Rs 4)	4,608	
Labour (864× Rs 2)	1,728	
Overheads (864 × Re 1)	864	18,720

Process II a/c

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Work-in-progress (opening inventory)	400	Rs 5,760	By Normal loss	800	Rs 2,400
			By Abnormal loss	80	1,152
To Current costs:			*By Units completed:*		
Transferred from Process I	17,040	1,32,320	(i) Started earlier and completed		
Direct materials		64,288	during the current period		
Direct wages		31,696	(Rs 5,760 + Rs 1,080)	400	6,840
Overheads		15,848	(ii) Started and completed during the current period		
			@ Rs 15 per unit	14,720	2,20,800
			Units started but not completed/Work-in-progress	1,440	18,720
	17,440	2,49,912		17,440	2,49,912

Abnormal loss A/c

To Process II A/c	Rs 1,152	By Cash [sale proceeds of scrap (80 × Rs 3)]	240
		By Costing profit & loss A/c	912
	1,152		1,152

RQ.8.23 G.H. & Company Ltd. manufactures a product in the process costing and its work-in-progress stock at the end of each month is valued at FIFO basis.

At the beginning of the month of June, the inventory of work-in-progress showed 400 units, 40 per cent complete, valued as follows:

Material	Rs 3,600
Labour	3,400
Overheads	1,000
	8,000

In the month of June, materials were purchased for Rs 75,000. Wages and overheads amounted to Rs 79,800 and Rs 21,285, respectively. Actual issue of material to production was Rs 68,500. Finished stock was 2,500 units. There was no loss in process.

At the end of month, the work-in-progress inventory was 500 units, 60 per cent complete as to labour and overheads, and 80 per cent complete as to the material.

Prepare a process account for recording the month's transactions and a process cost sheet showing the total unit costs.

SOLUTION

Statement of equivalent production

Input (Units)	*Particulars*	*Units*	*Stage of completion (%)*			*Equivalent units produced*		
			Material	*Labour*	*Overheads*	*Material*	*Labour*	*Overheads*
400	Opening stock	400	60	60	60	240	240	240
2,600	Units introduced (2,100 + 500)							
	Units introduced and completed (2,500 – 400)	2,100	100	100	100	2,100	2,100	2,100
	Work-in-progress (closing stock)	500	80	60	60	400	300	300
3,000		3,000				2,740	2,640	2,640

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per unit*
Material issued	Rs 68,500	2,740	Rs 25.00
Labour	79,800	2,640	30.23
Overheads	21,285	2,640	8.06
			63.29

(i) *Cost incurred to complete opening work-in-process units*		
Material (240 × Rs 25)	Rs 6,000.00	
Labour (240 × Rs 30.23)	7,255.20	
Overheads (240 × Rs 8.06)	1,934.40	Rs 15,189.60
(ii) *Cost to produce 2,100 units introduced and completed during the current month:* (2,100 × Rs 63.29)		1,32,909
(iii) *Valuation of closing work-in-process*		
Material (400 × Rs 25)	10,000	
Labour (300 × Rs 30.23)	9,069	
Overheads (300 × Rs 8.06)	2,418	21,487

Process A/c

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To Opening stock	400	Rs 8,000	*By Transfer to finished stock:*		
To Current costs:	2,600		(i) Started earlier and	400	Rs 23,189
Material		68,500	completed in current period		
Labour		79,800	(Rs 8,000 + Rs 15,189)		
Overheads		21,285	(ii) Started and completed during the current period	2,100	1,32,909
			Work-in-process	500	21,487
	3,000	1,77,585		3,000	1,77,585

RQ.8.24 A company manufactures a product which involves two processes, namely, pressing and polishing. For the months of September, the following information is available:

	Pressing	*Polishing*
Opening stock	—	—
Input of units in process	1,200	1,000
Units completed	1,000	500
Units under process	200	500
Material cost	Rs 96,000	Rs 8,800
Conversion costs	2,88,000	52,000

For incomplete units in process, charge material costs at 100 per cent and conversion costs at 60 per cent in the pressing process and 50 per cent in the polishing process. Prepare a statement of cost and calculate the selling price per unit which will result in 25 per cent profit on the sales price.

SOLUTION

(I) *Statement of equivalent production*

Input (units)	*Particulars*	*Units*	*Stage of completion (%)*		*Equivalent units produced*	
			Material	*Conversion costs*	*Material*	*Conversion costs*
	Pressing:					
1,200	Units introduced					
	Units completed	1,000	100	100	1,000	1,000
	Work-in-progress (closing stock)	200	100	60	200	120
1,200		1,200			1,200	1,120
	Polishing:					
1,000	Units introduced					
	Units completed	500	100	100	500	500
	Closing stock	500	100	50	500	250
1,000		1,000			1,000	750

(ii) *Statement of cost*

Particulars	*Total cost produced*	*Equivalent units*	*Cost per unit*
Pressing:			
Material cost	Rs 96,000	1,200	Rs 80.00
Conversion costs	2,88,000	1,120	257.14
			337.14
Polishing:			
Cost transferred from pressing process (Rs 337.14 × 1,000)	3,37,140	1,000	337.14
Material cost	8,800	1,000	8.80
Conversion cost	52,000	750	69.33
			415.27

(iii) *Determination of selling price*

Cost per unit	Rs 415.27
(*Add* 25% profit on selling price or $33^{1}/_{3}$% on cost)	138.42
	553.69

RQ.8.25 A product passes through two processes, A and B. Output of process A is transferred to process B at cost plus 25 per cent and finished output of B is similarly transferred to finished stock at cost plus 25 per cent. There is no work-in-progress in any process on December 31. At this date, the following information is further available:

	Process A	*Process B*
Materials consumed	Rs 8,000	Rs 24,000
Wages	12,000	16,000
Closing stock (valued at prime cost)	4,000	12,000

Out of the finished stock, a portion remained at hand valued at Rs 11,000 and the balance was sold for Rs 58,000.

Prepare process accounts and the finished stock account. Question of overheads and opening stock is to be ignored. Also show how much reserves will be created for the unrealised profit.

SOLUTION

Process accounts

Particulars	*Total*	*Cost*	*Profit*	*Particulars*	*Total*	*Cost*	*Profit*
			Process A A/c				
To Materials consumed	Rs 8,000	Rs 8,000	—	By Process B			
To Wages	12,000	12,000	—	(transferred)	Rs 20,000	Rs 16,000	Rs 4,000
	20,000	20,000	—				
Less closing stock	4,000	4,000	—				
Prime Cost	16,000	16,000					
To Profit & loss A/c (0.25 × Rs 16,000)	4,000	—	4,000				
	20,000	16,000	4,000		20,000	16,000	4,000
			Process B A/c				
To Process A	20,000	16,000	4,000	By Finished stock			
To Materials consumed	24,000	24,000	—	A/c (transferred)	60,000	44,800	15,200
To Wages	16,000	16,000	—				
	60,000	56,000	4,000				
Less closing stock	12,000	11,200	800				
Prime Cost	48,000	44,800	3,200				
To Profit & loss A/c (0.25 × Rs 48,000)	12,000	—	12,000				
	60,000	44,800	15,200		60,000	44,800	15,200
			Finished Goods Stock A/c				
To Process B	60,000	44,800	15,200	By Sales revenue	58,000	36,587	21,413
Less closing stock	11,000	8,213	2,787				
Cost of goods sold	49,000	36,587	12,413				
To Profit & loss A/c	9,000	—	9,000				
	58,000	36,587	21,413		58,000	36,587	21,413

(i)	Process A		Rs 4,000
(ii)	Process B:		
	Current profits	Rs 12,000	
	Less closing stock reserve	800	11,200
(iii)	Finished goods sold:		
	Current profits	9,000	
	Less closing stock reserve	2,787	6,213
			21,413

RQ.8.26 In manufacturing the main product A, a company processes the resulting waste material into two by-products, M_1 and M_2. Using the method of working backwords from the sales value to an estimated cost, prepare a comparative profit and loss statement of the three products from the following data:

(i) Total costs upto separation point was Rs 1,36,000.

		A	M_1	M_2
(ii)	Sale (all production)	Rs 3,28,000	Rs 32,000	Rs 48,000
(iii)	Cost after separation	—	9,600	14,400
(iv)	Estimated net profit percentage to sales values	—	20	30
(v)	Estimated selling expenses as percentage of sales values	20	20	20

SOLUTION

Statement showing apportionment of joint costs between M_1 and M_2

Particulars		*By-products*	
		M_1	M_2
Sales revenue		Rs 32,000	Rs, 48,000
Less profits (20% and 30% of sales value of M_1 and M_2)		6,400	14,400
Total cost of sales		25,600	33,600
Less selling expenses (20% of sale value)		6,400	9,600
Less separable costs		9,600	14,400
Joint costs (balancing figure)		9,600	9,600
Joint cost share of main product A:			
Total costs at split-off point	Rs 1,36,000		
Less costs apportioned to by-products M_1 and M_2 (Rs 9,600 + Rs 9,600)	19,200		
	1,16,800		

Comparative profit and loss statement

Particulars	*Main product (A)*	*By-products*		*Total*
		M_1	M_2	
Sales revenue	Rs 3,28,000	Rs 32,000	Rs 48,000	Rs 4,08,000
Less share of joint costs	1,16,800	9,600	9,600	1,36,000
Less separable costs	—	9,600	14,400	24,000
Gross profit	2,11,200	12,800	24,000	2,48,000
Less selling expenses (20% of sale value)	65,600	6,400	9,600	81,600
Net Profit	1,45,600	6,400	14,400	1,66,400

RQ.8.27 Product Z yields by-products X and Y. The joint manufacturing expenses are Rs 65,500. From the following information, show how you would apportion the joint expenses of manufacture.

	X	*Y*	*Z*
(i) Sales	Rs 1,00,000	Rs 40,000	Rs 25,000
(ii) Manufacturing costs after separation	20,000	5,000	4,000
(iii) Estimated selling expenses on sales (%)	20	20	20
(iv) Estimated profit on sales (%)	20	25	30

SOLUTION

Apportionment of joint costs (By-products Y and Z)

Products	*Sale value*	*Profit*	*Separable costs*		*Joint costs*
			Manufacturing	*Selling*	
Y	Rs 40,000	Rs 10,000	Rs 5,000	Rs 8,000	Rs 17,000
Z	25,000	7,500	4,000	5,000	8,500

Share of product X:

Total joint costs		Rs 65,500
Less joint costs allocated to		
Y	Rs 17,000	
Z	8,500	25,500
		40,000

RQ.8.28 The Assam Oil Company Ltd. processes crude oil in Department 1. During the current period, the following costs were incurred in Department 1 to obtain 20,000 barrels of product A and 30,000 barrels of product B:

Direct materials	Rs 50,000
Direct labour	1,50,000
Variable overheads	75,000
Fixed overheads	53,000
	3,28,000

Product A could be sold at the split-off point for Rs 5 per barrel or processed in Department 2 at an additional cost of Rs 4 per barrel and then sold for Rs 10 per barrel. During the current period, all 20,000 barrels of A were processed in the Department. There was an ending inventory of 5,000 barrels of product A.

Product B must be processed further in Department 3. The following information from the current period is available about Department 3: Barrels processed, 31,000; Costs, Rs 3,10,000.

The figure of 31,000 barrels includes 1000 barrels from the previous period's production of Department I processed in this period. There is an ending inventory of 1,000 barrels of B. The selling price of B is Rs 20 per barrel.

You are required to determine to cost of ending finished inventories, using the net realisable value method to allocate the joint costs.

SOLUTION

Apportionment of joint costs (products A and B)

Product	*Output (barrels)*	*Selling price per barrel*	*Total sales value*	*Separable costs*	*Net realisable value*	*Joint cost*	*Total cost*	*Cost per barrel*
A	20,000	Rs 10	Rs 2,00,000	Rs 80,000	Rs 1,20,000	Rs 93,714	Rs 1,73,714	Rs 8.69
B	30,000	20	6,00,000	3,00,000	3,00,000	2,34,286	5,34,286	17.81
			8,00,000	3,80,000	4,20,000	3,28,000	7,08,000	

Statement showing cost of inventories

Product	*Cost per barrel*	*Inventory (in barrels)*	*Inventory cost*
A	Rs. 8.69	5,000	Rs 43,450
B	17.81	1,000	17,810

RQ.8.29 Calculate the estimated cost of production of by-products X and Y at the point of separation from the main product.

	By-product X	*By-product Y*
Selling price per unit	Rs 12	Rs 24
Cost per unit after separation from the main product	3	5
Units produced	500	200

Selling expenses amount to 25 per cent of the total works cost, that is, including both pre-separation and post-separation works cost.

Selling prices are arrived at by adding 20 per cent of the total of all costs, that is, the sum of work costs and selling expenses.

SOLUTION

Apportionment of joint costs (by-products X and Y)

Particulars	*By-products*	
	X	*Y*
Sales value	Rs 6,000	Rs 4,800
Less profit (20% of total costs or 1/6 of selling price)	1,000	800
Total cost of sales	5,000	4,000
Less selling expenses (25% of total works cost or 1/5 of cost of sales)	1,000	800
Works cost	4,000	3,200
Less separable costs	1,500	1,000
Joint costs	2,500	2,200
Units produced	500	200
Cost of production per unit at split-off point	5	11

RQ.8.30 Alfa Ltd. uses a chemical process to convert a single raw material into three separate products, A, B, and C which are separated at a single split-off point. A and B are ready for sale immediately after split-off point without further processing or any additional costs. Product C is processed further before being sold. During the year ending December 31, the quantities sold and the realisations were:

Product	*Quantity (M_t)*	*Sales value (Rs lakh)*
A	600	19.20
B	1,700	34.00
C	875	14.00

There were no opening inventories of A, B, and C. Total manufacturing costs for the year were Rs 50.50 lakh. Costs after split-off point to process product C were Rs 3 lakh. On December 31, the closing stocks were:

A	900 M_t
B	300 M_t
C	125 M_t

Prepare a statement of the 'cost' of inventories of A, B, and C. Your presentation should include a summary of the cost of goods sold by product-line and unit costs.

SOLUTION

Apportionment of joint costs (products A, B, and C)

Product	*Output (M_t)*	*Selling price per M_t*	*Total sales value*	*Separable cost*	*Net realisable value*	*Joint cost*	*Total cost*	*Cost per M_t*
A	1,500	Rs 3,200	Rs 48,00,000	—	Rs 48,00,000	Rs 24,00,000	Rs 24,00,000	Rs 1,600
B	2,000	2,000	40,00,000	—	40,00,000	20,00,000	20,00,000	1,000
C	1,000	1,600	16,00,000	Rs 3,00,000	13,00,000	6,50,000	9,50,000	950
					1,01,00,000	50,50,000	53,50,000	

Working Note

(i) Output = Units sold + closing stock

(ii) Selling price per M_t = Total sales value ÷ quantity sold

(iii) Joint costs have been apportioned in the ratio of net realisable value, i.e. 48:40:13 for products A, B, and C respectively.

Statement showing cost of goods sold and inventories

Product	*Cost per M_t*	*M_t sold*	*Cost of goods sold*	*Inventory M_t*	*Inventory cost*
A	Rs 1,600	600	Rs 9,60,000	900	Rs 14,40,000
B	1,000	1,700	17,00,000	300	3,00,000
C	950	875	8,31,250	125	1,18,750
			34,91,250		18,58,750

RQ.8.31 Giri & Sons Ltd. manufacture product A which yields two by-products, B and C. The actual joint expenses of manufacture for a period were Rs 80,000. It was estimated that the profit on each product as a percentage of sales would be 30, 25, and 15, respectively. The subsequent manufacturing expenses were as follows:

	A	*B*	*C*
Materials	Rs 1,000	Rs 750	Rs 250
Direct wages	2,000	1,250	500
Overheads	1,500	1,250	750
	4,500	3,250	1,500
Sales	60,000	40,000	25,000

The expenses other than manufacturing (if any) were apportioned to products on the basis of sales revenue. Prepare a statement showing the apportionment of joint expenses of manufacture over the different products.

SOLUTION

Apportionment of joint costs (by-products B and C)

Particulars	*Products*			*Total*
	A	*B*	*C*	
Sales revenue	Rs 60,000	Rs 40,000	Rs 25,000	Rs 1,25,000
Less profits	18,000	10,000	3,750	31,750
Total cost of sales	42,000	30,000	21,250	93,250

(*Contd.*)

(*Contd.*)

Less selling expenses:					
Total cost of sales	Rs 93,250				
Less separable costs	9,250				
Less Joint costs of manufacturing	80,000				
	4,000				
(apportioned in the ratio of sales revenue)		1,920	1,280	800	4,000
Less separable costs		4,500	3,250	1,500	9,250
Joint costs		35,580	25,470	18,950	80,000

RQ.8.32 The standard input and output in a chemical process are as follows:

Input (standard)

Raw material, 2,000 kgs at Re 1 per kg.
Labour and overheads, Re 1 per kg.

Output (standard)

A 1,000 kgs at Rs 3 per kg; Sale price, Rs 4 per kg
B 800 kgs at Rs 5 per kg; Sale price, Rs 6.50 per kg
C 100 litres at Rs 10 per litre; Sale price, Rs 12 per litre.

A can be processed further into another product X after incurring an additional expenditure of Re 1 per kg on labour and Re 0.50 per kg on overheads. No loss in the process is anticipated.

B can also be processed further into another product Y for which process labour and overheads at Re 1 per kg each have to be incurred. There will be process loss of 2 per cent which is to be taken as normal. X and Y have ready markets and the prices which they are likely to fetch are Re 4.50 and Rs 10 per kg, respectively.

You are required to analyse and present the data in a suitable form with a view to evaluating in-depth the processing of X and Y.

SOLUTION

Incremental analysis (sell now or process further)

Particulars	*Product X*	*Product Y*
(i) Number of units (kgs)	1,000	784
(ii) Incremental revenue from further processing per unit	Re 0.50	Rs 3.50
(iii) Total incremental revenue (i) × (ii)	500	2,744
(iv) *Less* incremental cost for further processing	1,500	800
(v) Incremental profit (loss)	(1,000)	1,944

Product A should not be processed further as it entails a loss of Rs 1,000, while it is profitable to further process product Y as it yields an incremental profit of Rs 1,944.

EXAMINATION QUESTIONS

EQ. 8.1 Explain briefly the procedure for valuation of work-in-process. (*CA—November, 2002*)
EQ. 8.2 Discuss the accounting treatment of the Spoilage and defectives in cost-accounts: (*CA—May, 2003*)
EQ. 8.3 Discuss the accounting treatment of spoilage and defectives in cost accounting. (*CA—November, 2003*)
EQ. 8.4 Discuss the treatment of spoilage and defectives in cost accounting. (*CA—May, 2005*)
EQ. 8.5 Discuss the treatment of spoilage and defectives. (*CA—May, 2007*)

EQ. 8.6 A product passes through two processes. The output of Process 1 becomes the input of Process II and the output of Process II is transferred to warehouse. The quantity of raw materials introduced into Process I is 20,000 kgs at Rs 10 per kg. The cost and output data for the month under review are as under:

	Process I	*Process II*
Direct materials	Rs 60,000	Rs 40,000
Direct labour	40,000	30,000
Production overheads	39,000	40,250
Normal loss	8%	5%
Output	18,000	17,400
Loss realisation of Rs/Units	2.00	3.00

The company's policy is to fix the selling price of the end product in such a way as to yield a profit of 20 per cent on selling price.

Required:

(i) Prepare the process accounts (ii) Determine the selling price per unit of the end product. (*CA—November, 2002*)

SOLUTION

(i) Process I Account

Particulars	*Kgs*	*Amount*	*Particulars*	*Kgs*	*Amount*
To raw materials	20,000	Rs 2,00,000	By normal loss	1,600	Rs 3,200
To direct materials			By abnormal loss		
To direct labour		60,000	@ Rs 18.25 per kg	400[1]	7,300[2]
To production overheads		40,000	By process II (output transferred		
		39,000	@ Rs 18.25 per kg)	18,000	3,28,500
	20,000	3,39,000		20,000	3,39,000

Process II Account

Particulars	*Kgs*	*Amount*	*Particulars*	*Kgs*	*Amount*
To process I account	18,000	Rs 3,28,500	By normal loss	900	Rs 2,700
To direct materials		40,000	By finished stock		
To direct labour		30,000	(output transferred		
To production			@ Rs 25.50 per kg)		
overheads	40,250			17,400	4,43,700
To abnormal gain @					
Rs 25.50 per kg.	300	7,650[3]			
	18,300	4,46,400		18,300	4,46,400

Working Notes

1. *Abnormal loss in process I account*

Normal output expected (20,000 kgs. – 8% Normal loss)	18,400 kgs
Less actual output	18,000
Abnormal loss	400

2. *Value of abnormal loss in process I*

Total cost of process I	Rs 3,39,000
Less sales value of normal loss (1,600 kgs × Rs 2)	3,200
Normal cost of normal output (20,000 kgs – 1,600 kgs)	3,35,800
Normal cost per kg (Rs 3,35,800/18,400 kgs)	18.25
Value of abnormal loss (400 kgs × Rs 18.25)	7,300

3. *Abnormal gain in process II account*

Normal output expected (18,000 kgs – 5% normal loss)	17,100 kgs
Actual output	17,400
Abnormal gain	300

4. *Value of abnormal gain in process II account*

Normal cost of normal output (17,100 kgs) (i.e., Rs 4,38,750 – Rs 2,700)	Rs 4,36,050
Normal cost per kg (Rs 4,36,050/17,100 kgs)	25.50
Value of abnormal gain (300 kgs × Rs 25.50)	7,650

(ii) *Determination of selling price per kg*

Cost per kg	Rs 25.50
Add desired profit @ 20% of selling price [Rs 20 on selling price of Rs 100 or 20 on cost of Rs 80 cost i.e., 25% on cost price (Rs 25.50 × 0.25)]	6.375
Selling price per kg	31.875

EQ. 8.7 ABC Ltd operates a simple chemical process to convert a single material into three separate items, referred to here as X, Y an Z. All three end products are separated simultaneously at a single split-off point.

Product X and Y are ready for sale immediately upon split-off without further processing or any other additional costs. Product Z, however, is processed further before being sold. There is no available market price for Z at the split-off point.

The selling prices quoted here are expected to remain the same in the coming year. During 2002-03, the selling prices of the items and the total amounts sold were:

X–186 tons sold for Rs 1,500 per ton

Y–527 tons sold for Rs 1,125 per ton

Z–736 tons sold for Rs 750 per ton

The total joint manufacturing costs for the year were Rs 6,25,000. An additional Rs 3,10,000 was spent to finished product Z.

There were no opening inventories of X, Y or Z. At the end of the year, the following inventories of complete units are on hand:

X–180 tons

Y–60 tons

Z–25 tons

There was no opening or closing work-in-progress.

Required:

(i) Compute the cost of inventories of X, Y and Z for balance sheet purposes and cost of goods sold for income statement purposes as of March 31, 2003, using:
  (a) Net realisable value (NRV) method of joint cost allocation.
  (b) Constant gross-margin percentage NRV method of joint-cost allocation.

(ii) Compare the gross-margin percentages for X, Y and Z using two methods given in requirement (i).

(*CA – May, 2003*)

SOLUTION (I) (A)

Statement showing joint cost allocation among products X, Y and Z (Net realizable value method)

Particulars	*Products*			*Total*
	X	*Y*	*Z*	
Final sales value of total production	Rs 5,49,000[@]	Rs 6,60,375[£]	Rs 5,70,750*	Rs 17,80,125
Less further processing costs	—	—	3,10,000	3,10,000
Net realisable value	5,49,000	6,60,375	2,60,750	14,70,125
Joint cost allocated[1]	2,33,398	2,80,748	1,10,854	6,25,000

[@](366 tons × Rs 1,500)
[£](587 tons × Rs 1,125)
*(761 tons × Rs 750)

Working Notes

1. *Apportionment of joint cost:*
X = (Rs 6,25,000/Rs 14,70,125) × Rs 5,49,000 = Rs 2,33,398
Y = (Rs 6,25,000/14,70,125) × Rs 6,60,375 = Rs 2,80,748
Z = (Rs 6,25,000/14,70,125) × Rs 2,60,750 = Rs 1,10,854

(i) (a) *Cost of goods sold for the year and cost of closing inventory as of March 31, 2003 (NRV method)*

Products (1)	*Allocated joint cost* (2)	*Further processing cost* (3)	*Cost of goods available for sale* (4) = (2) + (3)	*Cost of ending inventory*[2] (5)	*Cost of goods sold* (6) = (4) − (5)
X	Rs 2,33,378	—	Rs 2,33,398	Rs 1,14,785	Rs 1,18,613
Y	2,80,748	—	2,80,748	28,692	2,52,056
Z	1,10,854	3,10,000	4,20,854	13,846	4,07,008
Total	6,25,000	3,10,000	9,35,000	(1,57,323)	7,77,677

2. *Computation of total production:*

Products	*Quantity sold in tons*	*Quantity of ending inventory in tons*	*Total production*	*Ending inventory percentage*
(1)	*(2)*	*(3)*	*(4) (2) + (3)*	*(5) = (3)/(4)*
X	186	180	366	49.18%
Y	527	60	587	10.22
Z	736	25	761	3.29

Income statement (based on net realisable value method)

Products	*Sales revenue*	*Cost of goods sold*	*Gross margin*	*Gross margin %*
X	Rs 2,79,000[@]	Rs 1,18,613	Rs 1,60,387	57.49%
Y	5,92,875*	2,52,056	3,40,819	57.49
Z	5,52,000[£]	4,07,008	1,44,992	26.26
Total	14,23,875	7,77,677	6,46,198	

[@](186 tons × Rs 1,500)
[£](527 tons × Rs 1,125)
*(736 tons × Rs 750)

(i) (b) *Statement showing joint cost allocation among products X, Y and Z (Gross margin percentage net realisable value method)*

Particulars	*Products*			*Total*
	X	*Y*	*Z*	
Final sales value of total production	Rs 5,49,000	Rs 6,60,375	Rs 5,70,750	Rs 17,80,125
Less gross margin[3] (refer to working note)	2,60,641	3,13,517	2,70,967	8,45,125
	2,88,359	3,46,858	2,99,783	9,35,000
Less additional cost			3,10,000	3,10,000
Joint cost allocated	2,88,359	3,46,858	(10,217)	6,25,000

3. *Gross margin percentage*

Final sales value of production	Rs 17,80,125
Less joint costs and additional costs	9,35,000
Gross margin	8,45,125
Gross margin %(Rs 8,45,125/17,80,125) × 100	47.4756%

Cost of goods sold for the year and cost of closing inventory as of March 31, 2003 (using constant gross margin percentage NRV method)

Particulars	*Products*			*Total*
	X	*Y*	*Z*	
Allocated joint cost	Rs 2,88,359	Rs 3,46,858	(Rs 10,217)	Rs 6,25,000
Add additional cost			3,10,000	3,10,000
Cost of goods available for sale (CGAS)	2,88,359	3,46,858	2,99,783	9,35,000
Less cost of ending inventory	1,41,815*	35,449@	9,863£	1,87,127
Cost of goods sold	1,46,544	3,11,409	2,89,920	7,47,873

*(49.18% × 2,88,359)
@(10.22% × 3,46,858)
£(3.29% × 2,99,783)

Income statement (based on constant gross margin percentage NRV method)

Particulars	*Products*			*Total*
	X	*Y*	*Z*	
Sales revenue	Rs 2,79,000	Rs 5,92,875	Rs 5,52,000	Rs 14,23,875
Less cost of goods sold	1,46,544	3,11,409	2,89,920	7,47,873
Gross margin	1,32,456	2,81,466	2,62,080	6,76,002
Gross margin (%)	47.48	47.48	47.48	47.48

Comparative statement of gross margin percentage for X, Y and Z (using net realizable value and constant gross margin percentage NRV methods)

Method	*Product gross margin percentage*		
	X	*Y*	*Z*
Net realisable value	57.49	57.49	26.26
Constant gross margin percentage NRV	47.48	47.48	47.48

EQ. 8.8 RST Ltd. manufactures plastic moulded chairs. Three models of moulded chairs, all variation of the same design are standard, deluxe and executive. The company uses an operation costing system.

RST Ltd. has extrusion, form, trim and finish operations. Plastic sheets are produced by the extrusion operation. During the forming operation, the plastic sheets are moulded into chair seats and the legs are added. The standard model is sold after this operation. During the trim operation, the arms are added to the deluxe and executive models and the chair edges are smoothed. Only the executive model enters the finish operation, in which padding is added. All of the units produced received the same steps within each operation. In April, 2003 units of production direct material cost incurred are as follows:

	Units produced	*Extrusion materials*	*Form materials*	*Trim materials*	*Finish materials*
Standard model	10,500	Rs 1,26,000	Rs 42,000	Rs 0	Rs 0
Deluxe model	5,250	63,000	21,000	15,750	0
Executive model	3,500	42,000	14,000	10,500	21,000
	19,250	2,31,000	77,000	26,250	21,000

The total conversion costs for the month of April, 2003 are:

	Extrusion operation	*Form operation*	*Trim operation*	*Finish operations*
Total conversion costs	Rs 6,06,375	Rs 2,97,000	Rs 1,55,250	Rs 94,500

Required:

(i) For each product produced by RST Ltd. during April, 2003, determine the unit cost and the total cost. (ii) Now consider the following information for May. All unit costs in May are identical to the April unit costs calculated as above in (i). At the end of May, 1,500 units of the Deluxe model remain in work-in-progress. These units are 100 per cent complete as to materials and 65 per cent complete in the trim operation. Determine the cost of the Deluxe model work-in-process inventory at the end of May. (*CA—May, 2003*)

SOLUTION

Statement showing unit cost and total cost of three models of chairs

Particulars	*Standard model cost*	*Deluxe model cost*	*Executive model cost*
Extrusion material	Rs 12	Rs 12	Rs 12
Form material	4	4	4
Trim material	—	3	3
Finish material	—	—	6
Extrusion operation	31.50	31.50	31.50
Form operation	15.43	15.43	15.43
Trim operation	—	17.74	17.74
Finish operation	—	—	27.00
Total unit cost	62.93	83.67	116.67
Units produced	10,500	5,250	3,500
Total cost	6,60,765	4,39,267.5	4,08,345

Working Notes

(i) *Statement of material and conversion cost per equivalent unit:*

Particulars	*Extrusion*	*Form*	*Trim*	*Finish*
Equivalent units (1)	19,250*	19,250*	8,750**	3,500
Material cost (2)	Rs 2,31,000	Rs 77,000	Rs 26,250	Rs 21,000
Conversion cost (3)	6,06,375	2,97,000	1,55,250	94,500
Material cost per equivalent unit (2/1)	12	4	3	6
Conversion cost per equivalent unit (3/1)	31.50	15.43	17.74	27

*(10,500 + 5,250 + 3,500)
**(5,250 + 3,500)

(ii) *Statement showing cost of 1,500 units of Deluxe Model of chairs (Work-in-process inventory) at the end of May, 2003*

Particulars	*Equivalent (1)*	*Unit cost (2)*	*Total cost (3) = (1) × (2)*
Extrusion materials	1,500	Rs 12	Rs 18,000
Form materials	1,500	4	6,000
Trim materials	1,500	3	4,500
Extrusion operation	1,500	31.50	47,250
Form operation	1,500	15.43	23,145
Trim operation (1,500 x 65%)	975	17.74	17,296.50
Total cost			1,16,191.5

EQ. 8.9 From the following information for the month of October 2003, prepare process III cost accounts

Opening WIP in process III	1,800 units at Rs 27,000
Transfer from process II	47,700 units at Rs 5,36,625
Transferred to warehouse	43,200 units
Closing WIP of process III	4,500 units
Units scraped	1,800 units
Direct materials added in process III	Rs 1,77,840
Direct wages	87,840
Production overheads	43,920
Degree of completion:	

	Opening stock	*Closing stock*	*Scrap*
Material	80%	70%	100%
Labour	60%	50%	70%
Overheads	60%	50%	70%

The normal loss in the process was 5 per cent of the production and scrap was sold @ Rs 6.75 per unit.

(*CA—November, 2003*)

SOLUTION

Statement of equivalent production (Process III)

Input (units)	*Particulars*	*Units completed or otherwise*	*Equivalent units produced*					
			Material A		*Material B*		*Labour and overheads*	
			Quantity	*%*	*Quantity*	*%*	*Quantity*	*%*
1,800	Opening work-in-process	1,800	—	—	360	20	720	40
47,700	Units introduced and completed/transferred to next process	41,400	41,400	100	41,400	100	41,400	100
	Normal loss [5 per cent of (1,800 + 47,700 – 4,500)]	2,250 (450)	—- (450)	— 100	— (450)	— 100	— (450)	— 100
	Abnormal gain	4,500	4,500	100	3,150	70	2,250	50
49,500	Closing work-in-process	49,500	4,500		44,460		43,920	

Statement of cost

Particulars	*Total cost*	*Equivalent units produced*	*Cost per equivalent unit (1)/(2)*
	(1)	*(2)*	*(3)*
Material A			
Transferred from previous process	Rs 5,36,625		
Less sale value of normal scrap loss (2,250 units × Rs 6.75)	15,187		
	5,21,438	45,450	Rs 11.4728
		4	
Material B	1,77,840	44,460	2
Labour	87,840	43,920	1
Overheads	43,920	43,920	18.4728

Statement showing apportionment of process cost

1.	Opening work-in-process Material A		Rs 27,000
2.	Completed opening work-in-process—1,800		
	Material B (360 × Rs 4)	Rs 1,440	
	Wages (720 × Rs 2)	1,440	
	Overheads (720 × Re 1)	720	3,600
	Introduced and completed (41,400 units × Rs 18.4728)		7,64,773
	Total cost of 43,200 goods units completed		7,95,373
3.	Closing work-in-process (4,500 units)		
	Material A (4,500 unit × Rs 11.4728)	Rs 51,628	
	Material B (3,150 units × 4)	12,600	
	Wages (2,250 units × 2)	4,500	
	Overheads (2,250 units × 1)	2,250	Rs 70,978
4.	Abnormal gain units (450 × Rs 18.4728)		8,313

Process III A/c

Particulars	*Units*	*Amount*	*Particulars*	*Units*	*Amount*
To balance b/d	1,800	Rs 27,000	By normal loss	2,250	Rs 15,187
To process II A/c	47,700	5,36,625	By finished goods stock	43,200	7,95,373
To direct material		1,77,840	By closing work-in-process	4,500	70,978
To direct wages		87,840			
To production overheads					
To abnormal gain		43,920			
	450	8,313			
	49,950	8,81,538		49,950	8,81,538

EQ. 8.10 JKL Ltd produces two products – J and K together with a by-product L from a single main process (process I). Product J is sold at the point of separation for Rs 55 per kg, whereas product K is sold for Rs 77 per kg after further processing into product k2. By-product L is sold without further processing for Rs 19.25 per kg.

Process I is closely monitored by a team of chemists, who planned the output per 1,000 kg of input materials to be as follows:

Product J	500 kgs
Product K	350 kgs
Product L	100 kgs
Toxic waste	50 kgs

The toxic waste is disposed at a cost of Rs 16.50 per kg, and arises at the end of processing.

Process II which is used for further processing of product K into product K2, has the following cost structure:

Fixed costs	Rs 2,64,000 per week
Variable cost	16.50 per kg processed

The following actual data relate to the first week of the month:

Process I	
Opening work-in-progress	Nil
Material input	40,000 kgs costing Rs 6,60,000
Direct labour	4,40,00
Variable overheads	1,76,000
Fixed overheads	2,64,000
Outputs:	
Product J	19,200 kgs
Product K	14,400 kgs
Product L	4,000 kgs
Toxic waste	2,400 kgs
Closing work-in-progress	Nil
Process II	
Opening work-in-progress	Nil
Input of product K	14,400 kgs
Output of product K2	13,200 kgs
Closing work-in-progress (50% converted and conversion costs were incurred in accordance with the planned cost structure)	1,200 kgs

Required:
(i) Prepare process I account for the first week of the month using the final sales value method of attribute the pre-separation costs to join products. (ii) Prepare the toxic waste account and process I account for the first week of the month. (iii) Comment on the method used by the JKL limited to attribute the pre-separation costs to joint products. (iv) Advise the management of JKL limited whether or not, on purely financial grounds, it should continue to process product K into product K2:

(a) If product k could be sold at the point of separation for Rs 47.30 per kg; and
(b) If the 60 per cent of the weekly fixed costs of process II were avoided by not processing product K further.

(*CA—May, 2004*)

SOLUTION

(i) *Process I account*

Particular	*Units in Kg*	*Rate per kg*	*Amount*	*Particulars*	*Units in Kg*	*Rate per kg*	*Amount*
To material				By sales	4,000	Rs 19.25	Rs 77,000
To direct labour	40,000	Rs 16.50	Rs 6,60,000	(product L)			
To variable				By normal loss	2,000	(16.50)	(33,000)*
overheads			4,40,000	By abnormal loss	400	44	17,600
To fixed				By product J	19,200		7,21,171
overheads			1,76,000	By product K	14,400		7,57,229
			2,64,000				
	40,000		15,40,000		40,000		15,40,000

*Disposal costs and, therefore, deducted.

Working Notes

1. *Valuation of abnormal loss per kg:*
   = (Rs 15,40,000 – Rs 77,000 + Rs 33,000)/(40,000kgs × 0.85 excluding product L and waste)
   = Rs 14,96,000/34,000 kgs = Rs 44 per kg
2. *Calculation of joint cost of the output (J and K):*
   = Rs 15,40,000 + Disposal cost, [Rs 33,000 – Rs 77,000 – Rs 17,600] = Rs 14,78,400
3. *Allocation of joint cost between joint products J and K (using final sales value method)*

Products	*Quantity (kgs)*	*Sales value*	*Joint cost*
J	19,200	Rs 10,56,000 (19,200 kgs × Rs 55)	Rs 7,21,171
K	14,400	11,08,800 (14,400 kgs × Rs 77)	7,57,229
		21,64,800	14,78,400

(ii) *Toxic waste account*

Particulars	*Units in kg*	*Rate per kg*	*Amount*	*Particulars*	*Units in kg*	*Rate per kg*	*Amount*
To process I A/c	2,000	16.50	(Rs 33,000)	By balance c/d		16.50	(Rs 33,000)

Process II account

Particulars	*Units in kg*	*Rate per kg*	*Amount*	*Particulars*	*Units in kg*	*Rate per kg*	*Amount*
To process I A/c (product K)	14,400	Rs 52.585	Rs 7,57,229	By product K2	13,200	—	Rs 11,73,917
To variable overheads			2,37,600	By closing work-in-process	1,200	—	84,912
To fixed overheads		16.50	2,64,000				
			12,58,829				12,58,829

Working Note

1. *Valuation of 1,200 kgs of closing work-in-process*

Material 100% complete (1,200 kgs × Rs 52.585)	Rs 63,103
Fixed and variable overheads [(Rs 2,37,600 + Rs 2,64,000)/(13,800 units [14,200 – 600])] × 600 units	21,809
	84,912

(iii) *Comment on the method used by JKL Ltd:*

JKL Ltd has used the commonly used method of final sales value for allocating joint costs between products J and K. Other methods used are: (a) Physical measure method, (b) Constant gross margin percentage method and (c) Net realisable value method.

(iv) *Whether further processing of product K to K_2 should be undertaken or not:*

Incremental sales revenue per kg from further processing (Rs 77 – Rs 47.30)	Rs 29.70
Less incremental variable cost per kg of further processing	16.50
Incremental contribution per kg from further processing	13.20
Total incremental contribution (14,400 kgs × Rs 13.20)	1,90,080
Less avoidable fixed cost (60% × Rs 2,64,000)	1,58,400
Incremental profit	31,680.00

Break-even point = Avoidable fixed costs/Incremental contribution per kg = Rs 1,58,400/13.20 = 12,000 kgs
The company should opt for further processing in case the output is expected to exceed 12,000 kgs per week.

EQ. 8.11 Pokemon Chocolates manufactures and distributes chocolate products. It purchases Cocoa beans and processes them into two intermediate products:
Chocolate powder liquor base
Milk-chocolate liquor base.

These two intermediate products become separately identifiable at a single split off point. Every 500 pounds of cocoa beans yields 20 gallons of chocolate – powder liquor base and 30 gallons of milk-chocolate liquor base.

The chocolate power liquor base is further processed into chocolate powder. The milk-chocolate liquor base is further processed into milk-chocolate. Every 30 gallons of milk-chocolate liquor based yields 340 pounds of milk chocolate.

Production and sales data for October, 2004 are:
Cocoa beans processed 7,500 pounds
Costs of processing Cocoa beans to split off point (including purchase of beans) = Rs 7,12,500

	Production	*Sales*	*Selling price*
Chocolate powder	3,000 pounds	3,000 pounds	Rs 190 per pound
Milk chocolate	5,100	5,100	Rs 237.50 per pound

The October, 2004 separable costs of processing chocolate-powder liquor into chocolate powder are Rs 3,02,812.50. The October, 2004 separable costs of processing milk-chocolate liquor base into milk-chocolate are Rs 6,23,437.50.

Pokemon could have sold the chocolate powder liquor based for Rs 997.50 a gallon and the milk-chocolate liquor base for Rs 1,235 a gallon.

Required:

(i) Calculate how the joint cost of Rs 7,12,500 would be allocated between the chocolate powder and milk-chocolate liquor bases under the following methods:

(a) Sales value at split off point (b) Physical measure (gallons) (c) Estimated net realizable value, (NRV) and (d) Constant gross-margin percentage NRV.

(ii) What is the gross-margin percentage of the chocolate powder and milk-chocolate liquor bases under each of the methods in requirements (i)? (iii) Could Pokemon have increased its operating income by a change in its decision to fully process both of its intermediate products? Show your computation. (*CA—November, 2004*)

SOLUTION

(i) *Allocation of joint cost under various methods*

Particulars	*Chocolate powder liquor base*	*Milk chocolate liquor base*	*Total*
(a) Sales value at split of point method:			
Sales value of products at split off	Rs 2,99,250 (300 × Rs 997.50)	Rs 5,55,750 (450 gallons × Rs 1,235)	Rs 8,55,000
Weights (in proportion of sale value)	0.35	0.65	1.00
Joint cost allocated	(Rs 7,12,500 × 0.35) Rs 2,49,375	(Rs 7,12,500 × 0.65) Rs 4,63,125	7,12,500
(b) Physical measure method:			
Output	300 gallons	450 gallons	750 gallons
Weights (300:450)	(300/750) = 0.40	(450/750) = 0.60	
Joint cost allocated (in proportion of output)	(Rs 7,12,500 × 0.40) = Rs 2,85,000	(Rs 7,12,500 × 0.60) = Rs 4,27,500	1.00 Rs 7,12,500
(c) Net realisable value (NRV) method:			
Final sales value of production	(3,000 pounds × Rs 190) = Rs 5,70,000	(5,100 pounds × Rs 237.50) = Rs 12,11,250	Rs 17,81,250
Less separable costs	3,02,812.50	6,23,437.50	9,26,250
Net realizable value at split off point	2,67,187.50	5,87,812.50	8,55,000
Weights (in proportion of NRV)	0.3125	0.6875	1.00
Joint cost allocated	(Rs 7,12,500 × 0.3125) = Rs 2,22,656.25	(Rs 7,12,500 × 0.6875) = Rs 4,89,843.75	Rs 7,12,500
(d) Constant gross margin percentage NRV method:			
Final sales value of production	Rs 5,70,000	Rs 12,11,250	Rs 17,81,250
Less gross margin (8%)	45,600	96,900	1,42,500
Cost of goods available for sale	5,24,400	11,14,350	16,38,750
Less separable costs	3,02,812,50	623,437.50	9,26,250
Joint cost allocated	2,21,587.50	4,90,912.50	7,12,500

Working Note

Computation of gross margin

Final sales value of total production	Rs 17,81,250
Less joint and separable cost	16,38,750
Gross margin	1,42,500
Gross margin (%) (Rs 1,42,500/Rs 17,81,250)/ × 100	8

(ii) *Computation of gross margin of chocolate powder and milk chocolate liquor bases under various methods*

Particulars	*Sales value at split off*	*Physical measure*	*Net realizable value*	*Constant gross margin NRV*
Chocolate powder liquor base:				
Final sales value	Rs 5,70,000	Rs 5,70,000	Rs 5,70,000	Rs 5,70,000
Less separable costs	3,02,812.50	3,02,812.50	3,02,812.50	3,02,812.50
Less joint costs	2,49,375.00	2,85,000.00	2,22,656.25	2,21,587.50
Gross margin	17,812.50	(17,812.50)	44.531.25	45,600.00
Gross margin (%)	3.125	(3.125)	7.8125	8
Milk chocolate liquor base:				
Final sales value	Rs 12,11,250	Rs 12,11,250	Rs 12,11,250	Rs 12,11,250
Less separable costs	6,23,437.50	6,23,437.50	6,23,437.50	6,23,437.50
Less joint costs	4,63,125	4,27,500	4,89,843.75	4,90,912
Gross margin	1,24,687.50	1,60,312,50	97,968.75	96,900.50
Gross margin (%)	10.29	13.23	8.08	8

(iii) *Further processing of chocolate powder liquor base into chocolate powder*

Particulars	*Amount*
Incremental revenue [Rs 5,70,000 – (Rs 997.50 × 300)]	Rs 2,70,750
Less incremental costs	3,02,812,50
Incremental operating income	(32,062.50)

Further processing of milk chocolate liquor base into milk chocolate

Particulars	*Amount*
Incremental revenue [Rs 12,11,250 – (450 × Rs 1,235)]	Rs 6,55,500
Less incremental cost	6,23,437,50
Incremental operating income	32,062.50

From the above, it is clear that Pokemon Chocolates could increase operating income (by Rs 32,062.50) by processing further milk chocolate liquor base into milk chocolate and selling chocolate liquor base at split off point itself.

EQ. 8.12 A Company produces a component, which passes through two processes. During the month of April, materials for 40,000 components were put into process I of which 30,000 were completed and transferred to Process II. Those not transferred to Process II were 100% complete as to materials cost and 50% complete as to labour and overheads cost. The Process I costs incurred were as follows:

Direct materials	Rs 15,000
Direct wages	18,000
Factory overheads	12,000

Of those transferred to Process II, 28,000 units were completed and transferred to finished goods stores. There was a normal loss with no salvage value of 200 units in Process II. There were 1,800 units, remained unfinished in the process with 100% complete as to materials and 25% complete as regard to wages and overheads.

No further process material costs occur after introduction at the first process until the end of the second process, when protective packing is applied to the completed components. The process and packing costs incurred at the end of the Process II were:

Packing materials	Rs 4,000
Direct wages	3,500
Factory overheads	4,500

Required: (i) Prepare statement of equivalent production, cost per unit and Process I A/c. (ii) Prepare statement of equivalent production, cost per unit and Process II A/c. (*CA—May, 2006*)

SOLUTION

(i) *Statement of equivalent production (Process I)*

Input	*Particulars*	*Units completed or otherwise*	*Stage of completion %*		*Equivalent units produced*	
			Material	*Conversion costs*	*Material*	*Conversion costs*
40,000 units introduced	Units completed and transferred to process II	30,000	100	100	30,000	30,000
	Work-in-process	10,000	100	50	10,000	5,000
40,000		40,000			40,000	35,000

Statement of cost

Particulars	*Total cost*	*Equivalent production (units)*	*Cost per unit*
Materials	Rs 15,000	40,000	Rs 0.375
Conversion costs:			
Direct wages	18,000		
Factory overheads	12,000	35,000	0.85714
Total cost per unit			1.23214

Statement of apportionment of costs

Particulars	*Elements of cost*	*Equivalent production*	*Cost per unit*	*Total cost*	
Finished production	Materials	30,000	Re 0.375	Rs 11,250	
	Conversion costs	30,000	0.85714	25,714	Rs 36,964
Work-in-process	Materials	10,000	0.375	3,750	
	Conversion costs	5,000	0.85714	4,286	8,036
Total cost accounted					45,000

Process I Account

Particulars	*Units*	*Dr. Amount*	*Particulars*	*Units*	*Cr. Amount*
Top Direct materials	40,000	Rs 15,000	By Process II (transferred)	30,000	Rs 36,964
To Direct wages		18,000	By Work-in-process	10,000	8,036
To Factory overheads		12,000			
	40,000	45,000		40,000	45,000

(ii) *Statement of equivalent production (Process II)*

Input	*Particulars*	*Units completed or otherwise*	*Stage of completion %*		*Equivalent units produced*	
			Material	*Conversion costs*	*Material*	*Conversion costs*
Transferred from	Units completed	28,000	100	100	28,000	28,000
process I	Normal loss	200	—	—	—	
30,000 units	Work-in-process	1,800	100	25	1,800	450
30,000		30,000			29,800	28,450

Statement of cost

Particulars	*Total cost*	*Equivalent production (units)*	*Cost per unit*
Material cost (in terms of completed units transferred from Process I)	Rs 36,964	29,800	Rs 1.2404
Conversion costs:			
Direct wages	3,500		
Factory overheads	4,500	28,450	0.281195
Total cost per unit			1.521595

Statement of apportionment of costs

Particulars	*Element of cost*	*Equivalent production*	*Cost per unit*	*Total cost*	
Finished units	Materials	28,000	Rs 1.2404	Rs 34,731	
	Conversion costs	28,000	0.281195	7,874	
	Packing materials	28,000		4,000	Rs 46,605
Work-in-progress	Materials	1,800	1.2404	2,233	
	Conversion costs	450	0.281195	126	2,359
Total cost accounted					48,964

Process II Account

Particulars	*Units*	*Dr. Amount*	*Particulars*	*Units*	*Cr. Amount*
To Output transferred			By Finished stock	28,000	
from process I	30,000	Rs 36,964	(@ Rs 1.521595 per unit		
To Packing materials		4,000	+ Rs 4000 Packing		Rs 46,605
To Direct wages		3,500	material cost)		
To Factory overheads		4,500	By Normal loss	200	—
			By Work-in-progress	1,800	2,359
	30,000	48,964		30,000	48,964

EQ. 8.13 A company produces two joint products *P* and *Q* in 70 : 30 ratio from basic raw materials in department *A*. The input output ratio of department *A* is 100 : 85. Product *P* can be sold at the split of stage or can be processed further at department *B* and sold as product *AR*. The input output ratio is 100 : 90 of department *B*. The department *B* is created to process product *A* only and to make it product *AR*.
The selling prices per kg. are as under:

Product *P*	Rs 85
Product *Q*	Rs 295
Product *AR*	Rs 115

The production will be taken up in the next month.

Raw material	8,00,000 kgs.
Purchase price	Rs 80 per kg.

	Deptt. A *Rs Lacs*	*Deptt. B* *Rs Lacs*
Direct materials	35.00	5.00
Direct labour	30.00	9.00
Variable overheads	45.00	18.00
Fixed overheads	40.00	32.00
Total	150.00	64.00
Selling Expenses:		
	Rs in Lacs	
Product *P*	24.60	
Product *Q*	21.60	
Product *AR*	16.80	

Required: (i) Prepare a statement showing the apportionment of joint costs. (ii) State whether it is advisable to produce product AR or not. (*CA (PCE)—May, 2007*)

SOLUTION

(i) Statement showing joint cost allocation between products P and Q (net realisable value method) (Amount in Rs lakh)

Particulars	*Product*		*Total*
	P	*Q*	
Sales value of total production	Rs 404.60	Rs 591.60	Rs 996.20
Less selling expenses	24.60	21.60	46.20
Net realisable value/Net sale value	380.00	570.00	950.00
Joint cost allocated in the ratio of net realisable value 380 : 570 = 2 : 3 or (40% and 60%)	316	474	790.00

Working Notes

1. *Sales value of total production*

Input introduced in Department *A*	:	8,00,000 kgs
Input-output/yield ratio	:	85%
Output is (8,00,000 kgs × 0.85)	:	6,80,000 kgs
Ratio of output *P* and *Q*	:	70% and 30%
Product *P* (6,80,000 × 0.7)	:	4,76,000 kgs

Sale value of *P* (4,76,000 kgs × Rs 85)	:	Rs 404.60 lakh
Product *Q* (6,80,000 × 0.3)	:	2,04,000 kgs
Sale value of *Q* (2,04,000 kgs × Rs 290)	:	Rs 591.60 lakh

2. *Joint cost of total production*

Raw materials cost (8,00,000 kgs × Rs 80):	Rs 640 lakh
Total cost of Department *A*	150 lakh
Total joint cost	790 lakh

(ii) *Decision analysis: Sell product P or process further* *(Rs in lakh)*

Sales value after further processing (product *AR*) (4,76,000 kgs × 0.9 × Rs 115 per kg)		Rs 492.66
Less net sale value before further processing		380.00
Incremental sales revenue		112.66
Less further processing and additional costs:		
Cost of Department *B*	Rs 64.00	
Selling expenses	16.80	80.8
Incremental profit from further processing		31.86

Recommendation: The company would have increased profits by Rs 31.86 lakh by processing product *P* further in newly created department *B* and sell it as product *AR*.

EQ. 8.14 Following details are related to the work done in Process '*A*' of *XYZ* Company during the month of March current year:

Opening work-in-progress (2,000 units)	
Materials	Rs 80,000
Labour	15,000
Overheads	45,000
Materials introduced in Process 'A' (38,000 units)	14,80,000
Direct labour	3,59,000
Overheads	10,77,000
Units scrapped: 3,000 units	
Degreee of completion:	
Materials	100%
Labour and overheads	80%
Closing work-in-progress : 2,000 units	
Degree of completion:	
Materials	100%
Labour and overheads	80%
Units finished and transferred to Process 'B' : 35,000	
Normal loss:	
5% of total input including opening work-in-progress	
Scrapped units fetch Rs 20 per piece.	

You are required to prepare: (i) Statement of equivalent production: (ii) Statement of cost; (iii) Statement of distribution cost; and (iv) Process '*A*' Account, Normal and Abnormal Loss Accounts. (*CA (PE-II)—May, 2007*)

SOLUTION

(i) *Statement of equivalent production (Process A)*

Input	*Particulars*	*Units completed or otherwise*	*Stage of completion*		*Equivalent units produced*	
			Material	*Conversion costs*	*Material*	*Conversion costs*
2,000 units Opening WIP	Units completed	35,000	100	100	35,000	35,000
38,000 units introduced	Normal loss (0.5 × 40,000)	2,000	—	—	—	—
	Abnormal loss (3,000 – 2,000)	1000	100	80	1,000	800
	Closing WIP	2,000	100	80	2,000	1,600
40,000		40,000			38,000	37,400

(ii) *Statement of cost*

Particulars	*Total cost*	*Equivalent units produced*	*Cost per unit*
Opening material (improving WIP)	Rs 80,000		
Add materials introduced	14,80,000		
Less sale proceeds of normal loss (scrapped units), 2000 × Rs 20	(40,000)		
Total material cost	15,20,000	38,000	Rs 40
Opening conversion costs (in opening WIP)	60,000		
Add additional conversion costs incurred in process (Rs 3,59,000 + 10,77,000)	14,36,000		
	14,96,000	37,400	40
Total conversion costs			80

(iii) *Statement of distribution of costs*

Particulars	*Element of cost*	*Equivalent production*	*Cost per unit*	*Total*
Finished output	Total cost	35,000	Rs 80	Rs 28,00,000
Abnormal loss	Material	1,000	40	40,000
	Conversion costs	800	40	32,000
				72,000
Work-in-process (closing)	Material	2,000	40	80,000
	Conversion costs	1,600	40	64,000
				1,44,000
Total cost accounted (Rs 15,20,000 + Rs 14,96,000)				30,16,000*

*(Rs 28,00,000 + Rs 72,000 + Rs 1,44,000)

(iv) *Process A Account*

Particulars	*Units*	*Amount*	*Particulars*	*Unit*	*Amount*
To Opening WIP	2,000	Rs 1,40,000	By Normal loss	2,000	40,000
To Materials	38,000	14,80,000	By Abnormal loss	1,000	72,000
To Direct labour		3,59,000	By Process *B* (output	35,000	28,00,000
To Overheads		10,77,000	transferred at Rs 80 per unit)		
			By Closing WIP	2,000	1,44,000
	40,000	30,56,000		40,000	30,56,000

Normal Loss Account

To Process A	2,000	40,000	By sales	2,000	40,000
	2,000	40,000		2,000	40,000

Abnormal Loss Account

To Process A	1,000	72,000	By sales	1,000	20,000
			By costing P&L A/c	—	52,000
	1,000	72,000		1,000	72,000

9 Unit/Single/Output and Operating Costing

Introduction

The objective of this chapter is to describe unit and operating costing. While unit costing, like job and process costing, is applicable to manufacturing organisations, operating costing is suitable for cost determination in service organisations. The nature of service organsiations differs widely depending on the nature of service. Our focus in this chapter is, therefore, on elucidating the general procedure with special reference to transport costing. Section 1 of the chapter illustrates unit costing, and operating costing is the subject matter of Section 2. The main points are summarised in the last section.

UNIT/SINGLE/OUTPUT COSTING

Unit cost is a method of costing used in those industries, which are engaged in manufacturing *exclusively one* homogeneous product or a few grades of the same product. It is also referred to as *single/output costing*. The examples of industries in which this type of costing is applicable are cement, paper, sugar, steel, quarries, brickworks, and breweries. The *unit* cost is the average cost, that is, the total cost divided by the number of units produced. The cost units may be expressed in terms of number, weight, volume and time. The following is a list of some industries and the corresponding cost units adopted by them.

Type of industry	*Cost unit*
Brick making	1,000 bricks made
Steel manufacturing	Per tonne
Cement, coal, collieries, quarries	Per tonne
Paper	Per kg-tonne
Bolts, nuts	Gross or per 1,000
Paint manufacturing	Per litre
Gas works	Per 1,000 cubic metres produced
Electricity undertakings	Per kilowatt-hour

The computation of cost in unit costing is done in the form of cost sheet/production statement and production account.

Cost Sheet/Production Statement

A *cost sheet* or production statement is the statement that provides a logical, detailed and systematic presentation of various elements of cost information obtained through the cost records. It also includes the figures of sales revenue and profits. The term production statement may signify statement of units produced. Such a statement may more aptly be designated as a statement of costs and profits.

Production Account

Production account is an accounting presentation (ledger account shape) of the information contained in the production statement. In financial accounting, it is known by the name of *manufacturing account*. Whatever the mode of cost presentation, such a compilation is made at periodic intervals, say every month, every quarter. For the sake of comparison and cost control, wherever possible, the corresponding figure for the past period or standard cost figure may also be provided in the cost sheet or production statement.

In preparing the cost sheet/production account, the following items need special attention.

Salvage Value of Scrap Material Cost of production should be reduced by the sale proceeds of scrap. In case material is not processed, sale proceeds of such materials should be deducted from the cost of materials issued. Where materials have undergone manufacturing process, the sale proceeds from such scrap should be deducted from the factory cost.

Defective Product Defective products can sometimes be made saleable after incurring extra expenditure. When such defects are caused by normal reasons, the additional expenditure on salvaging these products is included as a part of factory cost; but in case of abnormal reasons, the cost of rectification of these products is transferred to the costing profit and loss account.

By-Product The sale proceeds realised from by-products is deducted from the factory cost.

Work-in-Process The adjustment for opening and closing work-in-process should be carried out at the appropriate stage (prime cost or work cost) in preparing the statement of cost of production.

The formats of cost sheet/production statement and production account are given in Exhibits 9.1 and 9.2.

Exhibit 9.1 *Cost Sheet/Production Statement for the Period.....*

(Units produced)

Particulars	*Last Period*		*Current Period*	
	Total cost	*Unit cost*	*Total cost*	*Unit cost*
Direct materials consumed				
Direct wages				
Other direct/chargeable expenses	—	—	—	—
Prime Cost				
Add factory or works overheads (specify each item)	—	—	—	—
Factory Cost, (gross)				
Add opening work-in-process				
Less closing work-in-process	—	—	—	—

(*Contd.*)

(*Contd.*)

Factory Cost (net)				
Add administrative overheads				
Cost of Production				
Add opening stock of finished goods				
Less closing stock of finished goods	—	—	—	—
Cost of Goods Sold				
Add selling overheads (specify each item)	—	—	—	—
Cost of Sales				
Add profit as per cent of cost price or selling price	—	—	—	—
Sales Revenue (Total)	—	—	—	—

Exhibit 9.2 *Production Account for the Period.....*

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To direct materials:	—	By prime cost c/d	—
Opening stock			
Add purchases			
Add carriage on purchase			
Less closing stock			
To direct labour			
To other direct/chargeable expenses			
To prime cost b/d		By closing stock of work-in-process	
To factory overheads (specify each item)		By factory cost c/d	
To opening stock of work-in-process			
To factory cost b/d		By cost of production c/d	
To administrative overheads (specify each item)			
To opening stock of finished goods		By closing stock of finished goods	
To cost of production b/d		By cost of goods sold c/d	
To cost of goods sold b/d		By cost of sales c/d	
To selling overheads (specify each item)			
To cost of sales b/d		By sales	
To profit (balancing figure)			

EXAMPLE 9.1

Work out, in cost sheet form, the unit cost of production per tonne of special paper, manufactured by a paper mill in March of the current year from the following data:

Direct materials:	
	Paper pulp—500 tonnes @ Rs 500 per tonne
	Other materials—100 tonnes @ Rs 300 per tonne
Direct labour:	
	80 skilled men @ Rs 30 per day for 25 days
	40 unskilled men @ Rs 20 per day for 25 days
Direct expenses:	
	Special equipment—Rs 30,000
	Special dyes—Rs 10,000
Works/factory overheads:	
	Variable @ 100 per cent and fixed @ 60 per cent on direct wages
	Administrative overhead @ 10 per cent of factory cost
	Selling and distribution overhead @ 15 per cent on work cost.

400 tonnes of special paper was manufactured and sold @ Rs 2,000 per tonne and Rs 8,000 was realised by the sale of waste material during the course of manufacture. The scrap value of the special equipment and dyes after utilisation in manufacture is nil.

Prepare the production account also.

SOLUTION

Cost Sheet for the Period Ending March, Current Year

Particulars	*Total cost (400 tonnes)*	*Cost per tonne*
Direct materials used:		
Paper pulp	Rs 2,50,000	Rs 625
Other materials	30,000	75
Direct labour cost:		
Skilled men (80 men × Rs 30 × 25 days)	60,000	150
Unskilled men (40 men × Rs 20 × 25 days)	20,000	50
Other direct expenses:		
Special equipment	30,000	75
Special dyes	10,000	25
Prime cost	4,00,000	1,000
Add factory overheads:		
Variable (100 per cent on direct wages)	80,000	200
Fixed (Rs 80,000 × 0.60)	48,000	120
Less sale proceeds of waste material	(8,000)	20
Factory/Works cost	5,20,000	1,300
Add administrative overheads:		
10 per cent of factory cost	52,000	130
Cost of production	5,72,000	1,430
Add selling and distribution overheads: (Rs 5,20,000 × 0.15)	78,000	195
Cost of sales	6,50,000	1,625
Profit	1,50,000	375
Sales	8,00,000	2,000

Note: Sale proceeds of waste materials have been deducted at the stage of factory overheads since materials have undergone manufacturing process.

Production Account for the Period Ending March Current Year

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To direct materials:		By prime cost c/d	Rs 4,00,000
Paper pulp			
(500 tonnes × Rs 500)	Rs 2,50,000		
Other materials			
(100 tonnes × Rs 300)	30,000		
To direct labour:			
Skilled men (80 × Rs 30 × 25)	60,000		
Unskilled men (40 × Rs 20 × 25)	20,000		
To other direct expenses:			
Special equipment	30,000		
Special dyes	10,000		
	4,00,000		4,00,000
To prime cost b/d	4,00,000	By sale proceeds of waste material	8,000
To factory overheads:			
Variable	80,000	By factory cost c/d	5,20,000
Fixed	48,000		
	5,28,000		5,28,000
To factory cost b/d	5,20,000	By cost of production c/d	5,72,000
To administrative overheads	52,000		
	5,72,000		5,72,000
To cost of production b/d	5,72,000	By cost of sales c/d	6,50,000
To selling and distribution overheads	78,000		
	6,50,000		6,50,000
To cost of sales b/d	6,50,000	By sales	8,00,000
To profit	1,50,000		
	8,00,000		8,00,000

EXAMPLE 9.2

The following extracts of costing information related to commodity Y for the half year ending September 30 of the current year:

Purchases of raw materials	Rs 1,32,000
Direct wages	1,10,000
Rent, rates, insurance and works overhead	44,000
Carriage inwards	1,584
Stock, April 1 of the current year:	
Raw materials	22,000
Finished products (1,600 tonnes)	17,600
Stock, September 30 of the current year:	
Raw materials	24,464
Finished products (3,200 tonnes)	35,200
Work-in-process, April 1	5,280
Work-in-process, September 30	17,600
Cost of factory supervision	8,800
Sales of finished product	3,30,000

Advertising, discounts allowed and selling costs amounted to Rs 0.75 per tonne sold and 25,600 tonnes of commodity were produced during the period.

You are required to ascertain (a) the value of raw materials used; (b) prime cost; (c) the cost of turnover of the period; (d) net profit for the period; and (e) net profit per tonne of the commodity sold.

SOLUTION

Production Statement/Cost Sheet for the Half-Year Ending September 30

Particulars	*Total cost*		*Cost per tonne*
Direct materials consumed:			
Opening stock	Rs 22,000		
Add purchases	1,32,000		
Add carriage on purchases	1,584		
Less closing stock	(24,464)	Rs 1,31,120	
Direct wages		1,10,000	
Prime cost (25,600 tonnes)		2,41,120	Rs 9.41875
Add factory overheads:			
Rent, rates, insurance and works overheads	44,000		
Cost of factory supervision	8,800	52,800	
Gross works cost		2,93,920	
Add opening work-in-process inventory		5,280	
Less closing work-in-process inventory		(17,600)	1.58125@
Net works cost (cost of production)		2,81,600	11.00
Add opening finished goods inventory (1,600 tonnes)		17,600	
Less closing finished goods inventory (3,200 tonnes)		(35,200)	—
Cost of goods sold (24,000 tonnes) (25,600 + 1,600 – 3,200)		2,64,000	11.00
Add selling and distribution overheads		18,000	0.75
Cost of sales		2,82,000	11.75
Add profit (balancing figure)		48,000	2.00
Sales revenue (24,000 tonnes)		3,30,000	13.75

@Factory overheads per tonne of output is Rs 1.58125, that is, cost of goods sold, Rs 11—prime cost, Rs 9.41875.

Note The firm is assumed using the average costing method of valuing work-in-process.

EXAMPLE 9.3 *(Production Account)*

From the following cost records of Garware Paints Limited, you are required to prepare production account with maximum possible break-up of costs and profits for the quarter ending March 31 of the current year:

Opening raw materials inventory	Rs 1,50,000
Closing raw materials inventory	1,80,000
Direct wages	1,00,000
Indirect wages	10,000
Opening work-in-process inventory	55,000
Closing work-in-process inventory	70,000
Sales	4,00,000

(*Contd.*)

(*Contd.*)

Purchase of raw materials	1,30,000
Carriage on purchases of materials	5,000
Factory rent, rates and power	30,000
Depreciation of plant and machinery	7,000
Repairs of machinery	3,000
Advertising	12,000
Office rent and taxes	5,000
Salesmen salaries and commission	15,000
Opening stock of finished goods inventory	1,00,000
Closing stock of finished goods inventory	65,000
Sale of scrap	2,000

SOLUTION

Production Account for the Quarter Ending March 31

Particulars		*Dr Amount*	*Particulars*	*Cr Amount*
To direct materials:				
Opening stock	Rs 1,50,000		By prime cost c/d	Rs 2,05,000
Add: purchases	1,30,000			
carriage	5,000			
Less closing stock	(1,80,000)	Rs 1,05,000		
To direct wages		1,00,000		
		2,05,000		2,05,000
To prime cost b/d		2,05,000		
To indirect wages		10,000	By factory cost c/d	2,38,000
To factory rent, rates and power		30,000		
To depreciation of plant and machinery		7,000		
To repairs of machinery		3,000		
		2,55,000		
Add opening work-in-process		55,000		
Less closing work-in-process		(70,000)		
Less sale of scrap		(2,000)		
		2,38,000		2,38,000
To factory cost b/d		2,38,000	By cost of production c/d	
To opening rent and taxes		5,000		
		2,43,000		2,43,000
To cost of production b/d		2,43,000	By closing stock	65,000
To opening stock		1,00,000	By cost of goods sold c/d	2,78,000
		3,43,000		3,43,000
To cost of goods sold b/d		2,78,000	By cost of sales c/d	3,05,000
To advertising		12,000		
To salesman salaries and commission		15,000		
		3,05,000		3,05,000
To cost of sales b/d		3,05,000	By sales	4,00,000
To profit		95,000		
		4,00,000		4,00,000

EXAMPLE 9.4 *(Projected Cost Sheet)*

Electronics Ltd furnishes the following information for 10,000 TV valves manufactured during the previous year:

Material	Rs 90,000
Direct wages	60,000
Power and consumable stores	12,000
Factory indirect wages	15,000
Lighting of factory	5,500
Defective work (cost of rectification)	3,000
Clerical salaries and management expenses	33,500
Selling expenses	5,500
Sale proceeds of scrap	2,000
Plant repairs, maintenance and depreciation	11,500

Last year, the net selling price was Rs 31.60 per unit and all the units were sold. As from April 1 of the current year, the selling price was reduced to Rs 31 per unit. It was estimated that production could be increased in the current year by 50 per cent due to spare capacity. Rates for materials and direct wages would increase by 10 per cent.

You are required to prepare a statement of cost and profit for the current year, assuming that 15,000 units will be produced and sold during the year and that factory overheads will be recovered as a percentage of direct wages, and office and selling expenses as a percentage of the works cost.

SOLUTION

Project Statement of Cost and Profit for the Current Year (Output 15,000 Units)

Particulars	*Total cost*	*Cost per unit*
Material cost @ Rs 9.90 per unit	Rs 1,48,500	Rs 9.90
Direct wages @ Rs 6.60 per unit	99,000	6.60
Prime cost	2,47,500	16.50
Add factory overheads (0.75 × direct wages)*	74,250	4.95
Work cost	3,21,750	21.45
Add office and selling overheads (0.20 × works cost)**	64,350	4.29
Cost of sales	3,86,100	25.74
Estimated profit (balancing figure sales price-cost of sales)	78,900	5.26
Sales revenue	4,65,000	31.00

Working Notes

**Determination of Factory Overheads:*

Factory overheads (previous year):	
Power and consumable stores	Rs 12,000
Factory indirect wages	15,000
Lighting of factory	5,500
Cost of rectification of defective work (assumed to be normal)	3,000
Plant repairs, maintenance and depreciations	11,500
Less sale of scrap	2,000
Total	45,000
Direct wages	60,000
Factory overheads as per cent of direct wages	75

***Determination of Office and Selling Overheads:*

Works cost (previous year):	
Material cost	Rs 90,000
Direct wages	60,000
Factory overheads as above	45,000
	1,95,000
Selling and office overheads (Rs 33,500 + Rs 5,500)	39,000
Office and selling overheads as per cent of works cost	20

Bid Price

Cost sheet or statement of cost of production and profit is a useful means of determining the bid price to be quoted for a specific tender. In preparing such a statement, probable changes in the input prices/rates should be taken into account. Moreover, fixed costs should be ignored if the tender output can be met out of the existing plant capacity of the firm. Consider Example 9.5.

EXAMPLE 9.5 *(Determination of Tender Price)*

From the following data, prepare a production statement of the Stove Manufacturing Company Ltd for the current year ending March 31:

Opening materials inventory	Rs 70,000
Closing materials inventory	9,800
Purchase of materials	1,05,000
Factory wages	1,90,000
Factory expenses	35,000
Establishment expenses	20,000
Opening finished inventory	Nil
Closing finished inventory	70,000
Sales	3,78,000

The number of stoves manufactured during the year was 8,000. The company wants to quote for the supply of 2,000 stoves for the coming year. The stoves to be quoted are similar to those in the current year but cost of materials is expected to increase by 10 per cent and factory labour by 20 per cent.

Prepare a statement showing the price to be quoted so as to give the same percentage of profit on turnover as was realised during the current year assuming that other costs will be the same as in the previous year.

SOLUTION

Statement of Cost of Production and Profit to Quote Prices

Particulars	*Total cost (2,000 units)*	*Cost per unit*
Materials cost	Rs 45,430[1]	Rs 22.715
Direct wages	57,000[2]	28.500
Prime cost	1,02,430	51.215
Add factory expenses @ Rs 4.375(Rs 35,000 ÷ 8,000 units)	8,750	4.375
Factory cost	1,11,180	55.590
Add establishment expenses @ Rs 2.50 (Rs 20,000 ÷ 8,000 units)	5,000	2.500
Cost of production	1,16,180	58.090
Add margin of profit (0.10 × sales or 1/9 of cost price)	12,908	6.454
Quotation price	1,29,088	64.544

Working Notes

[1]*Determination of Material Cost:*

Opening inventory		Rs 70,000
Add purchases		1,05,000
Less closing inventory		(9,800)
Cost of material consumed ÷ Number of stoves manufactured		1,65,200
		8,000
Material cost per unit		20.650
Add 10 per cent cost (increase)		2.065
Material cost (current) per unit		22.715

[2]*Determination of Labour Cost:* (Rs 1,90,000 ÷ 8,000)	23.75
Add 20 per cent increase	4.75
Current labour cost per unit	28.50

[3]*Determination of Margin of Profit on Sales of Previous Year:*

Sales revenue		Rs 3,78,000
Less cost of production:		
Cost of materials consumed	Rs 1,65,200	
Factory wages	1,90,000	
Factory expenses	35,000	
Establishment expenses	20,000	
	4,10,200	
Less closing inventory of finished product	(70,000)	3,40,200
Profit		37,800

Profit as per cent of sales revenue = (Rs 37,800 ÷ Rs 3,78,000) = 10 per cent

EXAMPLE 9.6 *(Cost Sheet with By-product)*

From the following particulars make out a weekly cost sheet showing profit on the main product of Mini Petroleum Company Ltd:

Crude oil used	5,00,000 litres @	Rs 0.50
Petrol produced (main product)	1,50,000 litres	2.50
By-products:		
(i) Lubricating oil produced	50,000 litres	2.00
(ii) Fuel oil produced	2,50,000 litres	1.00
(iii) Kerosene produced	30,000 litres	0.80
Raw materials consumed		48,000
Wages paid		1,20,000
Repairs and renewals		86,000
Salaries and general charges		50,000

Show the percentage of each product to the weight of crude oil used.

SOLUTION

Cost Sheet For the Week Ending (Units in Litres)

Particulars	*Quantity (litres)*	*Total cost*	*Cost per unit*
Crude oil used (input)	5,00,000	Rs 2,50,000	
Raw materials		48,000	
Wages		1,20,000	
Repairs and renewals		86,000	
Salaries and general charges		50,000	
Total cost of production of main product and by-products (joint cost)		5,54,000	
Less sale proceeds from by-products (output)			
Lubricating oil	(50,000)	(1,00,000)	
Fuel oil	(2,50,000)	(2,50,000)	
Kerosene	(30,000)	(24,000)	
Wastage (assumed to be normal)	(20,000)	Nil	
Cost of production of main product (petroleum)	1,50,000	1,80,000	Rs 1.20
Profit (balancing figure)		1,95,000	1.30
Sales revenue		3,75,000	2.50

Statement Showing the Percentage of Each Product to be Weight of Crude Used

Input (litres)	*Particulars*	*Output (litres)*	*Percentage*
5,00,000	*Crude oil*		
	Petrol	1,50,000	30
	Lubricating oil	50,000	10
	Fuel oil	2,50,000	50
	Kerosene	30,000	6
	Wastage	20,000	4
5,00,000	Total	5,00,000	100

OPERATING COSTING

The term operating costing is applied to unit costing of services as opposed to products. It is applicable where standardised services are provided either by an undertaking or by a service cost centre within an undertaking. Thus, operating costing is suitable for public utility undertakings providing services to the community at large, such as road and rail transport companies, electricity undertakings, hospitals, theatres. It is also suitable for cost ascertainment by ancillary services departments of manufacturing units such as power house, boiler house, hospital, internal transport and canteen for the benefit of employees.

Operating costing is essentially a part of unit costing. Like unit costing, the cost per unit in operating costing is based on average cost. Example of units to express average cost are as follows:

Organisation	*Cost unit*
Transport undertakings	Passenger-km (passenger traffic) or Tonne-km (goods transport)
Electricity boards/organisation	Kilowatt-hours
Hospitals	Patient-days, outpatients treated, cost per major or minor surgical operation
Boiler houses	Quantity (kg or lb) of steam generated
Canteens	Meals served; cups of tea sold.

The unit costs in service organisations are ascertained in the form of operating cost sheet. It is a statement of operating costs (and sometimes profit also) in operating costing. Corresponding to the fixed costs, variable costs and semi-variable costs in manufacturing organsiations, the operating costs in service organisations are generally categorised into three groups, namely standing charges, running costs and repairs and maintenance. The repairs and maintenance is often clubbed with running costs. The main elements of these categories of costs in the case of a transport undertaking are detailed as follows.

Standing Charges

Standing charges are those, which are incurred irrespective of the mileage run. Included in this category are the following expenses:

1. License fees
2. Insurance premium
3. Road, tax
4. Garage costs and administration
5. Drivers' wages (gross) including provident fund contribution of employers
6. Attendant-cum-cleaner's wages
7. Interest on capital (if considered as a part of cost).

Running Costs

Running costs are those which vary more or less in direct proportion to the mileage run. The following is a list of such expenses:

1. Cost of fuel (diesel, petrol etc.)
2. Lubricants, grease and oil
3. Repairs and maintenance (strictly semi-variable)
4. Cost of tyres, tubes and other spare parts
5. Depreciation

In costing transport undertakings, the cost unit is normally passenger-km (in the case of passenger traffic) and tonne-km (in the case of goods transport). However, passenger-km/tonne-km unit may not be applicable in all situations. For instance, where the material is bulky but of small weight, say, empty containers (drums, and tins), a certain maximum volume is often considered as equivalent to one tonne. For example, in sea freight a maximum volume of 40 cubic feet is considered equivalent to one tonne for freight purposes. Likewise, some other standard freight measure is adopted for items such as cars, televisions, refrigerators, and so on.

In transport, the total operating cost should be determined with reference to each vehicle under suitable cost headings, namely, standing charges, running charges and maintenance charges. The passenger-km or tonne-km can be conceived as a function of the following variables:

1. The number of vehicles (fleet)
2. The carrying capacity of the vehicle in terms of number of passengers/freight
3. Distance travelled
4. Number of days on an average for which the vehicle is likely to be in operation
5. Number of trips in a day; going and coming should be considered as two trips
6. Passenger/weight actually carried on an average

EXAMPLE 9.7

DHT Ltd is running 4 buses between two towns which are 100 kms apart: the seating capacity of each bus is 50 passengers and 80 per cent of this capacity is actually used. Each vehicle makes 2 round trips daily and the vehicles are working on an average of 25 days a month. Determine the passenger-kms. Also, determine cost per passenger-km, if the total operating costs for 4 buses are Rs 32,00,000.

SOLUTION

Passenger-km = Number of buses × Distance × Capacity × Trips × 2 × Days × Percentage of the capacity used
= (4 × 100 × 50 × 2 × 2 × 25) × 0.80 = 16,00,000

Cost per passenger-km =Total costs/ Total passenger-kms = Rs 32,00,000/16,00,000 = Rs 2

When the transport undertaking owns vehicles having different capacities, cost unit should be determined with reference to varying capacities.

EXAMPLE 9.8 *(Determination of Cost Unit When Vehicle Have Different Rated Capacities)*

A transport company operates the following fleet: 20 trucks of 10 tonne capacity, 10 trucks of 5 tonne capacity, 5 mini-trucks of 2 tonne capacity each.

The first two types of trucks are used for long distances and the mini-truck is utilised for local transport only. In a week, the following distances were covered by each of the trucks: 10 tonne capacity truck, 600 kms; 5 tonne capacity truck, 500 kms; 2 tonne capacity truck, 300 kms.

If the total cost is Rs 3,70,000, determine the cost per tonne-km, assuming that all vehicles worked to their full capacity during the period.

SOLUTION

Determination of Total Tonne-Kilometers (kms)

Number of vehicle	*Capacity in tonnes*	*Distance in kms*	*Tonne-kms*
20	10	600	1,20,000
10	5	500	25,000
5	2	300	3,000
			1,48,000

Cost per tonne-kilometre = Rs 3,70,000/1,48,000 = Rs 2.50

Each vehicle, in a way, is a *cost centre* in operating costing. Therefore, a separate cost sheet is maintained for each vehicle in the cost accounting department. Detailed information to be incorporated in the cost sheet is available from the *daily log sheet* maintained by the bus operators. The daily log sheet provides complete information in respect of each journey. For instance, it records kilometers travelled, weight or passengers carried, the time when the journey commenced and when it was completed. Apart from the journey, the log sheet also records the supplies of petrol, diesel or other materials made to the vehicle. Cost in respect of road tax, insurance, tyres and spares are entered directly in the records already maintained. Wages of the drivers and assistants are recorded from the payroll register.

When a transport company maintains its own repairs and maintenance department, the vehicle can be charged for the cost the time mechanics spend on its repairs and maintenance. For this purpose, they maintain *time sheets* to record time spent by them on each vehicle. Subsequently, these time sheets are the guiding reference to apportion cost of this department among various vehicles. Likewise, the material issued (tyres, tubes, and other spares) from the central store are classified and the relevant costs of such materials transferred to the concerned cost sheet of each vehicle.

At suitable periodical intervals, the costs are transferred from the vehicle cost sheets to the summary statement of the operating cost of the fleet as a whole. Costs are recorded under suitable headings of running costs and standing costs. The cost classification enables a comparison of each vehicle's performance. The total costs so determined are averaged out to determine cost per km or cost per tonne-km or cost per passenger-km as applicable. Comparison can be made with operating cost of other transport companies/ undertakings operating in that region to judge the operating efficiency of the firm.

Apart from inter-firm comparisons, certain ratios can also be determined and used for the purpose. One such ratio can be the *capacity utilisation ratio*. This ratio would measure the relationship between the capacity used (tonne-km/passenger-km) and the capacity available. The higher the ratio, the better it is. This ratio can be compared with the corresponding ratios of earlier years also. Another important ratio in this regard can be the *cost revenue ratio*. This ratio would establish the relationship between cost per tonne-km incurred and revenue per tonne-km realised; the lower the ratio, the better it is. The ratio of more than 1 (or 100 per cent) signals unprofitability and very high ratios point to deteriorating profitability.

Finally, for control purposes, the following data may be compiled for each vehicle at periodical intervals: (i) The mileage run, (ii) Fuel consumed and the km per litre, (iii) Lubricants consumed, and (iv) Working days analysis in respect of: (a) Running under load, (b) Under repair, (c) Loses through abnormal causes such as driver's absence or breakdown of vehicle. This exercise also helps in assessing whether it is profitable to operate a particular vehicle on a certain route or not.

SUMMARY

- Unit/single/output costing is a method of costing used in those industries which are engaged in the manufacture of a homogeneous product or a few grades of the same product such as cement, paper, sugar, steel, brick works, breweries. The cost units are expressed in terms of number, weight, volume and time. Examples of cost unit are per kg, per tonne, per litre, per gross and per 1,000 units.
- The computation of costs in unit costing is recorded in a cost sheet/production statement or production account. The various elements of cost are arranged in a way so as to calculate prime cost, works cost, cost of production, cost of goods sold and cost of sales. In preparing these, items like salvage value of scrap, defective products and work-in-process merit special attention.
- The cost accumulation process can be used to determine bid prices for quoting specifie tenders.
- Operating costing is applied to service organisations as well as to service departments of manufacturing organsiations. It is applicable to road or rail transport companies, electricity undertakings, hospitals, theatres and so on.

➔ The basic principles of cost determination are similar to those in unit costing, but the unit of measurement is composite such as passenger-km, tonne-km and kilowatt-hours. Another distinguishing feature of this type of costing is the basis of cost classification. The major elements of cost are standing charges (fixed costs) and running cost (variable and semi-variable costs).

SOLVED PROBLEMS

P.9.1 A factory is engaged in making standard products which pass through three departments. The cost figures of the factory for the month of November of the current year are furnished below:

		Departments		
Particulars	*Total*	*A*	*B*	*C*
Direct materials	Rs 18,600	Rs 7,500	Rs 6,400	Rs 4,700
Labour cost	15,000	6,000	5,000	4,000
Total overhead expenditure	7,500	3,000	2,500	2,000
	41,100	16,500	13,900	10,700

Prepare a simple cost sheet for products X and Y on the basis of data furnished below:

		Departments		
		A	*B*	*C*
Product X	— Material	Rs 100	Rs 200	Rs 300
	— Labour	50	60	70
Product Y	— Material	50	90	140
	— Labour	70	60	80

SOLUTION

Cost sheet of products X and Y for the month of November

Particulars	*Total cost*		*Percentage of total cost*	
	X	*Y*	*X*	*Y*
Department A				
Direct materials	Rs 100	Rs 50	Rs 11.50	Rs 8.40
Direct labour	50	70	5.74	11.77
Overheads (0.50 × direct wages)	25	35	2.87	5.88
(a) *Total*	175	155	20.11	26.05
Department B				
Direct materials	200	90	22.99	15.13
Direct labour	60	60	6.90	10.09
Overhead (0.50 × direct wages)	30	30	3.45	5.04
(b) *Total*	290	180	33.34	30.26
Department C				
Direct materials	300	140	34.48	23.53
Direct labour	70	80	8.05	13.45
Overhead (0.50 × direct wages)	35	40	4.02	6.72
(c) *Total*	405	260	46.55	43.70
Total (a+b+c)	870	595	100.00	100.00

Note: It is obvious from the cost figures of November that the firm is following the percentage of labour cost method as the basis of recovering overheads.

P.9.2 In a long established factory a plant installed 20 years ago at a cost of Rs 30,000 is still in use though its book value has been brought down to Re 1 (nominal). The cost figure of its output per mensum are given below:

Electrical power	Rs 300
Repairs and maintenance	450
Consumable stores	50
Wages of 12 workers (gross)	1,800
Raw materials (production)	26,000
Overheads allocated	2,400
	31,000

Units produced: 20,000, sold at Rs 2 per unit, selling expenses being Rs 3,000 per mensum.

The management scrapped this plant and installed a more efficient modern plant and particulars of its workings are given below:

Cost of new plant installed (subject to 10 per cent depreciation per annum)		Rs 1,35,000
Electric power		750
Repairs and maintenance		650
Consumable stores		100
Wages of 12 workers (existing)		2,700
Salaries of new mechanics and machinemen:		
2 mechanics, Rs 250 each	Rs 500	
3 mechanics, Rs 300 each	900	1,400
Overheads allocated		3,600

The new plant utilises raw materials costing Rs 80,000 per mensem and produces 70,000 units which are sold at Rs 2.10 each. The selling expenses increased to Rs 7,000 per mensem. The plant cost and additional capital outlay involved in increasing stock of raw materials and extended credit to customers was financed by a 9% Debenture issue for Rs 3,00,000, the proceeds of which were wholly utilised on the change-over from old to new plant. This change also involved lay-off of workers and the wages paid to them during the period and other losses due to non-working of the plant for a period of two months amounted to Rs 24,000 and it was decided by the management that the loss should be absorbed in production accounts in the remaining period of eight months in the current financial year.

You are required to prepare a comparative cost sheet for the last month of working of the old plant and the first month's working of the new plant indicating the monthly profit and loss on account of the change-over.

Assume that realisation on the sale of old plant is adjusted in the estimated loss of Rs 24,000 and ignore interest on extended credit to customer for which no indication has been given.

SOLUTION

Comparative cost sheet showing the effect of change of the existing plant to the new one on the profits of the firm

Particulars	*Old plant (20,000 units)*			*New plant (70,000 units)*		
	Total cost	*Unit cost*	*Per cent to cost price*	*Total cost*	*Unit cost*	*Per cent to total sale price*
Raw materials	Rs 26,000	Rs 1.30	Rs 65.0	Rs 80,000	Rs 1.14	Rs 54.28
Wages	1,800	0.09	4.5	2,700		
Salaries of new mechanics/ machinemen				1,400	0.058	2.77
Prime cost	27,800	1.39	69.5	84,100	1.198	57.05

(*Contd.*)

(*Contd.*)

Add factory overheads						
Electric power	300			750		
Repair and maintenance	450	0.04	2.0	650	0.020	0.95
Consumable stores	50			100		
Depreciation for 1 month:						
Old plant (book value)	—	—	—			
New plant (0.10 × Rs 1,35,000)/ 12 months				1,125	0.016	0.76
Factory cost	28,600	1.43	71.5	86,725	1.234	58.76
Add other miscellaneous overheads:						
Allocated overheads	2,400	0.12	6.00	3,600	0.045	2.14
Interest on debentures for one month (Rs 3,00,000 × 0.09 × 1/12)				2,250	0.032	1.52
Loss due to change-over of the plant to be spread over 8 months (Rs 24,000 ÷ 8)				3,000	0.043	2.05
Cost of production	31,000	1.55	77.5	95,575	1.354	64.47
Add selling overheads	3,000	0.15	7.5	7,000	0.100	4.76
Cost of sales	34,000	1.70	85.0	1,02,575	1.454	69.23
Profit (balancing figure)	6,000	0.30	15.0	44,425	0.646	30.77
Sales revenue	40,000	2.00	100.0	1,47,000	2.100	100.00

Notes:

1. Since expenses related to factory are separately given, allocated overheads are assumed to be administrative overheads.
2. Interest normally should not form part of cost sheet. But it has been taken into account here as the purpose of the exercise is to ascertain the comparative cost of production; the interest is clubbed with general overheads and not shown separately as a financial charge. Likewise, loss due to change-over is dealt with. Alternatively, both these expenses could have been shown as direct expenses.

P.9.3 A company manufacture four sizes of formica board, A, B, C and D in its workshop and transfers them to the sales department at a profit of 50 per cent on transfer price. The workers are paid piece rates of Rs 2, Rs 4, Rs 6 and Rs 8 per board for sizes A, B, C and D respectively. Dearness allowance at flat rate of Rs 10 per direct labour day is distributed among workers. Miscellaneous direct payments to workers are 25 per cent of the basic wages. From the following information for the month of July, you are required to find out the total cost per board of each size and its transfer price:

Sizes	*A*	*B*	*C*	*D*
Direct labour day	100	200	300	200
Number of boards manufactured	4,000	2,500	2,000	1,500
Direct materials	Rs 25,000	Rs 15,000	Rs 20,000	Rs 20,000
Workshops' overhead				
Indirect materials	Rs 4,800			
Indirect labour	4,000			
Indirect expenses	8,000			

Indirect materials are to be apportioned on the basis of direct material cost and remaining expenses are to be allocated on the basis of direct labour days.

SOLUTION

Statement of cost of production and profit of formica board (A, B, C and D) for the month ending July

Particulars	*Total cost*				*Cost per unit*			
	A	*B*	*C*	*D*	*A*	*B*	*C*	*D*
Direct materials	Rs 25,000	Rs 15,000	Rs 20,000	Rs 20,000	Rs 6.25	Rs 6.00	Rs 10.00	Rs 13.34
Direct wages[@]	11,000	14,500	18,000	17,000	2.75	5.80	9.00	11.33
Prime cost	36,000	29,500	38,000	37,000	9.00	11.80	19.00	24.67
Add factory overheads								
Indirect materials (0.10 × direct material cost): (Rs 8,000 ÷ 80,000)	2,500	1,500	2,000	2,000	0.63	0.60	1.00	1.33
Indirect labour (in proportion of number of labour days: (1:2:3:2)	500	1,000	1,500	1,000	0.12	0.40	0.75	0.67
Indirect expenses (1:2:3:2)	1,000	2,000	3,000	2,000	0.25	0.80	1.50	1.33
Factory cost/cost of production	40,000	34,000	44,500	42,000	10.00	13.60	22.25	28.00
Add 50 per cent of transfer price	40,000	34,000	44,500	42,000	10.00	13.60	22.25	28.00
Transfer price	80,000	68,000	89,000	84,000	20.00	27.20	44.50	56.00

[@]*Determination of direct wages*

Particulars	*A*	*B*	*C*	*D*
Piece wages (number of boards × wage rate)	Rs 8,000	Rs 10,000	Rs 12,000	Rs 12,000
Dearness allowance (labour days × Rs 10)	1,000	2,000	3,000	2,000
Miscellaneous payments (0.25 × piece wages)	2,000	2,500	3,000	3,000
	11,000	14,500	18,000	17,000

P.9.4 A toy manufacturer earns an average net profit of Rs 3 per piece on a selling price of Rs 15 by producing and selling 60,000 pieces at 60 per cent of the potential capacity. The composition of cost of sales is:

Direct material	:	Rs 4	
Direct wages	:	1	
Works overheads	:	6	(50 per cent fixed)
Sales overheads	:	1	(25 per cent variable)

During the current year, he intends to produce the same number but anticipates that:

1. His fixed charges will go up by 10 per cent
2. Rates of direct labour will increase by 20 per cent
3. Rates of direct material will increase by 5 per cent
4. Selling price cannot be increased

Under these circumstances, he obtains an order for a further 20 per cent of his capacity. What minimum price will you recommended for accepting an order to ensure the manufacturer an overall profit of Rs 1,83,500?

SOLUTION

Statement showing the cost of production and profit at 60,000 units

Particulars	*Total cost*	*Cost per unit*
Direct materials (Rs 4 × 105 × 60,000) ÷ 100	Rs 2,52,000	Rs 4.20
Direct labour (Rs 1 × 120 × 60,000) ÷ 100	72,000	1.20
Prime cost	3,24,000	5.40

(*Contd.*)

(*Contd.*)

Add factory overheads:		
Variable (60,000 × Rs 3)	1,80,000	3.00
Fixed (Rs 3 × 60,000) = Rs 1,80,000+10 per cent	1,98,000	3.30
Factory cost/cost of production	7,02,000	11.70
Add selling and distribution overheads:		
Variable (60,000 × Rs 0.25)	15,000	0.25
Fixed (60,000 × Rs 0.75) = Rs 45,000+10 per cent	49,500	0.825
Cost of sales	7,66,500	12.775
Profit (balancing figure)	1,33,500	2.225
Sales revenue (60,000 × Rs 15)	9,00,000	15.000

Statement showing determination of minimum price to be quoted for special order of 20,000 units

Particulars	*Total cost*	*Cost per unit*
Relevant cost of production:		
Direct materials	Rs 84,000	Rs4.20
Direct labour	24,000	1.20
Variable works overhead	60,000	3.00
Variable sales overhead	5,000	0.25
Total incremental cost of production	1,73,000	8.65
Add profit expected from special order(Rs1,83,500–Rs 1,33,500)	50,000	2.50
Minimum price	2,23,000	11.15

P.9.5 A manufacturer produces 8,000 units per month, per unit split-up cost and sales value of which are given below:

Direct material	Rs 30
Direct labour	20
Fixed overhead (Rs 2,00,000)	25
Variable overhead	40
	115
Selling and distribution expenses:	
Fixed (Rs 80,000)	10
Variable	15
	140
General administration (fixed Rs 2,40,000)	30
Margin of profit (subject to taxation)	5
Sales value	175

Due to increase in demand and consequent extension of delivery dates and dissatisfaction among customers, the management decided to provide for an output of 12,000 units per month in the next year (against anticipated demand of 15,000 units), which would involve a capital outlay of Rs 6,00,000 on which interest and financial charge would amount to 10 per cent per annum.

Prepare a comparative consolidated cost statement showing anticipated margin of profit for the present output (of 8,000 units) and the proposed output (of 12,000 units).

Assume that in the coming year there will be an all-round increase of 5 per cent in the different items of expenses except fixed expenses.

If the proposal is adopted, due to the proposed increase in output, there will be an increase of 25 per cent in fixed overheads, 20 per cent in fixed selling and distribution expenses and 10 per cent in general administration, apart from the interest and financial charges.

If it is decided to maintain the present level of sales, an increase of 2 per cent in sales price is possible and this figure should be taken for the level of production at 8,000 units per month.

SOLUTION

Consolidated cost statement showing margin of profit at present and proposed (8,000 and 12,000) output levels

	Total cost		*Cost per unit*	
Particulars	*8,000 units*	*12,000 units*	*8,000 units*	*12,000 units*
Direct materials	Rs 2,52,000	Rs 3,78,000	Rs 31.5	Rs 31.5
Direct labour	1,68,000	2,52,000	21.0	21.0
Prime cost	4,20,000	6,30,000	52.5	52.5
Add factory overheads:				
Fixed	2,00,000	2,50,000	25.0	20.83
Variable overheads	3,36,000	5,04,000	42.0	42.00
Factory cost	9,56,000	13,84,000	119.5	115.33
Add general overheads:				
Fixed	2,40,000	2,64,000	30.0	22.00
Interest charges(Rs 6,00,000 × 0.10 × 1/12)	—	5,000	—	0.42
Cost of production	11,96,000	16,53,000	149.5	137.75
Add selling and distribution overheads:				
Fixed	80,000	96,000	10.0	8.00
Variable	1,26,000	1,89,000	15.75	15.75
Cost of sales	14,02,000	19,38,000	175.25	161.50
Margin of profit	26,000	1,62,000	3.25	13.50
Sales revenue	14,28,000	21,00,000	178.50@	175.00@@

@Sale price would increase by 2 per cent (Rs 175 + Rs 3.50). @@Sale price would remain unchanged.

P.9.6 The following figures are extracted from the books of an iron foundry after the close of the year:

Raw materials opening stock	Rs 14,000
Purchases during the year	1,00,000
Closing inventory	10,000
Direct wages	20,000
Works overhead (50 per cent on direct wages)	

Stores overhead on materials, 10 per cent on the cost of materials, 10 per cent of the casting were rejected being not upto specification and a sum of Rs 800 was realised from sale of scrap; 10 per cent of the finished casting were found to be defective in manufacture and were rectified by expenditure of additional works overhead charges to the extent of 20 per cent on the proportionate direct wages. The total gross output of casting during the year was 2,000 tonnes.

Find out the manufacturing cost of the saleable casting per tonne.

SOLUTION

Cost sheet determining manufacturing cost of the saleable casting

Particulars		*Total cost*	*Cost per unit*
Direct materials consumed:			
Opening stock	Rs 14,000		
Add purchases	1,00,000		
Less closing stock	(10,000)	Rs 1,04,000	Rs 57.778
Direct wages		20,000	11.111
Prime cost		1,24,000	68.889

(*Contd.*)

(*Contd.*)

Add works overheads		
Factory overheads (0.50 × direct wages)	10,000	5.556
Stores overhead (0.10 × Rs 1,04,000)	10,400	5.778
Less scrap realised (0.10 × 2,000 tonnes)	(800)	(0.444)
Rectification cost of 10 per cent of good castings (2,000 tonnes – 200 tonnes) = 1800 tonnes × 0.10 = 180 tonnes) (Rs 20,000 × 180 × 20) ÷ (2,000 × 100)	360	0.200
Manufacturing cost of good castings (1,800 tonnes)	1,43,960	79.98

P.9.7 A company of repute manufactures four varieties of a product, namely, A, B, C, and D. If the company manufactures only one variety, the monthly production can be either 5,000 of A, or 10,000 of B or 15,000 of C or 30,000 of D. From the following information, you are required to find the profit or loss made on each variety, showing direct cost, works cost and total cost:

	A	*B*	*C*	*D*
Actual production in a month	675	1,800	4,050	9,450
Direct wages	Rs 3,000	Rs 5,500	Rs 7,500	Rs 21,000
Direct materials cost	3,500	6,500	9,000	27,500
Sales price per unit	30	20	15	12

Overhead expenses for the month are Rs 81,000. Selling and distribution cost is to be calculated at 10 per cent of works cost. Overhead expenses are to be allocated to each variety on the basis of units produced.

SOLUTION

Statement of costs and profits for products A, B, C, and D

Particulars	*Products*				*Total*
	A	*B*	*C*	*D*	
Direct wages	Rs 3,000	Rs 5,500	Rs 7,500	Rs 21,000	Rs 37,000
Direct materials	3,500	6,500	9,000	27,500	46,500
Prime/Direct cost	6,500	12,000	16,500	48,500	83,500
Add factory overheads (see working notes)	12,150	16,200	24,300	28,350	81,000
Work cost	18,650	28,200	40,800	76,850	1,64,500
Add selling and distribution cost	1,865	2,820	4,080	7,685	16,450
Total cost	20,515	31,020	44,880	84,535	1,80,950
Profit/(Loss)	(265)	4,980	15,870	28,865	49,450
Sales revenue	20,250	36,000	60,750	1,13,400	2,30,400

Working Note

Determination of factory overheads: Production in equivalent units expressed as follows: A, = 5,000 units or B, 10,000 units or C, 15,000 units or D, 30,000 units. Alternatively: 1 unit of A = 2 units of B (10,000 ÷ 5,000); 3 units of C (15,000 ÷ 5,000); 6 units of D (30,000 ÷ 5,000). A: B: C: D = 1:2:3:6. The overhead allocation should be determined by applying weights in the reverse order, that is 6:3:2:1 (A:B:C:D).

Products	*Production (units)*	*Weight*	*Total weighted value*	*Overheads allocated*	
A	675	6	4,050	[(Rs 81,000 × 4,050) ÷ 27,000] =	Rs 12,150
B	1,800	3	5,400	[(Rs 81,000 × 5,400) ÷ 27,000] =	16,200
C	4,050	2	8,100	[(Rs 81,000 × 8,100) ÷ 27,000] =	24,300
D	9,450	1	9,450	[(Rs 81,000 × 9,450) ÷ 27,000] =	28,350
			27,000		81,000

P.9.8 A Company manufactures radios, which are sold at Rs 1,600 per unit. The total cost is composed of 30 per cent for direct materials, 40 per cent for direct wages and 30 per cent for overheads. An increase in material price by 30 per cent and in wage rates by 10 per cent is expected in the following year, as a result of which the profit at current selling price may decrease by 40 per cent per unit. You are required to prepare a statement showing current and future profit at current selling price.

How much selling price should be increased to maintain the present rate of profit?

SOLUTION

Let X represent total cost per unit of radio manufactured and
Let Y represent total profit per radio sold. Thus
X + Y = Rs 1,600 (1)

Statement showing present and future cost per radio

Particulars	*Cost per unit*		
	Present	*Increase by*	*Future*
Direct material	0.30 X	0.09 X	0.39 X
Direct wages	0.40 X	0.04 X	0.44 X
Overheads	0.30 X	—	0.30 X
	X	0.13 X	1.13 X

Due to increase in total cost per unit (to 1.13 X), profits decrease by 40 per cent i.e., (to 0.6Y). As a result the new equation is

1.13X + 0.6Y = Rs 1,600 (2)

The two equations are: X + Y = Rs 1,600 (1)

1.13X + 0.6Y = Rs 1,600 (2)

Multiplying equation 1 by 1.13, we have

1.13X + 1.13Y = Rs 1,808

1,13X + 0.6Y = 1,600

or 0.53Y = Rs 208 or Y(Profit) = Rs 392.45 (Rs 208/0.53)

X (Cost) = Rs 1,600 – Rs 392.45 = Rs 1,207.55

Current profit per radio sold = Rs 392.45

Current cost per radio produced = Rs 1,207.55

Future cost per radio (Rs 1207.55 × 1.13) Rs 1,364.53

Future profit per radio at present selling price (Rs 1,600 – Rs 1,364.53) = Rs 235.47

Present rate of profit (say on cost) Rs 392.45/Rs 1,207.55 = 32.5 per cent

Statement showing selling price per radio to earn present rate of profit (32.5%)

Particulars	*Amount*
Direct material cost (Rs 1,207.55 × 0.39)	Rs 470.94
Direct wages (Rs 1,207.55 × 0.44)	531.32
Overheads (Rs 1.207.55 × 0.30)	362.27
Expected future cost	1,364.53
Profit margin per unit desired (Rs 1364.53 × 0.325)	443.47
Selling price (revised)	1,808.00

P.9.9 A Ltd has capacity to produce 1,00,000 units of a product every month. Its works cost at varying levels of production is as under:

Level (%)	*Works cost per unit*
10	Rs 400
20	390
30	380
40	370
50	360
60	350
70	340
80	330
90	320
100	310

Its fixed administration expenses amount to Rs 1,50,000 and fixed marketing expenses amount to Rs 2,50,000 per month respectively. The variable distribution cost amounts to Rs 30 per unit.

It can market 100 per cent of its output at Rs 500 per unit provided it incurs the following further expenditure:

(a) It gives gift items costing Rs 30 per unit of sale;
(b) It has lucky draws every month giving the first prize of Rs 50,000; 2nd prize of Rs 25,000, 3rd prize of Rs 10,000 and three consolation prizes of Rs 5,000 each to customers buying the product;
(c) It spends Rs 1,00,000 on refreshments served every month to its customers;
(d) It sponsors a television programme every week at a cost of Rs 20,00,000 per month;

It can market 30 per cent of its output at Rs 550 per unit without incurring any of the expenses referred to in (a) to (d) above.

Advise the company on its course of action. Show the supporting cost sheets.

SOLUTION

Comparative cost sheet showing profit at 30 per cent and 100 per cent level of capacity

	Capacity 30% (30,000 units)		*Capacity 100% (1,00,000 units)*	
Particulars	*per unit*	*per unit*	*Per unit*	*Per unit*
Works cost	Rs 380	Rs 1,14,00,000	Rs 310	3,10,00,000
Add fixed administration costs	5	1,50,000	1.50	1,50,000
Cost of production	385	1,15,50,000	311.50	3,11,50,000
Add marketing expenses:				
Fixed	8.33	2,50,000	2.50	2,50,000
Variable	30.00	9,00,000	30.00	30,00,000

(*Contd.*)

(*Contd.*)

Sales promotion expenses planned				
Gift items costs	—	—	30.00	30,00,000
Customers' prizes	—	—	1.00	1,00,000
Refreshments	—	—	1.00	1,00,000
Television programme cost	—	—	20.00	20,00,000
Cost of sales	423.33	1,27,00,000	396.00	3,96,00,000
Profit (balancing figure)	126.67	38,00,000	104.00	1,04,00,000
Sales revenue	500.00	1,65,00,000	500.00	5,00,00,000

Advice: The company is advised to spend money on sales promotion expenses. This will enable it to sell at 100 per cent capacity and earn higher profits (of Rs 1.04 crore).

P.9.10 From the following data calculate the cost per km of a vehicle.

Value of vehicle	Rs 15,000
Road license for the year	500
Insurance charges per year	100
Garage rent per year	600
Driver's wages per month	200
Cost of petrol per litre	0.80
Proportional charge for tyre and maintenance per km	0.20
Estimated life (kms)	1,50,000
Estimated annual mileage (kms)	6,000
Petrol consumption (kms/litre)	8

SOLUTION

Operating cost statement to determine cost per km

Particulars	*Total annual cost of 6,000 kms*	*Cost per km*
(A) Standing charges:		
Road licence fee for the year	Rs 500	Rs 0.083
Insurance charges for the year	100	0.017
Garage rent per year	600	0.100
Driver's wages per year (Rs 200 × 12)	2,400	0.400
Total	3,600	0.600
(B) Running charges:		
Depreciation of vehicle (Rs 15,000 × 6,000) ÷ 1,50,000	600	0.100
Cost of petrol (Rs 0.80 × 6,000) ÷ 8	600	0.100
Tyre and maintenance	1,200	0.200
Total	2,400	0.400
(C) Total running cost per km (A+B)	6,000	1.00

P.9.11 A transport service company is running four buses between two towns, 50 kms apart. Seating capacity of each bus is 40 passengers. The following particulars were obtained from their books:

Wages of drivers, conductors and cleaners	Rs 2,400
Salaries of office and supervisory staff	1,000
Diesel and other oil	4,000
Repairs and maintenance	800
Taxation, insurance, etc.	1,600
Depreciation	2,600
Interest and other charges	2,000
	14,400

Actual passengers carried were 75 per cent of the full capacity. All the four buses run on all days of the month. Find out the cost per passenger-km.

SOLUTION

Operating cost statement determining cost per passenger-km (3,60,000 passenger-kms)

Particulars	*Total cost*	*Cost per passenger-km*
(A) *Standing charges:*		
Wages of drivers, conductors and cleaners	Rs 2,400	Rs 0.007
Salaries of office and supervisory staff	1,000	0.003
Taxation, insurance, etc.	1,600	0.004
Interest and other charges	2,000	0.005
Total	7,000	0.019
(B) *Running charges:*		
Diesel and other oils	4,000	0.011
Repairs and maintenance	800	0.002
Depreciation	2,600	0.007
Total	7,400	0.021*
(C) Total cost per passenger-km (A+B)	14,400	0.040

Working Notes

Determination of passenger-kms = (Buses × capacity × distance × 2 × days) × 0.75 = (4 × 50 × 40 × 2 × 0.75) = 3,60,000.

P.9.12 The Delhi Bus Company Ltd operates a number of buses in Delhi city. The firm's buses make 200 trips per week with an average distance of 50 kms. Fares are Rs 0.10 per km per passenger and each bus can carry 40 passengers. The firm has the following cost structure.

Driver's pay, Rs 200 per week per driver	Rs 4,000
Conductors' pay, Rs 150 per week per conductor	3,000
Other salaries and wages	3,000
Depreciation and maintenance of buses	5,000
Petrol, diesel and variable costs (per bus per km)	1

Determine the firm's weekly income if it operates with its buses on an average 75 per cent utilisation.

SOLUTION

Statement of operating cost and profit for a week (3,00,000 passenger-kms)

Particulars		*Amount*
(A) Revenue (3,00,000 × Rs 0.10)		Rs 30,000
(B) *Operating costs*		
(a) *Standing charges:*		
Driver's pay	Rs 4,000	
Conductor's pay	3,000	
Other salaries and wages	3,000	
Total	10,000	
(b) *Running costs:*		
Depreciation and maintenance	5,000	
Petrol, diesel and other variable costs (Rs 1 × 10,000 kms)	10,000	
Total	15,000	
(c) Total costs (a+b)		25,000
(C) Profit (A – B)		5,000

Determination of passenger-kms = (Trips × kms × passengers capacity) × 0.75 = (200 × 50 × 40) × 0.75 = 3,00,000 kms

P.9.13 Iron ore is transported from two mines, A and B and unloaded at plots in a railway station. A is at a distance of 10 kms and B is at a distance of 15 kms from the railway plots. A fleet of lorries of 5-tonne carrying capacity is used for transport of ore from mines. Records reveal that lorries average a speed of 30 kms per hour when running and regularly take 10 minutes to unload at the railhead. At mine A, loading time averages 30 minutes per load while at mine B, loading time averages 20 minutes per load.

Driver's wages, depreciation, insurance, and taxes are found to cost Rs 9 per hour of operating. Fuel, oil, tyres, repairs and maintenance cost Rs 1.20 per km. Draw up a statement shownig the per tonne-km cost of carrying iron ore from each mine.

SOLUTION

Operating cost statement determining cost per tonne-km of carrying iron ore from two mines, A and B

		Mine A	*Mine B*
1.	Distance from railway station (one way) (kms)	10	15
2.	Distance from railway station (both ways or length of journey per trip)	20	30
3.	Speed of lorries (kms per hour)	30	30
4.	Time taken per trip (2) ÷ (3) (minutes)	40	60
5.	Loading time at mines (minutes)	30	20
6.	Unloading time at railway station (minutes)	10	10
7.	Total time taken per trip (4 + 5 + 6)	80	90
8.	Driver's wages, depreciation, insurance and taxes per hour (Rs)	9	9
9.	Driver's wages, depreciation insurance etc. per trip	12*	13.50**
10.	Fuel, oil, tyres, repairs and maintenance cost (Rs per km)	1.20	1.20
11.	Fuel oil, tyres, repairs, etc. per trip (2) × (10)	24	36
12.	Total cost (9 + 10)	36	49.50
13.	Total tonne-kms (kms × capacity)	50	75
14.	Cost per tonne-km (12 ÷ 13) (Rs)	0.72	0.66

* = (80 × Rs 9) ÷ 60 ** = (90 × Rs 9) ÷ 60

P.9.14 A transport company supplies the following details in respect of a truck of 5 tonne capacity.

Cost of truck	Rs 1,80,000
Diesel, oil, grease (per trip each way)	30
Repairs and maintenance (per month)	1,500
Driver's (monthly) wages	1,500
Cleaner-cum-attendant's wages (monthly)	750
Insurance (per year)	9,000
Road licence (per year)	3,600
General supervision charges (per year)	6,000
Estimated life (years)	10

The truck carries goods to and from the city covering a distance of 50 kms each way. While going to the city, freight is available for a full load of the truck and on its return journey it can fetch freight only up to 20 per cent of its capacity.

On the assumption that the truck runs on an average 25 days a month, you are required to determine the following: (i) Operating cost per tonne-km, (ii) Rate per tonne per trip that the company should charge if profit of 100 per cent on cost is to be earned, and (iii) What price would you charge if one wants to engage the truck for one day for a trip to the city and back?

SOLUTION

Operating cost statement to determine cost per km

Particulars	*Total cost per month of 7,500 tonne-kms*	*Cost per tonne-km*
(A) *Standing charges*		
Driver's wages	Rs 1,500	Rs 0.200
Cleaner-cum-attendant's wages	750	0.100
Insurance (Rs 9,000 ÷ 12)	750	0.100
Road licence (Rs 3,000 ÷ 12)	250	0.033
General supervision (Rs 6,000 ÷ 12)	500	0.067
Total	3,750	0.500
(B) *Running charges*		
Depreciation Rs 1,80,000 ÷ (12 × 10)	1,500	0.200
Diesel, oil, grease (Rs 30 × 50 trips that is, 2 trips daily for 25 days)	1,500	0.200
Repairs and maintenance	1,500	0.200
Total	4,500	0.600
(C) *Total cost per tonne-km (A+B)*	8,250	1.100

Working Notes

(i)	*Determination of tonne-km per month:*	
	*Trip to city:*50 kms ×5 tonnes capacity × 25 days	6,250
	*Return back from city:*50 kms × 25 days×1 tonne	1,250
		7,500
(ii)	Determination of freight rate:	
	Cost per tonne	Rs 1.10
	Add desired profit of 100 per cent of cost	1.10
	Freight rate per tonne-km	2.20
(iii)	*Quotation price:*	
	Feight tonne-km in both trips (250 + 50)	300
	Multiplied by freight rate per tonne-km	Rs 2.20
		660

P.9.15 A transport service company is running five buses between two towns which are 50 kms apart. Seating capacity of each bus is 50 passengers. The following particulars were obtained from their books for April related to current year:

Wages of drivers, conductors and cleaners	Rs 24,000
Salaries of office staff	10,000
Diesel oil and other oil	35,000
Repairs and maintenance	8,000
Taxation, insurance, etc.	16,000
Depreciation	26,000
Interest and other expenses	20,000
	1,39,000

Actual passengers carried were 75 per cent of seating capacity. All buses ran on all days of the month. Each bus made one round trip per day.

Find out the cost per passenger km.

SOLUTION

Operating cost statement to determine cost per km.

Particulars		*Total cost*
(A) Standing charges		
Wages of drivers, conductors and cleaners	Rs 24,000	
Salaries of office staff	10,000	
Taxation, insurance, etc	16,000	
Interest and other expenses	20,000	Rs 70,000
(B) Running charges		
Diesel oil and other oil	Rs 35,000	
Repairs and maintenance	8,000	
Depreciation	26,000	69,000
(C) Total cost		1,39,000
Divided by Passenger – kms		
(Buses × capacity × distance × 2 × actual capacity used × 30 days)		
i.e. (5 × 50 passengers × 50 kms × 2 trips × 0.75 capacity × 30 days)		
		5,62,500
(D) Cost per passenger km (Rs 1,39,000/5,62,500 kms)		Re. 0.2471

REVIEW QUESTIONS

RQ.9.1 Define unit costing. Name the industries to which this type of costing is most appropriate.

RQ.9.2 "Cost sheet and production account differ in presentation only." Elucidate the statement.

RQ.9.3 "Cost recording procedure in unit costing is considerably simplified." Explain.

RQ.9.4 How would you deal with the following items in a cost sheet (i) Wastage and scrap; (ii) By-products; (iii) Rectification cost of defective work; (iv) Work-in-process valued at prime cost or factory cost; (v) Carriage on purchase.

RQ.9.5 What is operating costing? Describe the type of industries in which such a system would be suitable.

RQ.9.6 Why is operating costing called service costing? Describe in brief the cost accumulating procedure under operating costing.

RQ.9.7 "Classification of total costs into fixed and variable costs and determination of cost unit are the two essential pre-requisites of operating costing." Explain the statement with suitable illustrations.

RQ.9.8 Describe in brief the usefulness of operating costing with the help of suitable illustrations.

RQ.9.9 Mr Gopal furnishes the following data relating to manufacture of a standard product during the month of April:

Raw material consumed	Rs 15,000
Direct labour charges	9,000
Machine-hours worked	900
Machine-hour rate	5
Administrative overheads (percentage of works cost)	20
Selling overheads (per unit sold)	0.50
Units produced	17,100
Units sold (at Rs 4 per unit)	16,000

Your are required to prepare a cost sheet from the above, showing:
(a) The cost per unit and a break-up of the total cost.
(b) Profit per unit sold and profit for the period.

SOLUTION

(a) *Cost sheet for the month of April*

Particulars	*Total cost (17,100 units)*	*Cost per unit*
Direct raw material used	Rs 15,000	Rs 0.8772
Direct labour charges	9,000	0.5263
Prime Cost	24,000	1.4035
Add factory overheads: (Machine hours × machine-hour rate, i.e. 900 × Rs 5)	4,500	0.2632
Factory Cost/Works Cost	28,500	1.6667
Add administrative overheads: 20% on works cost	5,700	0.3333
Cost of Production	34,200	2.0000

(b) *Statement showing profit per unit sold and total profit for the month of April*

Particulars	*Total (16,000 units)*	*Per unit*
Cost of goods sold	Rs 32,000	Rs 2.0
Add selling overheads	8,000	0.5
Cost of Sales	40,000	2.5
Profit (balancing figure)	24,000	1.5
Sales Revenue	64,000	4.0

RQ.9.10 Gem Ltd manufactures refrigerators. The following details are furnished in respect of its factory operations for the year ended December 31:

Work-in-progress, January 1 at prime cost	Rs 51,000	
Manufacturing expenses	15,000	Rs 66,000
Work-in-progress, December 31 at prime cost	45,000	
Manufacturing expenses	9,000	54,000
Stock of raw materials, January I		2,25,000
Purchase of raw material		4,77,000
Direct labour		1,71,000
Manufacturing expenses		84,000
Stock of raw material, December 31		2,04,000

On the basis of above data, prepare a statement showing the cost of production. Also indicate separately the amount of manufacturing expenses which enter into the cost of production.

SOLUTION

Production statement for the year ending December 31

Particulars		*Total cost*
Direct materials consumed:		
Opening stock	Rs 2,25,000	
Add purchases	4,77,000	
Less closing stock	2,04,000	Rs 4,98,000

(*Contd.*)

(*Contd.*)

Direct labour		1,71,000
Add opening work-in-progress		51,000
Less closing work-in-progress		45,000
Prime Cost		6,75,000
Add factory overheads		
Manufacturing expenses relevant for current year's production:		
Incurred to complete opening work-in-process	Rs 15,000	
Incurred to complete units introduced during the year (Rs 84,000 – Rs 9,000 included in closing work-in-process)	75,000	90,000
Factory Cost/Cost of Production[@]		7,65,000

[@]As there are no administrative costs.

RQ.9.11 The following particulars relate to M/s A & Company Ltd:

(i) Estimated material cost of Job, Rs 50,000 and the direct labour cost is likely to be Rs 10,000.
(ii) In the machine shop, it will require working by German machine for 20 hours and Japanese machine for 6 hours.
(iii) The machine-hour rates for German and Japanese machine are Rs 100 and Rs 150 respectively.
(iv) The direct wages in all the other shops last year amounted to Rs 8,00,000 as against Rs 4,80,000 factory overheads.
(v) Last year, factory cost of all the jobs amounted to Rs 25,00,000 as against Rs 3,75,000 for office expenses. Make out a quotation with 20 per cent profit on the selling price.

SOLUTION

Statement of cost of production and profit to determine bid price

Particulars		*Total cost*
Material cost		Rs 50,000
Direct wages		10,000
Prime Cost		60,000
Add factory overheads:		
German machine – (20 hours × Rs 100)	Rs 2,000	
Japanese machine – (6 hours × Rs 150)	900	2,900
Other factory overheads: [0.60 i.e. (Rs 4,80,000 ÷ Rs 8,00,000) × Rs 10,000 direct wages]		6,000
Factory Cost		68,900
Add office overheads: [0.15 i.e. (Rs 3,75,000 ÷ Rs 25,00,000) × factory cost]		10,335
Cost of Production		79,235
Add profit margin (20% on selling price or 25% of cost)		19,808.75
Bid Price		99,043.75

RQ.9.12 The working results of a section of a company engaged in the production and sale of machine X for the current year with estimates for the next year are as furnished below:

Particulars	*Current year*	*Next year*
(i) Raw material	150	200
(ii) Spares and purchased parts	250	300
(iii) Indirect materials and consumables	120	160

(*Contd.*)

(*Contd.*)

(iv) Factory power	100	120
(v) Direct labour cost	400	440
(vi) Factory overheads	330	400
Factory cost	1,350	1,620
(vii) Selling and administrative expenses	350	400
Cost of sales	1,700	2,020
(viii) Profit per machine	300	380
Selling price	2,000	2,400
(ix) Income: Profit on sale of 2,500 machines	7,50,000	9,50,000

It is proposed to produce only 2,000 machines next year and sell the same at Rs 2,500 per unit. The statement may be recast taking into consideration the following costs:

(a) Spares and purchased parts would cost Rs 320 per unit next year.
(b) Use of generator sets due to power cuts would cost Rs 150 per machine instead of Rs 120.
(c) Lay-off wages and so on would increase labour costs per machine by Rs 20 than the estimated amount.
(d) Variable expenses under factory overheads will increase by Rs 10 per machine. This head for both the years includes a sum of Rs 3,70,000 which is fixed.
(e) The apportionment of selling and administrative expenses for this section will be reduced by Rs 1,49,000 for the next year.

SOLUTION

Statement showing cost of production and profit during current year and next year

Particulars	*Total cost*		*Cost per machine*	
	Current year (2,500 machines)	*Next year (2,000 machines)*	*Current year*	*Next year*
Raw material	Rs 3,75,000	Rs 4,00,000	Rs 150	Rs 200
Spares and purchased parts	6,25,000	6,40,000	250	320
Direct labour cost	10,00,000	9,20,000	400	460
Prime Cost	20,00,000	19,60,000	800	980
Add factory overheads				
Indirect materials and consumables	3,00,000	3,20,000	120	160
Factory power	2,50,000	3,00,000	100	150
Factory overheads *(working note 1)*	8,25,000	8,94,000	330	447
Factory Cost	33,75,000	34,74,000	1,350	1,737
Add selling and administrative overheads *(working note 2)*	8,75,000	8,51,000	350	425.50
Cost of Sales	42,50,000	43,25,000	1,700	2,162.50
Profit (balancing figure)	7,50,000	6,75,000	300	337.50
Sales Revenue	50,00,000	50,00,000	2,000	2,500

Working Notes

1. *Determination of factory overheads*

Total factory overheads estimated (Rs 400 × 2,500)	Rs 10,00,000
Less fixed factory overheads	3,70,000
Variable factory overheads	6,30,000
Variable factory overheads per machine (Rs 6,30,000 ÷ 2,500)	252
Add increase in variable overheads per machine	10
	262
Revised estimate of variable overheads per machine	262
Fixed factory overheads per machine (Rs 3,70,000 ÷ 2,000)	185
Total factory overheads per machine	447

2. *Determination of selling and administrative expenses*

Total expenses (Rs 400 × 2,500)	10,00,000
Less reduction in expenses	1,49,000
Revised expenses	8,51,000
Selling and administrative expenses per machine (Rs 8,51,000 ÷ 2,000)	425.50

RQ.9.13 The following details are obtained from the cost records of Comet Paints Ltd for the month of September:

Stock of raw materials, September I	Rs 75,000
Stock of raw materials, September 30	91,500
Direct wages	52,500
Indirect wages	2,750
Sales	2,11,000
Work-in-progress, September 1	28,000
Work-in-progress, September 30	35,000
Purchase of raw materials	66,000
Factory rent, rates and power	15,000
Expenses on purchases	1,500
Carriage outwards	2,500
Advertising	3,500
Office rent and taxes	2,500
Travellers' wages and commission	6,500
Stock of finished goods, September I	54,000
Stock of finished goods, September 30	31,000
Depreciation of plant and machinery	3,500

Prepare a production account giving the maximum possible break-up of costs and profits for the month of September.

SOLUTION

Production account for the month of September

Particulars		*Dr. Amount*	*Particulars*	*Cr. Amount*
To Direct materials:			By Prime cost c/d	Rs 1,03,500
Opening stock	Rs 75,000			
Add purchases	66,000			
Less closing stock	91,500	Rs 49,500		

(*Contd.*)

(*Contd.*)

To Direct wages	52,500		
To Expenses on purchases	1,500		
	1,03,500		1,03,500
To Prime cost b/d	1,03,500	By Closing work-in-progress	35,000
To Opening work-in-progress	28,000	By Factory cost c/d	1,17,750
To Indirect wages	2,750		
To Factory rent, rates and power	15,000		
To Depreciation of plant and machinery	3,500		
	1,52,750		1,52,750
To Factory cost b/d	1,17,750	By Cost of production c/d	1,20,250
To Office rent and taxes	2,500		
	1,20,250		1,20,250
To Opening stock	54,000	By Closing stock	31,000
To Cost of production b/d	1,20,250	By Cost of goods sold c/d	1,43,250
	1,74,250		1,74,250
To Cost of goods sold b/d	1,43,250	By Cost of sales c/d	1,55,750
To Carriage outwards	2,500		
To Advertising	3,500		
To Travellers' wages and commission	6,500		
	1,55,750		1,55,750
To Cost of sales b/d	1,55,750	By Sales	2,11,000
To Profit & loss A/c (balancing figure)	55,250		
	2,11,000		2,11,000

RQ.9.14 The owner of a small undertaking consults you as to the minimum price at which he can sell the output of one of his departments which is intended for mass production. The company's record shows the following particulars for this department for the past year:

Production and sales (units)	100
Material	Rs 13,000
Direct labour	7,000
Direct charges	1,000
Work oncost	7,000
Office oncost	2,800
Selling oncost	3,200
Profit	5,000
	39,000

You ascertain that 40 per cent of the work oncost fluctuated directly with production and 70 per cent of selling oncost fluctuates with sales. It is anticipated that the department would produce 500 units per annum and the direct labour charges will be reduced by 20 per cent while fixed work on cost charges will increase by Rs 3,000. Office oncost and fixed selling oncost are anticipated to show increase of 25 per cent but otherwise no changes are expected. Prepare a statement for submission to your client.

SOLUTION

Cost sheet to determine selling price

Particulars		*Total cost (500 units)*	*Cost per unit*
Material cost		Rs 65,000	Rs 130
Direct labour		28,000	56
Direct charges		5,000	10
Prime Cost		98,000	196
Add Factory/Works oncost			
Fixed cost (existing) (Rs 7,000 × 0.60)	Rs 4,200		
Incremental fixed costs	3,000		
Variable costs @ Rs 28 per unit	14,000	21,200	42.4
		1,19,200	238.4
Add office oncost			
Existing	2,800		
Incremental (Rs 2,800 × 0.25)	700	3,500	7.0
Cost of Production		1,22,700	245.4
Add selling overheads			
Fixed (existing) (Rs 3,200 × 0.30)	960		
Incremental fixed costs (Rs 960 × 0.25)	240		
Variable costs @ Rs 22.4 per unit	11,200	12,400	24.8
Cost of Production		1,35,100	270.2
Add profit margin @ 14.7% of cost price (based on existing profit margin, i.e Rs 5,000 ÷ Rs 34,000)		19,860	39.7
Selling Price		1,54,960	309.9

RQ.9.15 A manufacturing company has an installed capacity of 1,20,000 units per annum. The cost structure of the products manufactured is as under:

(i) Variable cost (per unit)

Material	Rs 8
Labour (subject to a minimum of Rs 56,000 per month)	8
Overheads	3

(ii) Fixed overheads, Rs 1,04,000 per annum.

(iii) Semi-variable overheads, Rs 48,000 per annum at 60 per cent capacity, which increases by Rs 6,000 per annum for an increase of every 10 per cent of capacity utilisation or any part thereof.

The capacity utilisation for the next year is estimated at 60 per cent for 2 months, 75 per cent for 6 months, and 80 per cent for the rest of the year. If the company is planning to have a profit of 25 per cent on the selling price, calculate the estimated selling price for each unit of production. Assume there is no opening or closing stock.

SOLUTION

(i) *Budgeted production and sales for the year*

Percentage of capacity (1)	*Number of units per month* (2)*	*Number of months (3)*	*Budgeted production and sales (2 × 3) (4)*
60	6,000	2	12,000
75	7,500	6	45,000
80	8,000	4	32,000
			89,000

*1,20,000 units per annum ÷ 12 months = 10,000 units per month at 100 per cent capacity.

(ii) *Wages (Rs 8 per unit subject to minimum of Rs 56,000)*

Number of units per month	*Wages per month*	*Total wages*
6,000 (for 2 months)	Rs 56,000	Rs 1,12,000
7,500 (for 6 months)	60,000	3,60,000
8,000 (for 4 months)	64,000	2,56,000
		7,28,000

(iii) *Semi-variable Costs*

For 2 months at 60 per cent capacity = (Rs 48,000 × 2) ÷ 12	Rs 8,000
For 6 months at 75 per cent capacity = (Rs 60,000 × 6) ÷ 12	30,000
For 4 months at 80 per cent capacity = (Rs 60,000 × 4) ÷ 12	20,000
	58,000

Statement showing budgeted costs and profits for 89,000 units

Particulars	*Total cost*
Material cost (89,000 × Rs 8)	Rs 7,12,000
Wages	7,28,000
Variable overheads (89,000 × Rs 3)	2,67,000
Semi-variable costs	58,000
Fixed overheads	1,04,000
Total cost of production	18,69,000
Add desired profit margin [(1/4 on selling price or 1/3 on cost (1/3 × Rs 18,69,000)]	6,23,000
Budgeted sales revenue	24,92,000
Selling price per unit (Rs 24,92,000 ÷ 89,000 units)	28

RQ.9.16 Rohit has a small furniture factory. He specialises in the manufacture of small dining tables of standard size, of which he can make 15,000 in a year. The cost per table worked out as under for the previous year when he made and sold 10,000 tables:

Materials	Rs 30
Labour	10
Overheads (fixed) recovered @ 50% of material cost	15
Total cost	55

Prices are fixed by adding a standard margin of 10 per cent to the total cost arrived at above.
In the current year, due to a fall in the cost of materials, total cost worked out as under;

Materials	Rs 20
Labour	10
Overheads recovered @ 50% of material cost	10
40	

Mr. Rohit maintained his standard margin of 10 per cent on the cost of sales. Sales were at the previous year's level. You are required to:

(i) Determine profit or loss for the previous year, and

(ii) Compute the price which should have been charged in the current year to yield the same profit (loss) as in the previous year.

SOLUTION

(i) *Statement of profit for previous year*

Particulars			*Amount*
Sales revenue (Rs 60.5 × 10,000 units) (Rs 55 cost per unit + 10% margin)			Rs 6,05,000
Less costs			
Material	(Rs 30 × 10,000 units)	Rs 3,00,000	
Labour	(Rs 10 × 10,000 units)	1,00,000	
Fixed overheads	(Rs 15 × 10,000 units)	1,50,000	5,50,000
Profit			55,000

Note: It is assumed that fixed overheads charged to production match with actual fixed overheads.

(ii) *Statement of cost to determine selling price*

Material cost (Rs 20 × 10,000)	Rs 2,00,000
Labour costs (Rs 10 × 10,000)	1,00,000
Fixed overheads	1,50,000
Total costs	4,50,000
Desired profit	55,000
Total desired sales revenue	5,05,000
Selling price per unit (Rs 5,05,000 ÷ 10,000)	50.50

RQ.9.17 An entrepreneur owns a bus which runs from Delhi to Agra and back for 25 days in a month. The distance from Delhi to Agra is 170 kms. The bus completes the trip from Delhi to Agra and back on the same day. Calculate the fare the entrepreneur should charge a passenger if he wants to earn a profit of 33.33 per cent on cost. The following information is further available:

Cost of bus	Rs 3,00,000
Salary of driver per month	1,050
Salary of conductor per month	700
Salary of part-time accountant per month	480
Insurance per annum	6,720
Diesel consumption 16 kms. per gallon costing	25
Local taxes per annum	1,200
Lubricant oil per 100 kms	20
Repairs and maintenance per annum	1,000
Licence fee per annum	2,840
Normal capacity (person)	50
Depreciation rate per annum	20

The bus usually runs full up to 90 per cent of its capacity both ways. Interest is payable on the cost of bus at 10 per cent per annum.

SOLUTION

Operating cost statement to determine the fare of running a bus from Delhi to Agra per passenger-km

Particulars	*Total cost*	
(I) Standing charges		
Salary of driver (Rs 1,050 × 12)	Rs 12,600	
Salary of conductor (Rs 700 × 12)	8,400	
Salary of part-time accountant (Rs 480 × 12)	5,760	
Insurance	6,720	
Local taxes	1,200	
Licence fee	2,840	
Interest (0.10 × Rs 3,00,000)	30,000	
	67,520	
(II) Running charges		
Deprecation of bus (0.20 × Rs 3,00,000)	60,000	
Diesel cost per annum [(170 × 2 × 25 day × 12 months) × Rs 25] ÷ 16	1,59,375	
Lubricant oil (1,02,000 kms × Rs 20) ÷ 100	20,400	
Repairs and maintenance per annum	1,000	
	2,40,775	
(III) Total charges (I + II)	3,08,295	
(IV) Total passenger-kms in a year: (170 × 2 × 25 days × 12 months × 45 persons)	45,90,000	
(V) Cost per passenger-km. (III ÷ IV)		0.067
(VI) *Add* desire profit ($33^1/_3$% on cost)		0.022
Fare per passenger-km		0.089
Fare charges (Re 0.089 × 170 kms.)		15.13

RQ.9.18 A factory which uses a large amount of coal is situated between two collieries, X and Y, with both being at a distance of 5 and 10 kms, respectively, from the factory. A fleet of lorries of 5 tonnes carrying capacity is used for collecting coal from the pitheads. The lorries average a speed of 20 kilometres per hour when running and generally take 10 minutes to unload in the factory premises. At colliery X, loading time averages 30 minutes per load, while at colliery Y it is 20 minutes per load.

Driver's wages, licences, insurance, depreciation, garage, and similar charges cost Rs 6 per hour operated. Fuel, oil, tyres repairs, and similar charges cost 60 paise per km run.

Draw up a statement showing the cost per-tonne-kilometre of carrying coal from each colliery. If the coal is of same quality and price at pithead, which of the collieries should the company prefer to make purchases?

SOLUTION

Statement showing cost per ton – km of carrying coal from collieries X and Y

Particulars	*Colliery X*	*Colliery Y*
(I) Time taken per trip (minutes)	30	60
Loading time	30	20
Unloading time	10	10
	70	90

(*Contd.*)

(*Contd.*)

(II)	Standing charges per trip at the rate of Rs 6 per hour	Rs 7.0	Rs 9.0
(III)	Running charges @ 60 paise per km run	6.0	12.0
(IV)	Total cost per trip (ii + iii)	13.0	21.0
(V)	Tonne-kms	25	50
(VI)	Cost per tonne-km (iv ÷ v)	0.52	0.42
(VII)	Carrying cost per tonne	2.6	4.2

Conclusion: The coal purchases should be made from colliery X.

RQ.9.19 Union Transport Company Ltd supplies the following details in respect of a truck of a 5-tonne capacity:

Cost of truck	Rs 90,000
Estimated life (years)	10
Diesel, oil, grease, etc. per trip each way	15
Repairs and maintenance per month	500
Driver's wages per month	500
Cleaner's wages per month	250
Insurance per month	4,800
Tax per year	2,400
General supervision charges per year	4,800

The truck carries goods to and from the city covering a distance of 50 kms each way.
On outward trip, freight is available up to the full capacity and on return trip, 20 per cent of capacity.
Assume that the truck runs on an average of 25 days a month. Work out:

(a) Operating cost per tonne-km, and
(b) Rate per tonne per trip that the company should charge if a profit of 50 per cent on freight is to be earned.

SOLUTION

(a) *Statement showing operating cost per tonne-km*

	Particulars			*Total cost*
(i)	Standing charges per month			
	Driver's wages			Rs 500
	Cleaner's wages			250
	Insurance (Rs 4,800 ÷ 12 months)			400
	Taxes (Rs 2,400 ÷ 12 months)			200
	General supervision (Rs 4,800 ÷ 12 months)			400
				1,750
(ii)	Running charges per month			
	Depreciation (Rs 90,000 ÷ 120 months)			750
	Diesel, oil, grease (Rs 15 per trip × 2 times a day × 25 days)			750
	Repairs and maintenance			500
				2,000
(iii)	Total operating costs per month (i + ii)			3,750
(iv)	Tonne-kms per month			
	Outward trip (5 tonnes × 50 kms × 25 days)	6,250		
	Return trip (1 tonne × 50 kms × 25 days)	1,250	7,500	
(v)	Cost per tonne per km (iii ÷ iv)			0.50

(b) *Freight Rate Per Km*

Cost per tonne per km	Re. 0.50
Add 50% profit on freight rate (100% on cost)	0.50
	1.00

RQ.9.20 Mr. Ahuja runs a tempo service in the town and has two vehicles. He furnishes you the following data from which you have to compute the cost per running mile:

	Vehicle A	*Vehicle B*
Cost of vehicle	Rs 25,000	Rs 15,000
Road licence per year	750	750
Supervision and salary (yearly)	1,800	1,200
Driver's wages per hour	4	4
Cost of fuel per litre	1.50	1.50
Repairs and maintenance per mile	1.50	2.00
Tyre cost per mile	1.00	0.80
Garage rent per year	1,600	550
Insurance premium (yearly)	850	500
Miles run per litre	6	5
Mileage run during the year	15,000	6,000
Estimated life of vehicles (miles)	1,00,000	75,000

Charge interest at 10 per cent per annum on the cost of vehicle. The vehicles run 20 miles per hour on an average.

SOLUTION

Operating cost statement to compute cost per running mile of vehicles A and B

Particulars	*Total cost*	
	Vehicle A	*Vehicle B*
(i) *Standing charges per year:*		
Road licence	Rs 750	Rs 750
Supervision and salary	1,800	1,200
Garage rent	1,600	550
Insurance premium	850	500
Interest	2,500	1,500
Total	7,500	4,500
Mileage run during the year	15,000	6,000
Standing charges per mile	(a) 0.50	0.75
(ii) *Running charges per mile:*		
Depreciation	0.25	0.20
Driver's wages (Rs 4 ÷ 20 miles)	0.20	0.20
Fuel costs	0.25	0.30
Repairs and maintenance	1.50	2.00
Tyre cost	1.00	0.80
	(b) 3.20	3.50
(iii) Operating cost per mile (a + b)	3.70	4.25

EXAMINATION QUESTIONS

EQ. 9.1 Operation costing is defined as refinement of process costing. (*CA—May 2007*)

EQ. 9.2 A fire occurred in the factory premises on October 31, 2003. The accounting records have been destroyed. Certain accounting records were kept in another building. They reveal the following for the period September 1, 2003 to October 31, 2003:

(i)	Direct materials purchased	Rs 2,50,000
(ii)	Work in process inventory, 1.9.2003	40,000
(iii)	Direct materials inventory, 1.9.2003	20,000
(iv)	Finished goods inventory, 1.9.2003	37,750
(v)	Indirect manufacturing costs	40% of conversion cost
(vi)	Sales revenues	7,50,000
(vii)	Direct manufacturing labour	2,22,250
(viii)	Prime costs	3,97,750
(ix)	Gross margin percentage based on revenues	30%
(x)	Cost of goods available for sale	5,55,775

The loss is fully covered by insurance company. The insurance company wants to know the historical cost of the inventories as a basis for negotiating a settlement, although the settlement is actually to be based on replacement cost, not historical cost.

Required:

(i) Finished goods inventory, 31.10.2003 (ii) Work-in-process inventory, 31.10.2003 (iii) Direct materials inventory, 31.10.2003. (*CA—November, 2003*)

SOLUTION

(i) *Determination of finished goods inventory, 31-10-2003:*

Sales revenue	Rs 7,50,000
Less gross margin (30%)	2,25,000
Cost of goods sold	5,25,000
Less cost of goods available for sale	5,55,775
Finished goods inventory	30,775

(ii) *Determination of work-in-process inventory, (31-10-2003)*

Prime cost	Rs 3,97,750
Add indirect manufacturing cost (working note 3)	1,48,167
Add opening work-in-process (1-9-2003)	40,000
	5,85,917
Less cost of goods manufactured (working note 1)	5,18,025
Work-in-process inventory (31-10-2003)	67,892

(iii) *Determination of direct material inventory, 31-10-2003:*

Direct material inventory, 1-9-2003	Rs 20,000
Add direct material purchased	2,50,000
Total cost of direct materials	2,70,000
Less direct material cost (working note 2)	1,75,500
Direct material inventory 31-10-2003	94,500

Working Notes

1. *Cost of goods manufactured:*

Cost of goods available for sale	Rs 5,55,775
Less finished goods 1-9-2003	37,750
Cost of goods manufactured	5,18,025

2. *Cost of direct material inventory used during the month*
   Prime cost–Direct manufacturing labour cost: Rs 3,97,750–Rs 2,22,250 = Rs 1,75,500
3. *Conversion and indirect manufacturing cost:*
   Conversion cost = Direct manufacturing cost + Indirect manufacturing cost
   Indirect manufacturing cost = 40% of conversion cost
   Or Conversion cost = Direct manufacturing cost + 40% of conversion cost
   Or Conversion cost = Direct manufacturing cost/0.60 = Rs 2,22,250/0.60 = Rs 3,70,417
   Or Indirect manufacturing cost = 40% of Rs 3,70,417 = Rs 1,48,167

EQ. 9.3 EPS is a public school having 25 buses each plying in different directions for the transport of its school students. In view of large number of students availing of the bus service, the buses work two shifts daily both in the morning and in the afternoon. The buses are garaged in the school The workload of the students has been so arranged that in the morning, the first trip picks up senior students and the second trip plying an hour later picks up junior students. Similarly, in the afternoon, the first trip takes the junior students and an hour later the second trip takes the senior students home.

The distance traveled by each bus, one way is 16 kms. The school works 24 days in a month and remains closed for vacation in May and June. The bus fee, however, is payable by the students for all the 12 months in a year.

The details of expenses for the year 2003-2004 are as under:

Driver's salary–payable for all the 12 months	Rs 5,000 per month per driver
Cleaner's salary payable for all the 12 months (one cleaner has been employed for every five buses)	Rs 3,000 per month per cleaner
Licence fees, taxes etc.	Rs 2,300 per bus per annum
Insurance premium	Rs 15,600 per bus per annum
Repairs and maintenance	Rs 16,400 per bus per annum
Purchase price of the bus	Rs 16,50,000 each
Life of the bus	16 years
Scrap value	Rs 1,50,000
Diesel cost	Rs 18.50 per litre

Each bus gives an average of 10 kms per litre of diesel. The seating capacity of each bus is 60 students. The seating capacity is fully occupied during the whole year.
The school follows differential bus fees based on distance traveled as under:

Students picked up and dropped within the range of distance from the school	*Bus fee*	*Percentage of students availing this facility*
4 kms	25% of full	15%
8 kms	50% of full	30%
16 kms	full	55%

Ignore interest. Since the bus has to be based on average cost, you are required to:

(i) Prepare a statement showing the expenses of operating a single bus and the fleet of 25 buses for a year.

(ii) Work out average cost per student per month in respect of :

(a) Students coming from a distance of upto 4 kms from the school;

(b) Students coming from a distance of upto 8 kms from the school; and

(c) Students coming from a distance of upto 16 kms from the school. (*CA—May, 2004*)

SOLUTION (A)

(i) *Operating cost statement showing expenses of operating single bus and the fleet of 25 buses for a year*

Particulars	*Per bus per annum*	*Fleet of 25 buses per annum*
(A) Standing charges		
Driver's salary	Rs 60,000	Rs 15,00,000
Cleaners salary	7,200	1,80,000
License fee, taxes, etc.	2,300	57,500
Insurance	15,600	3,90,000
Depreciation	93,750	23,43,750
Total	1,78,850	44,71,250
(B) Running charges		
Diesel	56,832	14,20,800
Repairs and maintenance costs	16,400	4,10,000
Total	73,232	18,30,800
Total cost (A + B)	2,52,082	63,02,050

(ii) *Average cost per student per month in respect of students coming from a distance of:*

(a) 4 kms from the school (Rs 2,52,082/354 students × 12 months) = Rs 59.34

(b) 8 kms from the school (Rs 59.34 × 2) = Rs 118.68

(c) 16 kms from the school (Rs 59.34 × 4) = Rs 237.36

Working Notes

(a) *Calculation of diesel cost per bus per year*

Number of trips made by a bus each day	4
Distance traveled in one trip both ways (16 kms × 2 trips)	32 kms
Distance traveled per day by a bus (32 kms × 4 trips)	128 kms
Distance traveled in a month (128 kms × 24 days)	3,072 kms
Distance traveled in a year (3,072 kms × 10 months)	30,720 kms
No. of litres of diesel required per bus per year (30,720 kms/10kms)	3,072 litres
Cost of diesel per bus per year (3,072 litres × Rs 18.50)	Rs 56,832

(b) *Calculation of number of students per bus:*

Bus capacity of 2 trips	120 students
25% bus charge for 15% student (15% × 120 students)	18 students
50% bus charge for 30% students (30% × 120 students × 2)	72 students
Full bus charge for 55% students (55% × 120 × 4)	264 students
Total students	354 students

EQ. 9.4 Popeye Company is a metal and wood cutting manufacturer, selling products to the home construction market. Consider the following data for the month of October, 2004:

Sandpaper	Rs 5,000
Material-handling costs	1,75,000
Lubricants and coolants	12,500
Miscellaneous indirect manufacturing labour	1,00,000
Direct manufacturing labour	7,50,000
Direct materials, October 1, 2004	1,00,000
Direct materials, October 31, 2004	1,25,000
Finished goods, October 1, 2004	2,50,000
Finished goods, October 31, 2004	3,75,000
Work-in-process, October 1, 2004	25,000
Work-in-process, October 31, 2004	35,000
Plant-leasing costs	1,35,000
Depreciation-plant equipment	90,000
Property taxes on plant equipment	10,000
Fire insurance on plant equipment	7,500
Direct materials purchased	11,50,000
Sales revenues	34,00,000
Marketing promotions	1,50,000
Marketing salaries	2,50,000
Distribution costs	1,75,000
Customer-service costs	2,50,000

Required:

(i) Prepare an income statement with a separate supporting schedule of cost of goods manufactured. (ii) For all manufacturing items, indicate by V or F whether each is basically a variable cost or a fixed cost (where the cost object is a product unit). (*CA—November, 2004*)

SOLUTION

Schedule showing cost of goods manufactured for October 2004

Particulars		*Amount*
Direct materials:		
Opening stock	Rs 1,00,000	
Add purchase of direct materials	11,50,000	
Less closing stock	(1,25,000)	
Direct materials used		Rs 11,25,000
Direct manufacturing labour		7,50,000
Prime cost		18,75,000
Add indirect manufacturing costs:		
Sand paper Material handling cost	5,000	
Material handling cost	1,75,000	
Lubricants and coolants	12,500	
Miscellaneous indirect manufacturing labour	1,00,000	
Plant leasing cost	1,35,000	
Depreciation-plant and equipment	90,000	
Property tax-plant and equipment	10,000	
Fire insurance-plant & equipment	7,500	5,35,000
Gross works cost		24,10,000
Add opening work-in-process		25,000
Less closing work-in-process		(35,000)
Cost of goods manufactured		24,00,000

Income statement for the month ending Oct. 31, 2004

Revenues		Rs 34,00,000
Cost of goods sold:		
Opening stock of finished goods	Rs 2,50,000	
Cost of goods manufactured	24,00,000	
Less closing finished goods	(3,75,000)	22,75,000
Gross profit		11,25,000
Less marketing, distribution and customer service costs:		
Marketing promotions	1,50,000	
Marketing salaries	2,50,000	
Distribution costs	1,75,000	
Customer service costs	2,50,000	8,25,000
Operating income		3,00,000

(ii) *Classification of costs into variable cost or fixed cost:*

(i)	Direct materials used	Variable
(ii)	Direct manufacturing labour	Variable
(iii)	Sandpaper	Variable
(iv)	Material-handling cost	Variable
(v)	Lubricants and coolants	Variable
(vi)	Miscellaneous indirect manufacturing labour	Variable
(vii)	Plant leasing cost	Fixed
(viii)	Depreciation –plant and equipment	Fixed
(ix)	Property tax-plant and equipment	Fixed
(x)	Fire insurance-plant and equipment	Fixed

EQ. 9.5 A company runs a holiday home. For this purpose, it has hired a building at a rent of Rs 10,000 per month alongwith 5% of total taking. It has three type of suites for its customers, viz., single room, double rooms and triple rooms. Following information is given:

Type of suits	*Number*	*Occupancy percentage*
Single room	100	100%
Double rooms	50	80%
Triple rooms	30	60%

The rent of double room suite is to be fixed at 2.5 times of the single room suite and that of triple rooms suite as twice of the double rooms suite.

The other expenses for the current year are as follows:

Particulars	*Amount*
Staff salaries	Rs 14,25,000
Room attendants' wages	4,50,000
Lighting, heating and power	2,15,000
Repair and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	2,52,500

Provide profit @ 20% on total taking and assume 360 days in a year.

You are required to calculate the rent to be charged for each type of suite.

'Under the Rowan Premium Bonus system, a less efficient worker can obtain same bonus as a highly efficient worker.' Discuss with suitable examples. *(CA (PE-II)—May, 2007)*

SOLUTION

Computation of equivalent single room suites (ESRS)

Type of suite	*Occupancy*	*ESRS*
Single room	(100 rooms × 360 days) × 1.0	36,000 × 1 = 36,000
Double rooms	(50 rooms × 360 days) × 0.8	14,400 × 2.5 = 36,000
Triple rooms	(30 rooms × 360 days) × 0.6	6,480 × 5 = 32,400
		1,04,400

Statement showing total cost of operating holiday home

Particulars	*Amount*
Staff salaries	Rs 14,25,000
Room attendant's wages	4,50,000
Lighting, heating and power	2,15,000
Repairs and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	2,52,500
	26,20,500
Building rent (Rs 10,000 × 12 months) + 5% of total taking	1,20,000 + 5% on taking
Total cost	27,40,500 + 5% on taking

Desired taking/room rent = Rs 27,40,500 + 25% of total taking (consisting of 20% required profit + 5% for additional building rent).

Let X be the single room rent charge

$1{,}04{,}400x$ = Rs 27,40,500 + 25% of $(1{,}04{,}400x)$

$1{,}04{,}400x$ = Rs 27,40,500 + $26{,}100x$

$1{,}04{,}400x - 26{,}100x$ = Rs 27,40,500 or x = Rs 27,40,500 /78,300 = Rs 35

Room rents to be charged:

Single room suite per day Rs 35

Double room suite per day Rs 35 × 2.5 = 87.5

Triple room suite per day Rs 35 × 5 = Rs 175

10 Reconciliation and Integration

Introduction

The objective of this chapter is to illustrate the reconciliation of financial and cost accounts and their integration. The need for, and the procedure involved in, reconciling the financial and cost account, is outlined in Section 1. The preparation of integrated accounts is shown in Section 2. The main points are summarised in Section 3.

RECONCILIATION OF FINANCIAL AND COST ACCOUNTS

When manufacturing firms maintain a separate cost accounting system, the profit or loss shown by such cost books may not agree with the corresponding profit or loss revealed by the financial accounting system. This disparity in financial results is caused by the use of different cost accumulating procedures in the two systems. For instance, financial books record *all* items of expenses, namely, factory, administrative, selling, and so on, on *actual cost* basis, while in general, in cost books such expenses/overheads are charged to production on standard or budgeted cost basis. Likewise, the stock valuation procedure normally adopted in cost books is different from financial books. Moreover, certain items of expenditure and income are recorded only in one set of books. Therefore, there is need to reconcile the results shown by the cost and financial books. This reconciliation establishes arithmetical accuracy of both sets of books on the one hand, and explains factors causing differences in profit (losses) of these two books, on the other.

Reasons for Disagreement

The differences in results of cost and financial books can be attributed to the following reasons:

Transactions Included in One Set of Books Only Some transactions are recorded exclusively either in the financial accounts/books or in the cost accounts. Following is the list of items recorded only in financial accounts/books:

Items Recorded in Financial Accounts/Books Such items relate to (i) Appropriation of profits, (ii) Financial charges and (iii) Financial income.

Items Relating to the Appropriation of Profit Include the Following:

(i) Amounts transferred to different accumulated profit reserves, such as general reserve, dividend equalisation reserve, and so on.
(ii) Dividends paid to, or proposed for, preference shareholders and equity shareholders.
(iii) The extent of the amount of bonus shares issued to equity shareholders and appropriated out of the current year's profit and loss appropriation account.
(iv) Creation of additional provision for depreciation on plant and machinery and other fixed assets as well as the additional provision for bad and doubtful debts on sundry debtors.
(v) The sum transferred to Debenture Redemption Fund Account for the purpose of repayment of debentures or any other sum transferred to any other such account created for the purpose of discharge of long-term liability.

Items Exclusively Related to Financial Charges Pertain to the Following:

(i) Losses on sale of fixed assets such as plant and machinery or loss due to discarding or scrapping of plant.
(ii) Loss on sale of trade investments.
(iii) Amortisation of expenditure in respect of items, such as goodwill, preliminary expenses, expenses relating to capital issues, namely, underwriting commission, brokerage fees, legal charges, and so on.
(iv) Interest paid on debentures, long-tem loans, bank loans, owner's contributions, and so on, if interest is ignored in cost books.
(v) Damages payable
(vi) Penalties payable.
(vii) Office transfer expenses
(viii) Writing off the extraordinary abnormal losses of the past year(s) in instalments over a period of time.
(ix) Taxes paid.
(x) Capital expenditures such as payment of stamp duties and transfer fees paid on the purchase of shares treated as revenue expenses.

Transitions Exclusively Related to Financial Incomes Cover the Following Transactions:

(i) Profit from sale of fixed assets such as land, building, patents and, less often, from plant and equipment.
(ii) Profits accruing from disposition of trade investments.
(iii) Transfer fees received on issuing and registering transfer of shares.
(iv) Interest received on investments made outside the firm, namely, banks, inter-corporate loans and debentures, deposits made with financial institutions.
(v) Dividend received from shares of other companies.
(vi) Rent received or receivable from properties.
(vii) Appreciation of fixed assets.

Items Exclusively in the Purview of Cost Accounts The following notional charges are usually considered in cost accounts/books only.

1. Notional rent of premises if owned by the firm itself.
2. Notional interest on owner's capital contributions.
3. Sometimes it may so happen that a certain fixed asset, say, plant and machinery may have been fully depreciated so far as the book value is concerned, but it may be still in continuous use in the production department in view of its physical conditions and, hence, depreciation continues to be charged in cost books.

Treatment of Indirect Expenses/Overheads As stated earlier, the *actual expenses* incurred is the basis for treating overheads in financial accounts. In cost accounting, overheads are charged to production on the basis of some predetermined rate based on any of the following methods, namely, output, machine-hours, labour-hours percentage of the material cost, labour cost and prime cost. Reflecting the different basis of treatment, the overheads charged in cost books would either exceed or fall short of overheads recorded and shown in financial accounts, resulting in over-absorption or under-absorption of overheads. Over-absorption of overheads implies that actual expenses recovered and recorded in cost books are more compared to the financial accounts. As a result, the profit shown by cost books would naturally be less than that shown in the financial books. In case of under-absorption of overheads, the expenses recovered and charged in cost accounts would be less than the amount charged in financial accounts, showing high profits in cost accounts compared to the financial books of accounts.

Different Bases of Inventory Valuation The basis of inventory valuation may be different in cost and financial records.

Raw Materials Inventory In cost books, materials issued to various jobs/production centres are charged on the basis of any of methods used for the purpose of pricing of the issue of materials, that is, LIFO, FIFO, weighted average, inflated price, standard cost, and so on. The raw material inventory is shown in financial accounting on the basis of *cost or market price, whichever is lower.*

Work-in-process (W.I.P.) Inventory In cost accounts, the work-in-process inventory is valued on the basis of work cost, prime cost or cost of production. But in financial accounts, the basis of valuation is the cost of production.

Finished Goods Inventory The lower of the cost or the market price is normally the guiding criterion for valuing closing stock in financial accounts, whereas it may be valued for cost accounting purposes at prime cost or factory cost only.

Different Bases of Depreciation There are a number of methods of charging depreciation in financial accounts, for example, straight line and diminishing balance methods. On the other hand, in cost books, machine-hour rate or output basis are normally recognised as the ideal methods of charging depreciation.

Abnormal Losses and Gains The complete disregard of abnormal losses and gains in cost books can be yet another source of differences in profits of these two sets of books.

Procedure for Reconciliation

For the above reasons, the financial results shown by the two sets of books would be different from each other. The reconciliation of the financial results shown by the two systems of accounting is done in the form

of a reconciliation statement or memorandum reconciliation account. Their formats are given in Exhibits 10.1 and 10.2 respectively.

Exhibit 10.1 *Reconciliation Statement: Cost and Financial Profits*

Particulars	*Plus items*	*Minus items*
Profit (Loss) as per cost books		
Less expenses reducing profit in financial books but not recorded in cost books:		
Interest paid on loans		
Dividends paid to shareholders		
Taxes paid on profit		
Transfer to general or specific reserves		
Amortisation of deferred revenue expenditure		
Damages and penalties payable		
Add incomes augmenting profits in financial books not credited in cost books:		
Interest and dividend received		
Transfer fees received		
Profit on sale of fixed assets		
Less overheads under-absorbed or not recorded in cost accounts:		
Factory overheads (Actual overheads-Absorbed overheads)		
Administrative overheads (Actual-Absorbed)		
Selling and distribution overheads (Actual-Absorbed)		—
Add overheads over-absorbed in cost accounts:		
Factory overheads (Absorbed overheads-Actual overheads)		
Administrative overheads (Absorbed-Actual)		
Selling and distribution overheads (Absorbed-Actual)	—	
Less under-valuation of opening inventories and over-valuation of closing inventories in cost books causing cost profits to increase:		
Raw materials		
Work-in-process		
Finished goods		—
Add over-valuation of opening inventories and under-valuation of closing inventories in cost books causing cost profits to decrease:		
Raw materials		
Work-in-process		
Finished goods	—	
Less under-recovery of depreciation in cost books (Depreciation in financial accounts – Depreciation in cost accounts)	—	
Add over-charge of depreciation in cost books (Depreciation in cost accounts – Depreciation in financial accounts)		—
Profits (Loss) as per financial accounts		

If profits as per financial accounts are taken as the starting point, items added in Exhibit 10.1 would be subtracted and items deducted would be added and the profits (loss) arrived at would be profits as revealed by cost accounts.

Exhibit 10.2 *Memorandum Reconciliation Account*

Particulars	*Amount*	*Particulars*	*Amount*
1. Expenses not included *in cost books:*		1. Profit as per cost accounts	
Interest paid on loans		2. Incomes not credited in cost *accounts:*	
Dividends paid to shareholders		Dividends and interest received	
Taxes paid on profits		Transfer fees received	
Transfer to general or specific reserves		Profit on sale of fixed assets	
Amortisation of deferred revenue		3. Overheads over-absorbed in cost accounts	
Expenditure		4. Over-valuation of opening inventories	
Damages and penalties payable		5. Under-valuation of closing inventories	
2. Overheads under-absorbed or not recorded in cost accounts		6. Over-absorption of depreciation in cost books	
3. Under-valuation of opening inventories			
4. Over-valuation of closing inventories			
5. Under-recovery of depreciation in cost books			
6. Profit as per financial accounts			

EXAMPLE 10.1

The following figures are extracted from the financial accounts of Selwel Ltd for the current year ending March 31

Sales (20,000 units)		Rs 50,00,000
Materials		20,00,000
Wages		10,00,000
Factory overheads		9,00,000
Administrative overheads		5,20,000
Selling and distribution overheads		3,60,000
Finished goods (1,230 units)		3,00,000
Work-in-process:		
Materials	Rs 60,000	
Labour	40,000	
Factory overheads	40,000	1,40,000
Goodwill written off		4,00,000
Interest paid on capital		40,000

In the costing records, factory overhead is charged at 100 per cent of wages, administration overhead at 10 per cent of factory cost and selling and distribution overhead at the rate of Rs 20 per unit sold.

Prepare a statement, reconciling the profit as per cost records with the profit as per financial records.

SOLUTION

Financial Profit and Loss Account for the Current Year Ending March

Particulars	*Dr Amount*	*Particulars*		*Cr Amount*
To materials	Rs 20,00,000	By sales (20,000 units)		Rs 50,00,000
To wages	10,00,000	By finished goods (1,230 units)		3,00,000
To factory overheads	9,00,000	*By work-in-process*		
To administrative overheads	5,20,000	Materials	Rs 60,000	
To selling and distribution		Labour	40,000	
overheads	3,60,000	Overheads	40,000	1,40,000
To goodwill written off	4,00,000			
To interest paid on capital	40,000			
To net profit	2,20,000			
	54,40,000			54,40,000

Costing Profit and Loss Account for the Current Year Ending March

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To materials	Rs 20,00,000	By sales revenue	
To wages	10,00,000	(20,000 units × 250)	Rs 50,00,000
Prime cost	30,00,000		
To factory overheads			
(@ 100 per cent of wages)	10,00,000		
Gross works cost	40,00,000		
Less closing work-in-process	(1,40,000)		
Net works cost	38,60,000		
To administrative overheads			
(@ 10 per cent of factory cost)	3,86,000		
Cost of production	42,46,000		
(21,230 units @ Rs 200 per unit)			
Less closing stock (1,230 units			
@ Rs 200 per unit)	(2,46,000)		
Cost of goods sold	40,00,000		
To selling and distribution			
overheads [@ Rs 20 per unit			
(20,000 × Rs 20)]	4,00,000		
Cost of sales	44,00,000		
To net profit	6,00,000		
Sales	50,00,000		50,00,000

It is assumed that closing finished goods inventory is valued at total cost of production in the cost books.

Reconciliation Statement: Cost and Financial Profits

Particulars	*Plus items*	*Minus items*
Profit as per cost records	Rs 6,00,000	
Add over-absorption of factory overheads in cost records		
(Rs 10,00,000 – Rs 9,00,000)	1,00,000	
Less under-absorption of administration overheads in		
cost records (Rs 5,20,000 – Rs 3,86,000)		Rs 1,34,000

(*Contd.*)

(*Contd.*)

Add over-absorption of selling and distribution overheads in cost records (Rs 4,00,000 – Rs 3,60,000)		40,000	
Add under-valuation of finished goods in cost records (Rs 3,00,000 – Rs 2,46,000)		54,000	
Less expenses not charged in cost books:			
Goodwill written off	Rs 4,00,000		
Interest paid on capital	40,000		4,40,000
		7,94,000	5,74,000
Profit as per financial books			2,20,000

INTEGRATED ACCOUNTS

The preceding discussion has shown that there is the need for a reconciliation statement when separate sets of cost and financial records are made. The need for such a statement can be dispensed with if only *one* set of books is maintained to serve both financial and costing purposes. Such a system of accounts in which only one set of books is maintained to record both cost and financial transactions is referred to as integrated/ integral accounts.

Since under the integrated system of accounts only one set of books is maintained, there is considerable economy both in costs and clerical work in terms of time and effort. Moreover, the accounting function is considerably simplified, paving the way for a more efficient control system of accounting. Such a system enhances the speed of accounting work and, hence, also facilitates the reporting function of accounting.

Installation of Integrated Accounts System

The installation of the integrated accounts system involves consideration of the following principles.

Degree of Integration The first and foremost thing to be decided in the integrated accounting system is the degree/extent of integration, that is, whether the whole accounting system is to be integrated or the integration is to be done partially up to the stage of prime cost or factory cost.

Number of Control Accounts Theoretically speaking, a single control account covering all items relating to the costing department can serve the purpose. However, it would be operationally better and more convenient from the point of view of control, if separate control accounts are opened for each of the elements of cost, namely:

(a) Stores control account (for materials).
(b) Wages control account.
(c) Factory overhead control account.
(d) Administrative overhead control account.
(e) Selling and distribution overhead control account.
(f) For more details, the last three control accounts dealing with indirect overheads can be further sub-divided into fixed and variable expenses.
(g) If a firm has more than one factory, it is desirable to open a complete series of control accounts for each.
(h) Work-in-process control account (to take care of incomplete manufactured units).
(i) Finished stock control account (to record the finished goods).

(j) Sales ledger control account/sundry debtors control account (to tally the balance of this account with the summary of the balance of individual debtors account of sales ledger).
(k) Bought ledger control account/sundry creditors control account (for the purpose of tallying the balance of this account with the individual aggregate balances of each creditors in the purchase ledger).
(l) *Assets account:* A separate individual account should be created for each asset, namely, plant and equipment, furniture, building, cash and bank balances, and so on. All these accounts are prepared on the basis of the financial accounting principles.
(m) *Cost of sales account:* This account would represent the cost of goods sold during the period. The accounting procedure of dealing with this is explained later.
(n) Share capital account.
(o) Debentures account.
(p) Other long-term loans account.
(q) Reserves and surplus account.
(r) Any other liability account.
(s) *Pre-payment and outstanding expenses accounts:* Adjustment should be made in respect of all outstanding and accrued expenses by debiting the relevant expense account (say, wages control, factory overhead control, administrative and selling overheads control accounts) and crediting the corresponding expense suspense account (say, wages control suspense account, factory overhead control suspense account, and so on). The accounting procedure would be reversed for pre-payments of expenses. These adjustments would enable each expense control account to be representative of the charges for the given period. At the time of making payment in future, the relevant cost suspense account would be debited and pre-payments would be adjusted by transferring to the relevant cost control account in the subsequent period.

EXAMPLE 10.2 *(Treatment of Pre-payment and Outstanding Expenses)*

Journalise the following transactions under the integrated accounting system for a manufacturing firm:

(i)	Accrued wages	Rs 50,000
(ii)	Unexpired insurance of the factory premises	2,000
(iii)	Depreciation of plant and equipment	20,000

SOLUTION

Journal Entries

(i)	Wages control A/c	.. Dr	Rs 50,000	
	To wages control suspense A/c			Rs 50,000
	(Being accrued wages recorded)			
(ii)	Factory overhead control suspense A/c	...Dr	2,000	
	To factory overhead control A/c			2,000
	(Being unexpired insurance recorded to reduce factory overheads of the current year)			
(iii)	Factory overhead control A/c	....Dr	20,000	
	To plant and equipment			20,000
	(Being depreciation on plant and equipment charged to factory overhead control A/c)			

(*Contd.*)

(*Contd.*)

In the subsequent period, the first two transactions would be journalised in the following way:

(i) *Payment for accrued wages*			
Wages control suspense A/c	...Dr	50,000	
To Bank			50,000
(ii) *Transferring unexpired insurance expense to the current year's expenses:*			
Factory overhead control A/c	...Dr	2,000	
To factory overhead control suspense A/c			2,000

Cost Compilation at Regular Intervals Full details of items relating to raw materials, direct labour and various overheads available in corresponding stores ledger control account (for each of the elements of overheads) is made available at convenient intervals for the purposes of judging the internal position.

Transaction Relating to Financial Expenses and Appropriations Financial expense items such as interest on capital, writing off deferred revenue expenditure and appropriations items such as transfer to general or specific reserves, dividends paid, are dealt with as per the conventional principles of financial accounting.

Closure of Nominal Accounts At periodical intervals, say, a month or quarter, all nominal accounts would be closed by transferring to profit and loss account. The following points deserve special attention in this context:

(a) Cost of sales account would be prepared separately. This account would represent profit earned equivalent to the difference of sales revenue and cost of sales. The amount of profit so arrived at would be transferred to profit and loss account by passing the following journal entry

Cost of sales A/c ...Dr
To profit and loss A/c

In the case of loss, the entry would be reversed. Exhibit 10.3 shows the procedure of determining cost of sales.

Exhibit 10.3 *Cost of Sales A/c*

To finished stock ledger control A/c (Cost of goods sold)	——	By sales ledger control A/c (Sales made)	——
To selling and distribution overheads control A/c		By profit and loss A/c (loss)	
To profit and loss A/c (profit)			

(b) Items relating to financial expenses, over- and under-absorption of any type of overheads, abnormal losses and gains will be recorded in the profit and loss account. The format of profit and loss account is given in Exhibit 10.4.

Exhibit 10.4 *Profit and Loss Account*

To cost of sales (losses transferred from)	——	By cost of sales (profits transferred from)	——
For absorption or under-absorption of overheads:		*For over-absorption of overheads:*	
		By factory overheads control A/c	——
To factory overheads control A/c	——		

(*Contd.*)

(*Contd.*)

To administrative overheads control A/c	——	To administrative overheads control A/c	——
To selling overheads control A/c		By selling overheads control A/c	——
To abnormal losses (specify)	——	By abnormal gains (specify)	——
To financial expenses (specify)	——	By non-operating gains (specify)	——
To appropriations (specify)	——	By losses (current year)	——
To profit (current period)	——		

Personal and Real Accounts

Personal and real accounts will be carried to the balance sheet.

EXAMPLE 10.3 *(Accounting Procedure under Integrated Accounts)*

From the following information of a newly commenced manufacturing unit of Royal Industries Ltd., for the first quarter ending March 31, pass journal entries and prepare important ledger accounts, assuming that the cost and financial accounts are integrated:

Purchases of raw materials on credit	Rs 3,00,000
Wages paid	2,00,000
Indirect wages included in the wages paid	20,000
Direct materials issued to production	2,70,000
Factory expenses incurred	1,30,000
Factory expenses charged to production	1,55,000
Office and administrative expenses incurred	75,000
Office and administrative expenses charged to production	70,000
Selling and distribution overheads incurred	60,000
Selling and distribution overheads charged to sales	60,000
Credit sales during the period	8,00,000
Receipts from debtors	7,00,000
Paid to creditors	2,50,000
Finished product at cost	6,50,000
Closing stock of finished product	50,000
Interest paid	30,000

Assume that over- and under-absorption of overheads are straight-way carried to the profit and loss account. Also, determine the profit earned during the period.

SOLUTION

Journal Entries for the Quarter Ending March 31

Particulars		*Dr Amount*	*Cr Amount*
Stores ledger control A/c	Dr	Rs 3,00,000	
To bought ledger control A/c			Rs 3,00,000
(Being raw materials purchased on credit)			
Wages control A/c	Dr	2,00,000	
To cash			2,00,000
(Being wages paid as per the payroll)			

(*Contd.*)

(*Contd.*)

Work-in-process ledger control A/c	Dr	1,80,000	
Factory overhead control A/c	Dr	20,000	
To wages control A/c			2,00,000
(Being the allocation of wages between production and factory overhead)			
Work-in-process ledger control A/c	Dr	2,70,000	
To stores ledger control A/c			2,70,000
(Being materials issued for production)			
Factory overhead control A/c	Dr	1,30,000	
To cash/Bank			1,30,000
(Being factory overheads incurred and paid)			
Work-in-process ledger control A/c	Dr	1,55,000	
To factory overheads control A/c			1,55,000
(Being factory overheads charged to production)			
Office and administrative overheads control A/c	Dr	75,000	
To bank			75,000
(Being payment made for office overheads)			
Work-in-process ledger control A/c	Dr	70,000	
To office and administrative overhead control A/c			70,000
(Being office and administrative overheads charged to production)			
Selling and distribution overhead control A/c	Dr	60,000	
To bank			60,000
(Being payment made of selling overheads)			
Cost of sales A/c	Dr	60,000	
To selling and distribution overheads control A/c			60,000
(Being selling overheads charged to cost of sales account)			
Sales ledger control A/c	Dr	8,00,000	
To cost of sales A/c			8,00,000
(Being sales made of finished output on credit)			
Bank A/c	Dr	7,00,000	
To sales ledger control A/c			7,00,000
(Being cash received from debtors)			
Bought ledger control A/c	Dr	2,50,000	
To bank A/c			2,50,000
(Being payment made to creditors)			
Finished stock ledger control A/c	Dr	6,50,000	
To work-in-process ledger control A/c			6,50,000
(Cost of finished output transferred to stock ledger control account)			
Interest A/c	Dr	30,000	
To bank A/c			30,000
(Being interest paid)			

(*Contd.*)

(*Contd.*)

Profit and loss A/c	Dr	Rs 30,000	
To interest A/c			30,000
(Being interest transferred to profit and loss A/c)			
Cost of sales A/c	Dr	6,00,000	
To finished stock ledger control A/c			6,00,000
(Cost of finished output sold transferred to cost of sales)			
Profit and loss A/c	Dr	5,000	
To office and administrative overheads control A/c			5,000
(Being under-absorption of office overheads transferred to profit and loss account)			
Factory overhead control A/c	Dr	5,000	
To profit and loss A/c			5,000
(Being over-absorption of factory overheads transferred to profit and loss) A/c			
Cost of sales A/c	Dr	1,40,000	
To profit and loss A/c			1,40,000
(Profit on sales transferred to profit and loss A/c)			

Stores Ledger Control A/c

To bought ledger control A/c	Rs 3,00,000	By work-in-progress ledger control A/c	Rs 2,70,000
		By balance c/d	30,000
	3,00,000		3,00,000

Work-in-Process Ledger Control A/c

To wages control A/c (direct wages)	Rs 1,80,000	By stock ledger control A/c (finished output transferred)	Rs 6,50,000
To stores ledger control A/c (materials)	2,70,000	By balance c/d	25,000
To factory overheads control A/c (factory expenses charged to production)	1,55,000		
To office and administrative overhead control A/c (office expenses charged to production)	70,000		
	6,75,000		6,75,000

Wages Control A/c

To cash	Rs 2,00,000	By work-in-process control A/c	Rs 1,80,000
		By factory overheads control A/c	20,000
	2,00,000		2,00,000

Factory Overhead Control A/c

To wages control A/c (indirect wages)	Rs 20,000	By work-in-process ledger control A/c (charged to production)	Rs 1,55,000
To cash (expenses)	1,30,000		
To profit and loss A/c (over-recovery of factory overheads)	5,000		
	1,55,000		1,55,000

Office and Administrative Overhead Control A/c

To Bank	Rs 75,000	By work-in-process ledger control A/c (charged to production)	Rs 70,000
		By profit and loss A/c (under-absorption of overheads)	5,000
	75,000		75,000

Selling and Distribution Overhead Control A/c

To bank	Rs 60,000	By cost of sales A/c	Rs 60,000

Cost of Sales A/c

To finished stock ledger control A/c	Rs 6,00,000	By sales ledger control A/c	Rs 8,00,000
To selling and distribution overhead control A/c	60,000		
To profit and loss A/c	1,40,000		
	8,00,000		8,00,000

Sales Ledger Control A/c

To cost of sales A/c	Rs 8,00,000	By bank	Rs 7,00,000
		By balance c/d	1,00,000
	8,00,000		8,00,000

Bought Ledger Control A/c

To bank A/c	Rs 2,50,000	By stores ledger control A/c	Rs 3,00,000
To balance c/d	50,000		
	3,00,000		3,00,000

Finished Stock Ledger Control A/c

To work-in-process ledger control A/c	Rs 6,50,000	By cost of sales A/c	Rs 6,00,000
		By balance c/d	50,000
	6,50,000		6,50,000

Profit and Loss A/c

To interest	Rs 30,000	By factory overhead control A/c (over-recovery of overheads)	Rs 5,000
To office and administrative overheads control A/c (under-recovery)	5,000	By cost of sales	1,40,000
To balance c/d (profit of the quarter carried to the next quarter)	1,10,000		
	1,45,000		1,45,000

Integrated Accounts and Standard Cost Accounting

When the firm is following the standard costing system for recording costs, the integrated accounting system can be suitably modified to incorporate the same. The accounting procedure is similar to the one described before, except that there would be an additional entry in respect of variance account in the journal when actual costs differ from the standard costs. The relevant variance account (material, labour, overhead) would be debited if the actual costs are more than the standard costs and *vice-versa.*

EXAMPLE 10.4 *(Treatment of Standard Costing Under Integrated Account)*

Journalise the following transactions under the integrated accounting system of a firm.

(i) Raw materials purchased at Rs 1,10,000 (standard cost is Rs 1,00,000).
(ii) Wages paid, Rs 1,90,000 (standard cost is Rs 1,95,000).
(iii) Actual sales are Rs 5,00,000 as against budget sales of Rs 5,20,000.

SOLUTION

Journal Entries

(i)	Stores ledger control A/c	Dr	Rs 1,00,000	
	Material variance A/c	Dr	10,000	
	To bought ledger control A/c			Rs 1,10,000
	(Being purchase of materials and variance recorded)			
(ii)	Wage control A/c	Dr	1,95,000	
	To wages variance A/c			5,000
	To bank A/c			1,90,000
	(Being wages paid and wage variance recorded)			
(iii)	Sales ledger control A/c	Dr	5,00,000	
	Sales variance A/c	Dr	20,000	
	To cost of sales A/c			5,20,000
	(Being actual sales and sales variance recorded)			

All favourable and unfavourable variances would be transferred to the profit and loss account. The journal entry for transferring favourable variance(s) would be to debit the specific variance(s) account and credit the profit and loss account; and for adverse variances, the journal entry recorded would be just the reverse. Thus, the profit and loss account would be more comprehensive as it would include unfavourable variances on the debit side and favourable variances on the credit side.

SUMMARY

- The two systems of accounting, namely, financial and cost, maintained by a firm may show different operating results which should be reconciled to establish arithmetical accuracy of both types of records as also to identify the factors responsible for such differences. The main reasons for the difference in the results as revealed by financial and cost accounts are related to different cost accumulating procedures, such as, the inclusion of certain transactions in only one set of records, treatment of overheads, different bases of inventory valuation and depreciation, and treatment of abnormal losses and gains. The divergence in the financial results is reconciled in the form of either a reconciliation statement or a memorandum reconciliation account, taking the result shown by either of them as the starting point.

➔ There would be no need to reconcile the two sets of accounts if integrated accounts are maintained. In a system of integrated accounts, only one set of books is maintained to record both cost and financial transactions. Such a system of accounting requires the preparation of control accounts, such as stores, wages, factory overheads, administrative, selling and distribution, work-in-process, finished goods, sales ledger, bought ledger, assets account, cost of sales and pre-payment and outstanding expenses. The integrated accounts can also be modified to incorporate standard cost accounting.

SOLVED PROBLEMS

P.10.1 In reconciliation between cost and financial accounts, one of the areas of difference is the different methods of stock valuation. State with reasons, in each of the following circumstances, whether costing profit will be higher or lower than financial profit:

Items of stock	*Cost valuation*	*Financial valuation*
1. Raw material (opening)	Rs 50,000	Rs 60,000
2. Finished stock (opening)	60,000	50,000
3. Work-in-process (closing)	60,000	50,000
4. Finished stock (closing)	50,000	60,000

SOLUTION

1. Since the opening raw material inventory is under-valued by Rs 10,000 in cost records, the profits shown by the costing profit and loss account would be *higher* by Rs 10,000 *vis-à-vis* financial profits.
2. Since the opening finished goods inventory is *over-valued* by Rs 10,000 in cost records, profit would be *lower* by the same amount as compared to financial profits.
3. Since the closing work-in-process is *over-valued* in cost records by Rs 10,000, its profits would naturally be *higher* by Rs 10,000 as compared to financial profits.
4. Since the closing finished stock inventory is *under-valued* in cost records, its profit would be *lower* by Rs 10,000 *vis-à-vis* financial records.

P.10.2 From the following prepare a reconciliation statement.

Net profits as per financial records	Rs 1,28,755
Net profit as per costing records	1,72,400
Works overhead under-recovered in costing records	3,120
Administrative overhead recovered in excess in cost records	1,700
Depreciation charged in financial records	11,200
Depreciation recovered in costing records	12,500
Interest received but not included in costing records	8,000
Obsolescence loss charged in financial records	5,700
Income tax provided in financial books	40,300
Bank interest credited in financial books	750
Stores adjustments (credited in financial books)	475
Depreciation of stock charged in financial books	6,750

SOLUTION

Reconciliation Statement: Cost and Financial Profits (Costing Profit as Base)

Particulars		*Plus items*	*Minus items*
Net profit as per costing records		Rs 1,72,400	
Less works overhead under-recovered in costing records			Rs 3,120
Add administrative overheads over-absorbed in cost books		1,700	
Add depreciation charged in excess in cost books (Rs 12,500-Rs 11,200)		1,300	
Add incomes not credited in cost books:			
Interest received	Rs 8,000		
Bank interest	750		
Stores adjustment (credit)	475	9,225	
Less expenses not charged in cost books:			
Obsolescence loss	5,700		
Income tax	40,300		
Depreciation of stock	6,750		52,750
		1,84,625	55,870
Net profit as per financial books			1,28,755

Reconciliation Statement: Cost and Financial Profits (Financial Profit as Base)

Particulars		*Plus items*	*Minus items*
Net profit as per financial books		Rs 1,28,755	
Add works overhead over-recovered in financial books		3,120	
Less administrative overheads under-absorbed in financial books			Rs 1,700
Less depreciation under-charged in financial books (Rs 12,500 – Rs 11,200)			1,300
Less incomes credited only in financial books:			
Interest received	Rs 8,000		
Bank interest	750		
Stores adjustment (credit)	475		9,225
Add expenses charged only in financial books:			
Obsolescence loss	5,700		
Income tax	40,300		
Depreciation of stock	6,750	52,750	
		1,84,625	12,225
Net profit as per cost books			1,72,400

P.10.3 Given below is the trading and profit and loss account of Savera Plastics Ltd for the accounting year ended March 31.

Particulars	*Dr Amount*	*Particulars*	*Cr Amount*
To direct materials consumed	Rs 9,00,000	By sales (2,50,000 units)	Rs 22,50,000
To direct wages	6,00,000		
To factory expenses	3,60,000		
To office expenses	1,20,000		
To selling and distribution expenses	2,40,000		
To net profit	30,000		
	22,50,000		22,50,000

The normal output of the factory is 2,00,000 units. Factory overheads are fixed upto Rs 1,80,000 and office expenses are fixed for practical purposes. Selling and distribution expenses are fixed to the extent of Rs 1,50,000; the rest are variable.

You are required to prepare a statement of cost and profit as per cost records, and reconcile the profit so determined with that of the financial books.

SOLUTION

Statement of Cost and Profit for the Year Ending March 31

Particulars		*Amount*
Direct materials		Rs 9,00,000
Direct wages		6,00,000
Prime cost		15,00,000
Add factory overheads:		
Fixed overheads (Rs 1,80,000/Rs 2,00,000) × Rs 2,50,000	Rs 2,25,000	
Variable overheads (Rs 3,60,000 – Rs 1,80,000)	1,80,000	4,05,000
Factory cost		19,05,000
Add office expenses (Rs 1,20,000/Rs 2,00,000) × Rs 2,50,000		1,50,000
Cost of production (2,50,000 units)		20,55,000
Add selling and distribution expenses:		
Fixed (Rs 1,50,000/Rs 2,00,000) × Rs 2,50,000	1,87,500	
Variable (Rs 2,40,000 – Rs 1,50,000)	90,000	2,77,500
Cost of sales		23,32,500
Profit (Loss)		(82,500)
Sales revenue (2,50,000 × Rs 9)		22,50,000

Reconciliation Statement: Cost and Financial Profits

Particulars	*Plus items*	*Minus items*
Loss as per cost books		Rs 82,500
Add factory expenses over-absorbed in cost books (Rs 4,05,000 – Rs 3,60,000)	Rs 45,000	
Add office expenses over-absorbed in cost books (Rs 1,50,000 – Rs 1,20,000)	30,000	
Add selling and distribution expenses over-absorbed in cost books (Rs 2,77,500 – Rs 2,40,000)	37,500	
	1,12,500	82,500
Profit as per financial books	30,000	

P.10.4 From the following data prepare reconciliation statement:

Profit as per cost accounts	Rs 1,45,500
Works overheads under-recovered	9,500
Administrative overheads under-recovered	22,750
Selling overheads over-recovered	19,500
Overvaluation of opening stock in cost accounts	15,000
Overvaluation of closing stock in cost accounts	7,500
Interest earned during the year	3,750
Rent received during the year	27,000
Bad debts written off during the year	9,000
Preliminary expenses written off during the year	18,000

SOLUTION

Reconciliation Statement

Particulars	*Plus items*	*Minus items*
Profit as per cost account	Rs 1,45,500	
Add: Over-recovery of selling overheads	19,500	
Overvaluation of opening stock	15,000	
Income excluded from cost accounts		
—Interest earned	3,750	
—Rent received	27,000	
Less: Under-recoverey of work overheads		9,500
Under-recovery of administrative overheads		22,750
Over-valuation of closing stock		7,500
Expenses excluded from cost accounts		
—Bad debts		9,000
—Preliminary expenses		18,000
	2,10,750	66,750
Profit as per financial accounts		1,44,000

P.10.5 During the year, a company's profits have been estimated by the costing system to be Rs 23,063, whereas final accounts prepared by the auditors disclose profits of Rs 16,624. Given the following information, you are required to prepare a reconciliation statement showing clearly the reasons for the difference.

Profit and Loss Account for the Year Ended March 31.

To opening stock	Rs 2,47,179		By sales	Rs 3,46,500
Add purchases	82,154			
	3,29,333			
Less closing stock	(75,121)	Rs 2,54,212		
To direct wages		23,133		
To factory expenses		20,826		
To gross profit c/d		48,329		
		3,46,500		3,46,500
To administration expenditure		9,845	Gross profit b/d	48,329
To selling expenses		22,176	By sundry income	316
To net profit		16,624		
		48,645		48,645

The costing records show:

(i) A stock ledger closing balance of Rs 78,197.
(ii) A direct wage absorption account with a closing balance of Rs 24,867.
(iii) A factory overheads absorption account with a closing balance of Rs 19,714.
(iv) Administrative expenses calculated at 3 per cent of the selling price.
(v) Selling prices include 5 per cent for selling expenses.
(vi) No mention of sundry income.

SOLUTION

Reconciliation Statement; Cost and Financial Profits (Cost Book Profit as Base)

Particulars	*Plus items*	*Minus items*
Profit as per cost books	Rs 23,063	
Less closing stock over-valued in cost books (Rs 78,197 – Rs 75,121)		Rs 3,076
Add wages over-absorbed in cost books (Rs 24,867 – Rs 23,133)	1,734	
Less factory overheads under-absorbed in cost books (Rs 20,826 – Rs19,714)		1,112
Add administration expenses over-observed in cost books (Rs 10,395 – 9,845)	550	
Less selling expenses under-absorbed in cost books (Rs 22,176 – Rs 17,325)		4,851
Add sundry income not credited in cost books	316	
	25,663	9,039
Profit as per financial books		16,624

P.10.6 M/s Modern Company Limited furnishes the following summary of trading and profit and loss account for the current year ending March 31.

To raw materials	Rs 1,39,600	By sales (12,000 units)		Rs 4,80,000
To direct wages	76,200	By finished stock (200 units)		8,000
To production overheads	42,600	By work-in-process		
To selling and distribution overheads	42,700	Materials	Rs 28,200	
To administration overheads	39,100	Wages	11,796	
To preliminary expenses written off	2,200	Production overheads	7,999	47,995
To goodwill written off	2,501	By interest on securities (gross)		6,000
To dividend (net)	3,000			
To income-tax	4,100			
To net profit	1,89,994			
	5,41,995			5,41,995

The company manufactures a standard unit. The scrutiny of cost records for the same period shows that—

(i) Factory overheads have been allocated to production at 20 per cent on prime cost.

(ii) Administration overheads have been charged at Rs 3 per unit on units produced.

(iii) Selling and distribution expenses have been charged at Rs 4 per unit on units sold.

You are required to prepare a statement of cost, to work out profit as per cost accounts, and to reconcile the same with that shown in the financial accounts.

SOLUTION

Statement of Costs and Profit for the Year Ended March 31

Particulars	*Amount*
Materials consumed	Rs 1,39,600
Direct wages	76,200
Prime cost	2,15,800
Add factory overheads @ 20 per cent of prime cost	43,160
Gross works cost	2,58,960

(*Contd.*)

(*Contd.*)

Less closing work-in-process inventory:		
Materials	Rs 28,200	
Wages	11,796	
Production overheads	7,999	47,995
Works cost (Net)		2,10,965
Add administrative overheads (12,200 units × Rs 3)		36,600
Cost of production(12,200 units @ Rs 20.29 per unit)		2,47,565
Less closing stock (200 units × Rs 20.29)		4,058
Cost of goods sold		2,43,507
Add selling and distribution overheads@ Rs 4 per unit (12,000 × Rs 4)		48,000
Cost of sales		2,91,507
Profit (balancing figure)		1,88,493
Sales (12,000 units × Rs 40)		4,80,000

Assumptions

1. Work-in-process is assumed to have been valued on a financial books basis. It is logical, too, as the work-in-process is valued at factory cost as per costing principles.
2. Finished goods have been valued at the total cost of production. This has been done because the cost records shown that administration overheads have been charged @ Rs 3 per unit on units produced.

Reconciliation Statement: Cost and Financial Profits (Cost Books Profit as Basis)

Particulars		*Plus items*	*Minus items*
Profit as per cost books		Rs 1,88,493	
Add production overheads over-absorbed in cost records (Rs 43,160 – Rs 42,600)		560	
Less administration overheads under-absorbed in cost records (Rs 39,100 – Rs 36,600)			Rs 2,500
Add selling overheads over-absorbed in cost records (Rs 48,000 – Rs 42,700)		5,300	
Add closing stock under-valued in cost records (Rs 8,000 – Rs 4,058)		3,942	
Less expenses not recorded in cost books:			
Preliminary expenses written-off	Rs 2,200		
Goodwill written-off	2,501		
Dividend (net)	3,000		
Income tax	4,100		11,801
Add interest on securities not recorded as revenue income in cost books		6,000	
		2,04,295	14,301
Profit as per financial profit and loss account			1,89,994

P.10.7 From the following information provided by Royal Associates, prepare the financial profit and loss account and reconciliation statement.

Statement of Costs and Profit for the Current Year

Raw materials consumed:		
Opening inventory	Rs 59,000	
Add purchases	3,73,000	
Less closing inventory	(64,000)	Rs 3,68,000
Direct wages		5,96,000

(*Contd.*)

(*Contd.*)

Prime cost	9,64,000
Add works overheads	3,57,600
Less closing inventory of work-in-process	(25,600)
Factory cost	12,96,000
Add administration overheads	2,16,000
Cost of production (9,000 units)	15,12,000
Less closing stock of finished goods (1,400 units)	(2,35,200)
Cost of goods sold (7,600 units)	12,76,800
Add selling overheads (0.20 × total sales)	3,64,800
Cost of sales	16,41,600
Profit	1,82,400
Sales	18,24,000

Additional information:

1. Bad debts not charged in cost books	Rs 35,000
2. Work overheads under-absorbed in cost books	23,900
3. Administration overheads under-absorbed in cost books	29,000
4. Interest received on investments	13,600
5. Selling and distribution overheads over-recovered	36,800
6. There is a uniform basis of valuing work-in-process and finished goods Inventory in both financial and cost books	

SOLUTION

Trading and Profit and Loss Account for the Current Year Ending

Particulars		*Dr Amount*	*Particulars*	*Cr Amount*
To opening stock of raw materials	Rs 59,000		By sales	Rs 18,24,000
Add purchases	3,73,000		By closing inventory Work-in-process	25,600
Less closing inventory	(64,000)	Rs 3,68,000	Finished goods	2,35,200
To direct wages		5,96,000		
To work overheads (Rs 3,57,600 + 23,900)		3,81,500		
To gross profit c/d		7,39,300		
		20,84,800		20,84,800
To administration expenses (Rs 2,16,000 + 29,000)		2,45,000	By gross profit	7,39,300
			By interest on investment	13,600
To selling and distribution expenses (Rs 3,64,800 – Rs 36,800)		3,28,000		
To bad debts written-off		35,000		
To net profit		1,44,900		
		7,52,900		7,52,900

Reconciliation Statement: Cost and Financial Profits (Cost Books Profit as Base)

Particulars	*Plus items*	*Minus items*
Profit as per cost records	Rs 1,82,400	
Less works overheads under-absorbed in cost books		Rs 23,900
Less administrative overheads under-absorbed in cost books		29,000
Add selling and distribution overheads over-recovered in cost books	36,800	
Less bad debts not charged in cost books		35,000
Add interest on investment not credited in cost books	13,600	
	2,32,800	87,900
Profit as per financial books		1,44,900

P.10.8 The trading and profit and loss account of M/s XY (P) Ltd for the year ending March 31 (as prepared by the head office accounts department) is summarised as follows:

To stock, April 1	Rs 60,000	By sales	Rs 1,30,000
To purchases	82,000	By stock, December, 31	80,000
To wages	40,000		
To works expenses	1,800		
To gross profit c/d	26,200		
	2,10,000		2,10,000
To salaries	8,000	By gross profit b/d	26,200
To rent and rates	4,000	By rent received	6,000
To selling expenses	5,600	By dividend (gross)	20,000
To administration expenses	4,200		
To profit	30,400		
	52,200		52,200

The following information was also supplied:

	Particulars	*April 1*	*March 31*
1.	*Stock:*		
	Manufactured units	Rs 24,000	Rs 20,000
	Purchased units	14,000	44,000
	Raw materials	22,000	16,000
		60,000	80,000
2.	*Purchases:*		
	Purchased units	54,000	
	Raw materials	28,000	
		82,000	
3.	*Wages:*		
	Direct wages	30,000	
	Indirect wages	8,000	
	Clerical wages (sales)	2,000	
		40,000	
4.	*Salaries:*		
	Works supervision	2,200	
	Sales department	4,000	
	Administration	1,800	
		8,000	

(*Contd.*)

(*Contd.*)

5. *Rent and rates:*	
Works	2,000
Sales office	400
Let property	1,600
	4,000

Other particulars:

1. Purchased units 3,000 and manufactured units 10,000 were sold at the rate of Rs 10 each.
2. Units purchased at Rs 8 each. Units produced by the company were valued at Rs 8 each.
3. Administration expenditure—two-thirds to be charged to works supervision and one-third to sales supervision.
4. Dividend was on trade investments.

You are required to prepare a costing profit and loss account for the year ending March 31 for submission to the higher management. Also prepare cost and financial profit reconciliation.

SOLUTION

Costing Profit and Loss Account for the Year Ending March 31

Particulars		*Dr Amount*	*Particulars*	*Cr Amount*
To direct materials consumed:			By price cost c/d	Rs 64,000
Opening stock	Rs 22,000			
Add purchases	28,000			
Less closing stock	(16,000)	Rs 34,000		
To wages (direct)		30,000		
		64,000		64,000
To prime cost b/d		64,000	By factory cost b/d	80,800
To factory overheads:				
Works expenses	Rs 1,800			
Indirect wages	8,000			
Salaries	2,200			
Rent and rates	2,000			
Administrative expenses	2,800	16,800		
		80,800		80,800
To factory cost b/d		80,800	By cost of production c/d	82,600
To *administrative overheads:*				
Salaries		1,800		
		82,600		82,600
To cost of production b/d		82,600		
To *opening stock:*			*By closing stock:*	
Manufactured units	Rs 24,000		Manufactured units	20,000
Purchased units	14,000	38,000	Purchased units	44,000
To purchases (from outside)		54,000	By cost of goods sold c/d	1,10,600
		1,74,600		1,74,600
To cost of goods sold b/d		1,10,600	By sales	1,30,000
To clerical wages (sales)		2,000		
To salaries (sales department)		4,000		
To rent and rates (sales)		400		
To selling expenses		5,600		
To administrative expenses				
(1/3 × Rs 4,200)		1,400		
To profit and loss A/c		6,000		
		1,30,000		1,30,000

Reconciliation Statement: Cost and Financial Profits (cost records profits as base)

Particulars		*Plus items*	*Minus items*
Profit as per cost books		Rs 6,000	
Add income not credited in cost books:			
Rent received	Rs 6,000		
Dividends (gross)	20,000	26,000	
Less expenses not charged in cost books:			
Rent and rates for property let out		32,000	Rs 1,600
Profits as per financial books			1,600
			30,400

P.10.9 From the following profit and loss account, draw up a memorandum reconciliation account.

Profit and Loss Account for the Year Ending

Particulars	*Amount*	*Particulars*	*Amount*
To office salaries	Rs 11,282	By gross profit	Rs 54,648
To office expenses	6,514	By dividend received	400
To salesmen's salaries	4,922	By interest on bank deposits	150
To sales expenses	9,304		
To distribution expenses	2,990		
To loss on sale of machinery	1,950		
To fines	200		
To discount on debentures	100		
To net profit	17,936		
	55,198		55,198
To income tax	8,000	By net profit	17,936
To reserve	1,000		
To dividend	4,000		
To balance c/d	4,936		
	17,936		17,936

The cost accountant of the company has ascertained a profit of Rs 19,636 as per his books

SOLUTION

Memorandum Reconciliation Account

Particulars		*Particulars*	
To revenue transactions not Included in cost books:		By profit as per financial books	Rs 4,936
		By expenses transactions not included in cost books:	
Dividend received	Rs 400	Loss on sale of machinery	1,950
Interest on bank deposit	150	Fines	200
To profit as per cost books	19,636	Discount on debentures	100
		Income tax	8,000
		Reserve	1,000
		Dividends	4,000
	20,186		20,186

P.10.10 The following balances appeared on February 28 in the books of a company which has an integral system accounting.

Particulars	*Dr*	*Cr*
Capital and reserves		Rs 6,00,000
Creditors and accruals		1,76,000
Fixed assets	Rs 2,80,000	
Raw materials in store and process	1,60,000	
Direct wages in process	40,000	
Factory overheads in process (at standard)	20,000	
Finished stock	1,80,000	
Debtors	2,00,000	
Cash at bank	20,000	
Budgeted sales		11,70,000
Sales variances	24,000	
Standard factory cost of sales	9,86,000	
Material variance		10,000
Direct wages variance	14,000	
Factory overhead variance	4,000	
Administration and selling expenses	28,000	
	19,56,000	19,56,000

The following transactions took place during March:

1.	Budgeted sales	Rs 2,10,000
2.	Actual sales	1,96,000
3.	Cash received from debtors	1,90,000
4.	Cash paid to creditors	1,26,000
5.	Cash paid (direct wages)	46,000
6.	Raw materials purchased (actual cost)	80,000
7.	Excess materials issued (at standard cost)	2,000
8.	Factory expenses incurred	34,000
9.	Administration and selling expenses incurred	6,000
10.	Output finished (at standard cost):	
	Materials	1,00,000
	Direct wages	52,000
	Factory overhead	26,000
11.	Standard factory cost of actual sales	1,64,000
12.	Standard cost of materials purchased	84,000
13.	Closing valuation of work-in-process accounts (which are debited at actual and credited at standard):	
	Direct wages (at standard)	30,000
	Factory overhead (at standard)	26,000

You are required to (a) pass journal entries, (b) prepare ledger accounts, (c) prepare the profit and loss for the period ending March 31 and balance sheet as on that date.

SOLUTION

(a) *Journal Entries (for March)*

Particulars		*Dr Amount*	*Cr Amount*
Sales ledger control A/c	...Dr	Rs 1,96,000	
Sales variance A/c	...Dr	14,000	
To budgeted sales A/c			Rs 2,10,000
(Being the amounts of actual sales and sales variance recorded)			
Bank A/c	...Dr	1,90,000	
To sales ledger control A/c			1,90,000
(Being the receipts from debtors recorded)			
Bought ledger control A/c	...Dr	1,26,000	
To bank			1,26,000
(Being payment made to creditors)			
Wages control A/c	...Dr	46,000	
To bank			46,000
(Being wages paid to direct labourers)			
Stores ledger control A/c	...Dr	84,000	
To bought ledger control A/c			80,000
To material variances A/c			4,000
(Being raw materials and material variances recorded)			
Finished stock ledger control A/c	...Dr	1,00,000	
Material variance A/c	...Dr	2,000	
To stores ledger control A/c			1,02,000
(Being raw materials issued at standard cost and variances recorded)			
Factory overheads control A/c	...Dr	34,000	
To bank			34,000
(Being factory overheads paid)			
Administrative and selling overheads control A/c	...Dr	6,000	
To bank			6,000
(Being administration and selling overheads paid)			
Finished stock ledger control A/c	...Dr	52,000	
Wages variance A/c	...Dr	4,000	
To wages control A/c			56,000
(Being wages charged to finished goods and variance of Rs 4,000, that is, Rs 40,000 + 30,000 – 52,000 recorded)			
Finished stock ledger control A/c	...Dr	26,000	
Factory overhead variance A/c	...Dr	2,000	
To wages control A/c			28,000
(Being factory overheads charged to production and unfavourable variance of Rs 2,000 i.e., Rs 20,000 + 34,000 – Rs 26,000 – 26,000 recorded)			

(*Contd.*)

(*Contd.*)

Cost of sales A/c	...Dr	1,64,000	
To finished stock ledger control A/C			1,64,000
(Being standard cost of sales recorded)			
Profit and loss A/c	...Dr	12,46,000	
To cost of sales A/c			11,50,000
To sales variance A/c			38,000
To wages variance A/c			18,000
To factory overhead variance A/c			6,000
To administration and selling overhead control A/c			34,000
(Being various nominal accounts closed by transferring to profit and loss account)			
Budgeted sales A/c	...Dr	13,80,000	
Materials variance A/c	...Dr	12,000	
To profit and loss A/c			13,92,000
(Being budgeted sales and material variance favourable transferred to profit and loss A/c)			
Profit and loss A/c	...Dr	1,46,000	
To capitals and reserve A/c			1,46,000
(Being profit transferred to capital and reserve)			

(b) *Ledger Accounts*

Sales Ledger Control or Debtors A/c

Particulars	*Amount*	*Particulars*	*Amount*
To balance b/d	Rs 2,00,000	By bank	Rs 1,90,000
To budgeted sales A/c	1,96,000	By balance c/d	2,06,000
	3,96,000		3,96,000
To balance b/d	2,06,000		

Sales Variance A/c

To balance b/d	Rs 24,000	By profit and loss A/c (transferred)	Rs 38,000
To budgeted sales A/c	14,000		
	38,000		38,000

Budgeted Sales A/c

To profit and loss A/c (transferred)	Rs 13,80,000	By balance b/d	Rs 11,70,000
		By sales ledger control A/c	1,96,000
		By sales variance A/c	14,000
	13,80,000		13,80,000

Bought Ledger Control or Creditors and Accruals A/c

To bank	Rs 1,26,000	By balance b/d	Rs 1,76,000
To balance c/d	1,30,000	By stores ledger control A/c	80,000
	2,56,000		2,56,000
		By balance b/d	1,30,000

Wages Control or Direct Wages in Process A/c

To balance b/d	Rs 40,000	By finished goods ledger control A/c	Rs 52,000
To bank	46,000	By wages variance A/c	4,000
		By balance c/d	30,000
	86,000		86,000

Stores Ledger Control or Raw Materials in Stores and Spares A/c

To balance b/d	Rs 1,60,000	By finished stock ledger control A/c	Rs 1,00,000
To bought ledger control A/c	80,000	By material variance A/c	2,000
To material variance A/c	4,000	By balance c/d	1,42,000
	2,44,000		2,44,000
To balance b/d	1,42,000		

Material Variance A/c

To stores ledger control A/c	Rs 2,000	By balance b/d	Rs 10,000
To profit and loss A/c (transfer)	12,000	By stores ledger control A/c	4,000
	14,000		14,000

Finished Stock Ledger Control A/c

To balance b/d	Rs 1,80,000	By cost of sales A/c	Rs 1,64,000
To stores ledger control A/c	1,00,000	By balance c/d	1,94,000
To wages control A/c	52,000		
To factory overhead A/c	26,000		
	3,58,000		3,58,000
To balance b/d	1,94,000		

Factory Overhead Control or in Process A/c

To balance b/d	Rs 20,000	By finished stock ledger control A/c	Rs 26,000
To bank	34,000	By factory overhead variance A/c	2,000
		By balance c/d	26,000
	54,000		54,000
To balance b/d	26,000		

Administration and Selling Overhead Control A/c

To balance b/d	Rs 28,000	By profit and loss A/c (transfer)	Rs 34,000
To wages control A/c	6,000		
	34,000		34,000

Direct Wages Variance A/c

To balance b/d	14,000	By profit and loss A/c (transfer)	Rs 18,000
To wages control A/C	4,000		
	18,000		18,000

Factory Overhead Variance A/c

To balance b/d	Rs 4,000	By profit and loss A/c (transfer)	Rs 6,000
To factory overhead A/c	2,000		
	6,000		6,000

Cost of Sales A/c

To balance b/d	Rs 9,86,000	By profit and loss A/c(transfer)	Rs 11,50,000
To finished stock ledger control A/c	1,64,000		
	11,50,000		11,50,000

Bank A/c

To balance b/d	Rs 20,000	By bought ledger control A/c	Rs 1,26,000
To sales ledger control A/c	1,90,000	By wages control A/c	46,000
To balance c/d	2,000	By factory overheads control A/c	34,000
		By administration & selling overheads control A/c	6,000
	2,12,000		2,12,000
		By balance b/d (overdraft)	2,000

Profit and Loss A/c (for the period ending March 31)

To cost of sales A/c	Rs 11,50,000	By budgeted sales A/c	Rs 13,80,000
To sales variance A/c	38,000	By materials variance A/c	12,000
To wages variance A/c	18,000		
To factory overhead variance A/c	6,000		
To administration and selling overheads control A/c	34,000		
To net profit (current year)	1,46,000		
	13,92,000		13,92,000

Capital and Reserves A/c

To balance c/d	Rs 7,46,000	By balance b/d	Rs 6,00,000
		By profit and loss A/c (current year's profits)	1,46,000
	7,46,000		7,46,000
		By balance b/d	7,46,000

Fixed Assets A/c

To balance b/d	Rs 2,80,000	By balance c/d	Rs 2,80,000
	2,80,000		2,80,000
To balance b/d	2,80,000		

Balance Sheet as on March 31

Liabilities	*Amount*	*Assets*	*Amount*
Capitals and reserves	Rs 7,46,000	Fixed assets	Rs 2,80,000
Creditors and accruals	1,30,000	Finished stock	1,94,000
Bank overdraft	2,000	Materials in process	1,42,000
		Wages in process	30,000
		Factory overheads in process	26,000
		Debtors	2,06,000
	8,78,000		8,78,000

REVIEW QUESTIONS

RQ.10.1 Why is it necessary to reconcile cost and financial accounts?

RQ.10.2 A manufacturing firm prepares profit and loss account in cost books as well as in financial books. But the profits shown by the two books do not agree. Explain the reasons for the difference in profits as per the two sets of books. Would you recommend the reconciliation of the two profits? If yes, why?

RQ.10.3 At the end of an accounting period it is found that the profit shown by the financial accounts falls considerably short of the profits according to the cost accounts. Indicate how the discrepancy may have arisen.

RQ.10.4 Mention major items of expenses or income, which will appear in financial accounts but will not normally appear in cost accounts.

RQ.10.5 What do you understand by integrated accounts? State the advantages of integrated accounts. State in brief the procedure of installing such a system in a newly started manufacturing firm.

RQ.10.6 From the account books of Shankar and Company Ltd, manufacturing, trading, and profit & loss accounts are reproduced below:

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Raw materials		By Work-in-progress	
Opening stock	Rs 29,500	Material	Rs 4,000
Purchases	1,86,500	Wages	5,500
To Wages	2,98,000	Works expenses	3,300
To Works expenses	1,90,750	By Cost of goods manufactured	6,59,950
		By Closing stock of raw material	32,000
	7,04,750		7,04,750
To Cost of goods manufactured	6,59,950	By Sales (7,600 units)	9,12,000
To Administrative expenses	1,22,500	By Finished stock (1,400 units)	1,17,600
To Selling and distribution expenses	1,64,000	By Interest on investments	6,800
To Bad debts written off	17,500		
To Net profit transferred to appropriation account	72,450		
	10,36,400		10,36,400

The following information is also available:

(i) Accrued wages, Rs 17,000 included in wages.
(ii) Works expenses are allocated to production at 60 per cent of direct labour cost.
(iii) Administrative expenses are allocated at Rs 12 per unit of production.
(iv) Selling and distribution expenses are allocated so as to work out 20 per cent of selling price.

Prepare a costing profit and loss A/c and statement of reconciliation between the two accounts (cost and financial).

SOLUTION

Costing Profit and Loss A/c of Shanker and Company Ltd

Particulars		*Dr. Amount*	*Particulars*	*Cr. Amount*
To Material used			By Sales revenue	Rs 9,12,000
Opening Stock	Rs 29,500			
Add purchases	1,86,500			
Less Closing stock	32,000	Rs 1,84,000		
To Wages		2,98,000		
Prime Cost		4,82,000		

(*Contd.*)

(*Contd.*)

To Works expenses (0.60 × Rs 2,98,000)	1,78,800		
Works Cost (gross)	6,60,800		
Less Closing work-in-progress	12,800		
Works Cost (net)	6,48,000		
To Administrative expenses (9,000 units × Rs 12)	1,08,000		
Cost of Production	7,56,000		
Less Closing finished goods stock	1,17,600		
Cost of Goods Sold	6,38,400		
To Selling and distribution expenses (0.20 × Rs 9,12,000)	1,82,400		
Cost of Sales	8,20,800		
To Profit (balancing figure)	91,200		
	9,12,000		9,12,000

Reconciliation Statement: Cost and Financial Books

Particulars	*Plus items (+)*	*Minus items (–)*
Profit as per cost books	Rs 91,200	
Less under-absorption of works expenses (Rs 1,90,750 – Rs 1,78,800)		Rs 11,950
Less under-absorption of administrative expenses (Rs 1,22,500 – Rs 1,08,000)		14,500
Add over-absorption of selling and distribution expenses (Rs 1,82,400 – Rs 1,64,000)	18,400	
Less bad debts not recorded in cost books		17,500
Add interest received on investments not shown in cost books	6,800	
	1,16,400	43,950
Profit as per financial books	72,450	

RQ.10.7 The summary trading and profit and loss account from the financial accounts of S.N. Industries Ltd and some additional information is given below. You are required to prepare a detailed statement reconciling the profit of Rs 3,02,850 as disclosed by the financial accounts with the figure of Rs 2,74,625 as shown by the cost books.

Summary Trading and Profit and Loss account for the year ended December 31.

Particulars		*Dr. Amount*	*Particulars*	*Cr. Amount*
To Opening stock	Rs 25,000		By Sales revenue	Rs 15,75,000
Add purchases	6,75,000			
	7,00,000			
Less closing stock	42,500	Rs 6,57,500		
To Direct wages		2,12,500		
To *Factory overheads*				
Indirect wages	12,300			
Heat and power	34,200			
Miscellaneous	6,000			
Depreciation	61,000	1,13,500		
To Gross profit c/d		5,91,500		
		15,75,000		15,75,000

(*Contd.*)

(*Contd.*)

To *Selling expenses*				
Advertising	45,000		By Gross profit b/d	5,91,500
Salaries	95,000		By Dividend income	18,750
Bad debts	4,000			
Sundry	27,100	1,71,100		
To *Administration expenses*				
Salaries	Rs 82,000			
Printing and stationary	15,000			
Audit fee	2,000			
General	9,950	1,08,950		
To Financial expenses				
Debenture interest	20,000			
Bank interest	3,000			
Hire purchase interest	4,350	27,350		
To Net profit		3,02,850		
		6,10,250		6,10,250

Additional information

1. In the cost accounts (a) Works overhead, excluding depreciation, is charged at a rate of Re 0.25 per unit produced; (b) Selling overheads are charged at a rate of 12 per cent of sales turnover; (c) Administration expenses are charged at a fixed sum of Rs 1,25,000 per annum. This includes an allowance of Rs 15,000 to cover all financial incomes and expenditures.
2. Depreciation in the financial accounts is calculated on a straight line basis but in the cost accounts there is a fixed annual charge equivalent to half of the straight line calculation plus a running charge of Re 0.125 per unit produced.
3. The company owns the business premises but in the cost accounts, in addition to the items mentioned above, there is a notional charge of Rs 2,500 per annum for rent.
4. Items of a non-revenue nature are not included in the cost accounts.
5. In the cost accounts, stock is valued at direct cost (material and labour) but in the financial accounts, it includes an allowance for overheads.
6. Opening stock consists of 5,000 units valued at:

Material	Rs 15,500
Labour	5,500
Overheads	4,000
	25,000

Closing stock consists of 8,000 units valued at:

Material	26,500
Labour	8,500
Overheads	7,500
	42,500

Sales were 2,10,000 units @ Rs 7.50 per unit.

SOLUTION

Reconciliation Statement: Cost and Financial Books

Particulars			*Plus items*	*Minus items*
Profit as per financial books			Rs 3,02,850	
Add over-absorption of factory overheads (Financial books charges – Cost book charges) (See working notes)			3,125	
Less under-absorption of selling expenses (0.12 × Rs 15,75,000 = Rs 1,89,000 – Rs 1,71,100)				Rs 17,900
Less under-absorption of administration expenses (Rs 1,10,000 – Rs 1,08,950)				1,050
Less under-absorption of financial charges (net):				
Cost books		Rs 15,000		
Financial books				
Expenses	Rs 27,350			
Less dividends	18,750	8,600		6,400
Less notional rent charges not included in financial books				2,500
Add over-valuation of opening stock (Rs 25,000–Rs 21,000)			4,000	
Less over-valuation of closing stock (Rs 42,500–Rs 35,000)				7,500
			3,09,975	35,350
Profit as per cost books			2,74,645	

Working Notes

Over-absorption of factory overheads:			
Financial books charges			Rs 1,13,500
Less cost book charges:			
(a) Cash overheads (2,13,000 units × Re 0.25)		Rs 53,250	
(b) *Add* depreciation (0.50 × Rs 61,000)	Rs 30,500		
Incremental charges (Re 0.125 × 2,13,000)	26,625	57,125	1,10,375
			3,125

RQ.10.8 Prepare the following statements from the particulars given below:

(a) Statement of cost of manufacture and percentage of each item of cost to total cost, calculating factory overheads at 25 per cent of prime cost and office overheads at 75 per cent of factory overheads.

(b) Statement of profit as per cost accounts.

(c) Profit and loss A/c.

(d) A reconciliation statement.

Stock at the beginning:	
Raw material	Rs 8,000
Finished articles	16,000
Purchase of raw material	48,000
Wages	20,000
Office expenses	12,200
Works expenses	15,500
Sales	1,30,000
Stock at the end:	
Raw materials	12,000
Finished articles	4,000

Profit is fixed at 20 per cent on selling price.

SOLUTION

(a) *Cost Sheet*

Particulars		*Total cost*	*Per cent to total cost*
Raw material used			
Opening stock	Rs 8,000		
Add purchases	48,000		
Less closing stock	12,000	Rs 44,000	47.83
Wages		20,000	21.74
Prime Cost		64,000	69.57
Add factory overheads (0.25 × Rs 64,000)		16,000	17.39
Factory Cost		80,000	86.96
Add office overheads (0.75 × Rs 16,000)		12,000	13.04
Cost of Production		92,000	100.00

(b) *Statement of Cost and Profit*

Particulars	*Total amount*
Cost of production	Rs 92,000
Add Opening Stock	16,000
Less Closing Stock	4,000
Cost of goods sold	1,04,000
Profit (balancing figure)	26,000
Sales	1,30,000

(c) *Profit and Loss A/c*

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Opening finished goods inventory	Rs 16,000	By Sales	Rs 1,30,000
To Raw materials used (Rs 8,000 + Rs 48,000 – Rs 12,000)	44,000	By Closing finished goods inventory	4,000
To Wages	20,000		
To Office expenses	12,200		
To Works expenses	15,500		
To Net profit	26,300		
	1,34,000		1,34,000

(d) *Reconciliation Statement: Financial and Cost Books*

Particulars	*Plus items*	*Minus items*
Profit as per cost books	Rs 26,000	
Add over-absorption of factory overheads in cost books (Rs 16,000 – Rs 15,500)	500	
Less under-absorption of office overheads in cost books (Rs 12,220 – Rs 12,000)		Rs 200
	26,500	200
Profit as per financial books	26,300	

RQ.10.9 A radio manufacturing company, which commenced business on January 1, supplies you with the following information and asks you to prepare a statement showing the profit per radio sold. Wages and material are to be charged at actual cost, works expenses at 75 per cent on wages, and office expenses at 30 per cent on works cost. You

are also required to prepare a statement reconciling the profit as shown by the cost accounts with the profit as shown by the profit & loss A/c for the year.

There were no radio sets in stock or in course of manufacture on December 31 and the number of radio sets sold during the year was 540.

The particulars given are as under:

Material per set	Rs 240
Wages per set	80
Selling price per set	600

Prepare the necessary statements showing the actual profit for the year, if the works expenses were Rs 32,160 and the office expenses Rs 61,800.

SOLUTION

Statement of Cost and Profit in Cost Books for the Year Ending December 31

Particulars	*Total cost*
Material (Rs 240 × 540)	Rs 1,29,600
Wages (Rs 80 × 540)	43,200
Prime Cost	1,72,800
Add works expenses (0.75 × Rs 43,200)	32,400
Factory Cost/Works Cost	2,05,200
Add office expenses (0.30 × Rs 2,05,200)	61,560
Cost of Production/Goods Sold	2,66,760
Profit (balancing figure) (540 × Rs 106)	57,240
Sales (9,540 × Rs 600)	3,24,000

Profit and Loss A/c for the Year Ending December 31

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Material costs	Rs 1,29,600	By Sales revenue	Rs 3,24,000
To Wages	43,200		
To Works expenses	32,160		
To Office expenses	61,800		
To Profit	57,240		
	3,24,000		3,24,000

Reconciliation Statement: Cost and Financial Books

Particulars	*Plus items*	*Minus items*
Profit as per cost books	Rs 57,240	
Add over-absorption of works expenses in cost books (Rs 32,400 – Rs 32,160)	240	
Less under-absorption of office expenses in cost books (Rs 61,800 – Rs 61,560)		Rs 240
	57,480	240
Profit as per financial books	57,240	

RQ.10.10 A company's trading and profit and loss A/c was as follows:

To Purchases	Rs 25,210	By Sales (50,000 units	Rs 75,000
Less closing stock	4,080	@ Rs 1.50 each)	
	21,130	By Discount received	260
To Direct wages	10,500	By Profit on sale of land	2,340
To Works expenses	12,130		
To Selling expenses	7,100		
To Administrative expenses	5,340		
To Depreciation	1,100		
To Net profit	20,300		
	77,600		77,600

The profit as per cost accounts is Rs 19,770 only. Reconcile the financial and cost profits using the following information:

(a) Cost accounts valued closing stock at Rs 4,280.
(b) The work expenses in the cost accounts are taken at 100 per cent of direct wages.
(c) Selling and administrative expenses are charged in the cost accounts at 10 per cent of sales and Re 0.10 per unit respectively.
(d) Depreciation in the cost accounts is Rs 800.

SOLUTION

Reconciliation Statement: Cost and Financial Books

Particulars	*Plus items*	*Minus items*
Profit as per cost books	Rs 19,770	
Less closing stock over-valued in cost books (Rs 4,280 – Rs 4,080)		Rs 200
Less under-absorption of work expenses (Rs 12,130 – Rs 10,500)		1,630
Add over-absorption of selling expenses (Rs 7,500 – Rs 7,100)	400	
Less under-absorption of depreciation charges (Rs 1,100 – Rs 800)		300
Add income not shown in cost books		
Discount received	260	
Profit on sale of land	2,340	
	22,770	2,470
Profit as per financial books	20,300	

RQ.10.11 Pass the journal entries in an integrated accounting system for the following particulars.

(a) Issued material, Rs 3,00,000 of which Rs 2,80,000 (standard Rs 2,40,000) is direct material.
(b) Net wages paid Rs 70,000, deductions being Rs 12,000 (standard Rs 75,000).
(c) Gross salaries payable for the period are Rs 26,000 (standard Rs 25,000), deductions Rs 2,000.
(d) Sales (credit), Rs 8,00,000.
(e) Discount allowed, Rs 5,000.
(f) Salaries and wages allocation, Rs 60,000 direct (standard Rs 62,000) and out of the balance, 50 per cent production, 30 per cent administration, and 20 per cent selling and distribution overheads.

SOLUTION

Journal Entries

Particulars		*Dr. Amount*	*Cr. Amount*
(a) Work-in-process ledger control A/c	Dr.	Rs 2,40,000	
Factory overhead control A/c	Dr.	20,000	
Material variances A/c	Dr.	40,000	
To Stores ledger control A/c			Rs 3,00,000
(*Being direct material of Rs 2,40,000 and indirect material of Rs 20,000 issued at standard cost and variances recorded)*			
(b) Wages control A/c	Dr.	75,000	
Wages variances A/c	Dr.	7,000	
To Cash			70,000
To Employees' provident fund A/c			12,000
(Being wages paid and wage variance recorded)			
(c) Wages control A/c	Dr.	25,000	
Wages variance A/c	Dr.	1,000	
To Wages payable/suspense A/c			24,000
To Employee's provident fund and/or I.tax A/c			2,000
(Being gross salaries payable and variance recorded)			
(d) Sales ledger control A/c	Dr.	8,00,000	
To Cost of sales A/c			8,00,000
(Being sales made of finished goods on credit)			
(e) Selling and distribution overhead control A/c	Dr.	5,000	
To Sales ledger control A/c			5,000
(Being discount allowed on sales recorded)			
(f) Work-in-process ledger control A/c	Dr.	62,000	
Factory overhead control A/c	Dr.	20,000	
Administrative overheads control A/c	Dr.	12,000	
Selling and distribution overhead control A/c	Dr.	8,000	
To Wages control A/c			1,00,000
To Wages variance A/c			2,000
(Being allocation of wages between production and other types of overheads and variances recorded).			

RQ.10.12 Journalise the following transactions assuming that the cost and financial records are integrated:

Raw material purchased on credit	Rs 2,00,000
Direct material issued for production	1,50,000
Wages paid (30% indirect)	1,20,000
Manufacturing expenses incurred	84,000
Manufacturing overheads charged to production	92,000
Selling and distribution costs	20,000
Finished product (at cost)	2,00,000
Sales2,90,000	
Closing stock	Nil
Receipt from debtors	69,000
Payment to creditors	1,10,000

SOLUTION

Journal Entries (Integrated Accounts)

Particulars		*Dr. Amount*	*Cr. Amount*
Stores ledger control A/c	Dr.	Rs 2,00,000	
To Bought ledger control A/c			Rs 2,00,000
(Being raw materials purchased on credit)			
Work-in-process ledger control A/c	Dr.	1,50,000	
To Stores ledger control A/c			1,50,000
(Being direct materials issued for production)			
Wages control A/c	Dr.	1,20,000	
To Bank			1,20,000
(*Being wages paid*)			
Work-in-process ledger control A/c	Dr.	84,000	
Factory overhead control A/c	Dr.	36,000	
To Wages control A/c			1,20,000
(Being apportionment of wages between direct (70%) and indirect (30%)]			
Factory overhead control A/c	Dr.	84,000	
To Bank			84,000
(Being manufacturing expenses incurred and paid)			
Work-in-process ledger control A/c	Dr.	92,000	
To Factory overheads control A/c			92,000
(Being manufacturing overheads charged to production)			
Selling and distribution overheads control A/c	Dr.	20,000	
To Bank			20,000
(Being payment for selling and distribution costs)			
Finished stock ledger control A/c		2,00,000	
To Work-in-process ledger control A/c			2,00,000
(Cost of finished output transferred to finished stock ledger control A/c)			
Cost of sales A/c	Dr.	2,00,000	
To Finished stock ledger control A/c			2,00,000
(Cost of entire finished output sold transferred to cost of finished sales)			
Cost of sales A/c	Dr.	20,000	
To Selling and distribution overhead control A/c			20,000
(Being selling and distribution costs charged to cost of sales account)			
Sales ledger control A/c	Dr.	2,90,000	
To Cost of sales A/c			2,90,000
(Being sales made of finished output on credit)			
Bank A/c	Dr.	69,000	
To Sales ledger control A/c			69,000
(Being cash received from debtors)			
Bought ledger control A/c	Dr.	1,10,000	
To Bank A/c			1,10,000
(Being payment made to creditors)			

RQ.10.13 From the following information, show the control accounts in the general ledger of a factory where cost and financial accounts are integrated and prepare a trial balance as on March 31.

Ledger Balances as on April, 1

Share capital	Rs 1,50,000
Reserves	37,500
Sundry debtors	30,000
Plant and machinery	1,87,500
Sundry creditors	45,000
Bank (overdraft)	60,000
Raw material	75,000

Transactions during the year:

Raw material purchases	Rs 1,20,000
Raw material issued to production department	1,50,000
Raw material on hand, March 31	39,000
Direct wages: incurred (charged to production)	1,42,500
Factory overheads incurred	1,39,500
Production overheads incurred	1,31,250
Production overheads charged to production	1,39,500
Selling and distribution overheads	15,000
Finished stock (production at cost)	2,86,500
Finished stock (at selling price)	4,29,000
Payment to creditors	1,27,500
Receipts from debtors	4,50,000

SOLUTION

Bought Ledger Control A/c

To Bank	Rs 1,27,500	By Balance b/d	Rs 45,000
To Balance c/d	37,500	By Stores ledger control A/c	1,20,000
	1,65,000		1,65,000
		By Balance b/d	37,500

Stores Ledger Control A/c

To Balance b/d	75,000	By Work-in-process ledger control A/c	1,50,000
To Bought ledger control A/c	1,20,000	By Material variance A/c (balancing figure)	6,000
		By Balance c/d	39,000
	1,95,000		1,95,000
To Balance b/d	39,000		

Work-in-process (WIP) Ledger Control A/c

To Stores ledger control A/c	1,50,000	By Finished stock ledger control A/c	2,86,500
To Wages control A/c	1,39,500	By Balance c/d (balancing figure)	1,42,500
To Factory overhead control A/c	1,39,500		
	4,29,000		4,29,000
To Balance b/d	1,42,500		

Wages Control A/c

To Bank	1,42,500	By WIP ledger control A/c	1,39,500
		By Wages variance A/c	3,000
	1,42,500		1,42,500

Factory Overheads Control A/c

To Bank A/c	1,31,250	By WIP ledger control A/c	1,39,500
To Factory overhead cost variance A/c	8,250		
	1,39,500		1,39,500

Selling and Distribution Overheads Control A/c

To Bank	15,000	By Cost of sales A/c	15,000

Finished Stock Ledger Control A/c

To WIP ledger control A/c	2,86,500	By Cost of sales A/c	2,86,500

Cost of Sales A/c

To Finished stock ledger control A/c	2,86,500	By Sales ledger control A/c	4,29,000
To Wages variance A/c	3,000	By Factory overheads cost variance A/c	8,250
To Material variance A/c	6,000		
To Selling and distribution overheads control A/c	15,000		
To Profit & loss A/c (balancing figure)	1,26,750		
	4,37,250		4,37,250

Sales Ledger Control A/c

To Balance b/d	30,000	By Bank	4,50,000
To Cost of sales A/c	4,29,000	By Balance c/d	9,000
	4,59,000		4,59,000
To Balance b/d	9,000		

Bank A/c

To Balance b/d	4,50,000	By Balance b/d	60,000
To Balance c/d (overdraft)	26,250	By Bought ledger control A/c (payment to creditors)	1,27,500
		By Wages control A/c	1,42,500
		By Factory overhead control A/c	1,31,250
		By Selling and distribution overheads control A/c	15,000
	4,76,250		4,76,250
		By Balance b/d	26,250

Note: All production overheads incurred are assumed to involve cash payments. The cash payment will be reduced, however, to the extent of the amount of depreciation.

Trial balance as on March 31 of the Current Year

Particulars	*Dr. Amount*	*Cr. Amount*
Share capital		Rs 1,50,000
Reserves (Rs 37,500 + Rs 1,26,750)	1,64,250	
Debtors	Rs 9,000	
Plant and machinery	1,87,500	
Creditors		37,500
Bank overdraft		26,250
Raw material stock	39,000	
Work-in-process inventory	1,42,500	
	3,78,000	3,78,000

Note: Depreciation has not been charged on plant and machinery due to lack of information.

RQ.10.14 The profit and loss A/c as shown in the financial books of company for the current year ended September 30 together with a statement of reconciliation between the profit as per financial and cost accounts is given below:

Profit and Loss A/c for the Current Year Ended September 30

Opening stock:			Sales		Rs 15,00,000
Raw material	Rs 90,000		*Closing stock:*		
Work-in-progress	50,000		Raw material	Rs 98,000	
Finished goods	70,000	Rs 2,10,000	Work-in-progress	53,000	
Raw material purchases		5,00,000	Finished goods	72,000	2,23,000
Direct wages		2,00,000	Miscellaneous receipts		45,000
Factory overheads		2,00,000			
Administration expenses		1,70,000			
Selling & distribution expenses		2,20,000			
Preliminary expenses written-off		75,000			
Debenture interest		30,000			
Net profit		1,63,000			
		17,68,000			17,68,000

Statement of Reconciliation of Profit as per Financial and Cost Accounts

Profit as per financial accounts		Rs 163,000
(a) *Difference in valuation of stock*		
Add: Raw materials (closing stock)	Rs 1,200	
Work-in-progress (opening stock)	1,300	
Finished goods (opening stock)	2,000	
(closing stock)	1,000	
Total (A)	5,500	
Less: Raw materials (opening stock)	1,650	
Work-in-progress (closing stock)	750	
Total (B)	2,400	
(A – B)		3,100
(b) *Other items*		
Add: Preliminary expenses written-off	75,000	
Debenture interest	30,000	
	1,05,000	
Less: Miscellaneous receipts	45,000	60,000
Profit as per cost accounts		2,26,100

You are required to prepare the following accounts as they would appear in the costing ledger: (i) Raw material control A/c, (ii) Work-in-progress control A/c, (iii) Finished goods control A/c, (iv) Cost of sales A/c, and (v) Costing profit & loss A/c.

SOLUTION

Costing Ledger

Raw Material Control A/c

To Balance b/d (opening stock) (Rs 90,000 + Rs 1,650 under-valuation in financial books)	Rs 91,650	By WIP control A/c (balancing figure)	Rs 4,92,450
		Balance c/d (closing inventory)	99,200
To Bought ledger control A/c	5,00,000		
	5,91,650		5,91,650
To Balance b/d	99,200		

Work-in-process (WIP) Control A/c

To Balance b/d—opening inventory (Rs 50,000 – Rs 1,300 under-valuation in cost books)	48,700	By Finished goods control A/c	8,88,900
		By Balance c/d (closing inventory) (Rs 53,000 – Rs 750 under-valuation in cost books)	52,250
To Raw material control A/c	4,92,450		
To Wages control A/c	2,00,000		
To Factory overheads control A/c	2,00,000		
	9,41,150		9,41,150
To Balance b/d	52,250		

Finished Goods Control A/c

To Balance b/d–opening stock (Rs 70,000 – Rs 2,000 undervalued in cost books)	68,000	By Cost of sales A/c	10,53,900
		By Balance c/d (Rs 72,000 + Rs 1,000 overvalued in cost books)	73,000
To WIP control A/c	8,88,900		
To Administrative overheads control A/c	1,70,000		
	11,26,900		11,26,900
To Balance b/d	73,000		

Cost of Sales A/c

To Finished goods control A/c	10,53,900	By Costing profit & loss A/c	12,73,900
To Selling and distribution overheads control A/c	2,20,000		
	12,73,900		12,73,900

Costing Profit & Loss A/c

To Cost of sales A/c	12,73,900	By Sales ledger control A/c	15,00,000
To Net profit	2,26,100		
	15,00,000		15,00,000

RQ.10.15 In the absence of the chief accountant, you have been asked to prepare a month's cost accounts for a company which operates a batch costing system fully integrated with the financial accounts. The following relevant information is provided to you:

Balances at the beginning of month:		
Stores ledger control A/c		Rs 25,000
Work-in-progress control A/c		20,000
Finished goods control A/c		35,000
Prepaid production overheads brought forward from previous month		3,000
Transactions during the month:		
Material purchased		75,000
Material issued:		
To production	Rs 30,000	
To Factory maintenance	4,000	34,000
Materials transferred between batches		5,000
Total wages paid:		
To Direct workers	Rs 25,000	
To Indirect workers	5,000	30,000
Direct wages charged to batches		20,000
Recorded non-productive time of direct workers		5,000
Selling distribution overheads incurred		6,000
Other production overheads incurred		12,000
Sales		1,00,000
Cost of finished goods sold		80,000
Cost of goods completed and transferred into finished goods during the month		65,000
Physical value of work-in-progress at the end of the month		40,000
The production overheads absorption rate is 150 per cent of direct wages.		

Prepare the following accounts for the month: (a) Stores ledger control A/c, (b) Work-in-progress control A/c, (c) Finished goods control A/c, (d) Production overheads control A/c and (e) Profit & loss A/c.

SOLUTION

Stores Ledger Control A/c

To Balance b/d	25,000	By WIP control A/c	30,000
To Bought ledger control A/c	75,000	By Production overheads control A/c	4,000
	By Balance c/d	66,000	
	1,00,000		1,00,000
To Balance b/d	66,000		

Work-in-progress (WIP) Control A/c

To Balance b/d	20,000	By Finished goods control A/c	65,000
To Stores ledger control A/c	30,000	By Closing Work-in-process A/c	40,000
To Wages control A/c	20,000		
To Production overheads control A/c (150% of wages)	30,000		
To Profit & loss A/c	5,000		
	1,05,000		1,05,000

Finished Goods Control A/c

To Balance b/d	35,000	By Cost of sales/Profit & loss A/c	80,000
To WIP control A/c	65,000	By Balance c/d	20,000
	1,00,000		1,00,000

Production Overheads Control A/c

To Balance b/d (prepaid)	3,000	By Work-in-progress control A/c	
To Stores ledger control A/c	4,000	(20,000 × 1.50)	30,000
To Wages control A/c (indirect wages)	5,000		
To Wages control A/c (non-productive time of workers)	5,000		
To Bank	12,000		
To Profit & loss A/c [balancing figure (overabsorption of factory overheads)]	1,000		
	30,000		30,000

Profit & Loss A/c

To Finished goods control A/c (cost of goods sold)	80,000	By Sales ledger control A/c	1,00,000
		By Production overheads control A/c	1,000
To Selling and distribution overheads A/c	6,000	By WIP control A/c	5,000
To Net profit	20,000		
	1,06,000		1,06,000

Notes (i) Materials transferred between batches will have no bearing on control accounts, (ii) Non-productive time of direct workers is considered a part of production overheads.

RQ.10.16 ABC Ltd operates an integrated accounting system and the following details are given for the current year ended March 31:

Trial Balance as on March 31

Particulars	*Debit*	*Credit*
Share capital		Rs 20,00,000
Reserves		2,00,000
Creditors for purchases		1,50,000
Expenses creditors		20,000
Freehold buildings, at cost	Rs 5,00,000	
Plant and machinery, at cost	13,00,000	
Provision for depreciation on plant and machinery		1,00,000
Stock of		
Raw material	2,20,000	
Work-in-progress	40,000	
Finished goods	60,000	
Debtors	2,00,000	
Bank	1,50,000	
	24,70,000	24,70,000

The following data for the month of April is given:

Raw material purchased on credit	Rs 9,90,000
Raw material returned to suppliers	40,000
Material issued to production	8,50,000
Material returned from shop floor	20,000
Factory wages paid	
Productive	2,50,000
Non-productive	50,000
Salaries paid	
Administration	1,00,000
Selling & distribution	75,000
Overhead expenses incurred but not paid	
Production	3,00,000
Administration	50,000
Selling & distribution	1,00,000
Depreciation for the month on plant and machinery	50,000
Sales on credit	20,00,000
Cash received from debtors	19,50,000
Paid the following by cheque	
Creditors for purchases	10,00,000
Creditors for expenses	4,30,000
Production overheads applied to production	3,90,000
Administrative overheads applied to finished goods	1,45,090
Selling and distribution overhead applied to cost of sales	1,80,000
Closing stock	
Work-in-progress	2,10,000
Finished goods	2,15,000

You are required to (a) show the appropriate ledger accounts, (b) prepare the income statement for April, and (c) prepare the balance sheet as at April 30.

SOLUTION

(a) Appropriate Ledger Accounts

Stores Ledger Control A/c

To Balance b/d	2,20,000	By Bought ledger control A/c (returned)	40,000
To Bought ledger control A/c	9,90,000	By WIP ledger control A/c	8,50,000
To WIP ledger control A/c	20,000	(material issued)	
	By Balance c/d	3,40,000	
	12,30,000		12,30,000
To Balance b/d	3,40,000		

Bought Ledger Control A/c

To Stores ledger control A/c (returned)	40,000	By Balance b/d	1,50,000
To Bank	10,00,000	By Stores ledger control A/c	
To Balance c/d	1,00,000	(purchases)	9,90,000
	11,40,000		11,40,000
		By Balance b/d	1,00,000

Work-in-process (WIP) Ledger Control A/c

To Balance b/d	40,000	By Stores ledger control A/c	20,000
To Stores ledger control A/c	8,50,000	By Finished stock ledger control A/c (balancing figure)	13,00,000
To Wages control A/c (productive)	2,50,000	By Balance c/d	2,10,000
To Factory overheads control A/c	3,90,000		
	15,30,000		15,30,000
To Balance b/d	2,10,000		

Wages Control A/c

To Bank	3,00,000	By WIP ledger control A/c	2,50,000
		By Factory overheads control A/c	50,000
	3,00,000		3,00,000

Factory Overheads Control A/c

To Wages control A/c (non-productive)	50,000	By WIP ledger control A/c (overheads applied)	3,90,000
To Expenses ledger control A/c	3,00,000	By Factory overheads	10,000
To Provision for depreciation on plant and machinery	50,000	[cost variance (unfavourable) transferred to income statement]	
	4,00,000		4,00,000

Administration Overheads Control A/c

To Bank (salaries)	1,00,000	By Finished stock ledger control A/c	1,45,000
To Expenses ledger control A/c (other expenses)	50,000	By Unfavorable variance transferred to income statement	5,000
	1,50,000		1,50,000

Selling and Distribution Overhead Control A/c

To Bank (salaries)	75,000	By Cost of sales A/c	1,80,000
To Expenses ledger control A/c (other expenses)	1,00,000		
To Favourable variance transferred to income statement	5,000		
	1,80,000		1,80,000

Expenses Ledger Control A/c

To Bank	4,30,000	By Balance b/d (creditors)	20,000
To Balance c/d	40,000	By Factory overheads control A/c	3,00,000
		By Administration overheads control A/c	50,000
		By Selling and distribution overheads control A/c	1,00,000
	4,70,000		4,70,000
		By Balance b/d	40,000

Provision for Depreciation on Plant and Machinery A/c

To Balance c/d	1,50,000	By Balance b/d	1,00,000
		By Factory overheads control A/c	50,000
	1,50,000		1,50,000
		By Balance b/d	1,50,000

Sales Ledger Control A/c

To Balance b/d	2,00,000	By Bank	19,50,000
To Sales	20,00,000	By Balance c/d	2,50,000
	22,00,000		22,00,000
To Balance b/d	2,50,000		

Finished Stock Ledger Control A/c

To Balance b/d	60,000	By Cost of sales A/c (balancing figure)	12,90,000
To WIP ledger control A/c	13,00,000	By Balance c/d	2,15,000
To Administrative overheads control A/c	1,45,000		
	15,05,000		15,05,000
To Balance b/d	2,15,000		

Cost of Sales A/c

To Finished stock ledger control A/c	12,90,000	By Income statement	14,70,000
To Selling and distribution overheads control A/c	1,80,000		
	14,70,000		14,70,000

Bank A/c

To Balance b/d	1,50,000	By Wages control A/c	3,00,000
To Sales ledger control A/c	19,50,000	By Administrative overheads control A/c	1,00,000
		By Selling and distribution overheads control A/c	75,000
		By Expenses ledger control A/c	4,30,000
		By Bought ledger control A/c	10,00,000
		By Balance c/d	1,95,000
	21,00,000		21,00,000
To Balance b/d	1,95,000		

(b) *Income Statement for the Month of April*

Particulars		*Amount*
Sales		Rs 20,00,000
Less cost of sales		14,70,000
Less unfavourable variances		
Factory overheads	Rs 10,000	
Administrative overheads	5,000	15,000
Add favourable variance		
Selling and distribution overheads		5,000
Net profit		5,20,000

(c) *Balance Sheet as at April 30*

Liabilities		*Amount*	*Assets*	*Amount*
Share capital		Rs 20,00,000	Plant and machinery at cost	Rs 13,00,000
Reserves	Rs 2,00,000		Freehold buildings at cost	5,00,000
Add net income	5,20,000	7,20,000	Accumulated depreciation	(1,50,000)
Creditors for purchases		1,00,000	*Stock*:	
Creditors for expenses		40,000	Raw material	3,40,000
			Work-in-process	2,10,000
			Finished goods	2,15,000
			Debtors	2,50,000
			Bank	1,95,000
		28,60,000		28,60,000

EXAMINATION QUESTIONS

EQ. 10.1 What are the essential pre-requisites of integrated accounting system? Discuss. (*CA—November, 2006*)

EQ. 10.2 What is integrated accounting system? State its advantages. (*CA (PE-II)—May, 2007*)

EQ. 10.3 Enumerate the factors which cause difference in profits as shown in financial accounts and cost accounts. (*CA (PCE)—May, 2007*)

EQ. 10.4 The following is the trading and profit & loss Account of Omega Limited for the current year ended March 31, 2008.

Particulars	*Dr. Amount*	*Particulars*		*Cr. Amount*
To Materials consumed	Rs 23,01,000	By Sales		Rs 48,75,000
To Direct wages	12,05,750	(30,000 units)		
To Production overheads	6,92,250	By Finished goods stock		1,30,000
To Administration overheads	3,10,375	(1,000 units)		
To Selling and distribution overheads	3,68,875	By Work-in-progress:		
To Preliminary expenses written off	22,750	Materials	Rs 55,250	
To Goodwill written off	45,500	Wages	26,000	
To Fines	3,250	Production Overheads	16,250	97,500
To Interest on mortgage	13,000	By Dividends received		3,90,000
To Loss on sale of machine	16,250	By Interest on bank		
To Taxation	1,95,000	deposits		65,000
To Net profit for the year	3,83,500			
	55,57,500			55,57,500

Omega Limited manufactures a standard unit.

The cost accounting records of Omega Ltd. show the following:

(i) Production accounting records have been charged to work-in-progress at 20% on prime cost.

(ii) Administration overheads have been recovered at Rs 9.75 per finished unit.

(iii) Selling and distribution overheads have been recovered at Rs 13 per unit sold.

(iv) The under or over-absorption of overheads has not been transferred to costing P/L A/c.

(*CA—November, 2005*)

Proforma costing profit and loss account for the year ended March 31, 2008

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Direct materials consumed	Rs 23,01,000	By Sales	Rs 48,75,000
To Direct wages	12,05,750	By Closing stock	
Prime cost	35,06,750	(1,000 units × Rs 142.35* per unit)	1,42,350
To Factory overheads		By Work-in-progress	97,500
(20% of prime cost)	7,01,350		
To Administration overheads			
(31,000 finished units × Rs 9.75)	3,02,250		
To Selling and distribution overheads			
(30,000 units sold × Rs 13)	3,90,000		
To Net profit	2,14,500		
	51,14,850		51,14,850

**Valuation of closing stock:*

Cost of production (prime cost + factory and administrative overheads)	Rs 45,10,350
Less Closing work-in-progress	(97,500)
Cost of finished units (31,000)	44,12,850
Cost per unit (Rs 44,12,850/31,000 units)	142.35

Reconciliation statement: cost and financial profits

Particulars		*Amount*
Net profit as per costing profit and loss account		Rs 2,14,500
Less Over-valuation of closing stock in cost books (Rs 1,42,350 – Rs 1,30,000)		(12,350)
Add Factory overheads over-absorbed in cost books (Rs 7,01,350 – Rs 6,92,250)		9,100
Less Administrative overheads under-absorbed in costs books (Rs 3,10,375 – Rs 3,02,250)		(8,125)
Add Selling and distribution overheads over-absorbed in cost books (Rs 3,90,000 – Rs 3,68,875)		21,125
Add Incomes not recorded in cost books (Dividends received + Interest on bank deposits)		4,55,000
Less Expenses not included in cost books		
Preliminary expenses written off	Rs 22,750	
Goodwill written off	45,500	
Fines	3,250	
Interest on mortgage	13,000	
Loss on sale of machine	16,250	
Taxation	1,95,000	(2,95,750)
		3,83,500

EQ. 10.5 *ABC* Ltd. has furnished the following information from the financial books for the year ended 31st March, 2008:

Profit and Loss Account

To			By		
	Opening stock (500 units at Rs 140 each)	Rs 70,000		Sales (10,250 units)	Rs 28,70,000
	Materials consumed	10,40,000		Closing stock (250 units at Rs 200 each)	50,000
	Wages	6,00,000			
	Gross profit c/d	12,10,000			
		29,20,000			29,20,000

(Contd)

(Contd)

To	Factory overheads	3,79,000	By	Gross profit b/d	12,10,000
	Administration overheads	4,24,000		Interest	1,000
	Selling expenses	2,20,000		Rent received	40,000
	Bad debts	16,000			
	Preliminary expenses	20,000			
	Net profit	1,92,000			
		12,51,000			12,51,000

The cost sheet shows the cost of materials at Rs 104 per unit and the labour cost at Rs 60 per unit. The factory overheads are absorbed at 60% of labour cost and administration overheads at 20% of factory cost. Selling expenses are charged at Rs 24 per unit. The opening stock of finished goods is valued at Rs 180 per unit.

You are required to prepare:

(i) A statement showing profit as per cost accounts for the year ended 31st March, 2008; and

(ii) A statement showing the reconciliation of profit as disclosed in Cost accounts with the profit shown in financial accounts. (*CA (PE-II)—May, 2007*)

SOLUTION

Statement of cost and profit (as per cost accounts) for the year ended March 31, 2008

Particulars	*Amount*
Materials consumed (direct)	Rs 10,40,000
Wages (direct)	6,00,000
Prime cost	16,40,000
Add Factory overheads (Rs 6,00,000 × 0.6)	3,60,000
Factory cost	20,00,000
Add Administrative overheads (Rs 20,00,000 × 0.2)	4,00,000
Cost of production (10,000 units)	24,00,000
Add Opening stock (500 units × Rs 180)	90,000
Less Closing stock (250 units × Rs 240)	(60,000)
Cost of goods sold (10,250 units)	24,30,000
Add Selling expenses (10,250 units × Rs 24)	2,46,000
Cost of sales	26,76,000
Profit (balancing figure)	1,94,000
Sales	28,70,000

*Units produced = Units sold (10,250) + Closing stock (250) – Opening stock (500) = 10,000

Reconciliation statement: Cost and financial profits

Particulars	*Amount*
Profit as per cost books	Rs 1,94,000
Add over-valuation of opening stock in cost books (Rs 90,000 – Rs 70,000)	20,000
Less over-valuation of closing stock in cost books (Rs 60,000 – Rs 50,000)	(10,000)
Less factory overheads under-absorbed in cost books (Rs 3,79,000 – Rs 3,60,000)	(19,000)
Less administrative overheads under-absorbed in cost books (Rs 4,24,000 – Rs 4,00,000)	(24,000)
Add over-absorption of selling overheads in cost books (Rs 2,46,000 – Rs 2,20,000)	26,000
Add incomes not recorded in cost books (Interest Rs 1,000 + Rent received Rs 40,000)	41,000
Less expenses not included in cost books (Bad debts Rs 16,000 + Preliminary expenses Rs 20,000)	(36,000)
Profit as per financial books	1,92,000

Part Three

Marginal Costing, Break-Even Analysis, Cost Variance Analysis

This part discusses marginal costing, break-even analysis, standard costs and cost variance analysis. The Marginal/Variable and Absorption (full) Costing methods for income determination are described in Chapter 11. Chapter 12 covers Volume-Cost-Profit (Break-Even) Analysis as a tool of profit planning. While Standard Costs are discussed in Chapter 13, Cost Variance Analysis is illustrated in Chapter 14.

11 Variable (Marginal) Costing and Absorption (Full) Costing

Introduction

Variable costing and absorption costing are not systems of costing such as process, operating, batch or job costing. Variable costing is a technique in which only variable costs are taken into account for purposes of product costing, inventory valuation and other allied important management decisions. In absorption costing, total costs are taken into account for these purposes. Thus, the variable costing technique is in marked contrast to the orthodox costing system known as 'full/absorption/traditional/conventional costing'. The material point of difference between the two techniques of costing is that the 'full' costing method 'absorbs' all costs necessary to produce the product and have it in a saleable form, while the variable costing technique recognises only variable costs as production costs. Thus, direct material, direct labour and variable overheads constitute the only relevant costs in variable costing whereas the full/absorption costing technique recognises fixed overheads also as a product cost in addition to material, labour and variable overheads. Hence, conceptually these two techniques differ in only one respect: fixed manufacturing overheads are excluded from product cost under absorption costing.

The two techniques of costing are, however, not mutually exclusive and are complementary in character. Income statements for external reporting and for tax purposes are to be on a full costing basis.[1] The usefulness of variable costing is that, it helps management in arriving at profit-maximising decisions in certain situations. It is for this reason that variable costing becomes more useful for internal reporting purposes. Thus, both techniques are significant. Which costing technique is to be employed depends on the purpose.

Section 1 presents a comparison of variable and absorption costing from the point of view of income determination. The merits and demerits of variable costing are listed in Section 2. The chapter concludes with the main points.

VARIABLE AND ABSORPTION COSTING: A COMPARISON

Variable costing is employed under the assumption that a certain investment in facilities and other productive factors is required before products can be manufactured. For instance, a factory building is to be hired for which rent is to be paid, plant is to be installed on which there will be a depreciation charge, factory insurance payment, property taxes, salary of plant manager and such other expenses have to be initially and subsequently incurred each year in the manufacturing business. Hence, the fixed costs resulting from this investment are not product costs but period cost. These costs must be incurred in order to have a manufacturing establishment and they will recur each year. Logically, therefore, "the fixed costs of manufacturing should be expensed each year and not carried as part of the cost of an inventory."[2] In other words, the principle underlying variable costs is that fixed manufacturing overhead are not inventoriable costs; they are period costs and must be matched against the revenue of that year. In contrast to this, absorption costing indicates that the manufacturing fixed overheads are inventoriable costs; they are the product costs and must be matched against the revenue of the year in which sales are made. Format 11.2 shows the flow of costs in an absorption costing system. The cost flow pattern for variable costing in shown in Format 11.1.

Format 11.1 Income Statement (Variable Costing)

		Amount
Sales revenue (Units sold × selling price)		
Less: Variable costs (production costs):		
Direct material cost	. . . . .	. . . . .
Direct labour cost	. . . . .	
Variable manufacturing overheads	. . . . .	
Total cost of good manufactured	. . . . .	
Plus: Cost of inventory in the beginning of the year (Units × variable cost)	. . . . .	
Less: Cost of inventory at the end of the year (Units × variable cost)	(. . . . .)	
Cost of goods manufactured and sold		(. . . . .)
Contribution (manufacturing)		. . . . .
Less: Variable non-production costs:		
Selling and distribution costs		—
Administrative costs	. . . . .	(. . . . .)
Other costs (specify)	. . . . .	. . . . .
Contribution (final)	. . . . .	—
Less: Fixed costs:		
Fixed production costs	. . . . .	
Fixed non-production costs (specify individual items)	. . . . .	(. . . . .)
Net income before income taxes		—
Less: Income taxes		(. . . . .)
Net income after income taxes		

Format 11.2 Income Statement (Absorption Costing)

		Amount
Sales revenue (Number of units sold × selling price)		—
Less: Total costs of manufacturing:		
Direct material cost	—	
Direct labour cost	—	
Variable manufacturing overhead	—	
Fixed manufacturing overhead	—	
Total cost of goods manufactured		—
Plus: Cost of inventory in the beginning of the year (Units × total cost)		—
Less: Cost of inventory at the end of the year (Units × total cost)	( )	
Cost of goods manufactured and sold		( )
Gross margin (manufacturing) (unadjusted)		
Adjustment for capacity variance (+Favourable –Unfavourable)		(±)
Gross margin (adjusted)		
Less: Non-production costs:		
Selling and distribution costs		
Administrative costs	—	
Other costs (specify)	—	
Net income before income taxes	—	( )
Less: Income taxes		( )
Net income after taxes		

Note If the firm's operating capacity is different from the normal capacity, there will be capacity variance. The adjustment for such a variance is to be made before determining the gross margin. If capacity variance is favourable, the amount is to be deducted from the total costs of goods manufactured and sold; the amount is added to the cost if capacity variance is unfavourable.

Everything is common in both the formats except that fixed manufacturing overheads form part of production costs with 'full' costing whereas it is non-production cost is the case of variable costing. It is also important to note that the treatment of overheads other than manufacturing, namely, selling and administrative, is the same under both the techniques, full or variable.

The justification of the use of variable costing *vis-à-vis* absorption costing is based on two important factors:

1. Fixed costs relate to a particular period of time and should, therefore, be charged to that period only and to no other.
2. There is no method which is capable of apportioning fixed manufacturing costs to products. In the full costing method, fixed overheads are recovered from production by some agreed recovery method. This recovery can never be accurate and may even sometimes be misleading. Further, fixed overheads (such as rates and insurance), are predominantly concerned with time rather than volume of output and so should be recovered during the current period and not carried forward to burden the next.[3]

The differences between the two costing techniques can be better highlighted by showing the procedure of income statement preparation under the two costing concepts/techniques.

In variable costing, as explained earlier, product costs should include only the variable factory costs, and the fixed (period) costs should be charged to the revenue of the accounting period. The excess of sales revenue (SR) over variable costs (VC) is known as contribution (C) utilised towards the recovery of *first* fixed expenses (FC/period costs) and, second, to contribute to profits. On the other hand, absorption costing is based on the principle that all the manufacturing costs (direct, variable, as well as non-variable costs)

should be charged to the production of a given period and fixed manufacturing overheads are charged to the products by using a pre-determined rate, designated as the standard fixed overhead rate (SFOR) of recovery. This rate is elaborated in a later chapter in detail and is usually determined with reference to budgeted fixed manufacturing overheads and the hours of operation at a normal level of production. The SFOR is determined by dividing the former amount with the latter amount. The products are assigned a standard charge for fixed overheads. If the plant operates above or below its normal capacity, the fixed manufacturing overheads will be over/under-absorbed; the over/under-absorbed overhead amount is designated as the capacity variance and is written off to operations for the year.

From the above principles of absorption costing, it follows that profits are affected not only by the sales volume, selling price, cost of production, but also by the quantity of units produced during the period. Accordingly, a firm may produce goods regardless of sales, and still the profit and loss account may reflect profit earned, whereas in reality there is simply a piling up of stocks of inventory in the factory godowns. The hypothetical/typical case for such a situation is that a firm has produced more than its normal capacity and, therefore, over-absorbed its actual fixed overheads. The firm, in spite of not making sales of even a single unit, will show gross margin to the extent of over-absorption of the fixed manufacturing overheads. Example 11.1 illustrates this point.

EXAMPLE 11.1

Hypothetical Ltd furnishes the following information from its cost records for the first quarter of the current year:

Normal production (units)	1,000
Actual production (units)	1,100
Actual overheads per quarter at normal production	Rs 4,000
Other expenses per quarter	300
Standard fixed overhead rate per unit	4
Variable costs per unit	6
Sales volume (selling price is Rs 14)	Nil

Prepare the income statement under absorption and variable costings.

SOLUTION

The income statements are shown in Tables 11.1 and 11.2 respectively.

Table 11.1 Income Statement (Absorption Costing)

Particulars		*Amount*
Sales revenue		Nil
Less: *Total cost of manufacturing:*		
Variable costs (1,100 × Rs 6)	Rs 6,600	
Fixed overheads (1,100 × Rs 4)	4,400	
	11,000	
Less: Cost of inventory at the end of the year (1,100 × Rs 10)	11,000	Nil
Cost of goods manufactured and sold		
Gross margin (unadjusted)		Nil
Capacity variance (favourable) (over-absorbed, 100 × Rs 4)		Rs 400
Gross margin (adjusted)		400
Less: Other expenses		300
Net income before taxes		100

Table 11.2 Income Statement (Variable Costing)

Particulars		*Amount*
Sales revenue		Nil
Less: Variable costs (production costs) (1,100 × Rs 6)	Rs 6,600	
Less: Cost of inventory at the end of the year (1,100 × Rs 6)	6,600	
Cost of goods manufactured and sold		Nil
Contribution		Nil
Less: Fixed costs:		
Fixed overheads	4,000	
Other expenses	300	Rs (4,300)
Net income before taxes (loss)		(4,300)

There is a marked difference in the profit results under the two methods: absorption costing shows net profit of Rs 100, while a loss of Rs 4,300 is reported under variable costing. This result is ascribed to the fact that under absorption costing, the fixed manufacturing overheads are inventoriable, whereas in variable costing inventory is valued only at variable costs. In Example 11.1, inventory is valued at Rs 11,000 in absorption costing, while its valuation is Rs 6,600 in variable costing. This is how the difference of Rs 4,400 is accounted for.

From the above, it may be deduced that changes in inventory will influence reported income under the two costing techniques because under variable costing, fixed costs are deducted in the period in which they are incurred whereas under absorption costing, a portion of fixed costs is carried over with inventory. The reported net income, thus, differs under the two methods. When production exceeds sales, fixed cost absorption is more in full costing compared to variable costing and, therefore, to that extent, income/profits under absorption costing are more. The results are reversed when sales exceed production. Profits would be identical under the two methods, if production coincides with sales. Example 11.2 clearly brings out these differences.

EXAMPLE 11.2

Hypothetical Ltd furnishes the following information for its three different periods:

	Year 1	*Year 2*	*Year 3*
Production (units)	*10,000*	*10,000*	*10,000*
Sales (units)	10,000	5,000	15,000

Sales price per unit, Rs 12
Variable cost per unit, Rs 6
Fixed costs per year (at normal capacity of 10,000 units), Rs 40,000
Standard fixed overhead rate: Rs 4 per unit.
Show the profit under variable and absorption costing in different years.

SOLUTION

The profit is shown in Table 11.3.

Table 11.3 Income Statements for the Years Ended 1, 2, 3

Particulars	*Absorption Costing*	*Variable Costing*
	Year 1 (Production = Sales)	
Sales (10,000 × Rs 12)	Rs 1,20,000	Rs 1,20,000
Less: *Cost of goods manufactured*		
Variable costs (10,000 × Rs 6)	60,000	60,000
Fixed costs (10,000 × Rs 4)	40,000	
Cost of goods manufactured and sold	1,00,000	60,000
Gross margin	20,000	—
Contribution	—	60,000
Less: Fixed costs	—	40,000
Net income before taxes	20,000	20,000
	Year 2 (Production < Sales)	
Sales (5,000 × Rs 12)	60,000	60,000
Less: *Cost of goods manufactured*		
Variable costs (10,000 × Rs 6)	60,000	60,000
Fixed costs (10,000 × Rs 4)	40,000	—
Total cost of goods manufactured	1,00,000	60,000
Less: Cost of inventory at the end of the year		
(5,000 × Rs 10)	(50,000)	
(5,000 × Rs 6)		(30,000)
Cost goods manufactured and sold	50,000	30,000
Gross margin	10,000	—
Contribution	—	30,000
Less: Fixed costs	—	40,000
Net income (loss)	10,000	(10,000)
	Year 3 (Sales > Production)	
Sales (15,000 × Rs 12)	1,80,000	1,80,000
Less: Cost of goods manufactured:		
Variable costs (10,000 × Rs 6)	60,000	60,000
Fixed costs (10,00 × Rs 4)	40,000	—
Total cost of goods manufactured	1,00,000	60,000
Plus: Cost of inventory in the year's beginning		
(5,000 × Rs 10)	50,000	
(5,000 × Rs 6)		30,000
Cost of goods manufactured and sold	1,50,000	90,000
Gross margin	30,000	—
Contribution	—	90,000
Less: Fixed costs		40,000
Net income	30,000	50,000

Summary of Results

Year 1: Net income is identical in both the methods.
Year 2: Absorption costing shows more profit than variable costing.
Year 3: Variable costing shows more profit than absorption costing.

All Years Combined: The total net income will be the same under either costing method because the total production and sales are equal (30,000 units).

Reasons for the Differences In year 1, the results of net income are identical because the equality of production and sales does not affect the level of inventory on hand. All goods produced have been sold and, thus, all fixed costs of production are charged to the income statement under absorption costing as well as variable costing.

In year 2, when sales are less than production, there is an increase in the level of inventory on hand. Under absorption costing, the increase in inventory carries proportionate fixed costs (to be spent next year) which means that fixed costs charged to revenue are less under absorption costing than under variable costing. Thus, the net income reported under variable costing is less than under absorption costing. The amount of Rs 20,000 is equivalent to 5,000 units of inventory multiplied by Rs 4 (standard fixed overhead rate).

In year 3, when sales exceed production, there is a decrease in the level of inventory on hand. Under absorption costing, the inventory of year 2 would carry a part of fixed costs (Rs 20,000). Thus, under absorption costing fixed costs charged against the revenue of the current year will be higher by Rs 20,000 compared to variable costing. Hence, the additional fixed costs of Rs 20,000 under full costing makes the net income revealed by variable costing more by this amount.

The fact that fixed costs move along with inventory signifies that the fixed costs will be released as part of goods sold in a later year(s) when sales are in excess of production. Hence, profits will not necessarily increase with increase in sales revenue. In fact, the profits will decrease if the effect of shifting fixed costs from one year to another as a part of inventory cost is more than the increased contribution to be derived from increased sales.[4]

The situation visualised above is by no means imaginary. For obvious reasons, the management will be bewildered by the decrease in profits with increased sales volume when no change whatsoever has occurred in selling prices and costs. In general, profits are expected to increase with increase in sales volume. Consider Example 11.3.

EXAMPLE 11.3

Hypothetical Ltd had the following relevant information for years 1 and 2:

Standard variable costs per unit		Rs 6
Sales price per unit		10
Fixed manufacturing overhead (at normal capacity of 1,50,000 units)		3,00,000
Selling and administrative expenses		
Fixed		1,30,000
Variable (per cent of sales)		5
Production volume: units	Year 1	1,70,000
	2	1,40,000
Sales volume:	1	1,40,000
	2	1,60,000

There was no inventory at the beginning of year 1. Income tax rate is 35 per cent.

REQUIRED: 1. Prepare income statements for the two years under absorption costing and variable costing.

2. Show a reconciliation of the difference in net income for the two years (1 and 2) taken together.

SOLUTION

Table 11.4 Income Statement (Absorption Costing) for the Years 1 and 2

Particulars	*Year 1*	*Year 2*
Number of units produced	1,70,000	1,40,000
Number of units sold	1,40,000	1,60,000
Sales revenue	Rs 14,00,000	Rs 16,00,000
Less: Cost of manufacturing:		
Standard variable cost (Rs 6 per unit)	10,20,000	8,40,000
Fixed cost (Rs 2 per unit)	3,40,000	2,80,000
Total standard cost of manufacturing (Rs 8 per unit)	13,60,000	11,20,000
Plus: Cost of inventory (beginning)	—	2,40,000
Less: Cost of inventory (ending)	(2,40,000)	(80,000)
Cost of goods manufactured and sold (at standard absorption cost)	11,20,000	12,80,000
Gross margin manufacturing (unadjusted)	2,80,000	3,20,000
± Capacity variance	40,000 (F)	20,000 (A)
Gross margin (adjusted)	3,20,000	3,00,000
Less: Non-production costs:		
Selling and administrative expenses	2,00,000	2,10,000
Net income before taxes	1,20,000	90,000
Less: Income taxes (0.35)	42,000	31,500
Net income after taxes	78,000	58,500

F = Favourable, A = Adverse

Table 11.5 Income Statement (Variable Costing) for the Years 1 and 2

Particulars	*Year 1*	*Year 2*
Number of units produced	1,70,000	1,40,000
Number of units sold	1,40,000	1,60,000
Sales revenue	Rs 14,00,000	Rs 16,00,000
Less: Variable costs:		
Standard variable cost @ Rs 6 per unit	10,20,000	8,40,000
+ Cost of inventory at standard cost (beginning)	Nil	1,80,000
– Cost of inventory at standard cost (ending)	(1,80,000)	(60,000)
Standard cost of goods manufactured and sold	8,40,000	9,60,000
@ of Rs 6 per unit sold	8,40,000	9,60,000
Contribution (manufacturing)	5,60,000	6,40,000
Less: Variable non-production costs:		
Selling and administrative expenses	70,000	80,000
Contribution (final)	4,90,000	5,60,000
Less: Fixed costs:		
Fixed overheads	3,00,000	3,00,000
Selling and administrative expenses	1,30,000	1,30,000
Net income before taxes	60,000	1,30,000
Less: Taxes (0.35)	21,000	45,500
Net income after taxes	39,000	84,500

The income statement under absorption costing shows that the company earned less profit in year 2 compared to year 1 inspite of 20,000 more units sold in year 2 and there was no decrease either in selling price or increase in cost (both fixed and variable). Ordinarily, profits are expected to increase with increase in sales volume.

The income statement constructed on a variable costing basis shows, that the contribution has increased in year 2 as result of selling 20,000 more units. The profits are in tune with sales volume when the variable costing technique is adopted.

VARIABLE AND ABSORPTION COSTING: RECONCILIATION

The difference in results given by the above two methods can be explained in terms of: (i) The standard fixed overhead rate (SFOR); and (ii) The change in the inventories that has taken place during the period under consideration. Table 11.6 provides a complete explanation of the differences in results.

Table 11.6 Reconciliation Statement of Net Income Before Taxes under Absorption Costing and Variable Costing

Particulars	*Year 1*	*Year 2*	*Combined*
Net income before taxes as per:			
Absorption costing	Rs 1,20,000	Rs 90,000	Rs 2,10,000
Variable costing	60,000	1,30,000	1,90,000
Difference (to be explained)	60,000	(40,000)	20,000
(a) Standard fixed overhead rate	2	2	2
Change in inventory units:			
Opening inventory	Nil	30,000	—
Ending inventory	30,000	10,000	10,000
(b) Change in inventory	30,000	(20,000)	10,000
(c) Increase (decrease) difference in net income is explained by the product of (a) × (b)	60,000	(40,000)	20,000

Likewise, an increase in net income before taxes under variable costing by Rs 70,000 in year 2 compared to year 1 can be explained in the form of a reconciliation statement (Table 11.7 and Table 11.8).

Table 11.7 Reconciliation Statement (Variable Costing)

Particulars	*Amount*
Increase in sales revenue in year 2 (20,000 × Rs 10)	Rs 2,00,000
Less: Increased manufacturing variable cost in year 2 (20,000 × Rs 6)	1,20,000
Increased contribution (20,000 × Rs 4)	80,000
Less: Increased selling and administrative costs (0.05 × Rs 2,00,000)	10,000
Increased contribution (final)	70,000

Table 11.8 Reconciliation Statement (Absorption Costing)

Particulars	*Amount*
Increased contribution (already explained in variable costing reconciliation statement)	Rs 70,000
Less: Fixed costs of year 1 on 30,000 units at the rate of Rs 2 per unit shifted to year 2 (decreases year 1 cost)	60,000
Fixed costs of year 1 shifted to year 2 (increases year 2 cost)	60,000
Add: Fixed cost of year 2 on 10,000 units at the rate of Rs 2 per unit shifted to year 3 (decreases year 2 cost)	20,000
Increase in costs caused by shift in fixed cost	1,00,000
Net decrease in net income before income taxes	(30,000)

Emphasis on Production or Sales Example 11.3 shows that variable costing focuses on sales, while the emphasis of absorption costing is on production. In profit making organisations, sales are generally regarded more important than production because out of sales all expenses are to be met and profits earned. It is very difficult to believe that profits can increase with more production without being sold. Therefore, a variable costing report on profits earned by the firm is more logical than an absorption costing report based on production. "However differences attributable to a lack of balance between sales and production are not revealed by variable costing. Sales activity may be overemphasised at the expense of production. In reality, profits depend upon both sales and production."[5]

Still another noteworthy feature of income determination under the two costing methods relates to total profits across time periods. A reference to Example 11.2 shows that the total net income for three years is Rs 60,000 under both the methods.

In most industries, production will tend to equal sales over a long period of time. Therefore, over the long run, the two methods will produce similar results. Any controversy between the advocates of absorption costing and variable costing, in terms of income determination, is a matter of timing in the matching of fixed costs with revenues.[6]

As a logical sequel to the above, if a company follows the practice of preparing interim income statements quarterly/half-yearly to take stock of the firm's profits and if the demand for inventories and internal financial statements for its product is seasonal, profits will tend to fluctuate widely. This aspect should be recognised by management while studying income statements constructed on the principle of variable costing.

As stated earlier, the controversy between the two methods is futile. The controversy can be examined from two perspectives: external financial statements prepared for investors and internal financial statements for the use of management. The absorption costing method is adopted for the first purpose. The second purpose is best served by variable costing. This conclusion will be further reinforced by the discussion that follows which overwhelmingly demonstrates that the marginal contribution approach of variable costing is an important tool of profit planning and cost control. Thus, the choice of either method of costing is based upon a particular situation rather than on the innate superiority of one over the other.

ADVANTAGES AND LIMITATIONS OF VARIABLE COSTING

Advantages

We now briefly outline the advantages of variable costing:

1. In contrast to absorption costing, there is no problem of allocating and absorbing fixed overheads in variable costing as all fixed costs are considered period costs and written off against the total contribution of that period.
2. There is no complication of over-absorption of factory overheads or even their under-absorption as in the case of absorption costing. It may be recalled that the income under absorption costing is to be adjusted upwards for favourable capacity variance (over-absorption is to be adjusted upwards when the actual production exceeds the normal capacity) and downwards for unfavourable capacity variance (under-absorption of factory overheads when the actual production is less than the normal capacity). This aspect makes the income statement under absorption costing more difficult to prepare and understand than the income statement based on variable costing.
3. Management usually finds it easier to understand a variable income statement than one prepared on the basis of absorption costing. This is so because the former statements show profit responding more to changing sales levels than the combination of sales and production levels inasmuch as income statements prepared on the basis of absorption costing may show less profits with increased sales volume, though the cost and selling prices remain unchanged. Thus, the variable costing technique provides a measure of income, which is more accurate than under absorption costing. In fact, in situations of favourable capacity variance, absorption costing with no sales will show profits.
4. The impact of fixed costs on profits is emphasised because the total amount of such cost for the period appears in the income statement.
5. The process of bifurcation of costs into fixed and variable is of immense practical utility in cost control. There is a close nexus between variable costs and the controllable costs classification. This relationship assists the control function. It is imperative for effective cost control that responsibility of cost control must be with those who make cost-incurring decisions. This is possible through variable costing as it recognises the diverse behaviour of costs in relation to volume and/or time; only variable costs are charged to production, while the period costs which the management decides upon are not charged to production and so the foreman is not accountable for depreciation, insurance, property taxes, rent and such other fixed costs over which he has no control. Fixed costs for this reason are controllable only at the highest level of management. On the other hand, variable costs are incurred by all levels of management and by operators. The responsibility for variable costs can be traced with a substantial degree of certainty and, thus, allow the necessary control to be exercised. Thus, variable costing delineates responsibility clearly and assists management in the control function.

   In marked contrast, variable and fixed costs are treated alike under absorption costing, though they require different types of treatment for facilitating control. In this system, variable costs are clubbed with fixed costs, which are not controllable at the departmental level. From the above, it follows that variable costing is in alignment with responsibility accounting and, thus, facilitates management by exception.
6. Variable costs are relevant inputs for correct decision-making in many situations. Without variable costs data, management is likely to take wrong decisions affecting the profitability of the company. In recent years, there is an increasing acceptance among industries to use variable costing as a tool of profit planning.
7. Variable costing ties on with such effective plans for cost control as standard costs and flexible budgets. In fact, the flexible budget is an aspect of variable costing and many companies, thus, use variable costing methods for this purpose without recognising them as much.[7]

Limitations

The users of variable costing should, however, guard against its limitations both as regards income measurement and as a tool of profit planning:

1. Segregation of total cost into fixed and variable elements is a difficult task, particularly in the case of semi-variable costs. In such situations, resort to arbitrary classification may have to be made.
2. Variable costing carries the potential danger of encouraging a short-sighted approach to profit planning at the cost of a long-term view. There is the danger of too many sales being made at a price slightly higher than variable costs, possibly resulting in losses or very low profits. Management should not lose sight of the fact that profits will not result unless all the costs have been recovered; it should recognise that in the ultimate analysis fixed costs are also to be recovered from the selling price only. Management is likely to gather a very wrong impression of recovering only variable costs from the selling price.
3. Variable costing carries the danger of misinterpretation particularly where products require high investment outlay and the variable cost may constitute a small proportion of total cost of a product. The total contribution yield may be insufficient to warrant such an outlay. "In a manufacturing plant that is highly automated, the amount of variable cost may be small and this situation magnifies the problem of applying the technique."[8]
4. Focusing attention on the contribution margin and the possible non-recognition of fixed cost by management may be dangerous.
5. There is a difficulty in applying the technique to industries where large stocks of work-in-progress are locked up, particularly in contracting firms. If overheads were not included in the closing value of work-in-progress for each year of the contract, there would be losses, while at the end of the contract, when revenue is received, there would be a large profit. The fluctuations in profits in partly evened out by valuing work-in-progress at the total cost plus some element of profit.''[9]

To sum up, it can be said that in principle there is no conflict between variable costing and absorption costing as regards accounting of costs. Both are equally important—variable costing for internal reporting and absorption costing for external users. Being so, management should recognise the importance of variable costing in profit planning (in specific situations) and cost control in general. The most useful contribution of variable costing is that it helps management in vital decision-making, particularly in dealing with problems, which require short-term decisions where fixed costs do not count.

SUMMARY

- Variable costing is a technique in which only variable costs are considered for product costing, inventory valuation and other allied management decisions. It is, thus, in marked contrast to the orthodox costing system known as full costing, absorption costing, traditional costing, conventional costing and so on.
- The material point of difference between these two techniques is that the full costing method 'absorbs' all costs necessary to produce the product and have it in a saleable form, while variable costing recognises only variable cost as production and selling cost. In operational terms, the two techniques differ in one respect: fixed manufacturing overheads are excluded from product cost under variable costing but are included as a part of product cost under absorption costing.

- Nevertheless, they are not mutually exclusive; rather they are complementary in nature. Income statements for external reporting and for income-tax purposes are to be prepared on a full costing basis. The usefulness of variable costing is that it helps management to arrive at profit-maximising decisions in certain situations. It is for this reason that variable costing is more useful for internal reporting. Thus, both techniques are important and which technique is to be employed depends upon the purpose and the circumstances.
- The principle underlying variable costing is that the fixed manufacturing overheads are not inventoriable costs; they are period costs and must be matched against the revenue for the period. In contrast, absorption costing indicates that the manufacturing overheads are inventoriable costs; they are product costs and must be matched against the revenue for the year in which sales are made. The preparation of the income statement, therefore, in the case of variable costing is different from absorption costing. The concept of variable costs (separation of fixed costs from variable costs) is, however, not only useful in income measurement but is also very significant in managerial decision-making.
- The core of variable costing is the contribution margin. Contribution margin is the difference between sales revenue and variable costs. It is out of the contribution that the fixed costs are met and the excess of contribution over fixed costs represents the profit. The contribution approach is useful for decision-making.

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SOLVED PROBLEMS

P.11.1 The Hind General Corporation Ltd produces a product, which has the following costs:
Variable manufacturing costs: Rs 4 per unit
Fixed manufacturing costs: Rs 2,00,000 per year
The normal capacity is set at 2,00,000 units
There are no work-in-process inventories

Last year, the company produced 2,00,000 units and sold 90 per cent at a price of Rs 7 per unit. In the current year, the company produced 2,10,000 units and sold 2,15,000 units at the same price.

Prepare income statement for both the years based on (a) absorption costing, and (b) variable costing.

SOLUTION

Income Statement for the Previous Year and Current Year (Absorption Costing) of Hind General Corporation Ltd

Particulars	*Previous year*	*Current year*
Production (units)	2,00,000	2,10,000
Sales (units)	1,80,000	2,15,000
Opening inventory (units)	—	20,000
Closing inventory (units)	20,000	15,000
Sales revenue @ Rs 7 per unit	Rs 12,60,000	Rs 15,05,000
Less production costs:		
Variable manufacturing costs@ Rs 4 per unit	8,00,000	8,40,000
Fixed manufacturing costs @ Re 1 per unit (Rs 2,00,000 ÷ 2,00,000 normal capacity in units)	2,00,000	2,10,000
Total production cost of the current year	10,00,000	10,50,000
Add cost of inventory at the beginning of the year @ Rs 5 per unit	—	1,00,000
Less cost of inventory at the end of the year @ Rs 5 per unit	(1,00,000)	(75,000)
Cost of goods sold	9,00,000	10,75,000
Gross margin (unadjusted)	3,60,000	4,30,000
Add favourable capacity variance in the current year (10,000 × Re 1)	—	10,000
Gross margin (adjusted)/net income	3,60,000	4,40,000

Income Statements of the Previous Year and Current Year (Variable Costing)

Particulars	*Previous year*	*Current year*
Production (units)	2,00,000	2,10,000
Sales (units)	1,80,000	2,15,000
Opening inventory (units)	—	20,000
Closing inventory (units)	20,000	15,000
Sales revenue @ Rs 7 per unit	Rs 12,60,000	Rs 15,05,000
Less production costs:		
Variable manufacturing costs @ Rs 4 per unit	8,00,000	8,40,000
Add cost of inventory @ Rs 4 per unit	—	80,000
Less cost of inventory @ Rs 4 per unit at the end of the year	(80,000)	(60,000)
Cost of goods sold	7,20,000	8,60,000
Contribution (manufacturing and final)	5,40,000	6,45,000
Less non-production costs	(2,00,000)	(2,00,000)
Net income	3,40,000	4,45,000

P.11.2 Aggarwal Industries Ltd has a standard variable manufacturing cost of Rs 8 per unit produced. Fixed production costs are Rs 1,10,000 per month (for standard volume of 11,000 units per month) and fixed selling and administrative expenses are Rs 70,000 per month. The firm begins January with no inventories and had the following activity in January, February and March:

	January	*February*	*March*
Production (units)	12,000	10,000	11,000
Sales (units)	10,000	11,000	11,000

The selling price was Rs 30 per unit in each month.

You are required to prepare monthly income statements using both variable and absorption costing methods. You are also required to account for the difference, if any, in the results reported under the two methods.

SOLUTION

Comparative Income Statements (from January to March) of Aggarwal Industries Ltd Under Absorption and Variable Costing Methods

Particulars	*January*		*February*		*March*	
	Absorption	*Variable*	*Absorption*	*Variable*	*Absorption*	*Variable*
Production (units)	12,000	12,000	10,000	10,000	11,000	11,000
Sales (units)	10,000	10,000	11,000	11,000	11,000	11,000
Sales revenue	Rs 3,00,000	Rs 3,00,000	Rs 3,30,000	Rs 3,30,000	Rs 3,30,000	Rs 3,30,000
Less production costs:						
Variable manufacturing cost @ Rs 8 per unit	96,000	96,000	80,000	80,000	88,000	88,000
Fixed manufacturing overheads @ Rs 10 per unit (Rs 1,100,000 ÷ 11,000)	1,20,000	—	1,00,000	—	1,10,000	—
Plus cost of opening inventory	—	—	36,000	16,000	18,000	8,000
Less cost of closing inventory	(36,000)	(16,000)	(18,000)	(8,000)	(18,000)	(8,000)
Cost of goods produced and sold	1,80,000	80,000	1,98,000	88,000	1,98,000	88,000
Gross margin unadjusted/ Contribution	1,20,000	2,20,000	1,32,000	2,42,000	1,32,000	2,42,000
Add capacity variance favourable (less unfavourable) @ Rs 10 per unit	10,000	—	(10,000)	—	—	—
Gross margin adjusted/ Contribution	1,30,000	2,20,000	1,22,000	2,42,000	1,32,000	2,42,000
Less non-production costs:						
Fixed manufacturing costs	—	(1,10,000)	—	(1,10,000)	—	(1,10,000)
Fixed selling and administrative expenses	(70,000)	(70,000)	(70,000)	(70,000)	(70,000)	(70,000)
Net income	60,000	40,000	52,000	62,000	62,000	62,000

Reconciliation Statement of Income (January - March)

Particulars	*Net income*		
	January	*February*	*March*
Absorption costing	Rs 60,000	Rs 52,000	Rs 62,000
Variable costing	40,000	62,000	62,000
Difference to be explained: increase (decrease) in profits of absorption costing *vis-à-vis* variable costing	20,000	(10,000)	—
(a) Inventory units			
Opening inventory	—	2,000	1,000
Closing inventory	2,000	1,000	1,000
Increase (decrease) in inventory	2,000	(1,000)	—
(b) Standard fixed overhead rate per unit (Rs)	10	10	—
(c) Change in net income [(a) × (b)]	20,000	(10,000)	—

P.11.3 S.K. Industries Ltd produced and sold 1,50,000 plastics buckets. Each bucket was sold at a price of Rs 20. The variable costs were Rs 14 per bucket and fixed manufacturing costs were Rs 3,00,000 per annum. The company's normal production capacity is 1,50,000 plastic buckets.

1. You are required to prepare income statements under absorption costing and variable costing methods and comment on the results.
2. What would be the effect on income under the two different costing methods in the following situations: (a) Buckets produced and sold, 1,40,000 and (b) Buckets produced and sold, 1,60,000.

SOLUTION

Income Statement (Absorption and Variable Costing Methods)

Particulars	*Absorption costing*	*Variable costing*
Production and sales (units)	1,50,000	1,50,000
Sales revenue	Rs 30,00,000	Rs 30,00,000
Less production costs:		
Variable costs @ Rs 14 per unit	21,00,000	21,00,000
Fixed overheads @ Rs 2 per unit (Rs 3,00,000 ÷ 1,50,000 normal capacity)	3,00,000	—
Total cost of production/cost of goods sold	24,00,000	21,00,000
Income/Contribution	6,00,000	9,00,000
Less non-production costs:	—	—
Fixed manufacturing costs	—	3,00,000
Income	6,00,000	6,00,000

Incomes are the same under both the costing methods, for production is equivalent to sales (1,50,000 units). Differences in net income arise only when production varies from sales.

Income Statements under Variable and Absorption Costing Systems, Assuming Production and Sales: (a) 1,40,000 units, (b) 1,60,000 units:

Particulars	*(a) 1,40,000 units*		*(b) 1,60,000 units*	
	Absorption	*Variable*	*Absorption*	*Variable*
Sales revenue @ Rs 20 per unit	Rs 28,00,000	Rs 28,00,000	Rs 32,00,000	Rs 32,00,000
Less production costs:				
Variable costs @ Rs 14 per unit	19,60,000	19,60,000	22,40,000	22,40,000
Fixed overheads @ Rs 2 per unit	2,80,000	—	3,20,000	—
Cost of goods produced and sold	22,40,000	19,60,000	25,60,000	22,40,000
Gross margin (adjusted)/Contribution	5,60,000	8,40,000	6,40,000	9,60,000
Less capacity variance:				
Unfavourable and add capacity variance favourable @ Rs 2 per unit (10,000 units)	(20,000)	—	20,000	—
Gross margin (adjusted)/Contribution	5,40,000	8,40,000	6,60,000	9,60,000
Less non-production costs:				
Fixed manufacturing costs	—	3,00,000	—	3,00,000
Net income	5,40,000	5,40,000	6,60,000	6,60,000

Net incomes again are the same under both costing systems, as production is equal to sales in both situations. The fact whether production is equal to normal capacity or not, does not have any impact whatsoever on the net income. Here, production of 1,40,000 units as well as 1,60,000 units is different from 1,50,000, the normal level of production.

P.11.4 The Seers Can Company Ltd has two plants, one in Bombay, and the other in Calcutta. The physical characteristics of the plants are similar and the results of the operations of both plants are compared each month in order to judge the performance of the two managements. The April income statements of the two plants were as follows:

	Bombay plant	*Calcutta plant*
Sales	Rs 18,00,000	Rs 18,00,000
Less: Manufacturing cost of sales	12,60,000	13,60,000
Selling and administrative expenses	4,40,000	4,40,000
Net income	1,00,000	—

Each plant sells its product for the same price. During the month of April, each plant sold and shipped 3,00,000 cans. The production for the month at the two plants was as follows:

	Bombay plant	*Calcutta plant*
Opening stock (number of cans)	1,00,000	1,00,000
Production during the month	4,00,00,000	3,00,00,000
	4,01,00,000	3,01,00,000
Cans shipped during the month	3,00,00,000	3,00,00,000
Closing stock	1,01,00,000	1,00,000

The Bombay plant built up its stock in April in anticipation of the canning season, which begins in May on the West Coast. The East Coast canning season begins in the middle of June.

The standard cost sheet for the type of can sold in April discloses the following information for both plants:

	Cost per 1,000 cans
Direct material	Rs 25
Direct labour	5
Variable overheads	2
Fixed overheads	10
	42

For each plant, the manufacturing fixed costs budgeted for the month were Rs 4,00,000. There were no spending or efficiency variances. All selling and administrative expenses were of a fixed nature.

Prepare revised income statements for the two plants, using variable costing. Explain the difference in income between the two plants.

SOLUTION

Income Statement (Variable Costing) for the Month Ending April

Particulars	*Bombay plant*	*Calcutta plant*
Production (cans)	4,00,00,000	3,00,00,000
Sales (cans)	3,00,00,000	3,00,00,000
Sales revenue	Rs 18,00,000	Rs 18,00,000
Less: production costs:		
Direct material	10,00,000	7,50,000
Direct labour	2,00,000	1,50,000
Variable overheads	80,000	60,000
Total cost of production	12,80,000	9,60,000
Add cost of opening inventory(at standard cost)	3,200	3,200
Less closing inventory (at standard cost)	(3,23,200)	(3,200)

(*Contd.*)

(*Contd.*)

Cost of cans produced and sold	9,60,000	9,60,000
Contribution	8,40,000	8,40,000
Less: non-production costs:		
Fixed overheads	4,00,000	4,00,000
Selling and administrative expenses	4,40,000	4,40,000
Net income	Nil	Nil

Difference in income statements of the two plants on the basis of variable costing is nil. There would be a difference when a comparison is made of income statements for the Bombay plant on the basis of variable costing and absorption costing. The following reconciliation statement will explain the difference.

Reconciliation Statement of Income for Bombay Plant for the Month of April

Net income:	
Absorption costing	Rs 1,00,000
Variable costing	Nil
Difference to be explained:	1,00,000
(a) Standard fixed overhead rate Rs 10 (per 1,000 cans)	
(b) Change in inventory units:	
Opening inventory	1,00,000
Closing inventory	1,01,00,000
Change in inventory (increase)	1,00,00,000
(c) Difference in net income [(a) × (b)]	1,00,000

The Bombay plant produced 4,00,00,000 cans and, therefore, could absorb the entire amount of fixed overheads of Rs 4,00,000 @ Rs 10 per 1,000 cans. The Calcutta plant operated at below its normal capacity, as only 3,00,00,000 cans were produced.

There is a capacity variance unfavourable to the extent of Rs 1,00,000 (fixed overheads were under-absorbed by Rs 1,00,000). This also explains the difference in the net income between the two plants even on an absorption costing basis.

P.11.5 For several months the top management of a company has been puzzled by fluctuations in the income as reported by the accountant. The results for February, March and April as reported are as follows:

	February	*March*	*April*
Sales	Rs 18,00,000	Rs 18,00,000	Rs 9,00,000
Less: Manufacturing cost of sales	16,60,000	13,60,000	4,30,000
Selling and administrative expenses	4,40,000	4,40,000	4,40,000
Total	21,00,000	18,00,000	8,70,000
Net income (loss)	(3,00,000)	—	30,000

There has been no change in sales price during the three month period. During the months of February and March, the plant sold 3,00,00,000 units. In April, it sold 1,50,00,000 units.

The production for the three months was as follows:

	February	*March*	*April*
Opening inventory (units)	3,01,00,000	1,00,000	1,00,000
Production during the month	—	3,00,00,000	6,00,00,000
	3,01,00,000	3,01,00,000	6,01,00,000
Units sold	3,00,00,000	3,00,00,000	1,50,00,000
Closing inventory	1,00,000	1,00,000	4,51,00,000

The standard cost for the type of the units sold discloses the following information:

	Cost per 1,000 units
Direct material and labour	30
Overheads: Variable	2
Fixed	10
	42

The fixed manufacturing costs budgeted for each of the months were Rs 4,00,000. There were no spending or efficiency variances during the three months. All selling and administrative expenses were of a fixed nature.

You are required to prepare comparative income statements for the three months, using variable costing.

SOLUTION

Income Statement for February, March and April (Variable Costing)

Particulars	*February*	*March*	*April*
Production (units)	Nil	3,00,00,000	6,00,00,000
Sales (units)	3,00,00,000	3,00,00,000	1,50,00,000
Sales revenue	Rs 18,00,000	Rs 18,00,000	Rs 9,00,000
Less: production costs:			
Standard variable cost (@) Rs 32 per 1,000)	Nil	9,60,000	19,20,000
Add: opening inventory	9,63,200	3,200	3,200
Less: opening inventory	(3,200)	(3,200)	(14,43,200)
Cost of goods produced and sold	9,60,000	9,60,000	4,80,000
Contribution (manufacturing)	8,40,000	8,40,000	4,20,000
Less: non-production costs:			
Fixed overheads	4,00,000	4,00,000	4,00,000
Selling and administrative expenditure	4,40,000	4,40,000	4,40,000
Net income (loss)	Nil	Nil	(4,20,000)

P.11.6 As the chief financial analyst of a company, you have been asked by the chief executive to explain the differences between two income statements prepared for his consideration: one was prepared by the controller and the other by the sales manager. Both used the same data from operations.

	Statement A	*Statement B*
Sales (30,000 units)	Rs 30,00,000	Rs 30,00,000
Cost of goods sold:		
Opening inventory	—	—
Production costs	18,00,000	27,00,000
Less: closing inventory	(6,00,000)	(9,00,000)
Total	12,00,000	18,00,000
Gross profit	18,00,000	12,00,000
Less: other costs	(15,00,000)	(6,00,000)
Income	3,00,000	6,00,000

The only variable costs of production are Rs 40 per unit.

(i) Determine which statement was prepared using variable costing and which using absorption costing. Explain how do you know it?

(ii) Determine: (a) fixed production costs; (b) selling and administrative costs; (c) production in units; and (d) cost per unit of inventory for both statements.

SOLUTION

1. Statement A was prepared using variable costing and statement B using absorption costing. This can be determined in several ways: (a) Production costs are less in statement A because fixed costs are excluded, (b) Similarly, value of inventory is less in statement A because inventory is valued only at variable cost and fixed costs are excluded, (c) Other costs (non-production costs) are higher in statement A because of inclusion of fixed costs which are charged against the income of the same year.
2. (a) *Determination of fixed production costs:*

Production cost (absorption costing)	Rs 27,00,000
Production cost (variable costing)	18,00,000
Difference represents fixed production costs	9,00,000

(b) *Determination of selling and administrative costs*

Other costs	15,00,000
Less fixed production costs	9,00,000
Selling and administrative costs	6,00,000

(c) *Production (in units) Statement A*

1. Cost of goods sold (30,000 units)	Rs 12,00,000
2. Variable cost per unit (Rs 12,00,000 ÷ 30,000)	40
3. Total production cost (variable)	18,00,000
4. Production in units (Rs 18,00,000 ÷ Rs 40)	45,000

(d) *Cost Per Unit of Inventory*

	Variable costing basis	*Absorption costing basis*
1. Closing inventory	Rs 6,00,000	Rs 9,00,000
2. Closing inventory (units) (45,000 – 30,000)	15,000	15,000
3. Cost per unit (1) ÷ (2)	40	60

P.11.7 Following is the income statement of Jain Tubes Company Ltd prepared on the basis of absorption costing:

Sales		Rs 4,70,000
Cost of goods sold:		
Opening inventory (variable costs, Rs 42,000)	Rs 70,000	
Current production cost	2,56,000	
Less: closing inventory (variable costs, Rs 31,200)	3,26,000	
	(52,000)	2,74,000
Gross margin (manufacturing) (unadjusted)		1,96,000
Less capacity variance (unfavourable)		32,000
Gross margin (adjusted)		1,64,000
Less: selling and distribution cost		20,000
Administrative cost		22,000
Net income before taxes		1,22,000

Additional Information

(a) The fixed manufacturing overheads are absorbed at a standard rate per unit of product.
(b) Total fixed cost of the current year (budgeted as well as actual) is Rs 1,34,400.
(c) All units in inventory at the end of the year were manufactured during the year.
(d) Prepare an income statement on variable costing basis.

SOLUTION

Income Statement (Variable Costing Basis)

Particulars	*Amount*
Sales revenue	Rs 4,70,000
Less cost of goods sold:	
Variable manufacturing cost (current production) (Working note)	1,53,600
Add cost of opening inventory	42,000
Less cost of closing inventory	(31,200)
Total	1,64,400
Contribution (manufacturing and final)	3,05,600
Less non-production costs:	
Fixed manufacturing costs	(1,34,400)
Selling and distribution costs	(20,000)
Administrative costs	(22,000)
Net income before taxes	1,29,200

Working Notes

Current production costs (absorption costing)		Rs 2,56,000
Less fixed overheads absorbed:		
Total fixed overheads	Rs 1,34,400	
Less unfavourable capacity variance (representing un-absorbed fixed overheads)	32,000	(1,02,400)
Current production costs (variable)		1,53,600

P.11.8 Mr Mukesh, The Chief Accountant of the Standard Glass Manufacturing Company Ltd has prepared the following income statement on traditional costing basis for three quarters of the current year.

Particulars	*Quarter 1*	*Quarter 2*	*Quarter 3*
Sales revenue	Rs 5,25,000	Rs 4,50,000	Rs 5,25,000
Less total current cost of manufacturing goods	4,55,000	5,20,000	3,90,000
Add cost of opening inventory	Nil	Nil	1,30,000
Less cost of closing inventory	Nil	(1,30,000)	(65,000)
Cost of goods produced and sold	4,55,000	3,90,000	4,55,000
Gross margin (unadjusted)	70,000	60,000	70,000
Less capacity variance	15,000	Nil	30,000
Gross margin (adjusted)	55,000	60,000	40,000
Selling and administrative expenses	20,000	20,000	20,000
Net income before taxes	35,000	40,000	20,000
Less income taxes (0.35)	12,250	14,000	7,000
Net income after taxes	22,750	26,000	10,000

(a) *Additional information:*

Units produced	35,000	40,000	30,000
Units sold	35,000	30,000	35,000

(b) Standard fixed manufacturing overhead rate is Rs 3 per unit.

The management of the company is surprised at the results of the second quarter. It believes there must be some mistake in the income statement.

You are required to explain the income differences to the management by revising the statements on variable costing basis.

SOLUTION

Income Statements for Three Quarters of Current Year on Variable Costing Basis

Particulars	*Quarter*		
	1	*2*	*3*
Units produced	35,000	40,000	30,000
Units sold	35,000	30,000	35,000
Opening inventory (units)	—	—	10,000
Closing inventory (units)	—	10,000	5,000
Sales revenue	Rs 5,25,000	Rs 4,50,000	Rs 5,25,000
Less: manufacturing variable costs of goods sold (see working note)	3,50,000	4,00,000	3,00,000
Add cost of opening inventory @ Rs 10 per unit	—	—	1,00,000
Less cost of closing inventory	—	(1,00,000)	(50,000)
Cost of goods sold	3,50,000	3,00,000	3,50,000
Contribution (final)	1,75,000	1,50,000	1,75,000
Less non-production costs:			
Fixed manufacturing overheads	(1,20,000)	(1,20,000)	(1,20,000)
Fixed selling overheads	(20,000)	(20,000)	(20,000)
Net income before income taxes	35,000	10,000	35,000
Less income taxes (0.35)	(12,250)	(3,500)	(12,250)
Net income after taxes	22,750	6,500	22,750

Working Notes

1. Determination of variable costs:

Total cost of goods manufactured (including fixed overheads)	4,55,000	5,20,000	3,90,000
Less fixed overheads @ Rs 3 per unit	(1,05,000)	(1,20,000)	(90,000)
Variable costs	3,50,000	4,00,000	3,00,000

2. Fixed manufacturing overhead (Fixed costs absorbed + Capacity variance) = Rs 1,05,000 + Rs 15,000
   = Rs 1,20,000.

P.11.9 The Chief Executive of PS Ltd, is puzzled by the income statements of the two most recent months—April and May, because sales increased in May and yet profits declined. He asks you to explain the results:

Income Statement

Particulars	*April*	*May*
Sales (Rs 20 per unit)	Rs 2,00,000	Rs 2,50,000
Standard cost of sales	1,20,000	1,50,000
Standard gross profit	80,000	1,00,000
Capacity variance favourable (unfavourable)	8,000	(16,000)
Selling and administrative expenses	20,000	20,000
Income	68,000	64,000

The standard fixed cost per unit is Rs 8, based on normal production capacity of 12,000 units per month.

You are required to

1. Determine production in each month.
2. Explain the results to the chief executive.
3. Prepare income statements based on variable costing.

SOLUTION

1. *Determination of Volume of Production:*

Particulars	*April*	*May*
(a) Capacity variance representing actual production Production is more (less) than normal production	Rs 8,000	Rs (16,000)
(b) Standard fixed cost per unit	8	8
(c) Production more (less) than normal [(a) ÷(b)]	1,000	(2,000)
(d) Normal production	12,000	12,000
(e) Actual production [(d) ± (c)]	13,000	10,000

2. *Explanation:* The Chief Executive should be advised that the income statements have been prepared on the basis of absorption costing in which the size of profit is influenced, *inter-alia*, by the level of production. Since production was more in April, so were the profits. The true picture will emerge only when income statements are prepared on a variable costing basis.
3. *Income Statement Based on Variable Costing*

Particulars	*April*	*May*
Production (units)	13,000	10,000
Sales (units) [sales revenue ÷ Rs 20]	10,000	12,500
Opening inventory (units)	—	3,000
Closing inventory (units)	3,000	500
Sales revenue	Rs 2,00,000	Rs 2,50,000
Less cost of goods sold:		
Variable manufacturing cost @ Rs 4 per unit	52,000	40,000
Plus cost of opening inventory @ Rs 4 per unit		12,000
Less cost of closing inventory	(12,000)	(2,000)
Total cost of goods sold	40,000	50,000
Contribution (final)	1,60,000	2,00,000
Less non-production costs:		
Fixed overheads (12,000 × Rs 8)	(96,000)	(96,000)
Selling and administrative expenses	(20,000)	(20,000)
Profit	44,000	84,000

Working Notes

Determination of variable costs	*April*	*May*
Total standard cost of sales	Rs 1,20,000	Rs 1,50,000
Less fixed overheads @ Rs 8 per unit:		
April (10,000 × Rs 8)	(80,000)	
May (12,500 × Rs 8)	(1,00,000)	
Variable costs (balancing figure)	40,000	50,000

REVIEW QUESTIONS

RQ.11.1 If a company sells more units than it produces, would the profits reported by absorption costing tend to be higher or lower than the profits reported by variable costing? Why?

RQ.11.2 What advantages are gained by separating fixed expenses from variable expenses? It has been said that the statement "fluctuating overheads are those which vary with output" is an unjustifiable simplification. How would you qualify the statement? How would your qualification affect your treatment of fluctuating overheads when compiling costs?

RQ.11.3 Distinguish between marginal costing and absorption costing. Also, examine their relative appropriateness.

RQ.11.4 "Direct costing produces income statements that are a more accurate reflection of the true profit fluctuations than the income statements produced by absorption costing." State briefly why you either agree or disagree with this statement.

RQ.11.5 "It is said that an income statement prepared by the variable costing procedure is more helpful to management than an income statement prepared by the absorption cost method." Do you agree? Discuss with the help of a suitable illustration.

RQ.11.6 Below are given standard unit costs for the production of a spray attachment manufactured by Carson Products Company Ltd:

Direct material	Rs 1.60
Direct labour	1.50
Variable manufacturing overheads	1.20
Fixed manufacturing overheads	3.00

At normal operating capacity, 2,00,000 units of product should be manufactured. Variable selling and administrative expenses amount to 50 paise a unit, and the fixed selling and administrative expenses amount to Rs 75,000 a year. Income-taxes are estimated at 40 per cent of net income before taxes. Production and sales data for year 1 and year 2 are follows:

Inventory on hand, January 1, year 1 (units)	28,000
Number of units produced in year 1	2,00,000
Number of units sold in year 1	1,60,000
Number of units produced in year 2	1,50,000
Number of units sold in year 2	1,80,000

In both years, each spray attachment was sold for Rs 10.50. Prepare income statements for the two years by the absorption costing method. Also prepare income statement for two years by the variable costing method.

SOLUTION

Income Statements for Years 1 and 2 (Absorption Costing) of Carson Products Company Ltd

Particulars	*Year 1*	*Year 2*
Production (units)	2,00,000	1,50,000
Sales	1,60,000	1,80,000
Opening inventory	28,000	68,000
Closing inventory	68,000	38,000
Sales revenue (@ Rs 10.50 per unit)	Rs 16,80,000	Rs 18,90,000
Less production costs		
Direct materials @ Rs 1.60 per unit	3,20,000	2,40,000
Direct labour @ Rs 1.50 per unit	3,00,000	2,25,000
Variable manufacturing overheads @ Rs 1.20 per unit	2,40,000	1,80,000
Fixed manufacturing overheads @ Rs 3 per unit	6,00,000	4,50,000
Total production costs @ Rs 7.30 per unit	14,60,000	10,95,000

(*Contd.*)

(*Contd.*)

Plus cost of inventory at the beginning of the year @ Rs 7.30 per unit	2,04,400	4,96,400
Less cost of inventory at the end of the year @ Rs 7.30 per unit	(4,96,400)	(2,77,400)
Cost of goods sold	11,68,000	13,14,000
Gross margin (unadjusted)	5,12,000	5,76,000
Less capacity variance unfavorable in year 2 (50,000 × Rs 3, fixed overhead rate)	—	(1,50,000)
Gross margin (adjusted)	5,12,000	4,26,000
Less non-production costs		
Selling and administrative (fixed)	(75,000)	(75,000)
Variable @ Rs 0.50 per unit on units sold	(80,000)	(90,000)
Net income before taxes	3,57,000	2,61,000
Less taxes (0.40)	(1,42,800)	(1,04,400)
Income after taxes	2,14,200	1,56,600

Income Statements for the Years 1 and 2 (Variable Costing)

Particulars	*Year 1*	*Year 2*
Production (units)	2,00,000	1,50,000
Sales	1,60,000	1,80,000
Opening inventory	28,000	68,000
Closing inventory	68,000	38,000
Sales revenue @ Rs 10.50 per unit	Rs 16,80,000	Rs 18,90,000
Less production costs		
Direct material @ Rs 1.60 per unit	3,20,000	2,40,000
Direct labour @ Rs 1.50 per unit	3,00,000	2,25,000
Variable manufacturing overheads @ Rs 1.20 per unit	2,40,000	1,80,000
Total production costs @ Rs 4.30 per unit	8,60,000	6,45,000
Plus cost of inventory at the beginning of the year @ Rs 4.30 per unit	1,20,400	2,92,400
Less cost of inventory at the end of the year @ Rs 4.30 per unit	(2,92,400)	(1,63,400)
cost of goods sold	6,88,000	7,74,000
Total contribution (manufacturing)	9,92,000	11,16,000
Less variable selling and administrative expenses	(80,000)	(90,000)
Total contribution (final)	9,12,000	10,26,000
Less non-production costs		
Fixed manufacturing overheads (2,00,000 × Rs 3)	(6,00,000)	(6,00,000)
Fixed selling and administrative expenses	(75,000)	(75,000)
Net income before taxes	2,37,000	3,51,000
Less taxes (0.40)	(94,800)	(1,40,400)
Income after taxes	1,42,200	2,10,600

RQ.11.7 The Bindu Company Ltd began operations in year 1. It is now the end of year 2. This company has automated its entire operations, as a result of which it has no variable costs. It has fixed costs which do not vary wit production, The following data pertains to its operations for the years 1 and 2:

	Year 1	*Year 2*
Sales (in kgs)	12,000	12,000
Production (in kgs)	24,000	—
Selling price per unit	Rs 15	Rs 15
Production costs	2,00,000	2,00,000
Selling costs	10,000	10,000

Prepare income statements for year 1, year 2 and the two years combined under: (a) absorption costing system, and (b) direct costing system.

SOLUTION

Comparative Income Statement for the Years Ending 1 and 2 Under Absorption and Direct Costing Systems of Bindu Company Ltd

Particulars	*Year 1*		*Year 2*	
	Absorption	*Direct*	*Absorption*	*Direct*
Production (kgs)	24,000	24,000	—	—
Sales (kgs)	12,000	12,000	12,000	12,000
Opening inventory (kgs)	—	—	12,000	12,000
Closing inventory (kgs)	12,000	12,000	—	—
Sales revenue (@ Rs 15 per Kg)	Rs 1,80,000	Rs 1,80,000	Rs 1,80,000	Rs 1,80,000
Less production cost:				
Variable	—	—	—	—
Fixed (assumed 24,000 kgs normal capacity)	2,00,000	—	—	—
Plus cost of inventory at the beginning of the year	—	—	1,00,000	—
Less cost of inventory at the end of the year	(1,00,000)	—	—	—
Cost of goods sold	1,00,000	—	1,00,000	—
Gross margin (unadjusted)/contribution	80,000	1,80,000	80,000	1,80,000
Less unfavourable capacity variance in absorption costing in year 2 (no capacity variance in year 1)	—	—	(2,00,000)	—
Gross margin (adjusted)/total contribution	80,000	1,80,000	1,20,000	1,80,000
Less non-production costs				
Fixed manufacturing (variable costing)	—	(2,00,000)	—	(2,00,000)
Selling costs	(10,000)	(10,000)	(10,000)	(10,000)
Net Income/(loss)	70,000	(30,000)	(1,30,000)	(30,000)

RQ.11.8 The data below relates to a company which makes and sells computers.

	March	*April*
Sales (in units)	5,000	10,000
Production (in units)	10,000	5,000
Selling price/unit	Rs 100	Rs 100
Variable production cost/unit	50	50
Fixed production overheads incurred	1,00,000	1,00,000
Fixed production overhead costs, per unit, being the predetermined overhead absorption rate	10	10
Selling, distribution and administration costs (all fixed)	50,000	50,000

You are required to present comparative profit statements for each month using variable costing.

SOLUTION

Income Statement for March and April Using Variable Costing

Particulars	*March*	*April*
Production (units)	10,000	5,000
Sales	5,000	10,000
Opening inventory	Nil	5,000
Closing inventory	5,000	Nil
Sales revenue @ Rs 100 per unit	Rs 5,00,000	Rs 10,00,000
Less production costs:		
Variable production cost @ Rs 50 per unit	5,00,000	2,50,000
Total production costs	5,00,000	2,50,000
Add cost of opening inventory (@ Rs 50 per unit)	—	2,50,000
Less cost of closing inventory (@ Rs 50 per unit)	2,50,000	Nil
Cost of goods sold	2,50,000	5,00,000
Total contribution (final)	2,50,000	5,00,000
Less non-production costs:		
Fixed overheads—manufacturing	1,00,000	1,00,000
Fixed overheads—selling distribution and administration	50,000	50,000
Net income before taxes	1,00,000	3,50,000

RQ.11.9 Wonder Ltd manufactures a single product, ZEST. The following figures relate to ZEST for a one-year period.

Activity level (%)	50	100
Sales and production (units)	400	800
Sales (Rs lakh)	8	16
Production costs:		
Variable	3.20	6.40
Fixed	1.60	1.60
Selling and administration costs:		
Variable	1.60	3.20
Fixed	2.40	2.40

The normal output for the year is 800 units. Fixed costs are incurred evenly throughout the year and actual fixed costs are the same as budgeted. There was no stock of ZEST at the beginning of the year. In the first quarter, 220 units were produced and 160 units were sold.

(a) What would be the fixed production costs absorbed by ZEST if absorption costing is used?
(b) What would be the under/over-recovery of overheads during the period?
(c) What would be the profit using absorption costing?
(d) What would be the profit using marginal costing?
(e) Why is there a difference between the answers to (c) and (d)?

SOLUTION

(a) *Absorption of Fixed Production Costs*

$$\text{Standard fixed overhead rate per unit} = \frac{\text{Total budgeted fixed production costs}}{\text{Normal level of output (units)}} = \frac{\text{Rs } 1,60,000}{800} = \text{Rs } 200$$

$$= \text{Units produced} \times \text{Rs } 200 = 220 \times \text{Rs } 200 = \text{Rs } 44,000$$

(b) *Under/over-recovery of Overheads*

Yearly fixed production costs	Rs 1,60,000	
Quarterly fixed costs incurred (Rs 1,60,000 × 3) ÷ 12	40,000	
Amount charged to production	44,000	
Over-recovery of overheads	4,000	

(c) *Profit Under Absorption Costing*

Sales revenue (160 units × Rs 2,000)		Rs 3,20,000
Less production costs of goods sold		
Variable manufacturing costs (Rs 800 × 220)	Rs 1,76,000	
Fixed manufacturing cost (Rs 200 × 220)	44,000	
Total cost of production (Rs 1,000 × 220)	2,20,000	
Less closing stock (Rs 1,000 × 60 units)	60,000	1,60,000
Gross margin (unadjusted)		1,60,000
Add capacity variance (favourable)		4,000
Gross margin (adjusted)		1,64,000
Less non-production costs:		
Selling and administrative costs (fixed) (Rs 2,40,000 ÷ 4)	60,000	
Variable sales and administrative costs (160 × Rs 400)	64,000	1,24,000
Profit		40,000

(d) *Income Statement Under Marginal Costing*

Sales revenue (160 units × Rs 2,000)		Rs 3,20,000
Less production cost of goods sold:		
Variable manufacturing costs (Rs 800 × 220)	Rs 1,76,000	
Less closing stock (Rs 800 × 60)	48,000	1,28,000
Total contribution (manufacturing)		1,92,000
Less variable sales and administrative costs (160 × Rs 400)		64,000
Total contribution (final)		1,28,000
Less non-production costs;		
Fixed manufacturing costs	40,000	
Fixed selling and administrative costs	60,000	1,00,000
Profit		28,000

(e) Statement Accounting for the Difference in Profits in the Two Costing Systems

Increase in inventory (units)	60
(×) Standard fixed overhead rate per unit	× Rs 200
Total change in profit	Rs 12,000

Conclusion: The difference between the answers to (c) and (d) is due to increase in inventory units by 60.

RQ.11.10 Topclass Products Ltd has several product-lines with a sales manager in charge of each. He is paid a bonus based on income generated by his product-line.

In analysing the performance of one product-line, the sales manager noted that sales declined from Rs 8 lakh last year to Rs 6 lakh for the current year. However, the product-line manager received a larger bonus than last year because net income increased from Rs 90,000 last year to Rs 1,20,000 for the current year.

The general sales manager wonders how the product-line manager got entitled to a bonus with a decline in sales. He also wants to know how the net income increased when sales declined.

As a cost accountant, you are required to prepare the income statements based on which the bonus was paid. Explain with supporting figures why net income increased when sales declined. What do you think of the present method of paying the bonus? Can you suggest some other method?

The data given in support of the bonus payment is:

	Year 2	*Year 1*
Units sold @ Rs 20	30,000	40,000
Standard variable cost of production per unit	Rs 8	Rs 8
Fixed factory overhead costs	200,000	2,00,000
Selling and distribution expenses (assumed to be fixed)	1,40,000	1,40,000
Standard fixed factory overhead per unit	5	5
Units produced	50,000	30,000
Units—Opening finished goods inventory	—	10,000

All factory overhead variances are written off to the cost of goods sold.

SOLUTION

Income Statement (Based on Which Bonus is Paid)

Particulars	*Year 1*	*Year 2*
Production (units)	30,000	50,000
Sales	40,000	30,000
Opening inventory	10,000	—
Closing inventory	—	20,000
Sales revenue	Rs 8,00,000	Rs 6,00,000
Less production costs:		
Standard variable cost @ Rs 8 per unit	2,40,000	4,00,000
Standard fixed factory overhead @ Rs 5 per unit	1,50,000	2,50,000
Total production costs	3,90,000	6,50,000
Add cost of opening inventory @ Rs 13 per unit	1,30,000	—
Less cost of closing inventory @ Rs 13 per unit	—	2,60,000
Cost of goods sold	5,20,000	3,90,000
Gross margin (unadjusted)	2,80,000	2,10,000
Less capacity variance (unfavourable)	50,000	—
Add capacity variance (favourable) (40,000 normal capacity)	—	50,000
Gross margin (adjusted)	2,30,000	2,60,000
Less non-production costs:		
Selling and distribution expenses	1,40,000	1,40,000
Income before taxes	90,000	1,20,000

The present method of paying bonus is based on the full costing system. The appropriate basis of bonus payment would be one linked to sales and not to production. Income determination based on variable costing is consistent with this principle. It is recommended that the payment of bonus should be linked to income statement prepared on the basis of variable costing.

Income Statement (Based on Variable Costing)

Particulars	*Year 1*	*Year 2*
Sales revenue	Rs 8,00,000	Rs 6,00,000
Less production cost		
Standard variable cost @ Rs 8 per unit	2,40,000	4,00,000

(*Contd.*)

(*Contd.*)

Add cost of opening inventory @ Rs 8 per unit	80,000	—
Less cost of closing inventory @ Rs 8 per unit	—	1,60,000
Cost of goods sold	3,20,000	2,40,000
Total contribution	4,80,000	3,60,000
Less non-production costs		
Fixed factory overheads	2,00,000	2,00,000
Selling and distribution expenses	1,40,000	1,40,000
Income before taxes	1,40,000	20,000

RQ.11.11 The following income statement was prepared by the accountant of XYZ Co. Ltd for the current year ending March 31:

Sales (20,000 units)		Rs 2,40,000
Cost of goods sold		
Material	Rs 80,000	
Labour	50,000	
Factory overheads		
Variable	32,000	
Fixed	28,000	1,90,000
Gross profit		50,000
Selling and administrative expenses		
Variable	18,000	
Fixed	42,000	60,000
Net loss		(10,000)

Prepare a revised income statement based on variable costing.

SOLUTION

Income Statement (Variable Costing Basis) of XYZ Company Ltd

Particulars	*Amount*
Sales revenue	Rs 2,40,000
Less production costs	
Material	80,000
Labour	50,000
Variable factory overheads	32,000
Total cost of production/goods sold	1,62,000
Total contribution (manufacturing)	78,000
Less variable selling and administrative costs	18,000
Total contribution (final)	60,000
Less nonproduction costs	
Fixed factory overheads	28,000
Fixed selling and administrative costs	42,000
Net loss	(10,000)

It is assumed that normal level of activity is 20,000 units. Total actual fixed costs (factory as well as selling and administrative) have been absorbed under absorption costing system.

RQ.11.12 The following data pertain to the operations of Bombay Glass Manufacturing Company Ltd for the current year:

Normal capacity (units)	1,00,000
Practical capacity	1,50,000
Budgeted production	1,20,000
Actual production	1,10,000
Actual sales (Rs 20 per unit)	1,00,000
Standard variable production cost per unit	Rs 10
Fixed production cost budgeted	6,00,000

During the year, there were no variable cost variances; fixed costs incurred were equal to the budgeted amount. There were no beginning inventories and no selling, general and administrative expenses.

You are required to prepare income statements using various methods of dealing with overhead costs in absorption costing. Use the long format with the details of beginning and ending inventories and the production costs.

SOLUTION

Determination of Standard Cost (Absorption Costing)

Particulars	*Normal capacity*	*Practical capacity*	*Budgeted production*
Standard variable cost per unit	Rs 10	Rs 10	Rs 10
Plus standard fixed cost per unit			
(Rs 6,00,000 ÷ 1,00,000 units of normal capacity)	6		
(Rs 6,00,000 ÷ 1,50,000 units of practical capacity)		4	
(Rs 6,00,000 ÷ 1,20,000 units of budgeted production)			5
Standard cost per unit	16	14	15

Income Statement (Absorption Costing)

Sales (1,00,000 units)	Rs 20,00,000	Rs 20,00,000	Rs 20,00,000
Less production costs			
Variable : Rs 10 per unit	11,00,000	11,00,000	11,00,000
Fixed : Rs 6 per unit	6,60,000		
: Rs 4 per unit		4,40,000	
: Rs 5 per unit			5,50,000
Total cost of production	17,60,000	15,40,000	16,50,000
Add beginning inventory	—	—	—
Less closing inventory			
(10,000 × Rs 16)	(1,60,000)		
(10,000 × Rs 14)		(1,40,000)	
(10,000 × Rs 15)			(1,50,000)
Cost of goods sold	16,00,000	14,00,000	15,00,000
Gross margin (unadjusted)	4,00,000	6,00,000	5,00,000
Add capacity variance favourable and *less* (unfavourable)	60,000	(1,60,000)	(50,000)
Gross margin (adjusted)	4,60,000	4,40,000	4,50,000)

RQ.11.13 The manager of Royal Industries Ltd is confused by the income statements he has received from his accountant. He is particularly concerned that his return on sales declined much more than sales in February as compared to January.

Income Statements

	January	*February*
Sales revenue	Rs 4,50,000	Rs 3,75,000
Cost of sales	1,80,000	1,50,000
Gross profit	2,70,000	2,25,000
Operating expenses		
Rent	6,000	6,000
Salaries, wages, commissions	1,57,500	1,42,500
Property insurance, taxes, etc.	4,500	4,500
Supplies	9,000	7,500
Miscellaneous expenses	29,500	29,500
Total operating expenses	2,06,500	1,90,000
Operating income	63,500	35,000
Return on sales (%)	14.11	9.33

The manager informs you that in salaries, wages, and commissions, the accountant includes the salaries of several clerks and of himself. All salesmen work on commissions @ 20 per cent of sales. Expenses on account of supplies vary directly with sales. For various reasons, sales in February was expected to decline by Rs 75,000. But he had expected income of Rs 52,912.50 on sales of Rs 3,75,000 @ 14.11 per cent.

You are required to explain the income differences to the manager by using contribution based income statement.

SOLUTION

Contribution-based Income Statement of Royal Industries Ltd

Particulars	*January*	*February*
Sales revenue	Rs 4,50,000	Rs 3,75,000
Less production and other costs (variable):		
Cost of sales (assumed)	1,80,000	1,50,000
Salesmen's commissions (0.20 x sales)	90,000	75,000
Supplies	9,000	7,500
Total relevant variable cost of goods sold	2,79,000	2,32,500
Total contribution (final)	1,71,000	1,42,500
Less fixed costs		
Rent	6,000	6,000
Salaries and wages	67,500	67,500
Property insurance, taxes, etc.	4,500	4,500
Miscellaneous expenses	29,500	29,500
Total fixed costs	1,07,500	1,07,500
Operating income	63,500	35,000

Explanation: Fixed costs (Rs 1,07,500) will not decline *pro-rata* with decrease in sales. Therefore, return on sales at the rate of 14.11 per cent cannot be maintained.

RQ.11.14 It is the end of year 2. The All Fixed Company Ltd began operations in January, year 1. The company has no variable costs. All of its costs are fixed; they do not vary with output.

The All Fixed Company Ltd is located on the banks of a river and has its own hydro-electric plant to supply power, light and heat. The company manufactures a synthetic fertiliser from air and river water and sells its product at a price which is not expected to change. It has a small staff, all hired on an annual salary basis. The output of the plant can be increased or decreased by adjusting dials on a control panel. The following is the data regarding operations of the All Fixed Company Ltd:

	Year 1	*Year 2*[@]
Sales (tonnes)	10,000	10,000
Production	20,000	—
Selling price per tonne	Rs 30	Rs 30
Production costs (fixed)	2,80,000	2,80,000
General and administrative expenses	40,000	40,000

[@]Management adopted the policy, effective from January 1, year 2, of producing only as the product was needed to fill orders. During year 2, sales were the same as for year 1 and were met entirely from inventory.

Required:

(i) Prepare columnar income statements for year 1 and year 2 using (a) absorption costing and (b) marginal costing.
(ii) What inventory costs would be carried in the balance sheets in December, year 1 and year 2 under each method?

SOLUTION

Particulars	*Year 1*		*Year 2*	
	Absorption	*Variable*	*Absorption*	*Variable*
(i) Columnar Income Statements for the Years 1 and 2 Under Absorption and Variable Costing Methods:				
Production (in units)	20,000	20,000	—	—
Sales (in units)	10,000	10,000	10,000	10,000
Opening inventory (in units)	—	—	10,000	10,000
Closing inventory (in units)	10,000	10,000	—	—
Sales revenue @ Rs 30 per tonne	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000
Less production costs				
Variable costs	—	—	—	—
Fixed costs (absorbed from actual production @ Rs 14 per unit)	2,80,000	—	—	—
	2,80,000	—	—	—
Add cost of opening inventory @ Rs 14 per unit in absorption costing	—	—	1,40,000	—
Less cost of closing inventory	(1,40,000)	—	—	—
Cost of goods sold	1,40,000	—	1,40,000	—
Gross margin (unadjusted)/contribution	1,60,000	3,00,000	1,60,000	3,00,000
Less capacity variance (unfavourable) in year 2 in absorption costing	—	—	(2,80,000)	—
Gross margin (adjusted)/contribution	1,60,000	3,00,000	(1,20,000)	3,00,000
Less non-production costs				
Fixed costs	—	(2,80,000)	—	(2,80,000)
General and administrative	(40,000)	(40,000)	(40,000)	(40,000)
Net Income (loss)	1,20,000	(20,000)	(1,60,000)	(20,000)
(ii) *Inventory costs, year 1: closing*	1,40,000	—		
Inventory costs, year 2: closing			—	—

RQ.11.15 ABC Motors assembles and sells motor vehicles. It uses an actual costing system, in which unit costs are calculated on a monthly basis. Data relating to March and April of the current year are:

Particulars	*March*	*April*
Unit data:		
Beginning inventory	0	150
Production	500	400
Sales	350	520
Variable cost data:		
Manufacturing costs per unit produced	Rs 10,000	Rs 10,000
Distribution costs per unit sold	3,000	3,000
Fixed cost data:		
Manufacturing costs	Rs 20,00,000	Rs 20,00,000
Marketing costs	6,00,000	6,00,000

The selling price per motor vehicle is Rs 24,000.

Required:

(i) Present income statements for ABC Motors in March and April under (a) variable costing, and (b) absorption costing.

(ii) Explain the differences between (a) and (b) for March and April.

SOLUTION

(i) (a) *Income Statements for March and April (Variable Costing)*

Particulars	*March*	*April*
Production	500	400
Sales	350	520
Opening inventory	—	150
Closing inventory	150	30
Sales revenue @ 24,000 per unit	Rs 84,00,000	Rs 1,24,80,000
Less Cost of goods sold		
Manufacturing costs @ Rs 10,000 per unit	50,00,000	40,00,000
Plus Cost of opening inventory	—	15,00,000
Less Cost of closing inventory	(15,00,000)	(3,00,000)
Cost of goods sold	35,00,000	52,00,000
Total contribution (manufacturing)	49,00,000	72,80,000
Less variable distribution cost @ Rs 3,000 per unit sold	10,50,000	15,60,000
Total contribution (final)	38,50,000	57,20,000
Less Total fixed costs	26,00,000	26,00,000
Operating income	12,50,000	31,20,000

(b) *Income Statements for March and April (Absorption Costing)*

Particulars	*March*	*April*
Production (units)	500	400
Sales	350	520
Opening inventory	—	150
Closing inventory	150	30
Sales revenue @ 24,000 per unit	Rs 84,00,000	Rs 1,24,80,000

(*Contd.*)

(*Contd.*)

Less Cost of goods sold		
Variable manufacturing costs (@ Rs 10,000 per unit)	50,00,000	40,00,000
Fixed manufacturing costs (@ Rs 4,000 per unit, March and @ Rs 5,000 per unit, April)	20,00,000	20,00,000
Total production cost (@ Rs 14,000 per unit, March and @ Rs 15,000 per unit, April)	70,00,000	60,00,000
Plus Cost of opening inventing @ Rs 14,000 per unit	—	21,00,000
Less Cost of closing inventory (@ Rs 14,000 per unit, March and @ Rs 15,000 per unit, April)	(21,00,000)	(4,50,000)
Cost of goods sold	49,00,000	76,50,000
Gross margin	35,00,000	48,30,000
Less non-production costs:		
Fixed marketing costs	6,00,000	6,00,000
Variable distribution costs	10,50,000	15,60,000
Operating income	18,50,000	26,70,000

(ii) Difference between two costing systems is due to treatment of fixed manufacturing costs. While it is treated as a part of production cost in absorption costing, it is considered as period cost under variable costing. In operational terms, both closing, and opening inventory are valued at higher cost in absorption costing *vis-a-vis* variable costing. Accordingly, difference in two accounting systems is explained by the following:

Fixed manufacturing cost included in closing inventory.

Less fixed manufacturing cost included in opening inventory.

Statement Accounting for the Difference in Profits in Two Accounting Systems

Particulars	*March*	*April*
(i) Profit as per absorption costing	Rs 18,50,000	Rs 26,70,000
(ii) Profit as per variable costing	12,50,000	31,20,000
(iii) Fixed manufacturing costs included in:		
Closing inventory	6,00,000 [1]	1,50,000 [2]
Less Opening inventory	—	6,00,000
Increase (decrease) in profits of absorption costing *vis-a-vis* variable costing	6,00,000	(4,50,000)

1. (Closing inventory 150 units × Rs 4,000 fixed manufacturing cost per unit)
2. (Closing inventory 30 units × Rs 5,000 fixed manufacturing cost per unit)

12

Volume-Cost-Profit Analysis/ Break-Even Analysis

Introduction

Profit planning is a function of the selling price of a unit of product, the variable cost of making and selling the product, the volume of product units sold, and, in the case of multi-product companies, sales-mix and, finally, the total fixed costs. The **volume-cost-profit (VCP) analysis** is a management accounting tool to show the relationship between these ingredients of profit planning. The entire gamut of profit planning is associated with VCP inter-relationships. A widely-used technique to study VCP relationships is break-even analysis.

A break-even analysis is concerned with the study of revenues and costs in relation to sales volume and, particularly, the determination of that volume of sales at which the firm's revenues and total costs will be exactly equal (or net income = zero). Thus, the break-even point (**BEP**) may be defined as a point at which the firm's total revenues are exactly equal to total costs, yielding zero income. The "no-profit, no-loss" point is a break-even point or a point at which losses cease and profits begin.

Break-even analysis, as a technique, seeks to provide answers to the following questions:

1. What sales volume is necessary to produce an *X* amount of operating profit?
2. What will the operating profit or loss at *X* sales volume be?
3. What profit will result from an *X* per cent increase in sales volume?
4. What is the additional sales volume required to make good an *X* per cent reduction in selling prices so as to maintain the current profit level?
5. What will the effect on operating profit be if the company's fixed costs have increased?
6. What will the effect on income be if the firm achieves a reduction in variable costs (say, material or direct labour)?
7. What is the required sales volume to cover the additional fixed charges from the proposed new project?
8. What will the effect on operating profit of the firm be if the sales mix is changed?
9. What will the effect on income be if there is an increase in fixed costs by an *X* amount due to new plant but will decrease the labour costs by *Y* amount per unit?
10. What sales volume is needed to achieve the budgeted profit?

BREAK-EVEN ANALYSIS

A break-even analysis shows the relationship between the costs and profits with sales volume. The sales volume which equates total revenue with related costs and results in neither profit nor loss is called the **break-even volume or point (BEP)**. If all costs are assumed to be variable with sales volume, the BEP would be at zero sales. If all costs were fixed, profits would vary disproportionately with sales and the BEP would be at a point where total sales revenue equalled fixed costs. However, both are purely hypothetical situations. In actual practice, costs consist of both fixed and variable elements.

The BEP can be determined by two methods:

1 Algebraic methods: (a) Contribution margin approach and (b) Equation technique, and
2 Graphic presentation: (a) Break-even chart and (b) Profit volume graph.

Algebraic Methods

Contribution Margin Approach The logic underlying the determination of the BEP under this approach can be stated by answering the following question:

"How many ice-creams, having a unit cost of Rs 2 and a selling price of Rs 3, must a vendor sell in a fair to recover the Rs 800 fees paid by him for getting a selling stall and additional cost of Rs 400 to install the stall?" The answer can be determined by dividing the fixed cost by the difference between the selling price (Rs 3) and cost price (Rs 2). Thus,

$$\text{BEP (units)} = \frac{\text{Fixed cost (Entry fees + Stall expenses)}}{\text{(Sales price – Unit variable cost)}} \tag{12.1}$$

(Rs 800 + Rs 400)/(Rs 3 – Rs 2) = 1,200 units

Or,

$$\text{BEP (units)} = \frac{\text{Fixed costs}}{\text{Contribution margin } (CM) \text{ per unit}} \tag{12.2}$$

Or,

$$\text{BEP (amount)/BEP (Sales revenue)/}BESR = \text{BEP (units)} \times \text{Selling price } (SP) \text{ per unit}$$
$$= 1{,}200 \times \text{Rs } 3 = \text{Rs } 3{,}600 \tag{12.3}$$

Or,

$$\text{BEP (amount)} = \frac{\text{Fixed costs}}{\text{Profit volume ratio (P/V ratio)}} \tag{12.4}$$

$$\text{P/V ratio}^{1} = \frac{\text{Contribution margin per unit}}{\text{Selling price per unit}} \tag{12.5}$$

$$\frac{\text{Re } 1}{\text{Rs } 3} = \text{or} \quad 33.33 \text{ per cent}$$

$$\text{BEP (amount)} = \text{Rs } 1{,}200 \div 0.3333 = \text{Rs } 3{,}600$$

From the P/V ratio, the variable cost to volume ratio (*V/V* ratio) can be easily derived:

$$V/V \text{ ratio} = 1 - \text{P/V ratio} \tag{12.6}$$

[1]A better term would be contribution to revenue ratio as the numerator is the contribution margin (difference between the selling price and variable costs) and not profit. The *P/V* ratio in a strict sense of the term represents the relationship between profi and selling price only after the BEP, that is, when fixed costs have been recovered. It is, therefore, not a very suitable term.

In the vendor's case, it is = 1–1/3 = 2/3 = 66.67 per cent

The *V/V* ratio, as the name suggests, establishes the relationship between variable costs (VC) and sales volume in amount. The direct method of its computation is:

$$\frac{\text{Variable cost}}{\text{Sales revenue}} = \text{Rs } 2 \div \text{Rs } 3 = 66.67 \text{ per cent} \quad (12.7)$$

Thus, P/V ratio + *V/V* ratio = 1 or 100 per cent

$$(1/3 + 2/3) = 1 \ (33.33 \text{ per cent} + 66.67 \text{ per cent}) = 100 \text{ per cent} \quad (12.8)$$

Margin of Safety The excess of the actual sales revenue (ASR) over the break-even sales revenue (*BESR*) is known as the **margin of safety**. Symbolically, margin of safety = (ASR – BESR)**(12.9)**

When the margin of safety (amount) is divided by the actual sales (amount), the margin of safety ratio (*M/S* ratio) is obtained. Symbolically,

$$M/S \text{ ratio} = \frac{(\text{ASR} - \text{BESR})}{\text{ASR}} \quad (12.10)$$

The *M/S* ratio indicates the percentage by which the actual sales may be reduced before they fall below the break-even sales volume. It is important that there should be a reasonable margin of safety, lest a reduced level of activity should prove disastrous. The higher the margin of safety ratio, the better it is from the point of view of the company as it indicates that a "sizeable" sales volume can fall before the BEP is reached. This measure acquires special significance in depression/recession.

Assume in the vendor's case that sales is 2,000 units (Rs 6,000); margin of safety (Rs 6,000 – Rs 3,600) = Rs 2,400; and the *M/S* ratio is Rs 2,400 ÷ Rs 6,000 = 40 per cent.

The amount of profit can be directly determined with reference to the margin of safety and P/V ratio. Symbolically,

$$\text{Profit} = [\text{Margin of safety (amount)}] \times \text{P/V ratio} \quad (12.11)$$

$$\text{Or Profit} = [\text{Margin of safety (units)} \times CM \text{ per unit}] \quad (12.12)$$

In the vendor's case, profit = Rs 2,400 × 0.3333 (33.33 per cent) = Rs 800 or 800 × Re 1 = Rs 800.

The reason is that once the total amount of fixed costs has been recovered, profits will increase by the difference of sales revenue and variable costs.

Equation Technique This is the most general form of analysis, which can be applied to any cost-volume-profit situation. It is based on an income equation: Sales revenue-Total costs = Net profit

Breaking up total costs into fixed and variable, Sales revenue – Fixed costs – Variable costs = Net profit. Or Sales revenue = Fixed costs + Variable costs + Net profit.

If *S* be the number of units required for break-even and sales revenue (*SP*) and variable costs (VC) are on per unit basis, the above equation can be written as follows:

$$SP\ (S) = \text{FC} + \text{VC}\ (S) + NI \quad (12.13)$$

Where SP = Selling price per unit
S = Number of units required to be sold to break-even
FC = Total fixed costs
VC = Variable costs per unit
NI = Net income (zero)
$SP\ (S) = \text{FC} + \text{VC}\ (S) + \text{zero}$
$SP\ (S) - \text{VC}\ (S) = \text{FC}$

or $S\,(SP - \text{VC}) = \text{FC}$

$$S = \frac{\text{FC}}{SP - \text{VC}} \tag{12.14}$$

It can be seen that Eq. 12.14 is identical to Eq. 12.2 (contribution margin approach). Yet, it is *specially useful in situations in which unit price and unit variable costs are not clearly identifiable.*

EXAMPLE 12.1

SV Ltd, a multi-product company, furnishes you the following data relating to the current year:

Particulars	*First half of the year*	*Second half of the year*
Sales	Rs 45,000	Rs 50,000
Total costs	40,000	43,000

Assuming that there is no change in prices and variable costs and that the fixed expenses are incurred equally in the two half-year periods, calculate for the year: (i) The profit-volume ratio, (ii) Fixed expenses, (iii) Break-even sales, and (iv) Percentage margin of safety.

SOLUTION

Sales revenue – Total costs = Net profit

Rs 45,000 – Rs 40,000 = Rs 5,000 (first half)

Rs 50,000 – Rs 43,000 = Rs 7,000 (second half)

On a differential basis: Δ Sales revenue, Rs 5,000 – Δ Total costs, Rs 3,000 = Δ Total profit, Rs 2,000

We know that only VC changes with a change in sales volume and, hence, change in total costs are equivalent to VC (Rs 3,000). Accordingly, the additional sales of Rs 5,000 has earned a contribution margin of Rs 2,000 [Rs 5,000 (*S*) – Rs 3,000 (VC)].

P/V ratio = Rs 2,000 ÷ Rs 5,000 = 40 per cent

V/V ratio = 100 per cent – 40 per cent = 60 per cent

Accordingly, 60 per cent of the total costs are made up of variable costs and the balance represents the total fixed costs (FC).

Sales revenue = Fixed costs + Variable costs + Net profit

Rs 95,000 = FC + 0.60 × (Rs 95,000) + Rs 12,000

Rs 95,000 = FC + Rs 57,000 + Rs 12,000

Rs 95,000 – Rs 69,000 = FC or Rs 26,000 = FC

BEP (amount) = Rs 26,000 ÷ 0.40 = Rs 65,000

Table 12.1 Verification

Particulars	*Amount*	*Per cent*
Break-even sales	Rs 65,000	100
Variable costs	39,000	60
Contribution	26,000	40
Fixed costs	26,000	40
Net income	Nil	Nil

$$M/S \text{ ratio} = \frac{(\text{Rs } 95{,}000 - \text{Rs } 65{,}000)}{\text{Rs } 95{,}000} = 31.58 \text{ per cent}$$

Break-Even Analysis Applications

Sales Volume Required to Produce Desired Operating Profit One application of a BE analysis is to determine the required sales volume to generate a budgeted amount of profit. The required sales are given by Eq. 12.15.

$$\text{(Fixed expenses + Desired operating profit)} \div \text{P/V ratio} \tag{12.15}$$

In Example 12.1, if the desired operating profit of *SV* Ltd is Rs 14,000, required sales volume = (Rs 26,000 + Rs 14,000)/0.40 = Rs 1,00,000

A variant of the above approach is that the management may be interested in knowing the required sales volume to produce the desired profit after taxes. In this case, the analysis must be expanded slightly. Assume that *SV* Ltd wants a net income after taxes of Rs 13,500 and that its current tax rate is 35 per cent, the net income after taxes is 65 per cent of the net income before taxes.

$$\text{Required sales volume} = \frac{\text{Fixed costs} + \left[\dfrac{\text{Desired income after taxes}}{1 - \text{tax rate}}\right]}{P/V \text{ ratio}} \tag{12.16}$$

$$= \frac{\text{Rs } 26{,}000 + \left[\dfrac{\text{Rs } 13{,}500}{1 - 0.35}\right]}{0.40} = \text{Rs } 1{,}16{,}923$$

Table 12.2 Verification

Sales volume	Rs 1,16,923
Less: Variable costs	70,154
Contribution	46,769
Less: Fixed costs	26,000
Profits before taxes	20,769
Less: Taxes (0.35)	7,269
Profit after taxes	13,500

Operating Profit at a Given Level of Sales Volume [Actual Sales Revenue (ASR) – Break-even Sales Revenue (BESR)] × P/V ratio (12.17)

Effect on Operating Profit of a Given Increase in Sales Volume [Budgeted Sales Revenue (*BSR*) – BESR] × P/V ratio (12.18)

Suppose that *SV* Ltd forecasts 10 per cent increase in sales next year, the projected profit will be:

$$(\text{Rs } 1{,}04{,}500 - \text{Rs } 65{,}000) \times 0.40 = \text{Rs } 15{,}800$$

Additional Sales Volume Required to Offset a Reduction in Selling Price The sales manager on the basis of a market research/survey may report to the management that due to increased competition in the market and the liberal import policy of the government, the present price is relatively higher. He may advise reduction in prices to stay in competition.

Suppose that *SV* Ltd reduces its selling price from Rs 10 a unit to Rs 9. The sales volume needed to offset reduced selling price/maintain a present operating profit of Rs 12,000 would be:

$$= \frac{\text{Desired profit } (P) + \text{Fixed expenses } (FC)}{\text{Revised } P/V \text{ ratio (Rs 3/Rs 9)}} = \text{Rs } (12{,}000 + \text{Rs } 26{,}000) \div 0.3333 = \text{Rs } 1{,}14{,}000$$

The required sales volume of Rs 1,14,000 represents an increase of about 20 per cent over the present level. The management should explore new avenues of sales potential to maintain the existing amount of profit.

On the other hand, if the firm has the opportunity to increase the unit selling price of the product, the impact of increased sales price would be that the BEP will be reached sooner because an increase in the selling price will raise the contribution margin, assuming no change in the variable costs. An increased contribution margin will decrease the sales volume necessary to reach a desired goals.

Assume that the management of *SV* Ltd increases the selling price of its product from Rs 10 to Rs 12, the desired sales volume would be: $\frac{FC + P}{\text{Revised } P/V \text{ ratio}}$ = Rs 38,000 ÷ 0.50 (Rs 6 ÷ Rs 12) = Rs 76,000

Effect of Changes in Fixed Costs A firm may be confronted with the situation of increasing fixed costs. An increase in the total budgeted fixed costs of a firm may be necessitated either by external factors, such as, an increase in property taxes, insurance rates, factory rent, and so on, or by a managerial decision of an increase in salaries of executives. More important than this in the latter category are expansion of the present plant capacity so as to cope with additional demand. The increase in the requirements of fixed costs would imply the computation of the following:

(a) Relative break-even points
(b) Required sales volume to earn the present profits
(c) Required sales volume to earn the same rate of profit on the proposed expansion programme as on the existing ones.

The effect of the increased FC*s* will be to raise the BEP of the firm. Assume the management of *SV* Ltd decides a major expansion programme of its existing production capacity. It is estimated that it will result in extra fixed costs of Rs 8,000 on advertisement to boost sales volume and another Rs 16,000 on account of new plant facility.

(a) *The relative BEPs will be:*

Present facilities = Fixed costs ÷ P/V ratio = Rs 26,000/0.40 = Rs 65,000
Proposed facilities = (Present FC*s* + Additional FC*s*) ÷ *P/V* ratio (12.19)
= (Rs 26,000 + Rs 24,000)/0.40 = Rs 125,000

It may be noted that increase in FC*s* (from Rs 26,000 to Rs 50,000) has caused disproportionate increase in the BEP (from Rs 65,000 to Rs 1,25,000).

(b) *The required sales volume to earn the present profit:*

[Present FC*s* + Additional FC*s* + Present profit (*NI*)] ÷ *P/V* ratio (12.20)
= [Rs 26,000 + Rs 24,000 + Rs 12,000] ÷ 0.40 = Rs 1,55,000

(c) *The required sales volume to earn the present rate of profit on investment:*

(Present FC*s* + Additional FC*s* + Present return on investment + Return on new investment) *P/V* ratio (12.21)

Let us assume that the present investment is Rs 1,00,000 and the new investment will involve an additional financial outlay of Rs 60,000. The required sales volume will be (Rs 26,000 + Rs 24,000 + Rs 12,000+ Rs 7,200 (0.12 × Rs 60,000)/0.40 = Rs 1,73,000

These computations may be reported in a summary form to the management as follows (Table 12.3).

Table 12.3 Effect of Changes in Fixed Costs

Particulars	*Present facilities*	*Prospective facilities*	*Increase*
Fixed costs	Rs 26,000	Rs 50,000	Rs 24,000
BEP sales volume	65,000	1,25,000	60,000
BEP sales volume (units)	6,500	12,500	6,000
Sales volume to earn existing profit	95,000	1,55,000	60,000
Sales volume in units to earn existing profit	9,500	15,500	6,000
Sales volume to earn existing ROI	95,000	1,73,000	78,000
Sales volume to earn existing ROI (in units)	9,500	17,300	7,800

Effect of Changes in Variable Costs Assuming an increase of VC by Re 1 a unit for *SV* Ltd, the new contribution margin will be: Rs 3 (Rs 10 – Rs 7) and the revised P/V ratio 0.30 that is, (Rs 3 ÷ Rs 10).
Revised BEP = (Rs 26,000)/0.30 = Rs 86,667
Desired sales volume to earn existing profit = Rs 38,000/0.30 = Rs 1,26,667

Assuming that variable costs of *SV* Ltd decline by Re 1 per unit, revised BEP = Rs 26,000/0.50 = Rs 52,000.

Desired sales volume to maintain existing profit = Rs 38,000/0.50 = Rs 76,000.

Effects of Multiple Changes So far we have assumed that a change takes place in one of the three variable affecting profits—cost, price and sales volume. In cases where more than one factor is affected, the BEP *analysis* can be applied as shown below:

$$\frac{FC + FC\ (\text{new}) + \left[\dfrac{\text{Desired } NI}{1 - \text{tax rate}}\right]}{[\text{Contribution margin per unit (New } SP - \text{New } VC)] \div \text{New selling price (New } SP)]} \qquad (12.22)$$

Assuming the following set of new Figures for *SV* Ltd:

Particulars	*Existing data*	*New data*
Selling price per unit	Rs 10	Rs 11
Fixed costs	26,000	40,000
Variable cost per unit	6	5.50
Contribution margin per unit	4	5.50
Desired net income after taxes (to maintain the existing ROI)	12,000	25,000
Tax rate	35 per cent	

SOLUTION

Desired sales volume (on the basis of new data) [Rs 26,000 + Rs 14,000 + (Rs 25,000 ÷ 0.65)] ÷ 0.50, that is (Rs 5.5 ÷ Rs 11) = (Rs 78,461.5) ÷ 0.50 = Rs 1,56,923

Desired sales volume on the basis of existing data = [Rs 26,000 + (Rs 12,000 ÷ 0.65)] ÷ 0.40 (Rs 4 ÷ Rs 10) = Rs 44,462 ÷ 0.40 = Rs 1,11,154.

VCP Analysis and a Segment of the Business The fundamental approach of applying the VCP analysis to a segment of the business is the same as applying it to the business as a whole. The VCP approach "may be applied to problems relative to individual product lines, territories, methods of sale, channels of distribution or any particular segment of the business which is under scrutiny"[2]. In all these decisions, fixed costs and P/V ratio are the required inputs. Where fixed costs are inclusive of allocated costs also, in additional to direct costs, two BEPs may be determined.

EXAMPLE 12.2

SV Ltd has four sales divisions. The relevant data for its northern division is reproduced below:
Direct fixed costs, Rs 10,000
P/V ratio, 0.40
Allocated fixed costs from head office, Rs 5,000

The sales volume required to cover direct expenses would be: Direct fixed costs/ P/V ratio (12.23)

$$= \text{Rs } 10{,}000/0.40 = \text{Rs } 25{,}000$$

The total sales volume required to cover all fixed costs would be higher as shown by equation 12.24:

$$\frac{\text{Direct FC}s + \text{Allocated FC}s}{\text{P/V ratio}} \tag{12.24}$$

$$= (\text{Rs } 10{,}000 + \text{Rs } 5{,}000) \div 0.40 = \text{Rs } 37{,}500$$

Multi-product Firms (Sales-mix) So far, we have confined our discussion to a one-product company. However, many manufacturers make more than one type of product. The relative proportion of each product sold in the aggregate sales is known as the sales-mix. A change in the mix of products sold usually affects the weighted average P/V ratio and, hence, the BEP. Thus, when the products have different P/V ratios, changes in the sales-mix/product-mix will affect the BEP and the results from operation.

EXAMPLE 12.3

The Garware Paints Ltd presents to you the following income statement in a condensed form for the first quarter ending March 31:

Particulars	*Product*			*Total*
	X	*Y*	*Z*	
Sales	Rs 1,00,000	Rs 60,000	Rs 40,000	Rs 2,00,000
Variable costs	80,000	42,000	24,000	1,46,000
Contribution	20,000	18,000	16,000	54,000
Fixed costs				27,000
Net income				27,000
P/V ratio	0.20	0.30	0.40	0.27
Break-even sales				1,00,000
Sales-mix (per cent)	0.50	0.30	0.20	100

If Rs 40,000 of the sales shown for Product *X* could be shifted equally to products *Y* and *Z*, the profit and the BEP would change as shown in Table 12.4.

Table 12.4 Break-even Point

Particulars	*Product*			*Total*
	X	*Y*	*Z*	
Sales	Rs 60,000	Rs 80,000	Rs 60,000	Rs 2,00,000
Less: Variable costs	48,000	56,000	36,000	1,40,000
Contribution	12,000	24,000	24,000	60,000
Less: Fixed costs				27,000
Net income				33,000
P/V ratio	0.20	0.30	0.40	0.30
BE sales				90,000
Sales-mix (per cent)	0.30	0.40	0.30	100

Example 12.3 shows that by increasing the mix of high P/V products (*Y* from 30 to 40 per cent, *Z* from 20 to 30 per cent) and decreasing the mix of a low P/V product (*X* from 50 to 30 per cent), the company can increase its overall profitability. In fact, it can further augment its total profits, if it can make, and the market can absorb, more quantities of *Y* and *Z*, say Rs 1 lakh each (Table 12.5).

Table 12.5

Particulars	*Product*		*Total*
	Y	*Z*	
Sales	Rs 1,00,000	Rs 1,00,000	Rs 2,00,000
Less: Variable costs	70,000	60,000	1,30,000
Contribution	30,000	40,000	70,000
Less: Fixed costs			27,000
Net income			43,000
P/V ratio	0.30	0.40	0.35
BE sales			77,143
Sales-mix (per cent)	0.50	0.50	100

From the above, it can be generalised that, other things being equal, management should stress products with higher contribution margins. For individual product line income statements, fixed costs should not be allocated or apportioned.

Finally, it may be stressed that there is a need for a closer study of cost structures of individual product line/department within the same firm or of two different companies. It may be possible that the two departments/companies may have the same profits but very different cost structures. For instance, observe the Figures in Table 12.6 of two departments of *SV* Ltd.

Table 12.6

Particulars	*Department X*		*Department Y*	
	Amount	*Per cent*	*Amount*	*Per cent*
Sales revenue	Rs 1,00,000	(100)	Rs 1,00,000	(100)
Less: Variable costs	70,000	(70)	20,000	(20)
Contribution / P/V ratio	30,000	(30)	80,000	(80)
Less: Fixed costs	20,000		70,000	
Profit	10,000		10,000	
BEP (amount)	66,667		87,500	
Margin of safety (MS)	33,333		12,500	
Margin of safety ratio	0.3333		0.125	

Department *Y* is operating closer to the BEP than Department *X*. Department *Y* has a narrower margin of safety (12.5 per cent) compared to 33.33 per cent of *X*. The margin of safety ratio signifies that if the sales of *Y* decreases by more than 12.5 per cent, it will operate at a loss. In other words, the margin/cushion of safety is relatively smaller. *X* will not operate at a loss unless its sales volume drops by more than 33.33 per cent.

This type of profit analysis for two different companies is of special significance from the point of view of outside investor who want to invest in one of the two companies. Assuming companies *X* and *Y* in place of the departments *X* and *Y* in the above tabulation, Company *X* is certainly less risky than Company *Y*.

Graphic Presentation

Under the algebraic technique of break-even analysis, separate computations were needed to arrive at the above set of figures. The utility of the graphical technique is that such a set of figures can be determined without involving any separate calculations.

Break-Even Chart/Volume Cost Profit (VCP) Graph The **break even chart** is a graphic relationship between volume, costs and profits. It shows not only the BEP but also the effects of costs and revenue at varying levels of sales. The break-even chart can, therefore, be more appropriately called the volume-cost-profit graph (VCP graph).

Assumptions Regarding the VCP Graph are

1. Costs can be bifurcated into variable and fixed components.
2. Fixed costs will remain constant during the relevant volume range of graph.
3. Variable cost per unit will remain constant during the relevant volume range of graph.
4. Selling price per unit will remain constant irrespective of the quantity sold within the relevant range of the graph.
5. In the case of multi-product companies, in addition to the above four assumptions, it is assumed that the sales-mix remains constant.
6. Finally, production and sales volumes are equal.

The VCP graph may be prepared in a simple or elaborate manner. Figure 12.1 is an example of a simple and traditional form. In Figure 12.1, sales are shown on the horizontal axis; the vertical axis measures costs and revenues corresponding to varying volume of sales. Sales are expressed in terms of units, rupees and percentage level of activity. The VCP relationships portrayed in such a graph are valid only within the relevant range that underlies the construction of the graph. The importance of a relevant range should be recognised because in practice most firms will progressively reduce fixed costs as the volume tends to decrease towards zero activity. Similarly, fixed costs are to be increased beyond a certain volume. Accordingly, in Figure 12.1 the lower limit and upper limit of the VCP have been drawn.

The BEP lies at the point of intersection of the sales line and the total cost line. The vertical distance between the sales revenue and the total cost line measures the estimated net income (after the BEP) and the estimated net loss (before the BEP) at the related sales volume. The fixed cost line is parallel to the horizontal axis. The variable cost line is superimposed on the fixed cost line and moves upward uniformly with sales volume at the variable cost to volume ratio. This is the total cost line. The sales revenue line starts from the point of origin and moves upward uniformly with volume. The meeting point of the total cost line and sales line is the BEP. At this point, an angle is formed known as the angle of incidence. The management objective should be to have an angle of as large a size as possible because a high angle is a sign of a high rate of profit after the fixed costs have been covered; the narrower angle will signify that profits after the fixed costs have been covered; the narrower angle will signify that profits will increase at a lower rate after the BEP, showing that variable costs form a large part of cost of sales. Figure 12.1 is based on the following data relating to Hypothetical Ltd (Example 12.4).

EXAMPLE 12.4

Selling price per unit		Rs 10
Fixed costs		60,000
Variable costs per unit		5
Relevant range (units)	: Lower limit	6,000
	: Upper limit	20,000

(*Contd.*)

(*Contd.*)

Break-up of variable costs per unit:	
Direct material	Rs 2
Direct labour	1.50
Direct expenses	1
Selling expenses	0.50
Actual sales, 18,000 units (Rs 1,80,000)	
Plant capacity, 20,000 units (Rs 2,00,000)	
Tax rate, 50 per cent	

Figure 12.1 has been drawn by using a sales line and a total cost line (including both fixed and variable costs). The steps involved in drawing the VCP graph are enumerated as follows:

1. Select an appropriate scale for sales volume on the horizontal axis, say, 2,000 units (Rs 20,000) per square, and plot the point for total sales revenues at relevant volume: 6,000 units ×

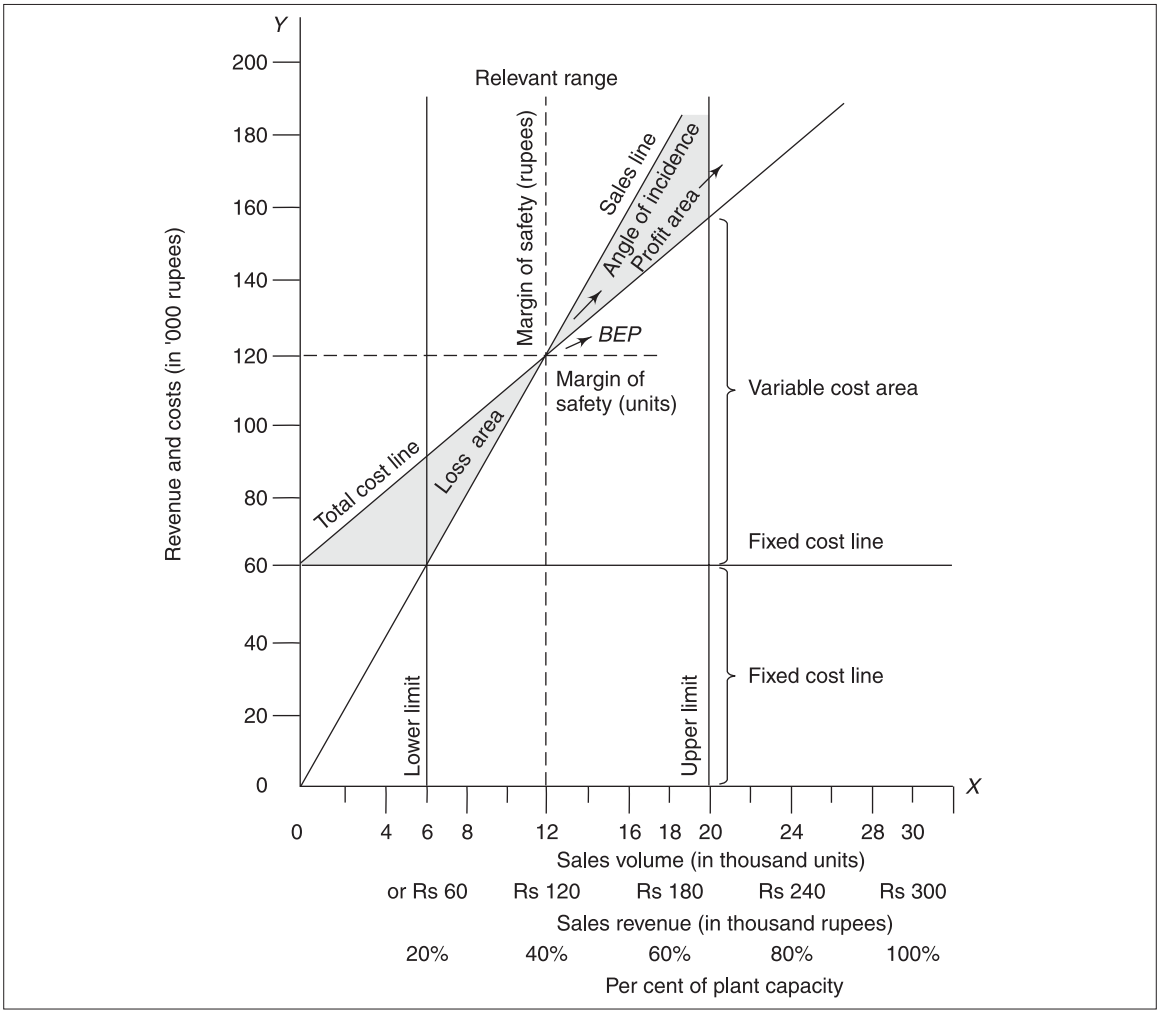

Figure 12.1 *Volume-Cost-Profit Graph (Traditional)*

Rs 10 = Rs 60,000. Draw the sales line from the origin to Rs 2,00,000 (the upper limit of the relevant range). Ensure that *all the points*, 0, Rs 60,000 and Rs 2,00,000 *fall in the same line*. This should be ensured for the total cost line also.

2. Select an appropriate scale for costs and sales revenues on the vertical axis, say, Rs 10,000 per square. Draw the line showing Rs 60,000 fixed cost parallel to the horizontal axis.
3. Determine the variable portion of costs at two volumes of scales (beginning and ending): 6,000 units × Rs 5 = Rs 30,000; 20,000 units × Rs 5 = Rs 1,00,000.
4. Variable costs are to be added to fixed costs (Rs 30,000 + Rs 60,000 = Rs 90,000). Plot the point at 6,000 units sales volume and Rs 1,00,000 + Rs 60,000 = Rs 1,60,000. Point is to be plotted at 20,000 units sales volume. This obviously is the total cost line.
5. The point of intersection of the total cost line and sales line is the BEP. To the right of BEP, there is a profit area and to the left of it, there is a loss area.
6. *Verification*: FC ÷ *CM* per unit = Rs 60,000 ÷ Rs 5 per unit = 12,000 units or Rs 1,20,000

Figure 12.1 has been drawn using different scales for the horizontal and vertical axis. Figure 12.2 has been drawn on a uniform scale for both axes. Since the scales are the same, the 45° *line will always be the proxy of the sales line*. Any amount of sales revenue on the horizontal axis will correspond to costs and revenue on the vertical axis. Let us illustrate taking two sales levels.

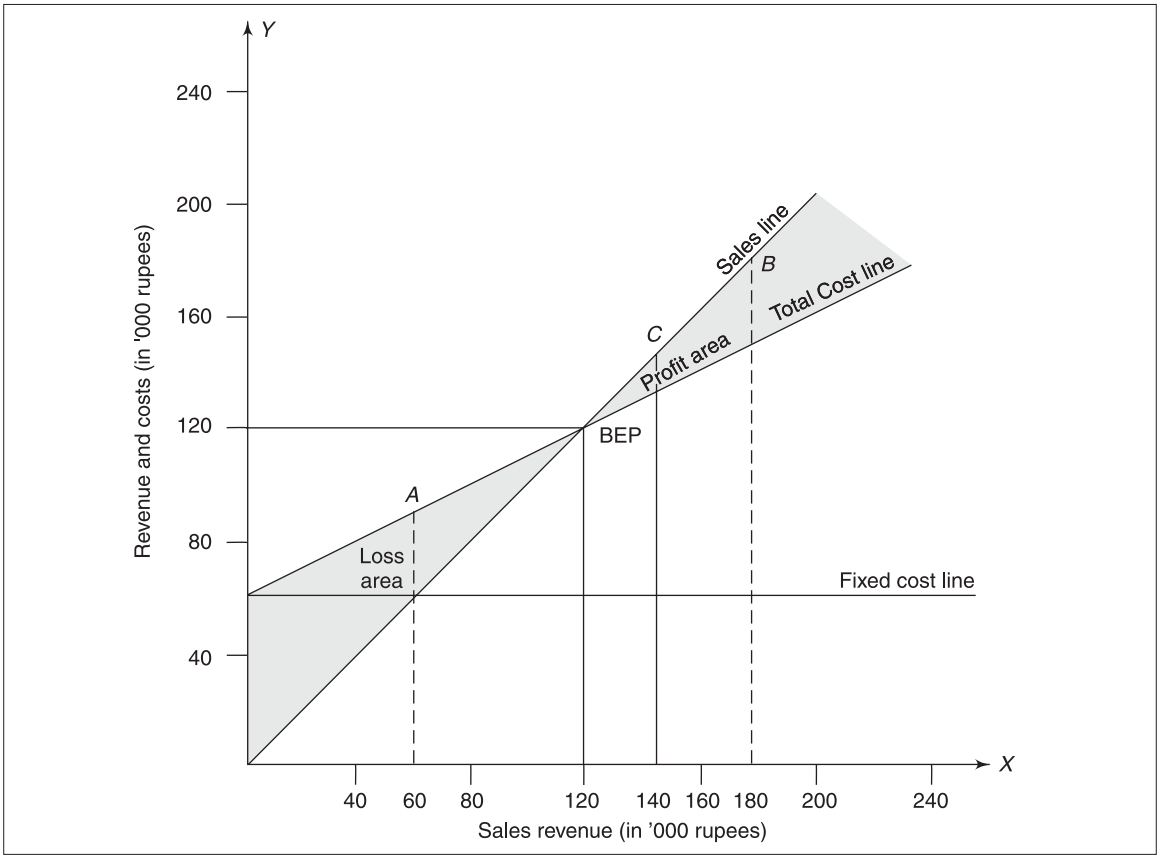

Figure 12.2 *Volume-Cost-Profit Graph, Same Scale*

1. *Rs 60,000:* FC = Rs 60,000
   VC = 30,000 (50 per cent variable cost to volume ratio)
   TC = 90,000
   Loss = 30,000 (*TC*, Rs 90,000 – Rs 30,000, sales revenue)

Thus, Rs 60,000 = Rs 60,000 + Rs 30,000 – Rs 30,000. Point A in Figure 12.2 clearly shows these three relevant figures at the sales volume of Rs 60,000.

2. *Rs 1,80,000:* FC = Rs 60,000
   VC = 90,000
   TC = 1,50,000
   Profit = 30,000

Thus, Rs 1,80,000 = Rs 60,000 (FC) + Rs 90,000 (VC) + Rs 30,000 (Profit). Point *B* in Figure 12.2 portrays these three relevant figures at the sales volume of Rs 1,80,000.

The VCP graph in Figure 12.3 is drawn with the details of the individual segment of variable cost and is more informative. The steps involved in drawing the graph include an additional step of adding variable costs to the fixed cost. This is to be repeated four times for four different components: material, labour, direct expenses and selling expenses. In fact, fixed costs can also be further split-up into parts. Such a graph provides a bird's-eye view of the entire cost structure to the management. By drawing a line perpendicular from any volume (horizontal axis), the corresponding cost and profit variables can be ascertained on the vertical axis. For instance, at 20,000 unit level, following are the various cost figures, as shown by the VCP graph (line *A*).

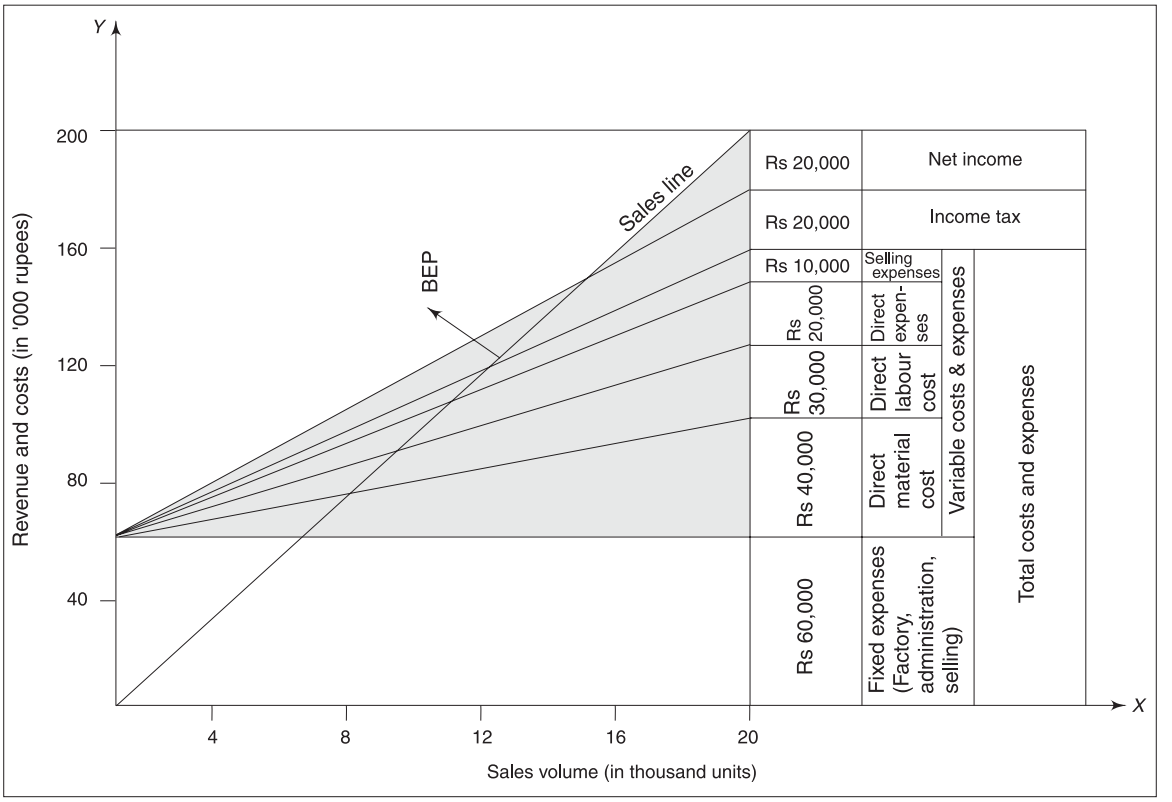

Figure 12.3 *Volume-Cost-Profit Graph, Cost-Wise*

Fixed costs	Rs 60,000
Variable costs:	
Material	40,000
Labour	30,000
Direct expenses	20,000
Selling expenses	10,000
Profit before taxes	40,000

VCP Applications Like the algebraic break-even applications, the VCP graph can also be applied to analyse the VCP relationship/profit planning. To illustrate, the company's management wants to know the sales volume, which will yield an operating profit of Rs 10,000. As explained earlier, the vertical distance between the total cost line and the total sales line represents profit (one square is Rs 10,000). At point *C*, one square distance is visible. Accordingly, from point C a perpendicular drawn to the horizontal axis gives the desired sales volume, that is, Rs 1,40,000. Likewise, answers to similar other questions are available in the VCP graph.

The Volume-Profit (V/P) Graph/Chart The volume-profit graph portrays the relationship of profit to volume. The profit-volume analysis graph, sometimes called V/P chart, supplements the VCP graphs. The usefulness of V/P graphs is that they show a direct relationship between sales volume and profits. Separate lines for costs and revenues are eliminated from the V/P chart as only profit points are plotted. In a way, therefore, they are more easy to understand the profit-volume relationship. However, both are often used together to obtain the advantages peculiar to each construction of V/P graph/chart.

Steps in the Construction of V/P Graph are

1. Select an appropriate scale for sales volume on the horizontal axis as for the VCP chart. This horizontal axis itself forms the sales line. This line should be drawn in the middle region of the graph because losses are to be represented on the side below the sales line and profits on the side above the sales line.
2. Select an appropriate scale for profit and loss (fixed cost) on the vertical axis. Total fixed costs are represented below the sales line on the left hand side of the vertical axis and profits are shown on the right hand side above the sales line.
3. Points are plotted on the V/P graph for the required fixed costs and profit at two or three assumed sales levels. Profits should be selected in such a way that one point is plotted below the sales line and the other above the sales line.
4. Like the VCP graph, the origin of the curve (profit line) would be a point of total fixed cost (showing the entire amount as loss) at zero sales level.
5. Join the point of origin with two points developed as per step 3 by a diagonal line which crosses the sales line at the BEP.

Like the VCP graph, the V/P chart does not aim at projecting only the BEP. It contains a set of points where each point measures the quantum of profit/loss in relation to the sales volume. Using the figures of Example 12.4 (except the upper limit increased to 21,000 units), the V/P graph has been drawn in Figure 12.4. The chart visualises what changes will take place in the profit and loss pattern with changes in sales revenue.

For instance, let us suppose that the management for the next year projects a sales revenue of Rs 2,10,000 (with no increase in fixed costs). The V/P chart readily shows that the amount of profit is Rs 45,000, whereas in the VCP graph, the amount is to be determined.

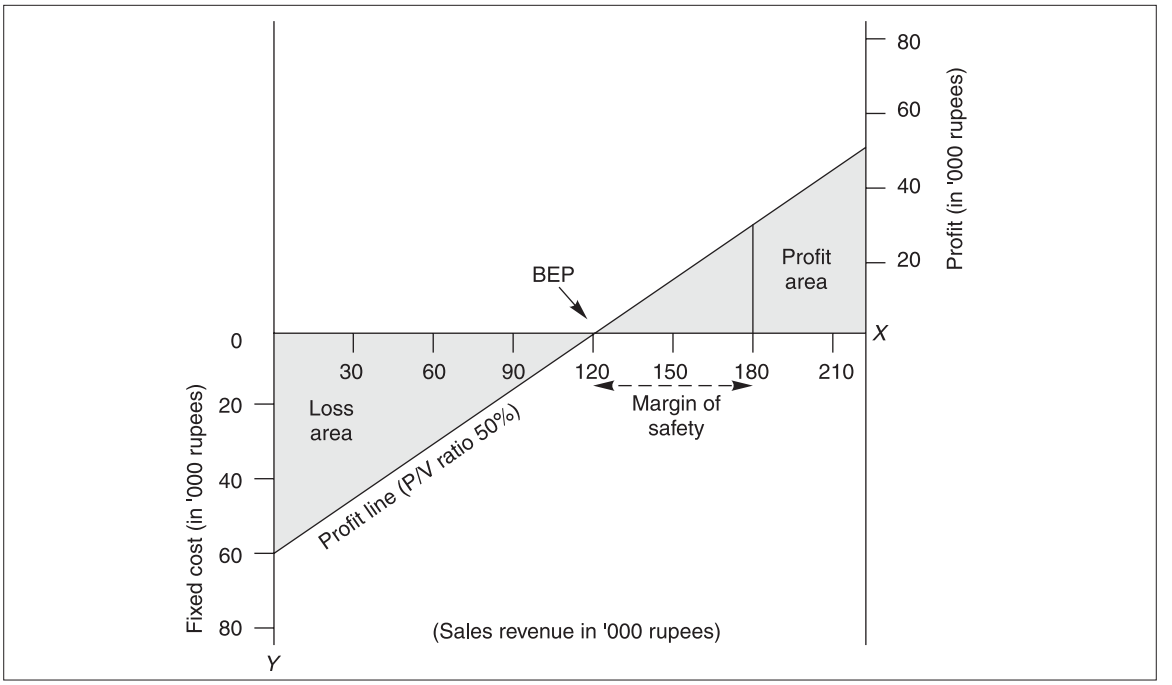

Figure 12.4 *Volume-Profit Graph*

Table 12.8 *Determination of Two Points for Figure 12.8 as per Step 3*

	Point I	*Point II*
Sales revenue	Rs 60,000	Rs 2,10,000
Less variable costs (0.50)	30,000	1,05,000
	30,000	1,05,000
Less fixed costs	60,000	60,000
Profit/(loss)	(30,000)	45,000

Changes in Fixed Costs The proposed changes in FCs do not alter the P/V ratio. But they do affect both BEP and profits. An increase in the amount of FCs decreases profits above the BEP and increases losses below BEP; while the reverse holds true when there is a decrease in the amount of FCs.

In Example 12.4, with the proposed change of Rs 10,000 (both ways) in fixed costs, the changes are summarised in Table 12.9.

Table 12.9

	Fixed costs		
	Increase (Rs 10,000)	*Original amount*	*Decrease (Rs 10,000)*
Sales revenue	Rs 1,80,000	Rs 1,80,000	Rs 1,80,000
Less variable costs	90,000	90,000	90,000
Contribution	90,000	90,000	90,000
Less fixed costs	70,000	60,000	50,000

(*Contd.*)

(*Contd.*)

Net income	20,000	30,000	40,000
Change in net income	(10,000)	N.A.	+ 10,000
BEP	1,40,000	1,20,000	1,00,000
Change in BEP	+ 20,000	N.A.	(20,000)
Margin of safety	40,000	60,000	80,000
Change in margin of safety	(20,000)	N.A.	+20,000
P/V ratio (per cent)	50	50	50

All the changes in Table 12.9 are clearly portrayed in Figure 12.5. Since the P/V ratio remains unchanged, the slope of the profit lines in Figure 12.9 remain the same. The only point of difference is that profit lines would originate at different points on the vertical axis. The procedure for determining the two points for the different profit lines is shown for Figure 12.5 in Table 12.10.

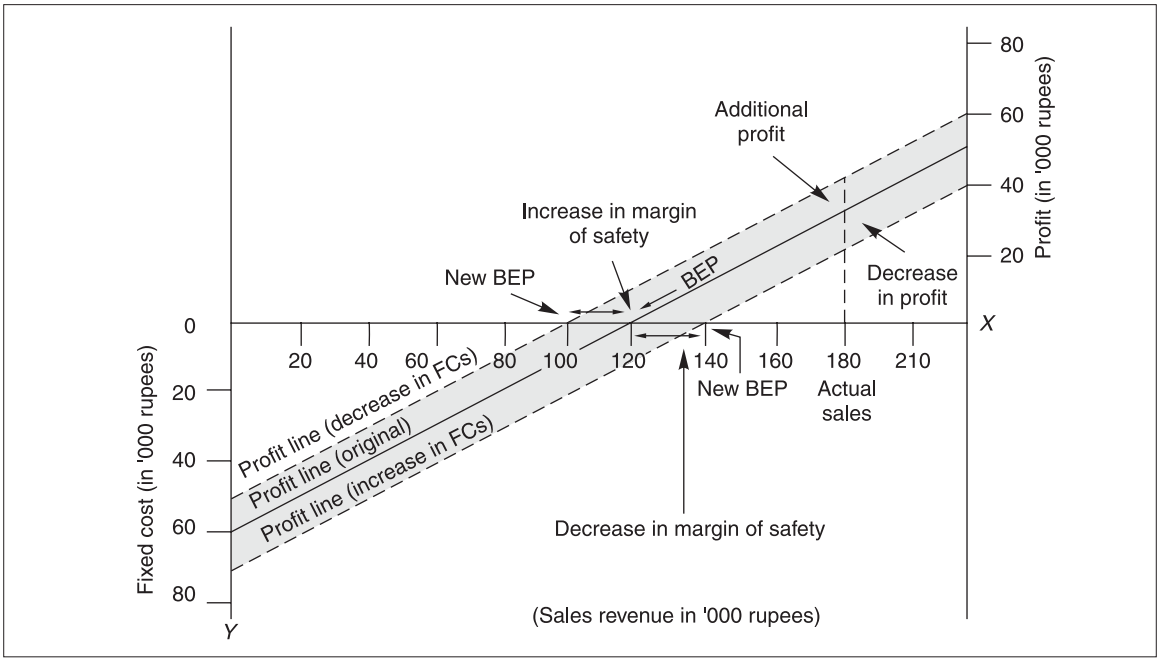

Figure 12.5 *Volume-Profit Graph, Change in Fixed Cost*

Table 12.10

	Point I			*Point II*		
Sales revenue		Rs 60,000			Rs 2,10,000	
Less variable costs		30,000			1,05,000	
Contribution		30,000			1,05,000	
Less fixed costs	(i)	50,000	(ii) Rs 70,000	(i)	50,000	(ii) Rs 70,000
Profit/(loss)	(i)	(20,000)	(ii) (40,000)	(i)	55,000	(ii) 35,000

Changes in Variable Costs The proposed changes in variable costs change the P/V ratio, the BEP and the net income at any sales volume. Figure 12.6 is based on changes in the VC of 20 per cent (both sides) for data included in Example 12.4 Table 12.11 incorporates the results due to the proposed change.

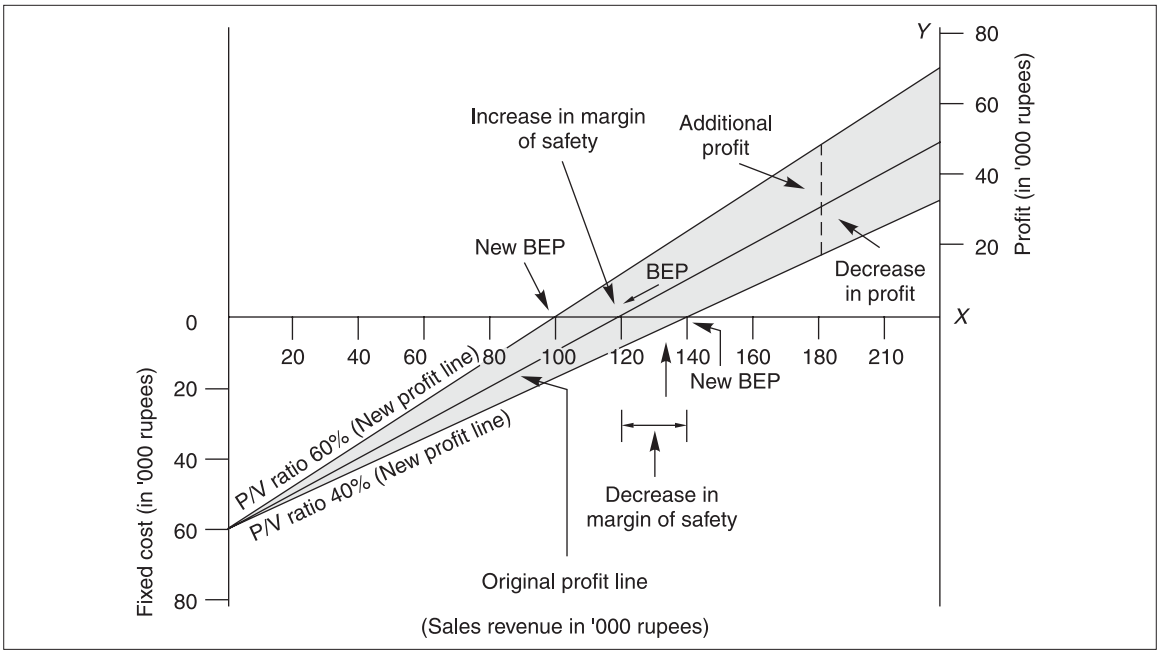

Figure 12.6 *Volume-Profit Graph, Change in Variable Cost*

Table 12.11 *Effecrt of Variable Cost on BEP and Margin of Safety*

	Variable costs		
	Increase 20 per cent *(Re 1* per unit*)*	*Original*	*Decrease 20 per cent (Re 1* per unit*)*
Sales revenues	Rs 1,80,000	Rs 1,80,000	Rs 1,80,000
Less: variable costs	1,08,000	90,000	72,000
Contribution	72,000	60,000	1,08,000
Less: fixed costs	60,000	60,000	60,000
Net income	12,000	30,000	48,000
Changes in net income	(18,000)	—	+ 18,000
BEP	1,40,000	1,20,000	1,00,000
Change in BEP	+ 20,000	—	(20,000)
Margin of safety	40,000	60,000	80,000
Change in margin of safety	(20,000)	—	+ 20,000

V/P graph, product-wise shown in Fig. 12.7, is based on data used in Example 12.5.

Changes in Selling Prices The proposed changes in selling prices affect the P/V ratio, the BEP and the net income/loss. To illustrate how well a profit-volume chart lends itself to portraying different profit lines, data used in Example 12.4 are revised so as to incorporate 25 per cent change in the price per unit from the original price and have been plotted in a V/P graph (Figure 12.8). The change pertains to both increase and decrease in the selling price.

The revised profit line lies above the original profit line in the case of increase in the selling price and lies below the original profit line when there is a decrease in the selling price per unit. The originating point of all the three profit lines remains unchanged.

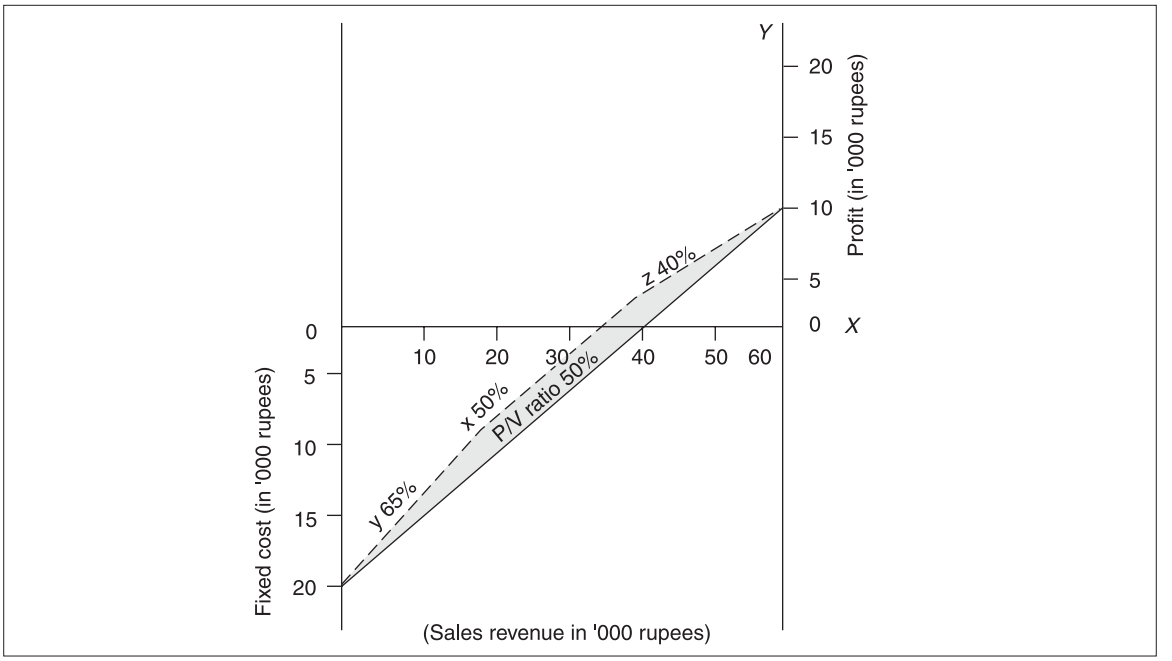

Figure 12.7 *Volume-profit Graph, Product-wise*

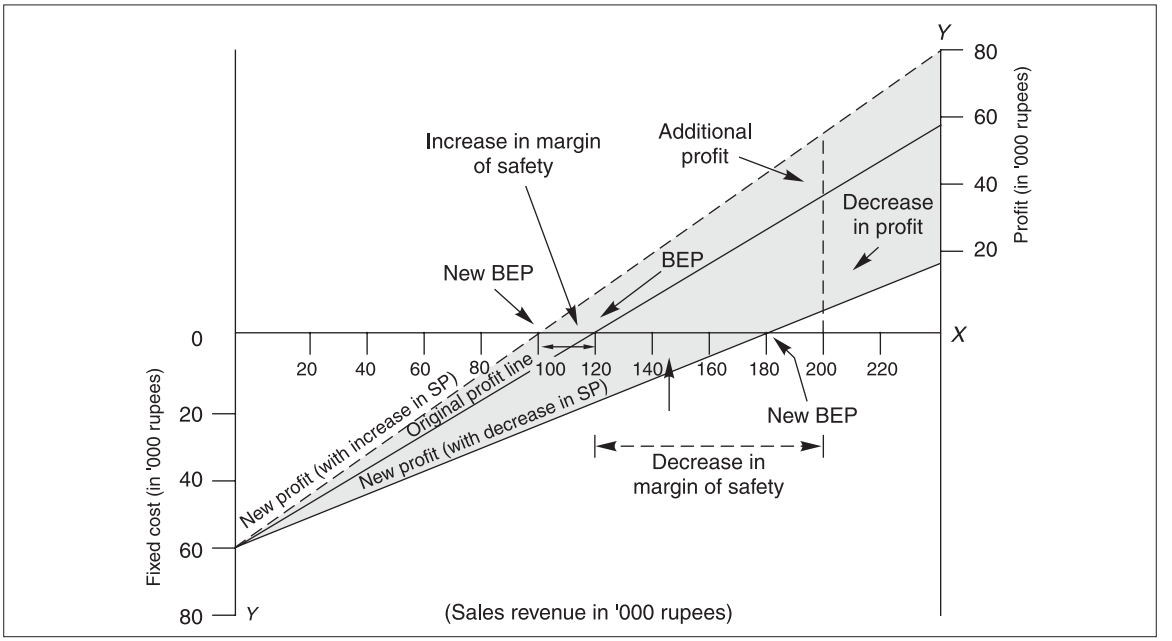

Figure 12.8 *Volume-profit Graph, Change in Selling Price*

Table 12.12 *Determination of Two Points for Each of the Two Profit Lines*

Particulars	*Point I*		*Point II*	
	VC Increase	*VC Decrease*	*VC Increase*	*VC Decrease*
Sales revenue (i) 60 per cent	Rs 60,000	Rs 60,000	Rs 2,10,000	Rs 2,10,000
Less: variable cost (ii) 40 per cent	36,000	24,000	1,26,000	84,000
Contribution	24,000	36,000	84,000	1,26,000
Less: fixed cost	60,000	60,000	80,000	60,000
Profit/(loss)	(36,000)	(24,000)	24,000	66,000

Table 12.13 contains the changes in profit due to a proposed change in the selling price. It is assumed that due to the change in price, the sales volume (units) changes in such a way that total sales revenue remains at Rs 1,80,000 (original amount).

Table 12.13 *Effect of Change in Selling Price on Profit, BEP and Margin of Safety*

Particulars	*Selling price*		
	Increase 25 per cent *(Rs 2.5 a unit)*	*Original (Rs 10 a unit)*	*Decrease 25* per cent *(Rs 2.5 a unit)*
Number of units	14,400	18,000	24,000
Unit selling price	Rs 12.5	Rs 10	Rs 7.5
Sales revenue	1,80,000	1,80,000	1,80,000
Less: variable costs (Rs 5 a unit)	72,000	90,000	1,20,000
Contribution	1,08,000	90,000	60,000
Less: fixed costs	60,000	60,000	60,000
Net profit/loss	48,000	30,000	—
Change in profit	+ 18,000	—	(– 30,000)
BEP	1,00,000	1,20,000	1,80,000
Change in BEP	(– 20,000)	—	+ 60,000
Margin of safety	80,000	60,000	—
Change in margin of safety	+ 20,000	—	(– 60,000)

The management may prepare the V/P chart showing the effect of various combinations of price increase/decrease, sales value decrease/increase and profit. There will be as many profit lines as there are profit plans. Such a chart certainly will be more fruitful to the management.

Assume a firm is dealing in a perfectly inelastic demand product. Therefore, it is assumed that sales volume in units (which was 18,000 in Example 15.4) remains unchanged. Figure 12.11 can be used to portray the changes. Table 12.15 provides the effects on profit factors which are clearly visible also on the volume-profit graph (Figure 12.11).

Table 12.14 *Determination of Two Points for Each of the Two Profit Lines*

Particulars	*Point I*		*Point II*	
	Selling price (SP)		*Selling price (SP)*	
	Increase	*Decrease*	*Increase*	*Decrease*
Sales revenues	Rs 60,000	Rs 60,000	Rs 2,10,000	Rs 2,10,000
Less: variable costs				
(i) SP increase (40 per cent)				
(Rs 5 ÷ Rs 12.5)	24,000	40,000	84,000	1,40,000

(*Contd.*)

(*Contd.*)

(iii) SP decrease (66.67 per cent) (Rs 5 ÷ Rs 7.5)				
Contribution	36,000	20,000	1,26,000	70,000
Less: fixed costs	60,000	60,000	60,000	60,000
Net profit (loss)	(24,000)	(40,000)	66,000	10,000

Table 12.15

Particulars	*Selling Price*		
	Increase 25% (Rs 2.5 a unit)	*Original (Rs10 a unit)*	*Decrease 25% (Rs 2.5 a unit)*
Number of units	18,000	18,000	18,000
Unit selling price	Rs 12.5	Rs 10	Rs 7.5
Sales revenue	2,25,000	1,80,000	1,35,000
Less: variable costs (Rs 5 a unit)	90,000	90,000	90,000
Contribution	1,35,000	90,000	45,000
Less: fixed costs	60,000	60,000	60,000
Net profit/(loss)	75,000	30,000	(15,000)
Change in profit/(loss)	45,000	N.A.	(45,000)
BEP	1,00,000	1,20,000	1,80,000
Change in BEP	(-20,000)	N.A.	+60,000
Margin of safety	1,25,000	60,000	(45,000)
Change in margin of safety	(65,000)	N.A.	(1,05,000)

However, it may be noted that changes prominently shown relate to earlier data where sales volume remains at Rs 1,80,000.

V/P Graph for Individual Products So far we have dealt with total sales and total profits for single-product firms. The virtue of the V/P graph is that it can be used to indicate the profit path of each product. It may be recalled here that the CVP chart fails to show such a relationship for individual products. The P/V chart portrays the cumulative effect of each product on the profit of the enterprise. The importance of such information is overwhelming from the point of view of the management because the management should know the figures showing not only the overall picture of P/V ratio but also the ratio for each product so that action can be taken to deal with any product(s) yielding a low P/V ratio. Low profit volume products can be replaced with more profit-yielding products.

EXAMPLE 12.5

Hypothetical Ltd company produces three products. The following are the results of one quarter.

Product	*Sales*	*Variable cost*
X	Rs 10,000	Rs 5,000
Y	20,000	7,000
Z	30,000	18,000

Fixed overheads: Rs 20,000

SOLUTION

These results can be analysed as follows (Table 12.16).

Table 12.16

Product	*Sales revenue*	*Variable cost*	*Contribution margin*	*P/V ratio(%)*
X	Rs 10,000	Rs 5,000	Rs 5,000	50
Y	20,000	7,000	13,000	65
Z	30,000	18,000	12,000	40
	60,000	30,000	30,000	50
Less: fixed costs			20,000	
Net income			10,000	
BEP = FC ÷ PV ratio = Rs 20,000 ÷ 0.50 = Rs 40,000				
Margin of safety = Rs 20,000				

Procedure for Drawing a V/P Graph (Figure 12.11)

1. Construct the P/V graph in the normal way as has been done for Figure 12.8, taking the weighted P/V ratio (Example 12.5) as 50 per cent of the profit line.
2. Arrange the given data in such a way that products are in order of descending P/V ratios. In Example 12.5, the sequence of products is Y, X and Z.
3. The profit yielding the highest P/V ratio is plotted first (product Y, 65 per cent PV ratio) and the product giving the lowest P/V ratio (product Z, P/V ratio, 40 per cent) is plotted last. The profit line for product Y begins at total fixed cost point of Rs 20,000 and is drawn to the Rs 7,000 point in the loss area directly below the sales volume of Rs 20,000.
4. The plotting shows that Rs 13,000 of the Rs 20,000 fixed costs have been recovered.

   The profit path of Product X starts at a point where Y's path ends. X's contribution is Rs 5,000 at the sales volume of Rs 10,000. It implies that out of Rs 7,000 unrecovered fixed costs (step 3), Rs 5,000 has been recovered. Therefore, the point is to be plotted at Rs 2,000 in the loss area directly below the sales volume of Rs 30,000 [Rs 20,000 (Y) + Rs 10,000 (X)].
5. The profit line for Product Z (having the lowest P/V ratio) starts at a point where the profit path for X ends. Z's contribution is Rs 12,000 and its sales volume is Rs 30,000. This indicates that not only has the uncovered fixed cost of Rs 2,000 been recovered but there is a net profit of Rs 10,000. Accordingly, its line starts in the loss area and ends in the profit area, crossing the sales line. The point is plotted at the profit figures of Rs 10,000 directly below the sales revenue of Rs 60,000 (Rs 20,000 Y + Rs 10,000 X + Rs 30,000 Z).

The plotting of the profit line for an individual product is a useful pictorial presentation from the point of view of management. If any of the products result in a loss and yields no contribution margin, its slope will be downward.

From Figure 12.11, it can be inferred that the larger the P/V ratio, the steeper is the profit path. Therefore, the management's objective should be to increase the P/V ratio, whenever it is possible to do so; where it cannot be increased, its endeavour should be to maintain it. The P/V ratio can be improved by increasing the selling price and decreasing the variable costs in the case of single-product companies. In the case of multiple-product companies, the additional factor can be the change in product-mix, as explained earlier.

Application of the P/V Ratio

1. Determination of BEP = FC ÷ P/V ratio
2. Determination of profit at given/budgeted sales volume = (Actual sales – *BE* sales) × *P/V* ratio.
3. Determination of sales volume to earn budgeted profit = (FC + *DP*) ÷ P/V ratio
4. Determination of change in sales volume to maintain the current level of profit if there is (a) a change in sales price, (b) change in variable cost = (FC + *DP*) ÷ Revised P/V ratio.

5. Determination of the percentage of net profit with the help of margin of safety ratio
= (P/V ratio × *MS* ratio) (12.25)

SUMMARY

- The cost-volume-profit (*CVP*) analysis is a tool to show the relationship between various ingredients of profit planning, namely, unit sales price (*SP*), unit variable cost (*VC*), fixed costs (*FC*), sales volume, and sales-mix (in the case of multi-product firms).
- The *CVP* analysis shows the relationship between costs and profit, and sales volume. The crucial step in this analysis is the determination of break-even point (*BEP*), which is defined as the sales level at which the total revenues equal total costs. It is the level at which losses cease and beyond which profit starts. The break-even technique has many applications for purposes of the *CVP* analysis.
- *BEP* can be determined by the following two methods; (1) *Algebraic*, comprising (a) Contribution margin approach and (b) Equation technique. (2) *Graphic presentation*, comprising (a) Break-even chart and (b) Volume-profit graph.
- In the *contribution margin approach, BEP* is computed on the basis of the relationship between the fixed costs and the contribution margin (*CM)*. The *CM* represents the difference between the sales revenue and the variable costs.
- The *equation technique* is particularly useful in situations where unit price and unit variable costs are not clearly defined. The excess of actual sales over the *BE* sales is the margin of safety. When margin of safety is divided by the actual sales, we get margin of safety ratio which indicates the percentage by which actual sales may decline without causing any loss to the firm.
- The break-even analysis is summarised below:

Contribution Margin Approach

(1) $$BEP \text{ (units)} = \frac{\text{Fixed costs } (FC)}{\text{Unit sale price } (SP) - \text{Unit variable cost } (VC)}$$

(2) $$= \frac{\text{Total fixed costs}}{\text{Unit contribution margin } (CM)}$$

(3) BEP (amount)/$BESR = BEP$ (units) × SP

(4) $$= \frac{\text{Total fixed costs}}{\text{Contribution/Profit volume ratio } (C/V \text{ or } P/V \text{ ratio})}$$

(5) $$C/V \ (P/V) \text{ ratio} = \frac{CM}{SP} \times 100$$

(6) $$= \frac{\text{Total contribution } (TC)}{\text{Total sales revenue } (TSR)} \times 100$$

(7) $$\text{Variable cost to volume } (V/V) \text{ ratio} = \frac{VC}{SP} \times 100$$

(8) $$= \frac{\text{Total variable costs } (TVC)}{TSR} \times 100$$

(9) $$= 1 - C/V \ (P/V) \text{ ratio}$$

(10) In brief, C/V (P/V) ratio + V/V ratio = 1 (100%)

(11) $$BESR \text{ (multi-product firm)} = \frac{FC}{\text{Weighted } C/V \text{ ratio}} \times 100$$

(12) $$\text{Weighted } C/V \text{ ratio} = \frac{TC \text{ from all products}}{TSR \text{ from all products}} \times 100$$

(13) $$\text{Margin of safety } (MS) = TSR - BESR$$

(14) $$MS \text{ ratio} = \frac{TSR - BESR}{TSR} \times 100$$

(15) $$\text{Profit} = MS \text{ (rupees)} \times C/V \ (P/V) \text{ ratio}$$

(16) $$= MS \text{ (units)} \times CM$$

Equation Technique

(17) $$BESR = TFC + TVC + NI \text{ (zero profit)}$$

➔ The break-even applications are summarised below:

1. (a) *Sales revenue required to earn desired operating profits (EBIT)*

$$= \frac{FC + \text{desired } EBIT}{C/V \text{ ratio}}$$

(b) *Sales revenue required to earn desired profits after taxes (EAT)*

$$= \frac{FC + (EAT/1 - \text{tax rate}, t)}{C/V \text{ ratio}}$$

2. *Operating profit at a given sales volume*

$$= (TSR - BESR) \times C/V \text{ ratio}$$

3. *Sales revenue to off-set reduction in sales price to maintain existing operating profits*

$$= \frac{FC + EBIT}{\text{Revised } C/V \text{ ratio}}$$

4. *Effect of changes in fixed costs*

(a) *The required sales revenue to maintain present operating profit*

$$= \frac{\text{Present } FC + \text{Additional } FC + \text{Present } EBIT}{C/V \text{ ratio}}$$

(b) *The required sales revenue to earn the present rate of return on investment*

Present F C + Additional FC + Present return on investment + Return on new investment

$$= \frac{\text{Present } FC + \text{Additional } FC + \text{Present return on investment} + \text{Return on new investment}}{C/V \text{ ratio}}$$

5. *Effect of changes in variable costs*

The required sales revenue to maintain existing operating profit

$$= \frac{FC + EBIT \text{ (Existing)}}{\text{Revised } C/V \text{ ratio}}$$

6. *Effect of multiple changes*

The required sales revenue to earn desired *EAT*

$$= \frac{FC + \text{Additional } FC + [\text{Desired } EAT/(1-t)]}{\text{Revised } C/V \text{ ratio}}$$

7. *Effect of change in sales-mix*
   The desired sales revenue to maintain existing *EBIT*

$$= \frac{FC + EBIT}{\text{Revised Weighted } C/V \text{ ratio}}$$

$$\text{Revised weighted C/V ratio} = \frac{\text{Total contribution at revised mix}}{\text{Total sales revenue at revised mix}} \times 100$$

- The break-even chart is a graphic presentation of the relationship between costs, profits, and sales. It shows not only the break-even sales but also the estimated costs and profit at various levels of the sales revenue. It is, therefore, also referred to as volume-cost-profit (*VCP*) graph/chart.
- The volume-profit graph shows a direct relationship between sales revenue and profits.

REFERENCES

1. Wilson, J.D., "Practical Application of Cost-Volume-Profit Analysis'' quoted by Anderson, D.L and D.L. Raun, *Information Analysis in Management Accounting* (John Wiley, New York, 1978), p 162.
2. Tuckker, *S*.A., *Break-Even System: A Tool for Profit Planning*, (Prentice Hall, Englewood Cliffs, N.J. 1963).

SOLVED PROBLEMS

P.12.1 From the following data, calculate the:
1. Break-even point expressed in terms of sale amount/revenue.
2. Number of units that must be sold to earn a profit of Rs 60,000 per year.

Sales price (per unit)	Rs 20
Variable manufacturing cost per unit	11
Variable selling cost per unit	3
Fixed factory overheads (per year)	5,40,000
Fixed selling costs (per year)	2,52,000

SOLUTION

1. BEP *(amount)* = (Fixed factory overheads + Fixed selling costs)/P/V ratio (Sales price – Variable manufacturing cost – Variable selling cost) ÷ Sales price = (Rs 5,40,000 + Rs 2,52,000)/0.30 (Rs 6 ÷ Rs 20) = Rs 26,40,000
2. *Desired sales volume (in units) to earn a profit of* Rs 60,000 = (Rs 7,92,000 + Rs 60,000)/ Rs 6 (CM per unit) = Rs 1,42,000 units

P.12.2 On investigation it was found that variable cost in *XYZ* Ltd is 80 per cent of the selling price. If the fixed expenses are Rs 10,000, calculate the break-even sales of the company.

Another firm, IMN Company Ltd, having the same amount of fixed expenses, has its break-even point at a lower figure than that of *XYZ* Ltd. Comment on the causes.

SOLUTION

BEP (amount) = Rs 10,000/ P/V ratio (100 per cent-Variable cost to volume ratio = 0.80)
= Rs 10,000/0.20 = Rs 50,000 (*XYZ* Ltd)

The lower break-even point of IMN Ltd *vis-à-vis XYZ* Ltd is due to its lower variable expenses to volume ratio, which in turn may be either due to its lower VC per unit or higher *SP* per unit, eventually yielding higher contribution margin and, hence, higher P/V ratio and lower BEP.

P.12.3 Two businesses, *AB* Ltd and *CD* Ltd, sell the same type of product in the same type of market. Their budgeted profit and loss accounts for the current year ending March 31, are as follows:

Particulars		*AB Ltd*		*CD Ltd*
Sales		Rs 150,000		Rs 1,50,000
Less: Variable costs	Rs 1,20,000		Rs 1,00,000	
Fixed costs	15,000	1,35,000	35,000	1,35,000
Net budgeted profit		15,000		15,000

You are required to:

1. Calculate the break-even points of each business; and
2. State which business is likely to earn greater profits in conditions of: (a) heavy demand for the product, (b) low demand for the product.

SOLUTION

1. BEP (amount) = Fixed cost/ P/V ratio; P/V ratio = Contribution/Sales revenuee
   BEP (AB Ltd) = Rs 15,000/0.20 = Rs 75,000
   P/V ratio = Rs 30,000/ Rs 1,50,000 = 20 per cent
   BEP (CD Ltd) = Rs 35,000/0.3333 = Rs 1,05,000
   P/V ratio = Rs 50,000/ Rs 1,50,000 = 33.33 per cent
2. Projected profit (heavy demand for the products):
   (a) CD Ltd is likely to earn larger profits in conditions of heavy demand of the product because its P/V ratio is higher than that of AB Ltd.
   (b) AB Ltd is likely to earn larger profits in condition of low demand of the product because its burden of fixed costs is much smaller than that of CD Ltd.

P.12.4 During the current year, *AB* Ltd showed a profit of Rs 1,80,000 on a sale of Rs 30,00,000. The variable expenses were Rs 21,00,000.

You are required to work out:

1. The break-even sales at present
2. The break-even sale if variable cost increase by 5 per cent
3. The break-even sale to maintain the profit as at present, if the selling price is reduced by 5 per cent.

SOLUTION

Rs 30,00,000, Sales = Rs 21,00,000, VC + FC + Rs 1,80,000, profit or FC = Rs 7,20,000

1. BEP = Rs 7,20,000/ PV ratio = Rs 7,20,000/0.30 = Rs 24,00,000
   P/V ratio = Rs 9,00,000/30,00,000 = 0.30
2. BEP (revised) = Rs 7,20,000/0.265 = Rs 27,16,981
   P/V ratio = Rs 7,95,000/ Rs 30,00,000 = 0.265
   Rs 7,95,000 Contribution = (Rs 30,00,000 – Rs 22,05,000, VC)
3. Revised P/V ratio with reduction in price

Sales revenue	Rs 28,50,000
Variable costs	21,00,000
Contribution	7,50,000

   P/V ratio (Rs 7,50,000 ÷ Rs 28,50,000) = 26.316 per cent
   Desired sales volume = Rs 9,00,000 (FC + *DP*)/0.26316 = Rs 34,19,973

P.12.5 Calculate from the following data (i) the value of output at which the business breaks even; and (ii) the percentage of capacity at which it breaks even:

Particulars	*Budget based on 100 per cent capacity*	*Shut down expenditure*
Direct wages	Rs 2,09,964	
Direct materials	2,44,552	
Works expenses	88,292	Rs 93,528
Selling and distribution expenses	21,000	40,188
Administrative expenses	9,492	20,508
Net sales	8,40,000	

SOLUTION **Determination of P/V Ratio**

(i) *Net sales*		Rs 8,40,000
Less: Variable costs:		
Direct wages	Rs 2,09,964	
Direct materials	2,44,552	
Works expenses	88,292	
Selling and distribution expenses	21,000	
Administrative expenses	9,492	5,73,300
Contribution (C)		2,66,700
P/V ratio (C ÷ Sales) (per cent)		31.75

BEP (amount) = Fixed costs (shut down expenditure)/P/V ratio = Rs 1,54,224/0.3175 = Rs 4,85,744.88
(ii) Break-even sales/Sales at 100 per cent capacity = Rs 4,85,744.88/Rs 8,40,000 = 57.83 per cent

P.12.6 The Soft-Flow Ink Ltd's income statement for the preceding year is presented below. Except as noted, the cost/revenue relationship for the coming year is expected to follow the same pattern as in the preceding year. Income statement for the year ending March 31 is as follows:

Sales (2,00,000 bottles @ Rs 2.5 paise each)		Rs 5,00,000
Variable costs	Rs 3,00,000	
Fixed costs	1,00,000	4,00,000
Pre-tax profit		1,00,000
Less: Taxes		35,000
Profit after tax		65,000

1. What is the break-even point in amount and units?
2. Suppose that a plant expansion will add Rs 50,000 to fixed costs and increase capacity by 60 per cent. How many bottles would have to be sold after the addition to break-even?
3. At what level of sales will the company be able to maintain its present pre-tax profit position even after expansion?
4. The company's management feels that it should earn at least Rs 10,000 (pre- tax per annum) on the new investment. What sales volume is required to enable the company to maintain existing profits and earn the minimum required return on new investments?
5. Suppose the plant operates at full capacity after the expansion, what profit will be earned?

SOLUTION

1. BEP (amount) = Rs 1,00,000/0.40 (Rs 2,00,000 ÷ Rs 5,00,000) = Rs 2,50,000
   BEP (units) = Rs 1,00,000/Re 1.0 = 1,00,000 units
2. BEP (increase in FC) = [Rs1,00,000 + Rs 50,000 (Additional FC)] ÷ Re 1.0 per unit = 1,50,000 units
3. Desired sales volume to maintain a pre- tax profit of Rs 1,00,000 = [Rs1,50,000 (FC) + Rs 1,00,000] ÷ 0.40 = Rs 6,25,000 (or 2,50,000 units)

4. Desired sales volume to earn a profit of Rs 1,10,000 (Rs 1,00,000 + Rs 10,000) = [Rs 1,50,000 + Rs 1,10,000]/0.40 = Rs 6,50,000 (or 2,60,000 units)
5. Present capacity (assumed operating at 100 per cent capacity) (bottles) 2,00,000
   Add: Additional capacity (60 per cent) 1,20,000
   Total capacity (bottles) 3,20,000

Statement of Income (32,00,000 units)

Sales (3,20,000 bottles @ Rs 2.5)	Rs 8,00,000
Less: Variable costs, 0.60 × (Rs 3,00,000 + Rs 5,00,000)	4,80,000
Contribution	3,20,000
Less: Fixed costs	1,50,000
Pre-tax profits	1,70,000
Less: Income tax	59,500
Profits after income tax	1,10,500

P.12.7 The following data are obtained from the records of a factory:

Sales (4,000 units @ Rs 25 each)		Rs 1,00,000
Variable costs:		
Materials consumed	Rs 40,000	
Labour charges	20,000	
Variable overheads	10,000	
Fixed overheads	18,000	88,000
Net profit		12,000

Calculate:

1. Number of units by selling which the company will break-even.
2. Sales needed to earn a profit of 20 per cent on sales.
3. Extra units, which should be sold to obtain the present profit if it is proposed to reduce the selling price by 20 per cent and 25 per cent.
4. Selling price to be fixed to bring down its break-even point to 600 units under present conditions.

SOLUTION

1. BEP (units), Fixed overheads = Rs 18,000/CM per unit, Rs 7.50 = 2,400 units

Determination of CM per Unit

Sales revenue (4,000 units)		Rs 1,00,000
Less: Variable costs		
Materials consumed	Rs 40,000	
Labour charges	20,000	
Variable overheads	10,000	70,000
Contribution (4,000 units)		30,000
CM per unit (Rs 30,000 ÷ 4,000)		7.5

2. (a) Sales revenue (SR) is a sum of total costs (TC) and total profits (TP) or (SR = TC + TP).
   (b) TC can be split into FC and VC.
   (c) VC will vary in direct proportion to SR.
   (d) Accordingly, SR = FC + VC (SR) + TP (SR). Let us suppose, SR = 100 per cent; TC = 80 per cent; TP = 20 per cent; VC = 70 per cent (Rs 70,000/Rs 1,00,000); FC = Rs 18,000

Substituting the values, we have,

100% SR = Rs 18,000 + 0.70 SR + 0.20 SR

0.10 SR = Rs 18,000

SR = Rs 18,000/0.10 = Rs 1,80,000

Verification

Sales revenue		Rs 1,80,000
Less: Variable cost (0.70)	Rs 1,26,000	
Less: Fixed overheads	18,000	1,44,000
Net profit		36,000
Net profit as percentage of sales revenue		20

3. Revised Contribution Margin per unit and Additional Units Required to maintain Profit of Rs 12,000

Particulars	*Selling price reduced by*	
	20 per cent	*25 per cent*
Revised selling price	Rs 20.00	Rs 18.75
Less: Variable cost (0.70 × Rs 25, original sales price)	17.50	17.50
Contribution	2.50	1.25
Desired sales volume (FC + NP) ÷ CM	30,000/2.50	30,000/1.25
Number of units required	12,000	24,000
Less: Existing number of units sold	4,000	4,000
Extra units to be sold to maintain a profit of Rs 12,000	8,000	20,000

4. BEP = FC/CM per unit
CM per unit = FC/BEP = Rs 18,000/600 units = Rs 30
Sales price (per unit) = CM per unit + Variable cost per unit = Rs 30 + Rs 17.50 = Rs 47.5

P.12.8 Calculate the break-even sales from the following data for a company producing three products:

Product	*Sales*	*Variable costs*
A	Rs 10,000	Rs 6,000
B	5,000	2,500
C	5,000	2,000
	20,000	10,500

Total fixed costs amount to Rs 5,700.

SOLUTION

Determination of Weighted P/V Ratio

Product	*Sales*	*Variable costs*	*Contribution*
A	Rs 10,000	Rs 6,000	4,000
B	5,000	2,500	2,500
C	5,000	2,000	3,000
	20,000	10,500	9,500

Weighted P/V ratio = (Total contribution/Total sales) × 100 = (Rs 9,500/ Rs 20,000) × 100 = 47.5 per cent
BEP = FC/Weighted P/V ratio = Rs 5,700/0.475 = Rs 12,000

P.12.9 *ABC* Ltd manufactures and sells four types of products under the brand names of *A*, *B*, *C* and *D*. The sales-mix in value comprises 33.33, 41.67, 16.67 and 8.33 per cents for products *A*, *B*, *C* and *D* respectively. The total budgeted sales (100 per cent) are Rs 60,000 per month. Operating costs are:
Variable costs as per cent of selling price: Product *A*, 60, *B*, 68, *C*, 80, and *D* 40. Fixed costs, Rs 14,700 per month.
Calculate the break-even point for the products on an over-all basis.

SOLUTION

Determination of Weighted PV Ratio

Product	*Sales revenue*	*(%)*	*Variable costs*	*(%)*	*Contribution*	*P/V ratio (%)*
A	Rs 20,000	(33.33)	Rs 12,000	(60)	Rs 8,000	40
B	25,000	(41.67)	17,000	(68)	8,000	32
C	10,000	(16.67)	8,000	(80)	2,000	20
D	5,000	(8.33)	2,000	(40)	3,000	60
Total	60,000	(100)	39,000	(65)	21,000	35

BEP = Fixed costs/ Weighted P/V ratio = Rs 14,700/0.35 = Rs 42,000

Confirmation

Variable costs (0.65 × Rs 42,000)	Rs 27,300
Fixed costs	14,700
Total costs	42,000
Total sales revenue	42,000

P.12.10 There are two similar plants under the same management. The management desires to merge these two plants. The following particulars are available:

	Factory I	*Factory II*
Capacity (%)	100	60
Sales (Rs lakh)	300	120
Variable costs	220	90
Fixed costs	40	20

You are required to calculate: (a) What the break- even capacity of the merged plant would be, and (b) What the profitability on working at 75 per cent of the merged capacity would be?

SOLUTION

(a) Break-even Capacity

	Factory I (at 100% capacity)	*Factory II (at 100% capacity)*	*Combined (at 100% capacity)*
Sales (Rs lakh)	300	200	500
Less: Variable costs	220	150	370
Contribution	80	50	130

Break-even (amount) = Fixed costs/Combined P/V ratio = Rs 60 lakhs/0.26 = Rs 230.769 lakh
0.26 = (Rs 130 lakh/Rs 500 lakh) × 100
Break-even point (per cent capacity) = (Break-even sales/Total capacity) × 100
= (Rs 230.8 lakh/ Rs 500 lakh) × 100 = 46.15 per cent. The break-even capacity of the merged plant would be approximately 46.15 per cent.

(b) Income Statement at 75 per cent Merged Capacity

Sales (Rs lakh)	375.00
Less: Variable costs (0.74 × *V/V* ratio)	277.50
Contribution	97.50
Less: Fixed costs	60.00
Net profit	37.50

Alternatively, (Actual sales – BE sales) × P/V ratio = (Rs 375 lakh – Rs 230.769 lakh) × 0.26 = Rs 37.50 lakh

P.12.11 The *XYZ* Ltd operates a chain of shoe stores. The stores sell 10 different styles of men's shoes with identical purchase costs and selling prices. The company is trying to determine the desirability of opening another store, which would have the following expense and revenue relationships per pair.

Variable data:	
Selling price	Rs 30.00
Cost of shoes	19.50
Salesmen's commission	1.50
Total variable expenses	21.00
Annual fixed expenses:	
Rent	60,000
Salaries	2,00,000
Advertising	80,000
Other fixed expenses	20,000
	3,60,000

Required (consider each question independently):

1. What is the annual break-even point in sales amount and in unit sales?
2. If 35,000 pairs of shoes are sold, what would the store's net income be?
3. If the store manager was paid Rs 0.30 per pair commission, what would the annual break-even point be in sales amount and in unit sales?
4. Refer to the original data. If the store manager were paid Rs 0.30 per pair as commission on each pair sold in excess of the break-even point, what would be the store's net income if 50,000 pairs were sold?
5. Refer to the original data. If sales commissions were discontinued in favour of Rs 81,000 increase in fixed salaries, what would the annual break-even point be in amount and in unit sales?
6. If the manager wants to compute separate break-even points for gents' and ladies' shoes, what additional assumption will you make and what information would you need?
7. If the store wants to build up stocks by the end of the accounting period, will your analysis still hold good?

SOLUTION

1. Selling price — Rs 30
   Less: Variable costs — 21
   CM per unit (pair) — 9
   P/V ratio (%) — 30
   BEP (amount) = Rs 3,60,000/0.30 = Rs 12,00,000
   BEP (units) = Rs 3,60,000/ CM per unit = Rs 3,60,000/Rs 9 = Rs 40,000 units
2. Income if 35,000 pairs of shoes are sold

Contribution (35,000 × Rs 9)	Rs 3,15,000
Less: Fixed cost	3,60,000
Loss	(45,000)

3. Contribution is Rs 8.70 (*less* by 30 paise commission paid to store manager): (Rs 30 – Rs 21.30)
   BEP (units) = Rs 3,60,000/Rs 8.70 = 41,380 pairs
   BEP (amount) = Rs 3,60,000/0.29 = Rs 12,41,379.30
   P/V ratio = Rs 8.70 ÷ Rs 30 = 29 per cent
4. CM per unit beyond the BEP × Margin of safety in units = Income
   Rs 8.70 × 10,000 (50,000 – 40,000) = Rs 87,000
5. Revised CM and P/V ratio

Sales price	Rs 30.00
Cost of shoes	19.50
CM	10.50
P/V ratio (%)	35

Fixed costs = Rs 3,60,000 + Rs 81,000 = Rs 4,41,000
BEP (in units) = Rs 4,41,000/Rs 10.50 = 42,000 units
BEP (amount) = Rs 4,41,000/0.35 = Rs 12,60,000
Alternatively, 42,000 × Rs 30 = Rs 12,60,000

6. Additional information required:
(i) Separate data of fixed cost for the two types of shoes.
(ii) Selling price as well as variable cost per pair of shoes both for gents and ladies are the same (assumption).

7. No, the analysis will not hold true because in the volume-cost-profit relationship, it is assumed that production is equal to sales in the manufacturing firms or purchases are equal to sales in the case of trading firms.

P.12.12 Market Well Ltd manufactures filing cabinets. For the current year, the company expects to sell 4,000 cabinets involving a loss of Rs 2,00,000. Only 40 per cent of the plant's normal capacity is being utilised during the current year. The fixed costs for the year are Rs 10,00,000 and fully variable costs are 60 per cent of sales value.

You are required to

1. Calculate the break-even point;
2. Calculate the profit if the company operates at 70 per cent of its normal capacity;
3. Calculate the sales required to achieve a profit of Rs 60,00,000;
4. Calculate the revised break-even point if the existing selling prices are decreased by 10 per cent, the total fixed and variable expenses remaining the same.

SOLUTION

1. BEP (amount) = FC/ PV ratio = Rs 10,00,000/0.40 = Rs 25,00,000

2. Determination of the Existing Sales Volume and Sales Price per Cabinet

Sales revenue	*X*
Less: Variable cost (0.60)	0.6 *X*
Contribution	(*X* – 0.6X)
Less: Fixed costs	Rs 10,00,000
Loss (given)	2,00,000

0.4 *X* – Rs 10,00,000 = (– Rs 2,00,000)
0.4 *X* = Rs 8,00,000
X = 20,00,000 (sales revenue)
Sales price per cabinet = Rs 20,00,000/4,000 cabinets = Rs 500
Number of cabinets sold at 70 per cent capacity = 7,000 = (4,000 × 70/40)

Projected Income Statement at 70 per cent Capacity

Sales revenue (7,000 × Rs 500)	Rs 35,00,000
Less: Variable cost (0.60)	21,00,000
Contribution	14,00,000
Less: Fixed costs	10,00,000
Profit	4,00,000

Alternatively, (Expected sales revenue – Break-even sales revenue) × P/V ratio or (Margin of safety) × P/V ratio = (Rs 35,00,000 – Rs 25,00,000) × 0.40 = Rs 4,00,000

3. Desired sales volume to earn a profit of Rs 60,00,000 = (FC + Rs 60,00,000)/0.40 = (Rs 10,00,000 + Rs 60,00,000)/0.40 = Rs 1,75,00,000

4. Break-even Point (Revised) at Reduced Selling Price by 10 per cent

Sales price	Rs 450
Less: Variable cost (0.60 × Rs 500)	300
CM	150
P/V ratio (Rs 150/Rs 450) (%)	33.33
BEP Rs (10,00,000/0.3333)	30,00,000

P.12.13 The question as to which products to stress in order to obtain the most profitable sales-mix has always been of prime importance to businessmen. The amount of profit contribution, or the difference between the selling price and the variable costs, tells how much each product is contributing to fixed costs and profit in the present sales-mix. This information assists management in forming an opinion as to which products will add to profits if sales of these units can be increased.

Direct cost data can be utilised in this type of analysis when management seeks an answer to the question: "Which product shall we push"?

Data	*Product A*	*Product B*
Selling price	Rs 12.60	Rs 5.50
Variable cost	9.62	4.18
Fixed costs	2.07	0.65
Units per hour	45	0.70

1. What is the amount of net profit for each product?
2. What is the percentage of profit to selling price for each product?
3. What is the amount of profit contribution towards fixed cost and the profit for each product?
4. What is the profit contribution ratio?
5. What is the profit contribution per hour for each product?
6. If one allocates: (a) 200 hours to Product *A* and 100 hours to Product *B* or (b) 100 hours to Product *A* and 200 hours to Product B, which of the two courses is more profitable?

SOLUTION

1. Net Profit for Products *A* and *B*

Particulars	*A*	*B*
Selling price	Rs 12.60	Rs 5.50
Less: Costs:		
Variable	9.62	4.18
Fixed	2.07	0.65
Net profit	0.91	0.67

2. Percentage of profit to selling price = (Net profit × 100) ÷ Selling price	7.22	12.18
3. Profit contribution (Selling price-Variable costs)	2.98	1.32
4. P/V ratio (%)	23.65	24
5. (Profit contribution per unit × Units produced per hour)		
Product *A* : Rs 2.98 × 45	134.10	
B : Rs 1.32 × 70		92.40

6. Statement of Profit

Particulars	*Alternative (a)*	*Alternative (b)*
Product A (Profit contribution per hour	Rs 134.10	Rs 134.10
× Hours)	× 200	× 100
	(a) 26,820	(a) 13,410
Product B (Profit contribution per hour	92.40	92.40
× Hours)	× 100	× 200
	(b) 9,240	(b) 18,480
Total profit [(a) + (b)]	36,060	31,890

Alternative (a) of allocating 200 hours to Product *A* and 100 hours to Product *B* is the more profitable course as it yields higher profits.

P.12.14 A.T. Ltd operating at 80 per cent level of activity furnishes the following information:

Particulars	*Products*		
	A	*B*	*C*
Selling price/units	Rs 10	Rs 12	Rs 20
Profit as percentage on selling price	25	33.33	20
Units produced and sold	10,000	15,000	5,000
Fixed costs	40,000	45,000	25,000

During the year, the variable costs are expected to increase by 10 per cent. There will, however, be no change in fixed costs, the selling prices and the units to be produced and sold. The sales potential for each of the products is unlimited.

(i) You are required to prepare a statement showing the P/V ratio, break-even point and margin of safety for each product and for the company as a whole.

(ii) The company intends to increase the production of only one of the three products to reach the full capacity level by utilising the spare capacity available. Assuming that all the three products take the same machine time, advise with reasons, which of the three products should be produced so that the overall profitability is the maximum.

SOLUTION

(i) Statement showing BEP, Margin of Safety and P/V Ratio of A.T. Ltd for Year 1 and 2

Particulars	*Year 1*				*Year 2*			
	A	*B*	*C*	*All combined*	*A*	*B*	*C*	*All combined*
Units produced and sold	10,000	15,000	5,000	30,000	10,000	15,000	5,000	30,000
Selling price per unit	Rs 10	Rs 12	Rs 20	Rs 12.666	Rs 10	Rs 12	Rs 20	Rs 12.666
Sales revenue	1,00,000	1,80,000	1,00,000	3,80,000	1,00,000	1,80,000	1,00,000	3,80,000
Less: Variable costs (see working notes)	35,000	75,000	55,000	1,65,000	38,500	82,500	60,500	1,81,500
Contribution	65,000	1,05,000	45,000	2,15,000	61,500	97,500	39,500	1,98,500
Less: Fixed costs	40,000	45,000	25,000	1,10,000	40,000	45,000	25,000	1,10,000
Operating profit	25,000	60,000	20,000	1,05,000	21,500	52,500	14,500	88,500
P/V ratio (%)	65	58.33	45	56.58	61.5	54.17	39.5	52.24
BEP				1,94,419				2,10,580
Margin of safety				1,85,581				1,69,420

WORKING NOTES

A Rs 1,00,000 = 40,000 FC + Rs 25,000 profit (0.25 × Rs 1,00,000) + VC, that is, Rs 35,000.

B Rs 1,80,000 = 45,000 FC + Rs 60,000 profit (0.3333 × Rs 1,80,000) + VC, that is, Rs 75,000.

C Rs 1,00,000 = 25,000 FC + Rs 20,000 profit (0.20 × Rs 1,00,000) + VC, that is, Rs 55,000.

(ii) Product *C* should be produced to utilise the *SP* are capacity of 20 per cent as its marginal contribution per unit is maximum as shown below:

Particulars	*A*	*B*	*C*
Sales price	Rs 10	Rs 12	Rs 20
Less: Variable cost per unit	3.5	5.0	11
CM	6.5	7.0	9.0

P.12.15 Hansa Ltd manufacturing a single product is facing severe competition in selling it at Rs 50 per unit. The company is operating at 60 per cent level of activity at which level sales are Rs 12,00,000; variable costs are Rs 30 per unit; semi-variable costs may be considerd fixed at Rs 90,000 when output is nil and the variable element is Rs 250 for each additional 1 per cent level of activity; fixed costs are Rs 1,50,000 at the present level of activity, but if a level of activity of 80 per cent or above is reached, these costs are expected to increase by Rs 50,000.

To cope with the competition, the management of the company is considering a proposal to reduce the selling price by 5 per cent. You are required to prepare a statement showing the operating profit at levels of activity of 60 per cent, 70 per cent and 82 per cent, assuming that:

1. The selling price remains at Rs 50; and
2. The selling price is reduced by 5 per cent.

Show also the number of units, which will be required to be sold to maintain the present profits if the company decides to reduce the selling price of the product 5 by per cent.

SOLUTION

Statement Showing Operating Profit (Flexible Budgets)

Particulars	*Percentage of capacity*					
	60		*70*		*82*	
	Old selling price	*New selling price*	*Old selling price*	*New selling price*	*Old selling price*	*New selling price*
Units	24,000	24,000	28,000	28,000	32,800	32,800
Sales price	Rs 50	Rs 47.50	Rs 50	Rs 47.50	Rs 50	Rs 47.50
Sales revenue	12,00,000	11,40,000	14,00,000	13,30,000	16,40,000	15,58,000
Less: Costs:						
Variable costs	7,20,000	7,20,000	8,40,000	8,40,000	9,84,000	9,84,000
Semi-variable costs	1,05,000	1,05,000	1,07,500	1,07,500	1,10,500	1,10,500
Fixed costs	1,50,000	1,50,000	1,50,000	1,50,000	2,00,000	2,00,000
Total costs	9,75,000	9,75,000	10,97,500	10,97,500	12,94,500	12,94,500
Operating profit	2,25,000	1,65,000	3,02,500	2,32,500	3,45,500	2,63,500

Sales volume required to maintain present level of profit: (Fixed costs + Profit)/CM per unit = (Rs 1,50,000 + 90,000 + 2,25,000)/Rs 16.875 = 27,556 units

WORKING NOTE

Selling price		Rs 47.50
Less: Variable cost	Rs 30.00	
Semi variable cost (variable element)	0.625	30.625
CM per unit		16.875

P.12.16 From the cost records of a company for a specific period, for product X, the information given in the first column can be ignored since it is only one of the several projections of an assistant accountant, but it may be useful to you.

	This period actual	*One of the future projections*
Sales (units)	10,000	20,000
Profit (loss)	Rs (10,000)	Rs 10,000
Fixed costs	30,000	30,000
Variable cost per unit	8	8

On the basis of the first column, determine

1. What increased sales volume is required to cover an additional attractive packaging cost of Rs 0.50 per unit, to increase the sales, at the existing sales price, to yield zero profit?
2. What increased sales volume in required at the present sale price, to cover an additional publicity expense of Rs 5,000 for that period, while yielding a profit of Rs 5,000.
3. What increased sale volume is required to reach a profit of Rs 4,000 while reducing the selling price by 3 per cent per unit?

SOLUTION

1. *Sales volume required to yield zero profit*: = Fixed costs/ CM per unit = Rs 30,000/Rs 1.50 = 20,000 units
   Sales volume required = 20,000 units (Rs 2,00,000)
   Existing sales volume = 10,000 units (Rs 1,00,000)
   Difference represents increase in sales volume required to make zero profit = 10,000 units (Rs 1,00,000)
2. *Assuming situation (2) independent of (1)*: Sales volume required to earn a profit of Rs 5,000 = [Rs 30,000 + Rs 5,000 (publicity expenses) + Rs 5,000 (profit)]/Rs 2 = 20,000 units (Rs 2,00,000); 10,000 units (Rs 1,00,000) is the increased sales volume required.
3. *Assuming (3) to be independent of situations (1) and (2)*: Desired sales volume to earn a profit of Rs 4,000 = (Rs 30,000 + Rs 4,000)/ (Rs 9.70 – 8) = 20,000 units (or Rs 1,94,000). Increased sales volume required is 10,000 units.

WORKING NOTE

Determination of total sales revenue and selling price per unit:
Total sales revenue = Total costs – Loss
Total costs = FC + (VC per unit × Sales in units)
Rs 80,000 = Rs 30,000 + (Rs 8 × 10,000)
Total sales revenue = Rs 1,10,000 – Rs 10,000 = Rs 1,00,000
SP per unit = Rs 1,00,000/10,000 = Rs 10

P.12.17 The ABC Ltd operates a restaurant an recreational facilities. The manager of the complex having 100 rooms, has asked your assistance in planning the coming year's operations. He is particularly concerned about the level of profits the firm is likely to earn.

Your conversation with the manager shows that he expects occupancy to be 70 per cent during the 200-day season that it is open. All rooms would be rented for Rs 100 per day for any number of persons. On an average, two persons occupy a room. This is the past experience, which the manager believes is an accurate guide to the future. He further informs you that each person staying in the hotel spends Rs 25 per day in the shops (also owned by the company) and Rs 50 in the restaurant. There are no charges for the use of recreational facilities.

Cost data are:

	Variable cost to volume ratio	
	Shop	*Restaurant*
Cost of goods sold	50	25
Supplies	5	15
Others	5	10

For the hotel, the variable costs are Rs 20 per day per occupied room, for cleaning, laundry, and utilities. Total fixed costs for the complex are Rs 10,00,000 per year.

You are required to do the following:

1. Prepare an income statement for the coming year based on the information given.
2. The manager believes that if room rent were reduced to Rs 80 per day, the occupancy would increase to 90 per cent. Will you endorse his suggestion of reducing the rent rates?

SOLUTION

1. *Income Statement*

Sales revenues:		
Hotel rooms (100 × 200 × 0.70 × Rs 100)	Rs 14,00,000	
Shops (100 × 200 × 0.70 × 2 × Rs 25)	7,00,000	
Restaurant (100 × 200 × 0.70 × 2 × Rs 50)	14,00,000	
		Rs 35,00,000

(*Contd.*)

(*Contd.*)

Less: variable costs		
Hotel rooms (100 × 200 × 0.70 × Rs 100)	2,80,000	
Shops (Rs 7,00,000 × 0.60, that is, 0.50 + 0.10)	4,20,000	
Restaurant (Rs 14,00,000 × 0.50 that is, 0.25+ 0.15+ 0.10)	7,00,000	14,00,000
Contribution		21,00,000
Less: fixed costs		10,00,000
Profit		11,00,000

2. *Income Statement (If Room Rents are Reduced)*

Sales revenue		
Hotel room (100 × 200 × 0.90 × Rs 80)	Rs 14,40,000	
Shops (100 × 200 × 0.90 × 2 × Rs 25)	9,00,000	
Restaurant (100 × 200 × 0.90 × 2 × Rs 50)	18,00,000	Rs 41,40,000
Less: variable costs		
Hotel rooms (100 × 200 × 0.90 × Rs 20)	3,60,000	
Shops (Rs 9,00,000 × 0.60)	5,40,000	
Restaurant (Rs 18,00,000 × 0.50)	9,00,000	18,00,000
Contribution		23,40,000
Less: fixed costs		10,00,000
Profit		13,40,000

Yes, we endorse the manager's suggestion to reduce the room rent.

REVIEW QUESTIONS

RQ.12.1 Define break-even analysis and outline its uses and applications.

RQ.12.2 (a) Discus the importance of the following in relation to break-even analysis:

(1) Break-even point
(2) Margin of safety
(3) Contribution
(4) Profit volume ratio.

(b) Write a short note on the angle of incidence in a break-even chart.

RQ.12.3 Explain the significance and objective of a break-even chart and state the factors which would cause the break-even point to change.

RQ.12.4 "The effect of a price increase is always to increase the P/V ratio, to bring down the break-even point and to widen the margin of safety." Discuss.

RQ.12.5 The "volume-cost-profit relationships provide management with a simplified framework for organising its thinking on a number of problems." Discuss.

RQ.12.6 Explain the limitations of a break-even analysis.

RQ.12.7 Asian Industries Ltd specialises in the manufacture of small capacity motors. The cost structure of a motor is as under: Material, Rs 50; Labour, Rs 80; Variable overheads, 75 per cent of labour cost. Fixed overheads of the company amount to Rs 2.40 lakh per annum. The sale price of the motor is Rs 230 each.

(a) Determine the number of motors that have to be manufactured and sold in a year in order to break-even.
(b) How many motors have to be made and sold to make a profit of Rs 1 lakh per year?
(c) If the sale price is reduced by Rs 15 each, how many motors have to be sold to break-even?

SOLUTION

(a)	Selling price of motor		Rs 230
	Less variable costs		
	Material	Rs 50	
	Labour	80	
	Variable overheads (0.75 × Rs 80)	60	190
	Contribution margin per motor		40
	BEP (motors) = Rs 2,40,000 ÷ Rs 40		6,000
(b)	Desired sales volume (units) to have a profit of Rs 1,00,000 = (Rs 2,40,000 + Rs 1,00,000) ÷ Rs 40 = 8,500 motors		
(c)	Revised selling price (Rs 230 – Rs 15)		Rs 215
	Less total variable costs		190
	Contribution margin per motor		25
	BEP (motors) = Rs 2,40,000 ÷ Rs 25		9,600

RQ.12.8 You are given the following information:

Output and sales (10,000 units)	Rs 2,00,000
Variable costs per unit	12
Fixed cost	40,000

It is proposed to reduce the selling price by 10 per cent.

(a) Calculate present and future profit–volume ratio.

(b) Calculate preset and future break–even points and

(c) Compute the sales volume to maintain the profit at the present level.

SOLUTION

(i) *Statement Showing P/V Ratio, BEP, BESR and Present Level of Profit*

Particulars	*Amount*
Selling price per unit (Rs 2,00,000/10,000 units sold)	Rs 20
Less variable cost per unit	12
Contribution per unit	8
Profit-volume ratio (Rs 8/Rs 20) (%)	40
Total fixed cost	Rs 40,000
BEP (units) (Rs 40,000/Rs 8)	5,000
BESR (Rs 40,000/0.4)	Rs 1,00,000
Profit [(Rs 2,00,000 – Rs 1,00,000 BESR) × 0.4 P/V ratio]	40,000

(ii) *Statement Showing P/V Ratio, BEP, BESR and Desired Sales Revenue (In Future)*

Particulars	*Amount*
Revised selling price (Rs 20 – 10% or Rs 2)	Rs 18
Less variable cost per unit	12
Contribution per unit	6
P/V ratio (Rs 6/Rs 18) (%)	33 1/3
BEP (units) (Rs 40,000/Rs 6)	6,667
BESR (Rs 40,000/33-1/3%)	Rs 1,20,000
Desired sales revenue to earn Rs 40,000 (FC + Rs 40,000)/33-1/3% [(Rs 40,000 + Rs 40,000) ÷ 33-1/3%]	2,40,000

RQ.12.9 From the following information find (a) BEP in rupees and (b) number of units to be sold to earn a net income of 10% of sales:

Selling price	Rs 20 per unit
Variable cost	12 per unit
Fixed cost	Rs 2,40,000

SOLUTION

(a) Determination of Break-even Sales Revenue, BESR

Particulars	*Amount*
Selling price per unit	Rs 20
Less variable cost per unit	12
Contribution per unit	8
P/V ratio (Rs 8/Rs 20) (%)	40
BESR (Rs 2,40,000 Fixed costs/0.4)	Rs 6,00,000

(b) Determination of Number of Units to Earn 10% of Sales

Let the number of units to be sold be	X
Sales revenue of X units @ Rs 20 per unit	20X
Profit 10% (i.e. 10% (×) 20X)	2X
Total costs (20X – 2X)	18X
Total variable costs @ Rs 12 per unit	12X
Contribution per unit	Rs 8
X = (Rs 2,40,000 + 2X)/Rs 8	
6X = Rs 2,40,000 or X = 40,000 units	

RQ.12.10 For two periods sales and profits were as under

	Period I	*Period II*
Sales	Rs 4,00,000	Rs 5,00,000
Profit	1,00,000	1,40,000

Find (a) BEP (b) Sales for a profit of Rs 2,00,000 (c) Profit when sales are Rs 6,00,000 and (d) Margin of safety when profit is Rs 50,000.

SOLUTION

(a) Determination of BESR

P/V ratio = (Increase in profits ÷ Increase in sales) = (Rs 40,000 ÷ Rs 1,00,000) = 40%

V/V ratio = 100% – P/V ratio 40% = 60%

BESR = TFC/PV ratio = Rs 60,000[1]/0.40 = Rs 1,50,000

(b) Desired Sales Revenue to Earn Rs 2,00,000

= (FC + Desired profit)/0.4 = (Rs 60,000 + Rs 2,00,00)/0.4 = Rs 6,50,000

(c) Profit at Sales revenue of Rs 6,00,000

Particulars	*Amount*
Sales revenue	Rs 6,00,000
Less variable costs (Rs 6,00,000 × 0.60)	3,60,000
Contribution	2,40,000
Less fixed cost	60,000
Profit	1,80,000

(d) Margin of Safety (MS) at Profit Level of Rs 50,000
= (Total sales revenue – BESR) × C/V ratio = Rs 50,000
= (Total sales revenue – Rs 1,50,000) × 0.4 = Rs 50,000
= Total sales revenue – Rs 1,50,000 = Rs 50,000/0.4 i.e., Rs 1,25,000
= Total sales revenue = Rs 2,75,000
MS = Rs 2,75,000 – Rs 1,50,000 = Rs 1,25,000

Working Note

(1) Sales revenue = Fixed cost + Variable cost + Total profit
Rs 4,00,000 = FC + 0.6 (Rs 4,00,000) + Rs 1,00,000
FC = Rs 60,000 i.e. (Rs 4,00,000 – Rs 1,00,000 – Rs 2,40,000)

RQ.12.11 Two companies P Ltd and Q Ltd producing and selling similar products forecasted their Profits and Loss a/c for the next year, which is as follows.

	P Ltd		*Q Ltd*	
Sales		Rs 3,00,000		Rs 3,00,000
Less: Variable Cost	Rs 2,00,000		Rs 2,25,000	
Fixed Expenses	50,000	2,50,000	25,000	2,50,000
Estimated Profit		50,000		50,000

Calculate:
(a) P/V ratio, break-even point and margin of safety for both the companies. (b) Sales required to earn a profit of Rs 30,000 for both companies. (c) Under the following situations, which company will show better results (i) Increase in sales (ii) Decrease in sales.

SOLUTION

(a and b) Statement Showing P/V Ratio, BEP, Margin of Safety and Desired Sales Revenue

Particulars	*P Ltd.*	*Q Ltd.*
Sales revenue	Rs 3,00,000	Rs 3,00,000
Less variable cost	2,00,000	2,25,000
Total contribution	1,00,000	75,000
Fixed expenses	50,000	25,000
P/V ratio (%) (Total contribution/Sales revenue)	33.33	25
BEP (Amount) (Fixed expenses/P/V ratio)	1,50,000	1,00,000
Margin of safety (sales revenue – BESR)	1,50,000	2,00,000
Desired sales revenue to earn profits of Rs 30,000 (TFC + Rs 30,000)/PV ratio	2,40,000	2,20,000

(c) Since P/V ratio s higher in the case of Q Ltd., it will show better result (compared to P Ltd.) when sales increase; in the event of decrease in sales, company P will show better results as its fixed costs as well as BESR is lower.

RQ.12.12 An analysis of costs of Sullivan Manufacturing Company gives the following information. You are required to determine

(a) Break-even sales volume
(b) Profit at the budgeted sales of Rs 18,50,000.

Cost elements	*Variable costs (Percentage of sales)*	*Fixed costs*
Direct materials	32.8	
Director labour	28.4	
Factory overheads	12.6	Rs 1,89,900
Distribution overheads	4.1	58,400
Administrative overheads	1.1	66,700

SOLUTION

Statement Showing BESR and Budget Profit

Particulars		*Amount*
Fixed costs:		
Factory overheads	Rs 1,89,900	
Distribution overheads	58,400	
Administrative overheads	66,700	Rs 3,15,000
Variable costs (as percentage of sales):		
Direct materials	32.8	
Direct labour	28.4	
Factory overheads	12.6	
Distribution overheads	4.1	
Administrative overheads	1.1	79.0
P/V ratio (100% – 79.0%) (%)		21.0
(a) BESR (Rs 3,15,000/0.21)		Rs 15,00,000
(b) *Profit at budget sales of Rs 18,50,000*		
(Budgeted sales – BESR) × P/V ratio; (Rs 18,50,000 – Rs 15,00,000) × 0.21		73,500

RQ.12.13 PQR Ltd has furnished the following data for the two years:

	Year I	*Year II*
Sales	Rs 8,00,000	?
Profit/volume ratio (P/V ratio) (%)	50	37.5
Margin of safety sales as a % of total sales	40	21.875

There has been substantial savings in the fixed cost in the year 2 due to the restructuring process. The company could maintain its sales quantity level of year 1 in year 2 by reducing selling price.

You are required to calculate the following:

(i) Sales for year 2
(ii) Fixed cost for year 2
(iii) Break-even sales for year 2

SOLUTION

(i) *Determination of Sales for Year 2*
Let us assume sales revenue of year 2 as S
Sales revenue (S) – Variable costs = Contribution
S – Rs 4,00,000[1] = 0.375 (×) S
Or 0.625 S Rs 4,00,000, or S = Rs 4,00,000/0.625 = Rs 6,40,000

(ii and iii) Fixed Cost and BESR for Year 2

(a) Margin of Safety ratio = (Sales revenue – BESR)/Sales revenue
21.875% = (Rs 6,40,000 – BESR) ÷ Rs 6,40,000
Rs 1,40,000 = Rs 6,40,000 – BESR
Or BESR = Rs 5,00,000

(b) BESR = Fixed cost/PV ratio or (37.5%)
Fixed cost = Rs 5,00,000 × 0.375 = Rs 1,87,500

Working Note
(1) Determination of variable costs

Sales revenue	Rs 8,00,000
Less variable costs (Rs 8,00,000 × 0.50* V/V ratio)	4,00,000
Variable costs in year 1	4,00,000**

*1-P/V ratio = V/V ratio; 1 – 0.5 = 0.5 V/V ratio
**Since sales quantity in year 2 remains unchanged, variable cost in year 2 will be equal to year 1.

RQ.12.14 For two consecutive years, sales and losses were as follows:

Particulars	*Year 1*	*Year 2*
Sales revenue	Rs 10,00,000	Rs 15,00,000
Loss	2,00,000	50,000

Determine break-even sales.

SOLUTION

P/V ratio = (Decrease in loss ÷ Increase in sales)
= Rs 1,50,000/Rs 5,00,000 = 30%
V/V ratio = 100% – 30% P/V ratio = 70%
BESR = TFC/P/V ratio = Rs 5,00,000[1]/0.30 = Rs 16,66,667

Working Note
1. *Determination of fixed cost*
SR = TFC + TVC – Losses
Rs 10,00,000 = TFC + 0.7 (Rs 10,000,000) – Rs 2,00,000
TFC = Rs 5,00,000

RQ.12.15 The Taylor Company Ltd produces two products, A and B. Expected data for the first year of operations is:

	A	*B*
Expected sales (units)	8,000	12,000
Selling price	Rs 45	Rs 55
Variable costs	30	35

Total fixed costs are expected to be Rs 3,60,000 for the year.

You are required to answer the following:

(i) If sales, prices and costs are as expected, what will be the operating income and the break-even volume in sales revenue?

(ii) Assume that prices and costs were as expected, but Taylor sold 12,000 units of A and 8,000 units of B. Recalculate the operating income and the break-even volume in sales revenue.

SOLUTION

(i) *Determination of Break-even Point*

Product	*Expected sales revenue (units × selling price per unit)*	*Variable costs (units × variable cost per unit)*	*Contribution*
A	Rs 3,60,000	Rs 2,40,000	Rs 1,20,000
B	6,60,000	4,20,000	2,40,000
Total	10,20,000	6,60,000	3,60,000

Weighted *P/V* ratio = (Rs 3,60,000 ÷ Rs 10,20,000) × 100 = 35.3 per cent
BEP (amount) = Rs 3,60,000, FC ÷ (36/102) = Rs 10,20,000.

Statement Showing the Operating Income (Loss)

Particulars	*Product A*	*Product B*	*Combined*
Sales revenue	Rs 3,60,000	Rs 6,60,000	Rs 10,20,000
Less variable costs	2,40,000	4,20,000	6,60,000
Contribution	1,20,000	2,40,000	3,60,000
Less fixed costs			3,60,000
Operation income			Nil

(ii) *Statement Showing Operating Income at Different Sales-mixes*

Particulars	*Product A*	*Product B*	*Combined*
Sales revenue	Rs 5,40,000	Rs 4,40,000	Rs 9,80,000
Less variable costs	3,60,000	2,80,000	6,40,000
Contribution	1,80,000	1,60,000	3,40,000
Less fixed costs			3,60,000
Income (loss)			(20,000)

Break-even point = *FC* ÷ *P/V* ratio = Rs 3,60,000 ÷ (34/98) = Rs 10,37,647

RQ.12.16 The per cycle price structure of a cycle made by the Cycle Company Ltd is as follows:

Material	Rs 60
Labour	20
Variable overheads	20
	100
Fixed overheads	50
Profit	50
Selling price	200

This is based on the manufacture of 1 lakh cycles per annum.

The company expects that due to competition, they will have to reduce selling price, but they want to keep the total profit intact. What level of production will have to be reached, that is, how many cycles will have to be made to get the same amount of profits, if: (a) the selling price is reduced by 10 per cent, (b) the selling price is reduced by 20 per cent?

SOLUTION

Present level of profit: Rs 50 per cycle × 1,00,000 = Rs 50,00,000.
Fixed overheads = Rs 50 × 1,00,000 = Rs 50,00,000.

It is assumed that the Cycle Company Ltd was absorbing the entire fixed overheads from 1 lakh cycles only.

Revised Contribution Margin When Sales Price is Reduced

	Situation (a)	*Situation (b)*
Sales price	Rs 180	Rs 160
Less variable costs per cycle	100	100
Contribution margin	80	60

Desired sales volume = (*FC* + Desired profit) ÷ Revised *MC* per unit

(a) Rs 1,00,00,000 ÷ Rs 80 = 1,25,000 cycles
(b) Rs 1,00,00,000 ÷ Rs 60 = 1,66,667 cycles

RQ.12.17 (a) From the following data of a manufacturing unit, find out (i) sales to break-even and (ii) sales to earn a profit of Rs 8,000.

Sales (8,000 units @ Rs 10)	Rs 80,000
Variable expenses	64,000
Contribution	16,000
Fixed expenses	24,000
Loss	(8,000)

(b) The following information is available for companies A and B.

		Company A		*Company B*
Units produced and sold		40,000		40,000
Revenue		Rs 80,000		Rs 80,000
Variable costs	Rs 20,000		Rs 60,000	
Fixed costs	50,000	70,000	10,000	70,000
Net operating income		10,000		10,000

(i) What is the break-even point for each company?
(ii) How would you explain the difference that you observe between these companies' break-even points?

SOLUTION

(a) (i) *BEP* = *FC* ÷ *P/V* ratio = Rs 24,000 ÷ 0.20 [(Rs 1,60,000 × 100) ÷ Rs 80,000] = Rs 1,20,000.
(ii) Desired sales volume to earn profit of Rs 8,000 = (Rs 24,000 + Rs 8,000) ÷ 0.20 = Rs 1,60,000.
(b) (i) *BEP* = [Rs 50,000 ÷ 0.75 (Rs 60,000 × Rs 100) ÷ Rs 80,000] = Rs 66,667 (company A)
= [Rs 10,000 ÷ 0.25 (Rs 20,000 × 100) ÷ Rs 80,000] = Rs 40,000 (company B)
(ii) Since fixed costs of company A are higher than those of company B, its break-even point is higher.

RQ.12.18 A company has an opening stock of 6,000 units of output. The production planned for the current period is 24,000 units and expected sales for the current period amount to 28,000 units. The selling price per unit of output is Rs 10. Variable cost per unit is expected to be Rs 6 per unit while it was only Rs 5 per unit during the previous period. What is the break-even volume for the current period if the total fixed costs for the current period are Rs 86,000? Assume that the first-in first-out system is followed.

SOLUTION

BEP = Total fixed costs ÷ Contribution margin per unit.

As the contribution margin per unit (*CMPU*) is not uniform for all units to be sold during the current year, the *BEP* would be: (6,000 units from previous year + Total fixed costs – Contribution of 6,000 units from previous year) ÷ *CMPU* of the current year = 6,000 + [Rs 86,000 – Rs 30,000 (i.e. 6,000 × Rs 5)] ÷ Rs 4 = 20,000 units.

RQ.12.19 Two manufacturing companies, having the following operating details, decide to merge:

	Company 1	*Company 2*
Capacity utilization (%)	90	60
Sales (Rs lakh)	540	300
Variable costs (Rs lakh)	396	225
Fixed costs (Rs lakh)	80	50

Assuming that the merger goes through, calculate:
(i) Break-even sales of the merged plant and the capacity utilisation at that stage.
(ii) Profitability of the merged plant at 80 per cent capacity utilisation.
(iii) Sales turnover of the merged plant to earn a profit of Rs 75 lakh.

(iv) When the merged plant is working at a capacity to earn a profit of Rs 75 lakh, what percentage increase in selling price is required to sustain an increase of 5 per cent in fixed overheads?

SOLUTION

(i) *Determination of BEP of the Merged Plant (100% Capacity) (Rs lakh)*

	Company 1	*Company 2*	*Merged company*
Sales revenue	600	500	1,100
Less variable costs	440	375	815
Total contribution	160	125	285
C/V ratio (Rs 285 × 100) ÷ 1,100(%)			25.9

Break-even sales revenue of merged plant = Rs 130 lakh ÷ 0.259 = Rs 501.75 lakh.
Break-even capacity of merged plant = (Rs 50175 lakh ÷ Rs 1,100 lakh) × 100 = 45.6 percent.

(ii) *Profitability of Merged Plant (80 per cent capacity)*

Sales revenue (Rs 1,100 lakh × 0.80)	Rs 880
Less variable costs (Rs 880 lakh × 0.741, variable cost ratio)	652
Total contribution	228
Less fixed costs	130
Profit	93

(iii) Desired sales revenue to earn Rs 75 lakhs profit = $\frac{\text{Rs 130 lakh + Rs 75 lakh}}{0.259}$ = Rs 791.23 lakh.

(iv) Increase in fixed overheads, 5% = Rs 6.5 lakh
Desired increase in selling price to sustain 5% increase in fixed overheads = (Rs 6.5 lakh ÷ Rs 791.23) lakh × 100 = 0.82 per cent.

RQ.12.20 A, B, and C are three similar plants under the same management who wants to merge them for better operation. The details are as under:

Plant	*A*	*B*	*C*
Capacity operated (%)	100	70	50
Turnover (Rs lakh)	300	280	150
Variable costs	200	210	75
Fixed costs	70	50	62

You have to find out: (i) the capacity of the merged plant for breaking event, (ii) the profit at 75 per cent capacity of the merged plant, and (iii) the turnover from the merged plant to give a profit of Rs 28 lakh.

SOLUTION

(i) *Determination of Break-even Capacity of Merged Plant: 100 Per cent Capacity*

Particulars	*A*	*B*	*C*	*Merged plant*
Turnover (Rs lakh)	300	400	300	1,000
Less variable costs	200	300	150	650
Total contribution	100	100	150	350

Weighted *C/V* ratio = (Rs 350 lakh ÷ Rs 1,000 lakh) × 100 = 35 per cent

BEP = [Rs 182 (Rs 70 + Rs 50 + Rs 62)] ÷ 0.35 = Rs 520 lakh.

BEP (% capacity) = (Rs 520 lakh ÷ Rs 1,000 lakh) × 100 = 52 per cent.

(ii) *Profit at 75 per cent capacity of merged plant:* (Budgeted sales at 75 % capacity – Break-even sales revenue) × *C/V* ratio = Rs 80.5 lakh (Rs 750 lakh – Rs 520 lakh) × 0.35

(iii) *Desired sales turnover to give profit of Rs 28 lakh* = (Rs 182 lakh + Rs 28 lakh) ÷ 0.35 = Rs 600 lakh

RQ.12.21 Cookwell Ltd manufactures pressure cookers with the selling price being Rs 300 per unit. Currently the capacity utilisation is 60 per cent with a sales turnover of Rs 18 lakh. The company proposes to reduce the selling price by 20 per cent but desires to maintain the same profit position by increasing the output. Assuming that all the increased output could be made and sold, determine the level at which the company should operate to achieve the desired objective.

The following data is further available:

(i) Variable costs per unit, Rs 60.

(ii) Semi-variable costs (including a variable element of Rs 10 per unit), Rs 1,80,000.

(iii) Fixed costs, Rs 3,00,000 will remain constant up to 80 per cent level. Beyond this an additional amount of Rs 60,000 will be incurred.

SOLUTION

Determination of Income at 60 per cent Level of Capacity

Particulars	*Total amount*
Sales revenue (6,000 units[1] × Rs 300)	Rs 18,00,000
Less variable costs	
Variable costs (6,000 units × Rs 60)	3,60,000
Variable component in semi-variable costs (6,000 units × Rs 10)	60,000
Total variable costs (6,000 units × Rs 70)	4,20,000
Total contribution (6,000 units × Rs 230)	13,80,000
Less fixed costs	3,00,000
Less fixed component in semi-variable costs	1,20,000
Profit	9,60,000

[1](Rs 18,00,000 ÷ Rs 300) = 6,000 units at 60 per cent or 10,000 units at 100 per cent capacity.

Statement Showing Determination of Desired Sales Volume to Maintain Profit of Rs 9,60,000 When Sales Price is Reduced by 20 Per cent

Revised selling price [Rs 300 – (20%)] per unit	Rs 240
Less variable costs	70
Revised contribution per unit	170

Desired sales volume to maintain profit = (Rs 4,20,000 + Rs 9,60,000) ÷ Rs 170 = 8,118 units or 81.2 percent. Capacity expansion beyond 80 per cent will require additional fixed costs of Rs 60,000. Therefore, the desired sales volume to maintain profit = (Rs 4,80,000 + Rs 9,60,000) ÷ Rs 170 = 8,471 units 84.7 per cent

The company should operate at 84.7 per cent level of capacity to maintain the existing profit of Rs 9,60,000.

RQ.12.22 PQ Ltd has been offered a choice to buy one out of two machines, 'A' and 'B'. You are required to compute:

(a) Break-even point for each of the machines.

(b) The level of sales at which both machines would earn equal profit.

(c) The range of sales at which one is more profitable than the other.

The relevant data is given below:

	Machines	
	A	*B*
Annual output in units	10,000	10,000
Fixed costs	Rs 30,000	Rs 16,000
Profit at above level of production	30,000	24,000

The market price of the product is expected to be Rs 10 per unit.

SOLUTION

(a) *Determination of Break-even Point of Machines A and B*

Particulars	*Machine A*	*Machine B*
Sales revenue (10,000 × Rs 10)	Rs 1,00,000	Rs 1,00,000
Less fixed costs	30,000	16,000
Less profit	30,000	24,000
Variable costs (balancing figure)	40,000	60,000
Contribution (sales revenue – *VC*)	60,000	40,000
C/V ratio (%)	60	40
Contribution per unit	6	4
Variable cost per unit	4	6
BEP (in units)	5,000	4,000
BEP (amount)	50,000	40,000

(b) *The level of sales at which both machines would earn equal profit:*

Since the selling price per unit of output of machines A and B is the same, the two machines will have equal profit at the sales level at which their costs of operations (variable + fixed) are equal.

Let us assume the sales level is 'X' units. Total costs at this level of sales for machines A and B would be 4X + 30,000 and 6X + 16,000 respectively. Solving for X, we have 4X + 30,000 = 6X + 16,000 = 30,000 – 16,000 = 6X – 4X = 14,000 = 2X = 7,000 = X (level of sales).

At the level of 7,000 units of sales, both machines will yield equal profit (Rs 12,000).

(c) Since the *BEP* is lower in machine B, it will be more profitable than A for unit sales range of 4,000 – 6,999. For sales ranges beyond 7,000, machine A will be more profitable due to higher *C/V* ratio.

RQ.12.23 Kalyan University conducts a special course on "Computer Applications" for a month during summer. For this, it invites applications from graduates. An entrance test is taken of the candidates and based on the same, a final selection of hundred candidates is made. The entrance test consists of four objective type examinations and is spread over four days with one examination per day. Each candidate is charged a fee of Rs 50 for appearing in the entrance text. The following data relates to the past two years:

Statement of net revenue from the entrance text for the course on "Computer Applications"

	Year 1	*Year 2*
Gross revenue (fees collected)	Rs 1,00,000	Rs 1,50,000
Costs		
Valuation	40,000	60,000
Question booklets	20,000	30,000
Hall rent at Rs 2,000 per day	8,000	8,000
Honorarium to chief administrator	6,000	6,000

(*Contd.*)

(*Contd.*)

Supervision charges (one supervisor for every 100 candidates at the rate of Rs 50 per day)	4,000	6,000
General administration expenses	6,000	6,000
Total costs	84,000	1,16,000
Net revenue	16,000	34,000

You are required to compute (a) the budgeted net revenue if 4,000 candidates are expected to take up the entrance text next year, (b) the break-even number of candidates, and (c) the number of candidates to be enrolled if the net income desired is Rs 20,000.

SOLUTION

(a) *Budgeted Income Statement When 4,000 Students Take-up the Entrance Test*

Particulars		*Amount*
Gross revenue/fees (Rs 50 × 4,000)		Rs 2,00,000
Less variable costs		
Valuation (Rs 20 × 4,000)	Rs 80,000	
Question booklets (Rs 10 × 4,000)	40,000	
Supervision charges (40 supervisors × Rs 50 per day × 4 days)	8,000	1,28,000
Contribution		72,000
Less fixed costs		
Hall rent	Rs 8,000	
Honorarium to chief administrator	6,000	
General administration expenses	6,000	20,000
Net revenue		52,000

Working Notes

Number of students in year 2 (Rs 1,50,000 ÷ Rs 50) = 3,000
Valuation charges per student (Rs 60,000 ÷ 3,000) = Rs 20
Question booklets (Rs 30,000 ÷ 3,000) = Rs 10

(b) Since the supervision charges are on the basis of 100 students, the *BEP* has been determined with reference to 100 students:

Gross revenue (Rs 50 × 100)		Rs 5,000
Less variable costs		
Valuation (Rs 20 × 100)	Rs 2,000	
Question booklets (Rs 10 × 100)	1,000	
Supervision charges (Rs 50 × 4)	200	3,200
Contribution per 100 students		1,800
Contribution margin per student (Rs 1,800 ÷ 100)		18
BEP (students) (Rs 20,000 ÷ Rs 18)		1,111

Since one supervisor is needed for every 100 students, variable supervision charges included above is Rs 2 per student. Therefore, unrecovered expenses will be Rs 178 (Rs 200 – Rs 22). Additional candidates required would be Rs 178 ÷ Rs 20 and contribution per student (excluding supervision charges) would be 9. Therefore, *BEP* is 1,120 candidates (1,111 + 9).

(c) The desired number of candidates to have income of Rs 20,000 = (Rs 20,000 + Rs 20,000) ÷ Rs 18 = 2,222.

As stated in part (b), 22 candidates will need one supervisor. Therefore, under-recovery of supervision cost = Rs 200 – Rs 44 = Rs 156.

Number of students required to recover Rs 156 = Rs 156 ÷ Rs 20 = 8.

Therefore, the desired number of candidates = 2,230 = (2,222 + 8).

RQ.12.24 Bharat Company Ltd is at present operating at 60 per cent capacity, producing at the rate of 10,000 units a month, a single product selling for Rs 9 a unit. The current year's results are as follows:

Sales (1,20,000 units @ Rs 9)		Rs 10,80,000
Cost of sales		
Direct material	Rs 1,80,000	
Direct labour	3,60,000	
Variable overheads	90,000	
Fixed overheads	1,35,000	7,65,000
Gross profit		3,15,000
Selling expenses		
Fixed	Rs 50,000	
Variable	36,000	22,000
Administration expenses: fixed		22,000
		2,07,000

Although this firm is operating at a relatively high net profit rate of almost 20 per cent on sales even at a plant capacity of 60 per cent; it is a fact that if the price per unit could be reduced by 20 per cent, the volume of sales would increase to 1,80,000 units per year with an increase in the fixed manufacturing overheads of Rs 9,000 per year. If sales price could be reduced by $33^1/_3$ per cent, the volume of sales would increase to a full capacity of 2,00,000 units with increase in excess of the 60 per cent level as follows: fixed manufacturing overheads, Rs 11,000; fixed selling expenses, Rs 2,000; and fixed administrative expenses, Rs 6,000.

You are required to prepare (i) a comparative statement showing the net income under the three alternative profit-volume relationships, and (ii) compute the break-even sales point in each case.

SOLUTION

(i) *Comparative Income Statements Under Alternative Profit-volume Relationships*

Particulars	*Existing*	*Proposed changes*	
	Price per unit Rs 9	*Reduction in price by 20% to Rs 7.20 per unit*	*Reduction in price by $33^1/_3$% to Rs 6 per unit*
Sales (in units)	1,20,000	1,80,000	2,00,000
Sales volume	Rs 10,80,000	Rs 12,96,000	Rs 12,00,000
Less variable costs:			
Direct materials @ Rs 1.50 per unit	1,80,000	2,70,000	3,00,000
Direct labour @ Rs 3 per unit	3,60,000	5,40,000	6,00,000
Variable overheads @ Re 0.75 per unit	90,000	1,35,000	1,50,000
Contribution (manufacturing)	4,50,000	3,51,000	1,50,000
Less variable selling expenses @ Re 0.30 per unit	36,000	54,000	60,000
Contribution (final)	4,14,000	2,97,000	90,000

(*Contd.*)

(*Contd.*)

Less fixed costs			
Manufacturing overheads	1,35,000	1,44,000	1,46,000
Selling expenses	50,000	50,000	52,000
Administration expenses	22,000	22,000	28,000
Net income (loss)	2,07,000	81,000	(1,36,000)
P/V ratio (per rupee)	414/1,080	297/1,296	9/120
BEP	5,40,000	9,42,546	30,13,333

RQ.12.25 The following information is furnished to you with regard to a manufacturing concern for its operations during year 1.

Direct material	Rs 1,75,000
Direct labour	50,000
Fixed overheads	55,000
Semi-variable overheads	70,000
Variable overheads	65,000
Sales (at Rs 800 per unit)	4,00,000

It was estimated that, at *the existing level of capacity utilisation*, half the semi-variable overheads were in the nature of fixed overheads, whereas variable overheads accounted for the other half.

You are required to make necessary calculations to answer the following queries:

(i) At what level of output is the break-even point likely to be reached during the year 2, if there is no change in the price level?

(ii) What price per unit should be quoted in respect of a tender to be executed during year 3 if fixed costs are likely to go up by 10 per cent, variable costs by 20 per cent, and a 12 per cent profit margin is sought to be attained on the total cost?

SOLUTION

(i) *Determination of Break-even Point*

Sales revenue		Rs 4,00,000
Less variable costs		
Direct materials	Rs 1,75,000	
Direct labour	50,000	
Variable overheads	65,000	
Semi-variable overheads (50% variable)	35,000	3,25,000
Contribution		75,000
P/V ratio (%)		18.75

BEP (amount) = Fixed costs ÷ *P/V* ratio = (Rs 55,000 + Rs 35,000) ÷ 0.1875 = Rs 4,80,000.
BEP (in units) = Rs 4,80,000 ÷ Rs 800 (selling price per unit) = 600.

(ii) *Comparative Cost Statement Per Unit to Determine Tender Price Per Unit*

	Cost per unit	
	Year 2	*Year 3*
Variable costs		
Direct material	Rs 350	Rs 420
Direct labour	100	120
Overheads (including 50% of semi-variable)	200	240

(*Contd.*)

(*Contd.*)

Fixed costs		
Overheads (including 50% fixed part of semi-variable overheads)	180	198
Total costs	830	978
+ 12% profit margin on total cost in year 3		117.36
Tender price per unit		1,095.36

[It is assumed that total fixed costs are absorbed by 500 units produced (Rs 4,00,000 ÷ Rs 800)].

RQ.12.26 A company is considering expansion. Fixed costs amount to Rs 4,20,000 and are expected to increase by 1,25,000 when plant expansion is completed. The present plant capacity is 80,000 units a year. Capacity will increase by 50 per cent with expansion. Variable costs are currently Rs 6.80 per unit and are expected to go down by Re 0.40 per unit with the expansion. The current selling price is Rs 16 per unit and is expected to remain the same under each alternative. What are the break-even points under eight alternative? Which alternative is better, and why?

SOLUTION

Pre-expansion BEP (amount) = [Rs 4,20,000 ÷ 0.575 (Rs 9.20 ÷ Rs 16) × 100]	Rs 7,30,435
BEP (in units) = (Rs 7,30,434.78 ÷ Rs 16)	45,653
Post-expansion BEP (amount) = [Rs 5,45,000 ÷ 0.60 (Rs 9.6 ÷ Rs 16) × 100]	9,08,333
BEP (in units) = (Rs 9,08,333 ÷ Rs 16)	56,771

Comparative Income Statement (Pre-expansion and Post-expansion Progamme) Assuming Sales Equal to Plant Capacity

Particulars	*Pre-expansion*	*Post-expansion*
Production/sales (units)	80,000	1,20,000
Selling price	Rs 16	Rs 16
Sales revenue	Rs 12,80,000	Rs 19,20,000
Less variable costs	5,44,000	7,68,000
Contribution	7,36,000	11,52,000
Less fixed costs	4,20,000	5,45,000
Net income	3,16,000	6,07,000

As to which alternative is better, the answer hinges upon the sales volume. Simply on the basis of *BEP*, one may be tempted to conclude that since *BEP* is higher with expansion, the alternative of the *status-quo* is better. But this decision, in fact, may not be an optimal decision if the firm is able to increase its sales. The very fact that the firm is contemplating an increase in its plant capacity is a pointer to the inadequacy of the existing plant capacity to cater to the customers' demand. The alternative of expansion of plant capacity appears to be a better one.

RQ.12.27 The sales of Forma Ltd in the first half of the current year amounted to Rs 2,70,000 and profit earned was Rs 7,200. The sales in the second half year registered an increase and amounted to Rs 3,42,000. The profit earned was Rs 20,700 in that half year. Assuming no change in fixed cost, calculate (i) the *P/V* ratio, (ii) the amount of profit when sales are Rs 2,16,000, and (iii) the amount of sales required to earn a profit of Rs 36,000.

SOLUTION

	Sales	*Profit*	*Cost*
1st half Rs 2,70,000		Rs 7,200	Rs 2,62,800
2nd half	3,42,000	20,700	3,21,300

(i) *P/V* ratio = (Δ Profit ÷ ΔSales) × 100 = (Rs 13,500 ÷ Rs 72,000) × 100 = 18.75 per cent.
(ii) *Profit When Sales are Rs 2,16,000*

	6 months	*12 months*
Sales revenue	Rs 2,16,000	Rs 2,16,000
Less variable cost [81.25% (100% – 18.75%)]	1,75,500	1,75,500
Contribution	40,500	40,500
Less fixed cost	43,425[@]	86,850
Net profit (loss)	(2,925)	(46,350)

(iii) *Desired sales volume to earn a profit of Rs 36,000* = (Rs 86,850 + Rs 36,000) ÷ 0.1875 = Rs 6,55,200.

Working Notes
[@]*Determination of FC*
Rs 2,70,000 = *FC* + 81.25% × (Rs 2,70,000) + Rs 7,200
Rs 2,70,000 = *FC* + Rs 2,19,375 + Rs 7,200
Rs 2,70,000 – Rs 2,26,575 = *FC*
Rs 43,425 = *FC* (for 6 months)
Rs 86,850 = *FC* (for 12 months).

RQ.12.28 The following particulars are given: current unit price, Rs 1,000; unit variable cost, Rs 500; fixed costs, Rs 30 lakh.

The following two suggestions are under the consideration of the management of an industrial company: (a) 10 per cent reduction in price to yield an increase in sales volume from 6,600 to 7,900 units (b) 10 per cent increase in price with decrease in volume of sales from 6,600 to 5,700 units.

Prepare a statement comparing gross revenue, profit contribution and *P/V* ratio of these two alternatives with the present results. Which suggestion would you recommend?

SOLUTION

Statement Showing the Impact of Changes in Sales Price on Income

Particulars	*Present sales price (Rs 1,000)*	*Proposed selling price*	
		Decrease 10%	*Increase 10%*
Sales price	1,000	900	1,100
Sales volume (units)	6,600	7,900	5,700
Sales revenue (gross)	Rs 66,00,000	Rs 71,10,000	Rs 62,70,000
Less variable costs @ Rs 500 per unit	33,00,000	39,50,000	28,50,000
Profit contribution	33,00,000	31,60,000	34,20,000
Less fixed costs	30,00,000	30,00,000	30,00,000
Net profit	3,00,000	1,60,000	4,20,000

The suggestion of an increase in sales price is recommended as it would augment profits from Rs 3,00,000 to Rs 4,20,000.

RQ.12.29 Reprographics Ltd manufactures a document-reproducing machine which has a variable cost structure as follows:

Material	Rs 40
Labour	10
Overheads	4
Selling price	90

Sales during the current year are expected to be Rs 13,50,000 and fixed overheads, Rs 1,40,000.

Under a wage agreement, an increase of 10 per cent is payable to all direct workers from the beginning of the forthcoming year, while the material costs are expected to increase by $7^1/_2$ per cent, variable overhead costs by 5 percent, and fixed overhead costs by 3 per cent.

You are required to calculate: (a) the new selling price if the current profit/volume ratio is to be maintained, and (b) the quantity to be sold during the forthcoming year to yield the same amount of profit as the current year, assuming the selling price is to remain at Rs 90.

SOLUTION

(a) *Determination of Current Profit-volume Ratio*

Selling price per unit		Rs 90
Less variable costs per unit		
Material	Rs 40	
Labour	10	
Overhead	4	54
Contribution per unit		36
P/V ratio or *C/V* ratio (Rs 36 ÷ Rs 90)(%)		40
Determination of new selling price to have 40 per cent P/V ratio:		
Revised material cost (Rs 40 + $7^1/_2$%)		43
Revised labour cost (Rs 10 + 10%)		11
Revised variable overheads (Rs 4 + 5%)		4.20
Revised variable costs		58.20

(SP – VC) ÷ *SP* = 0.4

SP – Rs 58.20 = 0.4 SP

$SP - 0.4\ SP = \text{Rs } 58.20$, or $0.6\ SP = \text{Rs } 58.20$, or $SP = \frac{\text{Rs } 58.20}{0.6} = \text{Rs } 97$

(b) *Desired Sales Revenue to Maintain Current Profits at Sales Price of Rs 90 Per Unit*

(i) *Profits in the current year*:

Contribution (Rs 13,50,000 × 0.40)	Rs 5,40,000
Less fixed costs	1,40,000
	4,00,000

(ii) *(Fixed costs + Additional fixed costs + Rs 4,00,000)* ÷ Contribution per unit (Rs 90 – Rs 58.20)
= (Rs 1,40,000 + Rs 4,200 + Rs 4,00,000) ÷ Rs 31.80 = 17,114 units.

RQ.12.30 The cost structure (%) of an article with a selling price of Rs 45,000 is as follows:

Direct material	50
Direct labour	20
Overheads	30

An increase of 15 per cent in the cost of material and of 25 per cent in the cost of labour is anticipated. These increased costs in relation to the present selling price would cause a 25 per cent decrease in the amount of present profit per article.

You are required (a) to prepare a statement of profit per article at present and (b) the revised selling price to produce the same percentage of profit to sales as before.

SOLUTION

(a) 1. Let total costs be represented by x and total profits by y.
Therefore, $x + y = \text{Rs } 45{,}000$ (i)

2. *Increase in:*
   Material costs from 50% to 57.5% (7.5%).
   Direct labour costs from 20% to 25% (5%).
   This increase of 12.5% in total costs reduces profits by 25%. From this it follows that:
   Revised costs are $x + 12.5\% = 1.125x$
   Revised profits are $y - 0.25y = 0.75y$
   Therefore, $1.125x + 0.75y$ = Rs 45,000 (ii)
3. Thus,
   $x + y$ = Rs 45,000 (i)
   $1.125x + 0.75y$ = Rs 45,000 (ii)
   Multiplying equation (i) by 1.125,
   $1.125x + 1.125y$ = Rs 50,625 (i)
   $1.125x + 0.75y$ = Rs 45,000 (ii)
   Subtracting equation (ii) from equation (i),
   $0.375y$ = Rs 5,625, or y = Rs 5,625 ÷ 0.375 = Rs 15,000
   y(profits) = Rs 15,000
   x(costs) = Rs 30,000 (Rs 45,000 – Rs 15,000).

Statement of Profit

Selling price		Rs 45,000
Less costs		
Direct material (Rs 30,000 × 0.50)	Rs 15,000	
Direct labour (Rs 30,000 × 0.20)	6,000	
Overheads (Rs 30,000 × 0.30)	9,000	30,000
Profit		15,000
Profit as per cent of sales (Rs 15,000 ÷ Rs 45,000)		$33\frac{1}{3}$
Profit as per cent of costs (Rs 15,000 ÷ Rs 30,000)		50

(b) *Determination of Revised Selling Price*

Direct material costs (Rs 15,000 + 15% per unit)	Rs 17,250
Direct labour costs (Rs 6,000 + 25% per unit)	7,500
Overheads (Rs 9,000 per unit)	9,000
Revised total cost	33,750
Add desired profit ($33\frac{1}{3}$ per cent of sales price or 50 per cent of cost price)	16,875
Revised selling price	50,625

RQ.12.31 Last year, Mr. Mukesh was engaged as a consultant to the Bajaj Electricals Ltd and prepared some analysis of its cost-volume-profit-relationships. Among his findings was that the profit-volume ratio was 40 per cent at the firm's planned selling price of Rs 50. The firm expected to sell 8,000 units at the price of Rs 50, which would result in an income of Rs 96,000. Mukesh stressed the point in his report to the chief executive of the company that profits would change at the rate of Re 0.40 per rupee change in sales.

The chief executive called Mukesh to tell him that the result did not come out as were told to him. The firm earned profits of Rs 1,26,400 on sales volume of Rs 4,53,600. Although variable costs per unit were incurred as expected, the firm had higher fixed costs than expected because of a Rs 4,000 advertising campaign during the year. The campaign was coupled with an increase in selling price and the chief executive was very pleased with the results. However, Mukesh is asked to explain why profit did not increase by 40 per cent of the added sales volume of Rs 53,600, but rather somewhat more.

You are required to do the following:

(i) Reconstruct the income statement for the year based on the actual results.

(ii) Determine (a) the number of units sold and (b) the selling price per unit.
(iii) Explain to the chief executive why the results were at variance with the planned results.

SOLUTION

(i) *Income statement contains* sales revenue, variable costs, fixed costs, and profit (loss). In the problem, sales and income are known; we are required to determine variable costs and fixed costs. Given the *P/V* ratio of 0.40, the expected contribution margin is Rs 1,60,000, (0.40 × 8,000 × Rs 50) and expected profit is Rs 96,000. Hence, expected fixed costs would be Rs 64,000 (Rs 1,60,000 – Rs 96,000). The actual fixed costs were higher by the amount of advertisement expenditure of Rs 4,000, that is actual fixed costs would be Rs 68,000. Since actual income was Rs 1,26,400 and fixed costs were Rs 68,000, total actual contribution must have been Rs 1,94,400 (Rs 1,26,400 + Rs 68,000). Variable costs, then, should be Rs 2,59,200 (Rs 4,5 3,600 – Rs 1,94,400).

The income statement for the year would be as follows:

Sales	Rs 4,53,600
Less variable costs	2,59,200
Contribution	1,94,400
Less fixed costs	68,000
Net income	1,26,400

(ii)(a) Since variable costs per unit were as expected, variable costs per unit = (0.60 × Rs 50) = Rs 30. Total actual variable costs were Rs 2,59,200. Units sold were (Rs 2,59,200 ÷ Rs 30) = 8,640

(b) Sales price per unit = Total sales revenue ÷ Number of units sold = Rs 4,53,600 ÷ 8,640 = Rs 52.50

Mr . Mukesh's answer to the chief executive should highlight change in the selling price and fixed costs. In the cost-volume-profit-relationships, assumptions are critical. If they vary, the planned and actual results are bound to differ. Here, selling price has gone up causing higher *P/V* ratio (variable cost per unit remains constant) and, hence, more profit rate than Re 0.40 per rupee of additional sales. Revised *P/V* ratio is 42.86 per cent (9/21 per rupee of sales). Furthermore, additional fixed costs have been incurred. These two factors have distorted the cost-volume profit-relationship stipulated by Mr. Mukesh.

13 Standard Costs

Introduction

The term "planning" refers to what a firm wishes to achieve and the actions to be taken to achieve the desired objectives. Control is the process of ensuring that action conform to plans. In other words, control as a management function, means that once a course of action has been decided, operational decisions and activities of management should coincide with the plans. This implies that management needs some criterion for judging the results of operating decisions. Cost data constitute an important element of the financial information to accomplish it. One approach to ensure that operations are in conformity with plans is to compare the actual performance with some standard. A widely-used technique is ''standard cost'' and variance analysis. The objective of this chapter is to discuss this control concept. In other words, standard cost is considered here as a criterion to measure performance. While Sections 1-3 cover meaning of standards, their establishment and components, the main points are summarised in Section 4.

MEANING OF STANDARDS

Standards are performance expectations.[1] In other words, standards may be defined as measured quantities which should be attained in connection with some particular operation or activity. Stated in terms of a test of efficiency, a standard is a precise measure of what should occur if the performance is efficient. For example, a certain number of words per minute is a standard for an efficient steno-typist; a certain percentage of marks may be a standard to qualify in a certain examination or to obtain a certain grade, say A, or a division, say first, and so on. In other words, when we say that the standard for a typist is, say, 80 words per minute, what is meant is that a particular typist is considered efficient depending on his typing speed per minute *vis-à-vis* 80 words per minute. If he attains, or exceeds this level, his performance will be rated satisfactory, if not, he has to improve if the goals of the organisation are to be achieved. Thus, in a sense, a standard describes an approach to implement and achieve the goals of the firm. The standards are generally set by management in accordance with the best judgement. However, standards can be set only for repetitive

tasks, that is, for work which is repeated again and again; standards cannot be set for tasks which are not performed regularly and continuously.

Thus defined, standards are different from another criterion to evaluate performance, namely, budgets. Budgets, as a tool of planning and control, have already been discussed in an earlier chapter of this book. One difference between standards and budgets is to be found in their scope of activity. While a budget relates to an entire activity or operation, the standard presents the same information on a per unit basis. For instance, the cost of material to produce 1,000 units is Rs 5,000. In terms of budget, the cost of materials is expected to be Rs 5,000. The standard would express it as Rs 5 per unit. Secondly, budgets and standards are set by different persons. Usually, a budget committee prepares the budgets; the standards are generally established by management accountants in consultation with engineers, management, and so on. Moreover, functionally, budgets are used for planning and coordination purposes, whereas standards are primarily used as a control device.

Standard cost may, therefore, be defined as a criterion or measure of acceptable cost performance. That is to say, whether the cost incurred by a firm is reasonable or not, can be judged in relation to the standard costs. Standard costs may be: (i) Ideal, (ii) Expected, and (iii) Normal/attainable. The ideal standard cost refers to estimates of costs under ideal or perfect conditions. The assumption would be that there would be no waste, no scrap, no idle items, no machine breakdown, and so on. Such a standard, obviously, cannot be achieved in real world situations.

The expected standard cost is based upon the most likely attainable result. Technically, it means what *can* happen and not what *should* happen. It is really not a standard in the real sense of the term as there is no inherent element of efficiency, which is the basic consideration underlying standard costs.

Normal standards or currently attainable standards assume normal conditions as opposed to perfect conditions in the sense that normal wastage, normal breakdown and normal mistakes are visualised as part of the operations. Therefore, such standard costs may be defined as costs which are attainable but their achievement requires that operations and activities are efficient.[2] *For our purpose, standard costs invariably refer to the normal standard costs.*

ESTABLISHING COST STANDARDS

The effectiveness of standard cost, as a tool, will ultimately depend upon how the standards themselves have been established. Care, therefore, must be taken to set up standards which consider all relevant facts such as the employees, their abilities and aspirations and their degree of control over operations, and so on. There are several ways to devise standards: (i) Engineering estimates, (ii) Observed behaviour, (iii) Predicted behaviour, and (iv) Desired behaviour. The standard cost in a particular situation may be based on two or more of these techniques.

Engineering Estimates

One basis of setting up cost standards is engineering estimates. Technically, a standardised relationship between, say, a given unit of output and given units of input (say, raw materials) can be estimated fairly accurately depending upon the specifications of the machinery. On the basis of such technical specifications, cost standards can be set. Thus, cost standards according to the engineering estimates are based on what can be accomplished.

Observed Behaviour

Another technique to establish cost standards is past experience. Here, the approach is to treat the achievements of the past as standards for the future. If the processes and procedures of the past have not changed and are likely to operate in future also, this can provide a reliable guide for the future. If, however, changes occur in the processes and procedures, observed behaviour (what happened in the past) can certainly not provide a reliable basis for setting cost standards.

Predicted Behaviour

It is also likely that certain changes, such as technological, may be in the offing. These are likely to have a bearing on the cost estimates. In such cases, what is most likely to happen, that is, predicted behaviour in terms of adjustment to the historical standard cost, can be used to set cost standards.

Desired Behaviour

Desired behaviour can also affect standard cost. The term "desired behaviour" means what management desires. The desire of the management may be based on the experience of similar concerns or the industry as a whole. This basis will bring the cost standards of the company in line with those of the industry as a whole.

In brief, while several techniques are available to establish cost standards, it is basically based on management's judgement. In setting up of standards, management should be careful. Standards should be set at a level at which they are attainable with reasonable efforts. If they are too strict and too high, they may be difficult to achieve, leading to all-round demoralisation. If, on the other hand, cost standards are set low, there may not be sufficient motivation to achieve them.

COMPONENTS OF STANDARD COST

From the preceding discussion standard costs may be defined as costs that should be reasonably incurred in the manufacturer of a product.[3] The main components of standard costs are: (i) Standard direct material cost, (ii) Standard direct labour cost, and (iii) Manufacturing overheads.

Standard Direct Material Cost

The standard direct material cost of a product is based upon price and quantity standards. In operational terms,

Standard direct material cost = Price standards of direct material × Quantity standard of direct material (13.1)

Direct Materials Price Standard One of the most important items of cost is the cost of direct materials used in the manufacture of goods. To exercise control over the cost, therefore, an important element of cost control is the price paid for the purchase of materials. In other words, one important dimension of materials cost control is that the price paid should be reasonable. Hence, the need for a materials price standard which is defined as the price which should be paid for particular direct raw material under the most favourable possible conditions. What is the most *favourbale possible condition* will differ from firm to firm depending upon the circumstances of each case. Therefore, material price standards should be set for each firm and not for the industry as a whole.

The standard material price should include all the components of the amount which is to be spent to acquire a particular material. To illustrate, in the first place, assuming the same quality of goods, the standard should be set on the basis of the lowest price. If, however, the supplier who is prepared to sell the material at the lowest cost, is not able to deliver them when needed, or he is not dependable, there will be no real saving to the firm. In such cases, differences in quality and/or in service may justify the setting up of the price standard on the basis of the higher price to be charged by the more reliable suppliers. Secondly, a firm has to incur freight charges on the purchase of raw materials which affect the cost of the materials. Since freight charges normally vary with the distance between the buyer and the supplier, while setting a material price standard, the firm should consider purchasing from the closest possible supplier, other things being equal. A related aspect is that in the case of purchase through imports, additional cost is involved in the form of import duties. These have to be taken into account while fixing standard price. Thirdly, discounts available on the purchase of materials are also relevant to the fixation of price standards. The discounts fall into two categories: (i) Quantity discounts which are granted for purchase in relatively large doses; (ii) Cash discounts which are granted for prompt payment. The effect of discounts is lower costs and, hence, lower price standards. The setting up of a materials price standard is illustrated in Example 13.1.

EXAMPLE 13.1

Hypothetical Ltd, on the basis of investigation of alternative sources of supply, decides to purchase raw materials from the most advantageous supplier—ABC Ltd which quotes a list price of Rs 1,820 per tonne, exclusive of freight charges. It also offers a quantity discount @ Rs 70 per tonne for orders exceeding 20 tonnes. It also allows 2 per cent cash discount for payment within 15 days. Moreover, freight charges are likely to be Rs 1,700 per carload (20 tonnes of materials) and payable directly to the carrier. Compute the standard materials price for Hypothetical Ltd.

SOLUTION

Computation of Standard Materials Price

1. List price (per tonne)	Rs 1,820
2. *Less* quantity discount (per tonne)	70
Car load price	1,750
3. *Less* cash discount (0.02)	35
	1,715
4. *Add* freight charges (Rs 1,700 ÷ 20 tonnes)	85
Standard price per tonne	1,800

This standard price provides a basis for planning future material costs and for controlling current costs by providing a criterion against which actual prices paid may be evaluated.

Materials Quantity (Usage) Standard The quantity of the materials used is the second factor affecting cost of material. In order to standardise cost of materials, therefore, the quantity of materials used for the production of a particular product should also be standardised. The standards of the quantity of consumption of raw materials is referred to as materials quantity standards or materials usage standards. Such standards can be determined on the basis of two factors: (i) The necessary input-output relationship between materials and products and also upon observation of actual experience, (ii) The inherent loss of materials in the production processes owing to factors such as weight losses due to scrapping and smoothing, shrinkage and evaporation, and so on. Consider Example 13.2.

EXAMPLE 13.2

Hypothetical Ltd of Example 13.1 produces a single product by using steel. Each finished product weighs 380 kgs. Past experience coupled with careful engineering studies show that a loss of 5 per cent occurs in the weight of the input material in the production process. What is the standard material usage per unit?

SOLUTION

Computation of Standard Materials Usage Per Unit

Weight of finished product (kgs)	380
Allowance for normal loss in the production process (0.05)	20
Standard material usage	400

Two points in this connection are notable. First, there will be different quantity standards for different materials; and different standards may apply to the usage of a single material in different products/departments. Second, the material quantity standard does not provide for loss of materials due to: (1) Careless handling, (2) Damage to units in process, and (3) Other undesirable circumstances. In fact, the material usage standard is intended to eliminate such types of material losses.

Total Material Cost Standard The total material cost standard is computed by multiplying price standards by quantity standards. This is illustrated in Example 13.3.

EXAMPLE 13.3

Continuing the case of Hypothetical Ltd of **Examples 13.1 and 13.2**, the standard price is Rs 1,800 per tonne; the standard quantity is 420 kgs per finished units of product. Compute the total standard material cost.

SOLUTION

Standard material cost = (Standard usage × Standard price per kg)
Standard price per kg = Rs 1,800/ 2,000 = Rs 0.9
Standard material cost = Rs 0.9 × 400 = Rs 360

Standard Direct Labour Cost

The second component of total standard cost is direct standard labour cost. It is calculated by multiplying Labour rate standards by Labour time standards.

Labour Rate/Price Standards The payment to labour for carrying on production is wages, which is paid either on a time basis (monthly, weekly, daily) or on a piece basis (per piece of production). The use of the term "labour rate/ price standard" is conventionally limited to wage rates standard only, that is, in case of time wage payment only. The wage rate standards are normally either a matter of company policy, or more often, the result of negotiations between management and union. Moreover, in most cases, there will be several different wage rates depending upon the degree of skill, the element of danger, seniority of workers, and so on. Thus, labour rate standards are quite different from material price standards. They are not entirely under the control of management. To illustrate, assume that Hypothetical Ltd has two production departments. In the first, the current standard wage rate is Rs 48 per hour. In the second, the standard wage rate is Rs 50 per hour. This has to be related to the labour time standard to work out the total labour standard.

Labour Time Standards The quantity (amount) of labour is measured in terms of time devoted to the completion of a particular operation. Therefore, labour time standards may be defined as the amount of time which a particular operation should take. They are normally established on the basis of observation of actual operations and a critical evaluation of whether or not those operations are being performed as efficiently as is feasible.[4] A fairly familiar and popular example are time and motion studies. It is on the basis of these that labour time standards are generally set. They should, of course, include provision for a reasonable amount of time lost simply because human beings are not mechanical devices and cannot utilise every single moment on the job for actual production. However, no allowance is made while setting standards for prolonged periods of illness or for incompetence.

Assuming that engineering studies in Hypothetical Ltd show that in one of its departments one unit of output should be produced in one-fourth of an hour, whereas in the other department it is one-half of an hour, the total labour time standard is three quarter-hour.

Total Labour Cost Standard The total labour cost standard is equal to labour rate standard multiplied by labour time standard. For Hypothetical Ltd the total labour cost standard would be:

(a) For Department 1 : Rs 48 × 1/4 hour = Rs 12
(b) For Department 2 : Rs 50 × 1/2 hour = Rs 25
(c) Total = (a + b) = Rs 37

Overheads Standards

The third component of cost standard is overheads. There is a basic difference between overheads standard and material and labour standards. It has been shown in the preceding sections that the standard material and labour costs are based upon price and quantity standards. The logic underlying this is that a functional relationship exists between the number of units of a product and the quantities of material and labour required as also the fact that each material has its standard price and each worker his standard wage rate. In sharp contrast, no such functional relationships exists between the units produced and total overheads cost. Even that portion of manufacturing overhead which varies with the volume of production cannot be directly related to production in the same way as direct material and direct labour. Therefore, the determination of overhead standard is different from that of direct materials and labour.

For these reasons, standard costs for overheads are generally based on budget and not upon standards. Operationally, they are determined essentially in the same way as normal manufacturing overhead rates which are covered in another chapter of this book. The overheads are, for purposes of planning and control, classified into: (i) Variable, and (ii) Fixed. The standard variable rate is set directly per unit of volume just as a normal variable rate. The volume measure is some measure of input, such as direct labour cost or hours. The determination of the standard fixed overhead is slightly different from that of the normal fixed overhead. This difference lies in the volume at which they are set. Normal fixed rates, illustrated in an earlier chapter in this book, are set at the budgeted volume for the budget period. Standard fixed rates, on the other hand, are usually set at some volume representative of the firm's operations over a longer period than a single budget period.

The volume level most commonly selected for setting standard manufacturing overheads rates is normal volume. The more logical and feasible concept of normal volume is the preferred rate of operating capacity. Each firm identifies a particular rate, or level of capacity/activity at which it would most like to operate its plants. Logically, this is the level at which the mix of productive inputs is optimal and the total manufacturing cost per unit is minimum. Such a concept of normal volume is consistent with the notion of standard cost—cost that should be incurred under efficient operating conditions. It is estimated that the preferred level of operating capacity is at or near 90 per cent of full capacity.[5]

EXAMPLE 13.4

Assume that Hypothetical Ltd uses direct labour-hours as the basis to allocate overheads to production. The variable overhead is budgeted at Rs 16 per direct labour-hour in Department 1. The fixed manufacturing overhead is budgeted at a total of Rs 16,00,000 per year and normal production volume has been established at 4,00,000 direct labour-hour per year. In Department 1, variable manufacturing overhead is budgeted at Rs 10 per direct labour-hour and fixed overhead at Rs 12,00,000 per year. Normal production volume is 8,00,000 labour-hours per year. Compute the standard overhead rates.

SOLUTION

Computation of Standard Overhead Rates

	Department 1	*Department 2*
1. Standard fixed overhead rate per Labour-hour (Fixed overheads ÷ Normal production volume)	Rs 4 (Rs 16,00,000/4,00,000)	Rs 1.5 (Rs 12,00,000/8,00,000)
2. Variable overhead per unit (Standard labour time × Variable overhead)	4 (1/4 hour × Rs 16)	5.0 (1/2 hour × Rs 10)
3. Fixed overhead per unit (Standard labour time × Standard fixed overhead rate)	1 (1/4 hour × Rs 4)	0.75 (1/2 hour × Rs 1.5)

Standard Cost Sheet

A summarised view of total standard cost is presented in the form of a standard cost sheet or standard cost card. The information about Hypothetical Ltd is presented in Table 13.1.

Table 13.1 *Hypothetical Limited—Standard Cost Sheet*

(a) Direct materials (400 kgs × Rs 0.9)		Rs 360.00
(b) Direct labour:		
Department 1	Rs 12	
Department 2	25	37.00
(c) Variable manufacturing overhead:		
Department 1	4	
Department 2	5	9.00
(d) Fixed manufacturing overhead:		
Department 1	1.00	
Department 2	0.75	1.75
		407.75

SUMMARY

Standard costs represent a control technique. In a sense, they are a target, which the management attempts to achieve. The control process involves a comparison of the actual performance with the standards set by

management. The extent of success would be revealed by the relationship between the actual and the standard. If the actual performance coincides with the target, the performance can be said to be satisfactory. In case of divergence or deviations, management would have to analyse the causes. These deviations are technically referred to as ''variance''. Therefore, variance analysis is an important control concept related to standard costs. In other words, the variances which basically represent performance deviations are a significant element of the information base of an effective control system. The next two chapters discuss cost and revenue variances.

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1. R.M. Copeland and P.E. Dashcher, *Management Accounting*, (John Wiley and Sons, New York, 1978), p. 382.
2. D.T. Decoster and E.L. Schafer, *Management Accounting*, (John Wiley and Sons, New York, 1979), p. 204
3. J.M. Fremgen, *Accounting for Managerial Analysis*, (Richard D. Irwin, Homewood, Illinois, 1976), p. 237.
4. Fremgen, *op. cit*., p. 233.
5. *Ibid*., p. 239.

REVIEW QUESTIONS

RQ.13.1 (a) What are the points of similarity and points of difference between budgets and standard costs?
(b) What are the several types of standards and what are the assumptions on which these standards are based?

RQ.13.2 What is "standard costing" and how would you distinguish it from "budgetary control?"

RQ.13.3 Write short notes on the following:
(a) Standard costing as tool of management control.
(b) Control through standard costs.

RQ.13.4 How do standards and standard costs facilitate managerial planning and control?

RQ.13.5 What factors should be considered in setting a: (a) Materials price standard; (b) Materials usage standard; (c) Labour rate standard; and (d) Labour time standard?

RQ.13.6 What is the nature of the fundamental difference between standard costs for direct materials and labour and standard manufacturing overhead costs?

14 Cost Variances Analysis

Introduction

Chapter 13 introduced an important control concept-standard costs. The object of this chapter is to illustrate the use of standard costs for purposes of planning and control of costs in a manufacturing concern. This objective is achieved by the process of comparison of actual costs (AC) incurred with the pre-determined standard costs (SC) and then seeking the reasons for the variances, if any. *Variance represents the difference between AC and SC*. If AC is less than SC, this is a sign of efficiency and the difference is termed as "favourable" variance (F). If the AC is more than SC, this is a sign of inefficiency and the difference is designated as "unfavourable"/"adverse" variance (U/A). Favourable variance is also sometimes referred to as "positive variance" while unfavourable variance is called "negative variance". The words favourable/positive and unfavourable/negative are merely indicative of the direction of variance from the SC. They need not necessarily be good or bad from the point of view of the firm. Such a qualitative evaluation can be made only after the underlying cause of the variance has been determined. And, above all, the answer will depend on the type of standards set by the firm. If standards are properly set in that they are reasonable and accurate and are revised from time to time in the light of changed circumstances, deviations would be true deviations. However, if standards are not properly set, conclusions drawn—favourable or unfavourable—will be distorted. A still more serious situation would occur, when guided by such a wrong conclusion, futile efforts would be initiated by the management to correct the "not - incorrect operation."

Given the fact that standards are properly set (currently attainable), variances would serve as useful tool in the implementation of the concept of "management by exception" in that variances keep the management informed about the erratic and out-of-line behaviour of the business. The basic rule of management by exception is to concentrate on operations and segments of an enterprise that deviate from target performance and not to spend much time reviewing satisfactory performances. Further, both favourable and unfavourable variances deserve attention. An unfavourable variance suggests a condition that may require correction. A favourable variance may suggest an opportunity that management can exploit.[1]

Variances, as a control device, are calculated to assign/fix responsibility for deviations from the SC and, thus, to control the cost. For purposes of control, variances are classified as controllable and uncontrollable cost variances.

If a variance can be traced with the responsibility of a particular individual, it is said to be a "controllable" variance. If variance stems from causes beyond the control of responsible individuals, it is said to be "uncontrollable". Thus, uncontrollable variance arises when the responsibility for the variance cannot be attributed to any individual in an organisation. For instance, the increase in the price of materials and increase in the wage rates are commonly referred to as un/non-controllable variances, whereas excessive usage of materials in production, more than standard hours taken by labourers in production, are examples of controllable variances. This distinction of variances into controllable and uncontrollable is extremely important. Controllable variances are carefully analysed and reported to the management to enable it to pursue corrective action, and, thus, facilitate the implementation of the principle of management by exception.

As already observed, variances relate to costs of manufacturing enterprises. The three elements of the costs of such enterprises are: (i) Material (ii) Labour and (iii) Overheads. A complete list of the different types of material and labour variances is given in Figures 14.1. Sections 1–2 cover the cost variances associated with materials and labour respectively. The accounting for standard costs is illustrated in Section 3. The summary is given in Section 4.

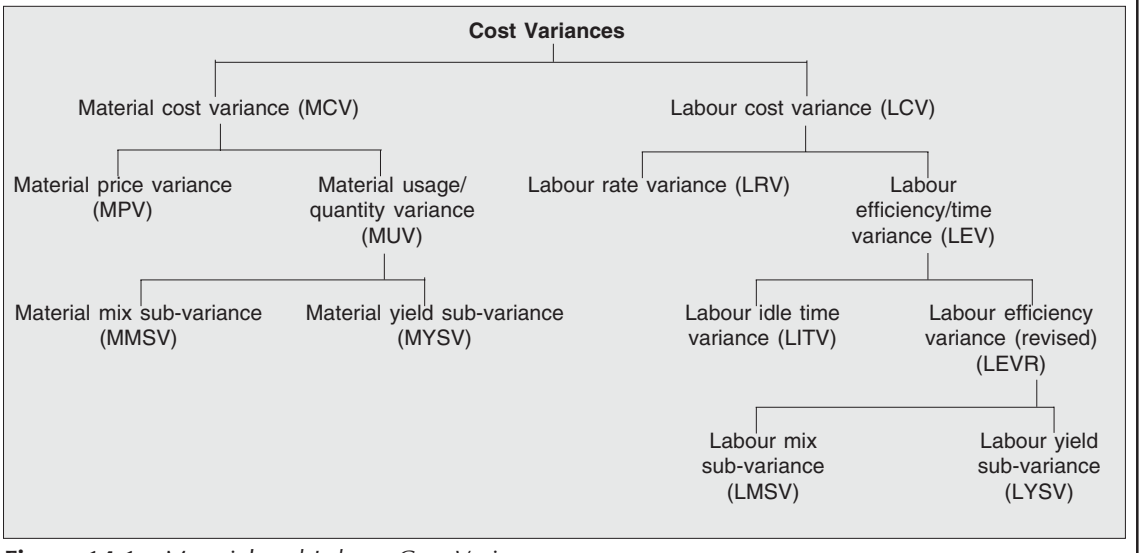

Figure 14.1 *Material and Labour Cost Variances*

MATERIAL VARIANCES

Material variances are more popularly known as material cost variances (MCV). The MCV is the difference between the standard cost of materials that should have been incurred in manufacturing the actual output (TSMC) and the cost of materials that has been actually incurred (TAMC).

Symbolically,

$$MCV = (SQ \times SP \times AO) - (AQ \times AP \times AO) \text{ (on per unit basis)} \quad (14.1)$$

$$MCV = (TSMC - TAMC) \text{ (on aggregate basis)} \quad (14.2)$$

Where,

SQ = Standard usage of materials per unit
SP = Standard price of materials per unit
AO = Actual output in units
TSMC = Total standard cost of actual output
AQ = Actual usage of materials per unit
AP = Actual price of materials per unit
TAMC = Total actual cost incurred

Consider Example 14.1.

EXAMPLE 14.1

Compute the material cost variance (MCV) from the following information.

Particulars	*Standard*	*Actual*
Material usage per unit (kgs)	2	2.2
Price per kilogram (Rs)	14	15
Actual units produced		100

SOLUTION

$MCV = (SQ \times SP \times AO) - (AQ \times AP \times AO)$
$= (2 \times Rs\ 14 \times 100) - (2.2 \times Rs\ 15 \times 100) = Rs\ 2{,}800 - Rs\ 3{,}300 = Rs\ 500$ (unfavourable/Adverse)

From the above, it is apparent that the MCV depends on two factors—the price paid for materials, and the quantity of materials used in actual production. Accordingly, the MCV which is a total variance can be bifurcated into two sub-variances: (i) Material price variance (MPV); (ii) Material usage/quantity variance (MUV).

Material Price Variance (MPV)

MPV will occur when the actual price paid for the purchase of materials is different from the standard price. This variance arises at the time of purchase and logically should be identified at that point. A more appropriate title for this type of MPV would be the material purchased price variance.[2] Obviously, the total amount of variance should depend on the number of units purchased; the greater the number of units purchased, the larger should be the size of MPV. Thus, the MPV is a function of (i) the difference between the actual price (AP) and the standard price (SP) per unit of material; and (ii) the actual number of units purchased (AQ). Symbolically,

$$MPV = (SP - AP) \times AQ \quad (14.3)$$

When actual price exceeds standard price, the variance is unfavourable (U/A); favourable variance (F) results when standard price is greater than actual price. There will be no variance if both the prices are equal. For the facts, in Example 14.1, the MPV would be: (Rs 15 – Rs 14) × 220 kgs = Rs 220 (unfavourable/A)

Factors Responsible for MPV There may be many causal factors for the MPV. Some of them may be acting favourably while others unfavourably. An illustrative list of the factors having a bearing on MPV is given below:

1. Changes in the basic price of materials due to inflation.
2. Excess transport charges, that is, freight on goods purchased which are normally considered as part of the cost of purchases.
3. Change in the pattern of amount of taxes and customs duties.
4. Increased excise duty on goods purchased and, hence, a higher price charged by the suppliers of their products.
5. In situations of material shortages, the price charged by, and paid to, the suppliers may be higher than the normal price.
6. Purchases may not have been made from the most desirable supplier or favourable market.
7. Not availing of cash discounts due to inadequate cash resources, while such discounts were well taken into account while determining the standard price.
8. Failure to take advantage of off-season low price.
9. Sudden change in the production volume, forcing the purchase manager to buy uneconomic quantities.
10. Change in standard quality or specifications of materials resulting in different prices being paid.
11. Use of substitute material having a different unit price from the standard.
12. Failure to purchase in the pre-estimated lot size resulting in a loss of trade discount.

Responsibility for MPV Material price variance is mainly the responsibility of the purchase officers who are in charge of making the entire purchases of the firm. Normally, they are required to prepare a statement which analyses the reasons for the variances. From the factors enumerated above, it is very clear that the purchase department may not be always held responsible for paying higher or lower than the standard price; the responsibility for some of the factors may rest with persons other than purchasing officers. For instance, the responsibility of a sudden change in production schedule rests with the production manager. Likewise, a general price increase falls beyond the jurisdiction of purchase officers. The purchases of smaller quantities depriving the benefit of trade discount and making late payment resulting in foregoing cash discount on account of lack of finances with the firm are not factors for which they are accountable. For example, the average market price of the materials purchased by a firm has increased by 10 per cent (on account of additional excise duty imposed on the manufacturer supplying the material to the firm) from the firm's standard price, and the MPV is unfavourable by 7 per cent. The situation implies efficient purchasing practices whereas simple computation would yield the opposite conclusion of ineffective/inefficient purchasing practices. On the contrary, the purchase manager might succeed in achieving a favourable material price variance by purchasing from an unreliable supplier, but consequent delivery delays may be fatal to the firm in that it may cause partial shutdown of production facilities, having an adverse impact on meeting customer's orders in time. Such a variance is favourable only in name and clearly not in effect.

Obviously, it would be naive to automatically assign all results directly to the purchasing department without a detailed analysis. It is logical, therefore, to attribute a segment of material price variance to a department(s) other than purchasing. For example, if a foreman of a production department fails to notify purchase requisitions of materials in time, an emergency order may become imperative to make available the required supplies so as to avert a production stoppage, entailing higher price being paid and perhaps also higher freight charges. Clearly, the production department is responsible for the creation of such a variance. From the *operational* viewpoint, however, it can be said that the causes rest with the purchase officer and it is his responsibility to explain unusual circumstances.

Material Usage/Quantity Variance (MUV)

The second component of MCV, material quantity/usage variance (MUV), measures how well the materials in production are utilised. This variance occurs when actual usage of material differs from standard usage. The data for actual usage of materials is collected from a summary of materials issue reports during the relevant period, while the standard quantity of materials in production would simply be the product of standard quantity of materials required for each unit of product and the number of units produced during the period. Since the MPV has already taken into account price differences, the MUV ignores such differences and the difference of quantities is multiplied by the standard price per unit. Symbolically

$$\text{MUV} = [(\text{SQ} \times \text{AO}) - (\text{AQ} \times \text{AO})] \times \text{SP} \tag{14.4}$$

For Example 14.1, the MUV would be: = $[(2 \times 100) - (2.2 \times 100)] \times$ Rs 14 = Rs 280 (unvarouable).

Since the actual consumption of materials is more than the standard quantity required for producing 100 units of output, the MUV is unfavourable.

Factors Responsible for MUV There may be several reasons for a material quantity variance. The important ones are listed below:

1. Carelessness in the use of materials handled by workers and other production personnel.
2. Poor or improper machine adjustment.
3. Substitution of sub-standard or defective materials causing excessive materials consumption.
4. Change in product specification or design requiring usage different from the standard.
5. Inefficient and inadequate inspection of raw materials.
6. Theft of the materials due to poor janitorial services.
7. Wastage due to inefficient production methods or unskilled/untrained employees.
8. Substitution of higher quality materials than the standard leading to lower usage of materials.
9. Improvement in the production process and extra care taken by the workers in carrying out their jobs.
10. Pilferage, wastage and spoilage due to poor stock-keeping function.
11. Defective tools, machines, plant and equipment coupled with their improper maintenance leading to frequent breakdowns and more usage of raw materials.
12. Actual mix of materials being different from the standard mix.
13. Actual yield being different from the standard yield.

Responsibility for MUV The overall responsibility for this variance lies with the production personnel. However, this should not be allowed to become a general premise as in the case of MPV. For instance, the principal cause of a favourable MUV should be the substitution of above-standard materials which result in less waste than what was anticipated when the standard quantity was set. But the purchase of above-standard materials is certainly likely to contribute to an unfavourable material price variance as the higher quality materials would cost more. "Both variances would have been unavoidable, if the materials specified in developing the standard costs were not available, and the purchasing agent bought what he could".[3] From a practical viewpoint, for such a variance, production personnel do not deserve any appreciation and purchasing personnel any criticism. Likewise, the changes in product specifications may cause either favourable or unfavourable usage variances for which the only solution is to change the material usage standard. These examples tend to show that mere arithmetical computation of MUV or for that matter of any variance is not enough. It is the investigation into the causes of variances, which is more fruitful/useful from the point of control.

Graphical Presentation of Material Variances

In Figure 14.3, total MCV (unfavourable) or Rs 500 is partly the result of the high material prices and partly the result of more quantities used.

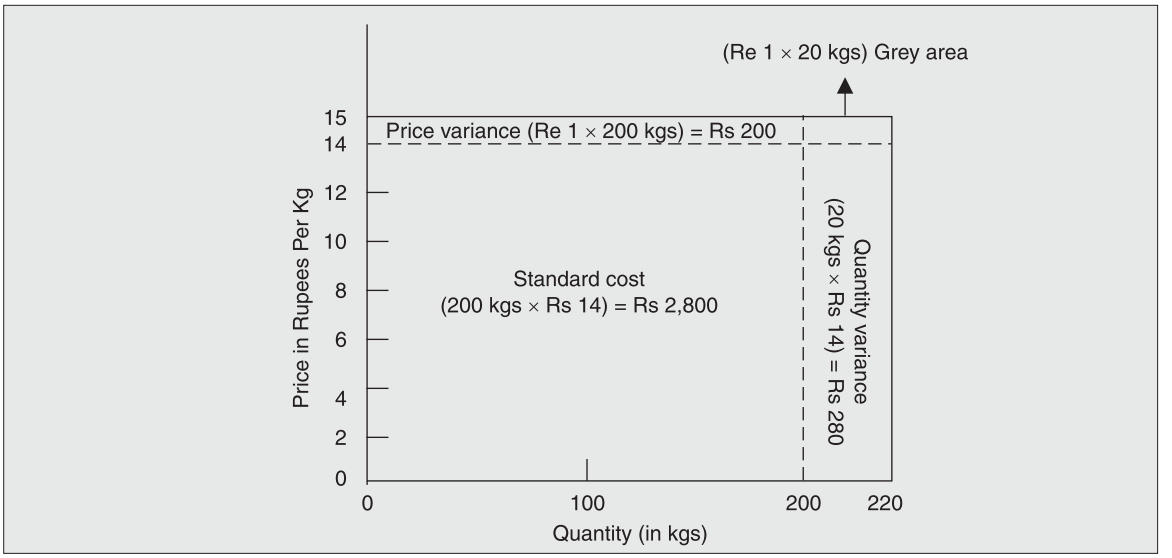

Figure 14.2 *Material Variances*

Clearly, at least Rs 200 of the variance is a material price variance and Rs 280 is the material usage variance. But the remaining Rs 20 is what is called as a "grey area"[4]. It is an inextricable combination of the influence of both a high rate and more material used. But it will be just logical if Rs 20 variance is clubbed with material price variance because the production personnel cannot be held responsible for the high prices paid by the purchase department. Moreover, it is the responsibility of the purchase manager to make the materials available at standard rates to the production department and, therefore, Figure 14.3 needs modification in terms of clubbing the grey area with price variance. The modification is shown in Figure 14.4.

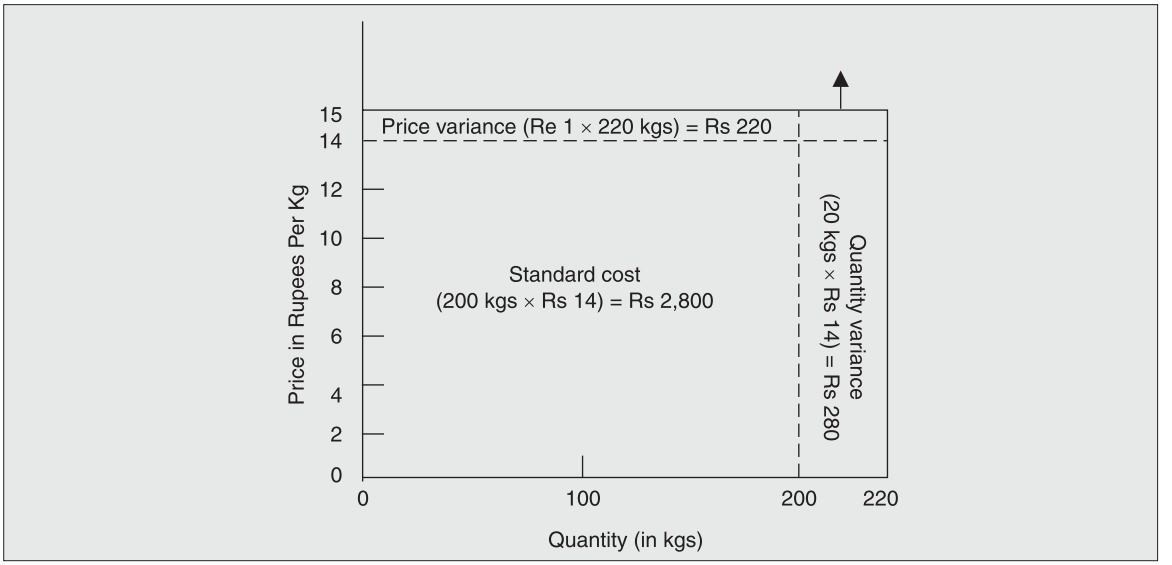

Figure 14.3 *Modified Material Variances*

It is in this context that the conventional variance analysis, which includes the joint price-efficiency variance as a part of an overall price variance, is said to be logically deficient. Further, the efficiency variance is considered more important than the price variance as the manager can exert more direct influence over the efficiency variance. It is also felt that joint-price efficiency variance is less likely to cause arguments if it is buried in the efficiency variance.[5]

The MUV can be further subdivided into (i) Material mix sub-variance and (ii) Material yield sub-variance.

Material Mix Sub-Variance (MMSV) It is possible that a product may use more than one type/grade of raw materials or combination of materials. This combination is called the material mix. In such a situation, it may be possible to alter the mix of materials used from the pre-determined standard mix (ratio) set, the reasons being non-availability or inadequate supply of one or more types of raw material, or the price of a particular type of material may have gone up making it uneconomical in the given price situations of its finished product: the availability of a new substitute for one or more types of raw materials already being used either because they are cheaper and/or better in quality.

Thus, substituting one raw material for another, even though the total input quantity of all materials does not exceed the standard amount, merits a separate computation. This is determined by a material mix variance. It may be stressed that the material mix variance is not an additional variance; it is a sub-variance of material usage/quantity variance and, therefore, it is more appropriately designated as material mix sub-variance (MMSV). Thus, the MMSV is a function of the difference between the standard mix and the actual mix input/quantities of all grades of materials actually used and their corresponding standard prices. Such a variance is to be calculated for each type of material. Symbolically,

MMSV = (Standard mix of actual total quantity of material used) – (Actual mix of actual quantity of material used) × SR

For the sake of abbreviation, standard mix may be referred to as revised standard quantity (RSQ) and actual mix (AM). Accordingly,

$$\text{MMSV} = (\text{RSQ} - \text{AQ}) \times \text{SR} \tag{14.5}$$

EXAMPLE 14.2

A manufacturing company uses the following standard mix of their compound in one batch of its production line:

50 kgs of material X at the standard price of Rs 2.
30 kgs of material Y at the standard price of Rs 3.
20 kgs of material Z at the standard price of Rs 4.

The actual mix was as follows:

60 kgs of material X
40 kgs of material Y
10 kgs of material Z.

Determine the MMSV.

SOLUTION

The determination of MMSV involves the following steps:

1. Standard proportion (mix) of materials X, Y and Z (5:3:2) or (50:30:20).
2. Actual total quantity used, 110.
3. Standard mix of actual quantity used (RSQ) by using the following criterion:
   (Total actual quantity used) × (Standard proportion of each type of material) (14.6)

Where

X = 110 kgs × 5/10 = 55 kgs
Y = 110 kgs × 3/10 = 33 kgs
Z = 110 kgs × 2/10 = 22 kgs

MMSV = (RSQ – AQ) × SP

X (55 – 60) × Rs 2 = Rs 10 (unfavourable)
Y (33 – 40) × Rs 3 = Rs 21 (unfavourable)
Z (22 – 10) × Rs 4 = Rs 48 (favourable)
Net MMSV = Rs 17 (favourable)

Example 14.2 demonstrates that MUV is unfavourable as the total usage (110 kgs) exceeds the actual usage (100 kgs) but the MMSV is favourable. This may be indicative of general production inefficiencies.

MMSV will occur only when there is a difference between standard material mix ratio and actual material mix ratio. It has no relation with actual material consumption. There may be a higher or lower amount of material usage from the standard but there will be no MMSV if standard mix matches with actual mix. This is illustrated in Table 14.1.

Table 14.1 Material Mix Sub-variance

Type of materials	*Combination of materials (kgs)*			
	Standard	*Actuals (in different situations)*		
		(1)	*(2)*	*(3)*
X	50	45	55	45
Y	30	27	33	36
Z	20	18	22	19
	100	90	110	100

In situations (1) and (2), there will be no MMSV as the proportion of the AQ used is in tune with standard proportion or RSQ and AQ are the same. To take situation (1) for illustration purposes: (RSQ – AQ) × SR

X = 90 × 5/10 = (45 – 45) × Rs 2 = Nil
Y = 90 × 3/10 = (27 – 27) × Rs 3 = Nil
Z = 90 × 2/10 = (18 – 18) × Rs 4 = Nil

In situation (3), though there is no material usage variance, there is MMSV:

X = (50 – 45) × Rs 2 = Rs 10 (favourable)
Y = (30 – 36) × Rs 3 = Rs 18 (unfavourable)
Z = (20 – 19) × Rs 4 = Rs 4 (favourable)
Net MMSV = Rs 4 (unfavourable)

Thus, the MMSV is a consequence of relative rather than absolute differentials in materials usage.

The computation of the MMSV is a useful exercise in that it reveals information that might otherwise be concealed. It shows separately the effect of varying the mix of materials on the material cost variance. Above all, the substantial deviations from the standard product mix may adversely affect the quality of the product.

In Example 14.2, the unfavourable MUV is Rs 10, as shown by the following calculations:

MUV = (SQ – AQ) × SR

X = (50 kgs – 60 kgs) × Rs 2 = Rs 20 (unfavourable)
Y = (30 kgs – 40 kgs) × Rs 3 = Rs 30 (unfavourable)
Z = (20 kgs – 10 kgs) × Rs 4 = Rs 40 (favourable)
Net MUV = Rs 10 (unfavourable)

Taking away the MMSV (Rs 17 favourable), there is a balance of Rs 27 (unfavourable) to be explained. Obviously, this figure represents excess usage. The materials usage variance (revised) should reveal the excess usage (Rs 27), as shown in Table 14.2.

Table 14.2 Material usage Variance

Material	*SQ*	*AQ*	*SP*	*Total SC*
A	50	60	Rs 2	Rs 100
B	30	40	3	90
C	20	10	4	80
	100	110	2.7	270

MUV (revised) = (AQ – SQ) × Weighted average SP = (110 – 100) × Rs 2.7 = Rs 27 (unfavourable)

Weighted average standard price = Total SC/Total SQ = Rs 270/100 = Rs 2.7. Thus,

$$\text{MUV} = \text{MMSV} + \text{MUV (revised)} \tag{14.7}$$

Material Yield Sub-Variance (MYSV) The material usage variance (revised) can be more appropriately designated as material yield sub-variance (MYSV). Excess or under material usage from the standard clearly reflects that actual production (yield) is more or less than standard production (yield) expected out of the actual materials input. "The world 'yield' denotes 'output', but this facts is not always directly recognised in the calculations used to ascertain the sub-variance. Often inputs of materials for a specific output are considered."[6] In other words, if the actual material usage is more than the standard, the yield variance would be negative or unfavourable. On the other hand, if standard material quantity exceeds the actual usage, the yield is favourable in that actual production is more than standard production.

In Example 14.2, on the basis of inputs, the yield sub-variance would be given by the following formula: (Actual input-Standard input) × Weighted average standard input price = (110 – 100) × Rs 2.7 = Rs 27 (unfavourable)

Keeping in view the meaning of yield as production, it will be more logical to determine MYSY on the basis of ouputs, that is, standard and actual production (yield). It is determined as follows:

$$\text{MYSV} = (\text{Standard yield} - \text{Actual yield}) \times \text{Standard material cost per unit of finished output} \tag{14.8}$$

Alternatively, MYSV = (Standard loss of final product in units – Actual loss of final product of units)

$$\times \text{Standard material cost unit of finished output} \tag{14.9}$$

The concept of MYSV is particularly useful in the case of process industries like sugar, chemicals, and so on where a certain specified yield is expected from a given input of materials.

EXAMPLE 14.3

In a chemical manufacturing company, 80 per cent is the standard yield expected of actual inputs; 50 units of inputs are introduced in the process and actual final production achieved is 38 units. The standard price per unit of input is Rs 8. Determine the material yield sub-variance by various methods.

SOLUTION

(a) *Output basis:*

(i) (Standard yield – Actual yield) × Standard material cost per unit of finished output
= [40 (0.80 × 50) – 38] × Rs 10 (Rs 8 × 100/80) = Rs 20 (unfavourable)

(ii) (Standard loss – Actual loss) × (Standard material per unit of finished output)
= (10 – 12) × Rs 10 = Rs 20 (unfavourable).

(b) *Input basis:*

(Actual input – Standard input) × Standard input price = [50 – 47.5 (38 × 10)/8] × Rs 8 = Rs 20 (unfavourable)

It is important to note that in the case of the output basis of determining the MYSV, the multiplying factor is standard yield price which is higher than standard input price. This is because the actual input

required to produce one unit of final output would be higher. Therefore, loss or gain in the actual output from the standard should be at the standard yield price.

In the case of the input basis, the excess or lower consumption of materials for obvious reasons should be valued at the standard input price. In the case of products making use of more than one type of raw material, the multiplying factor should be the weighted average standard input price. Both the methods would give identical results.

LABOUR VARIANCES

Labour variance is popularly known as labour cost variance. Labour, unlike materials, cannot be stored. Therefore, the purchase and usage of labour services go hand in hand. However, labour cost variance (LCV) is computed like material cost variance. It is the difference between the standard labour costs and the actual labour costs of the period.

Symbolically,

$$LCV = (SH \times SR \times AO) - (AH \times AR \times AO) \text{ (on per unit basis)} \quad (14.10)$$

$$LCV = (TSLC - TALC) \text{ (on aggregative basis)} \quad (14.11)$$

Where

SH = Standard labour hours required per unit
SR = Standard wage rate per hour
AO = Actual output achieved during the period
AH = Actual labour hours spent per unit
AR = Actual wage rate per hour
TSLC = Total standard labour cost of actual output
TALC = Total actual labour cost of actual output

EXAMPLE 14.4

From the following information, compute the labour cost variance (LCV).

Particulars	*Standard*	*Actual*
Labour-hours per unit	4	5
Wage rate (Rs)	2.5	3
Actual units produced		100

SOLUTION

$$LCV = [(SH \times SR \times AO) - (AH \times AR \times AO)]$$
$$= (4 \times \text{Rs } 2.5 \times 100) - (5 \times \text{Rs } 3 \times 100) = \text{Rs } 500 \text{ (unfavourable/A)}$$

It is useful to mention here that the treatment of labour variances, in large measure, parallels material variances. The LCV can be divided into: (i) Labour rate variance and (ii) Labour efficiency variance.

Labour/Wage Rate Variance (LRV)

This arises when there is a difference between the actual wage rate paid and the pre-determined standard wage rate. The LRV ignores the question of whether the actual labour-hours worked during the period were more or less than the standard labour-hours required to complete the work; it is concerned only with actual worked hours. Thus, the LRV is a function of the difference between the actual wage rate (AR) and the standard wage rate (SR) and the actual total labour-hours worked. Symbolically,

$$LRV = (SR - AR) \times AH \times AO \quad (14.12)$$

In Example 14.4, LRV = (Rs 2.5 – Rs 3.0) × 5 × 100 = Rs 250 (unfavourable)

It is important to note here that if the mode of wage payment is on a product basis, the LRV would be equal to the difference between the standard piece wage rate and the actual piece wage rate multiplied by the actual units produced during a period. The LRV should be determined for each grade of labour, namely, skilled, semi-skilled and unskilled separately.

Factors Responsible for LRV The labour rate variance can be traced to a variety of causes. The important of these are enumerated below:

1. Change in the basic wage structure or in piece work rate not yet reflected in the standard wage rage.
2. Employing a worker-mix (explained later) different from the standard-mix which was originally planned. For instance, less skilled workers may be employed in place of skilled workers planned in the standard wage rate. Conversely, work which used to be performed by lower paid employees may have been assigned to the more skilled workers. In either case, a wage rate which is different from the standard wage rate will be paid.
3. To meet the demand of urgent orders, workers may have been asked to work overtime. The overtime rates may be higher than the standard wage rate, causing a variance to result.
4. During a recession period of lower demand and output, the lower paid unskilled labourers may have been laid off and their task assigned to higher paid skilled labourers. Skilled labourers are to be paid at a higher wage rate as compared to unskilled labourers.
5. Casual and temporary workers employed to meet seasonal demands or some special urgent job orders, are paid at the rates different from the standard.

Responsibility for LRV From the reasons outlined above, it is very clear that the LRV, often, will be an uncontrollable variance for rates are usually determined by supply and demand conditions in the labour market, wage awards by Wage Tribunals/Boards, and so on. The departmental executives may be held responsible only for that portion of the LRV which arises due to employment of wrong grades of labour. It does not mean that the LRV is of no significance to the management. Being largely uncontrollable in nature, the management should revise the wage rate standard for future periods.

Labour Efficiency Variance (LEV)

This is similar to the material usage variance. The time required by the labour force is an index of its efficiency. Accordingly, the variance which seeks to isolate the impact of working greater or lesser number of hours than the standard hours in production is called the labour efficiency variance (LEV) or labour time variance. Like material usage variance, LEV is concerned only with the standard wage rate. Thus, LEV is a function of the difference between the hours workers should have consumed in actual production and the actual hours worked and the standard wage rate. Symbolically,

$$\text{LEV} = [(\text{SH} \times \text{AO}) - (\text{AH} \times \text{AO})] \times \text{SR} \qquad (14.13)$$

In Example 14.4, LEV will be: [(4 × 100) – (5 × 100)] × Rs 2.5 = Rs 250 (unfavourable)

However, if the method of piece wages payment is followed in the organisation, there will be no labour efficiency variance.

Reasons for LEV The chief causes giving rise to LEV are outlined as follows:

1. Lack of congenial working conditions adversely affecting the efficient working of the labour force. Examples of poor working conditions are inadequate or excessive heating, lighting and ventilation.
2. Failure to maintain machinery, equipment and tools in proper working condition or workers having to work with old and defective machines and tools which have frequent breakdowns.
3. Use of sub-standard raw materials, or higher standard raw materials requiring more or less time than the standard.

4. Inefficient organisation leading to delays in routing work, materials, tools and instructions.
5. Incompetent supervision or more strict supervision than required.
6. Work on new machines, equipment or tools in a factory requiring less time than provided for, but the standard remains unrevised.
7. Basic inefficiency of workers due to inadequate training, incorrect instructions and worker's dissatisfaction owing to low morale and lack of motivation.
8. Change in the quality control standards.
9. Increase in labour turnover.
10. Gang composition (labour-mix) being different from the standard.

This variance is of prime significance to the production managers. It is the best indication of labour efficiency. Hence, its causes should be carefully thought over and reported so that prompt action can be initiated to overcome the cause. This variance, unlike LRV, is largely controllable in nature, is more amenable to managerial action and management's prompt action can lead to large savings. To overcome an unfavourable LEV, management's endeavour should be to provide a conducive environment in terms of the introduction of new equipment or tools and their proper maintenance, proper lighting and ventilation facilities, and so on. These measures will help in improving the general efficiency of the workers.

The labour efficiency variance can be sub-divided into (a) Idle time variance; (b) Labour revised efficiency variance consisting of (i) Labour mix sub-variance and (ii) Labour yield sub-variance.

Idle Time Variance This variance represents that segment of the LEV which arises due to the standard cost of those actual hours for which the workers have been paid but during which they remain idle due to non-availability of raw materials, breakdown of machines, failure of power and such other abnormal circumstances. This variance, by definition, is unfavourable and is calculated as follows:

$$\text{(Idle time in hours} \times \text{Standard wage rate)} \tag{14.14}$$

Therefore, it will be more coherent to compute the true labour efficiency variance after making an adjustment for this factor. In the absence of that, the LEV is likely to be misunderstood. The management may regard the labour force inefficient which in fact may not be the case. In other words, employees will be blamed for inefficiency when the true cause may have been beyond their control, such as breakdown in power supply, and so on. To demonstrate the point, assume in Example14.4 that the number of idle time hours during the period was 110. The idle time variance would be unfavourable by Rs 275 (110 hours × Rs 2.5). The workers, in fact, actually worked only for 390 hours, the standard hours allowed for which were 400. Clearly, the workers are more efficient and not inefficient. The earlier conclusion has just got reversed. The revised LEV is Rs 25 favourable [(390 hours – 400 hours) × Rs 2.5]. Thus, it is useful to segregate idle time variance from the total LEV:

Idle time variance	Rs 275 (unfavourable)
Labour efficiency variance (revised)	25 (favourable)
Total labour efficiency variance	250 (unfavourable)

This form of presentation of reporting LEV is certainly more useful to the management for controlling future costs and initiating control action compared to the single figure of the total LEV of Rs 250.

Labour Revised Efficiency Variance Sometimes a change in the grade of labour employed on an operation has to be made from the standard labour-mix due to shortage of one grade of labour during a certain period. The variance which isolates the impact of such a change in gang composition (labour-mix) on the labour cost variance is designated as the labour-mix variance or gang composition variance. Like the material mix sub-variance (MMSV), this variance is a function of the difference between the actual labour-mix and standard labour-mix and the standard wage rate. Symbolically,

LEV = [Standard mix of actual labour hours worked (RSH) – Actual mix of actual hours worked (AH)] × SR (14.15)

EXAMPLE 14.5

The standard labour – mix for producing 100 units a of product is:
4 skilled men @ Rs 3 per hour for 20 hours
6 unskilled men @ Rs 2 per hour for 20 hours
But due to shortage of skilled men, more unskilled men were employed to produce 100 units. Actual hours paid for were:
2 skilled men @ Rs 4 per hour for 25 hours
10 unskilled men @ RS 2.50 per hour for 25 hours.
Compute the labour mix variance.

SOLUTION

The data can be presented as follows:

Category of workers	*Standard*					*Actual*				
	Number	*Hours*	*Total hours*	*SR*	*TSLC*	*Number*	*Hours*	*Total hours*	*AR*	*TALC*
Skilled	4	20	80	3	240	2	25	50	4	200
Unskilled	6	20	120	2	240	10	25	250	2.5	625
Total			200	2.4	480			300	2.75	825

LCV = TSLC – TALC = Rs 480 – Rs 825 = Rs 345 (unfavourable)

(a) LRV = (SR – AR) × AH
  (i) Skilled = (Rs 3 – Rs 4) × 50 = Rs 50 (unfavourable)
  (ii) Unskilled = (Rs 2 – Rs 2.5) × 250 = Rs 125 (unfavourable)
  Total LRV = Rs 175 (unfavourable)

(b) LEV = (SH – AH) × SR
  (i) Skilled = (80 – 50) × Rs 3 = Rs 90 (favourable)
  (ii) Unskilled = (120 – 250) × Rs 2 = Rs 260 (unfavourble)
  Total LEV = Rs 170 (unfavourable)

Total LEV can be split into: (a) Labour mix sub-variance, and (b) Labour yield sub-varinace

Labour Mix Sub-Variance To determine the labour mix sub-variance (LMSV), we are required to calculate the values of revised standard hours for two grades of labour. The revised standard hours for skilled and unskilled labourers respectively would be: Actual total hours × Proportion of skilled hours to the total standard hours.

$$= \frac{300 \times 80}{200} = 120 \text{ hours (skilled)}$$

$$= \frac{300 \times 120}{200} = 180 \text{ hours (unskilled)}$$

LMSV = (RSH – AH) × SR

(i) Skilled = (120 – 50) × Rs 3 = Rs 210 (favourble)
(ii) Unskilled = (180 – 250) × Rs 2 = Rs 140 (unfavourble)
Total LMSV = Rs 70 (favourable)

The residual LEV should be Rs 240 (unfavourable).

Labour Yield Sub-Variance Like the material yield sub-variance, it is determined after taking away the materials mix sub-variance. The basis of computation of labour yield sub-variance (LYSV) would be to find out how many more or less than the total absolute standard hours (and not their break-up) are used in making the actual production (here 100 units). Here, the number of standard hours required are 200; the actual hours worked are 300. The difference is to be multiplied by the weighted average standard rate. Symbolically.

LYSV = (TSHs – TAHs) × Weighted average SR = (200 – 300) × Rs 2.4 = Rs 240 (unfavourable)

The above method of determining the LYSV is based on the input basis. The LYSV like the MYSV can be determined on the output basis also. The formula is:

(Standard yield in units expected from the actual hours worked-Actual yield) × Standard labour cost per unit (14.16)

= (150 – 100) × Rs 4.8 = Rs 240 (unfavourable)

In 300 hours, the standard yield should be 150 units because in 200 hours, the expected yield is 100 units.

LEV = LMSV = Rs 70 (favourable)
LYSV = Rs 240 (unfavourble)
= Rs 170

This information indicates to the management that on account of employing more unskilled labourers, the LMSV turned out to be favourable. But it had an adverse bearing on the overall efficiency as the actual hours used were considerably larger than standard hours required to complete the work.

It is important to note that the two labour sub-variances—LMSV and LYSV—are parts of LEV adjusted for idle time variance. Total LEV has three sub-variances. To illustrate, assume idle time hours are 30. The revised values of various labour variances would be as follows:

LCV = (As in Example 14.5) = Rs 345 (unfavourable)
LRV = Rs 175 (unfavourable)
TLEV = Rs 170 (unfavourable)

Labour idle time variance:

Skilled: (5 hours × Rs 3) = Rs 15
Unskilled: (25 hours × Rs 2) = Rs 50
Rs 65 (unfavourable)

The other two sub-variances will be based on the remaining working hours (300 – 30) = 270 hours.

$$\text{RSH: Skilled} = 270 \times \frac{80}{200} = 108 \text{ hours}$$

$$\text{Unskilled} = 270 \times \frac{120}{200} = 162 \text{ hours}$$

LMSV = (RSHs – Ahs) × SR
Skilled = (108 – 45) × Rs 3 = Rs 189 (favourable)
Unskilled = (162 – 225) × Rs 2 = Rs 126 (unfavourable)
Total LMSV = Rs 63 (favourable)

Note It is assumed that actual idle hours were in the ratio of 1:5 (50 : 250, actual hours worked).
LYSV = (200 – 270) × Rs 2.4 = Rs 168 (unfavourable)

STANDARD COST ACCOUNTING

The preceding discussions have shown that variance analysis is based on a comparison of standard and actual data. The availability of standard data is, therefore, a prerequisite of variance analysis. This section dwells on the methods of incorporating standard costs in the accounting records.

Standard costs should be considered as costs which pass through the cost accumulation procedure into financial statements. There are three methods of incorporating standard costs in the costs accounting cycle: (i) single plan (full standard costing plan), (ii) partial plan, and (iii) dual plan. Of these, the first, namely, full standard costing plan is more appropriate for purposes of variance analysis, because debits and credits to the work-in-process account under this plan are made at standard costs only.

Under the single plan, the difference between standard and actual costs are debited or credited to the related variance account. Favourable variances are represented by credit balances as they reflect cost reductions or savings as compared with standard costs. Conversely, debit balances imply unfavourable variances as they represent excess costs.

The accounting procedure is similar to that of the actual cost system, the only difference being that there is an additional variance account that appears on the debit side in the case of excess actual cost, and on credit side in the case of lower actual costs, compared with standard costs. The accounting procedure of recording variances is illustrated below:

1. (a)	(i)	*Purchase of materials* (AP > SP):		
		Materials Inventory A/c	Dr	
		Materials Price Variance A/c	Dr	
		To Suppliers/Cash		
	(ii)	(AP < SP)		
		Materials Inventory A/c	Dr	
		To Materials Price Variance A/c		
		To *Suppliers/Cash*		

The materials inventory account is debited, in all the cases, at the standard price of the units purchased. The liability in terms of the amount payable to the suppliers (in the case of credit purchases) is always at the actual cost, the difference being in the balance to be transferred to the materials price variance account.

(b)	(i)	*Usage of materials:* (AQ > SQ)		
		Work-in-process A/c	Dr	
		Materials Usage Variance A/c	Dr	
		To Materials Inventory A/c		
	(ii)	(SQ < AQ)		
		Work-in-process A/c	Dr	
		To *Materials Inventory* A/c		
		To Materials Usage Variance A/c		
	(iii)	(SQ = AQ)		
		Work-in-process A/c	Dr	
		To Materials Inventory A/c		

The work-in-process account is debited for the standard quantity of materials to be consumed in producing the actual output at standard price. Materials inventory account, as already appearing at the standard price, will be credited by the product of actual quantities used and the standard price.

2. (a)	(i)	*Accruals of direct labour* (AR > SR)	
		Direct labour payroll	Dr
		Labour rate variance	Dr
		To Accrued payroll	
	(ii)	(SR < AR)	
		Direct labour payroll	Dr
		To Accrued payroll	
		To Labour rate variance	
	(iii)	(SR = AR)	
		Direct labour payroll	Dr
		To Accrued payroll	

The direct labour payroll account is debited in all the cases at the standard wage rate (SR). The total amount debited would be equal to actual hours worked, multiplied by the SR per hour. The accrued payroll account will be credited with the actual amount payable to the workers. The labour rate variance accounts for this difference.

(b)	(i)	*Actual hours used:* (AH > SH)	
		Work-in-process A/c	Dr
		Labour efficiency variance A/c	Dr
		To Direct labour payroll	
	(ii)	(AH < SH)	
		Work-in-process A/c	Dr
		To Direct labour payroll	
		To Labour efficiency variance	
	(iii)	(AH = SH)	
		Work-in-process A/c	Dr
		To Direct labour payroll	

The work-in-process account is debited for the standard hours in production at the standard wage rate. The direct labour payroll amount is determined by multiplying actual hours worked with standard wages rate. The difference between the two represents favourable or unfavourable labour efficiency variance.

Standard Accounting Procedure for Completed Products

Under the single plan system, the work-in-process account is debited at standard costs only. Consequently, it will be standard costs of the completed units that will be transferred from that account to the finished product account. The required entry for the purpose is:

Finished product (at standard cost)	Dr
To Work-in-process (at standard costs)	
When goods are sold to customers the following two entries will be required:	
1. Debtors A/c	Dr
To Sales (at selling price)	
2. Cost of goods sold (at standard cost)	Dr
To Finished cost inventory (at standard cost)	

SUMMARY

- Variance analysis is a control technique. The control process involves comparison of actual costs *(AC)* with the standard costs (*SC*). Variances represent the difference between *AC* and *SC*. They basically relate to performance deviations. If *AC* is less than *SC*, it is a sign of efficiency and the difference is termed 'favourable'/'positive'. If it is more than *SC*, it is a sign of inefficiency and the difference is referred to as 'unfavourable'/'negative'.
- As controlling devices, variances help to assign responsibility for deviations and, thus, to control cost. For this purpose, they are classified as controllable and uncontrollable. If a variance can be traced with the responsibility of a particular segment, it is said to be controllable. If a variance arises from causes beyond the control of responsible individuals, it is said to be *uncontrollable*. This distinction is extremely important for managerial control.
- The cost variances relate to the costs of a manufacturing enterprise. The three elements of the costs of such an enterprise are: material, labour, and overheads.
- Material variances are summarised below:

Variance	*Formula*
(A) Material cost variance (*MCV*) (unit basis)	$(AQ \times AO \times AP) - (SQ \times SP \times AO)$
or MCV (aggregate basis)	*TAMC – TSMC*
(B) (i) Material purchase price variance	$(AP - SP) \times AQ$ purchased
(ii) Material price variance (*MPV*)	$(AP - SP) \times AQ$ issued
(C) Material usage/quality variance (*MUV*) (unit basis)	$[(AQ \times AO) - (SQ \times AO)] \times SP$
or MUV (aggregate basis)	or $(TAMQ - TSMQ) \times SP$
(i) Material-mix sub-variance (*MMSV*) and	$(RSQ - AQ) \times SP$
(ii) Material-yield sub-variance (*MYSV*) (output basis)	$(AY - SY) \times SMC$ per finished unit
or MYSV (input basis)	$(TAMQ - TSMQ) \times$ Weighted average standard price per unit of material

Where,

AQ	Actual usage of material per unit
AO	Actual output in units
AP	Actual price of material per unit
SQ	Standard usage of material per unit
SP	Standard price of material per unit
TAMC	Total actual material costs incurred
TSMC	Total standard costs of actual output
TAMQ	Total actual quantity of material used
TSMQ	Total standard quantity of material required
RSQ	Revised standard quantity, i.e. standard mix/proportion of actual total quantity of material used
AY	Actual yield (actual finished output)
SY	Standard yield (expected output, given the actual input).

- Labour variances are summarised below:

Variance	*Formula*
(A) Labour cost variance (*LCV*), (unit basis)	$[(AH \times AO \times AR) - (SH \times SR \times AO)]$
or LCV (aggregate basis)	*(TALC – TSLC)*
(B) Labour/Wage rate variance (*LRV*)	$(AR - SR) \times TAH$ paid for

(*Contd.*)

(*Contd.*)

(C) Labour efficiency variance (*LEV*)	(*TAH – TSH*) × *SR* per hour
or	
(i) Labour idle time variance (*LIV*) *and*	(*IH*) × *SR* per hour
(ii) Labour efficiency variance revised (*LEV* revised)	(*TAHW – TSH*) × *SR* per hour
or	
Labour-mix sub-variance (*LMSV*)	(*RSH – AH*) × *SR* per hour
Labour-yield sub-variance (*LYSV*) (output basis)	(*AY – SY*) × Standard labour cost per finished unit
or LYSV (input basis)	(*TAH – TSH*) × Weighted average standard rate per hour

Where,

AH	Actual labour-hours spent per unit
AO	Actual output achieved in units
AR	Actual wage rate per hour
SH	Standard labour-hours required per unit
SR	Standard wage rate per hour
TALC	Total actual labour cost of actual output
TSLC	Total standard labour cost of actual output
TAH	Total actual labour-hours paid for
TSH	Total standard hours allowed for actual output
IH	Idle hours
TSHW	Total actual hours worked for production (*TAH – IH*)
RSH	Revised standard hours, i.e. standard proportion of actual hours used.

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SOLVED PROBLEMS

P.14.1 In a manufacturing process the following standards apply

Standard price	:	Raw material X @ Re 1 per kg
		Raw material Y @ Rs 5 per kg
Standard mix (by weight)	:	75% X, 25% Y
Standard yield	:	(Weight of product as percentage of weight of raw material, 90%)

In a period, the actual costs, usages and output were as follows:

Used: 4,400 kgs, X costing Rs 4,650
1,600 kgs, Y costing Rs 7,850

Output: 5,670 kgs of products

The budget output for the period was 7,200 kgs.

Prepare a statement, showing how the material cost variance is built up, and give activity and yield percentages.

SOLUTION

Total input requirement = 5,670 kgs $\times \frac{100}{90}$ = 6,300 kgs

Raw material X = 4,725 kgs (0.75 × 6,300 kgs)
Y = 1,575 kgs (0.25 × 6,300 kgs)

	Standard			*Actual*		
Raw material	*(SQ)(kgs)*	*(SR)*	*(SC)*	*(AQ) (kgs)*	*(AR)*	*(AC)*
X	4,725	Rs 1	Rs 4,725	4,400	Rs 465/440	Rs 4,650
Y	1,575	5	7,875	1,600	785/160	7,850
Total	6,300	2	12,600	6,000	125/60	12,500

Material cost variance: (SC – AC) = (Rs 12,600 – Rs 12,500) = Rs 100 (favourable)

Material cost variance is built up of the following three sub-variances:

1. *Material price variance:* (SR – AR) × AQ = (SR × AQ) – (AR × AQ)
   Raw material X = (Re 1 × 4,400) – Rs 4,650 = Rs 250 (adverse)
   Y = (Rs 5 × 1,600) – Rs 7,850 = 150 (adverse)
   400 (adverse)
2. *Material mix variance* = (Standard mix of actual quantity used – Actual mix of actual quantity used) × SR
   Raw material X (0.75 × 6,000 = 4,500 – 4,400) × Re 1 = Rs 100 (favourable)
   Y (0.25 × 6,000 = 1,500 – 1,600) × Rs 5 500 (adverse)
   Total material mix variance 400 (adverse)
3. *Material yield variance:* (Standard yield – Actual yield) × SC per unit = (5,400 – 5,670) × Rs 12,600/5,670 = Rs 600 (favourable)
   Standard yield = 0.90 × 6,000 kgs = 5,400 kgs
   Alternatively, material yield variance, can be calculated on an input basis also: (Standard quantity of raw materials required to produce actual output – Actual quantity used for actual production) × Standard weighted average cost per kg = (6,300 – 6,000) × Rs 2 = Rs 600 (favourable).
   The material cost variance is built up of MPV, Rs 100 (A), MMV, Rs 400 (A), and MYV, Rs 600 (F) = 100 (favourable).

   $$\text{Activity percentage} = \frac{\text{Standard yield for actual input}}{\text{Budgeted output}} \times 100 = \frac{5,400}{7,200} \times 100 = 75 \text{ per cent}$$

   $$\text{Yield percentage} = \frac{\text{Actual yield}}{\text{Standard yield}} \times 100 = \frac{5,670}{5,400} \times 100 = 105 \text{ per cent}$$

P.14.2 The standard material cost for 100 kgs of chemical D is made up of
Chemical A—30 kgs @ Rs 4 per kg
Chemical B—40 kgs @ Rs 5 per kg
Chemical C—80 kgs @ Rs 6 per kg

In a batch, 500 kgs of chemical D were produced from a mix of:
Chemical A—140 kgs at a cost of Rs 588
Chemical B—220 kgs at a cost of Rs 1,056
Chemical C—440 kgs at a cost of Rs 2,860

How do the yield, mix and the price factors contribute to the variance in the actual cost per 100 kgs of chemical D over the standard cost?

SOLUTION

Table Containing Actual Input Used for 100 kgs (500 kgs ÷ 5 = 100 kgs)

Chemical	*SQ (kgs)*	*SR*	*SC*	*AQ (kgs)*	*AR*	*AC*
A	30	Rs 4	Rs 120	28	Rs 4.2	Rs 117.6
B	40	5	200	44	4.8	211.2
C	80	6	480	88	6.5	572.0
	150	5.33	800	160	5.63	900.8

Material cost variance: (TSC – TAC) = (Rs 800 – Rs 900.80) = Rs 100.80 (adverse)

1. *Material price variance:* (SR – AR) × AQ
   A: (Rs 4 – Rs 4.20) × 28 kgs = Rs 5.60 (adverse)
   B: (Rs 5 – Rs 4.80) × 44 kgs = 8.80 (favourable)
   C: (Rs 6 – Rs 6.50) × 88 kgs = 44.00 (adverse)
   40.80 (adverse)
2. *Material mix variance:* (RSQ – AQ) × SR
   A: 160 × 30/150 = (32 kgs – 28 kgs) × Rs 4 = Rs 16 (favourable)
   B: 160 × 40/150 = (42.67 kgs – 44 kgs) × Rs 5 = 6.67 (adverse)
   C: 160 × 80/150 = (85.33 kgs – 88 kgs) × Rs 6 = 16.00 (adverse)
   6.67 (adverse)
3. *Material yield variance:* [Standard yield (SY) – Actual yield (AY) × SC per unit] = (106.667 – 100) × Rs 8
   = Rs 53.33 A

   Standard yield = Standard production expected from actual quantity used, that is, (160 kgs × 100)/150 kgs
   = 106.67 kgs

   SC per unit = Total standard cost/Total standard output = Rs 800/100 kgs = Rs 8 per kg

Alternatively, material yield variance can be calculated on input basis also: (Total standard quality of raw material required to produce actual output – Actual quantity used for actual production) × Standard weighted average cost per kg = (150 kgs – 160 kgs) × Rs 5.33 = Rs 53.33 (adverse).

P.14.3 A foundry producing castings of a standard alloy uses standard costs. The standard mixture is as follows:

40 per cent material A at Rs 300 per tonne
30 per cent material B at Rs 100 per tonne
10 per cent material C at Rs 420 per tonne
20 per cent scrap metal of this alloy.

It is expected that from each charge, there will be a 5 per cent loss in melt, 35 per cent will be returned to scrap stock (runners, heads, etc.) and 60 per cent will be good castings. Scrap is credited and charged at the standard average cost of the metal mixture. Scrap is credited and charged at the standard average cost of the metal mixture. In a certain period, the following materials are purchased and used:

380 tonnes material A at Rs 310 per tonne
330 tonnes material B at Rs 110 per tonne
90 tonnes material C at Rs 420 per tonne
200 tonnes scrap metal at standard price.

From this material, 608 tonnes of good castings are produced and 340 tonnes of scrap metal are returned to scrap metal stock.

Prepare information for management showing standard metal costs, and variances from standard in respect of this period.

SOLUTION

The standard mixture of 608 tonnes of good casting will be as follows:

Since 60 tonnes of good castings require a standard mixture of 100 tonnes, 608 tonnes require = (608 × 100)/60 = 6,080/6 tonnes, the standard inputs of materials A, B, C and scrap would be 40 per cent, 30 per cent, 10 per cent, and 20 per cent of 6,080/6 tonnes, respectively.

The following table presents the above information:

Materials	*Standard*			*Actual*		
	SQ (tonnes)	*SR*	*SC*	*AQ (tonnes)*	*AR*	*AC*
Material A	1,216/3	Rs 300	Rs 1,21,600	380	Rs 310	Rs 1,17,800
B	304	100	30,400	330	110	36,300
C	608/6	420	42,560	90	420	37,800
Scrap metal	608/3	240	48,640	200	240	48,000
Total	6,080/6	240	2,43,200	1,000	239.9	2,39,900

Standard average price of scrap metal: Total standard cost of material A + B + C/Total quantity of material A, B, C = Rs 1,94,560 ÷ 4,864/6 = Rs 240

Total quantity of material A, B, C 4,864/6

Standard metal cost per tonne (Rs 2,43,200 ÷ 608) = Rs 400

Material cost variance: (Rs 2,43,200 – Rs 2,39,900) = Rs 3,300 (favourable)

(A) *Material price variance:* (SR – AR) × AQ

Material	A (Rs 300 – Rs 310) × 380	=	Rs 3,800 (adverse)
	B (Rs 100 – Rs 110) × 330	=	3,300 (adverse)
	C (Rs 420 – Rs 420) × 90	=	Nil
			7,100 (adverse)

(B) *Material usage variance:* (SQ – AQ) × SR

Material	A (1,216/3 tonnes – 380 tonnes) × Rs 300	=	Rs 7,600 (favourable)
	B (304 tonnes – 330 tonnes) × Rs 100	=	2,600 (adverse)
	C (608/6 tonnes – 90 tonnes) × Rs 420	=	4,760 (favourable)
	Scrap metal (608/3 tonnes – 200 tonnes) × Rs 240	=	640 (favourable)
			10,400 (favourable)

Material usage variance has two components:

(a) *Material mix variance:* (Standard mix of actual quantity used – Actual mix of actual quantity) × SR

Material	A (0.40 × 1,000 = 400 tonnes – 380 tonnes) × Rs 300	=	Rs 6,000 (favourable)
	B (0.30 × 1,000 = 300 tonnes – 330 tonnes) × Rs 100	=	3,000 (adverse)
	C (0.10 × 1,000 = 100 tonnes – 90 tonnes) × Rs 420	=	4,200 (favourable)
	Scrap metal (0.20 × 1,000 = 200 tonnes – 200 tonnes) × Rs 240		Nil
			7,200 (favourable)

(b) *Material yield variance:* (Standard yield – Actual yield) × SC per tonne

(600 tonnes – 608 tonnes) × Rs 400 = Rs 3,200 (favourable)

Total material cost variance = Rs 7,100 (adverse) + Rs 7,200 (favourable) + Rs 3,200 (favourable)
= Rs 3,300 (favourable).

P.14.4 Standard material for 100 kgs Chemical 456 is given below

Kgs		*Total*
45	of material A @ Rs 2 per kg	Rs 90
40	of material B @ Rs 4 per kg	160
25	of material C @ Rs 6 per kg	150
110		
10	standard loss	
100		400

Actual production 2,000 units of Chemical 456 and actual material usage is as follows:

Material A	1,000 kgs @ Rs 1.90 per kg	Rs 1,900
Material B	850 kgs @ Rs 4.20 per kg	3,570
Material C	450 kgs @ Rs 6.50 per kg	2,925
	2,300 kgs	8,395

Calculate the following: (i) Material cost variance, (ii) Material price variance, (iii) Material mixture variance, (iv) Material yield variance, and (v) Material usage variance.

SOLUTION

Standard material input required to produce 2,000 units of chemical 456

Material A: (45/100 × 2,000) = 900 kgs
B: (40/100 × 2,000) = 800 kgs
C: (25/100 × 2,000) = 500 kgs

	Standard			*Actual*		
Material	*SQ (kgs)*	*SR*	*SC*	*AQ (kgs)*	*AR*	*AC*
A	900	Rs 2.00	Rs 1,800	1,000	Rs 1.90	Rs 1,900
B	800	4.00	3,200	850	4.20	3,570
C	500	6.00	3,000	450	6.50	2,925
	2,200	3.63	8,000	2,300	3.65	8,395
	200 (standard loss)					
	2,000 (standard output)					
	Rs 4 SC per unit					

1. *Material cost variance:* (SC – AC): (Rs 8,000 – Rs 8,395) = Rs 395 (adverse)
2. *Material price variance:* (SR – AR) × AQ
   Material A: (Rs 2 – Rs 1.90) × 1,000 kgs = Rs 100 (favourable)
   B: (Rs 4 – Rs 4.20) × 850 kgs = 170 (adverse)
   C: (Rs 6 – Rs 6.50) × 450 kgs = 225 (adverse)
   295 (adverse)
3. *Material mix variance:* (RSQ – AQ) × SR
   Material A: [(2,300 × 45) ÷ 110) – 1,000 kgs] × Rs 2 = Rs 118.18 (adverse)
   B: [(2,300 × 40) ÷ 110) – 850 kgs] × Rs 4 = 54.55 (adverse)
   C: [(2,300 × 25) ÷ 110) – 450 kgs] × Rs 6 = 436.36 (favourable)
   263.63 (favourable)
4. *Material yield variance:* (SY – AY) × SC per kg = [(2,300 × 100) ÷ 110) – 2,000 units] × Rs 4
   = Rs 363.63 (adverse)
5. *Material usage variance:* (SQ – AQ) × SR
   Material A: (900 kgs – 1,000 kgs) × Rs 2 = Rs 200 (adverse)
   B: (800 kgs – 850 kgs) × Rs 4 = 200 (adverse)
   C: (500 kgs – 450 kgs) × Rs 6 = 300 (favourable)
   100 (adverse)

Alternatively,

Material mix variance	Rs 263.63 (favourable)
Plus, material yield variance	363.63 (adverse)
	100.00 (adverse)

P.14.5 From the data given below, calculate:

(a) Individual material price variance for the two materials, X and Y, assuming that the variances are calculated at the time of purchase;

(b) Individual material usage variances for material X and Y assuming that there was no work-in-progress, either at the commencement or at the end of the period.

Particulars	*Material X*		*Material Y*	
	Quantity (kg)	*Value*	*Quantity (kg)*	*Value*
Raw material purchases	2,000	Rs 4,000	5,000	Rs 6,250
Issued to work	2,150		3,950	
Work stock of material				
Opening	300		1,000	
Closing	200		1,250	
Standard price				
Material X – Rs 1.90 per kg				
Material Y – Rs1.30 per kg				
Standard usage:				

	Material X	*Material Y*
Product A	1 kg	1 kg
Product B	0.5 kg	1 kg

Output during the period
Product A—1,130 units
Product B—2,550 units

SOLUTION

(a) *Material purchase price variance* = [Actual rate (AR) – Standard rate (SR)] × Actual quantity (AQ) purchased
Material X : [(AR × AQ) – (SR × AQ)] = Rs 4,000 – (Rs 1.90 × 2,000) = Rs 4,000 – Rs 3,800
= Rs 200 (unfavourable)
Material Y = Rs 6,250 – (Rs 1.30 × 5,000) = Rs 6,250 – Rs 6,500 = Rs 250 (unfavourable)

(b) *Material usage variance* = (Actual quantity used – Standard quantity) × SR

Actual quantity used:	*Material X*	*Material Y*
Opening stock (kgs)	300	1,000
Add issues to work	2,150	3,950
Less closing stock	(200)	(1,250)
	2,250	3,700
Standard usage:		
Product A	1,130	1,130
Product B	1,275	2,550
	2,405	3,680

Material X: (2,250 kgs – 2,405 kgs) × Rs 1.90 = Rs 294.5 (favourable)
Material Y: (3,700 kgs – 3,680 kgs) × Rs 1.30 = Rs 26 (favourable)

P.14.6 One kg of the product K requires two chemicals, A and B. The following are the details of the product K for the month of June.

(a) Standard mix of chemical A, 50 per cent and chemical B, 50 per cent
(b) Standard price per kg of chemical A, Rs 12 and chemical B, Rs 15
(c) Actual input of chemical B, 70 kgs
(d) Actual price per kg of chemical A, Rs 15
(e) Standard normal loss,10 per cent of total output
(f) Material cost variance,total,Rs 650 adverse
(g) Material yield variance,total,Rs 135 adverse
(h) Actual output, 90 kgs

You are required to calculate: (i) Material mix variance(total), (ii) Material usage variance(total), (iii) Material price variance(total), (iv) Actual loss of actual input, (v) Actual input of chemical A, and (vi) Actual price per kg of chemical B.

SOLUTION

(i) *Material mix variance* = (Standard mix of actual quantity used – Actual mix) × Standard rate

A: [(110 kgs × 0.50 = 55kgs – 40 kgs)] × Rs 12 =	Rs 180	(favourable)
B: [(110 kgs × 0.50 = 55kgs – 70 kgs)] × Rs 15 =	225	(unfavourable)
	45	(unfavourable)

(ii) *Material usage variance* = Material mix variance + Material yield variance = Rs 45 (unfavourable) + Rs 135 (unfavourable) = Rs 180 (unfavourable)

(iii) *Material price variance* = (SR – AR) × AQ

A: (Rs 12 – Rs 15) × 40 kgs =	Rs 120	(unfavourable)
B: (Rs 15 – Rs 20) × 70 kgs =	350	(unfavourable)
	470	(unfavourable)

(iv) *Actual loss of actual input* = (Actual input – Actual output) = 110kgs – 90 kgs = 20 kgs

(v) *Actual input of chemical A,* = 40 kgs

(vi) *Actual price per kg of chemical B* = Rs 20

WORKING NOTES

Standard material input and cost required to produce 90 kgs of product K

(a) Chemical A	50 kgs	@ Rs 12 per kg	Rs 600
Chemical B	50 kgs	@ Rs 15 per kg	750
	100 kgs		1,350
Less standard normal loss	10 kgs		
Actual output	90 kgs		

(b) Standard rate per kg of product K = Rs 1,350/90 kgs = Rs 15

(c) Material yield variance = (SY – AY) × SR per kg of final product

Rs 135 U = (SY – 90 kgs) × Rs 15

Rs 135 U = 15 SY – Rs 1,350

Rs 135 U + Rs 1,350 = 15 SY

Rs 1,485 = 15 SY or SY = Rs 1,485/15 = 99 kgs

(d) Actual total input of A and B chemicals = 99 kgs × 100/90 = 110 kgs

(e) Actual inputs of chemical being 70 kgs, input of chemical A would be 40 kgs

(f) Actual costs of material used = Standard cost (Rs 1350) + (unfavourable) material cost variance (Rs 650)
= Rs 2,000

(g) Total cost of chemicals A and B	Rs 2,000
Less cost of chemical A (40 kgs × Rs15)	600
Costs of chemical B(70 kgs)	1,400
Cost of chemical B per kg (Rs 1,400/70 kgs)	20

P.14.7 From the data given below, calculate each of the three wage variances for the two departments:

Particulars	*Department A*	*Department B*
Actual gross wages	Rs 2,000	Rs 1,800
Standard hours produced	8,000	6,000
Standard rate per hour	0.30	0.35
Actual hours worked	8,200	5,800

SOLUTION

Labour cost variance: Actual wages paid – Standard wages charged to production (SH × SR)

Department A: Rs 2,000 – (8,000 × Rs 0.30) = Rs 400 (favourable)

B: Rs 1,800 – (6,000 × Rs 0.35) = Rs 300 (favourable)

Labour rate variance: (SR – AR) × Actual hours (AH) worked) or : (SR × AH) – (AR × AH)

Department A: (Rs 0.30 × 8,200) – Rs 2,000 = Rs 460 (favourable)

B: (Rs 0.35 × 5,800) – Rs 1,800 = Rs 230 (favourable)

Labour efficiency variance: (Standard hours produced – Actual hours worked) × Standard rate per hour

Department A: (8,000 – 8,200) × Rs 0.30 = Rs 60 (adverse)

B: (6,000 – 5,800) × Rs 0.35 = Rs 70 (favourable)

Confirmation

Particulars	*Department A*	*Department B*
Labour rate variance	Rs 460 (favourable)	Rs 230 (favourable)
Labour efficiency variance	60 (adverse)	70 (favourable)
Labour cost variance	400 (favourable)	300 (favourable)

P.14.8 The standard output of product EXE is 25 units per hour in the manufacturing department of a company, employing 100 workers. The standard wage rate per labour-hour is Rs 6. In a 42-hour week, the department produced 1,040 units of EXE despite loss of 5 per cent of time paid due to abnormal reasons. The hourly wage rates actually paid were Rs 6.20, Rs 6, and Rs 5.70, respectively, to 10,30 and 60 of the workers.

Compute relevant variances.

SOLUTION

Basic data:

1. *Standard man-hour per unit* Since 25 units are standard output when 100 workers are engaged for 1 hour, the standard man-hours per unit is 4.

2. *Standard data*

Standard man-hours for actual output	*Rate per hour*	*Amount*	*Number of workers*	*Actual hours Col. 4 (×) 42*	*Idle time paid for*	*Effective hours*	*Rate per hour*	*Amount paid*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9) = (5× 8)*
4,160*	Rs 6	Rs 24,960	10	420	21	399	Rs 6.20	Rs 2,604
			30	1,260	63	1,197	6.00	7,560
			60	2,520	126	2,394	5.70	14,364
		24,960		4,200	210	3,990		24,528

*1,040 units × 4 hours

Computation of variances:

Labour cost variance =(Standard labour cost – Actual labour cost) = (Rs 24,960 – Rs 24,528)
= Rs 432 (favourable)

Labour rate variance = (Standard rate per hour – Actual rate per hour) × Actual hours

(Rs 6 – Rs 6.20) × 420 hours = Rs 84 (adverse)

(Rs 6 – Rs 6) × 1,260 hours = Nil

(Rs 6 – Rs 5.70) × 2,520 hours = 756 (favourable)

672 (favourable)

Labour efficiency variance = (Standard man-hours – Actual production hours) × Standard rate per hour
= (4,160 hours – 3,990 hours) × Rs 6 = Rs 1,020 (favourable)

Labour idle variance = Standard rate per hour × Idle time = Rs 6 × 210 hours = Rs 1,260 (adverse)

Verification:

Labour cost variance = Labour rate variance + Labour efficiency variance + Labour idle time variance
Rs 432 (favourable) = Rs 672 (favourable) + Rs 1,020 (favourable) – Rs 1,260 (adverse)

P.14.9 The standard labour, and the actual labour employment in a week for a job are as under:

Particulars	*Skilled workers*	*Semi-skilled workers*	*Unskilled workers*
(A) Standard number of workers in the gang	32	12	6
(B) Standard wage rate per hour	Rs 3	Rs 2	Rs 1
(C) Actual number of workers employed in the gang during the week	28	18	4
(D) Actual wage rate per hour	4	3	2

During the 40-hours working week, the gang produced 1,800 standard labour-hours of work. Calculate the: (1) Labour efficiency variance; (2) Labour mix variance; (3) Rate of wages variance; and (4) Total labour cost variance.

SOLUTION

Category of workers	*Number of workers*	*Number of hours*	*Total hours*	*Wage rate*	*Total wages*
		Standard			
Skilled	32	40	1,280	Rs 3	Rs 3,840
Semi-skilled	12	40	480	2	960
Unskilled	6	40	240	1	240
			2,000	2.52	5,040
			Actual		
Skilled	28	40	1,120	4	4,480
Semi-skilled	18	40	720	3	2,160
Unskilled	4	40	160	2	320
			2,000	3.48	6,960

1. *Labour efficiency variance:* (Standard labour-hours – Actual labour-hours) × Standard weighted average wage rate = (1,800 – 2,000) × Rs 2.52 = Rs 504 (adverse)
2. *Labour mix variance:* (Standard mix of actual hours worked – Actual mix of actual hours) × Standard wage rate
   Since standard total hours and actual total hours are the same (2,000 hours), there is no need to calculate a revised standard mix of actual hours.
   Accordingly,

Skilled workers: (1,280 – 1,120) × Rs 3	=	Rs 480 (favourable)
Semi-skilled workers: (480 – 720) × Rs 2	=	480 (adverse)
Unskilled workers: (240 – 160) × Re 1	=	80 (favourable)
Total labour mix variance		80 (favourable)

3. *Rate of wages variance:* (SR – AR) × AH

Skilled workers: (Rs 3 – Rs 4) × 1,120	=	Rs 1,120 (adverse)
Semi-skilled workers: (Rs 2 – Rs 3) × 720	=	720 (adverse)
Unskilled workers: (Rs 1 – Rs 2) × 160	=	160 (adverse)
Total labour rate variance		2,000 (adverse)

4. *Total labour cost variance:* (Total standard labour cost at standard hours – Actual labour cost at actual hours)
Standard labour cost = (Standard hours × Standard weighted average wage rate)
= (1,800 × Rs 2.52) = Rs 4,536 – Rs 6,960 = Rs 2,424 (adverse)

P.14.10 A gang of workers normally consists of 30 men, 15 women, and 10 boys. They are paid standard hourly rates as under:

Men	Rs 0.80
Women	0.60
Boys	0.40

In a normal working week of 40 hours, the gang is expected to produce 2,000 units of output.

During the week ended December 31, the gang consisted of 40 men, 10 women, and 5 boys. The actual wages paid were at the rate of Rs 0.70, Rs 0.65 and Rs 0.30, respectively. Four hours were lost due to abnormal idle time and 1,600 units were produced.

Calculate: (i) Wage variance; (ii) Wage rate variance; (iii) Labour efficiency variance; (iv) Gang composition variance (labour mix variance); and (v) Labour idle time variance.

SOLUTION

1. *Wage variance:* (Standard labour cost of actual output – Actual labour cost) = Rs 1,184 – Rs 1,440 or (40 × Rs 36) = Rs 256 (adverse)
Standard cost = (Standard cost per gang-hour × Standard gang-hours required for actual output) = (Rs 37 × 32) = Rs 1,184
Standard Labour Cost (SLC) per Gang-hour

Composition of gang	*Number*	*Rate*	*TSC*
Men	30	Rs 0.80	Rs 24
Women	15	0.60	9
Boys	10	0.40	4
Total SLC per gang hour			37

Standard gang-hours required: (Actual output ÷ Standard output per gang-hour) = 1,600/50 (2000 ÷ 40) = 32
Actual Labour Cost (ALC) per Gang-hour

Particulars	*Number*	*AR*	*Total AC*
Men	40	Rs 0.70	Rs 28.00
Women	10	0.65	6.50
Boys	5	0.30	1.50
Total ALC per gang hour			36.00

2. *Wage rate variance:* (Standard rate – Actual rate) × Actual hours paid for

Men:	(Rs 0.80 – Rs 0.70) × 40 × 40	=	Rs 160 (favourable)
Women:	(Rs 0.60 – Rs 0.65) × 10 × 40	=	20 (adverse)
Boys:	(Rs 0.40 – Rs 0.30) × 5 × 40	=	20 (favourable)
			160 (favourable)

3. *Labour Efficiency Variance*

	Standard composition of gang		*Standard gang hours for actual production*		*Total standard hours required*		*Actual hours paid for*		*Standard wage rate per hour*		*Labour efficiency variance*
Men	(30	×	32	=	960	–	1,600)	×	Rs 0.80	=	512 (adverse)
Women	(15	×	32	=	480	–	400)	×	Rs 0.60	=	48 (favourable)
Boys	(10	×	32	=	320	–	200)	×	Rs 0.40	=	48 (favourable)
											416 (adverse)

4. *Labour idle time variance:* (Idle hours × Standard rate)

Men:	(40 × 4) × Rs 0.80	=	Rs 128 (adverse)
Women:	(10 × 4) × Rs 0.60	=	24 (adverse)
Boys	(5 × 4) × Rs 0.40	=	8 (adverse)
			160 (adverse)

5. *Labour mix variances* (Gang composition variance): (Standard mix used for actual hours used in the production – Actual mix of actual hours) × SWR

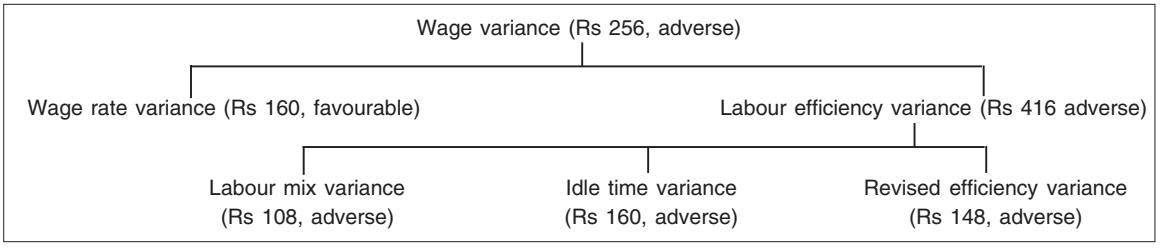
Actual hours used = (Total actual hours – Idle time)

Men	(40 × 40)	1,600
Women	(10 × 40)	400
Boys	(5 × 40)	200
		2,200
Less: Idle time	(55 × 4)	220
Total actual hours		1,980

[Standard mix of actual hours		–	*Actual mix]*		×	*SWR*	=	*Labour mix variance*
Men:	(6/11 × 1,980) = 1,080	–	1,440	(40 × 36)	×	Rs 0.80	=	Rs 288 (adverse)
Women:	(3/11 × 1,980) = 540	–	360	(10 × 36)	×	Rs 0.60	=	108 (favourable)
Boys:	(2/11 × 1,980) = 360	–	180	(5 × 36)	×	Rs 0.40	=	72 (favourable)
	1,980		1,980					108 (adverse)

Labour efficiency variance (revised): (Standard gang-hours required for actual production – Actual gang hours used in production) × Standard wage rate per gang-hours = (32 – 36) × Rs 37 = Rs 148 (adverse).

Summary:



P.14.11 The Standard Supply Company Ltd produces a single article which goes through two operating departments. The standard cost card for this article indicated the following data:

	Standard time (hours)	*Standard rate*	*Total*
Department A	2.2	Rs 5.40	Rs 11.88
Department B	1.6	6.00	9.60

The production for the month of August is 1,000 units. The actual labour costs in the two departments were:

	Hours	*Cost*
Department A	2,000	Rs 12,908
Department B	1,800	10,200

Compute the labour cost, rate and efficiency variances.

SOLUTION

Department	*Standard time required to produce 1,000 units*	*Standard wage rate*	*Total standard wage bill*	*Actual time taken (hours)*	*Actual cost*
A	2,200 (1,000 × 2.2)	Rs 5.40	Rs 11,880	2,000	Rs 12,908
B	1,600 (1,000 × 1.6)	6.00	9,600	1,800	10,200
	3,800 (1,000 × 3.8)	5.65	21,480	3,800	23,108

Labour cost variance: (Total standard labour cost – Total actual labour cost) = (Rs 21,480 – Rs 23,108) = Rs 1,628 (adverse)

1. Labour rate variance

Department A : (Rs 5.40 × 2,000) – Rs 12,908 = Rs 2,108 (adverse)
Department B : (Rs 6.00 × 1,800) – Rs 10,200 = 600 (favourable)
1,508 (adverse)

Labour efficiency variance

Department A : (2,200 hours – 2,000 hours) × Rs 5.4 = Rs 1,080 (favourable)
Department B : (1,600 hours – 1,800 hours) × Rs 6 = 1,200 (adverse)
120 adverse

P.14.12 From the following data of ABC Ltd relating to the budgeted and actual performance for the month of March, compute direct material and direct labour cost variances.

Budgeted data for March:	
Units to be manufactured	1,50,000
Units of direct material required (based on standard rates)	4,95,000
Planned purchase for raw material (units)	5,40,000
Average unit cost of direct material (Rs)	8
Direct labour-hours per unit of finished goods	0.75
Total direct labour costs (Rs)	29,92,500
Actual data at the end of March:	
Units actually manufactured	1,60,000
Direct material costs(purchase costs based on units actually issued)	43,41,900
Direct material costs (purchase costs based on units actually issued)	45,10,000
Average unit costs of direct material (Rs)	8.20
Total direct labour-hours for March	1,25,000
Total direct labour costs for March (Rs)	33,75,000

SOLUTION

(i) *Material Cost Variance*

Actual material costs		Rs 43,41,900
Less standard material costs:		
Units actually manufactured	1,60,000	
(×) Direct raw material per unit (Rs 4,95,000/Rs 1,50,000)	× 3.3	
Total units of raw material	5,28,000	
(×) Standard unit cost of direct material	× Rs 8	42,24,000
		1,17,900 (unfavourable)

(a) Material price variance (SR – AR) × AQ = (Rs 8 – Rs 8.20) × 5,29,500 units* = Rs 1,05,900 (unfavourable)
*5,29,500 units = Rs 43,41,900/Rs 8.20 per unit

(b) Material usage variance (SQ – AQ) × AR = (5,28,000 – 5,29,500) × Rs 8 = Rs 12,000 (unfavourable)

(ii) *Labour Cost Variance*

Actual labour costs		Rs 33,75,000	
Less standard labour costs:			
Units actually manufactured	1,60,000		
(x) Direct labour cost per unit	× Rs 19.95	31,92,000	
		1,83,000	(unfavourable)

(a) Labour rate variance: (SR – AR) × AH = (Rs 26.60@ × 1,25,000) – Rs 33,75,000 = Rs 50,000 (unfavourable) [@ Rs 19.95 per unit/0.75 hour = Rs 26.60 per hour]

(b) Labour efficiency variance: (SH – AH) × SR per hour = (1,60,000 × 0.75 = Rs 1,20,000 hours – 1,25,000) × Rs 26.6 = Rs 1,33,000 (unfavourable)

REVIEW QUESTIONS

RQ.14.1 What is the significance of the term "variance" relating to standard costing? What types of variances are computed for (a) materials, and (b) labour?

RQ.14.2 Distinguish between:

1. Labour rate variance and Labour efficiency variance.
2. Materials price variance and Materials usage variance.

RQ.14.3 State the significance and the method of computing the following:

1. Materials mix variance.
2. Materials yield variance.
3. True labour efficiency variance.

RQ.14.4 A manufacturing concern which has adopted standard costing furnishes the following information:

Standard:	Material for 70 kgs of finished products	100 kgs
	Price of material	Re 1 per kg
Actual:	Output	2,10,000 kgs
	Material used	2,80,000 kgs
	Cost of material	Rs 2,52,000

Calculate: (i) the material usage variance, (ii) the material price variance, and (iii) the material cost variance.

SOLUTION

Computation of Variances

(i) *Material usage variance:* (*SQ* – *AQ*) × *SR* = (3,00,000 kgs – 2,80,000 kgs) × Re. 1 = Rs 20,000 F
Standard quantity (*SQ*) = (100 × 2,10,000 kgs) ÷ 70 = 3,00,000 kgs

(ii) *Material price variance* : (*SR* – *AR*) × AQ *or* [(*SR* × *AQ*) – (AR × AQ)] = (Re. 1 × 2,80,000 kgs) – Rs 2,52,000 = Rs 28,000 F

(iii) *Material cost variance:* (*SC* – *AC*) *or* [(*SQ* × *SR*) – (*AQ* × *AR*)] = (3,00,000 kgs × Re 1) – Rs 2,52,000 = Rs 48,000 F

RQ.14.5 The Standard Metal Company Ltd manufactures a single product, the standard mix of which is: material *X*, 60 per cent @ Rs 20, material *Y*, 40 per cent @ Rs 10.

Normal loss in production is 20 per cent of input. Due to shortage of material *X*, the standard mix is changed. Actual results for the month of June are:

Material *X* (kgs at Rs 20)	210	Rs 4,200
Y (kgs at Rs 9)	190	1,710
Input	400	5,910
Loss	70	—
Output	330	5,910

Calculate material price, mix, and yield variances.

SOLUTION

Standard input requirement to produce 330 kgs = (330 kgs × 100) ÷ 80 = 412.5 kgs

Standard proportion of material X and Y:

= 412.5 kgs × 0.60 = 247.5 kgs (material *X*)

= 412.5 kgs × 0.40 = 165.0 kgs (material *Y*)

The following table contains the relevant information to determine various required material variances:

Material	*SQ (kgs)*	*SR*	*SC*	*AQ (kgs)*	*AR*	*AC*
X	247.5	Rs 20	Rs 4,950	210	Rs 20	Rs 4,200
Y	165.0	10	1,650	190	9	1,710
	412.5	16	6,600	400	14.775	5,910

Computation of Variances

(i) *Material price variance:* (*SR* – *AR*) × *AQ*

Material *X* : (Rs 20 – Rs 20) × 210 kgs = Nil

Y : (Rs 10 – Rs 9) × 190 kgs = Rs 190 F

Rs 190 F

(ii) *Material mix variance* (*RSQ* – *AQ*) × *SR*

Material *X* : [(400 × 0.60) = 240 kgs – 210 kgs)] × Rs 20 = Rs 600 F

Y : [(400 × 0.40) = 160 kgs – 190 kgs)] × Rs 10 = 300 U

300 F

(iii) *Material yield variance:* (*SY* – *AY*) × *SC* per kg = [(400 kgs – 20%)= 320 kgs – 330 kgs] × Rs 20 = Rs 200 F

[*SC* per kg = Rs 6,600 ÷ 330 kgs (412.5 kgs – 20%) = Rs 20 per kg

RQ.14.6 From the following data calculate the (i) material price variance, (ii) material usage variance, and (iii) material cost variance.

Quantity of material purchased (units)	3,000
Value of material purchased	Rs 9,000
Standard quantity of material required for one tonne of finished product (units)	25
Standard rate of material per unit	2
Opening stock of material	Nil
Closing stock of material (units)	500
Finished production during the period (tonnes)	80

SOLUTION

Computation of Variances

(i) *Material price variance* = (*SR* – *AR*) × AQ: (Rs 2.00 – Rs 3.00*) × 3,000 units = Rs 3,000 U

*(Rs 9,000 ÷ 3,000 units purchased)

(*Contd.*)

(*Contd.*)

(ii) *Material usage variance* = (*SQ* – *AQ*) × *SR:* (2,000 units – 2,500 units) × Rs 2 = Rs 1,000 U
SQ = (Finished product, 80 tonnes × *SQ* required per tonne, 25 units) = 2,000 units
AQ = (Quantity purchased, 3,000 units – Closing stock, 500 units) = 2,500 units

(iii) *Material cost variance:*

Material price variance	Rs 3,000 U
Add material usage variance	1,000 U
	4,000 U

Alternatively, (*TSMC* – *TAMC*) = Rs 8,000 – Rs 4,000 = Rs 4,000 U
TSMC = (Finished product in tonnes × *SQ* per tonne × *SR* per unit) = (80 × 25 × Rs 2) = Rs 4,000
TAMC = (Value of material purchased – Value of closing stock at standard cost* = [Rs 9,000 – (500 units × Rs 2)] = Rs 8,000

RQ.14.7 From the data given below, calculate (i) the material price variance, (ii) the material yield variance, and (iii) the material mix variance.

Raw material	*Standard*	*Actual*
A	40 units at Rs 50 per unit	50 units at Rs 50 per unit
B	60 units at Rs 40 per unit	60 units at Rs 45 per unit

SOLUTION

Material	*Standard*			*Actual*		
	SQ (units)	*SR*	*SC*	*AQ (units)*	*AR*	*AC*
A	40	Rs 50	Rs 2,000	50	Rs 50	Rs 2,500
B	60	40	2,400	60	45	2,700
Total	100	44	4,400	110	520/11	5,200

Computation of Variances

(i) Material price variance: (*SR* – *AR*) × *AQ*
A : (Rs 50 – Rs 50) × 50 units = Nil
B : (Rs 40 – Rs 45) × 60 units = Rs 300 U
300 U

(ii) *Material yield variance:* (*TSQ* – *TAQ*) × Weighted *SR:* = (100 units – 110 units) × Rs 44 = Rs 440 U

(iii) *Material-mix variance:* (*RSQ* – *AQ*) × *SR*
A: (110 × 40) ÷ 100 units – [50 units] × Rs 50 = Rs 300 U
B: (110 × 60) ÷ 100 units – [60 units] × Rs 40 = 240 F
60 U

RQ.14.8 From the following figures given to you, calculate material variances.

Production for the period, 192 units

	Material X	*Material Y*
Standard price per tonne	Rs 240	Rs 320
Actual price paid per tonne	227.50	308
Actual weight (tonnes)	16	13

*It is assumed that company adopts full standard costing plan (single plan) in which differences between standard and actual costs are transferred to a specific variance account. In operational terms, *materials inventory account* appears at standard cost.

The standard production for the period represented by the above figures is 400 units for which the standard quantity allowance for material is 30 tonnes of X and 25 tonnes of Y.

SOLUTION

The standard inputs required of material X and material Y to produce 192 units would be:

Material *X* : (30 tonnes ÷ 400 units) × 192 units = 14.4 tonnes

Y : (25 tonnes ÷ 400 units) × 192 units = 12 tonnes.

Material	*SQ (tonnes)*	*SR*	*SC*	*AQ (tonnes)*	*AR*	*AC*
X	14.4	Rs 240	Rs 3,456	16	Rs 227.5	Rs 3,640
Y	12.0	320	3,840	13	308.0	4,004
	26.4	276.36	7,296	29	263.58	7,644

Calculation of Variances

Material cost variance (*TCS* − *TAC*) = (Rs 7,296 − Rs 7,644) = Rs 348 U

(i) *Material price variance* = (*SR* − *AR*) × *AQ*

Material *X* : (Rs 240 − Rs 227.50) × 16 tonnes = Rs 200 F

Y : (Rs 320 − Rs 308.00) × 13 tonnes = 156 F

356 F

(ii) *Material yield variance* = (*TSQ* − *TAQ*) × Weighted *SR* per tonne = (26.4 tonnes − 29.0 tonnes) × (Rs 7,296 ÷ 26.4 = Rs 718.55 U

(iii) *Material-mix variance* = (*RSQ* − *AQ*) × *SR*

Material *X* : $\left[\left(\frac{29 \text{ tonnes} \times 30}{55}\right) - 16\right] \times$ Rs 240 = Rs 43.64 U

Y : $\left[\left(\frac{29 \text{ tonnes} \times 25}{55}\right) - 13\right] \times$ Rs 320 = 58.18 F

14.54 F

Confirmation : (i) Rs 356 F + (ii) Rs 718.55 U + (iii) Rs 14.54 F = Rs 348.01 U

RQ.14.9 A company produces a certain chemical, the standard material cost being:

40 per cent of material *X* at Rs 20 per tonne.

60 per cent of material *Y* at Rs 30 per tonne.

A standard loss of 10 per cent is expected in production. During one month, 171 tonnes of chemical was produced from the use of 90 tonnes of material *X* at Rs 18 per tonne and 110 tonnes of material *Y* at Rs 34 per tonne. Calculate the following variances for the month: (i) materials price variance, (ii) materials mix variance, and (iii) materials yield variance.

SOLUTION

Standard material inputs required to produce 171 tonnes of chemical, given 10 per cent standard loss = (171 tonnes × 100) ÷ 90 = 190 tonnes.

Standard proportions of materials *X* and *Y*

190 tonnes × 0.40 = 76 tonnes *(X)*

190 tonnes × 0.60 = 114 tonnes *(Y)*

Material	*SQ (tonnes)*	*SR*	*SC*	*AQ (tonnes)*	*AR*	*AC*
X	76	Rs 20	Rs 1,520	90	Rs 18	Rs 1,620
Y	114	30	3,420	110	34	3,740
	190	26	4,940	200	26.8	5,360
	–19 standard loss					
	171 standard output					
	Rs 28.89 *SC* per tonne (Rs 4,940 ÷ 171 tonnes)					

Calculation of Variances

(i) *Material price variance* = (*SR* – *AR*) × *AQ*

Material *X* : (Rs 20 – Rs 18) × 90 tonnes = Rs 180 F

Y : (Rs 30 – Rs 34) × 110 tonnes = 440 U

260 U

(ii) *Material-mix variance* = (*RSQ* – *AQ*) × *SR*

Material X : $\left[\left(\frac{40 \times 200}{100}\text{ tonnes}\right) - 90\text{ tonnes}\right] \times$ Rs 20 = Rs 200 U

Y : $\left[\left(\frac{60 \times 200}{100}\text{ tonnes}\right) - 110\text{ tonnes}\right] \times$ Rs 30 = 300 F

100 F

(iii) *Material yield variance* = (*SY* – *AY*) × SC per tonne = (200 tonnes – 10% = 180 tonnes – 171 tonnes) × (Rs 4,940 ÷ 171) = Rs 260 U

RQ.14.10 A chemical company produces a petro-product using the following proportion of material:

	Pounds	*Cost per pound*	*Amount*
Material A	50	Rs 5.00	Rs 250
B	40	6.00	240
C	60	3.00	180
	150	4.47	670
Standard shrinkage ($33^1/_3$%)	50	—	—
Net weight and costs	100	6.70	670

Recent production run yielding 100 output pounds required input of:

	Pounds	*Per pound*
Material A	40	Rs 5.20
B	55	6.00
C	65	2.60
	160	

Calculate material price, mix and yield variances.

SOLUTION

Computation of Variances

(i) *Material price variance* = (*SR* − *AR*) × *AQ*

Material A	(Rs 5.00 − Rs 5.20) × 40 =	Rs 8 U
B	(Rs 6.00 − Rs 6.00) × 55 =	Nil
C	(Rs 3.00 − Rs 2.60) × 65 =	26 F
		18 F

(ii) *Material-mix variance* = (*RSQ* − *AQ*) × *SR*

Material A	$\left(\frac{160 \times 50}{150} \text{ pounds} = 53.33 \text{ pounds} - 40 \text{ pounds}\right) \times$ Rs 5 =	Rs 66.65 F
B	$\left(\frac{160 \times 40}{150} \text{ pounds} = 42.67 \text{ pounds} - 55 \text{ pounds}\right) \times$ Rs 6 =	73.98 U
C	$\left(\frac{160 \times 60}{150} \text{ pounds} = 64.00 \text{ pounds} - 65 \text{ pounds}\right) \times$ Rs 3 =	3.00 U
		10.33 U

(iii) *Material yield variance* = (*SY* − *AY*) × *SC* per pound = (160 pounds − $33^1/_3$% = 106.67 pounds − 100 pounds) × Rs 6.70 = Rs 44.69 U

RQ.14.11 A gang of workers normally consists of 10 men, 5 women and 5 boys, paid at standard hourly rates of Rs 4, Rs 3 and Rs 2, respectively. In a normal working week of 40 hours, the gang is expected to produce 1,000 units of output.

In a certain week, the gang consisted of 13 men, 4 women and 3 boys, 72 hours were worked, actual wages paid amounted to Rs 2,500, and 1,000 units of output were produced.

Present the information in respect of labour cost variance arising during this period.

SOLUTION

Standard

Composition of gang	*Number of workers*	*Number of hours worked per week*	*Total hours worked per week*	*Wage rate per hour*	*Total wages*
Men	10	40	400	Rs 4	Rs 1,600
Women	5	40	200	3	600
Boys	5	40	200	2	400
			800	3.25	2,600

Actual

Composition of gang	*Number of workers*	*Number of hours worked per week*	*Total hours worked per week*	*Wage rate per hour*	*Total wages*
Men	13	72	936	N.A.	N.A.
Women	4	72	288	N.A.	N.A.
Boys	3	72	216	N.A.	N.A.
			1,440		2,500

Computation of Variances

Labour cost variance: (Total standard labour cost to produce 1,000 units – Total actual labour cost) = Rs 2,600 – Rs 2,500 = Rs 100 F

Total labour efficiency variance: [Standard hours (*SH*) – Actual hours (*AH*) × Standard wage rate per hour (*SWR*)

Men	(400 hours – 936 hours) × Rs 4 =	Rs 2,144 U
Women	(200 hours – 288 hours) × Rs 3 =	264 U
Boys	(200 hours – 216 hours) × Rs 2 =	32 U
		2,440 U

Total labour efficiency variance can be split into two sub-variances:

(i) *Labour mix sub-variance:* [Standard mix of actual hours worked (*RSH*) – Actual mix of actual hours (*AH*)] × Standard wage rate per hour

Men: $\frac{1,440 \times 400}{800}$ = (720 hours – 936 hours) × Rs 4 = 864 U

Women: $\frac{1,440 \times 200}{800}$ = (360 hours – 288 hours) × Rs 3 = 216 F

Boys: $\frac{1,440 \times 200}{800}$ = (360 hours – 216 hours) × Rs 2 = 288 F

360 U

(ii) *Labour efficiency sub-variance:* (Total standard hours allowed for actual production – Actual hours used) × Weighted standard wage rate per hour = (800 hours – 1,440 hours) × Rs 3.25 = Rs 2,080 U

(iii) *Labour rate variance (indirect method):* (Total labour cost variance – Total labour efficiency variance) = Rs 100 F – Rs 2,440 U = Rs 2,540 F

Since the actual wage rate of men, women and boys is not given, it is not possible to compute labour rate variance by direct method.

RQ.14.12 Using the following information, calculate each of the three labour variances for each department.

	Department X	*Department Y*
Gross wages, direct	Rs 28,080	Rs 19,370
Standard hours produced	8,640	6,015
Standard rate per hour	3	3.40
Actual hours worked	8,200	6,395

SOLUTION

Computation of Variances

Labour cost variance = (Standard wages charged to production (*SH* × *SR*) – Actual wages paid)

Department X : [(8,640 × Rs 3) = Rs 25,920 – Rs 28,080] = Rs 2,160 U

Y : [(6,015 × Rs 3.40) = Rs 20,451 – Rs 19,370] = Rs 1,081 F

Labour rate variance = (*SR* – *AR*) × *AH* worked or (SR × AH) – (*AR* × *AH*)

Department X : [(Rs 3 × 8,200) = Rs 24,600 – Rs 28,080] = Rs 3,480 U

Y : [(Rs 3.40 × 6,395) = Rs 21,743 – Rs 19,370] = Rs 2,373 F

Labour efficiency variance = (SH – AH) × SR

Department X : (8,640 – 8,200) × Rs 3 = Rs 1,320 F

Y : (6,015 – 6,395) × Rs 3.40 = Rs 1,292 U

Appendices

Table A-1 The Compound Sum of One Rupee

Year	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.110
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331
4	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611
6	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358
10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594
11	1.116	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853
12	1.127	1.268	1.426	1.601	1.796	2.012	2.252	2.518	2.813	3.138
13	1.138	1.294	1.469	1.665	1.886	2.133	2.410	2.720	3.066	3.452
14	1.149	1.319	1.513	1.732	1.980	2.261	2.579	2.937	3.342	3.797
15	1.161	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177
16	1.173	1.373	1.605	1.873	2.183	2.540	2.952	3.426	3.970	4.595
17	1.184	1.400	1.653	1.948	2.292	2.693	3.159	3.700	4.328	5.054
18	1.196	1.428	1.702	2.026	2.407	2.854	3.380	3.996	4.717	5.560
19	1.208	1.457	1.753	2.107	2.527	3.026	3.616	4.316	5.142	6.116
20	1.220	1.486	1.806	2.191	2.653	3.207	3.870	4.661	5.604	6.727
21	1.232	1.516	1.860	2.279	2.786	3.399	4.140	5.034	6.109	7.400
22	1.245	1.546	1.916	2.370	2.925	3.603	4.430	5.436	6.658	8.140
23	1.257	1.577	1.974	2.465	3.071	3.820	4.740	5.871	7.258	8.954
24	1.270	1.608	2.033	2.563	3.225	4.049	5.072	6.341	7.911	9.850
25	1.282	1.641	2.094	2.666	3.386	4.292	5.427	6.848	8.623	10.834
30	1.348	1.811	2.427	3.243	4.322	5.743	7.612	10.062	13.267	17.449
35	1.417	2.000	2.814	3.946	5.516	7.686	10.676	14.785	20.413	28.102
40	1.489	2.208	3.262	4.801	7.040	10.285	14.974	21.724	31.408	45.258
45	1.565	2.438	3.781	5.841	8.985	13.764	21.002	31.920	48.325	72.888
50	1.645	2.691	4.384	7.106	11.467	18.419	29.456	46.900	74.354	117.386

(*Contd.*)

Table A-1 The Compound Sum of One Rupeee *(Contd.)*

Year	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	1.110	1.120	1.130	1.140	1.150	1.160	1.170	1.180	1.190	1.200
2	1.232	1.254	1.277	1.300	1.322	1.346	1.369	1.392	1.416	1.440
3	1.368	1.405	1.443	1.482	1.521	1.561	1.602	1.643	1.685	1.728
4	1.518	1.574	1.630	1.689	1.749	1.811	1.874	1.939	2.005	2.074
5	1.685	1.762	1.842	1.925	2.011	2.100	2.192	2.288	2.386	2.488
6	1.870	1.974	2.082	2.195	2.313	2.436	2.565	2.700	2.840	2.986
7	2.076	2.211	2.353	2.502	2.660	2.826	3.001	3.185	3.379	3.583
8	2.305	2.476	2.658	2.853	3.059	3.278	3.511	3.759	4.021	4.300
9	2.558	2.773	3.004	3.252	3.518	3.803	4.108	4.435	4.785	5.160
10	2.839	3.106	3.395	3.707	4.046	4.411	4.807	5.234	5.695	6.192
11	3.152	3.479	3.836	4.226	4.652	5.117	5.624	6.176	6.777	7.430
12	3.498	3.896	4.334	4.818	5.350	5.936	6.580	7.288	8.064	8.916
13	3.883	4.363	4.898	5.492	6.153	6.886	7.699	8.599	9.596	10.699
14	4.310	4.887	5.535	6.261	7.076	7.987	9.007	10.147	11.420	12.839
15	4.785	5.474	6.254	7.138	8.137	9.265	10.539	11.974	13.589	15.407
16	5.311	6.130	7.067	8.137	9.358	10.748	12.330	14.129	16.171	18.488
17	5.895	6.866	7.986	9.276	10.761	12.468	14.426	16.672	19.244	22.186
18	6.543	7.690	9.024	10.575	12.375	14.462	16.879	19.673	22.900	26.623
19	7.263	8.613	10.197	12.055	14.232	16.776	19.748	23.214	27.251	31.948
20	8.062	9.646	11.523	13.743	16.366	19.461	23.105	27.393	32.429	38.337
21	8.949	10.804	13.021	15.667	18.821	22.574	27.033	32.323	38.591	237.373
22	9.933	12.100	14.713	17.861	21.644	26.186	31.629	38.141	45.923	55.205
23	11.026	12.552	16.626	20.361	24.891	30.376	37.005	45.007	54.648	66.247
24	12.239	15.178	18.788	23.212	28.625	35.236	43.296	53.108	65.031	79.496
25	13.585	17.000	21.230	26.461	32.918	40.874	50.656	62.667	77.387	95.395
30	22.892	29.960	39.115	50.949	66.210	85.849	111.061	143.367	184.672	237.373
35	38.574	52.799	72.066	98.097	133.172	180.311	243.495	327.988	440.691	590.657
40	64.999	93.049	132.776	188.876	267.856	378.715	533.846	750.353	1051.642	1469.740
45	109.527	163.985	244.629	363.662	538.752	795.429	1170.425	1716.619	2509.583	3657.176
50	184.559	288.996	450.711	700.197	1083.619	1670.669	2566.080	3927.189	5988.730	9100.191

(*Contd.*)

Table A-2 The Compound Value of an Annuity of One Rupee

Year	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050	2.060	2.070	2.080	2.090	2.100
3	3.030	3.060	3.091	3.122	3.152	3.184	3.215	3.246	3.278	3.310
4	4.060	4.122	4.184	4.246	4.310	4.375	4.440	4.506	4.573	4.641
5	5.101	5.204	5.309	5.416	5.526	5.637	5.751	5.867	5.985	6.105
6	6.152	6.308	6.468	6.633	6.802	6.975	7.153	7.336	7.523	7.716
7	7.214	7.434	7.662	7.898	8.142	8.394	8.654	8.923	9.200	9.487
8	8.286	8.583	8.892	9.214	9.549	9.897	10.260	10.637	11.028	11.436
9	9.368	9.755	10.159	10.583	11.027	11.491	11.978	12.488	13.021	13.579
10	10.462	10.950	11.464	12.006	12.578	13.181	13.816	14.487	15.193	15.937
11	11.567	12.169	12.808	13.486	14.207	14.972	15.784	16.645	17.560	18.531
12	12.682	13.412	14.192	15.026	15.917	16.870	17.888	18.977	20.141	21.384
13	13.809	14.680	15.618	16.627	17.713	18.882	20.141	21.495	22.953	24.523
14	14.947	15.974	17.086	18.292	19.598	21.015	22.550	24.215	26.019	27.975
15	16.097	17.293	18.599	20.023	21.578	23.276	25.129	27.152	29.361	31.772
16	17.258	18.639	20.157	21.824	23.657	25.672	27.888	30.324	33.003	35.949
17	18.430	20.012	21.761	23.697	25.840	28.213	30.840	33.750	36.973	40.544
18	19.614	21.412	23.414	25.645	28.132	30.905	33.999	37.540	41.301	45.599
19	20.811	21.840	25.117	27.671	30.539	33.760	37.379	41.446	46.018	51.158
20	22.019	24.297	26.870	29.778	33.066	36.785	40.995	45.762	51.169	57.274
21	23.239	25.783	28.676	31.969	35.719	39.992	44.865	50.422	56.754	65.002
22	24.471	27.299	30.536	34.248	38.505	43.392	49.005	55.456	62.872	71.402
23	25.716	28.845	32.452	36.618	41.340	46.995	53.435	60.893	69.531	79.542
24	26.973	30.421	34.426	39.082	44.501	50.815	58.176	66.764	76.789	88.496
25	28.243	32.030	36.459	41.645	47.726	54.864	63.248	73.105	84.699	98.346
30	34.784	40.567	47.575	56.084	66.438	79.057	95.459	113.282	136.305	164.491
35	41.659	49.994	50.461	73.651	90.318	11.432	138.234	172.314	215.705	271.018
40	48.885	60.401	75.400	95.024	120.797	154.758	199.630	259.052	337.872	442.580
45	56.479	71.891	92.718	121.027	159.695	212.737	285.741	386.497	525.840	718.881
50	64.461	84.577	112.794	152.664	209.341	290.325	406.516	573.756	815.051	1163.865

(*Contd.*)

Table A-2 The Compound Value of an Annuity of One Rupee *(Contd.)*

Year	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.110	2.120	2.130	2.140	2.150	2.160	2.170	2.180	2.190	2.200
3	3.342	3.374	3.407	3.440	3.472	3.506	3.539	3.572	3.606	3.640
4	4.710	4.779	4.850	4.921	4.993	5.066	5.141	5.215	5.291	5.338
5	6.228	6.353	6.480	6.610	6.742	6.877	7.014	7.154	7.297	7.442
6	7.913	8.115	8.323	8.535	8.754	9.897	9.207	9.442	9.683	9.930
7	9.783	10.089	10.405	10.730	11.067	11.414	11.772	12.141	12.523	12.916
8	11.859	12.300	12.757	13.233	13.727	14.240	14.773	15.327	15.902	16.499
9	14.164	14.776	15.416	16.085	16.786	17.518	18.285	19.086	19.923	20.799
10	16.722	17.549	18.420	19.337	20.304	21.321	22.393	23.521	24.709	25.959
11	19.561	20.655	21.814	23.044	24.349	25.733	27.200	28.755	30.403	32.150
12	22.713	24.133	25.650	27.271	29.001	30.850	32.824	34.931	37.180	39.580
13	26.211	28.029	29.984	32.088	34.352	36.786	39.404	42.218	45.244	48.496
14	30.095	32.392	34.882	37.581	40.504	43.672	47.102	50.818	54.841	59.196
15	34.405	37.280	40.417	43.842	47.580	51.659	56.109	60.965	66.260	72.035
16	39.190	42.753	46.671	50.980	55.717	60.925	66.648	72.938	79.850	87.442
17	44.500	48.883	53.738	59.117	65.075	71.673	78.978	87.067	96.021	105.930
18	50.396	55.749	61.724	68.393	75.836	84.140	93.404	103.739	115.265	128.116
19	56.939	63.439	70.748	78.968	88.211	98.603	110.283	123.412	138.165	154.739
20	64.202	72.052	80.946	91.024	102.443	115.379	130.031	146.626	165.417	186.687
21	72.264	81.968	92.468	104.767	118.809	134.840	153.136	174.019	197.846	225.024
22	81.213	92.502	105.489	120.434	137.630	157.414	180.169	206.342	236.436	217.028
23	91.147	104.602	120.203	138.295	159.274	183.600	211.798	244.483	282.359	326.234
24	102.173	118.154	136.829	158.656	184.166	213.976	248.803	289.490	337.007	392.480
25	114.412	133.333	155.616	181.867	212.790	249.212	292.099	342.598	402.038	471.976
30	199.018	241.330	293.192	356.778	434.738	530.306	647.423	790.932	966.698	1181.865
35	341.583	431.658	546.663	693.552	881.152	1120.699	1426.448	1816.607	2314.173	2948.294
40	581.812	767.080	1013.667	1341.979	1779.048	2360.724	3134.412	4163.094	5529.711	7343.715
45	986.613	1358.208	1874.086	2590.464	3585.031	4965.191	6879.008	9531.258	13203.105	18280.914
50	1668.732	2399.975	3459.344	4994.301	7217.488	10435.449	15088.805	21812.273	31514.492	45496.094

(*Contd.*)

Table A-3 The Present Value of One Rupee

Year	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909
2	.980	.961	.943	.925	.907	.890	.873	.857	.842	.826
3	.971	.942	.915	.889	.864	.840	.816	.794	.772	.751
4	.961	.924	.888	.855	.823	.792	.763	.735	.708	.683
5	.951	.906	.863	.822	.784	.747	.713	.681	.650	.621
6	.942	.888	.837	.790	.746	.705	.666	.630	.596	.564
7	.933	.871	.813	.760	.711	.665	.623	.583	.547	.513
8	.923	.853	.789	.731	.677	.627	.582	.540	.502	.467
9	.914	.837	.766	.703	.645	.592	.544	.500	.460	.424
10	.905	.820	.744	.676	.614	.558	.508	.463	.422	.386
11	.896	.804	.722	.650	.585	.527	.475	.429	.388	.350
12	.887	.789	.701	.625	.557	.497	.444	.397	.356	.319
13	.879	.773	.681	.601	.530	.469	.415	.368	.326	.290
14	.870	.758	.661	.577	.505	.442	.388	.340	.299	.263
15	.861	.743	.642	.555	.481	.417	.362	.315	.275	.239
16	.853	.728	.623	.534	.458	.394	.339	.292	.252	.218
17	.844	.714	.605	.513	.436	.371	.317	.270	.231	.198
18	.836	.700	.587	.494	.416	.350	.296	.250	.212	.180
19	.828	.686	.570	.475	.396	.331	.227	.232	.194	.164
20	.820	.673	.554	.456	.377	.312	.258	.215	.178	.149
21	.811	.660	.538	.439	.359	.294	.242	.199	.164	.135
22	.803	.647	.522	.422	.342	.278	.226	.184	.150	.123
23	.795	.634	.507	.406	.326	.262	.211	.170	.138	.112
24	.788	.622	.492	.390	.310	.247	.197	.158	.126	.102
25	.780	.610	.478	.375	.295	.233	.184	.146	.116	.092
30	.742	.552	.412	.308	.231	.174	.131	.099	.075	.057
35	.706	.500	.355	.253	.181	.130	.094	.068	.049	.036
40	.672	.453	.307	.208	.142	.097	.067	.046	.032	.022
45	639	.410	.264	.171	.111	.073	.048	.031	.021	.014
50	.806	.372	.228	.141	.087	.054	.034	.021	.013	.009

(*Contd.*)

Table A-3 The Present Value of One Rupee *(Contd.)*

Year	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	.901	.893	.885	.877	.870	.862	.855	.847	.840	.833
2	.812	.797	.783	.769	.756	.743	.731	.718	.706	.694
3	.731	.712	.693	.675	.658	.641	.624	.609	.593	.579
4	.659	.636	.613	.592	.572	.552	.534	.516	.499	.482
5	.593	.567	.543	.519	.497	.476	.456	.437	.419	.402
6	.535	.507	.480	.456	.432	.410	.390	.370	.352	.335
7	.482	.452	.425	.400	.376	.354	.333	.314	.296	.279
8	.434	.404	.376	.351	.327	.305	.285	.266	.249	.233
9	.391	.361	.333	.308	.284	.263	.243	.225	.209	.194
10	.352	.322	.295	.270	.247	.227	.208	.191	.176	.162
11	.317	.287	.261	.237	.215	.195	.178	.162	.148	.135
12	.286	.257	.231	.208	.187	.168	.152	.137	.124	.112
13	.258	.229	.204	.182	.163	.145	.130	.116	.104	.093
14	.232	.205	.181	.160	.141	.125	.111	.099	.088	.078
15	.209	.183	.160	.140	.123	.108	.095	.084	.074	.065
16	.188	.163	.141	.123	.107	.093	.081	.071	.062	.054
17	.170	.146	.125	.108	.093	.080	.069	.060	.052	.045
18	.153	.130	.111	.095	.081	.069	.059	.051	.044	.038
19	.138	.116	.098	.083	.070	.060	.051	.043	.037	.031
20	.124	.104	.087	.073	.061	.051	.043	.037	.031	.026
21	.112	.093	.077	.064	.053	.044	.037	.031	.026	.022
22	.101	.083	.068	.056	.046	.038	.032	.026	.022	.018
23	.091	.074	.060	.049	.040	.033	.027	.022	.018	.015
24	.082	.066	.053	.043	.035	.028	.023	.019	.015	.013
25	.074	.059	.047	.038	.030	.024	.020	.016	.013	.010
30	.044	.033	.026	.020	.015	.012	.009	.007	.005	.004
35	.026	.019	.014	.010	.008	.006	.004	.003	.002	.002
40	.015	.011	.008	.005	.004	.003	.002	.001	.001	.001
45	.009	.006	.004	.003	.002	.001	.001	.001	.000	.000
50	.005	.003	.002	.001	.001	.001	.000	.000	.000	.000

(*Contd.*)

Table A-3 The Present Value of One Rupee *(Contd.)*

Year	*21%*	*22%*	*23%*	*24%*	*25%*	*26%*	*27%*	*28%*	*29%*	*30%*
1	.826	.820	.813	.806	.800	.794	.787	.781	.775	.769
2	.683	.672	.661	.650	.640	.630	.620	.610	.601	.592
3	.564	.551	.537	.524	.512	.500	.488	.477	.466	.455
4	.467	.451	.437	.423	.410	.397	.384	.373	.361	.350
5	.386	.370	.355	.341	.328	.315	.303	.291	.280	.269
6	.319	.303	.289	.275	.262	.250	.238	.227	.217	.207
7	.263	.249	.235	.222	.210	.198	.188	.178	.168	.159
8	.218	.204	.191	.179	.168	.157	.148	.139	.130	.123
9	.180	.167	.155	.144	.134	.125	.116	.108	.101	.094
10	.149	.137	.126	.116	.107	.099	.092	.085	.078	.073
11	.123	.112	.103	.094	.086	.079	.072	.066	.061	.056
12	.102	.092	.083	.076	.069	.062	.057	.052	.047	.043
13	.084	.075	.068	.061	.055	.050	.045	.040	.037	.033
14	.069	.062	.055	.049	.044	.039	.035	.032	.028	.025
15	.057	.051	.045	.040	.035	.031	.028	.025	.022	.020
16	.047	.042	.036	.032	.028	.025	.022	.019	.017	.015
17	.039	.034	.030	.026	.023	.020	.017	.015	.013	.012
18	.032	.028	.024	.021	.018	.016	.014	.012	.010	.009
19	.027	.023	.020	.017	.014	.012	.011	.009	.008	.007
20	.022	.019	.016	.014	.012	.010	.008	.007	.006	.005
21	.018	.015	.013	.011	.009	.008	.007	.006	.005	.004
22	.015	.013	.011	.009	.007	.006	.005	.004	.004	.003
23	.012	.010	.009	.007	.006	.005	.004	.003	.003	.002
24	.010	.008	.007	.006	.005	.004	.003	.003	.002	.002
25	.009	.007	.006	.005	.004	.003	.003	.002	.002	.001
30	.003	.003	.002	.002	.001	.001	.001	.001	.000	.000
35	.001	.001	.001	.001	.000	.000	.000	.000	.000	.000
40	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
45	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
50	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Table A-4 The Present Value of an Annuity of One Rupee

Year	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.326	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.746	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.560	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.679	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.352	14.878	13.590	12.462	11.470	10.594	9.818	9.129	8.514
21	18.857	17.011	15.415	14.029	12.821	11.764	10.836	10.017	9.292	8.649
22	19.661	17.658	15.937	14.451	13.163	12.042	11.061	10.201	9.442	8.772
23	20.456	18.292	16.444	14.857	13.489	12.303	11.272	10.371	9.580	8.883
24	21.244	18.914	16.936	15.247	13.799	12.550	11.469	10.529	9.707	8.985
25	22.023	19.524	17.413	15.622	14.094	12.783	11.654	10.675	9.823	9.077
30	25.808	22.397	19.601	17.292	15.373	13.765	12.409	11.258	10.274	9.427
35	29.409	24.999	21.487	18.665	16.374	14.498	12.948	11.655	10.567	9.644
40	32.835	27.356	23.115	19.793	17.159	15.046	12.332	11.925	10.757	9.779
45	36.095	29.490	24.519	20.720	17.774	15.456	13.606	12.108	10.881	9.863
50	39.197	31.424	25.730	21.482	18.256	15.762	13.801	12.234	10.962	9.915

(*Contd.*)

Table A-4 The Present Value of an Annuity of One Rupee *(Contd.)*

Year	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	.901	.893	.885	.877	.870	.862	.855	.847	.850	.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.487	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	5.303	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.669	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.585	5.316	5.070	4.843
20	7.963	7.469	7.024	6.623	6.259	5.929	5.628	5.353	5.101	4.870
21	8.075	7.562	7.102	6.687	6.312	5.973	5.665	5.384	5.127	4.891
22	8.176	7.645	7.170	6.743	6.359	6.011	5.696	5.410	5.149	4.909
23	8.266	7.718	7.230	6.792	6.399	6.044	6.723	5.432	5.167	4.925
24	8.348	7.784	7.283	6.835	6.434	6.073	5.747	5.451	5.182	4.937
25	8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948
30	8.694	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979
35	8.855	8.176	7.586	7.070	6.617	6.215	5.858	5.539	5.251	4.992
40	8.951	8.244	7.634	7.105	6.642	6.233	5.871	5.548	5.258	4.997
45	9.008	8.283	7.661	7.123	6.654	6.242	5.877	5.552	5.261	4.999
50	9.042	8.305	7.675	7.133	6.661	6.246	5.880	5.554	5.262	4.999

(*Contd.*)

Table A-4 The Present Value of an Annuity of One Rupee *(Contd.)*

Year	*21%*	*22%*	*23%*	*24%*	*25%*	*26%*	*27%*	*28%*	*29%*	*30%*
1	8.26	.820	.813	.806	.800	.794	.787	.781	.775	.769
2	1.509	1.492	1.474	1.457	1.440	1.424	1.407	1.392	1.376	1.361
3	2.074	2.042	2.011	1.981	1.952	1.923	1.896	1.868	1.842	1.816
4	2.540	2.494	2.448	2.404	2.362	2.320	2.280	2.241	2.203	2.166
5	2.926	2.864	2.803	2.745	2.689	2.635	2.583	2.532	2.483	2.436
6	3.245	3.167	3.092	3.020	2.951	2.885	2.821	2.759	2.700	2.643
7	3.508	3.416	3.327	3.242	3.161	3.083	3.009	2.937	2.868	2.802
8	3.726	3.619	3.518	3.421	3.329	3.241	3.156	3.076	2.999	2.925
9	3.905	3.786	3.673	3.566	3.463	3.366	3.273	3.184	3.100	3.019
10	4.054	3.923	3.799	3.682	3.570	3.465	3.364	3.269	3.178	3.092
11	4.177	4.035	4.902	3.776	3.656	3.544	3.437	3.335	3.239	3.147
12	4.278	4.127	3.985	3.851	3.752	3.606	3.493	3.387	3.286	3.190
13	4.362	4.203	4.053	3.912	3.780	3.656	3.538	3.427	3.322	3.223
14	4.432	4.265	4.108	3.962	3.824	3.695	3.573	3.459	3.351	3.249
15	4.489	4.315	4.153	4.001	3.859	3.726	3.601	3.483	3.373	3.268
16	4.536	4.357	4.189	4.033	3.887	3.751	3.623	3.503	3.390	3.283
17	4.576	4.391	4.219	4.059	3.910	3.771	3.640	3.518	3.403	3.295
18	4.608	4.419	4.243	4.080	3.928	3.786	3.654	3.529	3.413	3.304
19	4.635	4.442	4.263	4.097	3.942	3.799	3.664	3.539	3.421	3.311
20	4.657	4.460	4.279	4.110	3.954	3.808	3.673	3.546	3.427	3.316
21	4.675	4.476	4.292	4.121	3.963	3.816	3.679	3.551	3.432	3.320
22	4.690	4.488	4.302	4.130	3.970	3.822	3.684	3.556	3.436	3.323
23	4.703	4.499	4.311	4.137	3.976	3.827	3.689	3.559	3.438	3.325
24	4.713	4.507	4.318	4.143	3.981	3.831	3.692	3.562	3.441	3.327
25	4.721	4.514	4.323	4.147	3.985	3.834	3.694	3.564	3.442	3.329
30	4.746	4.534	4.339	4.160	3.995	3.842	3.701	3.569	3.447	3.332
35	4.756	4.541	4.345	4.164	3.998	3.845	3.703	3.571	3.448	3.333
40	4.760	4.544	4.347	4.166	3.999	3.846	3.703	3.571	3.448	3.333
45	4.761	4.545	4.347	4.166	4.000	3.846	3.704	3.571	3.448	3.333
50	4.762	4.545	4.348	4.167	4.000	3.846	3.704	3.571	3.448	3.333

Section Two

Financial Management

The theme of *Financial Management* is structured round the decision-making in the three inter-related financial areas: investment—long-term as well as current assets; financing; and dividend policy. Also included are the important tools of financial planning and management. The main discussion is divided into 5 parts comprising sisteen chapters.

Part I of the book, which provides the setting to the detailed discussions that follow subsequently, contains two chapters. Chapter 1 outlines the *nature* of financial management in terms of its emerging and contemporary scope and objectives. The concern of Chapter 2 is with the time value of money, i.e. compounding and discounting or present value techniques and their practical applications in financial decision-making, particularly capital budgeting, valuation of long-term securities and risk and return.

Part II, comprising two chapters, is devoted to the tools of analysis in financial management. While Chapter 3 explains and illustrates the statement of changes in financial position (funds flow and cash flow), the financial statement analysis (ratio analysis) is described in Chapter 4.

The subsequent discussions relate to the important decision-making areas in financial management. Thus, Part III focusses on the first and the most important aspect, namely, the long-term investment decision or capital budgeting. It consists of 3 chapters. The first of these (Chapter 5) in devoted to principls and techniques of capital budgeting. Chapter 6 attempts to develop the concept and measurement of cost of capital—the most controversial element in financial management. The last chapter of this part (Chapter 7) dwells on long and medium-term sources of finances.

The second important decision involved in financial management (financing decision) is covered in the three chapters of Part IV. The discussions in Chapter 8 pertaining to the two inter-related aspects, i.e. operating and financial leverage, set the framework for the capital structure decisions of a firm. The capital structure theories, reflecting the controversy in the financial literature regarding the theoretical relationship between capital structure, cost of capital and value of a firm are examined in Chapter 9. In the light of the conclusions of this chapter, the considerations having a bearing on the designing of an appropriate capital structure are highlighted in the next chapter (Chapter 10).

Finally, Part V of the book focusses on the management of current assets, more popularly designated as working capital management. The first chapter of this part provides an overview of working capital management and deals respectively with the theory of working capital management in terms of the basic strategies for efficient management of current assets and current liabilities, the planning and determinants of working capital and the financing of working capital (Chapter 11). The next three chapters look into the management of the individual components of current assets. While cash management is the theme of Chapter 12, the various dimensions of receivables management are explained in Chapter 13. The last chapter (Chapter 14) discusses the relevant aspects of inventory management.

Part One

Background

This part of the text provides an overview of financial management and some basic financial concepts underlying contemporary financial management practices. Chapter 1 discusses the nature of financial management in terms of its scope, objectives, relationship with other disciplines and the organisation of finance function. Chapter 2 is devoted to some basic financial concepts, namely, time value of money, valuation of long-term securities and return and risk. This part of the text sets the stage for subsequent discussions of financial management.

1 Financial Management—An Overview

Introduction

Finance may be defined as the art and science of managing money. The major areas of finance are: (1) financial services and (2) managerial finance/corporate finance/financial management. While **financial services** is concerned with the design and delivery of advice and financial products to individuals, businesses and governments within the areas of banking and related institutions, personal financial planning, investments, real estate, insurance and so on, **financial management** is concerned with the duties of the financial managers in the business firm. Financial managers actively manage the financial affairs of any type of business, namely, financial and non-financial, private and public, large and small, profit-seeking and not-for-profit. They perform such varied tasks as budgeting, financial forecasting, cash management, credit administration, investment analysis, funds management and so on. In recent years, the changing regulatory and economic environments coupled with the globalisation of business activities have increased the complexity as well as the importance of the financial managers' duties. As a result, the financial management function has become more demanding and complex. This chapter provides an overview of financial management function. It is organised into six Sections:

- Relationship of finance and related disciplines
- Scope of financial management
- Goal/objectives of financial management
- Agency problem
- Organisation of the finance function
- Emerging role of finance managers in India

FINANCE AND RELATED DISCIPLINES

Financial management, as an integral part of overall management, is not a totally independent area. It draws heavily on related disciplines and fields of study, such as economics, accounting, marketing, production and quantitative methods. Although these disciplines are interrelated, there are key differences among them. In this Section, we discuss these relationships.

Finance and Economics

The relevance of economics to financial management can be described in the light of the two broad areas of economics: macroeconomics and microeconomics.

Macroeconomics is concerned with the overall institutional environment in which the firm operates. It looks at the economy as a whole. Macroeconomics is concerned with the institutional structure of the banking system, money and capital markets, financial intermediaries, monetary, credit and fiscal policies and economic policies dealing with, and controlling level of, activity within an economy. Since business firms operate in the macroeconomic environment, it is important for financial managers to understand the broad economic environment. Specifically, they should (1) recognise and understand how monetary policy affects the cost and the availability of funds; (2) be versed in fiscal policy and its effects on the economy; (3) be aware of the various financial institutions/financing outlets; (4) understand the consequences of various levels of economic activity and changes in economic policy for their decision environment and so on.

Microeconomics deals with the economic decisions of individuals and organisations. It concerns itself with the determination of optimal operating strategies. In other words, the theories of microeconomics provide for effective operations of business firms. They are concerned with defining actions that will permit the firms to achieve success. The concepts and theories of microeconomics relevant to financial management are, for instance, those involving (1) supply and demand relationships and profit maximisation strategies, (2) issues related to the mix of productive factors, 'optimal' sales level and product pricing strategies, (3) measurement of utility preference, risk and the determination of value, and (4) the rationale of depreciating assets. In addition, the primary principle that applies in financial management is **marginal analysis**; it suggests that financial decisions should be made on the basis of comparison of marginal revenue and marginal cost. Such decisions will lead to an increase in profits of the firm. It is, therefore, important that financial managers must be familiar with basic microeconomics.

To illustrate, the financial manager of a department store is contemplating to replace one of its online computers with a new, more sophisticated one that would both speed up processing time and handle a large volume of transactions. The new computer would require a cash outlay of Rs 8,00,000 and the old computer could be sold to net Rs 2,80,000. The total benefits from the new computer and the old computer would be Rs 10,00,000 and Rs 3,50,000 respectively. Applying marginal analysis, we get:

Benefits with new computer	Rs 10,00,000	
Less: Benefits with old computer	3,50,000	
Marginal benefits (**a**)		Rs 6,50,000
Cost of new computer	8,00,000	
Less: Proceeds from sale of old computer	2,80,000	
Marginal cost (**b**)		5,20,000
Net benefits [(**a**) – (**b**)]		1,30,000

As the store would get a net benefit of Rs 1,30,000, the old computer should be replaced by the new one.

Thus, a knowledge of economics is necessary for a financial manager to understand both the financial environment and the decision theories which underline contemporary financial management. He should be familiar with these two areas of economics. Macroeconomics provides the financial manager with an insight into policies by which economic activity is controlled. Operating within that institutional framework, the financial manager draws on microeconomic theories of the operation of firms and profit maximisation. A basic knowledge of economics is, therefore, necessary to understand both the environment and the decision techniques of financial management.

Finance and Accounting

The relationship between finance and accounting, conceptually speaking, has two dimensions: (i) they are closely related to the extent that accounting is an important input in financial decision making; and (ii) there are key differences in viewpoints between them.

Accounting function is a necessary input into the finance function. That is, accounting is a subfunction of finance. Accounting generates information/data relating to operations/activities of the firm. The end-product of accounting constitutes financial statements such as the balance sheet, the income statement (profit and loss account) and the statement of changes in financial position/sources and uses of funds statement/cash flow statement. The information contained in these statements and reports assists financial managers in assessing the past performance and future directions of the firm and in meeting legal obligations, such as payment of taxes and so on. Thus, accounting and finance are functionally closely related. Moreover, the finance (treasurer) and accounting (controller) activities are typically within the control of the vice-president/director (finance)/chief financial officer (CFO) as shown in Fig. 1.2. These functions are closely related and generally overlap; indeed, financial management and accounting are often not easily distinguishable. In small firms the controller often carries out the finance function and in large firms many accountants are intimately involved in various finance activities.

But there are two key differences between finance and accounting. The first difference relates to the treatment of funds, while the second relates to decision making.

Treatment of Funds The viewpoint of accounting relating to the funds of the firm is different from that of finance. The measurement of funds (income and expenses) in accounting is based on the **accrual principle/system**. For instance, revenue is recognised at the point of sale and not when collected. Similarly, expenses are recognised when they are incurred rather than when actually paid. The accrual-based accounting data do not reflect fully the financial circumstances of the firm. A firm may be quite profitable in the accounting sense in that it has earned profit (sales less expenses) but it may not be able to meet current obligations owing to shortage of liquidity due to uncollectable receivables, for instance. Such a firm will not survive regardless of its levels of profits.

The viewpoint of finance relating to the treatment of funds is based on **cashflows**. The revenues are recognised only when actually received in cash (i.e. cash inflow) and expenses are recognised on actual payment (i.e. cash outflow). This is so because the financial manager is concerned with maintaining solvency of the firm by providing the cashflows necessary to satisfy its obligations and acquiring and financing the assets needed to achieve the goals of the firm. Thus, cashflow-based returns help financial managers avoid insolvency and achieve the desired financial goals.

To illustrate, total sales of a trader during the year amounted to Rs 10,00,000 while the cost of sales was Rs 8,00,000. At the end of the year, it has yet to collect Rs 8,00,000 from the customers. The accounting view and the financial view of the firms performance during the year are given below.

Accounting view (Income statement)		*Financial view (Cash flow statement)*	
Sales	Rs 10,00,000	Cash inflow	Rs 2,00,000
Less: Costs	8,00,000	*Less*: Cash outflow	8,00,000
Net profit	2,00,000	Net cash outflow	(6,00,000)

Obviously, the firm is quite profitable in accounting sense, it is a financial failure in terms of actual cash flows resulting from uncollected receivables. Regardless of its profits, the firm would not survive due to inadequate cash inflows to meet its obligations.

Decision Making Finance and accounting also differ in respect of their purposes. The purpose of accounting is collection and presentation of financial data. It provides consistently developed and easily interpreted data on the past, present and future operations of the firm. The financial manager uses such data for financial decision making. It does not mean that accountants *never* make decisions or financial managers *never* collect data. But the primary focus of the functions of accountants is on collection and presentation of data while the financial manager's major responsibility relates to financial planning, controlling and decision making. Thus, in a sense, finance begins where accounting ends.

Finance and Other Related Disciplines

Apart from economics and accounting, finance also draws—for its day-to-day decisions—on supportive disciplines such as marketing, production and quantitative methods. For instance, financial managers should consider the impact of new product development and promotion plans made in marketing area since their plans will require capital outlays and have an impact on the projected cash flows. Similarly, changes in the production process may necessitate capital expenditures which the financial managers must evaluate and finance. And, finally, the tools of analysis developed in the quantitative methods area are helpful in analysing complex financial management problems.

The marketing, production and quantitative methods are, thus, only indirectly related to day-to-day decision making by financial managers and are supportive in nature while economics and accounting are the primary disciplines on which the financial manager draws substantially.

The relationship between financial management and supportive disciplines is depicted in Fig. 1.1.

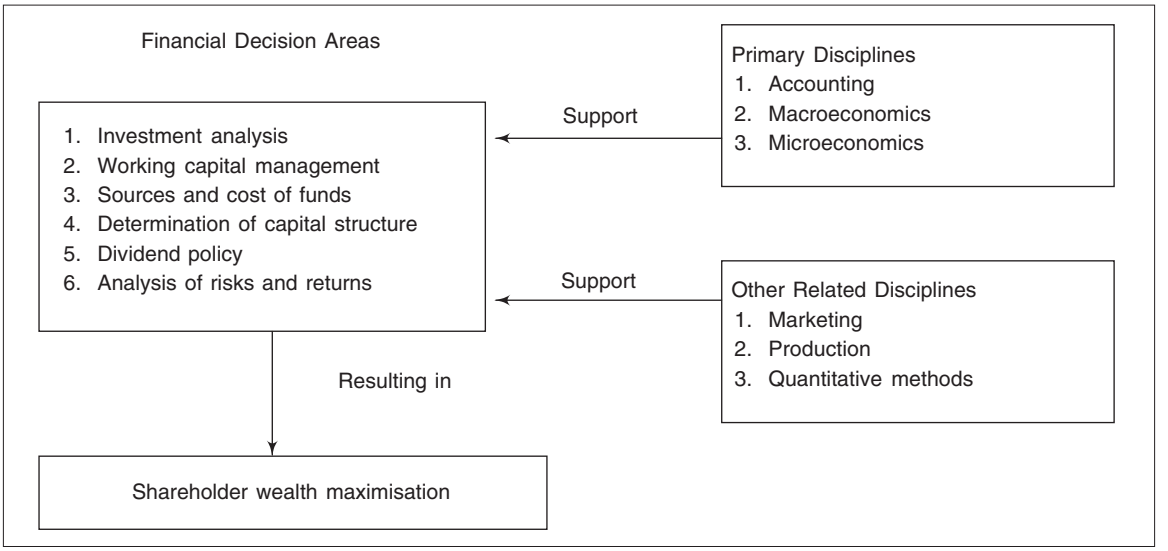


Figure 1.1 *Impact of Other Disciplines on Financial Management*

SCOPE OF FINANCIAL MANAGEMENT

The approach to the scope and functions of financial management is divided, for purposes of exposition, into two broad categories: (a) The Traditional Approach, and (b) The Modern Approach.

Traditional Approach

The **traditional approach** to the scope of financial management refers to its subject-matter, in academic literature in the initial stages of its evolution, as a separate branch of academic study. The term 'corporation finance' was used to describe what is now known in the academic world as 'financial management'. As the name suggests, the concern of corporation finance was with the financing of corporate enterprises. In other words, the scope of the finance function was treated by the traditional approach in the narrow sense of procurement of funds by corporate enterprise to meet their financing needs. The term 'procurement' was used in a broad sense so as to include the whole gamut of raising funds externally. Thus defined, the field of study dealing with finance was treated as encompassing three interrelated aspects of raising and administering resources from outside: (i) the institutional arrangement in the form of financial institutions which comprise the organisation of the capital market; (ii) the financial instruments through which funds are raised from the capital markets and the related aspects of practices and the procedural aspects of capital markets; and (iii) the legal and accounting relationships between a firm and its sources of funds. The coverage of corporation finance was, therefore, conceived to describe the rapidly evolving complex of capital market institutions, instruments and practices. A related aspect was that firms require funds at certain episodic events such as merger, liquidation, reorganisation and so on. A detailed description of these major events constituted the second element of the scope of this field of academic study. That these were the broad features of the subject-matter of corporation finance is eloquently reflected in the academic writings around the period during which the traditional approach dominated academic thinking.[1] Thus, the issues to which literature on finance addressed itself was how resources could best be raised from the combination of the available sources.

The traditional approach to the scope of the finance function evolved during the 1920s and 1930s and dominated academic thinking during the forties and through the early fifties. It has now been discarded as it suffers from serious limitations. The weaknesses of the traditional approach fall into two broad categories: (i) those relating to the treatment of various topics and the emphasis attached to them; and (ii) those relating to the basic conceptual and analytical framework of the definitions and scope of the finance function.

The *first* argument against the traditional approach was based on its emphasis on issues relating to the procurement of funds by corporate enterprises. This approach was challenged during the period when the approach dominated the scene itself.[2] Further, the traditional treatment of finance was criticised[3] because the finance function was equated with the issues involved in raising and administering funds, the theme was woven around the viewpoint of the suppliers of funds such as investors, investment bankers and so on, that is, the outsiders. It implies that no consideration was given to viewpoint of those who had to take internal financial decisions. The traditional treatment was, in other words, the **outsider-looking-in approach**. The limitation was that internal decision making (i.e. **insider-looking-out**) was completely ignored.

The *second* ground of criticism of the traditional treatment was that the focus was on financing problems of corporate enterprise. To that extent the scope of financial management was confined only to a segment of the industrial enterprises, as non-corporate organisations lay outside its scope.

Yet another basis on which the traditional approach was challenged was that the treatment was built too closely around episodic events, such as promotion, incorporation, merger, consolidation, reorganisation and so on. Financial management was confined to a description of these infrequent happenings in the life of an enterprise. As a logical corollary, the day-to-day financial problems of a normal company did not receive much attention.

Finally, the traditional treatment was found to have a lacuna to the extent that the focus was on long-term financing. Its natural implication was that the issues involved in working capital management were not in the purview of the finance function.

The limitations of the traditional approach were not entirely based on treatment or emphasis of different aspects. In other words, its weaknesses were more fundamental. The conceptual and analytical shortcoming of this approach arose from the fact that it confined financial management to issues involved in procurement of external funds, it did not consider the important dimension of allocation of capital. The conceptual framework of the traditional treatment ignored what Solomon aptly described as the **central issues of financial management**.[4] These issues were reflected in the following fundamental questions which a finance manager should address. Should an enterprise commit capital funds to certain purposes? Do the expected returns meet financial standards of performance? How should these standards be set and what is the cost of capital funds to the enterprises? How does the cost vary with the mixture of financing methods used? In the absence of the coverage of these crucial aspects, the traditional approach implied a very narrow scope for financial management. The modern approach provides a solution to these shortcomings.

Modern Approach

The **modern approach** views the term financial management in a broad sense and provides a conceptual and analytical framework for financial decision making. According to it, the finance function covers both acquisition of funds as well as their allocations. Thus, apart from the issues involved in acquiring external funds, the main concern of financial management is the efficient and wise allocation of funds to various uses. Defined in a broad sense, it is viewed as an integral part of overall management.

The new approach is an analytical way of viewing the financial problems of a firm. The main contents of this approach are:[5] What is the total volume of funds an enterprise should commit? What specific assets should an enterprise acquire? How should the funds required be financed? Alternatively, the principal contents of the modern approach to financial management can be said to be: (i) How large should an enterprise be, and how fast should it grow? (ii) In what form should it hold assets? and (iii) What should be the composition of its liabilities?

The three questions posed above cover between them the major financial problems of a firm. In other words, the financial management, according to the new approach, is concerned with the solution of three major problems relating to the financial operations of a firm, corresponding to the three questions of investment, financing and dividend decisions. Thus, financial management, in the modern sense of the firm, can be broken down into three major decisions as functions of finance: (i) The investment decision, (ii) The financing decision, and (iii) The dividend policy decision.

Investment Decision The investment decision relates to the selection of assets in which funds will be invested by a firm. The assets which can be acquired fall into two broad groups: (i) long-term assets which yield a return over a period of time in future, (ii) short-term or current assets, defined as those assets which in the normal course of business are convertible into cash without diminution in value, usually within a year. The first of these involving the first category of assets is popularly known in financial literature as **capital budgeting**. The aspect of financial decision making with reference to current assets or short-term assets is popularly termed as **working capital management**.

Capital Budgeting Capital budgeting is probably the most crucial financial decision of a firm. It relates to the selection of an asset or investment proposal or course of action whose benefits are likely to be available in future over the lifetime of the project. The long-term assets can be either new or old/existing ones. The *first* aspect of the capital budgeting decision relates to the choice of the new asset out of the alternatives available or the reallocation of capital when an existing asset fails to justify the funds committed. Whether an asset will be accepted or not will depend upon the relative benefits and returns associated

with it. The measurement of the worth of the investment proposals is, therefore, a major element in the capital budgeting exercise. This implies a discussion of the methods of appraising investment proposals.

The *second* element of the capital budgeting decision is the analysis of risk and uncertainty. Since the benefits from the investment proposals extend into the future, their accrual is uncertain. They have to be estimated under various assumptions of the physical volume of sale and the level of prices. An element of risk in the sense of uncertainty of future benefits is, thus, involved in the exercise. The returns from capital budgeting decisions should, therefore, be evaluated in relation to the risk associated with it.

Finally, the evaluation of the worth of a long-term project implies a certain norm or standard against which the benefits are to be judged. The requisite norm is known by different names such as **cut-off rate**, **hurdle rate**, **required rate**, **minimum rate of return** and so on. This standard is broadly expressed in terms of the cost of capital. The concept and measurement of the cost of capital is, thus, another major aspect of capital budgeting decision. In brief, the main elements of capital budgeting decisions are: (i) the long-term assets and their composition, (ii) the business risk complexion of the firm, and (iii) the concept and measurement of the cost of capital.

Working Capital Management Working capital management is concerned with the management of current assets. It is an important and integral part of financial management as short-term survival is a prerequisite for long-term success. One aspect of working capital management is the trade-off between profitability and risk (liquidity). There is a conflict between profitability and liquidity. If a firm does not have adequate working capital, that is, it does not invest sufficient funds in current assets, it may become illiquid and consequently may not have the ability to meet its current obligations and, thus, invite the risk of bankruptcy. If the current assets are too large, profitability is adversely affected. The key strategies and considerations in ensuring a trade-off between profitability and liquidity is one major dimension of working capital management. In addition, the individual current assets should be efficiently managed so that neither inadequate nor unnecessary funds are locked up. Thus, the management of working capital has two basic ingredients: (1) an overview of working capital management as a whole, and (2) efficient management of the individual current assets such as cash, receivables and inventory.

Financing Decision The second major decision involved in financial management is the financing decision. The investment decision is broadly concerned with the asset-mix or the composition of the assets of a firm. The concern of the financing decision is with the financing-mix or capital structure or leverage. The term **capital structure** refers to the proportion of debt (fixed-interest sources of financing) and equity capital (variable-dividend securities/source of funds). The financing decision of a firm relates to the choice of the proportion of these sources to finance the investment requirements. There are two aspects of the financing decision. *First*, the theory of capital structure which shows the theoretical relationship between the employment of debt and the return to the shareholders. The use of debt implies a higher return to the shareholders as also the financial risk. A proper balance between debt and equity to ensure a trade-off between risk and return to the shareholders is necessary. A capital structure with a reasonable proportion of debt and equity capital is called the **optimum capital structure**. Thus, one dimension of the financing decision whether there is an optimum capital structure and in what proportion should funds be raised to maximise the return to the shareholders? The second aspect of the financing decision is the determination of an appropriate capital structure, given the facts of a particular case. Thus, the financing decision covers two interrelated aspects: (1) the capital structure theory, and (2) the capital structure decision.

Dividend Policy Decision The third major decision area of financial management is the decision relating to the dividend policy. The dividend decision should be analysed in relation to the financing

decision of a firm. Two alternatives are available in dealing with the profits of a firm: (i) they can be distributed to the shareholders in the form of dividends or (ii) they can be retained in the business itself. The decision as to which course should be followed depends largely on a significant element in the dividend decision, the **dividend-pay out ratio**, that is, what proportion of net profits should be paid out to the shareholders. The final decision will depend upon the preference of the shareholders and investment opportunities available within the firm. The second major aspect of the dividend decision is the factors determining dividend policy of a firm in practice.

To conclude, the traditional approach to the functions of financial management had a very narrow perception and was devoid of an integrated conceptual and analytical framework. It had rightly been discarded in the academic literature. The modern approach to the scope of financial management has broadened its scope which involves the solution of three major decisions, namely, investment, financing and dividend. These are interrelated and should be jointly taken so that financial decision making is optimal. The conceptual framework for optimum financial decisions is the objective of financial management. In other words, to ensure an optimum decision in respect of these three areas, they should be related to the objectives of financial management. The goals/objectives of financial management are discussed in Section 3.

Key Activities of the Financial Manager

The primary activities of a financial manager are: (i) performing financial analysis and planning, (ii) making investment decisions and (iii) making financing decisions.

Performing Financial Analysis and Planning The concern of financial analysis and planning is with (a) transforming financial data into a form that can be used to monitor financial condition, (b) evaluating the need for increased (reduced) productive capacity and (c) determining the additional/reduced financing required. Although this activity relies heavily on accrual-based financial statements, its underlying objective is to assess cash flows and develop plans to ensure adequate cash flows to support achievement of the firm's goals.

Making Investment Decisions Investment decisions determine both the mix and the type of assets held by a firm. The mix refers to the amount of current assets and fixed assets. Consistent with the mix, the financial manager must determine and maintain certain optimal levels of each type of current assets. He should also decide the best fixed assets to acquire and when existing fixed assets need to be modified/replaced/liquidated. The success of a firm in achieving its goals depends on these decisions.

Making Financing Decisions Financing decisions involve two major areas: *first*, the most appropriate mix of short-term and long-term financing; *second*, the best individual short-term or long-term sources of financing at a given point of time. Many of these decisions are dictated by necessity, but some require an in-depth analysis of the available financing alternatives, their costs and their long-term implications.

OBJECTIVES OF FINANCIAL MANAGEMENT

To make wise decisions a clear understanding of the objectives which are sought to be achieved is necessary. The objective provide a framework for optimum financial decision making. In other words, they are

concerned with designing a method of operating the internal investment and financing of a firm. The term 'objective' is used in the sense of a goal or **decision criterion** for the three decisions involved in financial management. It implies that what is relevant is not the overall objective or goal of a business but a operationally useful criterion by which to judge a specific set of mutually interrelated business decisions, namely, investment, financing and dividend policy. Moreover, it provides a normative framework. That is, the focus in financial literature is on what a firm should try to achieve and on policies that should be followed if certain goals are to be achieved. The implication is that these are not necessarily followed by firms in actual practice. They are rather employed to serve as a basis for theoretical analysis and do not reflect contemporary empirical industry practices. Thus, the term is used in a rather narrow sense of what a firm *should attempt* to achieve with its investment, financing and dividend policy decisions.

We discuss in this Section the alternative approaches in financial literature. There are two widely-discussed approaches: (i) Profit (total)/Earning Per Share (EPS) maximisation approach, and (ii) Wealth maximisation approach.

Profit/EPS Maximisation Decision Criterion

According to this approach, actions that increase profits (total)/EPS should be undertaken and those that decrease profits/EPS are to be avoided. In specific operational terms, as applicable to financial management, the profit maximisation criterion implies that the investment, financing and dividend policy decisions of a firm should be oriented to the maximisation of profits/EPS.

The term 'profit' can be used in **two** senses. As a *owner-oriented concept*, it refers to the *amount* and *share of national income* which is *paid to the owners of business*, that is, those who supply equity capital. As a *variant*, it is described as **profitability**. It is an operational concept[6] and signifies economic efficiency. In other words, profitability refers to a situation where output exceeds input, that is, the value created by the use of resources is more than the total of the input resources. Used in this sense, profitability maximisation would imply that a firm should be guided in financial decision making by one test; select assets, projects and decisions which are profitable and reject those which are not. In the current financial literature, there is a general agreement that profit maximisation is used in the second sense.

The rationale behind profitability maximisation, as a guide to financial decision making, is simple. Profit is a test of economic efficiency. It provides the yardstick by which economic performance can be judged. Moreover, it leads to efficient allocation of resources, as resources tend to be directed to uses which in terms of profitability are the most desirable. Finally, it ensures maximum social welfare. The individual search for maximum profitability provides the famous 'invisible hand' by which total economic welfare is maximised. Financial management is concerned with the efficient use of an important economic resource (input), namely, capital. It is, therefore, argued that profitability maximisation should serve as the basic criterion for financial management decisions.

The profit maximisation criterion has, however, been questioned and criticised on several grounds. The reasons for the opposition in academic literature fall into two broad groups: (1) those that are based on misapprehensions about the workability and fairness of the private enterprise itself, and (2) those that arise out of the difficulty of applying this criterion in actual situations. It would be recalled that the term objective, as applied to financial management, refers to an explicit operational guide for the internal investment and financing of a firm and not the overall goal of business operations. We, therefore, focus on the second type of limitations to profit maximisation as an objective of financial management.[7] The *main technical flaws* of this criterion are **ambiguity, timing of benefits,** and **quality of benefits**.

Ambiguity One practical difficulty with profit maximisation criterion for financial decision making is that the term profit is a vague and ambiguous concept. It has no precise connotation. It is amenable to different interpretations by different people. To illustrate, profit may be short-term or long-term; it may be total profit or rate of profit; it may be before-tax or after-tax; it may return on total capital employed or total assets or shareholders' equity and so on. If profit maximisation is taken to be the objective, the question arises, which of these variants of profit should a firm try to maximise? Obviously, a loose expression like profit cannot form the basis of operational criterion for financial management.

Timing of Benefits A more important technical objection to profit maximisation, as a guide to financial decision making, is that it ignores the differences in the time pattern of the benefits received over the working life of the asset, irrespective of when they were received. Consider Table 1.1.

Table 1.1 *Time-Pattern of Benefits (Profits)*

Time	*Alternative **A** (Rs in lakh)*	*Alternative **B** (Rs in lakh)*
Period **I**	50	—
Period **II**	100	100
Period **III**	50	100
Total	200	200

It can be seen from Table 1.1 that the total profits associated with the alternatives, A and B, are identical. If the profit maximisation is the decision criterion, both the alternatives would be ranked equally. But the returns from both the alternatives differ in one important respect, while alternative A provides higher returns in earlier years, the returns from alternative B are larger in later years. As a result, the two alternative courses of action are not strictly identical. This is primarily because a basic dictum of financial planning is **the earlier the better** as benefits received sooner are more valuable than benefits received later. The reason for the superiority of benefits now over benefits later lies in the fact that the former can be reinvested to earn a return. This is referred to as time value of money. The profit maximisation criterion does not consider the distinction between returns received in different time periods and treats all benefits irrespective of the timing, as equally valuable. This is not true in actual practice as benefits in early years should be valued more highly than equivalent benefits in later years. The assumption of equal value is inconsistent with the real world situation.

Quality of Benefits Probably the most important technical limitation of profit maximisation as an operational objective, is that it ignores the quality aspect of benefits associated with a financial course of action. The term **quality** here refers to the degree of certainty with which benefits can be expected. As a rule, the more certain the expected return, the higher is the quality of the benefits. Conversely, the more uncertain/fluctuating is the expected benefits, the lower is the quality of the benefits. An uncertain and fluctuating return implies **risk** to the investors. It can be safely assumed that the investors are **risk-averters**, that is, they want to avoid or at least minimise risk. They can, therefore, be reasonably expected to have a preference for a return which is more certain in the sense that it has smaller variance over the years.

The problem of uncertainty renders profit maximisation unsuitable as an operational criterion for financial management as it considers only the size of benefits and gives no weight to the degree of uncertainty of the future benefits. This is illustrated in Table 1.2.

Table 1.2 *Uncertainty About Expected Benefits (Profits)*

	Profit (Rs crore)	
State of Economy	*Alternative **A***	*Alternative **B***
Recession (Period I)	9	0
Normal (Period II)	10	10
Boom (Period III)	11	20
Total	30	30

It is clear from Table 1.2 that the total returns associated with the two alternatives are identical in a normal situation but the range of variations is very wide in case of alternative B, while it is narrow in respect of alternative A. To put it differently, the earnings associated with alternative B are more uncertain (risky) as they fluctuate widely depending on the state of the economy. Obviously, alternative A is better in terms of risk and uncertainty. The profit maximisation criterion fails to reveal this.

To conclude, the profit maximisation criterion is inappropriate and unsuitable as an operational objective of investment, financing and dividend decisions of a firm. It is not only vague and ambiguous but it also ignores two important dimensions of financial analysis, namely, risk, and time value of money. It follows from the above that an appropriate operational decision criterion for financial management should (i) be precise and exact, (ii) be based on the **'bigger the better'** principle, (iii) consider both quantity and quality dimensions of benefits, and (iv) recognise the time value of money. The alternative to profit maximisation, that is, wealth maximisation is one such measure.

Wealth Maximisation Decision Criterion

This is also known as value maximisation or net present worth maximisation. In current academic literature value maximisation is almost universally accepted as an appropriate operational decision criterion for financial management decisions as it removes the technical limitations which characterise the earlier profit maximisation criterion. Its operational features satisfy all the three requirements of a suitable operational objective of financial course of action, namely, exactness, quality of benefits and the time value of money.

The value of an asset should be viewed in terms of the benefits it can produce. The worth of a course of action can similarly be judged in terms of the value of the benefits it produces less the cost of undertaking it. A significant element in computing the value of a financial course of action is the precise estimation of the benefits associated with it. The wealth maximisation criterion is based on the concept of cash flows generated by the decision rather than accounting profit which is the basis of the measurement of benefits in the case of the profit maximisation criterion. Cash-flow is a precise concept with a definite connotation. Measuring benefits in terms of cash flows avoids the ambiguity associated with accounting profits. This is the first operational feature of the net present worth maximisation criterion.

The second important feature of the wealth maximisation criterion is that it considers both the quantity and quality dimensions of benefits. At the same time, it also incorporates the time value of money. The operational implication of the uncertainty and timing dimensions of the benefits emanating from a financial decision is that adjustments should be made in the cash-flow pattern, firstly, to incorporate risk and, secondly, to make an allowance for differences in the timing of benefits. The value of a stream of cash flows with value maximisation criterion is calculated by discounting its element back to the present at a capitalisation rate that reflects both time and risk. The value of a course of action must be viewed in terms of its worth to those providing the resources necessary for its undertaking. In applying the value maximisation criterion, the term **value** is used in terms of worth to the owners, that is, ordinary shareholders. The **capitalisation (discount) rate** that is employed is, therefore, the rate that reflects the time and risk preferences of the

owners or suppliers of capital. As a measure of quality (risk) and timing, it is expressed in decimal notation. A discount rate of, say, 15 per cent is written as 0.15. A large capitalisation rate is the result of higher risk and longer time period. Thus, a stream of cash flows that is quite certain might be associated with a rate of 5 per cent, while a very risky stream may carry a 15 per cent discount rate.

For the above reasons, the net present value maximisation is superior to the profit maximisation as an operational objective. As a decision criterion, it involves a comparison of value to cost. An action that has a discounted value—reflecting both time and risk—that exceeds its cost can be said to create value. Such actions should be undertaken. Conversely, actions, with less value than cost, reduce wealth and should be rejected. In the case of mutually exclusive alternatives, when only one has to be chosen, the alternative with the greatest net present value should be selected. In the words of Ezra Solomon,[8]

> The gross present worth of a course of action is equal to the capitalised value of the flow of future expected benefit, discounted (or captialised) at a rate which reflects their certainty or uncertainty. Wealth or net present worth is the difference between gross present worth and the amount of capital investment required to achieve the benefits being discussed. Any financial action which creates wealth or which has a net present worth above zero is a desirable one and should be undertaken. Any financial action which does not meet this test should be rejected. If two or more desirable courses of action are mutually exclusive (i.e. if only one can be undertaken), then the decision should be to do that which creates most wealth or shows the greatest amount of net present worth.

Using Ezra Solomon's symbols and methods, the net present worth can be calculated as shown below:

(i) $$W = V - C \tag{1.1}$$

Where W = Net present worth
V = Gross present worth
C = Investment (equity capital) required to acquire the asset or to purchase the course of action

(ii) $$V = E/K \tag{1.2}$$

Where E = Size of future benefits available to the suppliers of the input capital
K = The capitalisation (discount) rate reflecting the quality (certainty/uncertainty) and timing of benefits attached to E

(iii) $$E = G - (M + I + T) \tag{1.3}$$

Where G = Average future flow of gross annual earnings expected from the course of action, before maintenance charges, taxes and interest and other prior charges like preference dividend
M = Average annual reinvestment required to maintain G at the projected level
T = Expected annual outflow on account of taxes
I = Expected flow of annual payments on account of interest, preference dividends and other prior charges

The operational objective of financial management is the maximisation of W in Eq. (1.1). Alternatively, W can be expressed symbolically by a short-cut method as in Eq. (1.4). Net present value (worth) or wealth is

$$W = \frac{A_1}{(1+K)} + \frac{A_2}{(1+K)^2} + \ldots + \frac{A_n}{(1+K)^n} - C \tag{1.4}$$

where $A_1, A_2, \ldots A_n$ represents the stream of cash flows expected to occur from a course of action over a period of time;
K is the appropriate discount rate to measure risk and timing; and
C is the initial outlay to acquire that asset or pursue the course of action.

It can, thus, be seen that in the value maximisation decision criterion, the time value of money and handling of the risk as measured by the uncertainty of the expected benefits is an integral part of the exercise. It is, moreover, a precise and unambiguous concept, and therefore, an appropriate and operationally feasible decision criterion for financial management decisions.

It would also be noted that the focus of financial management is on the value to the owners or suppliers of equity capital. The wealth of the owners is reflected in the market value of shares. So wealth maximisation implies the maximisation of the market price of shares. In other words, maximisation of the market price of shares is the operational substitute for value/wealth/net present value maximisation as a decision criterion.

In brief, what is relevant is not the overall goal of a firm but a decision criterion which should guide the financial course of action. Profit/EPS maximisation was initially the generally accepted theoretical criterion for making efficient economic decisions, using profit as an economic concept and defining profit maximisation as a criterion for economic efficiency. In current financial literature, it has been replaced by the wealth maximisation decision criterion because of the shortcomings of the former as an operational criterion, as (i) it does not take account of uncertainty of risk, (ii) it ignores the time value of money, and (iii) it is ambiguous in its computation. Owing to these technical limitations, profit maximisation cannot be applied in real world situations. Its modified form is the value maximisation criterion. It is important to note that value maximisation is simply extension of profit maximisation to a world that is uncertain and multiperiod in nature. Where the time period is short and degree of uncertainty is not great, value maximisation and profit maximisation amount to essentially the same thing.[9]

However, two important issues are related to the value/share price-maximisation, namely, **economic value added** and **focus on stakeholders**.

ORGANISATION OF FINANCE FUNCTION

The responsibilities for financial management are spread throughout the organisation in the sense that financial management is, to an extent, an integral part of the job for the managers involved in planning, allocation of resources and control. For instance, the production manager (engineer) shapes the investment policy (proposal of a new plant); the marketing manager/analyst provides inputs in forecasting and planning; the purchase manager influences the level of investment in inventories; and the sales manager has a say in the determination of receivables policy. Nevertheless, financial management is highly specialised in nature and is handled by specialists. Financial decisions are of crucial importance. It is, therefore, essential to set up an efficient organisation for financial management functions.

Since finance is a major/critical functional area, the ultimate responsibility for carrying out financial management functions lies with the top management, that is, board of directors/managing director/chief executive or the committee of the board. However, the exact nature of the organisation of the financial management function differs from firm to firm depending upon factors such as size of the firm, nature of its business, type of financing operations, ability of financial officers and the financial philosophy, and so on. Similarly, the designation of the chief executive of the finance department also differs widely in case of different firms. In some cases, they are known as finance managers while in others as vice-president (finance), director (finance), and financial controller and so on. He reports directly to the top management. Various sections within the financial management area are headed by managers such as controller and treasurer.

Figure 1.2 depicts the organisation of the financial management function in a large typical firm.

The *job of the chief financial executive* does not cover only routine aspects of finance and accounting. As a member of top management, he is closely associated with the formulation of policies as well as decision

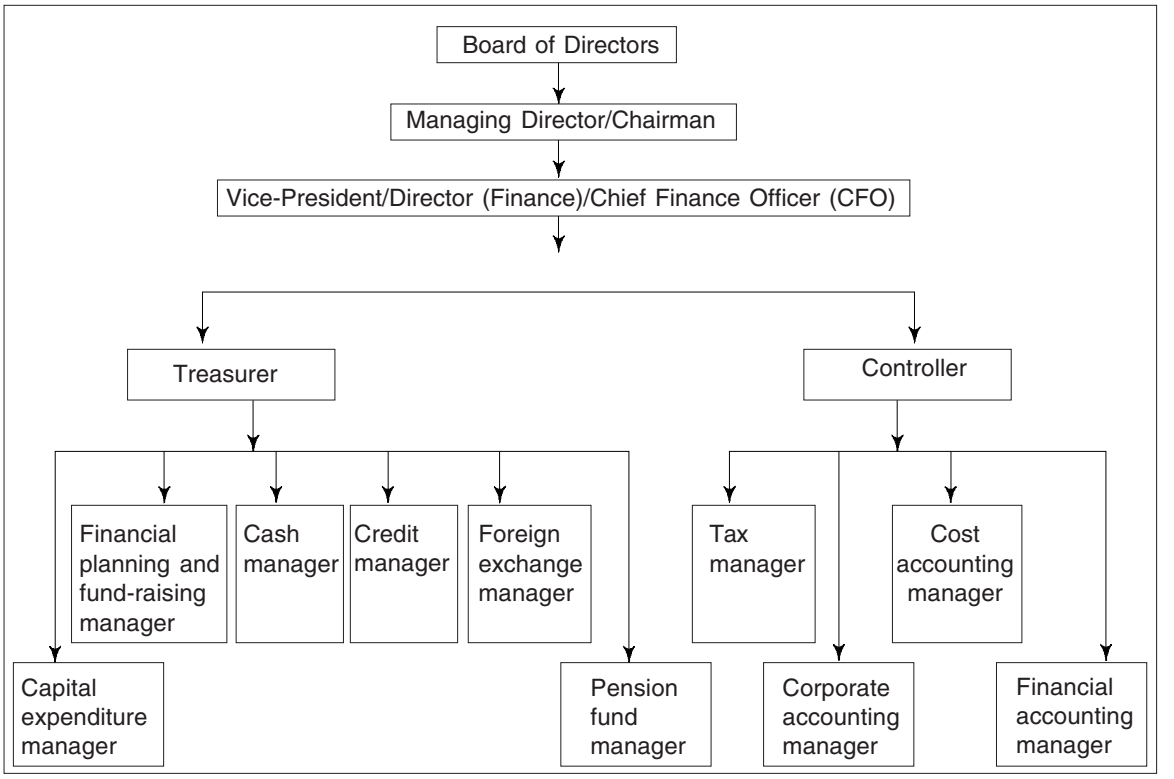


Figure 1.2 *Organisation of Financial Management Function*

making. Under him are controllers and treasurers, although they may be known by different designations in different firms. The tasks of financial management and allied areas like accounting are distributed between these two key financial officers. Their functions are described below.

The **main concern of the treasurer** is with the financing activities of the firm. Included in the range of his functions are: (i) obtaining finance, (ii) banking relationship, (iii) investor relationship, (iv) short-term financing, (v) cash management, (vi) credit administration, (vii) investments, and (viii) insurance.

The **functions of the controller** are related mainly to accounting and control. The typical functions performed by him include: (i) financial accounting, (ii) internal audit, (iii) taxation, (iv) management accounting and control, (v) budgeting, planning and control, and (vi) economic appraisal and so on.

EMERGING ROLE OF FINANCE MANAGERS IN INDIA

Reflecting the emerging economic and financial environment in the post-liberalisation era, the role/job of financial managers in India has become more important, complex and demanding. The key challenges are, *inter-alia*, in the areas specified below: (a) financial structure, (b) foreign exchange management, (c) treasury operations, (d) investor communication, (e) management control and (f) investment planning. The main elements of the changed economic and financial environment, *inter alia*, are the following:

- Considerable relaxation in industrial licensing framework in terms of the modifications in the Industries Development (Regulations) Act;

- Abolition of the Monopolies and Restrictive and Trade Practices (MRTP) Act and its replacement by the Competition Act;
- Repeal of Foreign Exchange Regulation Act (FERA) and enactment of a liberalised Foreign Exchange Management Act (FEMA);
- Abolition of Capital Issues (Control) Act and the setting-up of the Securities and Exchange Board of India (SEBI) under the SEBI Act for the regulation and development of the securities market and the protection of investors;
- Enactment of the Insurance Regulatory and Development Authority (IRDA) Act and the setting-up of the IRDA for the regulation of the insurance sector and the consequent dismantling of the monopoly of LIC and GIC and its subsidiaries;
- Emergence of the capital market at the centre-stage of the financing system and the disappearance of the erstwhile development/public financial/term lending institutions from the Indian financial scene;
- Emergence of a highly articulate and sophisticated money market;
- Globalisation, convertibility of rupee, liberalised foreign investments in India, Indian foreign investment abroad;
- Market-determined interest rate, emergence of highly innovative financial instruments;
- Growth of mutual funds; credit rating, other financial services;
- Rigorous prudential norms, credit risk management framework for banks and financial institutions;
- Access to Euro-issues, American Depository Receipts (ADRs);
- Privatisation/disinvestment of public sector undertakings.

SUMMARY

- Financial management/corporate finance/managerial finance is concerned with the duties of the finance manager in a business firm. He performs such varied tasks as budgeting, financial forecasting, cash management, credit administration, investment analysis and funds procurement. The recent trends towards globalisation of business activity has created new demands and opportunities in managerial finance.
- Finance is closely related to both macroeconomics and microeconomics. Macroeconomics provides an understanding of the institutional structure in which the flow of finance takes place. Microeconomics provides various profit maximisation strategies based on the theory of the firm. A financial manager uses these to run the firm efficiently and effectively. Similarly, he depends on accounting as a source of information/data relating to the past, present and future financial position of the firm. Despite this interdependence, finance and accounting differ in that the former is concerned with cash flows, while the latter provides accrual-based information; and the focus of finance is on the decision making but accounting concentrates on collection of data.
- The financial management function covers decision making in three inter-related areas, namely, investment including working capital management, financing and dividend policy. The three key activities of the financial manager are (1) performing financial analysis; (2) making investment decisions and (3) making financing decisions.
- The goal of the financial manager is to maximise the owners/shareholders wealth as reflected in share prices rather than profit/EPS maximisation because the latter ignores the timing of returns, does not directly consider cash flows and ignores risk. As key determinants of share price, both return and risk must be assessed by the financial manager when evaluating decision alternatives.

- The importance of the finance function depends on the size of the firm. Financial management is an integral part of the overall management of the firm. In small firms, the finance functions are generally performed by the accounting departments. In large firms, there is a separate department of finance headed by a specialist known by different designations such as vice-president, director of finance, chief finance officer and so on.
- Reflecting the emerging economic and financial environment in the post-liberalisation era since the early nineties, the role/job of finance managers in India has become more important, complex and demanding. The key challenges are in the areas of (1) financial structure, (2) foreign exchange management, (3) treasury operations, (4) investor communication, (5) management control and (6) investment planning.

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REVIEW QUESTIONS

RQ.1.1 Describe the close relationship between finance and economics and explain why the finance manager should possess a basic knowledge of economics. What is the primary economic principle used in managerial finance?

RQ.1.2 What are the major differences between accounting and finance with respect to (a) emphasis on cash flows and (b) decision making?

RQ.1.3 Briefly explain the three key activities of the financial manager.

RQ.1.4 Briefly describe the three basic reasons why profit/EPS maximisation fails to be consistent with wealth maximisation.

RQ.1.5 What is the goal of the firm? Discuss how to measure achievement of this goal.

RQ.1.6 Who are a firm's stakeholders and what consideration is often given to them in pursuing the firm's goal? Why?

RQ.1.7 Define agency costs and explain why firms incur them. What are structuring expenditures and how are they used? Describe and differentiate between incentives and performance compensation plans.

RQ.1.8 Contrast the salient features of the traditional and modern approaches to financial management.
RQ.1.9 Describe the three broad areas of financial decision making.
RQ.1.10 Comment on the emerging role of the finance manager in India.
RQ.1.11 How is the finance function typically organised in a large organisation?

EXAMINATION QUESTIONS

EQ.1.1 Explain two basic functions of financial management. (*CA—November, 2002*)
EQ.1.2 In what ways is the "firm value" maximisation objective superior to "profit maximisation" objective? Explain. (*CA—May, 2003*)
EQ.1.3 Discuss the 'Profit maximisation' and 'Wealth maximisation' objective of a firm. (*CA—November, 2003*)
EQ.1.4 Discuss the functions of a chief financial officer. (*CA—May, 2004*)
EQ.1.5 Discuss the changing scenario of financial management in India. (*CA—May, 2006*)
EQ.1.6 Discuss the conflicts in profit versus wealth maximisation principle of the firm. (*CA—November, 2006*)
EQ.1.7 What are the main responsibilities of a chief financial officer of an organisation? (*CA(PCE)—May, 2007*)

2 Time Value of Money

Introduction

The object of this chapter is to illustrate the basics of the mathematics of finance, that is, the time value of money. Recognition of the time value of money in financial decision-making is extremely important. It was observed in Chapter 1 that wealth maximisation, as an objective of financial management, is superior to profit maximisation because, among other things, the former incorporates the timing of benefits received while the latter ignores it. Given the objective of wealth maximisation, much of the subject-matter of financial management is future oriented. A financial decision taken today has implications for a number of years, that is, it spreads into the future. For example, firms have to acquire fixed assets for which they have to pay a certain sum of money to the vendors. The benefits arising out of the acquisition of such assets will be spread over a number of years in the future, till the working life of the assets. On the other hand, funds have to be procured from different sources such as raising of capital through new issues, bank borrowings, term loans from financial institutions, sale of debentures and so on. These involve a cash inflow at the time of raising funds as well as an obligation to pay interest/dividend and return the principal in future. It is on the basis of a comparison of the cash outflows (outlays) and the benefits (cash inflows) that financial decisions are made. For a meaningful comparison the two variables must be strictly comparable. One basic requirement of comparability is the incorporation of the time element in the calculations. In other words, in order to have a logical and meaningful comparison between cash flows that accrue in different time periods, it is necessary to convert the sums of money to a common point of time. This section is devoted to a discussion of the techniques for doing so. We first explain the meaning of, and rationale underlying, the time value of money. The technique employed in adjusting the timing aspect of financial decision making through compounding is explained subsequently. The discounting techniques are illustrated thereafter. The important applications of these techniques are also demonstrated.

Rationale

Conceptually, 'time value of money' means that the value of a unit of money is different in different time periods. The value of a sum of money received today is more than its value received after some time.

Conversely, the sum of money received in future is less valuable than it is today. In other words, the present worth of a rupee received after some time will be less than a rupee received today. Since a rupee received today has more value, rational investors would prefer current receipt to future receipts. The time value of money can also be referred to as *time preference for money*.

The main reason for time preference for money is to be found in the reinvestment opportunities for funds which are received early. The funds so invested will earn a rate of return; this would not be possible if the funds are received at a later time. The time preference for money is, therefore, expressed generally in terms of a rate of return or more popularly as a discount rate. The expected rate of return as also the time value of money will vary from individual to individual depending, *inter alia*, on his perception. We illustrate the time value of money using a simple example.

Suppose, Mr X is given the choice of receiving Rs 1,000 either now or one year later. His choice would obviously be for the first alternative as he can deposit the amount in his saving bank account and earn a nominal rate of interest, say, five per cent. At the end of the year, the amount will accumulate to Rs 1,050. In other words, the choice before Mr X is between Rs 1,050 and Rs 1,000 at the end of the year. As a rational person, Mr X should be expected to prefer the larger amount (i.e. Rs 1,050 here). Here we say that the time value of money, that is, the rate of interest is five per cent. It may, thus, be seen that future cash flows are less valuable because of the investment opportunities of the present cash flows.

What applies to an individual applies equally, if not in greater measure, to a business firm. It is because business firms make decisions which have ramifications extending beyond the period in which they were taken. For instance, the capital budgeting decision generally involves the current cash outflows in terms of the amount required for purchasing a new machine or launching a new project and the execution of the scheme generates future cash inflows during its useful life. Let us assume that the project cost (current cash outflows) is Rs 10,00,000. To keep the illustration simple, it is assumed that the project has a useful life of only one year in which it is estimated to have cash inflows of Rs 10,80,000 (at the end of the first year). The project appears to be *prima facie* acceptable as it adds Rs 80,000 as profit. However, when we take into account a rate of interest, say, of 10 per cent, the earlier conclusion will have to be revised as, without the project, the sum could have amounted to Rs 11,00,000. Likewise, when the decision is made to raise a loan of Rs 10,00,000 from a financial institution or by issuing debentures, for a period of 10 years, the firm is not only under obligation to meet interest payment as and when it becomes due on the debt at fixed intervals but also must make provisions so that it can repay Rs 10,00,000 when the loan or debentures become due. Thus, time value of money is of crucial significance. This requires the development of procedures and techniques for evaluating future incomes in terms of the present.

Techniques

The preceding discussion has revealed that in order to have logical and meaningful comparisons between cash flows that result in different time periods it is necessary to convert the sums of money to a common point in time. There are two techniques for doing this: (1) Compounding, and (2) Discounting.

Compounding Technique Interest is compounded when the amount earned on an initial deposit (the initial principal) becomes part of the principal at the end of the first compounding period. The term principal refers to the amount of money on which interest is received. Consider Example 2.1.

EXAMPLE 2.1

If Mr X invests in a saving bank account Rs 1,000 at 5 per cent interest compounded annually, at the end of the first year, he will have Rs 1,050 in his account. This amount constitutes the principal for earning interest

for the next year. At the end of the next year, there would be Rs 1,102.50 in the account. This would represent the principal for the third year. The amount of interest earned would be Rs 55.125. The total amount appearing in his account would be Rs 1,157.625. Table 2.1 shows this compounding procedure:

Table 2.1 *Annual Compounding*

Year	*1*	*2*	*3*
Beginning amount	Rs 1,000	Rs 1,050	Rs 1,102.50
Interest rate	0.05	0.05	0.05
Amount of interest	50	52.50	55.125
Beginning principal	1,000	1,050	1,102.50
Ending principal	1,050	1,102.50	1,157.625

This compounding procedure will continue for an indefinite number of years. The compounding of interest can be calculated by the following equation:

$$A = P\ (1 + i)^n \tag{2.1}$$

in which

A = amount at the end of the period
P = principal at the beginning of the period
i = rate of interest
n = number of years

The amount of money in the account at the end of various years is calculated by using Eq. 2.1.

Amount at the end of year 1 = Rs 1,000 (1 + .05) = Rs 1,050
2 = Rs 1,050 (1 + .05) = Rs 1,102.50
3 = Rs 1,102.50 (1 + .05) = Rs 1,157.625

The amount at the end of year 2 can be ascertained by substituting Rs 1,000 (1 + .05) for Rs 1,050, that is, Rs 1,000 (1 + .05) (1 + .05) = Rs 1,102.50.

Similarly, the amount at the end of year 3 can be determined in the following way: Rs 1,000 (1 + .05) (1 + .05) (1 + .05) = Rs 1,157.625.

Thus, after substituting the actual figures for the investment of Rs 1,000 in the formula $A = P\ (1 + i)^n$, we arrive at the same result as in Table 2.1. This is the fundamental equation of compound interest. The formula is useful as it can be applied quite readily for wide ranges of i and n. However, the calculations involved will be tedious and time-consuming if the number of years involved is large, say, 15 years or 20 years. To find the compound value of Rs 1,000, assuming the rate of interest to be 5 per cent, the compounding factor 1.05 is to be raised to fifteenth power or twentieth power. In order to simplify the compound interest calculations, compound interest tables for values $(1 + i)^n$ for wide ranges of i and n have been compiled. Table A-1 given in Appendix I at the end of the book gives compound value interest factor of one rupee at different rates of interest for different time periods. The compounded values can be readily calculated with the help of Table A-1. For instance, if Mr X wishes to find out how much his savings, Rs 1,000, will accumulate to in 15 years at 5 per cent rate of interest, application of the formula will require solving 1.05 raised to the power of fifteen: Rs 1,000 $(1.05)^{15}$ = A

Using Table A-1, we find that the compound value interest factor (CVIF) of Re 1 at 5 per cent interest rate for 15 years is 2.079. Multiplying the initial principal (Rs 1,000) by 2.079, we obtain Rs 2,079. With the help of the table, it is possible to calculate the compounded value for any combination of interest rate, i and number of years, n. Let us take another illustration.

The compound interest phenomenon is most commonly associated with various savings institutions. These institutions emphasise the fact that they pay compound interest on savings deposited with them. If an

investor deposits Rs 20,000 with a bank which is paying interest at 8 per cent on a 15-year time deposit, we consult Table A-1 and read the relevant value in the 15th row (time period) in the column of 8 per cent (rate of interest). This value is 3.172. Multiplying this factor by the actual deposit of Rs 20,000, we find his savings will accumulate to Rs 63,440.

Two important observations can be made from the Table A-1 for the sum of Re one. The first is that as the interest rate increases for any given year, the compound interest factor also increases. Thus, the higher the interest rate, the greater is the future sum. The second point is that for a given interest rate the future sum of a rupee increases with the passage of time. Thus, the longer the period of time, the higher is the compound interest factor. However, it should be borne in mind that for an interest rate of zero per cent, the compound interest factor always equals 1 and, therefore, the future amount always equals the initial principal.

Semi-annual and Other Compounding Periods In the above examples we have assumed annual compounding of interest at the end of the year. Very often the interest rates are compounded more than once in a year. Savings institutions, particularly, compound interests semi-annually, quarterly and even monthly.

Semi-annual Compounding means that there are two compounding periods within the year. Interest is actually paid after every six months at a rate of one-half of the annual (stated) rate of interest.

EXAMPLE 2.2

Assume Mr X places his savings of Rs 1,000 in a two-year time deposit scheme of a bank which yields 6 per cent interest compounded semi-annually. He will be paid 3 per cent interest compounded over four periods—each of six months' duration. Table 2.2 presents the calculations of the amount Mr X will have from the time deposit after two years.

Table 2.2 *Semi-annual Compounding*

Year	*6 months*	*1 Year*	*18 months*	*2 years*
Beginning amount	Rs 1,000.00	Rs 1,030.00	Rs 1,060.90	Rs 1,092.73
Interest rate	0.03	0.03	0.03	0.03
Amount of interest	30.00	30.90	31.83	32.78
Beginning principal	1,000.00	1,030.00	1,060.90	1,092.73
Ending principal	1,030.00	1,060.90	1,092.73	1,125.51

Table 2.2 reveals that his savings will amount to Rs 1,060.90 and Rs 1,125.51 respectively at the end of the first and second years.

Quarterly Compounding means that there are four compounding periods within the year. Instead of paying the interest once a year, it is paid in four equal instalments after every three months. Using the above illustration, there will be eight compounding periods and the rate of interest for each compounding period will be 1.5 per cent, that is (1/4 of 6 per cent).

Table 2.3 presents the relevant calculations regarding the amount he will have at the end of two years, when interest is compounded quarterly. At the end of the first year, his savings will accumulate to Rs 1,061.363 and at the end of the second year he will have Rs 1,126.49.

Table 2.3 *Quarterly Compounding*

Period (months)	*Beginning amount*	*Interest factor*	*Amount of interest*	*Beginning principal*	*Ending principal*
3	Rs 1,000.000	0.015	Rs 15.000	Rs 1,000.000	Rs 1,015.000
6	1,015.000	0.015	15.225	1,015.000	1,030.225
9	1,030.225	0.015	15.453	1,030.225	1,045.678
12	1,045.678	0.015	15.685	1,045.678	1,061.363
15	1,061.363	0.015	15.920	1,061.363	1,077.283
18	1,077.283	0.015	16.159	1,077.283	1,093.442
21	1,093.442	0.015	16.401	1,093.442	1,109.843
24	1,109.843	0.015	16.647	1,109.843	1,126.490

Table 2.4 presents a comparative picture of Mr X's savings at the end of two years when they are compounded annually, half-yearly and quarterly. The table warrants the generalisation that the more frequently the interest is compounded, the greater is the amount of money accumulated. This is primarily because interest is earned more frequently.

Table 2.4 *Comparison of Annual, Semi-annual and Quarterly Compounding*

	Compounding period		
End of year	*Annual*	*Half-yearly*	*Quarterly*
1	Rs 1,060.00	Rs 1,060.90	Rs 1,061.36
2	1,123.60	1,125.51	1,126.49

The effect of compounding more than once a year can also be expressed in the form of a formula. Equation 2.1 can be modified as Eq. 2.2.

$$P\left\{1+\frac{i}{m}\right\}^{mn} = A \tag{2.2}$$

in which m is the number of times per year compounding is made. For semi-annual compounding, m would be 2, while for quarterly compounding it would equal 4 and if interest is compounded monthly, weekly and daily, would equal 12, 52 and 365 respectively.

The general applicability of the formula can be shown as follows, assuming the same figures of Mr X's savings of Rs 1,000:

1. For semi-annual compounding, Rs 1,000 $\left\{1+\frac{0.06}{2}\right\}^{2\times 2}$ = Rs 1,000 $(1 + 0.03)^4$ = Rs 1,125.51

2. For quarterly compounding, Rs 1,000 $\left\{1+\frac{0.06}{4}\right\}^{4\times 2}$ = Rs 1,000 $(1 + 0.015)^8$ = Rs 1,126.49

The table of the sum of Re 1 (Table A-1) can also be used to simplify calculations when compounding occurs more than once a year. We are required simply to divide the interest rate by the number of times compounding occurs, that is ($i \div$ m) and multiply the years by the number of compounding periods per year, that is, ($m \times n$). In our example, we have to look at Table A-1 for the sum of rupee one under the 3 per cent column and in the row for the fourth year when compounding is done semi-annually, the respective rate and year figures would be 1.5 per cent and the eighth year in quarterly compounding.

The compounding factor for 3 per cent and 4 years is 1.126 while the factor for 1.5 per cent and 8 years is 1.127. Multiplying each of the factors by the initial savings deposit of Rs 1,000, we find Rs1,126 (Rs 1,000 × 1.126) for semi-annual compounding and Rs 1,127 (Rs 1,000 × 1.127) for quarterly compounding. The corresponding values found by the long method are Rs 1,125.51 and Rs 1,126.49 respectively. The difference can be attributed to the rounding off of values in Table A-1.

Future/Compounded Value of a Series of Payments So far we have considered only the future value of a single payment made at time zero. In many instances, we may be interested in the future value of a series of payments made at different time periods. For simplicity, we assume that the compounding time period is one year and payment is made at the end of each year. Suppose, Mr X deposits each year Rs 500, Rs 1,000, Rs 1,500, Rs 2,000 and Rs 2,500 in his saving bank account for 5 years. The interest rate is 5 per cent. He wishes to find the future value of his deposits at the end of the 5th year. Table 2.5 presents the calculations required to determine the sum of money he will have.

Table 2.5 *Annual Compounding of a Series of Payments*

End of year	*Amount deposited*	*Number of years compounded*	*Compounded interest factor from Table A-1*	*Future value (2) × (4)*
1	*2*	*3*	*4*	*5*
1	Rs 500	4	1.216	Rs 608.00
2	1,000	3	1.158	1,158.00
3	1,500	2	1.103	1,654.50
4	2,000	1	1.050	2,100.00
5	2,500	0	1.000	2,500.00
				8,020.50

Column 3 of Table 2.5 indicates that since the deposits are made at the end of the year, the first deposit will earn interest for four years, the second for three years and so on. The last payment of Rs 2,500 comes at the end of the fifth year and, therefore, the future value remains Rs 2,500. The future value of the entire stream of payments is the sum of the individual future values, that is, Rs 8,020.50. The graphic presentation of these values is shown in the following time scale diagram which shows the equivalence of money sums (Fig. 2.1).

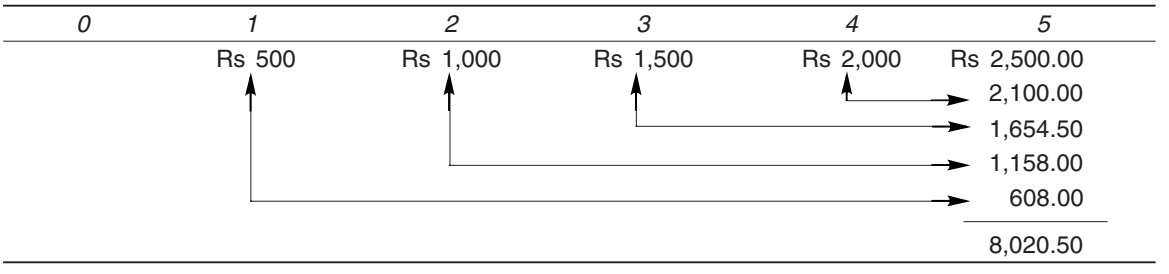

Figure 2.1 *Graphic Illustration of Compounding Values*

It may be noted here that we are making use of the compound interest formula for each payment separately. For instance, Rs 500 put in at the end of the first year compounds for four years, and has a future value of Rs 608 at 5 per cent interest [Rs $500(1 + 0.05)^4$]. Similarly, Rs1,000 deposited at $n = 2$ compounds for 3 years and amounts to Rs 1,158 [Rs $1,000(1 + 0.05)^3$] and so on.

Compound Sum of an Annuity An annuity is a stream of equal annual cash flows. Annuities involve calculations based upon the regular periodic contribution or receipt of a fixed sum of money. The calculations required to find the sum of an annuity on which interest is paid at a specified rate compounded annually are illustrated in Example 2.3.

EXAMPLE 2.3

Mr X deposits Rs 2,000 at the end of every year for 5 years in his saving account paying 5 per cent interest compounded annually. He wants to determine how much sum of money he will have at the end of the 5th year.

SOLUTION

Table 2.6 presents the relevant calculations:

Table 2.6 *Annual Compounding of Annuity*

End of year	*Amount deposited*	*Number of years compounded*	*Compounded interest factor from Table A-1*	*Future value (2) × (4)*
1	*2*	*3*	*4*	*5*
1	Rs 2,000	4	1.216	Rs 2,432
2	2,000	3	1.158	2,316
3	2,000	2	1.103	2,206
4	2,000	1	1.050	2,100
5	2,000	0	1.000	2,000
				11,054

The calculations in this case can be cut short and simplified since the compound interest factor is to be multiplied by the same rupee amount (Rs 2,000) each year as shown in the following calculations:

Amount at the end of 5 years = Rs 2,000 (1.216) + Rs 2,000 (1.158) + Rs 2,000 (1.103) + Rs 2,000 (1.050) + Rs 2,000 (1.000)

Taking out the common factor Rs 2,000, = Rs 2,000 (1.216 + 1.158 + 1.103 + 1.050 + 1.000)

= Rs 2,000 (5.527) = Rs 11,054.

From the above, it follows that in order to find the sum of the annuity, the annual amount must be multiplied by the sum of the appropriate compound interest factor annuity (CVIFA). Such calculations are available for a wide range of i and n. They are given in Table A-2, labelled as the sum of an annuity table. To find the answer to the annuity question of Example 2.3, we are required to look for the 5 per cent column and the row for the fifth year and multiply the factor by the annuity amount of Rs 2,000. From the table we find that the sum of annuity of Re 1 deposited at the end of each year for 5 years is 5.526 (CVIFA). Thus, when multiplied by Rs 2,000 annuity (A) we find the total sum as Rs 11,052.

Symbolically, $$Sn = CVIFA \times A$$

where A is the value of annuity, and $CVIFA$ represents the appropriate factor for the sum of the annuity of Re 1 and Sn represents the compound sum of an annuity. The answer which we get from the long method was Rs 11,054. This discrepancy can be attributed to the rounding off of values in Table A-2. Moreover, it may be noted that the sum of an annuity is always larger than the number of years the annuity runs, unless of course, when interest rate is zero; in the latter case it will equal the number of years.

Annuity tables are of great help in the field of investment banking as they guide the depositors and investors as to what sum an amount (X) paid for number of years, n, will accumulate to at a stated rate of

compound interest. Let us illustrate. Mr X wishes to know the sum of money he will have in his saving account which pays 5 per cent interest at the end of 12 years if he deposits Rs .1,000, at the end of each year for the next twelve years. The appropriate factor for the sum of a twelve-year annuity at 5 per cent as given in Table A-2 is 15.917. Multiplying this factor by Rs 1,000 deposit, we find the resultant sum to be Rs 15,917.

Present Value or Discounting Technique The concept of the present value is the exact opposite of that of compound value. While in the latter approach money invested now appreciates in value because compound interest is added, in the former approach (present value approach) money is received at some future date and will be worth less because the corresponding interest is lost during the period. In other words, the present value of a rupee that will be received in the future will be less than the value of a rupee in hand today. Thus, in contrast to the compounding approach where we convert present sums into future sums, in present value approach future sums are converted into present sums. Given a positive rate of interest, the present value of future rupees will always be lower. It is for this reason, therefore, that the procedure of finding present values is commonly called *discounting*. It is concerned with determining the present value of a future amount, assuming that the decision maker has an opportunity to earn a certain return on his money. This return is designated in financial literature as the discount rate, the cost of capital or an opportunity cost. These concepts are elaborated in Chapter 6. Let us illustrate the discounting procedure by an example (2.4).

EXAMPLE 2.4

Mr X has been given an opportunity to receive Rs 1,060 one year from now. He knows that he can earn 6 per cent interest on his investments. The question is: what amount will he be prepared to invest for this opportunity?

To answer this question, we must determine how many rupees must be invested at 6 per cent today to have Rs 1,060 one year afterwards.

Let us assume that P is this unknown amount, and using Eq. 2.1 we have: $P(1 + 0.06) = \text{Rs } 1{,}060$

Solving the equation for P, $P = \dfrac{\text{Rs } 1{,}060}{1.06} = \text{Rs } 1{,}000$

Thus, Rs 1,000 would be the required investment to have Rs 1,060 after the expiry of one year. In other words, the present value of Rs 1,060 received one year from now, given the rate of interest of 6 per cent, is Rs 1,000. Mr X should be indifferent to whether he receives Rs 1,000 today or Rs 1,060 one year from today. If he can either receive more than Rs 1,060 by paying Rs 1,000 or Rs 1,060 by paying less than Rs 1,000, he would do so.

Mathematical Formulation Since finding present value is simply the reverse of compounding, the formula for compounding of the sum can be readily transformed into a present value formula. As shown in the preceding section, according to the compounding formula, $A = P(1 + i)^n$. Therefore, the present value equation becomes:

$$P = \frac{A}{(1+i)^n} = A\left\{\frac{1}{(1+i)^n}\right\} \tag{2.3}$$

in which P is the present value for the future sum to be received or spent; A is the sum to be received or spent in future; i is interest rate, and n is the number of years. Thus, the present value of money is the reciprocal of the compounding value.

Present Value Tables In order to simplify the present value calculations, tables are readily available for various ranges of i and n. Table A-3 in the Appendix gives the present value factors (PVIF) for various discount rates and years. Since the factors in Table A-3 give the present value of one rupee for various combinations of i and n, we can find the present value of the future lump sum by multiplying it with the appropriate present value interest factor (PVIF) from Table A-3.
In terms of a formula, it will be:

$$P = A\ (PVIF) \tag{2.4}$$

EXAMPLE 2.5

Mr X wants to find the present value of Rs 2,000 to be received 5 years from now, assuming 10 per cent rate of interest. We have to look in the 10 per cent column of the fifth year in Table A-3. The relevant PVIF as per Table A-3 is 0.621.

Therefore, present value = Rs 2,000 (0.621) = Rs 1,242

Some points may be noted with respect to present values. First, the expression for the present value factor for n years at i per cent, $1/(1 + i)^n$ is the reciprocal or inverse of the compound interest factor for n years at i per cent, $(1 + i)^n$. This observation can also be confirmed by finding out the reciprocal of the relevant present value factor of Example 2.5. The reciprocal of 0.621 is 1.610. The compound interest factor from Table A-1 for 5 years at 10 per cent is 1.611. The difference is due to rounding off of values in Table A-1.

In other words, in Example 2.5, the sum of Rs 1,242 will be compounded to Rs 2,000 in five years at 10 per cent rate of interest [Rs 1,242 × 1.611) = Rs 2,000.862]. The difference of Re 0.862 is attributable to the fact that the table values are rounded figures. This indicates that both the methods, compounding and discounting of adjusting time value of money, yield identical results. Second, Table A-3 shows that the farther in the future a sum is to be received, the lower is its present value. See, for instance, the following extract from Table A-3:

Time (years)	*2*	*4*	*6*	*8*	*10*
5 per cent discount factor	*0.907*	*0.823*	*0.711*	*0.677*	*0.614*

Finally, the perusal of Table A-3 also reveals that the greater is the discount rate, the lower is its present value. Observe in this connection the following:

Discount rate	*4*	*8*	*12*	*16*	*20*
5 years time period	*0.822*	*0.681*	*0.567*	*0.476*	*0.402*

Thus, the higher the discount rate, the lower is the present value factor; and the longer the period of time, and correspondingly, the lower is the present value factor and *vice versa*. At the discount rate of zero per cent, the present value factor always equals one and, therefore, the future value of the funds equals their present value. But this aspect is only of academic importance as in actual practice the business firms can rarely, if ever, obtain the resources (capital) at zero rate of interest.

Present Value of a Series of Cash Flows So far we have considered only the present value of a single receipt at some future date. In many instances, especially in capital budgeting decisions, we may be interested in the present value of a series of receipts received by a firm at different time periods. Like compounding, in order to determine the present value of such a mixed stream of cash inflows, all that is required is to determine the present value of each future payment and then to aggregate them to find the total present value of the stream of cash flows. Symbolically,

$$P = \frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + \frac{C_3}{(1+i)^3} + \ldots + \frac{C_n}{(1+i)^n}$$

$$= \sum_{t=1}^{n} \frac{C_t}{(1+i)^t} \tag{2.5}$$

in which P = the sum of the individual present values of separate cash flows; C_1, C_2, C_3 ... C_n, refer to cash flows in time periods 1, 2, 3 ... n.

This is the general form of the present value formula. To put the formula in a more practical perspective, we will have

$$P = C_1\,(IF_1) + C_2(IF_2) + C_3(IF_3) + \ldots + C_n(IF_n)$$

$$= \sum_{t=1}^{n} C_t\,(IF_t) \tag{2.6}$$

in which IF_1, IF_2, IF_3, ... IF_n represents relevant present value factors in different time periods, 1,2,3 ... n.

If the time value of money is 10 per cent, we can easily find the present value of the following series of yearly payments (Example 2.6).

EXAMPLE 2.6

Year	*Cash flows*
1	Rs 500
2	1,000
3	1,500
4	2,000
5	2,500

In order to solve this problem, the present value of each individual cash flow discounted at 10 percent for the appropriate number of years is to be determined. The sum of all these individual values is then calculated to get the present value of the total stream. The present value factors required for the purpose are obtained from Table A-3. The results are summarised in Table 2.7.

Table 2.7 *Present Value of a Mixed Stream of Cash Flows*

Year end	*Cash flows*	*Present value factor (2) × (3)*	*Present value*
1	*2*	*3*	*4*
1	Rs 500	0.909	Rs 454.50
2	1,000	0.826	826.00
3	1,500	0.751	1,126.50
4	2,000	0.683	1,366.00
5	2,500	0.621	1,552.50
			5,325.50

Annuity We have already defined an annuity as a series of equal cash flows of an amount each time. Due to this nature of an annuity, a short cut is possible. Example 2.7 clarifies this method.

EXAMPLE 2.7

Mr X wishes to determine the present value of the annuity consisting of cash inflows of Rs 1,000 per year for 5 years. The rate of interest he can earn from his investment is 10 per cent.

SOLUTION

Table 2.8 shows the required calculations:

Table 2.8 *Long Method for Finding Present Value of an Annuity of Rs 1,000 for Five Years*

Year end	*Cash flows*	*Present value factor*	*Present value (2) × (3)*
1	*2*	*3*	*4*
1	Rs 1,000	0.909	Rs 909.00
2	1,000	0.826	826.00
3	1,000	0.751	751.00
4	1,000	0.683	683.00
5	1,000	0.621	621.00
			3,790.00

Table 2.8 shows the long way of determining the present value of annuity. This method is the same as the one adopted for mixed stream. This procedure yields a present value of Rs 3,791. However, calculations can be greatly cut short as the present value factor for each year is to be multiplied by the annual amount of Rs 1,000. This method of calculating the present value of the annuity can also be expressed as an equation:

P = Rs 1,000 (0.909) + Rs 1,000 (0.826) + Rs 1,000 (0.751) + Rs 1,000 (0.683) + Rs 1,000 (0.621)
= Rs 3,790.

Simplifying the equation by taking out 1,000 as common factor outside the equation,

P = Rs 1,000 (0.909 + 0.826 + 0.751 + 0.683 + 0.621) = Rs 1,000 (3.790) = Rs 3,790

Thus, the present value of an annuity can be found by multiplying the annuity amount by the sum of the present value factors for each year of the life of the annuity. Such ready-made calculations are available in Table A-4. This table presents the sum of present values for an annuity (PVIFA)/annuity discount factor (ADF) of Re 1 for wide ranges of interest rates, i, and number of years, n. From Table A-4 the sum ADF for five years at the rate of 10 per cent is found to be 3.791. Multiplying this factor by annuity amount (C) of Rs 1,000 in this example gives Rs 3,791. This answer is the same as the one obtained from the long method.

Now we can write the generalised formula to calculate the present value of an annuity:

$$\mathrm{P} = \frac{C_1}{(1+i)} + \frac{C_2}{(1+i)^2} + \frac{C_3}{(1+i)^3} + \ldots + \frac{C_n}{(1+i)^n}$$

$$= C\left\{\frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \frac{1}{(1+i)^3} + \ldots + \frac{1}{(1+i)^n}\right\}$$

$$= C\left\{\sum_{t=1}^{n} \frac{1}{(1+i)^t}\right\} \tag{2.7}$$

The expression within brackets gives the appropriate annuity discount factor. Therefore, in more practical terms the method of determining present value is

$$P = C\ (ADF) = \text{Rs } 1{,}000\ (3.791) = \text{Rs } 3{,}791$$

It may be noted that the interest factor for the present value of an annuity is always less than the number of years the annuity runs, whereas in case of compounding the relevant factor is larger than the number of years the annuity runs. The facts given in Example 2.7 can be shown graphically (Fig. 2.2).

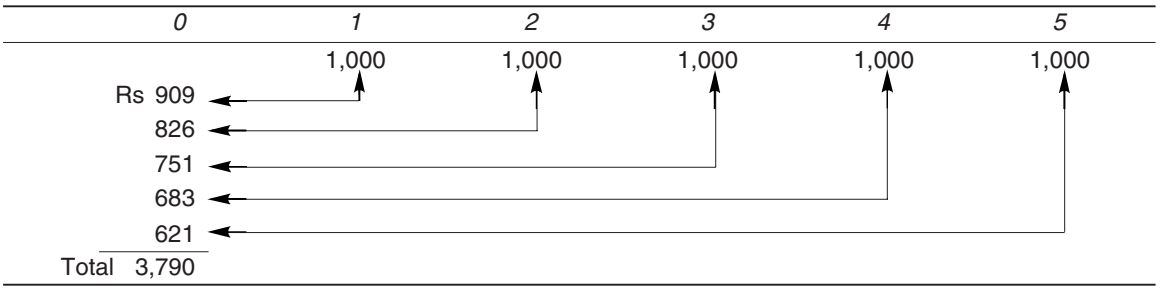

Figure 2.2 *Graphic Illustration of Present Values*

Table A-4 can be easily applied to other problems relating to annuity also as shown in Example 2.8.

EXAMPLE 2.8

The ABC company expects to receive Rs 1,00,000 for a period of 10 years from a new project it has just undertaken. Assuming a 10 per cent rate of interest, how much would be the present value of this annuity?

SOLUTION

The appropriate ADF (annuity discount factor) of a 10 year annuity at 10 per cent is to be found from the 10th row (representing time period) against the 10 per cent interest column from Table A-4. This value is 6.145. Multiplying this factor by the annuity amount of Rs1,00,000, we find that the sum of the present value of annuity is Rs 6,14,500.

Let us take an example to clarify how the problems involving varying cash inflows are to be worked out (Example 2.9).

EXAMPLE 2.9

If ABC company expects cash inflows from its investment proposal it has undertaken in time period zero, Rs 2,00,000 and Rs 1,50,000 for the first two years respectively and then expects annuity payment of Rs 1,00,000 for the next eight years, what would be the present value of cash inflows, assuming a 10 per cent rate of interest?

SOLUTION

We can solve the problem by applying the long method of finding the present values for each year's amount by consulting Table A-3. But we would like to apply the short-cut procedure as most of the payments are part of an annuity. Table 2.9 presents the relevant calculations:

Table 2.9 *Present Value of Uneven Cash Inflows Having Annuity*

1.	*Present value of Rs 2,00,000 due in year 1 = (Rs 2,00,000 × 0.909)[a] = Rs 1,81,800*
	Present value of Rs 1,50,000 due in year 2 = (Rs 1,50,000 × 0.826)[a] = Rs 1,23,900

(*Contd.*)

(*Contd.*)

2. Present value of eight year annuity with Rs 1,00,000 receipts:
   (A) Present value at the beginning of year 3 = Rs 1,00,000 (5.335)[b] = Rs 5,33,500
   (B) Present value at the beginning of year 1 = Rs 5,33,500 (0.826) = Rs 4,40,671[c]
3. Present value of total series = Rs 7,46,371

[a] Present value factor at 10 per cent from Table A-3.
[b] Present value factor at 10 per cent from Table A-4.
[c] (6.145 – 1.736) × Rs 1,00,000

It may be noted that the present values (PV) of Rs 2,00,000 and Rs 1,50,000 (uneven cash flows) received at the end of the first and second years respectively are to be determined with reference to Table A-3. The present value of subsequent cash inflows of Rs 1,00,000 each for 8 years is found in Table A-4. The value of an annuity of Rs 1,00,000 for 8 years is found to be Rs 5,33,500. The most important point to note here is that Rs 5,33,500 is the present value at the beginning of the third year (end of year 2). Therefore, its present worth in time period zero would obviously be less than Rs 5,33,500. This amount would have to be discounted back for two years at 10 percent. The present value factor for 2 years at 10 per cent discount is 0.826. Multiplying this sum by Rs 5,33,500 we get Rs 4,40,671. When the present values of the first two payments are added to the present value of the annuity component, we obtain the sum of the present value of the entire investment. For a better understanding of the problem, a graphic representation of the procedure of calculating the present value (PV) of such a problem has been given in Fig. 2.3.

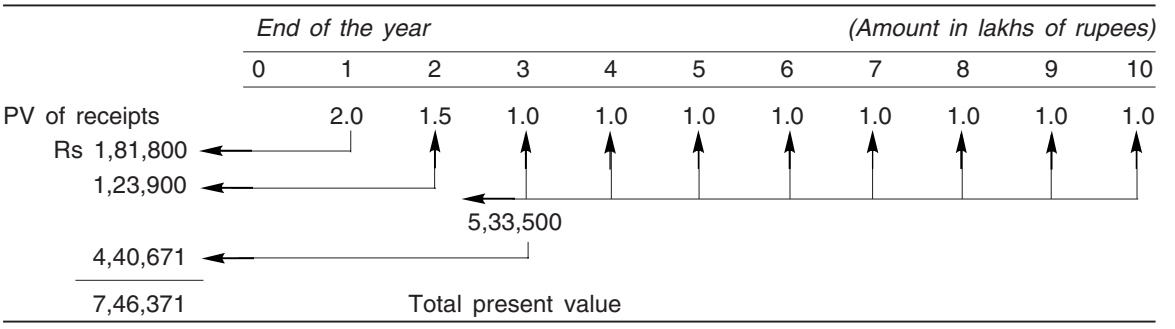

Figure 2.3 *Graphic Presentation of Present Value of Mixed Streams*

Present Value of an Infinite Life Annuity (Perpetuities) An annuity that goes on for ever is called a perpetuity. The present value of a perpetuity of Rs C amount is given by the formula:

$$\frac{C}{i} \tag{2.8}$$

This is because as the length of time for which the annuity is received increases, the annuity discount factor also increases but if the length goes on extending, this increase in the annuity factor slows down. In fact, as annuity life becomes infinitely long ($n \to \Phi$), the annuity discount factor approaches an upper limit. Such a limit is $1/i$. In other words, the appropriate factor is found by merely dividing 1 by the discount rate. The validity of this method can be seen by looking at the facts in Table A-4 for discount rates of 8, 12, 16 and 20 percent for a period of 50 years. As the number of years approaches 50, the value of these factors approaches, 12.23, 8.31, 6.25 and 5.00 respectively. Substituting 0.08, 0.12, 0.16 and 0.20 into our upper discount limit formula of $1/i$, we find the factors for finding the present value of perpetuities at these rates as 12.5, 8.33, 6.25 and 5.00.

EXAMPLE 2.10

Mr X wishes to find out the present value of investments which yield Rs 500 in perpetuity, discounted at 5 per cent. The appropriate factor can be calculated by dividing 1 by 0.05. The resulting factor is 20. That is to be multiplied by the annual cash inflow of Rs 500 to get the present value of the perpetuity, that is, Rs 10,000. This should, obviously, be the required amount if a person can earn 5 per cent on investments. It is so because if the person has Rs 10,000 and earns 5 per cent interest on it each year, Rs 500 would constitute his cash inflow in terms of interest earnings, keeping intact his initial investments of Rs 10,000.

Practical Applications of Compounding and Present Value Techniques

In the preceding sections we have outlined compounding and discounting techniques. These techniques have a number of important applications, relevant to the task of the financial manager and investors. Some of these are illustrated here.

1. A financial manager is often interested in determining the size of annual payments to accumulate a future sum to repay an existing liability at some future date or to provide funds for replacement of an existing machine/asset after its useful life. Consider Example 2.11.

EXAMPLE 2.11

Company XYZ is establishing a sinking fund to retire Rs 5,00,000, 8 per cent debentures, 10 years from today. The company plans to put a fixed amount into the fund each year for 10 years. The first payment will be made at the end of the current year. The company anticipates that the funds will earn 6 per cent a year. What equal annual contributions must be made to accumulate Rs 5,00,000, 10 years from now?

SOLUTION

The solution to this problem is closely related to the process of finding the compounded sum of an annuity. Table A-2 indicates that the annuity factor for 10 years at 6 per cent is 13.181. That is, one rupee invested at the end of each year for 10 years will accumulate to Rs 13.181 at the end of the 10th year. In order to have Rs 5,00,000 the required amount would be Rs 5,00,000 ÷ 13.181 = Rs 37,933.39. If Rs 37,933.39 is deposited at the end of each year for ten years, there will be Rs 5,00,000 in the account.

2. When the amount of loan taken from financial institutions or commercial banks is to be repaid in a specified number of equal annual instalments, the financial manager will be interested in determining the amount of the annual instalment. Consider Example 2.12.

EXAMPLE 2.12

A limited company borrows from a commercial bank Rs 10,00,000 at 12 per cent rate of interest to be paid in equal annual end-of-year instalments. What would the size of the instalment be? Assume the repayment period is 5 years.

SOLUTION

The problem relates to loan amortisation. The loan amortisation process involves finding out the future payments over the term of the loan whose present value at the interest rate just equals the initial principal borrowed. In this case, the company has borrowed Rs 10,00,000 at 12 per cent. In order to determine the size of the payments, the 5-year annuity discounted at 12 per cent that has a present value of Rs 10,00,000 is to be determined.

Present value, P, of an n year annuity of amount C is found by multiplying the annual amount, C, by the appropriate annuity discount factor (ADF) from Table A-4, that is, $P = C$ (ADF), or $C = P$/ADF in which P is the amount of loan, that is, (Rs 10,00,000), ADF is the present value of an annuity factor corresponding to 5 years and 12 per cent. This value is 3.605 as seen from Table A-4. Substituting the values, we have

$$C = \frac{\text{Rs } 10,00,000}{3.605} = \text{Rs } 2,77,393$$

Thus, Rs 2,77,393 is to be paid at the end of each year for 5 years to repay the principal and interest on Rs 10,00,000 at the rate of 12 per cent.

3. An investor may often be interested in finding the rate of growth in dividend paid by a company over a period of time. It is because growth in dividends has a significant bearing on the price of the shares. In such a situation compound interest tables are used. Let us illustrate it by an Example (2.13).

EXAMPLE 2.13

Mr X wishes to determine the rate of growth of the following stream of dividends he has received from a company:

Year	*Dividend (per share)*	
1	Rs 2.50	
2	2.60 }	1
3	2.74 }	2
4	2.88 }	3
5	3.04 }	4

SOLUTION

Growth has been experienced for four years. In order to determine this rate of growth, the amount of dividend received in year 5 has been divided by the amount of dividend received in the first year. This gives us a compound factor which is 1.216 (Rs 3.04 ÷ Rs 2.50). Now, we have to look at Table A-1 which gives the compounded values of Re 1 at various rates of interest (for our purpose the growth rate) and number of years. We have to look to the compound factor 1.216 against fourth year in the row side. Looking across year 4 of Table A-1 shows that the factor for 5 per cent is exactly 1.216; therefore, the rate of growth associated with the dividend stream is 5 per cent.

4. To determine the current values of debentures, the present value Tables A-3 and A-4 can be of immense use. The cash flow from a debenture consists of two parts: first, interest inflows at periodic intervals, say, semi-annually or annually and, second, the repayment of the principal on maturity. Since the interest payments on a debenture are made periodically throughout its life, it is easy to calculate the present value of this annuity type interest inflow by consulting Table A-4 and the present value of the face value of the debentures can be ascertained by discounting it at the market rate of interest by consulting Table A-3. The sum of the two values so obtained will be current worth of a debenture. If the interest is paid after six months, the factors are obtained for one-half of the discount rate and the number of years is doubled. Consider Example 2.14.

EXAMPLE 2.14

Suppose a particular debenture pays interest at 8 per cent per annum. The debenture is to be paid after 10 years at a premium of 5 per cent. The face value of the debenture is Rs 1,000. Interest is paid after every six

months. What is the current worth of the debenture, assuming the appropriate market discount rate on debentures of similar risk and maturity is equal to the debenture's coupon rate, that is, 8 per cent?

SOLUTION

Since the interest is compounded semi-annually over 10 years, the relevant compounding period equals to 20 and the discount rate will be one-half (4 per cent) of the yearly interest of 8 per cent. In other words, the investor will have an annuity of Rs 40 (4 per cent of Rs 1,000) for a compounding period of 20 years. The present value factor for 20 years and 4 per cent from Table A-4 is 13.59 which, when multiplied by Rs 40, gives us a present value for the interest cash flows of Rs 543.60. The present value of a maturity value of Rs 1,050 (as the debenture is to be redeemed at 5 per cent premium) will be found by multiplying Rs 1,050 by the factor for the present value of Re 1 to be received 20 years from now at 4 per cent. The relevant present value factor from Table A-3 is 0.456. Multiplied by Rs 1,050 maturity value, it gives us a present sum of Rs 478.8. The total value of the debentures would be equal to the total of these two values, that is, Rs 543.60 + Rs 478.8 = Rs 1,022.4.

SUMMARY

- Money has time value. A rupee today is more valuable than a rupee a year hence. A rupee a year hence has less value than a rupee today. Money has, thus, a future value and a present value. Although alternatives can be assessed by either compounding to find future value or discounting to find present value, financial managers rely primarily on present value techniques as they are at zero time ($t = 0$) when making decisions.
- Future value relies on compound interest to measure the value of future amounts. When interest is compounded, the initial principal/deposit in one period, along with the interest earned on it, becomes the beginning principal of the following period and so on. Interest can be compounded annually, semi-annually (half-yearly), quarterly, monthly and so on. The more frequently interest is compounded, the larger the future amount that would be accumulated and the higher the effective interest rate. The interest rate formula and the basic equation for the future value of a single amount are given below:
  - Basic formula of compounding: $A = P(1 + i)^n$
  - Compounding more than once a year: $P[1 + i/n]^{mn} = A$
  - Compounded sum of an annuity: $Sn = CVIFA \times A$
- Present value represents an opposite of future value. The present value of a future amount is the amount of money today equivalent to the given future amount on the basic of a certain return on the current amount. The interest factor formula and the basic equation of the present value are given below:
  - Basic formula: $A[1/(1 + i)^n]$
  - Present value of a series of cash flows: $= \sum_{t=1}^{N} \frac{C_t}{(1+i)^t} = \sum_{t=1}^{n} C_t (IF_t)$
  - Present value of an annuity: $C\left[\sum_{t=1}^{N} \frac{1}{(1+i)^t}\right]$
- The annual deposit to accumulate a given future sum can be found by solving the equation for the future value of an annuity for the annual payment. A loan can be amortised into equal payments by

solving the equation for the present value of an equity for the annual payment. Interest or growth rates can be estimated by finding the unknown interest in the equation for the present value of either a single amount or an annuity.

SOLVED PROBLEMS

P.2.1 Compute the present/discounted value of the following future cash inflows, assuming a required rate of 10 per cent: (a) Rs 100 a year for years 5 through 10 and (b) Rs 100 a year for years 1 through 3, nil in years 4 through 5 and Rs 100 a year for years 6 through 10.

SOLUTION

(a) P = Rs 100(PVIFA$_{10,10}$) – Rs 100(PVIFA$_{10,4}$) = Rs 100(6.1446) – Rs 100(3.1699) = Rs 614.46 – Rs 316.99 = Rs 297.47.

(b) P = Rs 100(PVIFA$_{10,3}$) + [Rs 100(PVIFA$_{10,10}$) – Rs 100(PVIFA$_{10,5}$)] = (Rs 100 × 2.4869) + [(Rs 100 × 6.1446) – (Rs 100 × 3.7908)] = Rs 248.69 + (Rs 614.46 – Rs 379.08) = Rs 248.69 + Rs 235.38 = Rs 484.07.

P.2.2 An investor is 50 years of age today. He will retire at the age of 60. In order to receive Rs 2,00,000 annually for 10 years after retirement, how much amount should he have at the time of retirement? Assume the required rate of return is 10 per cent.

SOLUTION

P_n(present value of annuity) = A × PVIFA$_{i,n}$ = P_{10} = Rs 2,00,000 (6.1446) = Rs 12,28,920.

P.2.3 An executive is about to retire at the age of 60. His employer has offered him two post-retirement options: (a) Rs 20,00,000 lump sum, (b) Rs 2,50,000 for 10 years. Assuming 10 per cent interest, which is a better option?

SOLUTION

$P_n = A \times$ PVIFA$_{i,\ n}$ = P_{10} = Rs 2,50,000(PVIFA$_{10,10}$) = Rs 2,50,000(6.1446) = Rs 15,36,150.

Since the lumpsum of Rs 20,00,000 is worth more now, the executive should opt for it.

P.2.4 Compute the present value of a perpetuity of Rs 100 year if the discount rate is 10 per cent.

SOLUTION

Present value of a perpetuity = A/i = Rs 100/0.10 = Rs 1,000.

P.2.5 ABC Ltd has Rs 10 crore bonds outstanding. Bank deposits earn 10 per cent per annum. The bonds will be redeemed after 15 years for which purpose ABC Ltd wishes to create a sinking fund. How much amount should be deposited to the sinking fund each year so that ABC Ltd would have in the sinking fund Rs 10 crore to retire its entire issue of bonds?

SOLUTION

$A = S_n$/FVIFA$_{i,\ n}$ = S_{15} = Rs 10 crore/FVIFA$_{10,15}$ = Rs 10 crore/31.772 = Rs 3,14,742.54.

P.2.6 ABC Ltd has borrowed Rs 30,00,000 from Canbank Home Finance Ltd to finance the purchase of a house for 15 years. The rate of interest on such loans is 24 per cent per annum. Compute the amount of annual payment/instalment.

SOLUTION

$P_n = A \times$ PVIFA$_{i,\ n}$

$A = P_n$/PVIFA$_{i,\ n}$ = P_{15} = Rs 30,00,000/PVIFA$_{24,15}$ = Rs 30,00,000/4.0013 = Rs 7,49,756.32.

P.2.7 *X* has taken a 20-month car loan of Rs 6,00,000. The rate of interest is 12 per cent per annum. What will be the amount of monthly loan amortisation?

SOLUTION

A = Rs 6,00,000/PVIFA$_{1,20}$ = Rs 6,00,000/18.0456 = Rs 33,249.1. Monthly interest = 12 per cent/12 = 1 per cent.

P.2.8 XYZ Ltd has borrowed Rs 5,00,000 to be repaid in fival equal annual payments (interest and principle both). The rate of interest is 16 per cent. Compute the amount of each payment.

SOLUTION

$A = P_n$/PVIFA$_{i,\ n} = P_5$/PVIFA$_{16,5}$ = Rs 5,00,000/3.2743 = Rs 1,52,704.39

P.2.9 ABC Ltd has borrowed Rs 1,000 to be repaid in equal instalments at the end of each of the next 3 years. The interest rate is 15 per cent. Prepare a amortisation schedule.

SOLUTION

Amount of equal instalment, A $= P_n$/PVIFA$_{i,\ n}$ = Rs 1,000/2.2832 = Rs 437.98

Amortisation schedule

Year	*Payment*	*Interest**	*Repayment of* principal	*Balance* outstanding
1	Rs 437.98	Rs 150.00	Rs 287.98	Rs 712.02
2	437.98	106.80	331.18	380.84
3	437.98	57.13	380.85	

*= Loan balance at the beginning of thge year × interest rate, e.g., year 1 = (Rs 1,000 × 0.15) = Rs 150.

P.2.10 The earnings of Fairgrowth Ltd were Rs 3 per share in year 1. They increased over a 10-year period to Rs 4.02. Compute the rate of growth or compound annual rate of growth of the earnings per share.

SOLUTION

$$F_n = P \times \text{FVIF}_{i,n}$$

$$\text{FVIF}_{i,n} = F_n/P$$

$$\text{FVIF}_{i,10} = \text{Rs } 4.02/\text{Rs } 3 = 1.340$$

According to Table-1 (Appendix), an FVIF of 1.340 at 10 years is at 3 per cent interest. The compound annual rate of growth in earnings per share is, therefore, 3 per cent.

REVIEW QUESTIONS

RQ.2.1 'Cash flows of two years in absolute terms are uncomparable.' Give reasons in support of your answer.

RQ.2.2 Define the following terms and phrases:

(a) Compound sum of an annuity
(b) Present value of a future sum
(c) Present value of an annuity
(d) Perpetuity
(e) Annuity
(f) Discount rate

RQ.2.3 What happens to the effective rate of interest as the frequency of compounding is increased?

RQ.2.4 As a financial consultant, will you advise your client to have term deposit in a commercial bank which pays 8 per cent interest compounded semi-annually or 8 per cent interest compounded annually? Why?

RQ.2.5 What effect do (a) increasing rate of interest and (b) increasing time period have on (i) the present value of a future sum and (ii) the future value of the present sum? Why?

RQ.2.6 For a given interest rate and a given number of years, is the factor for the sum of an annuity larger or smaller than the interest factor for the present value of the annuity?

RQ.2.7 Can annuity tables be used for all types of cash flows?

RQ.2.8 Explain the mechanics of calculating the present value of a mixed stream that includes an annuity.

RQ.2.9 'The finance manager should take account of the time value of money in order to make a correct and objective financial decision.' Elucidate the statement with the help of suitable illustrations.

EXAMINATION QUESTION

EQ. 2.1 A person is required to pay four equal annual payments of Rs 4,000 each in his deposit account that pays 10 per cent interest per year. Find out the future value of annuity at the end of 4 years. (*CA(PCE)—May, 2007*)

SOLUTION

Future Value of annuity = (Rs 4,000 × Compound interest factor of annuity at 10% rate of interest for 4 years, 4.641) = Rs 18,564

Part Two

Tools of Financial Analysis and Planning

One use of accounting information is decision making about a firm by outsiders such as shareholders, creditors and prospective investors. Part II, accordingly, is devoted to a discussion of the use of financial statements for decision making. The subject-matter of this part is divided into two chapters. Chapter 3 concerns itself with the preparation and use of cash flow statement. Chapter 4 discusses the techniques to analyse and interpret the balance sheet and profit and loss account.

3 Cash Flow Statement

Introduction

The two major financial statements, are balance sheet and income statement of a business/corporate firm. A balance sheet shows the financial position of the a firm as at the last day of the accounting period. An income statement focuses on financial performance (profit or loss) due to the operating activities of a firm during the period. Revenues recorded in income statement do not reflect cash inflows as the debtors may pay later. Likewise, some of the expenses shown in income statement may be non-cash expenses (depreciation, amortisation etc.) and some may not be paid in full (goods purchased on credit, salaries payable etc). Thus, the period's profit or loss does not bear direct relationship to the cash flows associated with the period's operations. It does not evidently provide information about the investing and financing activities of the firm during the accounting period.

This chapter describes the third financial statement a company is required to prepare, namely, the cash flow statement. The objective of the cash-flow statement is to provide information about the cash flows associated with operating, investing and financing activities of the firm during the accounting period. The information is significant to the stakeholders of a company. Dividends payable to the shareholders obviously are dependent on cash flows; interest payment and debt repayment to the lenders require the availability of cash; payment to the employees, suppliers and taxes in time is contingent upon the company's ability to generate adequate cash flows to meet these financial obligations.[1] For these reasons, cash flow statement (CFS) is the third major financial statement of a company. Section 1 outlines the meaning, sources and uses of cash, and usefulness of the CFS. The preparation of CFS is covered in Section 2. Its preparation in conformity with the AS-3 is illustrated in Section 3. The main points are summarised in Section 4.

MEANING, SOURCES AND USES OF CASH AND ITS USEFULNESS

Meaning

Cash flow statement is a statement which indicates sources of cash inflows and transactions of cash outflows

of a firm during an accounting period. The activities/transactions which generate cash inflows are known as sources of cash and activities which cause cash outflows are known as uses of cash. It is appropriately termed as *"**Where Got Where Gone Statement**"*.

It may be emphasised that the information contained in the CFS are objective and, hence, more credible and reliable *vis-à-vis* the other financial statements. The reason is that ***cash is cash*** and the amounts of cash flows are not affected by the subjective judgments and estimates that are normally made in revenues, expenses and other accruals.[2] The CFS is a financial document as it leaves no scope for any maneuvering on the amounts of cash inflows and cash outflows.

Sources and Uses of Cash

Exhibit 3.1 shows major items of cash inflows and cash outflows.

Exhibit 3.1 Cash Flow Statement of Hypothetical Limited

Particulars	*Amounts*
(I) Sources of Cash Inflows:	
(1) Business operations/operating activities	
(2) Non-business/operating activities (interest/dividend received)	
(3) Sale of long-term assets (plant, building and equipment)	
(4) Issue of additional long-term securities (equity, preference shares and debentures)	
(5) Additional long-term borrowings (banks and financial institutions)	
(6) Others sources (specify them)	
(II) Sources of Cash Outflows:	
(1) Purchase of long-term assets (plant and machinery, land and building, office equipments and furniture)	
(2) Redemption of preference shares and debentures	
(3) Repurchase of equity shares	
(4) Repayment of long-term borrowings	
(5) Cash dividends paid to shareholders (preference and equity)	
(6) Others items (specify)	
Net Increase (Decrease) in Cash **[I - II]**	

Usefulness

The cash flow statement helps to provide answers to users to some of the important questions related to the company such as the following:

- How much cash has been generated from normal business operating activities/operations of a company?
- What have been the other premier financing activities of the firm through which cash has been raised? What has happened to cash so obtained?
- How much cash has been spent on investment activities, say, on purchase of new plant and equipments?
- How was the redemption of preference shares and debentures accomplished?

- Have long-term sources of cash (internally generated plus raised externally) adequate to finance purchase of new long-term/fixed assets?
- What has been the proportion of debt and equity for cash raised from outside?
- Why are dividends not larger?
- Is the company borrowing to pay cash dividends?
- Has the liquidity position of the company improved?

Thus, the CFS enables the management to see whether the long-term funds are adequate to finance major fixed assets expansion. A situation in which short-term sources (bank overdraft, temporary loans, etc.) constitute the bulk of sources for long-term purposes may not be desirable. Such a pattern of financing is likely to cause problems for the firm to meet its current liabilities in future. Besides, the CFS also indicates the extent of reliance on external resources *vis-a-vis* the internal sources. Thus, the CFS clearly highlights the firm's financing and investment activities.

The CFS, when prepared on a projected basis, has immense potential/utility as a tool of financial planning. It shows the effect of various financing and investment decisions on future cashflows. If the implementation of the decision results in excessive or inadequate cash, steps may be taken to improve the situation or review the decisions. For instance, if the cash position is expected to deteriorate, funds may be raised by borrowing or issuing new equity shares. If the required amount is not feasible to be raised, plans for acquisition of assets may be postponed or alternative operative plans can be developed to ensure that the desired future level of business operations, expansion, and so on, are achieved. Thus, the CFS enables the management to revise/review its investments, operations and financing activities so as to conform to the desired financial inflow and outflow of resources. Above all, the long-term lenders can use the statement as a means of estimating the firm's ability to service their debts.

PREPARATION OF CASH FLOW STATEMENT

You will remember that the balance sheet and income statement are prepared from the ledger account balances of a company. In contrast, the cash flow statement is derived from these two financial statements. The CFS explains factors which have caused changes in assets, liabilities and shareholders' funds between the opening and closing dates of the accounting period. Therefore, the CFS can be prepared by (i) finding the difference in amounts among the various items (say, changes in long-term liabilities, long-term assets) between the comparative balance sheets and then (ii) analysing the causes of difference. The analysis, in some cases, is facilitated by the use of 'T' accounts. The preparation of CFS is illustrated in Example 3.1.

EXAMPLE 3.1

Given below are the balance sheets as on March 31, previous year and current year, and a statement of income and reconciliation of earnings for the current year of Electronics Ltd (EL). The only item in the plant and machinery account sold during the year was a specialised machine that originally cost Rs 15,00,000. The accumulated depreciation on this machine at the time of sale was Rs 8,00,000. The machine was sold for Rs 6,00,000 and full payment was received in cash. Electronics Ltd. purchased patents for Rs.16,00,000 during the year. Besides cash purchases of plant and equipment, the assets of another company were also purchased for Rs 1,00,00,000 payable in fully paid-up shares, issued at par; the assets purchased being goodwill, Rs 30,00,000 and plant, Rs 70,00,000.

Comparative Balance Sheets

Particulars	*March 31 Previous Year (Rs lakh)*	*March 31 Current Year (Rs lakh)*
Cash	74	37
Sundry debtors	54	47
Inventories	312	277
Prepaid expenses	6	4
Land	60	60
Patents	55	65
Plant and machinery	420	550
Less: Accumulated depreciation	(105)	(120)
Goodwill	—	30
Total Assets	876	950
Sundry creditors	86	102
Provision for income tax	89	17
Debentures	220	60
Equity capital	250	560
Retained earnings	231	211
Total Liabilities	876	950

Statement of Income and Reconciliation of Earnings for Current Year

Particulars		*Amount (Rs lakh)*
Net sales		1,977
Less: Cost of goods sold		1,480
Gross profit		497
Less: Operating expenses (includes depreciation on plant and machinery and amortisation of patents)		486
Less: Interest on debentures		14
Net loss from operations		(3)
Add: Retained earnings (previous year)		231
		228
Less: Dividend paid	16	
Less: Loss on sale of assets	1	17
Retained earnings (March 31, current year)		211

From the foregoing information, prepare a cash-flow statement for Electronics Ltd.

SOLUTION

Cash Flow Statement of Electronics Limited the current year

Particulars		*Amount (in Rs lakh)*
(A) Sources of cash inflows		
Business operations		
Cash from customers/debtors (1)*	Rs1,984	
Less payment to creditors (2)*	(1,429)	
Less operating expenses (5)*	(455)	
Less interest on debentures	14	
Less taxes paid (Rs 89- Rs17)	72	

(*Contd.*)

(*Contd.*)

Sale of machine	14
Issue of equity share capital (8)*	6
	210
	230
(B) Cash outflows	
Purchase of long-term assets	
Plant and machinery (6)*	75
Patents	16
Redemption of debentures (7)*	160
Dividends paid to equity shareholders	16
	267
(C) Net decrease in cash (B-A)	37
Cash at beginning of year	37
Cash at year-end	74

Note: Figures in brackets refer to working note number.

Working Notes

(A) Determination of cash from business operation requires recasting of income statement from accrual basis to cash basis. Exclusion of non-cash items, namely, depreciation and amortisation is obvious. The less obvious is the computation of cash inflows from debtors/customers and cash payments to creditors for goods purchased and expenses. The following working notes provide these required inputs.

(1) Cash Receipts from Debtors:

Sundry Debtors Account *(Amount in Rs lakh)*

Particulars	*Amount*	*Particulars*	*Amount*
To Balance b/f (opening balance)	54	By Cash (receipts from debtors,	
To Net sales (assumed credit sales)	1,977	balancing figure)	1,984
		By Balance c/d	47
	2,031		2,031

Alternatively *(in Rs lakh)*

Net sales	1,977
Add debtors due at the beginning of current year	54
Total amount receivable from debtors	2,031
Less debtors due at the end of current year	(47)
Cash receipts from debtors during current year	1,984

(2) Cash Payment to Creditors

Sundry Creditors Account

(Amount in Rs lakh)

Particulars	*Amount*	*Particulars*	*Amount*
To Cash (payments to creditors,		By Balance b/f (opening balance)	86
balancing figure)	1,429	By purchases* (assumed credit)	1,445
To Balance c/d	102		
	1,531		1,531

*Cost of goods sold = Opening stock + Purchases − Closing stock
= Rs 1,480 = Rs 312 + Purchases − Rs 277
= Rs 1,480 − Rs 312 + Rs 277 = Rs 1,445 (Purchases)

Alternatively

	(in Rs lakh)
Credit purchases	1,445
Add sundry creditors at the beginning of year	86
Total amount due/payable to creditors	1,531
Less sundry creditors at the year-end	(102)
Cash payment to creditors during the year	1,429

(3) Determination of Depreciation Charges

(a) T-Account Approach

Accumulated Depreciation Account

(Amount in Rs lakh)

Particulars	*Amount*	*Particulars*	*Amount*
To Machine (accumulated depreciation written off on machine sold)	8	By Balance b/f	105
To Balance c/d	120	By P&L A/c (depreciation amount charged during the year, balancing figure)	23
	128		128

(b) Statement Approach

(Amount in Rs lakh)

Opening balance at the beginning of year	105
Less depreciation written off on plant sold during current year	(8)
	97
Closing balance	120
Difference represents current year depreciation	23

(4) Determination of Amortisation Charges

Patent Account

(Amount in Rs lakh)

Particulars	*Amount*	*Particulars*	*Amount*
To Balance b/f	55	By Amortisation (balancing figures)	6
To Cash (purchases)	16	By Balance c/d	65
	71		71

(5) Determination Cash Operating Expenses

(Amount in Rs lakh)

Total operating expenses	486
Less depreciation (as it does not cause current cash outflow)	(23)
Less amortisation (non-cash expense)	(6)
Operating expenses (other than depreciation and amortization)	457
Less prepaid expenses (already paid in previous year)	(6)
Add expenses paid in advance in current year	4
Operating expenses paid in cash	455

(B) Likewise, changes in *long term assets*, in particular, plant and machinery require a more careful analysis to ascertain cash obtained from their sales and cash used in their acquisition because the

straight difference of the two years values do not indicate either purchase or sale. Such assets are subject to depreciation. Therefore, depreciation amount should be adjusted to ascertain the amount of such assets purchased/sold.

(6) Purchase of Plant and Machinery

(a) T-Account Approach

Plant and Machinery Account (Gross Basis)

(Amount in Rs lakh)

Particulars	*Amount*	*Particulars*	*Amount*
To Balance b/f	420	By Cash (sale value)	6
To Equity share capital	70	By Loss (P&L A/c)	1
To Cash (purchases, balancing figure)	75	By Accumulated depreciation (on plant sold)	8
		By Balance c/d	550
	565		565

(b) Statement Approach *(Amount in Rs lakh)*

Opening balance of plant and machinery	420
Less original purchase price of plant sold (Rs 6 + 1 + 8)	15
	405
Closing balance	550
Difference represents purchases	145
Less purchases against issue of share capital	70
Cash purchases of plant	75

(c) Equation Approach

Opening balance of plant and machinery (PM) + Purchases of PM during the year – *Initial* acquisition cost of PM sold during the year = Closing balance of PM (3.1)

Rs 420 + Purchases – Rs 15 = Rs 550

Purchases = Rs 550 – Rs 420 + 15 = Rs 145

Cash purchases = Total purchases Rs 145 – Purchases through issue of equity share capital Rs 75 = Rs 70

OR

(a) T-Account Approach

Plant and Machinery (Net Basis)

(Amount in Rs lakh)

Particulars	*Amount*	*Particulars*	*Amount*
To Balance b/f (Rs 420 – 105)	315	By Depreciation(charged during current year)	23
To Equtiy share capital	70	By Cash	6
To Cash (purchases, balancing figure	75	By P&L A/c (loss on sale of machine)	1
		By Balance c/d (Rs 550 – 120)	430
	460		460

(b) Statement Approach

(Amount in Rs lakh)

Opening balance of plant and machinery	Rs 315
Less book value of plant sold	7
Less depreciation charged during the year	23
	285
Closing balance	430
Difference represents purchases	145
Less purchases against issue of share capital	70
Cash purchase of plant	75

(c) Equation Approach

Opening balance of PM + Purchases of PM during the year – Book value of PM sold during the year – Depreciation charges during the year = Closing balance of PM (3.2)

Rs 315 + Purchases – Rs 7 – Rs 23 = Rs 430

Purchases = Rs 430 – Rs 315 + Rs 7 + Rs 23 = Rs 145

Cash purchases = Total purchases Rs 145 = Purchases through issue of equity share capital Rs 75 = Rs 70

(C) Treatment of changes in long-term liabilities are the easiest to deal. They relate to (i) fresh issue of shares and debentures or their redemption and (ii) additional long-term borrowings or their repayment. The increase is indicative of additional issue of securities or additional borrowings and, hence, is a source of cash.

The decrease represents repayment and, therefore, is use of cash, that is, cash outflow. However, if the increase in securities, say, in equity capital is caused due to issue of bonus shares, it is not a source of cash. Likewise, if increase in shares is an outcome of (i) payment for purchase of plant and machinery, land and building or any other asset and (ii) conversion of debentures into shares, such transactions do not affect cash inflow and are excluded.

(7) Redemption of Debentures

(Amount in Rs lakh)

Opening balance (at the year beginning)	220
Closing balance (at year-end)	60
Decrease in balance represents edemption of debentures	160

(8) Issue of Equity Share Capital for Cash

(Amount in Rs lakh)

Closing balance at current year-end	560
Less opening balance	250
Increase in balance represents additional issue	310
Less payment for goodwill (Rs 30) and for plant (Rs 70) by equity capital	100
Difference indicates additional cash raised through equity capital	210

It is emphasised that the amount of cash from business operations (in preparation of the CFS of Electronics Limited) has been determined using 'T' accounts extensively. Alternatively, cash from business operation can be computed by another approach. This approach uses less of 'T' account and involves two steps: (i) to determine working capital from business operations by excluding depreciation, amortisation, loss/gain on sale of long-term assets, non-operating incomes and (ii) to adjust the working capital from business operations by changes in current liabilities and current assets (except cash).

The rules for relating the changes in current assets and current liabilities to the profit and loss account in the computation of a flow of cash from operations are summarised below.

1. **All the increases in current assets excluding cash and decreases in current liabilities which increase working capital decrease cash**. The decrease in current liabilities takes place when they are paid in cash. For instance, decrease in creditors, bank overdrafts, bills payable and dividends payable will occur due to their payment. A word of explanation is necessary to show the negative impact of increase in current assets on cash. For instance, an increase in sundry debtors takes place when credit sales are greater than cash collections from them; inventories increase when the cost of goods purchased is more than the cost of goods sold. Increase in prepaid expenses involves payment of more cash than is required for their current services. Evidently, increase in current assets decreases cash.
2. **From the first follows the second rule—all decreases in current assets other than cash and increases in current liabilities which cause a decrease in working capital increase cash.** Debtors would decrease when cash collections are more than current credit sales. Inventories would decrease because cost of goods sold is more than cost of goods purchased; decrease in prepaid expenses reflects that the firm has paid less for services than are currently used.

Exhibits 3.2 and 3.3 show the procedure for determining cash from business operations.

Exhibit 3.2 Cash From Business Operations (Direct Method)

(A) Sales revenues
(B) *Less:* Expenses using working capital
Cost of raw materials used (or cost of goods sold)
Wages and salary expenses
Others manufacturing expenses (excluding depreciation)
Office expenses
Selling and distribution expenses
Interest
Income tax
(C) Working capital from business operations
(D) Adjustment to convert to cash basis
(i) *Add*: Decrease in WC (–CA or +CL)
Decrease in current assets other than cash (item-wise)
Increase in current liabilities (item-wise)
(ii) *Less*: Increase in WC (+CA or –CL)
Increase in current assets other than cash (item-wise)
Decrease in current liabilities (item-wise)
(E) Cash flow from business operations

Exhibit 3.3 Cash From Business Operation (Indirect Method)

(**A**) Net income (or loss) as shown by profit and loss account
(**B**) *Add:* Depreciation expenses;
Amortisation of goodwill, patents and other intangible assets;
Amortisation of discount on debentures or share issue expenses;
Amortisation of extraordinary losses occurred in previous years;
Loss on sale of non-current assets;
(**C**) *Less:* Amortisation of premium received on debentures;
Profit on sale of equipment (already included under sources)
Profit on revaluation of non-current assets (does not contribute to working capital)

(*Contd.*)

(*Contd.*)

	Dividends and interest received on investments (reported separately).
	(**A** + **B** − **C**) = Working capital from business operations.
(D)	Adjustment to convert to cash basis:
(i)	*Add*: Decrease in WC (–CA or +CL)
	Decrease in current assets other than cash (item wise)
	Increase in current liabilities (item-wise)
(ii)	*Less*: Increase in WC (+CA or –CL)
	Increase in current assets other than cash (item-wise)
	Decrease in current liabilities (item-wise)
(**E**)	Cash flow from business operations

Cash from business operations has been computed in Exhibited 3.4 and 3.5 for Electronics Limited using Exhibits 3.2 and 3.3 respetively.

Exhibit 3.4 Cash From Business Operation [Based on Exhibit 3.2]

(Amount in Rs lakh)

Net sales		1,977
Less cost of goods sold	1,480	
Less operating expenses (other than depreciation and amortization)	457	
Less interest on debentures	14	1,951
Working capital from business operations		26
Add (Decrease in WC i.e. - CA or + CL):		
Debtors	7	
Inventories	35	
Prepaid expenses	2	
Creditors	16	60
Less (increase in WC i.e. - CA or – CL)		
Provision for income-taxes		(72)
Cash from business operation		14

Exhibit 3.5 Cash From Business Operations [Based on Exhibit 3.3]

Net loss as per income statement		(3)
Add depreciation on plant and machinery		23
Add amortisation on patents		6
Working capital from business operations		26
Add (Decrease in WC i.e. – CA or + CL)		
Debtors	7	
Inventories	35	
Prepaid expenses	2	
Creditors	16	60
Less (increase in WC i.e. – CA or – CL)		
Provision for income-taxes		(72)
Cash from business operations		14

EXAMPLE 3.2

From the following information furnished to you relating to plant and equipment account of Hypothetical Ltd., determine cash obtained from sale of old plant and equipment.

Particulars	*Previous year (Rs thousand)*	*Current year (Rs thousand)*
Plant and equipment (gross)	100	125
Accumulated depreciation	20	30
Additional information:		
(i) Loss on sale of plant and equipment		1
(ii) Depreciation charged during the year on plant and equipment		14
(iii) Purchase of new plant during the year		35

SOLUTION

Equations 3.1 and 3.3 can be used to determine the required information to ascertain the sale proceeds from old plant and equipment (*PE*).

(i) Opening balance of *PE* (+) Purchases of *PE* during the year (–) Initial acquisition cost of *PE* sold during the year = Closing balance of *PE* (3.1)

= Rs 1,00,000 + Rs 35,000 – x = Rs 1,25,000

= x = Rs 1,35,000 – Rs 1,25,000 = Rs 10,000 (Purchase price of *PE* sold)

(ii) Opening balance of accumulated depreciation, *AD* + Depreciation charged during the year – *AD* written off on the *PE* sold during the year = Closing balance of *AD* (3.3)

= Rs 20,000 + Rs 14,000 – x = Rs 30,000

= x = Rs 34,000 – Rs 30,000 = Rs 4,000 (*AD* on *PE* sold)

The following information relating to the plant and equipment that has been sold is, thus, available:

Gross book value (purchase cost)	Rs 10,000
Accumulated depreciation	4,000
Net book value (Rs 10,000 – Rs 4,000)	6,000
Therefore, sale proceeds of plant (Rs 6,000 – Rs 1,000 loss)	5,000

The preceding information can also be obtained by preparing ledger accounts.

Plant and Equipment Account

Particulars	*Amount (Rs thousand)*	*Particulars*	*Amount (Rs thousand)*
Opening balance	100	Acquisition cost of sold plant (balancing figure)	10
Cash purchase of new plant	35	Closing balance	125
	135		135

Accumulated Depreciation Account

Total depreciation on sold plant (balancing figure)	4	Opening balance	20
		Depreciation expenses charged during the year	14
Closing balance	30		
	34		34

AS-3 - CASH FLOW STATEMENT

The Institute of Chartered Accountants of India (ICAI) issued the Accounting Standard (AS-3) relating to the preparation of cash flow statement (CFS) for accounting periods commencing on or after April 1, 2001 for enterprises (i) which have either turnover of more than Rs 50 crore in a financial year or (ii) the shares

of which are listed in stock exchange (i.e. the listed companies) in India or outside India or (iii) enterprises which are in the process of listing their equity or debt securities as evidenced by the Board of Directors' resolution in this regard. The CFS of listed companies should be presented as per the *indirect method* prescribed in AS-3. This Section explains and illustrates the CFS mandated by the ICAI.

Objectives

Information about the cash flows of an enterprise is useful in providing users of financial statements with a basis to assess the ability of the enterprise to generate cash and cash-equivalents and the needs of the enterprise to utilise those cash flows. The economic decisions that are taken by users require an evaluation of the ability of an enterprise to generate cash and cash-equivalents and the timing and certainty of their generation.

The CFS deals with the provision of information about the historical changes in cash and cash-equivalents of an enterprise by means of a cash flow statement which classifies cash flows during the period among (i) operating, (ii) investing and (iii) financing activities.

Benefits of Cash Flow Operation

A cash flow statement, when used in conjunction with the other financial statements, provides information that enables users to evaluate the changes in net assets of an enterprise, its financial structure (including its liquidity and solvency), and its ability to affect the amounts and timing of cash flows in order to adapt to changing circumstances and opportunities. Cash flow information is useful in assessing the ability of the enterprise to generate cash and cash-equivalents and enables users to develop models to assess and compare the present value of the future cash flows of different enterprises. It also enhances the comparability of the reporting of operating performance by different enterprises because it eliminates the effects of using different accounting treatments for the same transactions and events.

Definitions Associated with Cash Flow

Cash It consists of cash in hand and demand deposits with banks.

Cash Equivalents These are short-term highly liquid investments that are readily convertible into known amounts of changes in value. They have short maturity, say, of three months or less from the date of acquistion, for example, treasury bills.

Cash Flows These are inflows and outflows of cash and cash-equivalents.

Operating Activities Cash inflows from operating activities primarily accrue from the major revenue producing activities (i.e., sale of goods and rendering of services) of the enterprise. Therefore, they generally result from the transactions and other events that enter into the determination of net profit or loss. Examples of cash flows from operating activities are as follows:

- Cash receipts from the sale of goods and the rendering of services
- Cash receipts from royalties, fees, commissions, and other revenues
- Cash payments to suppliers for goods and services
- Cash payments to and on behalf of employees

- Cash receipts and cash payments of an insurance enterprise for premiums and claims, annuities and other policy benefits
- Cash payments or refunds of income taxes unless they can be specifically identified with financing and investing activities
- Cash receipts and payments relating to futures contracts, forward contracts, option contracts, and swap contracts when the contracts are held for dealing or trading purpose

Since the focus is on determining cash flows due to business/operating activities, non-operating expenses as well as non-operating incomes are excluded. In other words, both interest/dividend receipts and interest/dividend payments are excluded.

Investing Activities The investing activities relate to the acquisition and disposal of long-term assets and other investments not included in cash-equivalents. Their separate disclosure is important as they represent the extent to which expenditures have been made for resources intended to generate future income and cash flows. The principal items covered under this category of activities are as follows:

- Cash payments to acquire fixed assets (including intangibles). These payments include those relating to capitalised research and development costs and self-constructed fixed assets
- Cash receipts from disposal of fixed assets (including intangibles)
- Cash payments to acquire shares, warrants or debt instruments of other enterprises and interests in joint ventures
- Cash receipts from disposal of shares, warrants, or debt instruments of other enterprises and interests in joint ventures
- Cash advances and loans made to third parties
- Cash receipts from the repayment of advances and loans made to third parties

Financing Activities The financing activities report the changes in the size and composition of the share/owner's capital and debt of the enterprise. Their separate disclosure is useful in predicting claims on future cash flows by providers of funds (both capital and borrowings) to the enterprise. Examples of cash flows arising from financing activities are as follows:

- Cash proceeds from issue of shares or other similar instruments
- Cash proceeds from issue of debentures, loans, notes, bonds and other short-term or long-term borrowings
- Cash repayments of amounts borrowed
- Buy-back of shares
- Redemption of preference shares
- Dividend/interest paid

Reporting Cash Flows

From Operating Activities An enterprise is required to report cash flows from operating activities using either direct method or indirect method.

Direct Method Under this method, gross cash receipts and gross cash payments for the major items are disclosed, such as cash receipts from customers and cash paid to suppliers.

Indirect Method Under the indirect method, profit and loss account is adjusted for (i) the effects of transactions of non-cash nature such as depreciation, amortisation, deferred taxes, loss on sale of fixed

assets and unrealised foreign exchange gains and losses, (ii) changes during the period in inventories and operating receivables and payables, and (iii) for all other items for which the cash effects are shown either in financing or investing activities.

From Investing and Financing Activities An enterprise is required to report separately major classes of gross cash receipts and gross cash payments arising from investing and financing activities. The cash flows from operating, financing and investing activities are to be reported on a *net* basis.

Treatment of Some Major Items

While most of the items (to be included in the CFS) are self-explanatory in nature, some transactions/items merit more explanation. These relate to (i) foreign currency, (ii) extraordinary items, (iii) interest, (iv) dividends, (v) taxes on income, (vi) deferred taxes, (vii) investments in subsidiaries, associates and joint ventures, (viii) acquisitions and disposals of subsidiaries and other business units, (ix) non-cash transactions and (x) other disclosures.

Foreign Currency Cash Flows Cash flows arising from transactions in a foreign currency should be recorded in an enterprise's reporting currency by applying to the foreign currency amount the exchange rate between the reporting currency and the foreign currency at the date of the cash flow. A rate that approximates the actual rate may be used if the result is substantially the same as would arise if the rates at the dates of the cash flows were used.

The effect of changes in exchange rates on cash and cash-equivalents held in a foreign currency are to be reported as a separate part of the reconciliation of the changes in cash and cash-equivalents during the period.

Evidently, unrealised gains and losses arising from changes in foreign exchange rates are not cash flows.

Extraordinary Items Extraordinary items are unusual in nature, not frequent in occurrence and are material in amount. The cash flows associated with extraordinary items are disclosed separately as arising from operating, investing or financing activities in the CFS, to enable users to understand their nature and effect on the present and future cash flows of the enterprise. Examples include attachment of the property of the enterprise and insurance proceeds from earthquake disaster settlement.

Interest In general, cash flows arising from interest paid should be classified as cash flows from financing activities, say interest on loans/debts; interest paid on working capital loan and any other loan taken to finance operating activities are to be shown as a part of operating activities. Unless stated otherwise, interest paid is to be reported with financing activities. The reason is that they are cost of obtaining financial resources.

Interest received from short-term investments (classified as cash equivalents) are to be reckoned as cash inflows from operating activities.

Cash flows arising from interest paid and interest received in the case of a financial enterprises should be classified as cash flows from operating activities. The reason that is borrowing and lending are the normal business activities for such enterprises.

Dividends While dividends paid are classified as financing activities as they are cost of obtaining financial resources, dividends received on investments constitute a part of investment activities. The reason is that they are the returns on investments.

For the financial enterprises, dividends received form a part of operating activities and dividends paid as a part of financing activities.

Taxes on Income Taxes paid on income as well as tax refunds are usually classified as cash flows from operating activities. In the event of their specific identification with investment or financing activities, the tax cash flow is classified as an investing or financing activity as appropriate.

Deferred Taxes There can be differences in the amount of taxes payable, determined on the basis of financial accounting *vis-à-vis* tax accounting. One such item which can cause this distortion relates to the treatment of depreciation. For instance, for income-tax reporting, the machine may be subject to higher rate of depreciation compared to financial accounting. This lowers the taxes payable in the early years of machine purchased and increases the taxes payable in the latter years. **Deferred taxes are to be treated just like other expenses on accrual basis.** Deferring tax liabilities to the future years is referred to as deferred taxes. As a result, increase in deferred tax liabilities are considered as cash inflows and decrease as cash outflows.

Investments in Subsidiaries, Associates and Joint Ventures Enterprises having investments in susbsidiaries, associates and joint ventures are required to report in the CFS the cash flows between themselves and the investee/joint venture, for example, cash flows relating to dividends and advances.

Acquisitions and Disposals of Subsidiaries and Other Business Units The aggregate cash flows arising from acquisitions and from disposals of subsidiaries or other business units should be presented separately and classified as investing activities.

An enterprise should disclose, in aggregate, in respect of both acquisition and disposal of subsidiaries or other business units during the period, each of the following: (i) the total purchase or disposal consideration; and (ii) the portion of the purchase of disposal consideration discharged by means of cash and cash-equivalents.

Non-Cash Transactions Investing and financing transactions that do not require the use of cash or cash-equivalents should be excluded from a cash flow statement. Such transactions should be disclosed elsewhere in the financial statements in a way that provides all the relevant information about these investing and financing activities. Examples of non-cash transactions are: (i) the acquisition of assets/an enterprise by means of issue of shares and/or debentures, (ii) conversion of debt into equity and (iii) issue of bonus shares.

Other Disclosures An enterprise should disclose, together with a commentary by management, the amount of significant cash and cash-equivalent balances held by the enterprise that are not available for use by it. Examples include cash and cash-equivalent balances held by a branch of the enterprise that operates in a country where exchange controls or other legal restrictions apply as a result of which the balances are not available for use by the enterprise.

Exhibits 3.6 to 3.8 show the procedure of the preparation of the cash flow statement as per AS-3 (revised).

Exhibit 3.6 Direct Method Cash Flow Statement

Cashflow From Operating Activities
Cash receipts from customers
Cash paid to suppliers and employees
Cash generated from operations
Income tax
Cash flow before extraordinary items
Proceeds from earthquake disaster settlement

(*Contd.*)

(*Contd.*)

Net cash from operating activities
Cashflow From Investing Activities
Purchase of fixed assets
Proceeds from sale of equipments
Interest received
Dividends received
Net cash from investing activities
Cashflow From Financing Activities
Proceeds from issuance of share capital
Proceeds from long-term borrowings
Repayments of long-term borrowings
Interest paid
Dividends paid
Net cash used in financing activities
Net Increase in Cash and Cash-equivalents*
Cash and cash-equivalents at the beginning of a period
Cash and cash-equivalents at the end of a period

*Consists of cash on hand and balance with banks, investment in money market (short-term) investments and effect of exchange rate changes.

Exhibit 3.7 Indirect Method Cashflow Statement

Cashflow From Operating Activities
Net profit before taxation, and extraordinary items
Adjustment for
• Depreciation
• Foreign exchange loss
• Interest income
• Dividend income
• Interest expense
Operating profit before working capital changes
Decrease/(increase) in sundry debtors
Decrease/(increase) in inventories
Increase/(decrease) in sundry creditors
Cash generated from operations
Income tax paid
Cash flow before extraordinary items
Proceeds from earthquake disaster settlement
Net cash from operating activities
Cashflow From Investing Activities
Purchase of fixed assets
Proceeds from sale of equipment
Interest received
Dividends received
Net cash from investing activities
Cashflow From Financing Activities
Proceeds from issuance of share capital
Proceeds from long-term borrowings

(*Contd.*)

(*Contd.*)

Repayment of long-term borrowings
Interest paid
Dividends paid
Net cash used in financing activities
Net Increases in Cash and Cash-equivalents
Cash and cash-equivalents at the beginning of a period
Cash and cash-equivalents at the end of a period

Exhibit 3.8 Cashflow Statement of a Financial Enterprise

Cashflows From Operating Activities
Interest and commission receipts
Interest payment
Recoveries on loans previously written off
Cash payments to employees and suppliers
Operating profit before changes in operating assets
Decrease (or increase) in operating assets:
• Short-term funds
• Deposit held for regulatory or monetary control purposes
• Funds advanced to customers
• Net increase in credit card receivables
• Other short-term securities
Decrease (or increase) in operating liabilities
• Deposits from customers
• Certificates of deposit
• Net cash from operating activities before income tax
• Income taxes paid
Net cash from operating activities
Cashflows From Investing Activities
Dividends received
Interest received
Proceeds from sale of permanent investments
Purchase of permanenet investments
Purchase of fixed assets
Net cash from investing activities
Cashflows From Financing Activities
Issue of shares
Repayment of long-term borrowings
Net decrease in other borrowings
Dividends paid
Net cash used in financing activities

For the Electronics Ltd. in Example 3.1, the cash flow statement as per AS-3 is shown in Exhibits 3.9 and 3.10.

Exhibit 3.9 Cash Flow Statement of Electronics Limited for the Current Year (Direct Method)

(Amount in Rs lakh)

Particulars		*Amount*
Cash Flows From Operating Activities		
Cash receipts from customers	1,984[1]	
Cash paid to suppliers and employees	1,884[2]	
Cash generated from operations	100	
Income taxes paid	(72)	
Net cash from operating activities		28*
Cash Flows From Investing Activities		
Purchase of plant and machinery	(75)	
Purchase of patents	(16)	
Proceeds from sale of plant	6	
Net cash used in investing activities		(85)
Cash Flows From Financing Activities		
Proceeds from issuance of equity share capital	210	
Repayment of debentures (Rs 220 – 60)	(160)	
Interest paid to debenture-holders	(14)	
Dividends paid	(16)	20
Net decrease in cash balance (Rs 85 – 48)		(37)
Less		
Cash and cash equivalents at beginning of the year		74
Cash and cash equivalents at end of the year		37

* It may be recalled that cash from operating activities (shown in Section II) was Rs 14; the difference of Rs 14 (Rs 28 as per AS – 3 and Rs 14 as per CFS) is due to exclusion of interest payment on debentures (Rs 14); this interest payment is shown under financing activities.

Working Notes

(Amount in Rs lakh)

(1) Cash receipts from debtors and customers:	
Debtors at the beginning of the year	54
Add: Net sales during the year	1,977
Total sum receivable	2,031
Less: Debtors at the end of the year	47
Total	1,984
(2) Cash paid to suppliers and employees:	
Cost of goods sold	1,480
Add: Operating expenses excluding depreciation and amortisation (Rs 486 – 23 – 6)	457
Add: Curent year prepaid expenses	4
Less Previous year prepaid expenses	(6)
	455
Add: Creditors at the beginning of the year	86
Add: Inventories at the end of the year	277
Less: Creditors at the end of the year	(102)
Less: Inventories at the beginning of the year	(312)
Total	1,884

Exhibit 3.10 Cash Flow Statement of Electronics Limited for the current year (Indirect Method)

(Amount in Rs lakh)

Particulars		*Amount*
Cash flows From Operating Activities		
Net loss before taxation and extra-ordinary items	(4)	
Adjustments for:		
Depreciation	23	
Amortisation of patent	6	
Interest expenses	14	
Loss on sale of assets	1	
Operating profit before working capital changes	40	
Add: Decrease in debtors	7	
Add: Decrease in inventories	35	
Add: Prepaid expenses	2	
Add: Increase in creditors	16	
Cash generated from operations	100	
Less: Income-tax paid	72	
Net cash from operating activities		28
Cash flows From Investing Activities		
Purchase of plant and machinery	(75)	
Purchase of patents	(16)	
Proceeds from sale of plant	6	
Net cash used in investing activities		(85)
Cash flows From Financing Activities		
Proceeds from issuance of equity share capital	210	
Repayment of debentures (220 – 60)	(160)	
Interest paid to debentureholders	(14)	
Dividends paid	(16)	20
Net decrease in cash balance (78 – 41)		(37)
Cash and cash equivalents at beginning of the year		74
Cash and cash equivalents at end of the year		37

The statement highlights that the firm does not have enough funds from its operating activities (Rs 28 lakh) and financing activities (Rs 20 lakh) to cater to investment requirement of Rs 85 lakh, causing decline in cash (Rs 37 lakh).

SUMMARY

- Cash flow statement indicates sources of cash inflows and transactions of cash outflows of a firm during a period. It is also called "Where-Got Where-Gone" statement. The statement provides answers to many important questions related to financial position of an enterprise.
- The major sources of cash inflows are cash from: (i) business operations, (ii) non-business operations (like interest, dividend etc), (iii) sale proceeds of long-term assets, (iv) raising additional share capital and (v) long-term borrowings. The principal uses of cash are: (1) purchase of long-term assets, (ii) redemption of preference shares/debentures, (iii) repayment of long-term borrowings and (iv) payment of dividends.
- Cash flow statement (CFS) is an important tool of financial analysis. It clearly highlights the firm's operating, financing and investment activities. It enables the management to assess whether the firm has adequate long-term funds to finance major fixed assets expansion.
- Preparation of cash flow statement is mandatory for all the listed companies as well as for all enterprises which have turnover of more than Rs 50 crore in a financial year.
- The CFS shows the sources and uses of cash in terms of three components: (i) operating, (ii) financing and (iii) investing activities. The cash flows from each of these categories are to be reported on net basis.
- Cash flows from operating activities result from the major revenue producing activities of a firm. Accordingly, the income statement constitutes the main source of data. The major operating items are (i) cash receipts from customers, (ii) cash paid to suppliers and employees, (iii) income-tax and (iv) proceeds from extraordinary items.
- The items included in financing activities are: (i) proceeds from issue of share capital, (ii) proceeds from long-term borrowings, (iii) redemption of preference shares/debentures, (iv) repayment of long-term borrowings and (v) payment of interest and dividend to debenture-holders/lenders and shareholders respectively.
- Cash flows representing investment activities relate to capital expenditures incurred with intent to generate future earnings as cash flows and includes: (i) purchase of new fixed assets, (ii) proceeds from sale of existing fixed assets and (iii) interest and dividend received on investments made.

REFERENCES

1. Anthony, R. N. et al., *Accounting: Text and Cases,* (Tata McGraw-Hill, New Delhi), 2003, p.339.
2. *Ibid.,* p. 339.

SOLVED PROBLEMS

P.3.1 Answer the following:

(a) A company sold building for cash at Rs 100 lakh. The profit and loss account has shown Rs 40 lakh profit on sale of building. How will you report it in cash flow statement (based on AS-3)

(b) From the following information, determine cash received from debtors during current year:

Debtors in the beginning of current year	Rs 100 lakh
Total sales	2,000
Cash sales	500
Debtors at the end of current year	300

(c) Determine cash paid to suppliers/creditors from the following data during current year:

Cost of goods sold	Rs 480 lakh
Opening stock	30
Closing stock	50
Creditors at the beginning of year	60
Creditors at the end of the year	90
Cash purchases	40

(d) From the following (i) determine the gross amount of plant and machinery purchased and (ii) depreciation charged during the current year.
- Plant assets (net of depreciation) at year-end Rs 285 lakh and at the year-beginning Rs 127 lakh.
- Gross plant assets increased by Rs 186 lakh even through machine costing initially Rs 58 lakh with book value of Rs 38 lakh was sold at loss of Rs 25 lakh.

(e) Account balances relating to equipment during 2007–8 are as follows:

Particulars	*April 1, 2007*	*March 31, 2008*
Equipment	Rs 2,00,000	Rs 4,00,000
Less: Accumulated depreciation	50,000	70,000

Equipment with an original cost of Rs 40,000, having an accumulated depreciation of Rs 20,000, were sold at a gain of Rs 5,000. Determine: (i) Cash provided by the sale of equipment; (ii) Cash used to acquire equipment; (iii) Depreciation expense on equipment during 2007–8.

(f) Would your answer for **(e) (i), (ii) and (iii)** be different if the equipment were sold at a loss of Rs 5,000?

SOLUTION

(a) Cashflows from Investing Activities:
Proceeds from sale of building Rs 100 lakh.

(b) Cash Receipts from Debtors:

Debtors at the beginning of current year	Rs 100 lakh
Plus credit sales (Rs 2,000 – Rs 500)	1,500
Total sum receivable from debtors	1,600
Less debtors at the end of current year	300
Cash received from debtors	1,300

(c) **(i)** Determination of Credit Purchases:
- Cost of goods sold = Opening stock + Purchases (x) – Closing stock
  Rs 480 lakh = Rs 30 lakh + x – Rs 50 lakh
  x = Rs 480 lakh – Rs 30 lakh + Rs 50 lakh = Rs 500 lakh
- Credit purchases = Rs 500 lakh – Rs 40 lakh = Rs 460 lakh

(ii) Determination of Payment to Creditors:

Creditors at the beginning of year	Rs 60 lakh
Plus credit purchases	460
Total sum payable	520
Less creditors at the year-end	90
Payment to creditors	430

(d) **(i)** Plant and Machinery Purchased:

Net increase in gross value	Rs 186 lakh
Add initial cost of plant sold	58
	244

(ii) Depreciation Charges:

Plant assets (net) at year beginning	Rs 127 lakh
Plus purchase cost of new plant	244
Less book value of plant sold	(38)
	333
Closing balance	285
Difference represents depreciation	48

(e) **(i)** Cash From the Sale of Equipment

Original cost of the sold equipment	Rs 40,000
Less: Accumulated depreciation on the sold equipment	(20,000)
Net book value	20,000
Plus: Gain on the sold equipment	5,000
Cash proceeds from sale of equipment	25,000

(ii) Cash Spent on Purchase of Equipment

Balance of equipment on April 1, 2007 (gross)	Rs 2,00,000
Less: Gross book value of the sold equipment	(40,000)
Balance of equipment on March 31, 2008 without purchases	1,60,000
Actual balance as on March 31, 2008 of equipment	4,00,000
Difference representing purchases made during 2007–'08	2,40,000

(iii) Determination of Depreciation Amount Charged to the P&L A/c During 2008:

Balance of accumulated depreciation (1.4.2007)	Rs 50,000
Less: Writing-off depreciation on sold equipment during 2007–'08	(20,000)
Balance of accumulated depreciation without additional depreciation during 2007–'08	30,000
Actual balance as on March 31, 2008 of accumulated depreciation	70,000
Difference representing depreciation amount charged during 2007–'08	40,000

(f) Answers for parts **(e)(ii)** and **(e)(iii)** would remain unchanged. However, cash provided by the sale of equipment would be reduced by Rs 10,000. The relevant calculations would be as follows:

Net book value	Rs 20,000
Less loss on sale of equipment	(5,000)
	15,000

P.3.2 Compute cash provided from operations during the year 2008, from the following data:

Particulars	*April 1, 2007*	*March 31, 2008*
Sundry debtors	Rs 30,000	Rs 40,000
Sundry creditors	48,000	30,000
Outstanding expenses	3,000	6,000
Outstanding income	1,000	1,000
Stock in trade	55,000	60,000
Prepaid expenses	3,000	2,000
Accumulated depreciation (no retirements during the year)	50,000	60,000
Provision for doubtful accounts	1,500	2,000
Dividends payable	—	3,000
Bills receivable	10,000	12,000
Bills payable	8,000	6,000
Net income (as per profit and loss account)	—	80,000

SOLUTION

Determination of Cash From Operations:

Net income as per P&L A/c		Rs 80,000
Add Depreciation		10,000
Working capital from business operations		90,000
Less: Transactions other than cash, increasing working capital:		
(i) Increase in current assets:		
Sundry debtors	Rs 10,000	
Outstanding income	500	
Stock-in-trade	5,000	
Bills receivable	2,000	(17,500)
(ii) Decrease in current liabilities:		
Sundry creditors	18,000	
Bills payable	2,000	(20,000)
Add: Transactions other than cash, decreasing working capital:		
(i) Decrease in current assets: Prepaid expenses	1,000	1,000
(ii) Increase in current liabilities:		
Outstanding expenses	3,000	
Provision for doubtful accounts	500	
Dividends payable	3,000	6,500
Cash from operations		60,000

P.3.3 From the following summary cash account of Y Ltd., prepare cash flow statement for the current year ended March 31 in accordance with AS-3 using the direct method. The company does not have any cash equivalents.

Summary Cash Account

for the Current Year Ended March 31

	Rs ('000)		*Rs ('000)*
Opening balance	50	Payment to suppliers	2,000
Issue of equity shares	300	Purchase of fixed assets	200
Receipts from customers	2800	Overhead expenses	200

(*Contd.*)

(*Contd.*)

Sale of fixed assets	100	Wages and salaries	100
		Taxation	250
		Dividend	50
		Repayment of bank loan	300
		Closing balance	150
	3,250		3,250

SOLUTION

Cash Flow Statement of Y Ltd.
as per AS-3 for the Current Year ended March 31

Cash flows from operating activities:		*Amount*
Cash receipts from customers	Rs 28,00,000	
Cash paid to suppliers	(20,00,000)	
Wages and salaries	(1,00,000)	
Overhead expenses	(2,00,000)	
Cash generated from operations	5,00,000	
Income tax paid	2,50,000	
Net cash from operating activities		Rs 2,50,000
Cash flows from investing activities:		
Purchase of fixed assets	(2,00,000)	
Sale of fixed assets	1,00,000	
Net cash used in investing activities		(1,00,000)
Cash flows from financing activities:		
Issue of equity shares	3,00,000	
Repayment of bank loan	(3,00,000)	
Dividend	(50,000)	
Net cash used in financing activities		(50,000)
Net increase in cash and cash-equivalent		1,00,000
Cash and cash equivalent at beginning of year		50,000
Cash and cash equivalent at the end of year		1,50,000

P.3.4 Charatlal, the president and majority shareholder, was a superb operating executive. He was an imaginative, aggressive marketing man and an ingenious, creative production man. But he had little patience with financial matters. After examining the most recent balance sheet and income statement, he muttered, "We have enjoyed ten years of steady growth, this year was our most profitable year. Despite this, we are in the worst cash position in our history. Just look those current liabilities in relation to our available cash! This whole picture of the more you make, the poorer you get, just does not make sense. These statements must be cockeyed."
The balance sheets (in lakh of rupees) of Charat Engineering Ltd. are given below:

	March 31			*March 31*	
Assets	*Current Year*	*Previous year*	*Liabilities*	*Current year*	*Previous year*
Cash	2	10	Current liabilities	105	30
Receivables (net)	60	30			
Inventories	100	50	Long-term debt	150	—
Plan assets (net of accumulated depreciation)	300	100	Stockholder's equity	207	160
Total assets	462	190	Total equities	462	190

Net income before taxes, Rs 81 lakh. Taxes paid are Rs 27 lakh. Net income was Rs 54 lakh. Cash dividend paid were Rs 7 lakh. Depreciation was Rs 20 lakh. Fixed assets were purchase for Rs 220 lakh, Rs 150 lakh of which was financed via the issuance of long-term debt outright for cash.

Using cash flow statement (based on AS-3), write a short memorandum to Mr Charatlal, explaining why there is such squeeze for cash. Show working.

SOLUTION

Cash Flow Statement of Charat Engineering Ltd. (Indirect Method)

Particulars		*Amount in Rs lakh*
Cashflow from operating activities:		
Net profit before taxation and extraordinary items	Rs 81	
Adjustment for		
Depreciation	20	
Operating profit before working capital changes	101	
Increase in receivables (net)	(30)	
Increase in inventories	(50)	
Increase in current liabilities	75	
Cash generated from operations	96	
Income tax paid	27	
Net cash from operating activities		69
Cashflow from investing activities:		
Purchase of fixed assets	(220)	(220)
Net cash used for investing activities		
Cashflow from financing activities:		
Issuance of long-term debt	150	
Dividends paid	(7)	
Net cash from financing activities		143
Net decrease in cash		(8)
Cash at the beginning of current year		10
Cash at the end of the year		2

Memorandum: The squeeze for cash has resulted from major fixed assets expansion programme. The cash flow statement highlights that the company does not have enough funds from operating activities (Rs 69 lakh) and financing activities (Rs 143 lakh) to cater to investment requirements of Rs 220 lakh, causing decline in cash of Rs 8 lakh.

P.3.5 Prepare a statement from the following financial information of ABC company, to explain the causes of increase in cash despite the firm incurring losses.

(Amount in Rs lakh)

Income statement

Sales		Rs 600.0
Dividends from investment in another company		3.6
		603.6
Expenses		
Cost of goods sold	Rs 400	
Depreciation	50	
Other operating expenditure	175	
Interest	1.6	
Loss on sale of plant (sale value, Rs 7.2)	3.0	629.6
Net loss		(26)

(Amount in Rs lakh)

Retained earnings

Beginning balance	Rs 50
Net loss	(26)
Dividends	(16)
Ending balance	8

(Amount in Rs lakh)

Position statement

	Previous year	*Current year*
Cash	Rs 19.2	Rs 43.2
Sundry debtors	28.6	16.8
Inventory	33.0	22.0
Prepayments	2.2	1.8
Investments	18.0	18.0
Land	15.0	15.0
Plant and machinery	119.8	110.4
Accumulated depreciation	(75.2)	(78.4)
Total assets	160.6	148.8
Accounts payable	18.2	10.2
Accrued liabilities	1.2	2.4
Dividends payable	1.2	2.2
Debentures	12.0	16.0
Equity capital	50.0	60.0
Preference share capital	28.0	50.0
Retained earnings	50.0	8.0
Total liabilities	160.6	148.8

SOLUTION

Cash Flow Statement of ABC Company (Indirect Method)

Particulars		*Amount (in Rs lakh)*
Casflow from operating activities:		
Net loss before extraordinary items	(Rs 26)	
Adjustment for		
Depreciation	50	
Interest expenses	1.6	
Loss on sale of plant	3.0	
Dividend income	(3.6)	
Operating profit before working capital changes	25.0	
Decrease in sundry debtors	11.8	
Decrease in inventories	11.0	
Decrease in prepayments	0.4	
Decrease in accounts payable	(8.0)	
Increase in accrued liabilities	1.2	
Net cash from operating activities		41.4

(*Contd.*)

(*Contd.*)

Cash flow from investing activities:		
Purchase of plant and machinery	(47.6)	
Sale of plant	7.2	
Dividends received	3.6	
Net cash used in investing activities		(36.8)
Cash from financing activities:		
Proceeds from issuance of equity share capital	10	
Proceeds from issuance of preference share capital	22	
Proceeds from debentures	4	
Dividends paid to shareholders	(15)	
Interest paid on debentures	(1.6)	
Net cash from financing activities		19.4
Increase in cash		24.0
Cash at the beginning of current year		19.2
Cash at the end of current year		43.2

Working Notes:

(i) *Accumulated depreciation account*

To Plant (accumulated deprecation on plant sold) (balancing figure)	Rs 46.8	By Balance b/d	Rs 75.2
		By P&L A/c (depreciation of the current year)	50.0
To Balance c/d	78.4		
	125.2		125.2

(ii) *Gross value of plant sold*

Cash A/c	Dr	Rs 7.2	
P&L A/c (Loss)	Dr	3.0	
Accumulated depreciation A/c	Dr	46.8	
To plant			Rs 57.0

(iii) *Purchase of plant* — *Plant account*

To Balance b/f	Rs 119.8	By Cash	Rs 7.2
To Plant purchased (balancing figure)	47.6	By P&L A/c	3.0
		By Accumulated depreciation A/c	46.8
		By Balance c/d	110.4
	167.4		167.4

(iv) *Dividends paid* = Rs 1.2 payable of previous year + Rs 16 of current year – Rs 2.2 dividends payable at current year-end = Rs 15

P.3.6 Nandini Ltd. provides the following data:

Comparative trial balance

(Amount in Rs lakh)

	March 31 year 2	*March 31 year 1*	*Increase (decrease)*
Debit balance			
Cash	15	5	10
Working capital (other than cash)	Rs 185	Rs 95	Rs 90
Investments (long-term)	100	150	(50)

(*Contd.*)

(*Contd.*)

Building and equipment	500	400	100
Land	40	50	(10)
	840	700	140
Credit balance			
Accumulated depreciation	200	160	40
Bonds	100	50	50
Reserves	340	340	—
Equity shares	200	150	50
	840	700	140

Income Statement
for the period ending March 31, year 2

(Amount in Rs lakh)

Sales		Rs 1000
Cost of goods sold		500
Selling expenses	Rs 50	
Administrative expenses	50	100
Operating income		400
Other charges and credits:		
Gain on sale of building and equipment	Rs 5	
Loss on sale of investments	(10)	
Interest	(6)	
Taxes	(189)	(200)
Net income after taxes		200

Notes: (a) The depreciation charged for the year was Rs 60 lakh.
(b) The book value of the building and equipment disposed off was Rs 10 lakh.

Prepare a cash flow statement (based on AS-3).

SOLUTION

Cash Flow Statement of Nandini Limited (Indirect Method)

Particulars	*Amount in Rs lakh*	
Cashflow from operating activities:		
Net profit before taxation and extraordinary items	Rs 389	
Adjustment for		
Depreciation	60	
Gain on sale of building and equipment	(5)	
Interest expense	6	
Loss on sale of investments	10	
Operating profit before working capital changes	460	
Increase in working capital	(90)	
Cash generated from operations	370	
Income tax paid	189	
Net cash from operating activities		181
Cashflow from investing activities:		
Proceeds from sale of long-term investments (1)	40	

(*Contd.*)

(*Contd.*)

Proceeds from sale of land	10	
Proceeds from sale of building and equipment (Rs 10 lakh + Rs 5 lakh gain)	15	
Purchase of building and equipment (2)	(130)	
Net cash used in investing activities		(65)
Cashflow from financing activities:		
Proceeds from issuance of bonds (Rs 100 – Rs 50)	50	
Proceeds from issuance of equity shares (Rs 200 – Rs 150)	50	
Interest on debentures	(6)	
Dividend to equity shareholders (3)	(200)	
Net cash used in financing activities		(106)
Net increase in cash		10
Cash at the beginning of year 2		5
Cash at the end of year 2		15

Working Notes

(1) Proceeds from sale of long-term investments:

Investments at beginning of year -2	Rs 150 lakh
Less investment of year-end 2	100
Book value of investments sold	50
Less loss on sale of investments	(10)
Sale proceeds	40

(2) Purchase of building and equipment

Original cost of buildings and equipment at the beginning of year 2	Rs 400 lakh
Less original cost of building and equipment sold during year-2 (book value Rs 10 lakh Plus accumulated depreciation Rs 20 lakh*)	(30)
	370
Original cost of building and equipment at year-end 2	500
Difference represents purchases of building and equipment	130

*Accumulated Depreciation Account (in Rs lakh)

Particular	*Amount*	*Particular*	*Amount*
To Building and equipment (accumulated depreciation on sale, balancing figure)	20	By Balance b/f	160
		By P&L A/c (depreciation of current year)	60
To Balance c/d	200		
	220		220

(3) Since there is no increase in reserves (Rs 340 lakh), the entire net income after taxes of Rs 200 lakh represents payment of dividend to equity shareholders.

P.3.7 The chief executive of a plastic manufacturing company has reviewed the annual financial statements for the current year and is unable to determine from a reading of the balance sheet the reasons for the changes in cash during the year. He asks you for assistance and presents the following balance sheets of the Hypothetical Ltd.

Particulars	*Previous year March 31*	*Current year March 31*	*Increase (Decreases)*
Assets:			
Goodwill	Rs 1,00,000	(Nil)	Rs (1,00,000)
Buildings	2,80,000	Rs 4,05,000	1,25,000
Land	75,000	70,000	(5,000)
Machinery	1,00,000	1,65,000	65,000
Tools	35,000	20,000	(15,000)
Trade investments	7,500	9,000	1,500
Inventories	1,09,000	1,05,000	(4,000)
Sundry debtors	46,000	90,000	44,000
Bills receivable	13,500	10,500	(3,000)
Cash in hand	4,500	1,000	(3,500)
Unexpired insurance	700	600	(100)
Unamortised discount on debentures	1,250	1,050	(200)
	7,72,450	8,77,150	1,04,700
Liabilities:			
Equity share capital	2,00,000	3,50,000	1,50,000
Debentures	50,000	75,000	25,000
Sundry creditors	26,000	29,000	3,000
Bank overdraft	—	4,000	4,000
Bills payable	5,000	4,500	(500)
Bank loans (short-term)	3,400	750	(2,650)
Accrued taxes	1,500	2,500	1,000
Accrued interest	3,000	5,000	2,000
Allowance for doubtful accounts	1,150	2,250	1,100
Accumulated depreciation	90,500	1,35,600	45,100
Retained earnings	3,91,900	2,68,550	(1,23,350)
	7,72,450	8,77,150	1,04,700

Additional Information:

(i) There were no purchases or sales of tools.

(ii) Equity shares were issued at a discount of 10 per cent.

(iii) Old machinery that cost Rs.2,250 was scrapped and written off the books. Accumulated depreciation on such equipment was Rs 1,650.

(iv) The income statement for the current year is:

Sales (net)		Rs 6,25,000
*Less:*Expenses:		
Operating charges:		
Materials and supplies		1,25,000
Direct labour		1,05,000
Manufacturing overhead		90,750
Depreciation		61,750
Selling expenses		1,22,500
General expenses		1,15,000
Interest expenses		3,750
Unusual items:		
Writing off of goodwill		1,00,000
Writing off of land		5,000
Loss on machinery		600
Discount on issue of equity shares 15,000		7,44,350
Net loss		(1,19,350)

You are required to prepare cash flow statement based on AS-3.

SOLUTION

Cash Flow Statement of Plastic Manufacturing Company
for the Current Year (Indirect method)

Particulars		*Amount*
Cash flow from operating activities:		
Net loss	Rs (1,19,350)	
Adjusted for		
Depreciation	61,750	
Interest expenses	3,750	
Writing off of goodwill	1,00,000	
Writing off of land	5,000	
Loss on machinery	600	
Discount on issue of shares	15,000	
Amortisation of discount on debentures	200	
Operating profit before working capital changes	66,950	
Adjusted for changes in working capital:		
Decrease in inventories	4,000	
Increase in sundry debtors	(44,000)	
Decrease in bills receivable	3,000	
Decrease in unexpired insurance	100	
Increase in creditors	3,000	
Increase in bank overdraft	4,000	
Decrease in bills payable	(500)	
Decrease in bank loans (short-term)	(2,650)	
Increase in accrued taxes	1,000	
Allowance for doubtful debts	1,100	
Net cash from operating activities		Rs 36,000
Cash flow from investing activities:		
Purchase of machine (1)	(67,250)	
Purchase of building	(1,25,000)	
Purchase of trade investments	1,500	
Net cash used in investing activities		1,93,750
Cash flow from financing activities:		
Proceeds from issue of equity shares	1,35,000	
Proceeds from issue of debentures	25,000	
Interest paid (2)	(1,750)	
Dividend paid (3)	(4,000)	
Net cash from financing activities		1,54,250
Net decrease in cash and cash-equivalents		(3,500)
Cash and cash equivalents at the beginning of current year		4,500
Cash and cash equivalents at the end of current year		1,000

Working Notes

1. Purchase of Machine	
Machinery at beginning of the year	Rs 1,00,000
Less scrap value of machine	2,250
	97,750

(*Contd.*)

(*Contd.*)

Closing balance of machine	1,65,000
Difference represents purchase of machine*	67,250
2. Interest paid	
Accrued interest at the beginning of year	3,000
Interest due during the year	3,750*
	6,750
Less accrued interest at the end of the year	5,000
Interest paid	1,750

*Interest expenses are (Rs 1,750 paid + Payable, Rs 2,000). In operating activities, Rs 3,750 has been adjusted in determining figure of operating profit before working capital changes. Increase in accrued interest of Rs 2,000 (Rs 5,000 – Rs 3,000) is not adjusted subsequently as it would have added more to cash flow by Rs 2,000.
(to avoid double counting).

3. Determination of dividend amount:	
Balance of retained earnings 31st March, previous year	Rs 3,91,900
Less*:* Net loss of current year	1,19,350
	2,72,550

However, the balance of retained earnings as on December 31, current year is Rs 2,68,550, that is, Rs 4,000 less. In the absence of any other information, this amount is assumed to have been paid as dividends to equityholders.

P.3.8 The following are the summarised balance sheets of Sound Ltd. as on March 31 for the two consecutive years 1 and 2:

(*Rs in thousand*)

Particulars	*Year 2*	*Year 1*
Assets:		
Plant and machinery	1,980	1,010
Land and buildings	1,000	1,000
Long-term investments	550	550
Short-term investments	470	85
Sundry debtors	2,195	2,500
Inventories	1,400	1,300
Interest receivable	100	65
Cash in hand	300	500
Cash in bank	405	300
	8,400	7,310
Liabilities:		
Share capital	2,600	2,150
Reserve and surplus	1,460	900
15% debentures	2,000	1,800
Sundry creditors	440	650
Wages outstanding	40	20
Income-tax payable	400	450
Accumulated depreciation:		
Plant and machinery	910	840
Land and buildings	550	500
	8,400	7,310

Income Statement *for the period ending March 31, year 2*	*(Rs in thousand)*
Sales revenue	45,300
Less: Cost of sales	39,000
Gross profit	6,300
Less: Depreciation	(540)
Selling and administration expenses	(2,960)
Interest paid	(300)
Add: Interest income	65
Dividend income (gross)	95
Net profit before extraordinary items	2,660
Add: Insurance settlement received	10
	2,670
Less: Provision for income-taxes	550
Net profit after taxes	2,120

Additional Information (*Rs in thousand*):

(1) 15% Debentures of Rs 300 was redeemed during year 2.
(2) Tax deducted at source on dividends received (included in provision for taxes) amounts to Rs 15.
(3) A plant costing Rs 500, having accumulated depreciation of Rs 420 was sold for Rs 80.
(4) During year 2, interim dividend of Rs 760 was paid; final dividend paid was Rs 800.
(5) All sales and purchases are made on credit basis.

You are required to prepare a cash flow statement as per AS-3 (revised).

SOLUTION

Direct Method Cash Flow Statement		*(Rs in thousand)*
Cash flows from operating activities:		
Cash receipts from customers	45,605	
Cash paid to suppliers and employees	(42,250)	
Cash generated from operations	3,355	
Income tax paid	(585)	
Cash flow before extraordinary item	2,770	
Proceeds from insurance settlement	10	
Net cash from operating activities		2,780
Cash flows from investing activities:		
Purchases of plant and machinery	(1,470)	
Proceeds from sale of plant and machinery	80	
Interest received	30	
Dividends received (Rs 95 – 15)	80	
Net cash used in investing activities		(1,280)
Cash flows from financing activities:		
Proceeds from issuance of share capital	450	
Proceeds from issue of 15% debentures	500	
Redemption of 15% debentures	(300)	
Interest paid	(300)	
Dividends paid (interim + final)	(1,560)	
Net cash used in financing activities		(1,210)
Net increase in cash and cash-equivalent		290
Cash and cash-equivalent at beginning of year 2		885
Cash and cash-equivalents at the end of year 2		1,175

Working Notes

(figures in Rs '000)

1. Cash receipts from customers:	
Sales	45,300
Add: Sundry debtors at the beginning of year 2	2,500
	47,800
Less: Sundry debtors at the end of year 2	(2,195)
	45,605
2. Cash paid to suppliers and employees:	
Cost of sales	39,000
Add: Administrative and selling expenses	2,960
Sundry creditors at the beginning of year 2	650
Wages outstanding at the beginning of year 2	20
Inventories at the end of year 2	1,400
	44,030
Less: Sundry creditors at the end of year 2	(440)
Wages outstanding at the end of the year 2	(40)
Inventories at the end of year 1	(1,300)
	42,250
3. Income tax paid (including tax deducted at source from dividends received)	
Income tax for year 2 (including tax deducted at source from dividends received)	550
Add: Income tax liability at the beginning of year 2	450
Less: Income tax liability at the end of year 2	(400)
	600

Out of Rs 600, tax deducted at source on dividend received (amounting to Rs 15) is included in cash flows from investing activities and the balance of Rs 585 is included in cash flows from operating activities.

4. Interest received:	
Interest income for year 2	65
Add: Interest receivable in the beginning of year 2	65
Less: Amount receivable at the end of year 2	(100)
	30
5. Machinery purchased:	
Balance at the end of year 2	1,980
Add: Book value of machine sold	500
Less: Balance at the beginning of year 2	(1,010)
	1,470

Indirect Method Cash Flow Statement		*(Amount in '000 Rs)*
Cash flows from operating activities:		
Net profit before taxation and extraordinary items	2,660	
Adjustment for:		
Depreciation	540	
Interest income	(65)	
Dividend income	(95)	
Interest expenses	300	
Operating profit before working capital changes	3,740	
Decrease in sundry debtors	305	
Increase in wages outstanding	20	

(*Contd.*)

(*Contd.*)

Increase in inventories	(100)	
Decrease in creditors	(210)	
Cash generated from operations	3,355	
Income taxes paid	(585)	
Cash flow before extraordinary item	2,770	
Add: Insurance settlement	10	
Net cash from operating activities		2,780
Cash flows from investing activities:		
Purchase of plant and machinery	(1,470)	
Proceeds from sale of plant and machinery	80	
Interest received	30	
Dividends received (95 – 15)	80	
Net cash used in investing activities		(1,280)
Cash flows from financial activities:		
Proceeds from issuance of share capital	450	
Proceeds from issue of 15% debentures	500	
Redemption of 15% debentures	(300)	
Interest paid	(300)	
Dividends paid (interim + final)	(1,560)	
Net cash used in financing activities		(1,210)
Net increase in cash and cash-equivalent		290
Cash and cash-equivalents at beginning of year 2		885
Cash and cash-equivalents at the end of year 2		1,175

Cash and Cash-equivalents *(Figures in '000 Rs)*

Particulars	*Year 2*	*Year 1*
Cash in hand	300	500
Cash at bank	405	300
Short-term investments	470	85
	1,175	885

P.3.9 The following are the summarised balance sheets of Hypothetical Ltd. as at March 31 for the two consecutive years 1 and 2. Prepare CFS as per AS-3.

(Rs in thousand)

Particulars		*Year 2*		*Year 1*
Assets				
Cash on hand and balances with banks		200		25
Short-term investments		670		135
Sundry debtors		1,700		1,200
Interest receivable		100		—
Inventories		900		1,950
Long-term investments		2,500		2,500
Fixed assets at cost	2,180		1,910	
Accumulated depreciation	(1,450)		(1,060)	
Fixed assets (net)		730		850
Total assets		6,800		6,660

(*Contd.*)

(*Contd.*)

Liabilities		
Sundry creditors	150	1,890
Interest payable	230	100
Income taxes payable	400	1,000
Long-term debt	1,110	1,040
Total liabilities	1,890	4,030
Shareholders' Funds		
Share capital	1,500	1,250
Reserves	3,410	1,380
Total shareholders' funds	4,910	2,630
Total liabilities and shareholders' funds	6,800	6,660

Statement of Profit and Loss
for the year 2 ended March 31 *(Rs '000)*

Sales	30,650
Cost of sales	(26,000)
Gross profit	4,650
Depreciation	(450)
Administrative and selling expenses	(910)
Interest expense	(400)
Interest income	300
Dividend income	200
Foreign exchange loss	(40)
Net profit before taxation and extraordinary item	3,350
Extraordinary item-Insurance proceeds from earthquake disaster settlement	180
Net profit after extraordinary item	3,530
Income-tax	(300)
Net profit	3,230

ADDITIONAL INFORMATION *(Rs in thousand)*

(i) An amount of 250 was raised from the issue of share capital and a further 250 was raised from long-term borrowings.
(ii) Interest expense was 400 of which 170 was paid during the period. 100 relating to interest expense of the prior period was also paid during the period.
(iii) Dividends paid were 1,200.
(iv) Tax deducted at source on dividends received (included in the tax expense of 300 for the year) amounted to 40.
(v) During the period, the enterprise acquired fixed assets for 350. The payment was made in cash.
(vi) Plant with original cost of 80 and accumulated depreciation of 60 was sold for 20.
(vii) Foreign exchange loss of 40 represents the reduction in the carrying amount of a short-term investment in foreign-currency designated bonds arising out of a change in exchange rate between the date of acquisition of the investment and the balance sheet date.
(viii) Sundry debtors and sundry creditors include amounts relating to credit sales and credit purchases only.

SOLUTION

Direct Method Cash Flow Statement *(Rs '000)*

Cash flows from operating activities		
Cash receipts from customers	30,150	
Cash paid to suppliers and employees	(27,600)	

(*Contd.*)

(*Contd.*)

Cash generated from operations	2,550	
Income taxes paid	(860)	
Cash flow before extraordinary item	1,690	
Proceeds from earthquake disaster settlement	180	
Net cash from operating activities		1,870
Cash flows from investing activities		
Purchase of fixed assets	(350)	
Proceeds from sale of equipment	20	
Interest received	200	
Dividends received	160	
Net cash from investing activities		30
Cash flows from financing activities		
Proceeds from issuance of share capital	250	
Proceeds from long-term borrowings	250	
Repayment of long-term borrowings	(180)	
Interest paid	(270)	
Dividends paid	(1,200)	
Net cash used in financing activities		(1,150)
Net increase in cash and cash equivalents		750
Cash and cash equivalents at beginning of period (*see Note 1*)		160
Cash and cash equivalents at the end of period (*see Note 1*)		910

Indirect Method Cash Flow Statement		*(Rs '000)*
Cash flows from operating activities		
Net profit before taxation, and extraordinary item	3,350	
Adjustments for:		
Depreciation	450	
Foreign exchange loss	40	
Interest income	(300)	
Dividend income	(200)	
Interest expense	400	
Operating profit before working capital changes	3,740	
Increase in sundry debtors	(500)	
Decrease in inventories	1,050	
Decrease in sundry creditors	(1,740)	
Cash generated from operations	2,550	
Income taxes paid	(860)	
Cash flow before extraordinary item	1,690	
Proceeds from earthquake disaster settlement	180	
Net cash from operating activities		1,870
Cash flows from investing activities:		
Purchase of fixed assets	(350)	
Proceeds from sale of equipment	20	
Interest received	200	
Dividends received	160	
Net cash from investing activities		30
Cash flows from financing activities	250	
Proceeds from issuance of share capital	250	

(*Contd.*)

Proceeds from long-term borrowings	(180)	
Repayment of long-term borrowings	(270)	
Interest paid	(1,200)	
Dividends paid		(1,150)
Net cash used in financing activities		750
Net increase in cash and cash equivalents		750
Cash and cash equivalents at beginning of period (*see Note 1*)		160
Cash and cash equivalents at end of period (*see Note 1*)		910

Notes to the cash flow statement (direct method and indirect method)

1. Cash and cash-equivalents

Cash and cash equivalents consist of cash on hand and balances with banks, and investments in money-market instruments. Cash and cash-equivalents included in the cash flow statement comprise the following balance sheet amounts.

	Year 2	*Year 1*
Cash on hand and balances with banks	Rs 200	Rs 25
Short-term investments	670	135
Cash and cash-equivalents	870	160
Effect of exchange rate changes	40	—
Cash and cash equivalents as restated	910	160

Cash and cash-equivalents at the end of the period include deposits with banks of 100 held by a branch which are not freely remissible to the company because of currency exchange restrictions.

The company has undrawn borrowing facilities of 2,000 of which 700 may be used only for future expansion.

2. Total tax paid during the year (including tax deducted at source on dividends received) amounted to 900.

Alternative Presentation (indirect method):

As an alternative, in an indirect method cash flow statement, operating profit before working capital changes is sometimes presented as follows:

Revenues excluding investment income	Rs 30,650	
Operating expense excluding depreciation	(26,910)	
Operating profit before working capital changes		Rs 3,740

Working Notes:

(Figures in Rs '000)

1. Cash receipts from customers		
Sales		30,650
Add: Sundry debtors at the end of the year		1,200
		31,850
Less: Sundry debtors at the end of the year		1,700
		30,150
2. Cash paid to suppliers and employees		
Cost of sales		26,000
Administrative and selling expenses		910
		26,910
Add: Sundry creditors at the beginning of the year	1,890	

(*Contd.*)

(*Contd.*)

Inventories at the end of the year	900	2,790
Less: Sundry creditors at the end of the year	150	29,700
Inventories at the beginning of the year	1,950	2,100
		27,600

3. Income taxes paid (including tax deducted at source from dividends received)

Income tax expense for the year (including tax deducted at source from dividends received)	300
Add: Income tax liability at the beginning of the year	1,000
	1,300
Less: Income tax liability at the end of the year	400
	900

Out of 900, tax deducted at source on dividends received (amounting to 40) is included in cash flows from investing activities and the balance of 860 is included in cash flows from operating activities.

4. Repayment of long-term borrowings

Long-term debt at the beginning of the year	1,040
Add: Long-term borrowing made during the year	250
	1,290
Less: Long-term borrowings at the end of the year	1,110
	180

5. Interest paid

Interest expense for the year	400
Add: Interest payable at the beginning of the year	100
	500
Less: Interest payable at the end of the year	230
	270

REVIEW QUESTIONS

RQ.3.1 "The analysis of cash flow statement in any organisation can be very useful to the management." Elucidate the statement.

RQ.3.2 The cash flow statement is as useful to shareholders and lenders as to management. Explain.

RQ.3.3 Name three activities in which cash flows are classified as per Accounting Standard 3. Also give three examples of transactions covered in these activities.

RQ.3.4 Describe in brief the procedure of determining cash flow from operating activities as per indirect method of AS-3. Take an appropriate example to illustrate your answer.

RQ.3.5 Explain with example the two methods of determining cash provided by operating activities.

RQ.3.6 Explain why decrease in current liabilities decrease cash and decrease in current assets increase cash.

RQ.3.7 "Depreciation is a non-cash expense. Still it is an integral part of cash flows". Explain.

RQ.3.8 Write short notes on the following

(i) Cash-equivalents
(ii) Extra-ordinary items
(iii) Treatment of interest and dividends received in cash flow statement (based on AS-3).
(iv) Major non-cash items.

EXAMINATION QUESTIONS

EQ.3.1 From the information contained in income statement and balance sheet of 'A' Ltd., prepare cash flow statement:

Income statement for the year ended March 31, 2008

Net sales	(A)	Rs 2,52,00,000
Less:		
Cash cost of sales		1,98,00,000
Depreciation		6,00,000
Salaries and wages		24,00,000
Operating expenses		8,00,000
Provision for taxation		8,80,000
	(B)	2,44,80,000
Net operating profit (*A* – *B*)		7,20,000
Non-recurring income – Profits on sale of equipment		1,20,000
		8,40,000
Retained earnings and profits brought forward		15,18,000
		23,58,000
Dividends declared and paid during the year		7,20,000
Profit and Loss Account balance as on March 31, 2008		16,38,000

	Balance Sheet as on	
Assets	March 31, 2007	March 31, 2008
Fixed Assets:		
Land	Rs 4,80,000	Rs 9,60,000
Building and equipment	36,00,000	57,60,000
Current assets:		
Cash	6,00,0000	7,20,000
Debtors	16,80,000	18,60,000
Stock	26,40,000	9,60,000
Advances	78,000	90,000
	90,78,000	1,03,50,000
Liabilities and Equity	March 31, 2007	March 31, 2008
Share capital	Rs 36,00,000	Rs 44,40,000
Surplus in profit and loss account	15,18,000	16,38,000
Sundry creditors	24,00,000	23,40,000
Outstanding expenses	2,40,000	4,80,000
Income-tax payable	1,20,000	1,32,000
Accumulated depreciation on buildings and equipment	12,00,000	13,20,000
	90,78,000	1,03,50,000

The original cost of equipment sold during the year 2007-08 was Rs 7,20,000. (*CA—November, 2006*)

SOLUTION

Cash flow statement of '*A*' limited for the year ending March 31, 2008 (indirect method).

Particulars		*Amount*
Cash flow from operating activities:		
Net profit before taxation and extraordinary items	Rs 16,00,000	
Adjustment for: Depreciation	6,00,000	
Operating profit before working capital changes	22,00,000	
Increase in debtors	(1,80,000)	
Decrease in stock	16,80,000	
Increase in advances	(12,000)	
Decrease in sundry creditors	(60,000)	
Increase in outstanding expenses	2,40,000	
Cash generated from operations	38,68,000	
Income taxes paid	8,68,000	
Net cash from operations		Rs 30,00,000
Cash flows from investment activities:		
Purchase of land	(4,80,000)	
Purchase of buildings and equipments	(28,80,000)	
Proceeds from sale of equipment	3,60,000	
Net cash used in investing activities		(30,00,000)
Cash flows from financing activities:		
Proceeds from issuance of share capital	Rs 8,40,000	
Dividends paid	(7,20,000)	
Net cash from financing activities		1,20,000
Net increase in cash from cash–equivalents		1,20,000
Cash and cash–equivalents at the beginning of year		6,00,000
Cash and cash–equivalents at the end of the year		7,20,000

Working notes:

1. Net profit before taxation and extraordinary items

Net operating profit	Rs 7,20,000	
Add provision for taxation	8,80,000	Rs 16,00,000

2. Purchase of buildings and equipment

Building and equipment account (Gross)

To Opening balance	Rs 36,00,000	By Sale of equipment	
To Purchases during 2008		(original cost)	Rs 7,20,000
(balancing figure)	28,80,000	By Closing balance	57,60,000
	64,80,000		64,80,000

Accumulated depreciation account

To Depreciation written off on sale		By Opening balance	Rs 12,00,000
of equipment (balancing figure)	Rs 4,80,000	By Depreciation (2008)	6,00,000
To Closing balance	13,20,000		
	18,00,000		18,00,000

3. Proceeds from sale of equipment

Original cost of equipment	Rs 7,20,000	
Less accumulated depreciation	4,80,000	
Book value	2,40,000	
Add profit on sale of equipment	1,20,000	Rs 3,60,000

EQ.3.2 The Balance Sheet of Royal Limited as on 31st March, 2007 and 31st March, 2008 are given below:

Balance Sheet as on

Liabilities	*31.03.07*	*31.03.08*	*Assets*	*31.03.07*	*31.03.08*
Share capital	1,440	1,920	Fixed assets	3,840	4,560
Capital reserve	—	48	*Less:* Depreciation	1,104	1,392
General reserve	816	960		2,736	3,168
Profit and loss account	288	360	Investment	480	384
9% Debenture	960	672	Cash	210	312
Current liabilities	576	624	Other current assets		
Proposed dividend	144	174	(including stock)	1,134	1,272
Provision for tax	432	408	Preliminary expenses	96	48
Unpaid dividend	—	18			
	4,656	5,184		4,656	5,184

Additional Informations:

(i) During the year 2007–2008, Fixed Assets costing Rs 2,40,000 (accumulated depreciation Rs 84,000) was sold for Rs 1,20,000.

(ii) Provided Rs 4,20,000 as depreciation.

(iii) Some investments are sold at a profit of Rs 48,000 and Profit was credited to capital reserve.

(iv) It decided that stocks be valued at cost, whereas previously the practice was to value stock at cost less 10 per cent. The stock was Rs 2,59,200 as on 31.03.07. The stock as on 31.03.08 was correctly valued at Rs 3,60,000.

(v) It decided to write off fixed assets costing Rs 60,000 on which depreciation amounting to Rs 48,000 has been provided.

(vi) Debentures are redeemed at Rs 105.

Required:

Prepare a Cash Flow Statement (based on accounting Standard-3). (*CA(PE-II)—May, 2007*)

SOLUTION

Cash flow statement of Royal Limited as per AS-3 for the current year-ended March 31, 2008 (indirect method).

Particulars		*Amount*
Cash flows from operating activities:		
Net profit before taxation and extraordinary items	Rs 7,69,200	
Adjustments for:		
Depreciation	4,20,000	
Preliminary expenses written off	48,000	
Fixed assets written off	12,000	
Loss on sale of fixed assets (Rs 2,40,000 – Rs 84,000 – 1,20,000)	36,000	
Premium on redemption of debentures (Rs 2,88,000 × 0.05)	14,400	
Operating profit before working capital changes	12,99,600	
Increase in current assets Rs 12,72,000 – (Rs 11,34,000 + Rs 28,800 increase in stock valuation)	(1,09,200)	
Increase in current liabilities (Rs 6,24,000 – 5,76,000)	48,000	
Cash generated from operations	12,38,400	
Less income taxes paid	4,32,000	
Net cash from operating activities		Rs 8,06,400

(*Contd.*)

(*Contd.*)

Cash flows from investing activities:		
Purchase of fixed assets	(Rs 10,20,000)	
Sale of fixed assets	1,20,000	
Sale of investments (Rs 4,80,000 – 3,84,000 + Rs 48,000 profit)	1,44,000	
Net cash used in investing activities		(7,56,000)
Cash flows from financing activities:		
Proceeds from issuance of share capital	Rs 4,80,000	
Redemption of 9% debentures (Rs 2,88,000 × 1.05)	(3,02,400)	
Dividends paid (Rs 1,44,000 – 18,000)	1,26,000	
Net cash from financing activities		51,600
Net increase in cash and cash equivalents		1,02,000
Cash and cash equivalents at the beginning of year		2,10,000
Cash and cash equivalents at the end of year		3,12,000

Working Notes:

1. *Determination of net profit before taxation and extraordinary items:*

Increase in profit and loss account Rs 3,60,000 –	
(Rs 2,88,000 + Rs 28,800 increase in value of opening stock)	Rs 43,200
Plus increase in general reserve	1,44,000
Plus proposed dividend of current year	1,74,000
Plus provision for taxes of current year	4,08,000
	7,69,200

2. Increase in valuation of opening stock (Rs 2,59,200/0.9 = Rs 2,88,000) – Rs 2,59,200 Rs 28,800
3. Purchase of fixed assets:

Fixed assets account (Gross)

To Opening balance	Rs 38,40,000	By Cash	Rs 1,20,000
To Purchases (balancing figure)	10,20,000	By Accumulated depreciation	84,000
		By Loss on sale	36,000
		By Writing off	60,000
		By Closing balance	45,60,000
	48,60,000		48,60,000

4 Financial Statements Analysis

Introduction

A basic limitation of the traditional financial statements[1] comprising the balance sheet and the profit and loss account is that they do not give all the information related to the financial operations of a firm. Nevertheless, they provide some extremely useful information to the extent that the balance sheet mirrors the financial position on a particular date in terms of the structure of assets, liabilities and owners' equity, and so on and the profit and loss account shows the results of operations during a certain period of time in terms of the revenues obtained and the cost incurred during the year. Thus, the financial statements provide a summarised view of the financial position and operations of a firm. Therefore, much can be learnt about a firm from a careful examination of its financial statements as invaluable documents/performance reports. The analysis of financial statements is, thus, an important aid to financial analysis.

The focus of financial analysis is on key figures in the financial statements and the significant relationship that exists between them. The analysis of financial statements is a process of evaluating the relationship between component parts of financial statements to obtain a better understanding of the firm's position and performance.[2] The first task of the financial analyst is to select the information relevant to the decision under consideration from the total information contained in the financial statements. The second step is to arrange the information in a way to highlight significant relationships. The final step is interpretation and drawing of inferences and conclusions. *In brief, financial analysis is the process of selection, relation and evaluation*.[3]

The present chapter is devoted to an in-depth analysis of financial statements and its use for decision making by various parties interested in them. The focus of the chapter is on ratio analysis as the most widely used technique of financial statement analysis (Section 1). Section 2 of the chapter discusses common-size statements as method of analysis of financial statements. The importance of ratio analysis and its limitations are briefly outlined in Section 3. The major points are summarised in the last section of the chapter.

RATIO ANALYSIS

Meaning and Rationale

Ratio analysis is a widely-used tool of financial analysis. It is defined as the systematic use of ratio to interpret the financial statements so that the strengths and weaknesses of a firm as well as its historical performance and current financial condition can be determined. The term ratio refers to the numerical or quantitative relationship between two items/variables. This relationship can be expressed as (i) percentages, say, net profits are 25 per cent of sales (assuming net profits of Rs 25,000 and sales of Rs 1,00,000), (ii) fraction (net profit is one-fourth of sales) and (iii) proportion of numbers (the relationship between net profits and sales is 1:4). These alternative methods of expressing items which are related to each other are, for purposes of financial analysis, referred to as ratio analysis. It should be noted that computing the ratios does not add any information not already inherent in the above figures of profits and sales. What the ratios do is that they reveal the relationship in a more meaningful way so as to enable us to draw conclusions from them.

The rationale of ratio analysis lies in the fact that it makes related information comparable. A single figure by itself has no meaning but when expressed in terms of a related figure, it yields significant inferences. For instance, the fact that the net profits of a firm amount to, say, Rs 10 lakhs throws no light on its adequacy or otherwise. The figure of net profit has to be considered in relation to other variables. How does it stand in relation to sales? What does it represent by way of return on total assets used or total capital employed? If, therefore, net profits are shown in terms of their relationship with items such as sales, assets, capital employed, equity capital and so on, meaningful conclusions can be drawn regarding their adequacy. To carry the above example further, assuming the capital employed to be Rs 50 lakh and Rs 100 lakh, the net profits are 20 per cent and 10 per cent respectively. Ratio analysis, thus, as a quantitative tool, enables analysts to draw quantitative answers to questions such as: Are the net profits adequate? Are the assets being used efficiently? Is the firm solvent? Can the firm meet its current obligations and so on?

Basis of Comparison

Ratios, as shown above, are relative figures reflecting the relationship between variables. They enable analysts to draw conclussions regarding financial operations. The use of ratios, as a tool of financial analysis, involves their comparison, for a single ratio, like absolute figures, fails to reveal the true position. For example, if in the case of a firm, the return on capital employed is 15 per cent in a particular year, what does it indicate? Only if the figure is related to the fact that in the preceding year the relevant return was 12 per cent or 18 per cent, it can be inferred whether the profitability of the firm has declined or improved. Alternatively, if we know that the return for the industry as a whole is 10 per cent or 20 per cent, the profitability of the firm in question can be evaluated. Comparison with related facts is, therefore, the basis of ratio analysis. Four types of comparisons are involved: (i) trend ratios, (ii) inter-firm comparison, (iii) comparison of items within a single year's financial statement of a firm, and (iv) comparison with standards or plans.

Trends ratios involve a comparison of the ratios of a firm over time, that is, present ratios are compared with past ratios for the same firm. The comparison of the profitability of a firm, say, year 1 through 5 is an illustration of a trend ratio. Trend ratios indicate the direction of change in the performance–improvement, deterioration or constancy–over the years.

The inter-firm comparison involving comparison of the ratios of a firm with those of others in the same line of business or for the industry as a whole reflects its performance in relation to its competitors.

Other types of comparison may relate to comparison of items within a single year's financial statement of a firm and comparison with standards or plans.

Types of Ratios

Ratios can be classified into four broad groups: (i) Liquidity ratios, (ii) Capital structure/leverage ratios, (iii) Profitability ratios, and (iv) Activity ratios.

Liquidity Ratios The importance of adequate liquidity in the sense of the ability of a firm to meet current/short-term obligations when they become due for payment can hardly be overstressed. In fact, liquidity is a prerequisite for the very survival of a firm. The short-term creditors of the firm are interested in the short-term solvency or liquidity of a firm. But liquidity implies, from the viewpoint of utilisation of the funds of the firm, that funds are idle or they earn very little. A proper balance between the two contradictory requirements, that is, liquidity and profitability, is required for efficient financial management. The liquidity ratios measure the ability of a firm to meet its short-term obligations and reflect the short-term financial strength/solvency of a firm. The ratios which indicate the liquidity of a firm are: (i) net working capital, (ii) current ratios, (iii) acid test/quick ratios, (iv) super quick ratios, (v) turnover ratios, and (vi) defensive-interval ratios.

Net Working Capital Net working capital (NWC) represents the excess of current assets over current liabilities. The term current assets refers to assets which in the normal course of business get converted into cash without dimunition in value over a short period, usually not exceeding one year or length of operating/cash cycle whichever is more. Current liabilities are those liabilities which at the inception are required to be paid in short period, normally a year. Although NWC is really not a ratio, it is frequently employed as a measure of a company's liquidity position. An enterprise should have sufficient NWC in order to be able to meet the claims of the creditors and the day-to-day needs of business. The greater is the amount of NWC, the greater is the liquidity of the firm. Accordingly, NWC is a measure of liquidity. Inadequate working capital is the first sign of financial problems for a firm.

There is, however, no predetermined criterion as to what constitutes adequate NWC. Moreover, the size of the NWC is not an appropriate measure of the liquidity position of a firm as shown in Table 4.1:

Table 4.1 *Net Working Capital*

	Company A	*Company B*
Total current assets	Rs 1,80,000	Rs 30,000
Total current liabilities	1,20,000	10,000
NWC	60,000	20,000

If the size of NWC is a measure of liquidity, Company A must be three times as liquid as Company B. However, a deeper probe would show that this is not so. A comparison of current liabilities and current assets of both the firms shows that for each rupee of current liability, B has Rs 3 of current assets, while A has only Rs 1.50. Thus, while A has three times the NWC of B, the current assets of the former are only 1.5 times its current liabilities as compared to 3 times in case of the latter. Obviously, from the viewpoint of the ability to meet its current obligations, firm B is in a better position than firm A. Another limitation of NWC, as a measure of liquidity, is that a change in NWC does not necessarily reflect a change in the liquidity position of a firm. Witness Table 4.2.

Table 4.2 *Change in Net Working Capital*

	End-year 1	*End-year 2*
Current assets	Rs 1,00,000	Rs 2,00,000
Current liabilities	25,000	1,00,000
NWC	75,000	1,00,000

Although the NWC has gone up for the firm in Table 4.2 from Rs 75,000 to Rs 1,00,000, that is, by Rs 25,000 or 33.3 per cent between two points of time, there is, in reality, a deterioration in the liquidity position. In the first year, the firm had Rs 4 of current assets for each rupee of current liabilities; but by the end of the second year the amount of current assets for each rupee of current liabilities declined to Rs 2 only, that is, by 50 per cent. For these reasons, NWC is not a satisfactory measure of the liquidity of a firm for inter-firm comparison or for trend analysis.[4] A better indicator is the current ratio.

Current Ratio The current ratio is the ratio of total current assets to total current liabilities. It is calculated by dividing current assets by current liabilities:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} \tag{4.1}$$

The current assets of a firm, as already stated, represent those assets which can be, in the ordinary course of business, converted into cash within a short period of time, normally not exceeding one year and include cash and bank balances, marketable securities, inventory of raw materials, semi-finished (work-in-progress) and finished goods, debtors net of provision for bad and doubtful debts, bills receivable and prepaid expenses. The current liabilities defined as liabilities which are short-term maturing obligations to be met, as originally contemplated, within a year, consist of trade creditors, bills payable, bank credit, provision for taxation, dividends payable and outstanding expenses. The current ratio for firms A and B of Table 4.1 are shown in Table 4.3.

Table 4.3 *Current Ratio*

	Firm A	*Firm B*
$\frac{\text{Current assets}}{\text{Current liabilities}} = \frac{\text{Rs } 1,80,000}{\text{Rs } 1,20,000} = \frac{\text{Rs } 30,000}{\text{Rs } 10,000}$		
	= 3 : 2 (1.5 : 1)	3 : 1

Rationale The current ratio of a firm measures its short-term solvency, that is, its ability to meet short-term obligations. As a measure of short-term/current financial liquidity, it indicates the rupees of current assets available for each rupee of current liability/ obligation. *The higher the current ratio, the larger is the amount of rupees available per rupee of current liability, the more is the firm's ability to meet current obligations and the greater is the safety of funds of short-term creditors.* Thus, current ratio, in a way, is a measure of margin of safety to the creditors.

The need for safety margin arises from the inevitable unevenness in the flow of funds through the current assets and liabilities account. If the flows were absolutely smooth and uniform each day so that inflows exactly equalled absolutely maturing obligations, the requirement of a safety margin would be small. The fact that a firm can rarely count on such an even flow requires that the size of the current assets should be sufficiently larger than current liabilities so that the firm would be assured of being able to pay its current

maturing debt as and when it becomes due. Moreover, the current liabilities can be settled only by making payment whereas the current assets available to liquidate them are subject to shrinkage for various reasons, such as bad debts, inventories becoming obsolete or unsaleable and occurrence of unexpected losses in marketable securities and so on. The current ratio measures the size of the short-term liquidity 'buffer'. A satisfactory current ratio would enable a firm to meet its obligations even when the value of the current assets declines.

Interpretation In the case of company A in the above example, the current ratio is 1.5 : 1. It implies that for every one rupee of current liabilities, current assets of one-and-half rupees are available to meet them. In other words, the current assets are one-and-half times the current liabilities. The current ratio of 3 : 1 for company B signifies that current assets are three-fold its short-term obligations. The liquidity position, as measured by the current ratio, is better in the case of B as compared to A. This is because the safety margin in the former (200 per cent) is substantially higher than in the latter (50 per cent). A slight decline in the value of current assets will adversely affect the ability of firm A to meet its obligations and, therefore, from the viewpoint of creditors, it is a more risky venture. In contrast, there is a sufficient cushion in firm B and even with two-thirds shrinkage in the value of its assets, it will be able to meet its obligations in full. For the creditors the firm is less risky. The interpretation is: *in inter-firm comparison, the firm with the higher current ratio has better liquidity/short-term solvency*.

It is important to note that a very high ratio of current assets to current liabilities may be indicative of slack management practices, as it might signal excessive inventories for the current requirements and poor credit management in terms of overextended accounts receivable. At the same time, the firm may not be making full use of its current borrowing capacity.[5] Therefore, a firm should have a reasonable current ratio.

Although there is no hard and fast rule, conventionally, a current ratio of 2 : 1 (current assets twice current liabilities) is considered satisfactory. The logic underlying the conventional rule is that even with a drop-out of 50 per cent (half) in the value of current assets, a firm can meet its obligations, that is, a 50 per cent margin of safety is assumed to be sufficient to wardoff the worst of situations. The firm A of our example, having a current ratio of 1.5 : 1, can be interpreted, on the basis of the conventional rule, to be inadequately liquid from the point of view of its ability to always satisfy the claims of short-term creditors. The firm B, of course, is sufficiently liquid as its current ratio is 3 : 1. The rule of thumb (a current ratio of 2 : 1) cannot, however, be applied mechanically. What is a satisfactory ratio will differ depending on the development of the capital market and the availability of long-term funds to finance current assets, the nature of industry and so on.

In capital-rich countries, where long-term funds from the capital market are available in abundance, firms depend on current liabilities for financing a relatively small part of their current asset requirements and it is not unusual for a firm to finance two-thirds to three-quarters of its current assets by long-term sources.[6] This policy of relying to a limited extent on short-term credit (current liabilities) is probably to avoid the difficulty in which the firms may be put by the creditors in times of temporary adversity. In underdeveloped countries, there is no alternative to relying heavily on short-term financing. Yet, in view of the risk which such a practice entails, the firms would be well advised to keep the current liabilities within reasonable limits and finance a certain minimum part of the current assets by long-term sources. It may not be out of place to mention here that the Tandon Committee (1974) has prescribed in India the minimum scale of current asset financing by long-term funds.[7]

Another factor which has a bearing on the current ratio is the nature of the industry. For instance, public utility companies generally have a very low current ratio, as normally such companies have very little need for current assets. The wholesale dealers, on the other hand, purchasing goods on cash basis or on credit basis for a very short period but selling to retailers on credit basis, require a higher current ratio. If, in our

above example, firm A is a public utility, its liquidity position can be interpreted to be satisfactory even though its current ratio is less than the conventional norm. Thus, the standard norm of current ratio (2 : 1) may vary from industry to industry. However, a ratio of less than 1 : 1 would certainly be undesirable in any industry as at least some safety margin is required to protect the interest of the creditors and to provide cushion to the firm in adverse circumstances.

The current ratio, though superior to NWC in measuring short-term financial solvency, is a rather crude measure of the liquidity of a firm. The limitation of current ratio arises from the fact that it is a *quantitative* rather than a *qualitative* index of liquidity. The term quantitative refers to the fact that it takes into account the total current assets without making any distinction between various types of current assets such as cash, inventories and so on. A qualitative measure takes into account the proportion of various types of current assets to the total current assets. A satisfactory measure of liquidity should consider the liquidity of the various current assets *per se*. As already mentioned, while current liabilities are fixed in the sense that they have to be paid in full in all circumstances, the current assets are subject to shrinkage in value, for example, possibility of bad debts, unsaleability of inventory and so on. Moreover, some of the current assets are more liquid than others: cash is the most liquid of all; receivables are more liquid than inventories, the last being the least liquid as they have to be sold before they are converted into receivables and, then, into cash. A firm with a higher percentage of its current assets in the form of cash would be more liquid, in the sense of being able to meet obligations as and when they become due, than one with a higher percentage of slow moving and unsaleable inventory and/or slow paying receivables even though both have the same current ratio. In fact, the latter type of firm may encounter serious difficulties in paying its bills even though it may have a current ratio of 2 : 1, whereas the former may do well with a ratio lower than the conventional norm. Thus, the current ratio is not a conclusive index of the real liquidity of a firm. It fails to answer questions, such as, how liquid are the receivables and the inventory? What effect does the omission of inventory have on the liquidity of a firm? To answer these and related questions, an additional analysis of the quality of current assets is required. This is done in acid-test or quick ratio.

Acid-Test/Quick Ratio As observed above, one defect of the current ratio is that it fails to convey any information on the composition of the current assets of a firm. A rupee of cash is considered equivalent to a rupee of inventory or receivables. But it is not so. A rupee of cash is more readily available (i.e. more liquid) to meet current obligations than a rupee of, say, inventory. This impairs the usefulness of the current ratio. The acid-test ratio is a measure of liquidity designed to overcome this defect of the current ratio. It is often referred to as quick ratio because it is a measurement of a firm's ability to convert its current assets quickly into cash in order to meet its current liabilities. Thus, it is a measure of quick or acid liquidity.

The acid-test ratio is the ratio between quick current assets and current liabilities and is calculated by dividing the quick assets by the current liabilities:

$$\text{Acid-test ratio} = \frac{\text{Quick assets}}{\text{Current liabilities}} \tag{4.2}$$

The term quick assets refers to current assets which can be converted into cash immediately or at a short notice without diminution of value. Included in this category of current assets are (i) cash and bank balances; (ii) short-term marketable securities and (iii) debtors/receivables. Thus, the current assets which are excluded are: prepaid expenses and inventory. The exclusion of inventory is based on the reasoning that it is not easily and readily convertible into cash. Prepaid expenses by their very nature are not available to pay off current debts. They merely reduce the amount of cash required in one period because of payment in a prior period.[8] The acid-test ratio is calculated in Table 4.4.

Table 4.4 *Acid-Test Ratio*

Cash	Rs 2,000
Debtors	2,000
Inventory	12,000
Total current assets	16,000
Total current liabilities	8,000
(i) Current ratio	2 : 1
(ii) Acid-test ratio	0.5 : 1

Interpretation The acid-test ratio is a rigorous measure of a firm's ability to service short-term liabilities. The usefulness of the ratio lies in the fact that it is widely accepted as the best available test of the liquidity position of a firm. That the acid-test ratio is superior to the current ratio is evident from Table 4.4. The current ratio of the hypothetical firm is 2 : 1 and can certainly be considered satisfactory. This interpretation of the liquidity position of the firm needs modification in the light of the quick ratio. Generally speaking, an acid-test ratio of 1 : 1 is considered satisfactory as a firm can easily meet all current claims. In the case of the hypothetical firm the quick ratio (0.5 : 1) is less than the standard/norm, the satisfactory current ratio notwithstanding. The interpretation that can be placed on the current ratio (2 : 1) and acid-test (0.5 : 1) is that a large part of the current assets of the firm is tied up in slow moving and unsaleable inventories and slow paying debts. The firm would find it difficult to pay its current liabilities. The acid-test ratio provides, in a sense, a check on the liquidity position of a firm as shown by its current ratio. The quick ratio is a more rigorous and penetrating test of the liquidity position of a firm. Yet, it is not a conclusive test. Both the current and quick ratios should be considered in relation to the industry average to infer whether the firm's short-term financial position is satisfactory or not.

A variation of this ratio,[9] may be super-quick/acid-test ratio. This ratio is calculated by dividing the super-quick assets by the current liabilities of a firm. The super-quick current assets are cash and marketable securities. This ratio is the most rigorous and conservative test of a firm's liquidity position. Further, it is suggested that it would be useful, for the management, if the liquidity measure also takes into account 'reserve borrowing power' as the firm's real debt paying ability depends not only on cash resources available with it but also on its capacity to borrow from the market at short notice.

Turnover Ratio The liquidity ratios discussed so far relate to the liquidity of a firm as a whole. Another way of examining the liquidity is to determine how quickly certain current assets are converted into cash. The ratios to measure these are referred to as turnover ratios. These are, as activity ratios, covered in detail later in this chapter. Here, we focus on them to supplement the three liquidity ratios discussed above. The three relevant turnover ratios are (i) inventory turnover ratio; (ii) debtors turnover ratio; and (iii) creditors turnover ratio.

Inventory Turnover Ratio It is computed by dividing the cost of goods sold by the average inventory. Thus,

$$\text{Inventory turnover ratio} = \frac{\text{Cost of goods sold}}{\text{Average inventory}} \tag{4.3}$$

The cost of goods sold means sales minus gross profit. The average inventory refers to the simple average of the opening and closing inventory. The ratio indicates how fast inventory is sold. A high ratio is good from the viewpoint of liquidity and *vice versa*. A low ratio would signify that inventory does not sell fast and stays on the shelf or in the warehouse for a long time. This is illustrated in Example 4.1.

EXAMPLE 4.1

A firm has sold goods worth Rs 3,00,000 with a gross profit margin of 20 per cent. The stock at the beginning and the end of the year was Rs 35,000 and Rs 45,000 respectively. What is the inventory turnover ratio?

SOLUTION

$$\text{Inventory turnover ratio} = \frac{(\text{Rs } 3,00,000 - \text{Rs } 60,000)}{(\text{Rs } 35,000 + \text{Rs } 45,000) \div 2} = 6 \text{ (times per year)}$$

$$\text{Inventory holding period} = \frac{12 \text{ months}}{6} = 2 \text{ months}$$

Debtors Turnover Ratio It is determined by dividing the net credit sales by average debtors outstanding during the year. Thus,

$$\text{Debtors turnover ratio} = \frac{\text{Net credit sales}}{\text{Average debtors}} \tag{4.4}$$

Net credit sales consist of gross credit sales minus returns, if any, from customers. Average debtors is the simple average of debtors at the beginning and at the end of year. The analysis of the debtors turnover ratio supplements the information regarding the liquidity of one item of current assets of the firm. The ratio measures how rapidly debts are collected. A high ratio is indicative of shorter time-lag between credit sales and cash collection. A low ratio shows that debts are not being collected rapidly. This is shown in Example 4.2.

EXAMPLE 4.2

A firm has made credit sales of Rs 2,40,000 during the year. The outstanding amount of debt at the beginning and at the end of the year respectively was Rs 27,500 and Rs 32,500. Determine the debtor turnover ratio.

SOLUTION

$$\text{Debtors turnover ratio} = \frac{\text{Rs } 2,40,000}{(\text{Rs } 27,500 + \text{Rs } 32,500) \div 2} = 8 \text{ (times per year)}$$

$$\text{Debt collection period} = \frac{12 \text{ months}}{\text{Debtors turnover}} = 1.5 \text{ months}$$

Creditors Turnover Ratio It is a ratio between net credit purchases and the average amount of creditors outstanding during the year. It is calculated as follows:

$$\text{Creditors turnover ratio} = \frac{\text{Net credit purchases}}{\text{Average creditors}} \tag{4.5}$$

Net credit purchases = Gross credit purchases *less* returns to suppliers

Average creditors = Average of creditors outstanding at the beginning and at the end of the year

A low turnover ratio reflects liberal credit terms granted by suppliers, while a high ratio shows that accounts are to be settled rapidly. The creditors turnover ratio is an important tool of analysis as a firm can reduce its requirement of current assets by relying on supplier's credit. The extent to which trade creditors are willing to wait for payment can be approximated by the creditors turnover ratio. Consider Example 4.3.

EXAMPLE 4.3

The firm of Examples 4.1 and 4.2 has made credit purchases of Rs 1,80,000. The amount payable to the creditors at the beginning and at the end of the year is Rs 42,500 and Rs 47,500 respectively. Find out the creditors turnover ratio.

SOLUTION

$$\text{Creditors turnover ratio} = \frac{(\text{Rs } 1,80,000)}{(\text{Rs } 42,500 + \text{Rs } 47,500) \div 2} = 4 \text{ (times per year)}$$

$$\text{Creditor's payment period} = \frac{12 \text{ months}}{\text{Creditors turnover ratio } (4)} = 3 \text{ months}$$

The summing up of the three turnover ratios has a bearing on the liquidity of a firm. The combined effect of the three turnover ratios is summarised below:

Inventory holding period	2 months
Add debtor's collection period	+ 1.5 months
Less creditor's payment period	– 3 months
	0.5 months

As a rule, the shorter is this period, the better are the liquidity ratios as measured above and *vice versa*.

Defensive-Interval Ratio The liquidity ratios of a firm outlined in the preceding discussions throw light on the ability of a firm to pay its current liabilities. Apart from paying current liabilities, the liquidity position of a firm should also be examined in relation to its ability to meet projected daily expenditure from operations. The defensive-interval ratio provides such a measure of liquidity. It is a ratio between the quick/liquid assets and the projected daily cash requirements and is calculated according to Eq. 4.6.

$$\text{Defensive-interval ratio} = \frac{\text{Liquid assets}}{\text{Projected daily cash requirement}} \tag{4.6}$$

where

$$\text{Projected daily cash requirement} = \frac{\text{Projected cash operating expenditure}}{\text{Number of days in a year (365)}}$$

The projected cash operating expenditure is based on past expenditures and future plans. It is equivalent to the cost of goods sold excluding depreciation, plus selling and administrative expenditure and other ordinary cash expenses. Alternatively, a very rough estimate of cash operating expenses can be obtained by subtracting the non-cash expenses like depreciation and amortisation from total expenses. Liquid assets, as already stated, include current assets excluding inventory and prepaid expenses.

The defensive-interval ratio measures the timespan a firm can operate on present liquid assets (comprising cash and marketable securities and cash collected from debtors) without resorting to next year's income. Consider Example 4.4.

EXAMPLE 4.4

The projected cash operating expenditure of a firm from the next year is Rs 1,82,500. It has liquid current assets amounting to Rs 40,000. Determine the defensive-interval ratio.

SOLUTION

$$\text{Projected daily cash requirement} = \frac{\text{Rs } 1,82,500}{365} = \text{Rs } 500$$

$$\text{Defensive-interval ratio} = \frac{\text{Rs } 40,000}{\text{Rs } 500} = 80 \text{ days}$$

The figure of 80 days indicates that the firm has liquid assets which can meet the operating cash requirements of business for 80 days without resorting to future revenues. A higher ratio would be favourable as it would reflect the ability of a firm to meet cash requirements for a longer period of time. It provides a safety margin to the firm in determining its ability to meet basic operational costs. A higher ratio would provide the firm with a relatively higher degree of protection and tends to offset the weakness indicated by low current and acid-test ratios.[10] Sorter and Benston[11] have also suggested a ratio of liquid assets to daily cash operating expenditure as a measure of short-term solvency.

To conclude the discussion of liquidity ratios, the short-term solvency of a firm can be judged not merely in terms of the traditional liquidity ratios such as current and acid-tests, but the analysis should also be extended towards examining the quality of turnover of the items of current assets on which such ratios are based. These qualitative considerations (turnover ratios) coupled with the defensive-interval ratios would reveal the true liquidity position of the firm.

The liquidity ratios are, no doubt, primarily relevant from the viewpoint of the creditors of the firm. In theory, therefore, the higher the liquidity ratios, the better is the firm. But high ratios have serious implications from the firm's point of view. High current and acid-test ratios would imply that funds have unnecessarily accumulated and are not being profitably utilised. Similarly, an unusually high rate of inventory turnover may indicate that a firm is losing business by failing to maintain an adequate level of inventory to serve the customer's needs. A rapid turnover of debtors may reflect strict credit policies that hold revenue below levels that could be obtained by granting more liberal credit terms.

Finally, while interpreting the short-term position of the firm by the creditors, it should be recognised that the management may be tempted to indulge in 'window-dressing' just before the financial statements are prepared so as to make the current financial position appear better than what it actually is. For instance, by postponing purchase, allowing inventories to fall below the normal levels, using all available cash to pay off current liabilities and pressing collection on debtors, the current and acid-test ratios, and debtors turnover ratios may be artificially improved. Even when no deliberate attempt has been made to present a good picture, the current financial position shown by the year-end financial statements is probably more favourable than at any other time of the year. This is particularly true when a firm adopts a natural business year that ends during an ebb in the seasonal swing of business activity. At the time of peak activity, debtors, inventories and current liabilities tend to be at higher levels. In such cases, an analysis of current financial position based solely on year-end data will tend to over-state a firm's average liquidity position.[12]

Leverage/Capital Structure Ratios The second category of financial ratios is leverage or capital structure ratios. The long-term creditors would judge the soundness of a firm on the basis of the long-term financial strength measured in terms of its ability to pay the interest regularly as well as repay the instalment of the principal on due dates or in one lump sum at the time of maturity. The long-term solvency of a firm can be examined by using leverage or capital structure ratios. The leverage or capital structure ratios may be defined as financial ratios which throw light on the long-term solvency of a firm as reflected in its ability to assure the long-term creditors with regard to (i) periodic payment of interest during the period of the loan and (ii) repayment of principal on maturity or in predetermined instalments at due dates.

There are, thus, two aspects of the long-term solvency of a firm: (i) ability to repay the principal when due, and (ii) regular payment of the interest. Accordingly, there are two different, but mutually dependent and interrelated, types of leverage ratios. First, ratios which are based on the relationship between borrowed funds and owner's capital. These ratios are computed from the balance sheet and have many variations such as (a) debt-equity ratio, (b) debt-assets ratio, (c) equity-assets ratio, and so on. The second type of capital structure ratios, popularly called coverage ratios, are calculated from the profit and loss account. Included in this category are (a) interest coverage ratio, (b) dividend coverage ratio, (c) total fixed charges coverage ratio, (d) cash flow coverage ratio, and (e) debt services coverage ratio.

Debt-Equity Ratios The relationship between borrowed funds and owner's capital is a popular measure of the long-term financial solvency of a firm. This relationship is shown by the debt-equity ratios. This ratio reflects the relative claims of creditors and shareholders against the assets of the firm. Alternatively, this ratio indicates the relative proportions of debt and equity in financing the assets of a firm. The relationship between outsiders' claims and owner's capital can be shown in different ways and, accordingly, there are many variants of the debt-equity (D/E) ratio.

One approach is to express the D/E ratios in terms of the relative proportion of long-term debt and shareholders' equity. Thus,

$$\text{D/E ratio} = \frac{\text{Long-term debt}}{\text{Shareholders' equity}} \tag{4.7}$$

The debt considered here is exclusive of current liabilities. The shareholders' equity includes (i) equity and preference share capital, (ii) past accumulated profits but excludes fictitious assets like past accumulated losses, (iii) discount on issue of shares and so on.

Another approach to the calculation of the debt-equity ratio is to relate the total debt (not merely long-term debt) to the shareholders' equity. That is,

$$\text{D/E ratio} = \frac{\text{Total debt}}{\text{Shareholders' equity}} \tag{4.8}$$

The D/E ratio is, thus, the ratio of total outside liabilities to owners' total funds. In other words, it is the ratio of the amount invested by outsiders to the amount invested by the owners of business.

The difference between this and the first approach is essentially in respect of the treatment of current liabilities. While the former excludes them, the latter includes them in the numerator (debt). Should current liabilities be included in the amount of debt to calculate the D/E ratio? While there is no doubt that current liabilities are short-term and the ability of a firm to meet such obligations is reflected in the liquidity ratios, their amount fluctuates widely during a year and interest payments on them are not large, they should form part of the total outside liabilities to determine the ability of a firm to meet its long-term obligations for a number of reasons. For one thing, individual items of current liabilities are certainly short-term and may

fluctuate widely, but, as a whole, a fixed amount of them is always in use so that they are available more or less on a long-term footing. Moreover, some current liabilities like bank credit, which are ostensibly short-term, are renewed year after year and remain by and large permanently in the business. Also, current liabilities have, like the long-term creditors, a prior right on the assets of the business and are paid along with long-term lenders at the time of liquidation of the firm. Finally, the short-term creditors exercise as much, if not more, pressure on management. The omission of current liabilities in calculating the D/E ratio would lead to misleading results.

How should preference share capital be treated? Should it be included in the debt or equity? The exact treatment will depend upon the purpose for which the D/E ratio is being computed. If the object is to examine the financial solvency of a firm in terms of its ability to avoid financial risk, preference capital should be clubbed with equity capital. If, however, the D/E ratio is calculated to show the effect of the use of fixed-interest/dividend sources of funds on the earnings available to the ordinary shareholders, preference capital should be clubbed with debt.

Interpretation The D/E ratio is an important tool of financial analysis to appraise the financial structure of a firm. It has important implications from the view-point of the creditors, owners and the firm itself. The ratio reflects the relative contribution of creditors and owners of business in its financing. A high ratio shows a large share of financing by the creditors of the firm; a low ratio implies a smaller claim of creditors. The D/E ratio indicates the margin of safety to the creditors. If, for instance, the D/E ratio is 1 : 2, it implies that for every rupee of outside liability, the firm has two rupees of owner's capital or the stake of the creditors is one-half of the owners. There is, therefore, a safety margin of 66.67 per cent available to the creditors of the firm. The firm would be able to meet the creditors claims even if the value of the assets declines by 66.67 per cent. Conversely, if the D/E ratio is 2 : 1, it implies low safety margin (one-third) for the creditors.

If the D/E ratio is high, the owners are putting up relatively less money of their own. It is danger signal for the creditors. If the project should fail financially, the creditors would lose heavily. Moreover, with a small financial stake in the firm, the owners may behave irresponsibly and indulge in speculative activity. If they are heavily involved financially, they will strain every nerve to make the enterprise a success. In brief, the greater the D/E ratio, the greater is the risk to the creditors.

A high debt-equity ratio has equally serious implications from the firm's point of view also. A high proportion of debt in the capital structure would lead to inflexibility in the operations of the firm as creditors would exercise pressure and interfere in management. Secondly, such a firm would be able to borrow only under very restrictive terms and conditions. Further, it would have to face a heavy burden of interest payments, particularly in adverse circumstances when profits decline. Finally, the firm will have to encounter serious difficulties in raising funds in future.

The shareholders of the firm would, however, stand to gain in two ways: (i) with a limited stake, they would be able to retain control of the firm and (ii) the return to them would be magnified. With a larger proportion of debt in the financial structure, the earnings available to the owners would increase more than proportionately with an increase in the operating profits of the firm. This is because the debt carries a fixed rate of return and if the firm is able to earn on the borrowed funds a rate higher than the fixed-charge on loans, the benefit will go to the shareholders. This is illustrated in Table 4.5. Technically, this is referred to as leverage or trading on equity. The expression 'trading on equity' describes the practice of using borrowed funds carrying a fixed-charge in the expectation of obtaining a higher return to the equity holders. The leverage can, of course, work in the opposite direction also, if the return on borrowed funds is less than the fixed charge.[13]

A low D/E ratio has just the opposite implications. To the creditors, a relatively high stake of the owners implies sufficient safety margin and substantial protection against shrinkage in assets. For the company also,

the servicing of debt is less burdensome and consequently its credit standing is not adversely affected, its operational flexibility is not jeopardised and it will be able to raise additional funds. The shareholders of the firm are deprived of the benefits of trading on equity or leverage.

Table 4.5 *Trading on Equity (Amount in Rs thousand)*

		A	*B*	*C*	*D*
(a)	Total assets	1,000	1,000	1,000	1,000
	Financing pattern:				
	Equity capital	1,000	800	600	200
	15% Debt	—	200	400	800
(b)	Operating profit (EBIT)	300	300	300	300
	Less interest	—	30	60	120
	Earnings before taxes	300	270	240	180
	Less taxes (0.35)	105	94.5	84	63
	Earnings after taxes	195	175.5	156	117
	Return on equity (per cent)	19.5	21.9	26	58.5

The preceding discussion should leave no doubt that both high and low D/E ratios are not desirable. What is needed is a ratio which strikes a proper balance between debt and equity. What is the reasonable relationship between debt and equity? There cannot be a rigid rule. It will depend upon the circumstances, prevailing practices and so on. The general proposition is: *other's money should be in reasonable proportion to the owner's capital and the owners should have sufficient stake in the fortunes of the enterprise*. For instance, in a capital-rich country, the practice is to use as little debt as possible. A D/E ratio of 1 : 3 is regarded as indicative of a fairly heavy debt; a ratio of 1 : 1 would indicate an extremely heavy and unsatisfactory debt situation.[14] In underdeveloped countries such standards cannot be expected. It was not unusual to find firms having a D/E ratio of 2 : 1 or even 3 : 1 in the case of joint stock enterprises in India. One reason for such heavy dose of debt was to be found in the fact that enterprises had to depend, by and large, on public financial institutions (PFIs) which provided most of the funds in the form of loans. This had made the financial structure of companies lopsided and, on canons of sound financing practices, highly imprudent. The borrowers were finding it extremely difficult to service the debt burden and the overdues of the financial institutions rose unabated.[15] With the shift in the post-1991 period of dependence of the corporates on the capital market, their dependence on loans/debt has significantly declined.

Secondly, the D/E ratio cannot be applied mechanically without regard to the circumstances of each case, such as type and size of business, the nature of the industry and the degree of risk involved. For example, firms having a stable income such as an electricity company, can afford to have a higher D/E ratio. Similarly, a firm producing a basic product, like cement, can use a larger proportion of debt. The tolerable D/E ratio of a new company would be much lower than for an established one.

Debt to Total Capital Ratio The relationship between creditors' funds and owner's capital can also be expressed in terms of another leverage ratio. This is the debt to total capital ratio. Here, the outside liabilities are related to the total capitalisation of the firm and not merely to the shareholder's equity. Essentially, this type of capital structure ratio is a variant of the D/E ratio described above. It can be calculated in different ways.

One approach is to relate the long-term debt to the permanent capital of the firm. Included in the permanent capital are shareholders' equity as well as long-term debt. Thus,

$$\text{Debt to total capital ratio} = \frac{\text{Long-term debt}}{\text{Permanent capital}} \tag{4.9}$$

Another approach to calculating the debt to capital ratio is to relate the total debt to the total assets of the firm. The total debt of the firm comprises long-term debt plus current liabilities. The total assets consist of permanent capital plus current liabilities. Thus,

$$\text{Debt to total assets/capital ratio} = \frac{\text{Total debt}}{\text{Total assets}}$$

$$= \frac{\text{Total debt}}{\text{Permanent capital} + \text{Current liabilities}} \tag{4.10}$$

Still another variant of the D/E ratio is to relate the owner's/proprietor's funds with total assets. This is called the *proprietary ratio*. The ratio indicates the proportion of total assets financed by owners. Symbolically it is equal to:

$$\frac{\text{Proprietor's funds}}{\text{Total assets}} \tag{4.11}$$

Finally, it may also be of some interest to know the relationship between equity funds (also referred to as net worth) and fixed-income bearing funds (preference shares, debentures and other borrowed funds). This ratio, called the *capital gearing ratio*, is useful when the objective is to show the effect of the use of fixed-interest/dividend source of funds on the earnings available to the equity shareholders.

Interpretation As the ratio is like the D/E ratio, it gives results similar to the D/E ratio in respect of capital structure of a firm. The first of these (Equation 4.9), indicates what proportion of the permanent capital of a firm consists of long-term debt. If the ratio for a firm is 1 : 2, it implies that one-third of the total permanent capital of the firm is in the form of long-term debts. Although no hard and fast rules exist, conventionally a ratio of 1 : 2 is considered to be satisfactory.

The second ratio (Equation 4.10) measures the share of the total assets financed by outside funds. The third variant (Equation 4.11) shows what portion of the total assets are financed by the owner's capital. A low ratio of debt to total assets is desirable from the point of the creditors as there is sufficient margin of safety available to them. But its implications for the shareholders are that debt is not being exploited to make available to them the benefit of trading on equity. A firm with a very high ratio would expose the creditors to higher risk. The implications of the ratio of equity capital of total assets are exactly opposite to that of the debt to total assets. A firm should have neither a very high ratio nor a very low ratio.

Coverage Ratios The second category of leverage ratios are coverage ratios. These ratios are computed from information available in the profit and loss account. For a normal firm, in the ordinary course of business, the claims of creditors are not met out of the sale proceeds of the permanent assets of the firm. The obligations of a firm are normally met out of the earnings or operating profits. These claims consist of (i) interest on loans, (ii) preference dividend, and (iii) amortisation of principal or repayment of the instalment of loans or redemption of preference capital on maturity. The soundness of a firm, from the viewpoint of long-term creditors, lies in its ability to service their claims. This ability is indicated by the coverage ratios. The coverage ratios measure the relationship between what is normally available from operations of the firms and the claims of the outsiders. The important coverage ratios are: (i) interest

coverage, (ii) dividend coverage, (iii) total coverage, (iv) total cashflow coverage, and (v) debt service coverage ratio.

Interest Coverage Ratio It is also known as 'time-interest-earned ratio'. This ratio measures the debt servicing capacity of a firm insofar as fixed interest on long-term loan is concerned. It is determined by dividing the operating profits or earnings before interest and taxes (EBIT) by the fixed interest charges on loans. Thus,

$$\text{Interest coverage} = \frac{\text{EBIT}}{\text{Interest}} \tag{4.12}$$

It should be noted that this ratio uses the concept of net profits before taxes because interest is tax-deductible so that tax is calculated after paying interest on long-term loan. This ratio, as the name suggests, shows how many times the interest charges are covered by the EBIT out of which they will be paid. In other words, it indicates the extent to which a fall in EBIT is tolerable in the sense that the ability of the firm to service its interest payments would not be adversely affected. For instance, an interest coverage of 10 times would imply that even if the firm's EBIT were to decline to one-tenth of the present level, the net profits available for servicing the interest on loan would still be equivalent to the claims of the creditors. On the other hand, a coverage of five times would indicate that a fall in operating earnings only to upto one-fifth level can be tolerated. From the point of view of the creditors, the larger the coverage, the greater is the ability of the firm to handle fixed-charge liabilities and the more assured is the payment of interest to the creditors. However, too high a ratio may imply unused debt capacity. In contrast, a low ratio is a danger signal that the firm is using excessive debt and does not have the ability to offer assured payment of interest to the creditors.

Dividend Coverage Ratio It measures the ability of a firm to pay dividend on preference shares which carry a stated rate of return. This ratio is the ratio (expressed as x number of times) of net profits after taxes (EAT) and the amount of preference dividend. Thus,

$$\text{Dividend coverage} = \frac{\text{EAT}}{\text{Preference dividend}} \tag{4.13}$$

It can be seen that although preference dividend is a fixed obligation, the earnings taken into account are after taxes. This is because, unlike debt on which interest is a charge on the profits of the firm, the preference dividend is treated as an appropriation of profit. The ratio, like the interest coverage ratio, reveals the safety margin available to the preference shareholders. As a rule, the higher the coverage, the better it is from their point of view.

Total Coverage Ratio While the interest coverage and preference dividend coverage ratios consider the fixed obligations of a firm to the respective suppliers of funds, that is, creditors and preference shareholders, the total coverage ratio has a wider scope and takes into account all the fixed obligations of a firm, that is, (i) interest on loan, (ii) preference dividend, (iii) lease payments, and (iv) repayment of principal. Symbolically,

$$\text{Total coverage} = \frac{\text{EBIT} + \text{Lease payment}}{\text{Interest} + \text{Lease payments} + (\text{Preference dividend} + \text{Instalment of principal})/(1 - t)} \tag{4.14}$$

Total Cashflow Coverage Ratio However, coverage ratios mentioned above, suffer from one major limitation, that is, they relate the firm's ability to meet its various financial obligations to its earnings. In fact, these payments are met out of cash available with the firm. Accordingly, it would be more appropriate to relate cash resources of a firm to its various fixed financial obligations. The ratio, so determined, is referred to as *total cash flow coverage ratio*. Symbolically,

$$\text{Total cash flow coverage} = \frac{\text{EBIT} + \text{Lease Payments} + \text{Depreciation} + \text{Non-cash expenses}}{\text{Lease payment} + \text{Interest} + \dfrac{\text{(Principal repayment)}}{(1-t)} + \dfrac{\text{(Preference dividend)}}{(1-t)}} \tag{4.15}$$

The overall ability of a firm to service outside liabilities is truly reflected in the total cash flow coverage ratio: the higher the coverage, the better is the ability.

Debt-Service Coverage Ratio (DSCR) is considered a more comprehensive and apt measure to compute debt service capacity of a business firm. It provides the value in terms of the number of times the total debt service obligations consisting of interest and repayment of principal in instalments are covered by the total operating funds available after the payment of taxes: Earnings after taxes, EAT + Interest + Depreciation + Other non-cash expenditures like amortisation (OA). Symbolically,

$$\text{DSCR} = \frac{\sum_{t=1}^{n} \text{EAT}_t + \text{Interest}_t + \text{Depreciation}_t + OA_t}{\sum_{t=1}^{n} \text{Instalment}_t} \tag{4.16}$$

The higher the ratio, the better it is. In general, lending financial institutions consider 2:1 as satisfactory ratio. Consider Example 4.5.

EXAMPLE 4.5

Agro Industries Ltd has submitted the following projections. You are required to work out yearly debt service coverage ratio (DSCR) and the average DSCR: (*Figures in Rs lakhs*)

Year	*Net profit for the year*	*Interest on term loan during the year*	*Repayment of term loan in the year*
1	21.67	19.14	10.70
2	34.77	17.64	18.00
3	36.01	15.12	18.00
4	19.20	12.60	18.00
5	18.61	10.08	18.00
6	18.40	7.56	18.00
7	18.33	5.04	18.00
8	16.41	Nil	18.00

The net profit has been arrived after charging depreciation of Rs 17.68 lakh every year.

SOLUTION

Determination of debt service coverage ratio (Amount in lakhs of rupees)

Year	Net profit	Depre-ciation	Interest	Cash available (col. 2+3+4)	Principal instalment	Debt obligation (col. 4 + col. 6)	DSCR [col. 5 ÷ col. 7 (No. of times)]
1	2	3	4	5	6	7	8
1	21.67	17.68	19.14	58.49	10.70	29.84	1.96
2	34.77	17.68	17.64	70.09	18.00	35.64	1.97
3	36.01	17.68	15.12	68.81	18.00	33.12	2.08
4	19.20	17.68	12.60	49.48	18.00	30.60	1.62
5	18.61	17.68	10.08	46.37	18.00	28.08	1.65
6	18.40	17.68	7.56	43.64	18.00	25.56	1.71
7	18.33	17.68	5.04	41.05	18.00	23.04	1.78
8	16.41	17.68	Nil	34.09	18.00	18.00	1.89
Average DSCR (DSCR ÷ 8)							1.83

Profitability Ratios Apart from the creditors, both short-term and long-term, also interested in the financial soundness of a firm are the owners and management or the company itself. The management of the firm is naturally eager to measure its operating efficiency. Similarly, the owners invest their funds in the expectation of reasonable returns. The operating efficiency of a firm and its ability to ensure adequate returns to its shareholders depends ultimately on the profits earned by it. The profitability of a firm can be measured by its profitability ratios. In other words, the profitability ratios are designed to provide answers to questions such as (i) is the profit earned by the firm adequate? (ii) what rate of return does it represent? (iii) what is the rate of profit for various divisions and segments of the firm? (iv) what are the earnings per share? (v) what was the amount paid in dividends? (vi) what is the rate of return to equity-holders? and so on.

Profitability ratios can be determined on the basis of either sales or investments. The profitability ratios in relation to sales are (a) profit margin (gross and net) and (b) expenses ratio. Profitability in relation to investments is measured by (a) return on assets, (b) return on capital employed, and (c) return on shareholders' equity.

Profitability Ratios Related to Sales These ratios are based on the premise that a firm should earn sufficient profit on each rupee of sales. If adequate profits are not earned on sales, there will be difficulty in meeting the operating expenses and no returns will be available to the owners. These ratios consist of (i) profit margin, and (ii) expenses ratios.

Profit Margin The profit margin measures the relationship between profit and sales. As the profits may be gross or net, there are two types of profit margins: Gross profit margin and Net profit margin.

Gross Profit Margin is also known as gross margin. It is calculated by dividing gross profit by sales. Thus,

$$\text{Gross profit margin} = \frac{\text{Gross profits}}{\text{Sales}} \times 100 \tag{4.17}$$

If the sales of a firm amount to Rs 40,00,000 and its gross profits are Rs 10,00,000, the gross margin would be 25 per cent (Rs 10,00,000 ÷ Rs 40,00,000). If the gross margin (25 per cent) is deducted from

100, the result (75 per cent) is the ratio of cost of goods sold to sales. The former measures profits in relation to sales, while the latter reveals the relationship between cost of production and sale price.

Gross profit is the result of the relationship between prices, sales volume and costs. A change in the gross margin can be brought about by changes in any of these factors. The gross margin represents the limit beyond which fall in sales prices are outside the tolerance limit. Further, the gross profit ratio/margin can also be used in determining the extent of loss caused by theft, spoilage, damage, and so on in the case of those firms which follow the policy of fixed gross profit margin in pricing their products.

A high ratio of gross profits to sales is a sign of good management as it implies that the cost of production of the firm is relatively low. It may also be indicative of a higher sales price without a corresponding increase in the cost of goods sold. It is also likely that cost of sales might have declined without a corresponding decline in sales price. Nevertheless, a very high and rising gross margin may also be the result of unsatisfactory basis of valuation of stock, that is, overvaluation of closing stock and/or undervaluation of opening stock. A thorough investigation of the factors having a bearing on the high gross margin is called for.

A relatively low gross margin is definitely a danger signal, warranting a careful and detailed analysis of the factors responsible for it. The important contributory factors may be (i) a high cost of production reflecting acquisition of raw materials and other inputs on unfavourable terms, inefficient utilisation of current as well as fixed assets, and so on; and (ii) a low selling price resulting from severe competition, inferior quality of the product, lack of demand, and so on.

A firm should have a reasonable gross margin to ensure adequate coverage for operating expenses of the firm and sufficient return to the owners of the business, which is reflected in the net profit margin.

Net Profit Margin is also known as net margin. This measures the relationship between net profits and sales of a firm. Depending on the concept of net profit employed, this ratio can be computed in two ways:

1. $$\text{Operating profit ratio} = \frac{\text{Earnings before interest and taxes (EBIT)}}{\text{Sales}} \tag{4.18}$$

2. $$\text{Net profit ratio} = \frac{\text{Earnings after interest and taxes (EAT)}}{\text{Sales}} \tag{4.19}$$

The net profit margin is indicative of *management's ability to operate the business with sufficient success not only to recover from revenues of the period, the cost of merchandise or services, the expenses of operating the business (including depreciation) and the cost of the borrowed funds, but also to leave a margin of reasonable compensation to the owners for providing their capital at risk. The ratio of net profit (after interest and taxes) to sales essentially expresses the cost price effectiveness of the operation.*[16]

A high net profit margin would ensure adequate return to the owners as well as enable a firm to withstand adverse economic conditions when selling price is declining, cost of production is rising and demand for the product is falling.

A low net profit margin has the opposite implications. However, a firm with a low profit margin, can earn a high rate of return on investments if it has a higher inventory turnover. This aspect is covered in detail in the subsequent discussion. The profit margin should, therefore, be evaluated in relation to the turnover ratio. In other words, the overall rate of return is the product of the net profit margin and the investment turnover ratio. Similarly, the gross profit margin and the net profit margin should be jointly evaluated. The need for joint analysis arises because the two ratios may show different trends. For example, the gross margin may show a substantial increase over a period of time but the net profit margin may (i) have remained constant, or (ii) may not have increased as fast as the gross margin, or (iii) may actually have declined. It may be due to the fact that the increase in the operating expenses individually may behave

abnormally. On the other hand, if either as a whole or individual items of operating expenses decline substantially, a decrease in gross margin may be associated with an improvement in the net profit margin.

Expenses Ratio Another profitability ratio related to sales is the expenses ratio. It is computed by dividing expenses by sales. The term 'expenses' includes (i) cost of goods sold, (ii) administrative expenses, (iii) selling and distribution expenses, (iv) financial expenses but excludes taxes, dividends and extraordinary losses due to theft of goods, good destroyed by fire and so on.

There are different variants of expenses ratios. That is,

1. Cost of goods sold ratio $= \dfrac{\text{Cost of goods sold}}{\text{Net sales}} \times 100$ (4.20)

2. Operating expenses ratio $= \dfrac{\text{Adminsitrative expenses} + \text{Selling expenses}}{\text{Net sales}} \times 100$ (4.21)

3. Administrative expenses ratio $= \dfrac{\text{Adminsitrative expenses}}{\text{Net sales}} \times 100$ (4.22)

4. Selling expenses ratio $= \dfrac{\text{Selling expenses}}{\text{Net sales}} \times 100$ (4.23)

5. Operating ratio $= \dfrac{\text{Cost of goods sold} + \text{Operating expenses}}{\text{Net sales}} \times 100$ (4.24)

6. Financial expenses rario $= \dfrac{\text{Financial expenses}}{\text{Net sales}} \times 100$ (4.25)

Interpretation The expenses ratio is closely related to the profit margin, gross as well as net. For instance, if the operating profit margin is deducted from 100 per cent, the resultant is the operating ratio. Alternatively, when the operating ratio is subtracted from 100 per cent, we get the profit margin. If the sales and total non-financial expenses of a firm are Rs 40,00,000 and Rs 32,00,000 respectively, the *operating ratio* would be 80 per cent. It implies that total operating expenses including cost of goods sold consume 80 per cent of the sales revenues of the firm and 20 per cent is left for meeting interest, tax and dividends obligations as also retaining profits for future expansion. *The cost of goods sold ratio* shows what percentage share of sales is consumed by cost of goods sold and, conversely, what proportion is available for meeting expenses such as selling and general distribution expenses as well as financial expenses consisting of taxes, interest and dividends, and so on.

The expenses ratio is, therefore, very important for analysing the profitability of a firm. It should be compared over a period of time with the industry average as well as firms of similar type. As a working proposition, a low ratio is favourable, while a high one is unfavourable. The implication of a high expenses ratio is that only a relatively small percentage share of sales is available for meeting financial liabilities like interest, tax and dividends, and so on. An analysis of the factors responsible for a low ratio may reveal changes in the selling price or the operating expenses. It is likely that individual items may behave differently. While some operating expenses may show a rising trend, others may record a fall. The specific expenses ratio for each of the items of operating cost may be calculated. These ratios would identify the specific cause. To illustrate, an increase in selling expenses, may be due to a number of reasons: (i) general rise in selling expenses, (ii) inefficiency of the marketing department leading to uncontrolled promotional and other expenses, (iii) growing competition, (iv) ineffective advertising, (v) inefficient utilisation of resources, and the like.

A low operating ratio is by and large a test of operational efficiency. In case of firms whose major source of income and expenses are non-operating, the operating ratio, however, cannot be used as a yardstick of profitability.

To conclude, the profitability ratios based on sales are an important indicator of the operational efficiency of a manufacturing enterprise. However, they suffer from a serious limitation in that they are not useful from the viewpoint of the owners of the firm. Consider Example 4.6.

EXAMPLE 4.6

From the following information of a firm, determine (i) gross profit margin and (ii) net profit margin.

1.	Sales	Rs 2,00,000
2.	Cost of goods sold	1,00,000
3.	Other operating expenses	50,000

SOLUTION

(i) Gross profit margin $= \dfrac{\text{Rs } 1,00,000}{\text{Rs } 2,00,000} = 50$ per cent

(ii) Net profit margin $= \dfrac{\text{Rs } 50,000}{\text{Rs } 2,00,000} = 25$ per cent

The operating efficiency of the firm is fairly good. Assume, however, that the investments are Rs 10,00,000. The return on investments works out to be 5 per cent only. From the owner's point of view, rate of return on investments is a better measure of testing the profitability of a firm.

Profitability Ratios Related to Investments

Return on Investments (ROI) As already observed, the profitability ratios can also be computed by relating the profits of a firm to its investments. Such ratios are popularly termed as return on investments (ROI). There are three different concepts of investments in vogue in financial literature: assets, capital employed and shareholders' equity. Based on each of them, there are three broad categories of ROIs. They are (i) return on assets, (ii) return on capital employed, and (iii) return on shareholders' equity.

Return on Assets (ROA) Here, the profitability ratio is measured in terms of the relationship between net profits and assets. The ROA may also be called profit-to-asset ratio. There are various possible approaches to define net profits and assets, according to the purpose and intent of the calculation of the ratio. Depending upon how these two terms are defined, many variations of ROA are possible.

The concept of net profit may be (i) net profits after taxes, (ii) net profits after taxes plus interest, and (iii) net profits after taxes plus interest minus tax savings.[17] Assets may be defined as (i) total assets, (ii) fixed assets, and (iii) tangible assets. Accordingly, the different variants of the RAO are:

1. Return on assets (ROA) $= \dfrac{\text{Net profit after taxes}}{\text{Average total assets}} \times 100$ (4.26)

The ROA based on this ratio would be an underestimate as the interest paid to the creditors is excluded from the net profits. In point of fact, the real return on the total assets is the net earnings available to owners (EAT) and interests as assets are financed by owners as well as creditors. A more reliable indicator of the true return on assets, therefore, is the net profits inclusive of interest.

2. $$\text{ROA} = \frac{\text{Net profit after taxes} + \text{Interest}}{\text{Average total assets}} \times 100 \quad (4.27)$$

3. $$\text{ROA} = \frac{\text{Net profit after taxes} + \text{Interest}}{\text{Average tangible assets}} \times 100 \quad (4.28)$$

4. $$\text{ROA} = \frac{\text{Net profit after taxes} + \text{Interest}}{\text{Average fixed assets}} \times 100 \quad (4.29)$$

These measures, however, may not provide correct results for inter-firm comparisons particularly when these firms have markedly varying *capital structures*. As a measure of *operating performance*, therefore, Eqs. 4.27 to 4.29 should be substituted by the following.

$$\text{ROA} = \frac{\text{EAT} + \text{Interest} - \text{Tax advantage on interest}}{\text{Average total assets/Tangible assets/Fixed assets}} \quad (4.30)$$

This equation correctly reports the operating efficiency of firms as if they are all equity-financed.

The ROA measures the profitability of the total funds/ investments of a firm. It, however, throws no light on the profitability of the different sources of funds which finance the total assets. These aspects are covered by other ROIs.

Return on Capital Employed (ROCE) The ROCE is the second type of ROI. It is similar to the ROA except in one respect. Here the profits are related to the total capital employed. The term capital employed refers to long-term funds supplied by the creditors and owners of the firm. It can be computed in two ways. First, it is equal to non-current liabilities (long-term liabilities) plus owners' equity. Alternatively, it is equivalent to net working capital plus fixed assets. Thus, the capital employed basis provides a test of profitability related to the sources of long-term funds. A comparison of this ratio with similar firms, with the industry average and over time would provide sufficient insight into how efficiently the long-term funds of owners and creditors are being used. The higher the ratio, the more efficient is the use of capital employed.

The ROCE can be computed in different ways, using different concepts of profits and capital employed. Thus,

1. $$\text{ROCE} = \frac{\text{Net profit after taxes/EBIT}}{\text{Average total capital employed}} \times 100 \quad (4.31)$$

2. $$\text{ROCE} = \frac{\text{Net profit after taxes} + \text{Interest} - \text{Tax advantage on interest}}{\text{Average total capital employed}} \times 100 \quad (4.32)$$

3. $$\text{ROCE} = \frac{\text{Net profit after taxes} + \text{Interest}}{\text{Average total capital employed} - \text{Average intangible assets}} \times 100 \quad (4.33)$$

Return on Shareholders' Equity This profitability ratio carries the relationship of return to the sources of funds yet another step further. While the ROCE expresses the profitability of a firm in relation to the funds supplied by the creditors and owners taken together, the return on shareholders' equity measures exclusively the return on the owners' funds.

The shareholders of a firm fall into two broad groups: preference shareholders and equity shareholders. The holders of preference shares enjoy a preference over equity shareholders in respect of receiving dividends. In other words, from the net profits available to the shareholders, the preference dividend is paid

first and whatever remains belongs to the ordinary shareholders. The profitability ratios based on shareholders' equity are termed as *return on shareholders' equity*. There are several measures to calculate the return on shareholders equity: (i) Rate of return on (a) total shareholders' equity and (b) equity of ordinary shareholders; (ii) earnings per share; (iii) dividends per share; (iv) dividend–pay-out ratio; (v) dividend and earnings yield; and (vi) price-earnings ratio.

Return on Total Shareholders' Equity According to this ratio, profitability is measured by dividing the net profits after taxes (but before preference dividend) by the average total shareholders' equity. The term shareholders' equity includes (i) preference share capital; (ii) ordinary shareholders' equity consisting of (a) equity share capital, (b) share premium, and (c) reserves and surplus less accumulated losses. The ordinary shareholders' equity is also referred to as net worth. Thus,

$$\text{Return on total shareholders' equity} = \frac{\text{Net profit after taxes}}{\text{Average total shareholders' equity}} \times 100 \tag{4.34}$$

The ratio reveals how profitably the owners' funds have been utilised by the firm. A comparison of this ratio with that of similar firms as also with the industry average will throw light on the relative performance and strength of the firm.

Return on Ordinary Shareholders' Equity (Net Worth) While there is no doubt that the preference shareholders are also owners of a firm, the real owners are the ordinary shareholders who bear all the risk, participate in management and are entitled to all the profits remaining after all outside claims including preference dividends are met in full. The profitability of a firm from the owners' point of view should, therefore, in the fitness of things be assessed in terms of the return to the ordinary shareholders. The ratio under reference serves this purpose.

It is calculated by dividing the profits after taxes and preference dividend by the average equity of the ordinary shareholders.
Thus,

$$\text{Return on equity funds} = \frac{\text{Net profit after taxes} - \text{Preference dividend}}{\text{Average ordinary shareholders' equity or net worth}} \times 100 \tag{4.35}$$

This is probably the single most important ratio to judge whether the firm has earned a satisfactory return for its equity-holders or not. Its adequacy can be judged by (i) comparing it with the past record of the same firm, (ii) inter-firm comparison, and (iii) comparisons with the overall industry average. The rate of return on ordinary shareholders' equity is of crucial significance in ratio analysis vis-a-vis from the point of the owners of the firm.

Earnings Per Share (EPS) measures the profit available to the equity shareholders on a per share basis, that is, the amount that they can get on every share held. It is calculated by dividing the profits available to the shareholders by the number of the outstanding shares. The profits available to the ordinary shareholders are represented by net profits after taxes and preference dividend. Thus,

$$\text{EPS} = \frac{\text{Net profit available to equity holders}}{\text{Number of ordinary shares outstanding}} \tag{4.36}$$

Earnings Per Share (EPS) is a widely used ratio. Yet, EPS as a measure of profitability of a firm from the owner's point of view, should be used cautiously as it does not recognise the effect of increase in equity capital as a result of retention of earnings. In other words, if EPS has increased over the years, it does not

necessarily follow that the firm's profitability has improved because the increased profits to the owners may be the effect of an enlarged equity capital as a result of profit retentions, though the number of ordinary shares outstanding still remains constant. Another limitation of EPS is that it does not reveal how much is paid to the owners as dividend, nor how much of the earnings are retained in the business. It only shows how much *theoretically* belongs to the ordinary shareholders.

As a profitability ratio, the EPS can be used to draw inferences on the basis of (i) its trends over a period of time, (ii) comparison with the EPS of other firms, and (iii) comparison with the industry average.

Dividend Per Share (DPS) is the dividends paid to the shareholders on a per share basis. In other words, DPS is the net distributed profit belonging to the shareholders divided by the number of ordinary shares outstanding. That is,

$$\text{DPS} = \frac{\text{Dividend paid to ordinary shareholders'}}{\text{Number of ordinary shares outstanding}} \tag{4.37}$$

The DPS would be a better indicator than EPS as the former shows what exactly is received by the owners. Like the EPS, the DPS also should not be taken at its face value as the increased DPS may not be a reliable measure of profitability as the equity base may have increased due to increased retention without any change in the number of outstanding shares.

Dividend-Pay Out (D/P) Ratio is also known as pay-out ratio. It measures the relationship between the earnings belonging to the ordinary shareholders and the dividend paid to them. In other words, the D/P ratio shows what percentage share of the net profits after taxes and preference dividend is paid out as dividend to the equity holders. It can be calculated by dividing the total dividend paid to the owners by the total profits/earnings available to them. Alternatively, it can be found out by dividing the DPS by the EPS. Thus,

1. $$\text{D/P} = \frac{\text{Total dividend (cash dividend) to equityholders}}{\text{Total net profit belonging to equityholders}} \times 100 \tag{4.38}$$

2. $$\text{D/P} = \frac{\text{Dividend per ordinary share (DPS)}}{\text{Earnings per share (EPS)}} \times 100 \tag{4.39}$$

If the D/P ratio is subtracted from 100, it will give what percentage share of the net profits are retained in the business. To illustrate, if the net earnings after taxes and preference dividends are Rs 5,00,000 and the dividend paid to the ordinary shareholders amount to Rs 3,00,000, the D/P = 60 per cent. This implies that 40 per cent of the profits of the firm are retained (retention ratio) and 60 per cent distributed as dividends. Similarly, if the DPS is Rs 2 and EPS Rs 5, the D/P is 60 per cent. While 60 per cent profits are used to pay dividends, 40 per cent are ploughed back.

The D/P ratio is an important and widely-used ratio. The pay-out ratio can be compared with the trend over the years or an inter-firm and intra-industry comparison would throw light on its adequacy.

Earnings and Dividend Yield is closely related to the EPS and DPS. While the EPS and DPS are based on the book value per share, the yield is expressed in terms of the market value per share. The earnings yield may be defined as the ratio of earnings per share to the market value per ordinary share. Similarly, the dividend yield is calculated by dividing the cash dividends per share by the market value per share. That is,

1. Earning yield $= \dfrac{\text{EPS}}{\text{Market value per share}} \times 100$ (4.40)

2. Dividend yield $= \dfrac{\text{DPS}}{\text{Market value per share}} \times 100$ (4.41)

The earning yield is also called the earning-price ratio.

Price Earnings (P/E) Ratio is closely related to the earnings yield/earnings price ratio. It is actually the reciprocal of the latter. This ratio is computed by dividing the market price of the shares by the EPS. Thus,

$$\text{P/E ratio} = \frac{\text{Market price of share}}{\text{EPS}} \tag{4.42}$$

The P/E ratio reflects the price currently being paid by the market for each rupee of currently reported EPS. In other words, the P/E ratio measures investors' expectations and the market appraisal of the performance of a firm. In estimating the earnings, therefore, only normally sustainable earnings associated with the assets are taken into account. That is, the earnings are adjusted for income from, say, discontinued operations and extraordinary items as well as many other items not expected to occur. This ratio is popularly used by security analysts to assess a firm's performance as expected by the investors.

Earning Power—Overall Profitability The various profitability ratios discussed above throw light on the profitability of a firm from the viewpoint of (i) the owners of the firm, and (ii) the operating efficiency of the firm. The ratios covered under the rate of return to the equity holders fall under the first category. The operating efficiency of a firm in terms of the efficient utilisation of the resources is reflected in net profit margin. It has been observed that although a high profit margin is a test of better performance, a low margin does not necessarily imply a lower rate of return on investments if a firm has higher investments/assets turnover. Therefore, the overall operating efficiency of a firm can be assessed on the basis of a combination of the two. The combined profitability is referred to as *earning power*, return on investment (ROI) ratio. The *earning power* of a firm may be defined as the *overall* profitability of an enterprise. This ratio has two elements: (i) profitability on sales as reflected in the net profit margin, and (ii) profitability of investments which is revealed by the investment/assets turnover. The earning power (ROI ratio) of a firm can be computed by multiplying the net profit margin and the investment (assets) turnover. Thus,

$$\text{Earning power} = \text{Net profit margin} \times \text{Investment turnover} \tag{4.43}$$

We know that

$$\text{Net profit margin} = \frac{\text{Net profit after taxes}}{\text{Sales}} \tag{4.19}$$

$$\text{Investment turnover} = \frac{\text{Sales}}{\text{Average total investment}} \tag{4.44}$$

As already mentioned, the term 'investment' may refer to (i) total assets, (ii) capital employed, and (iii) shareholders' equity. For purposes of investment turnover, we use the term here in the first sense, that is, total assets. The investment turnover is discussed in detail in the section dealing with activity ratios. The earning power may be calculated as follows:

$$\text{Earning power} = \frac{\text{Net profit after taxes}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}$$

$$= \frac{\text{Net profit after taxes}}{\text{Total assets}} \tag{4.45}$$

The basic elements of the earning power of a firm are portrayed in Figure 4.1 This chart is known as the Du Pont Chart.

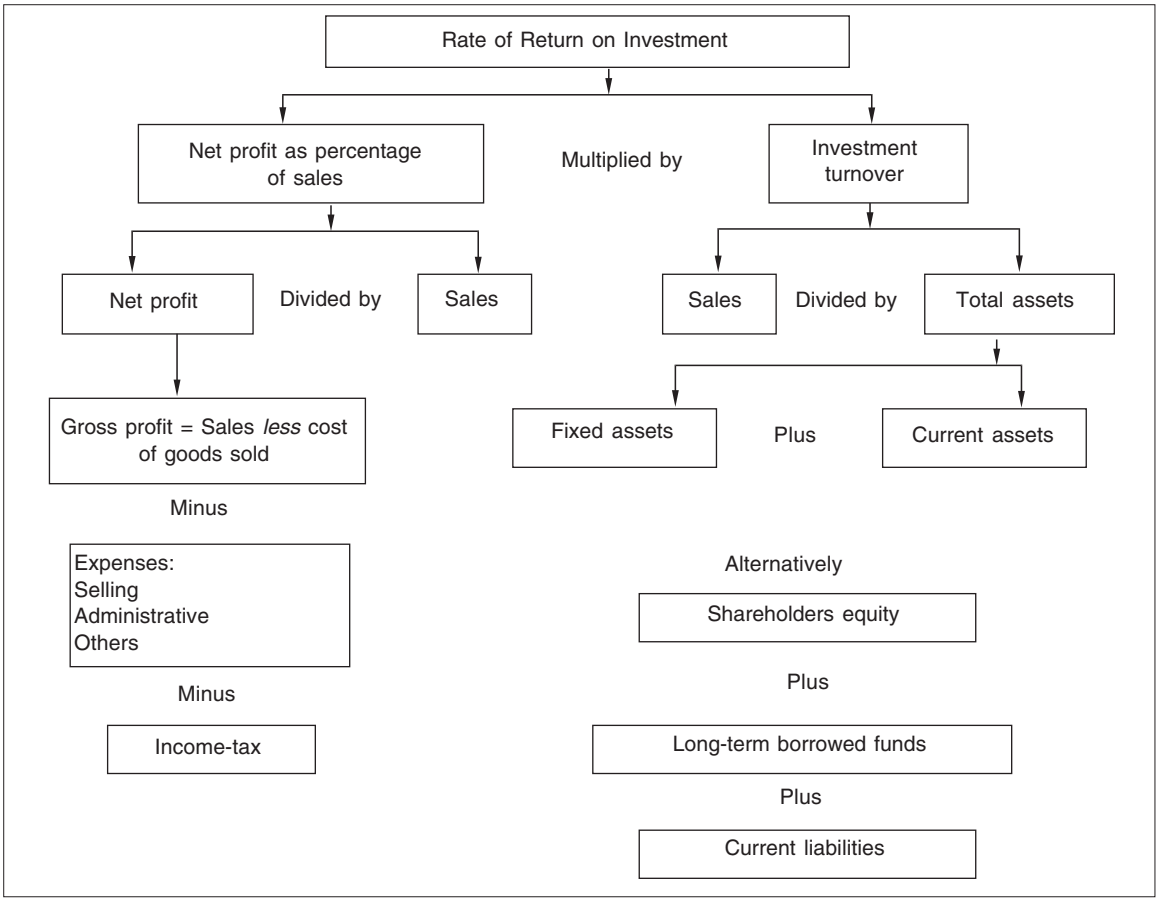

Figure 4.1 *Du Pont Chart*

The earning power or the ROI ratio is a central measure of the overall profitability and operational efficiency of a firm. It shows the interaction of profitability and activity ratios. It implies that the performance of a firm can be improved either by generating more sales volume per rupee of investment or by increasing the profit margin per rupee of sales. Consider Example 4.7.

EXAMPLE 4.7

Assume that there are two firms, A and B, each having total assets amounting to Rs 4,00,000, and average net profits of 10 per cent, that is, Rs 40,000, each. Firm A has sales of Rs 4,00,000, whereas the sales of firm B aggregate Rs 40,00,000. Determine the earning power of firms A and B.

SOLUTION

Table 4.6 *Earning Power of Firms A and B*

	Firm A	*Firm B*
1. Net sales	Rs 4,00,000	Rs 40,00,000
2. Net profit	40,000	40,000
3. Total assets	4,00,000	4,00,000
4. Profit margin (2 ÷ 1) (per cent)	10	1
5. Investment turnover (1 ÷ 3) (times)	1	10
6. ROI ratio (4 × 5) (per cent)	10	10

It is evident from Table 4.6 that the earning power of firms A and B is identical. While the firm A has higher profit margin, the B firm has higher investment turnover. Thus, the earning power is affected by two variables, namely, profit margin and investment turnover.

The usefulness of the Du Pont analysis lies in the fact that it presents the overall picture of the performance of a firm as also enables the management to identify the factors which have a bearing on profitability. In our example, if the firm B could improve its profit margin even marginally, say, from 1 per cent to 2 per cent, its earning power will be doubled, assuming sales are not affected. Similarly, firm A can double its earning power simply by a marginal increase in its investment turnover, as it indicates that the assets are used more efficiently, that is, more sales per rupee of investments. Thus, the ROI (earning power) ratio is a highly significant ratio which can be used to assess the profitability of a firm over a period of time, of its various divisions, as also for inter-firm and intra-industry comparisons. The two components of this ratio, namely, the profit margin and the investment turnover ratio, individually do not give an overall view as the former ignores the profitability of investments, while the latter fails to consider the profitability on sales.

The profitability analysis based on ROA can be extended further for a detailed examination of the return on equity (ROE). It is the most important measure of financial performance from the point of view of equityholders. The ROE can be decomposed into three following principal components:

$$\frac{\text{Earnings after taxes, EAT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \tag{4.46}$$

The three components in the ROE are indicative of net profit margin (profitability), assets turnover (efficiency in operations) and financial leverage (indicating the extent to which assets are financed by owners funds). Thus, the ROE is the product of the following three ratios:

$$\text{Net profit ratio } (\times) \text{ Assets turnover } (\times) \text{ Financial leverage/Equity multiplier} \tag{4.47}$$

The equation indicates that the management of the firm has three levers through which it can control ROE: (i) the net profit margin per rupee of sales, (ii) the sales generated per rupee of assets employed and (iii) the amount of equity used to finance the assets. While profit margin summarises profit performance as reflected in the income statement of a firm, assets turnover and financial leverage measure its performance with respect to assets and liabilities side of its balance sheet respectively. Thus, these three levers capture the major elements of financial performance of a firm.

Suppose in Example 6.7, Firm A uses equity capital of Rs 2 lakh and B of Rs 2.5 lakh in financing total assets of Rs 4 lakh. The financial leverage of A is 2 (Rs 4 lakh assets/Rs 2 lakh equity) and of B is 1.6 (Rs 4 lakh/Rs 2.5 lakh). The ROE for A and B can be computed using Equation 4.48.

$$\text{Net profit ratio} \times \text{Assets turnover} \times \text{Financial leverage} \tag{4.48}$$

$$10\% \times 1 \times 2 = 20\% \text{ (A)}$$

$$1\% \times 10 \times 1.6 = 16\% \text{ (B)}$$

Though the ROA for both firms is the same (10%), A has higher ROE (20%) than B (16%). The higher ROE of A primarily can be attributed to its higher financial leverage. The management of B can explore the possibility of increasing its financial leverage and thereby enhance the ROE of its equity owners. It will be profitable for B to employ more debt if the ROA is higher than the cost of debt. The relationship between ROA and ROE may be expressed as per Equation 4.49.

$$\text{ROE} = (\text{ROA} - \text{Interest cost} \div \text{Assets}) \times \text{Assets} \div \text{equity} \tag{4.49}$$

The three-component model of ROE (Equation 4.48) can be broadened further to consider the effect of interest and tax payments. The net profit ratio is to be disaggregated in the following three elements (the assets turnover and financial leverage ratios remaining unchanged).

$$\frac{\text{EAT}}{\text{Earnings before taxes (EBT)}} \times \frac{\text{EBT}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{Sales}} = \frac{\text{Net profit}}{\text{Sales}} \tag{4.50}$$

As a result of three sub-parts of net profit ratio, the ROE is composed of the following 5 components.

$$\frac{\text{EAT}}{\text{EBT}} \times \frac{\text{EBT}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \tag{4.51}$$

A 5-way break-up of ROE enables the management of a firm to analyse the effect of interest payments and tax payments separately from operating profitability. To illustrate further assume 8 per cent interest rate, 35 per cent tax rate and other operating expense of Rs 3,22,462 (Firm A) and Rs 39,26,462 (Firm B) for the facts contained in Example 4.7. Table 4.7 shows the ROE (based on the 5 components) of Firms A and B.

Table 4.7 ROE (Five-way Basis) of Firms A and B

Particulars	*Firm A*	*Firm B*
Net sales	Rs 4,00,000	Rs 40,00,000
Less: Operating expenses	3,22,462	39,26,462
Earnings before interest and taxes (EBIT)	77,538	73,538
Less: Interest (8%)	16,000	12,000
Earnings before taxes (EBT)	61,538	61,538
Less: Taxes (35%)	21,538	21,538
Earnings after taxes (EAT)	40,000	40,000
Total assets	4,00,000	4,00,000
Debt	2,00,000	2,50,000
Equity	2,00,000	1,50,000
EAT/EBT (times)	0.65	0.65
EBT/EBIT (times)	0.79	0.84
EBIT/Sales (per cent)	19.4	1.84
Sales/Assets (times)	1	10
Assets/Equity (times)	2	1.6
ROE (per cent)	20	16

Table 4.7 shows that there is little impact of taxes and interest payment on the difference in the ROE of the two firms (as reflected in the EAT/EBT as well as EBT/EBIT ratios). The financial leverage ratio, as pointed out earlier, is a major explanatory factor for higher ROE of Firm A *vis-à-vis* Firm B.

Activity Ratios Activity ratios are concerned with measuring the efficiency in asset management. These ratios are also called efficiency ratios or asset utilisation ratios. The efficiency with which the assets are used would be reflected in the speed and rapidity with which assets are converted into sales. The greater is the rate of turnover or conversion, the more efficient is the utilisation/management, other things being

equal. For this reason, such ratios are also designated as turnover ratios. Turnover is the primary mode for measuring the extent of efficient employment of assets by relating the assets to sales. An activity ratio may, therefore, be defined as a test of the relationship between sales (more appropriately with cost of sales) and the various assets of a firm. Depending upon the various types of assets, there are various types of activity ratios.

Inventory (or Stock) Turnover Ratio This ratio indicates the number of times inventory is replaced during the year. It measures the relationship between the cost of goods sold and the inventory level. The ratio can be computed in two ways.

First, it is calculated by dividing the cost of goods sold by the average inventory. Symbolically,

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average inventory}} \tag{4.52}$$

The average inventory figure may be of two types. In the first place, it may be the monthly inventory (stock) average. The monthly average can be found by adding the opening inventory of each month from, in case of the accounting year being a calendar year, January through January and dividing the total by thirteen.[18] If the firm's accounting year is other than a calendar year, say a financial year, (April to March), the average level of inventory can be computed by adding the opening inventory of each month from April through April and dividing the total by thirteen.[19] This approach has the advantage of being free from bias as it smoothens out the fluctuations in inventory level at different periods. This is particularly true of firms in seasonal industries. However, a serious limitation of this approach is that detailed month-wise information may present practical problems of collection for the analyst. Therefore, average inventory may be obtained by using another basis, namely, the average of the opening inventory and the closing inventory [i.e., (*opening inventory* + *closing inventory*) ÷ 2].

Not only are there difficulties in getting detailed information regarding inventory level, but data may also not be readily available to an analyst in respect of the cost of goods sold. To solve the problem arising out of non-availability of the required data, the second approach to the computation of inventory turnover ratio is based on the relationship between sales and closing inventory. Thus, alternatively,

$$\text{Inventory turnover} = \frac{\text{Sales}}{\text{Closing inventory}} \tag{4.53}$$

In theory, this approach is not a satisfactory basis as it is not logical. For one thing, the numerator (sales) and the denominator (inventory) are not strictly comparable as the former is expressed in terms of market price, the latter is based on cost. Secondly, the inventory figures are likely to be underestimates as firms traditionally have lower inventory at the end of the year. The net effect will be that the ratio given by this approach will be higher than the one given by the first approach.

In brief, of the two approaches to calculating the inventory turnover ratio, the first which relates the cost of goods sold to the average inventory is theoretically superior as it is logically consistent. The merit of the second approach is that it is free from practical problems of computation.

Interpretation The inventory/stock turnover ratio measures how quickly inventory is sold. It is a test of efficient inventory management. To judge whether the ratio of a firm is satisfactory or not, it should be compared over a period of time on the basis of trend analysis. It can also be compared with the level of other firms in that line of business as also with industry average as a whole.

In general, a high inventory turnover ratio is better than a low ratio. A high ratio implies good inventory management. Yet, a very high ratio calls for a careful analysis. It may be indicative of underinvestment in, or very low level of, inventory. A very low level of inventory has serious implications. It will adversely affect the ability to meet customer demand as it may not cope with its requirements. That is, there is a danger of the firm being out of stock and incurring high 'stock out cost'. It is also likely that the firm may be following a policy of replenishing its stock in too many small sizes. Apart from being costly, this policy may

retard the production process as sufficient stock of materials may not be available.

Similarly, a very low inventory turnover ratio is dangerous. It signifies excessive inventory or overinvestment in inventory. Carrying excessive inventory involves cost in terms of interest on funds locked up, rental of space, possible deterioration and so on. A low ratio may be the result of inferior quality goods, overvaluation of closing inventory, stock of unsaleable/obsolete goods and deliberate excessive purchases in anticipation of future increase in their prices and so on.

Thus, a firm should have neither too high nor too low inventory turnover. To avoid both 'stock out costs' associated with a high ratio and the costs of carrying excessive inventory with a low ratio, what is suggested is a reasonable level of this ratio. The firm would be well advised to maintain a close watch on the trend of the ratio and significant deviations on either side should be thoroughly investigated to locate the factors responsible for it. The computation of the turnover for the individual components of the inventory may be useful in this context. Such ratios can be computed in respect of raw materials and work-in-progress. Thus,

$$\text{Raw materials turnover} = \frac{\text{Cost of raw materials used}}{\text{Average raw material inventory}} \tag{4.54}$$

$$\text{Work-in-progress turnover} = \frac{\text{Cost of goods manufactured}}{\text{Average work-in-progress inventory}} \tag{4.55}$$

Receivables (Debtors) Turnover Ratio and Average Collection Period The second major activity ratio is the receivables or debtors turnover ratio. Allied and closely related to this is the average collection period. It shows how quickly receivables or debtors are converted into cash. In other words, the debtors turnover ratio is a test of the liquidity of the debtors of a firm.

The liquidity of a firm's receivables can be examined in two ways: (i) debtors/receivables turnover; (ii) average collection period.

The debtors turnover shows the relationship between credit sales and debtors of a firm. It can be calculated in two ways:

1. $$\text{Debtor turnover} = \frac{\text{Credit sales}}{\text{Average debtors} + \text{Average bills receivable}} \tag{4.56}$$

This approach requires two types of data. First, credit sales, which may not be readily available to the analyst. Similarly, the computation of the figure of average debtors and bills receivable involves practical difficulties. In theory, these figures should be measured, as in the case of average inventory, on the basis of the monthly average. Since this type of information is not likely to be available to the analyst, the alternative is to use the average of the opening and closing balances of debtors and bills receivable. The average in the above equation refers to the average of the opening and closing balances.

To avoid the difficulty arising out of the non-availability of information in respect of credit sales and average debtors and bills receivable, the alternative method is to calculate the debtors turnover in terms of the relationship between total sales and closing balance of debtors. Thus,

2. $$\text{Debtors turnover}^{20} = \frac{\text{Total sales}}{\text{Debtors} + \text{Bills receivable}} \tag{4.57}$$

The first approach to the computation of the debtors turnover is superior in that the question of the speed of conversion of sales into cash arises only in the case of credit sales. The effect of adopting the second approach would be to inflate the receivables turnover ratio.

The second type of ratio for measuring the liquidity of a firm's debtors is the average collection period. This is, in fact, interrelated with, and dependent upon, the receivables turnover ratio. It is calculated by dividing the days in a year by the debtors turnover. Thus,

$$\text{Average collection period} = \frac{\text{Months (days) in a year}}{\text{Debtors turnover}} \tag{4.58}$$

EXAMPLE 4.8

The credit sales of a firm in a year amount to Rs 12,00,000. The outstanding amount of debtors at the beginning and end of the year were Rs 1,40,000 and Rs 1,60,000 respectively. Determine the debtor turnover ratio and the average collection period.

SOLUTION

1. Debtor turnover ratio $= \dfrac{\text{Rs } 12,00,000}{(\text{Rs } 1,40,000 + \text{Rs } 1,60,000)/2} = 8$ (times per year)
2. Average debt collection period $= \dfrac{12 \text{ months}}{8} = 1.5$ months

We can get the debtor turnover by dividing the months (days) in the year by the average collection period (i.e. 12 ÷ 1.5 = 8). Likewise, if we divide the months (days) in the year by the debtor turnover ratio, we get the average collection period (12 ÷ 8 = 1.5).

Interpretation This ratio indicates the speed with which debtors/accounts receivable are being collected. A turnover ratio of 8 signifies that debtors get converted into cash 8 times in a year. The collection period of 1.5 months or 45 days implies that debtors on an average are collected in 45 days. Thus, it is indicative of the efficiency of trade credit management. The higher the turnover ratio and the shorter the average collection period, the better is the trade credit management and the better is the liquidity of debtors, as short collection period and high turnover ratio imply prompt payment on the part of debtors. On the other hand, low turnover ratio and long collection period reflect delayed payments by debtors. In general, therefore, short collection period (high turnover ratio) is preferable.

It is not, however, very prudent for a firm to have either a very short collection period or a very long one. A very long collection period would imply either poor credit selection or an inadequate collection effort. The delay in the collection of receivables would mean that, apart from the interest cost involved in maintaining a higher level of debtors, the liquidity position of the firm would be adversely affected. Moreover, there is the likelihood of a large number of accounts receivable becoming bad debts. Similarly, too short a period of average collection or too high a turnover ratio is not necessarily good. While it is true that it avoids the risk of receivables being bad debt as well as the burden of high interest on outstanding debtors, it may have an adverse effect on the volume of sales of the firm. Sales may be confined to only such customers as make prompt payments. The credit and collection policy of the firm may be very restrictive. Without reasonable credit, sales will be severely curtailed. Thus, a firm should have neither a very low nor a very high receivables turnover ratio; it should maintain it at a reasonable level. The reasonableness of the collection period can be judged in either of the following two ways.

First, the collection period of a firm can be compared with the industry practices of trade credit. Any notable deviation may result from (i) a more or less liberal policy of extending trade credit, or (ii) better/poor quality of receivables. A liberal trade credit policy may be aimed at augmenting sales.

Second, it may be more appropriately examined in relation to the credit terms and policy of the firm itself. In our example, the average collection period is 45 days or 1.5 months. This should be compared with the credit terms/period normally allowed by the firm. If the normal credit period, let us assume, as extended by the firm is 60 days or 2 months, it means the firm is able to collect its receivables well within the due dates. If, however, the credit period normally allowed is 1 month or 30 days, it means that the debtors are outstanding for a period longer than warranted by the firm's credit policy. This may be a reflection on the efficiency of the credit collection department: it has made either poor credit selection or inadequate collection effort. The management should investigate the reasons for the difficulties in the collection of receivables.

A related aspect of the average collection period is the ageing schedule. While the former is concerned with the liquidity of debtors/receivables as a whole, the latter analyses them in a disaggregative manner by dividing

the outstanding debtors on the basis of the duration during which they have been outstanding. The usefulness of the ageing schedule lies in the fact that it enables the analyst to identify the slow paying debtors in respect of whom the firm may have to encounter a serious collection problem. A hypothetical ageing schedule for the firm of our example, with an average collection period of 1.5 months is given in Table 4.8.

Table 4.8 *Ageing Schedule*

Outstanding period of debtors (1)	*Amount outstanding* (2)	*Percentage of total* (3)
Upto 30 days (1 month)	Rs 2,00,000	20
31-45 days (1.5 months)	2,00,000	20
46-60 days (2 months)	4,00,000	40
Above 60 days (more than two months)	2,00,000	20
	10,00,000	100

It can be seen from Table 4.8 that almost 60 per cent of the receivables are overdue as they remain outstanding beyond the average collection period of 45 days. Moreover, almost one-fifth of the outstanding debtors remain uncollected for more than 60 days. The ageing schedule, thus, supplements the collection period by showing how long the debtors are outstanding.

Assets Turnover Ratio This ratio is also known as the investment turnover ratio. It is based on the relationship between the cost of goods sold[21] and assets/investments of a firm. A reference to this was made while working out the overall profitability of a firm as reflected in its earning power. Depending upon the different concepts of assets employed, there are many variants of this ratio.
Thus,

1. Total assets turnover $= \dfrac{\text{Cost of goods sold}}{\text{Average total assets}}$ (4.59)

2. Fixed assets turnover $= \dfrac{\text{Cost of goods sold}}{\text{Average fixed assets}}$ (4.60)

3. Capital turnover $= \dfrac{\text{Cost of goods sold}}{\text{Average capital employed}}$ (4.61)

4. Current assets turnover $= \dfrac{\text{Cost of goods sold}}{\text{Average current assets}}$ (4.62)

5. Working capital turnover ratio $= \dfrac{\text{Cost of goods sold}}{\text{Net working capital}}$ (4.63)

Here, the total assets and fixed assets are net of depreciation and the assets are exclusive of fictitious assets like debit balance of profit and loss account and deferred expenditures and so on.

The assets turnover ratio, howsoever defined, measures the efficiency of a firm in managing and utilising its assets. The higher the turnover ratio, the more efficient is the management and utilisation of the assets while low turnover ratios are indicative of underutilisation of available resources and presence of idle capacity. In operational terms, it implies that the firm can expand its activity level (in terms of production and sales) without requiring additional capital investments. In the case of high ratios, the firm would normally be required, other things being equal, to make additional capital investments to operate at higher level of activity. To determine the efficiency of the ratio, it should be compared across time as well as with

the industry average. In using the assets turnover ratios one point must be carefully kept in mind. The concept of assets/fixed assets is net of depreciation. As a result, the ratio is likely to be higher in the case of an old and established company as compared to a new one, other things being equal. The turnover ratio is in such cases likely to give a misleading impression regarding the relative efficiency with which assets are being used. It should, therefore, be cautiously used.

COMMON SIZE STATEMENTS

Ratio analysis apart, another useful way of analysing financial statements is to convert them into common size statements by expressing absolute rupee amounts into percentages. When this method is pursued, the income statement exhibits each expense item or group of expense items as a percentage of net sales, and net sales are taken at 100 per cent. Similarly, each individual asset and liability classification is shown as a percentage of total assets and liabilities respectively. Statements prepared in this way are referred to as common-size statements.

Common-size comparative statements prepared for one firm over the years would highlight the relative changes in each group of expenses, assets and liabilities. These statements can be equally useful for inter-firm comparisons, given the fact that absolute figures of two firms of the same industry are not comparable. Financial statements and common-size statements of the Hypothetical Ltd are presented in Example 4.9.

EXAMPLE 4.9

The accompanying balance sheet and profit and loss account relate to Hypothetical Ltd. Convert these into common-size statements.

Balance Sheet as at 31st March

	Previous Year	*Current Year*
	(Amount in lakhs of rupees)	
Liabilities		
Equity share capital (of Rs 10 each)	240	240.0
General reserves	96	182.0
Long-term loans	182	169.5
Creditors	67	52.0
Outstanding expenses	6	—
Other current liabilities	9	6.5
	600	650.0
Assets		
Plant asset net of accumulated depreciation	402	390
Cash	54	78
Debtors	60	65
Inventories	84	117
	600	650

Income Statement for the year ended March 31

	Previous year	*Current year*
	(Amount in lakhs of rupees)	
Gross sales	370	480
Less returns	20	30
Net sales	350	450
Less cost of goods sold	190	215
Gross profit	160	235
Less selling, general and administrative cost	50	72
Operating profit	110	163
Less interest expenses	20	17
Earning before taxes	90	146
Less taxes	31.5	51.5
Earning after taxes	58.5	94.9

SOLUTION

Income Statement (Common-size) for the years ended March 31 (Percentages)

	Previous year	*Current year*
Net sales	100.0	100.0
Cost of goods sold	54.3	47.8
Gross profit	45.7	52.2
Selling, general and administrative expenses	14.3	16.0
Operating profit	31.4	36.2
Interest	5.7	3.8
Earnings before taxes	25.7	32.4
Taxes	9.0	11.4
Earnings after taxes (EAT)	16.7	21.0

Balance Sheets (Common-size as at March 31) (Percentages)

	Previous year	*Current year*
Owners' equity:		
Equity share capital	40.0	36.9
General reserves	16.0	28.0
	56.0	64.9
Long-term borrowings:		
Loan	30.3	26.1
Current liabilities:		
Creditors	11.2	8.0
Outstanding expenses	1.0	
Other liabilities	1.5	1.0
	13.7	9.0
Total liabilities	100.0	100.0

(*Contd.*)

(*Contd.*)

Fixed assets:		
Plant assets net of accumulated depreciation	67.0	60.0
Current assets:		
Cash	9.0	12.0
Debtors	10.0	10.0
Inventories	14.0	18.0
	33.0	40.0
Total assets	100.0	100.0

These percentage figures bring out clearly the relative significance of each group of items in the aggregative position of the firm. For instance, in the current year the EAT of Hypothetical Ltd has increased to 21 per cent from 16.7 per cent in the previous year. This improvement in profitability can mainly be traced to the decrease of 6.5 per cent in the cost of goods sold, reflecting improvement in efficiency of manufacturing operations. The decrease in financial overheads (interest) by 1.9 per cent during the current year can be traced to the repayment of a part of long-term loans. Further analysis indicates that profitability would have been more but for an increase in operating expenses ratio by 1.7 per cent.

The common-size balance sheets show that current assets as a percentage of total assets have increased by 7 per cent over previous year. This increase was shared by inventories (4 per cent) and cash (3 per cent); the share of debtors remained unchanged at 10 per cent. The proportion of current liabilities (mainly due to creditors) was also lower at 9 per cent in the current year compared to 13.7 per cent in the previous year. These facts signal overall increase in the liquidity position of the firm. Further, the share of long-term debt has also declined and owners' equity has gone up from 56 per cent in the previous year to 64.9 per cent in the current year.

IMPORTANCE AND LIMITATIONS OF RATIO ANALYSIS

Importance

As a tool of financial management, ratios are of crucial significance. The importance of ratio analysis lies in the fact that it presents facts on a comparative basis and enables the drawing of inferences regarding the performance of a firm. Ratio analysis is relevant in assessing the performance of a firm in respect of the following aspects: (i) liquidity position, (ii) long-term solvency, (iii) operating efficiency, (iv) overall profitability, (v) inter-firm comparison, and (vi) trend analysis.

Liquidity Position With the help of ratio analysis conclusions can be drawn regarding the liquidity position of a firm. The liquidity position of a firm would be satisfactory if it is able to meet its current obligations when they become due. A firm can be said to have the ability to meet its short-term liabilities if it has sufficient liquid funds to pay the interest on its short-maturing debt usually within a year as well as to repay the principal. This ability is reflected in the liquidity ratios of a firm. The liquidity ratios are particularly useful in credit analysis by banks and other suppliers of short-term loans.

Long-term Solvency Ratio analysis is equally useful for assessing the long-term financial viability of a firm. This aspect of the financial position of a borrower is of concern to the long-term creditors, security analysts and the present and potential owners of a business. The long-term solvency is measured by the leverage/capital structure and profitability ratios which focus on earning power and operating efficiency. Ratio analysis reveals the strengths and weaknesses of a firm in this respect. The leverage ratios, for instance, will indicate whether a firm has a reasonable proportion of various sources of finance or if it is

heavily loaded with debt in which case its solvency is exposed to serious strain. Similarly, the various profitability ratios would reveal whether or not the firm is able to offer adequate return to its owners consistent with the risk involved.

Operating Efficiency Yet another dimension of the usefulness of the ratio analysis, relevant from the viewpoint of management, is that it throws light on the degree of efficiency in the management and utilisation of its assets. The various activity ratios measure this kind of operational efficiency. In fact, the solvency of a firm is, in the ultimate analysis, dependent upon the sales revenues generated by the use of its assets–total as well as its components.

Overall Profitability Unlike the outside parties which are interested in one aspect of the financial position of a firm, the management is constantly concerned about the over-all profitability of the enterprise. That is, they are concerned about the ability of the firm to meet its short-term as well as long-term obligations to its creditors, to ensure a reasonable return to its owners and secure optimum utilisation of the assets of the firm. This is possible if an integrated view is taken and all the ratios are considered together.

Inter-firm Comparison Ratio analysis not only throws light on the financial position of a firm but also serves as a stepping stone to remedial measures. This is made possible due to inter-firm comparison and comparison with industry averages. A single figure of a particular ratio is meaningless unless it is related to some standard or norm. One of the popular techniques is to compare the ratios of a firm with the industry average. It should be reasonably expected that the performance of a firm should be in broad conformity with that of the industry to which it belongs. An inter-firm comparison would demonstrate the firm's position *vis-a-vis* its competitors. If the results are at variance either with the industry average or with those of the competitors, the firm can seek to identify the probable reasons and, in that light, take remedial measures.

Trend Analysis Finally, ratio analysis enables a firm to take the time dimension into account. In other words, whether the financial position of a firm is improving or deteriorating over the years. This is made possible by the use of trend analysis. The significance of a trend analysis of ratios lies in the fact that the analysts can know the direction of movement, that is, whether the movement is favourable or unfavourable. For example, the ratio may be low as compared to the norm but the trend may be upward. On the other hand, though the present level may be satisfactory but the trend may be a declining one.

Limitations

Ratio analysis is a widely used tool of financial analysis. Yet, it suffers from various limitations. The operational implication of this is that while using ratios, the conclusions should not be taken on their face value. Some of the limitations which characterise ratio analysis are (i) difficulty in comparison, (ii) impact of inflation, and (iii) conceptual diversity.

Difficulty in Comparison One serious limitation of ratio analysis arises out of the difficulty associated with their comparability. One technique that is employed is inter-firm comparison. But such comparisons are vitiated by different procedures adopted by various firms. The differences may relate to:

- Differences in the basis of inventory valuation (e.g. last in first out, first in first out, average cost and cost);
- Different depreciation methods (i.e. straight line vs written down basis);
- Estimated working life of assets, particularly of plant and equipment;
- Amortisation of intangible assets like goodwill, patents and so on;
- Amortisation of deferred revenue expenditure such as preliminary expenditure and discount on issue of shares;

- Capitalisation of lease;
- Treatment of extraordinary items of income and expenditure; and so on.

Secondly, apart from different accounting procedures, companies may have different accounting periods, implying differences in the composition of the assets, particularly current assets. For these reasons, the ratios of two firms may not be strictly comparable.

Another basis of comparison is the industry average. This presupposes the availability, on a comprehensive scale, of various ratios for each industry group over a period of time. If, however, as is likely, such information is not compiled and available, the utility of ratio analysis would be limited.

Impact of Inflation The second major limitation of the ratio analysis as a tool of financial analysis is associated with price level changes. This, in fact, is a weakness of the traditional financial statements which are based on historical costs. An implication of this feature of the financial statements as regards ratio analysis is that assets acquired at different periods are, in effect, shown at different prices in the balance sheet, as they are not adjusted for changes in the price level. As a result, ratio analysis will not yield strictly comparable and, therefore, dependable results. To illustrate, there are two firms which have identical rates of returns on investments, say 15 per cent. But one of these had acquired its fixed assets when prices were relatively low, while the other one had purchased them when prices were high. As a result the book value of the fixed assets of the former type of firm would be lower, while that of the latter higher. From the point of view of profitability, the return on the investment of the firm with a lower book value would be overstated. Obviously, identical rates of returns on investment are not indicative of equal profitability of the two firms. This is a limitation of ratios.

Conceptual Diversity Yet another factor which influences the usefulness of ratios is that there is difference of opinion regarding the various concepts used to compute the ratios. There is always room for diversity of opinion as to what constitutes shareholders' equity, debt, assets, profit and so on. Different firms may use these terms in different senses or the same firm may use them to mean different things at different times.

Reliance on a single ratio for a particular purpose may not be a conclusive indicator. For instance, the current ratio alone is not a adequate measure of short-term financial strength; it should be supplemented by the acid-test ratio, debtors turnover ratio and inventory turnover ratio to have a real insight into the liquidity aspect.

Finally, ratios are only a post-mortem analysis of what has happened between two balance sheet dates. For one thing, the position in the interim period is not revealed by ratio analysis. Moreover, they give no clue about the future.

In brief, ratio analysis suffers from some serious limitations. The analyst should not be carried away by its oversimplified nature, easy computation with a high degree of precision. The reliability and significance attached to ratios will largely depend upon the quality of data on which they are based. They are as good as the data itself. Nevertheless, they are an important tool of financial analysis.

SUMMARY

- Ratio analysis is a widely used tool of financial analysis. It is defined as the systematic use of ratio to interpret the financial statements so that the strengths and weaknesses of a firm, as well as its historical performance and current financial condition, can be determined.
- Ratios make the related information comparable. A single figure by itself has no meaning, but when expressed in terms of a related figure, it yields significant inferences. Thus, ratios are *relative figures* reflecting the relationship between related variables. Their use as tools of financial analysis involves their comparison as single ratios, like absolute figures, are not of much use. Three types of compari-

sons are generally involved: namely, (i) trend analysis, (ii) inter firm comparison, and (iii) comparison with standards or industry average.

- Trend analysis involves comparison of a firm over a period of time, that is, present ratios are compared with past ratios for the same firm. The comparison of the profitability ratios of a firm, say, year 1 to year 5, is an illustration of a trend analysis. It indicates the direction of change in the performance–improvement, deterioration or constancy–over the years.
- Interfirm comparison involves comparing the ratios of a firm with those of others in the same lines of business or for the industry as a whole. It reflects the firm's performance in relation to its competitors. Other types of comparisons may relate to the comparison of items within a single year's financial statement of firm and comparison with standards or plans.
- Ratios can broadly be classified into six groups: (i) liquidity, (ii) capital structure or leverage, (iii) profitability, (iv) activity, (v) integrated and (vi) growth.
- Liquidity ratios measure the ability of a firm to meet its short-term obligations and reflect its short-term financial strength or solvency. The important liquidity ratios are (a) current ratio, and (b) quick or acid test ratio.

  Current ratio is the ratio of total current assets (CAs) to total current liabilities (CLs). A satisfactory current ratio would enable a firm to meet its obligations, even if the value of its CAs decline. It is, however, a quantitative index of liquidity as it does not differentiate among the components of CAs, such as cash and inventory which are not equally liquid.

  The quick or acid test ratio takes into consideration the differences in the liquidity of the components of CAs. It represents the ratio between quick CAs and the total CLs. It is a rigorous measure and superior to the current ratio. However, both these ratios should be used as complementary to each other to analyse the liquidity position of a firm.

  The main liquidity ratios are computed as follows: (i) Current ratio = Current assets/Current liabilities. (ii) Acid test ratio = (Current assets – Stock – Pre-paid expenses)/Current liabilities. (iii) Super-quick ratio = (Cash + Marketable securities)/Current liabilities.
- The capital structure or leverage ratios throw light on the long-term solvency of a firm. This is reflected in its ability to assure the long-term creditors with regard to periodic payment of interest and the repayment of loan on maturity, or in pre-determined instalments at due dates. There are two types of such ratios: (a) debt-equity or debt-assets, and (b) coverage.

  The first type is computed from the balance sheet and reflects the relative contribution or stake of owners and creditors in financing the assets of the firm. In other words, such ratios reflect the safety margin to the long-term creditors.

  The second category of such ratios is based on the income statement, which shows the number of times the fixed obligations are covered by earnings before interest and taxes or cash inflows. In other words, they indicate the extent to which a fall in operating profit or cash inflows is tolerable, in that the ability to repay would not be adversely affected.

  The important leverage ratios are: **(i)** Debt/equity ratios = Total debt (long-term debt + current liabilities)/Shareholders' funds. **(ii)** Debt to total capital ratio = Total debt/Permanent capital (shareholder's funds + long-term debt). **(iii)** Debt to total assets ratio = Total debt/Total assets. **(iv)** Proprietary ratio = Owner's funds/Total assets. **(v)** Capital gearing ratio = (Preference share capital + Debentures + Other borrowed funds)/Equity funds (net worth). **(vi)** Interest coverage ratio (times-interest earned) = Earnings before interest and taxes (EBIT/Interest. **(vii)** Dividend coverage ratio = Earnings after taxes (EAT)/Preference dividend (D_p).

(viii) Total coverage ratio $= \dfrac{\text{EBIT + Lease payment}}{\text{Interest lease payment} + \left(\dfrac{D_p}{1-t}\right) + \dfrac{\text{Instalment of principal}}{(1-t)}}$.

(ix) Cash flow coverage ratio $= \dfrac{\text{EBIT + Lease payment + Depreciation}}{\text{Interest Lease payment} + \left(\dfrac{D_p}{1-t}\right) + \dfrac{\text{Instalment of principal}}{(1-t)}}$.

(x) Debt service coverage ratio

$$= \frac{\sum_{t=1}^{n} \text{EAT}_t + \text{Depreciation}_t + \text{Interest}_t + \text{Other non} - \text{cash expenses}_t}{\sum_{t=1}^{n} \text{Principal}_t + \text{Interest}_t}$$

➔ The profitability of a firm can be measured by the profitability ratios. Such ratios can be computed either from sales or investment.

The profitability ratios based on sales are (a) profit margin (gross and net), and (b) expenses or operating ratios. They indicate the proportion of sales consumed by operating costs and the proportion available to other expenses.

The profitability ratios related to investments include (i) return on assets, (ii) return on capital employed, and (iii) return on shareholders' equity, including earnings per share, dividend per share, dividend-payout ratio, earning and dividend yield.

The procedure of calculating profitability ratios based on sales are: (i) Gross profit ratio/margin = Gross profit (sales – cost of goods sold)/Net sales. (ii) Operating profit ratio/margin = EBIT/Net sales. (iii) Net profit ratio/margin = Earnings after taxes (EAT)/Net sales. (iv) Cost of goods sold ratio = Cost of goods sold/Net sales. (v) Operating expenses ratio = (Administrative expenses + Selling expenses)/Net sales. (vi) Administrative expenses ratio = Administrative expenses/Net sales. (vii) Selling expenses ratio = Selling expenses/Net sales. (viii) Operating ratio = (Cost of goods sold + Operating expenses)/Net sales.

Ratios related to total investment are calculated as follows: **(i)** Return on total assets = (*EAT* + Interest – Tax advantage on interest)/Average total assets. **(ii)** Return on capital employed = (EAT + Interest – Tax advantage on interest)/Average total capital employed. **(iii)** Return on shareholders' equity = EAT/Average total shareholders' equity. **(iv)** Return on equity funds = (EAT – Preference dividend)/Average ordinary shareholders' equity (net worth). **(v)** Earnings per share (EPS) = Net profit available to equity shareholders' (EAT – D_p)/Number of equity shares outstanding (N) **(vi)** Dividends per share (DPS) = Dividend paid to ordinary shareholders/Number of ordinary shares outstanding (N). **(vii)** Earnings yield = EPS/Market price per share. **(viii)** DPS/Market price per share. **(ix)** Dividend payment/payout (D/P) ratio = DPS/EPS. **(x)** Price-earnings (P/E) ratio = Market price of a share/EPS. **(xi)** Book value per share = Ordinary shareholders' equity/Number of equity shares outstanding.

➔ The activity ratios (also known as efficiency or turnover ratios) are concerned with measuring the efficiency in asset management. The efficiency with which assets are managed/used is reflected in the speed and rapidity with which they are converted into sales. Thus, the activity ratios are a test of relationship between sales/cost of goods sold and assets. Depending upon the type of assets, activity ratios may be (a) inventory/stock turnover, (b) receivables/debtors turnover, and (c) total assets turnover.

The first of these indicates the number of times inventory is replaced during the year or how quickly the goods are sold. It is a test of efficient inventory management.

The second category of turnover ratios indicates the efficiency of receivables management and shows how quickly trade credit is collected.

The total assets turnover represents the ratio of total assets to sales/cost of goods sold. It reveals the efficiency in managing and utilizing the total assets.

The computation procedure of these ratios is as follows: (i) Raw material turnover = Cost of raw materials used/Average raw materials inventory. (ii) Work-in-process turnover = Cost of goods manufactured/Average work-in-process inventory. (iii) Finished goods inventory turnover = Cost of goods sold/Average finished goods inventory. (iv) Debtors turnover ratio = Total credit sales/(Average debtors + Averages bills receivable). (v) Average collection period = Months (days) in year/Debtors turnover ratio. (vi) Total assets turnover = Cost of goods sold/Average total assets. (vii) Fixed assets turnover = Cost of goods sold/Average fixed assets. (viii) Current assets turnover = Cost of goods sold/Average current assets. (ix) Working capital turnover ratio = Cost of goods sold/Average net working capital. If data about cost of goods sold are not available, sales figures are used in the numerator.

- Integrated ratios provide better insight about financial and economic analysis of a firm. For instance of the rate of return on assets (ROA) can be decomposed in to net profit margin (EAT/Sales) and assets turnover (Sales/Total assets). Likewise, the ROE can be decomposed in the following two ways: (i) (EAT/Sales) × (Sales/Assets) × (Assets/Equity) and (ii) (EAT/EBT) × (EBT/EBIT) × (EBIT/Sales) × (Sales/Assets) × (Assets/Equity).
- Preparation of common-size financial statements is an extension of ratio analysis. These statements convert absolute sums into more easily understood percentages of some base amount. It is sales in the case of income statement and totals of assets and liabilities in the case of the balance sheet.
- Ratio analysis in view of its several limitations should be considered only as a tool for analysis rather than as an end in itself. The reliability and significance attached to ratios will largely hinge upon the quality of data on which they are based. They are as good or as bad as the data itself. Nevertheless, they are an important tool of financial analysis.

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18. Metcalf and Titard, *op. cit*., p. 174.
19. *Ibid*.
20. Deduction should not be made in respect of provision for bad and doubtful depts.
21. If the information regarding the cost of goods sold is not available, the figure of sales can be used.

SOLVED PROBLEMS

P.4.1 The Avon Ltd has a capital of Rs 10,00,000; its turnover is 3 times the capital and the net profit margin on sales is 6 per cent. What is the return on investment?

SOLUTION

Rate of return on investment = Margin of profit × Capital/Investment turnover

$$= \frac{\text{Net profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital}} = 0.06 \times 3 = 18 \text{ per cent}$$

P.4.2 B Raj Ltd sells goods on cash as well as credit (though not on deferred instalment terms). The following particulars are extracted from their books of accounts for the current year-end.

Total gross sales	Rs 1,00,000
Cash sales (included in above)	20,000
Sales returns	7,000
Total debtors at the end	9,000
Bills receivable	2,000
Provision for doubtful debts at the end of the year	1,000
Total creditors at the end	10,000

Calculate the average collection period.

SOLUTION

Total net credit sales = Gross sales – Cash sales – Sales returns = Rs 1,00,000 – Rs 20,000 – Rs 7,000 = Rs 73,000

$$\text{Debtors turnover} = \frac{\text{Credit sales}}{\text{Debtors} + \text{Bills receivable}} = \frac{\text{Rs } 73,000}{\text{Rs } 11,000} = \frac{73}{11}$$

$$\text{Average collection period} = \frac{365 \text{ days}}{\text{Debtors turnover } (73/11)} = 55 \text{ days}$$

P.4.3 The following are the ratios relating to the activities of National Traders Ltd:

Debtors velocity	3 months
Stock velocity	8 months
Creditors velocity	2 months
Gross profit ratio	25 per cent

Gross profit for the current year ended December 31 amounts to Rs 4,00,000. Closing stock of the year is Rs 10,000 above the opening stock. Bills receivable amount to Rs 25,000 and bills payable to Rs 10,000. Find out: (a) Sales, (b) Sundry debtors, (c) Closing stock, and (d) Sundry creditors.

SOLUTION

(a) *Determination of sales:* $\text{Sales} = \dfrac{\text{Rs } 4,00,000}{25} \times 100 = \text{Rs } 16,00,000$

(b) *Determination of sundry debtors:* Debtors velocity is 3 months. In other words, debtors' collection period is 3 months, or debtors' turnover ratio is 4. Assuming all sales to be credit sales and debtors turnover ratio being calculated on the basis of year-end figures,

$$\text{Debtors turnover ratio} = \frac{\text{Credit sales}}{\text{Closing debtors} + \text{Bills receivable}}$$

or

$$\text{Closing debtors + Bills receivable} = \frac{\text{Credit sales}}{\text{Debtors turnover ratio}} = \frac{\text{Rs } 16,00,000}{4} = \text{Rs } 4,00,000$$

$$\text{Closing debtors} = \text{Rs } 4,00,000 - \text{Rs } 25,000 = \text{Rs } 3,75,000$$

(c) *Determination of closing stock:* Stock velocity of 8 months signifies that the inventory holding period is 8 months, stock turnover ratio is 1.5 = (12 months ÷ 8).

$$\text{Stock turnover} = \frac{\text{Cost of goods sold (Sales} - \text{Gross profit)}}{\text{Average stock}}$$

$$1.5 = \frac{\text{Rs } 12,00,000}{\text{Average stock}}$$

$$\text{Average stock} = \frac{\text{Rs } 12,00,000}{1.5} = \text{Rs } 8,00,000$$

$$\text{Closing stock} - \text{Opening stock} = \text{Rs } 10,000 \quad (1)$$

$$\frac{\text{Closing stock} + \text{Opening stock}}{2} = \text{Rs } 8,00,000 \quad (2)$$

Or $$\text{Closing stock} + \text{Opening stock} = \text{Rs } 16,00,000 \quad (3)$$

Subtracting (1) from (3) we have,

$$2 \text{ Opening stock} = \text{Rs } 15,90,000$$

$$\text{Opening stock} = \text{Rs } 7,95,000$$

Therefore, $$\text{Closing stock} = \text{Rs } 8,05,000$$

(d) Determination of sundry creditors: Creditors velocity of 2 months signifies that the credit payment period is 2 months. In other words, creditors' turnover ratio is 6(12 months ÷ 2). Assuming all purchases to be credit purchases and creditors turnover is based on year-end figures,

$$\text{Creditors turnover ratio} = \frac{\text{Credit purchases}}{\text{Creditors} + \text{Bills payable}}$$

$$6 = \frac{\text{Rs } 12,10,000}{\text{Creditors} + \text{Rs } 10,000}$$

$$\text{Creditors + Rs } 10,000 = \frac{\text{Rs } 12,10,000}{6} = \text{Rs } 2,01,667$$

$$\text{Creditors} = \text{Rs } 2,01,667 - \text{Rs } 10,000 = \text{Rs } 1,91,667$$

Credit purchases are calculated as follows:

Cost of goods sold = Opening stock + Purchases – Closing stock
Rs 12,00,000 = Rs 7,95,000 + Purchases – Rs 8,05,000
Rs 12,00,000 + Rs 10,000 = Purchases
Rs 12,10,000 = Purchases (credit).

P.4.4 From the following details, prepare the balance sheet of ABC Ltd:

Stock turnover velocity	6
Capital turnover ratio	2
Fixed assets turnover ratio	4
Gross profit	20 per cent
Debt collection period	2 months
Creditors payment period	73 days

The gross profit was Rs 60,000. Closing stock was Rs 5,000 in excess of the opening stock.

SOLUTION

Balance sheet

Liabilities		*Assets*	
Capital	Rs 1,20,000	Closing stock	Rs 42,500
Creditors	49,000	Debtors	50,000
		Fixed assets	60,000
		Cash (balancing figure)	16,500
	1,69,000		1,69,000

Working Notes

1. Gross profit ratio $= \dfrac{\text{Gross profit}}{\text{Sales}} \times 100$

$$20 = \frac{\text{Rs } 60,000}{\text{Sales}} \times 100$$

Sales = Rs 3,00,000

Cost of goods sold = Sales – Gross profit = Rs 3,00,000 – Rs 60,000 = Rs 2,40,000

2. Stock turnover $= \dfrac{\text{Cost of goods sold}}{\text{Average stock}}$

$$6 = \frac{\text{Rs } 2,40,000}{\text{Average stock}}$$

$$\text{Average stock} = \frac{\text{Rs } 2,40,000}{6} = \text{Rs } 40,000$$

$$\frac{\text{Opening stock} + \text{Closing stock}}{2} = \text{Rs } 40,000 \quad (1)$$

Closing stock – Opening stock = Rs 5,000 (2)

Solving two equations simultaneously:

Closing stock + Opening stock = Rs 80,000 (3)

Closing stock – Opening stock = Rs 5,000

Subtracting equation 2 from equation 3, we have

2 Opening stock = Rs 75,000

Opening stock = Rs 37,500

Therefore, Closing stock = Rs 42,500

3. Capital turnover ratio $= \dfrac{\text{Cost of Sales}}{\text{Capital}}$

$$2 = \frac{\text{Rs } 2,40,000}{\text{Capital}}$$

Capital = Rs 1,20,000

4. Fixed assets turnover ratio $= \dfrac{\text{Cost of Sales}}{\text{Fixed assets}}$

$$4 = \frac{\text{Rs } 2,40,000}{\text{Fixed assets}}$$

$$\text{Fixed assets} = \frac{\text{Rs } 2,40,000}{4} = \text{Rs } 60,000$$

5. Debt collection period = 2 months

$$\text{Debtor turnover ratio} = \frac{12 \text{ months}}{\text{Debt collection period}} = \frac{12}{2} = 6$$

Or $$\text{Debtors turnover ratio} = \frac{\text{Credit sales}}{\text{Average debtors}}$$

Assuming sales to be credit sales and debtors turnover ratio is based on year-end figures, we have:

$$\text{Debtors} = \frac{\text{Rs } 3,00,000}{6} = \text{Rs } 50,000$$

6. Creditors payment period = 73 days

$$\text{Creditors turnover ratio} = \frac{365 \text{ days}}{\text{Creditors payment period}} = \frac{365 \text{ days}}{73 \text{ days}} = 5.$$

Assuming all purchases to be credit purchases, the amount of purchases is determined as follows:

Cost of goods sold = Opening stock + Purchases – Closing stock

Rs 2,40,000 = Rs 37,500 + Purchases – Rs 42,500

Rs 2,40,000 + Rs 42,500 – Rs 37,500 = Purchases

Rs 2,45,000 = Purchases

Assuming creditors turnover ratio is based on the year-end figure, the amount of creditors is as follows:

$$\text{Creditors turnover ratio} = \frac{\text{Credit purchases}}{\text{Closing creditors}}$$

$$5 = \frac{\text{Rs } 2,45,000}{\text{Closing creditors}}$$

$$\text{Rs } 49,000 = \text{Creditors}$$

P.4.5 The capital of E. Ltd. is as follows:

9% Preference shares, Rs 10 each	Rs 3,00,000
Equity shares of Rs 10 each	8,00,000
	11,00,000

Additional information: Profit (after tax at 35 per cent), Rs 2,70,000; Depreciation, Rs 60,000; Equity dividend paid, 20 per cent; Market price of equity shares, Rs 40.

You are required to compute the following, showing the necessary workings:

(a) Dividend yield on the equity shares.
(b) Cover for the preference and equity dividends.
(c) Earnings per shares.
(d) Price-earnings ratio.

SOLUTION

(a) *Dividend yield on the equity shares:* $= \frac{\text{Dividend per share}}{\text{Market price per share}} \times 100 = \frac{\text{Rs } 2\ (0.20 \times \text{Rs } 10)}{\text{Rs } 40} \times 100 = 5 \text{ per cent}$

(b) *Dividend coverage ratio:*

(i) Preference $= \frac{\text{Profit after taxes}}{\text{Dividend payable to preference shareholders}} = \frac{\text{Rs } 2,70,000}{\text{Rs } 27,000\ (0.09 \times \text{Rs } 3,00,000)} = 10 \text{ times}$

(ii) Equity: $= \frac{\text{Profit after taxes} - \text{Preference share dividend}}{\text{Dividend payable to equity shareholders at current rate of Rs 2 per share}}$

$$= \frac{\text{Rs } 2,70,000 - \text{Rs } 27,000}{\text{Rs } 1,60,000\ (80,000 \text{ shares} \times \text{Rs } 2)} = 1.52 \text{ times}$$

(c) Earnings per equity share: $= \frac{\text{Earnings available to equity shareholders}}{\text{Number of equity shares outstanding}} = \frac{\text{Rs } 2,43,00}{80,000} = \text{Rs } 3.04 \text{ per share}$

(d) *Price-earning (P/E) ratio* $= \frac{\text{Market price per share}}{\text{Earnings pe share}} = \frac{\text{Rs } 40}{\text{Rs } 3.04} = 13.2 \text{ times}$

P.4.6 Alpha Manufacturing Company Ltd has drawn up the following profit and loss account for the year ended March 31.

To Opening stock	Rs 26,000	By Sales	Rs 1,60,000
To Purchases	80,000	By Closing stock	38,000
To Wages	24,000		
To Manufacturing expenses	16,000		
To Gross profit c/d	52,000		
	1,98,000		1,98,000
To Selling and distribution expenses	4,000	By Gross profit b/d	52,000
To Administrative expenses	22,800	By Compensation for acquisition of land	4,800
To Value of furniture lost by fire	800		

(*Contd.*)

(*Contd.*)

To General expenses	1,200		
To Net profit	28,000		
	56,800		56,800

You are required to find out the operating ratio and the ratio of operating net profit to net sales.

SOLUTION

$$\text{Operating ratio} = \frac{\text{Cost of goods sold + Selling and distribution expenses + Administrative expenses + General expenses}}{\text{Sales}} \times 100$$

$$= \frac{\text{Rs}\,1,08,000 + \text{Rs}\,4,000 + \text{Rs}\,22,800 + \text{Rs}\,1,200}{\text{Rs}\,1,60,000} \times 100 = 85 \text{ per cent}$$

Ratio of operating profit to net sales would be 15 per cent = 100 per cent - operating ratio, i.e. 85 per cent.

Alternatively, $\text{Operating ratio} = \frac{\text{Operating profit}}{\text{Sales}} \times 100 = \frac{\text{Rs}\,24,000}{\text{Rs}\,1,60,000} \times 100 = 15$ per cent

Operating profit = Net profit + Non-operating expenses and/or losses – Non-operating incomes and/or profits
= Rs 28,000 + Rs 800 – Rs 4,800 = Rs 24,000

P.4.7 Z Ltd. purchased a retail store and commenced business on April 1. From the following information, you are required to prepare in as much details as possible, a trading and profit and loss account for the current year ended March 31 and a balance sheet as at the date.

Capital introduced on April 1	Rs 47,000
Drawings during the year	5,000
Working capital (current assets less current liabilities) at March 31	23,000
Depreciation of fixed assets during the year, based on a rate of 20 per cent per annum on cost	3,000
Ratio of annual sales to year-end values of fixed assets plus working capital	2:1
Ratio of current assets to current liabilities at the year-end	2:1
Ratio of liquid assets (cash plus debtors) to current liabilities on March 31	5:4
Debtors at the year-end are equal to 12 per cent of annual sales	
General expenses (excluding depreciation) are equal to 20 per cent of annual sales.	

The current assets consist of stocks (which are unchanged throughout the year), debtors and cash. Stocks are turned over four times during the year. The current liabilities consist only of creditors.

SOLUTION

Trading A/c of Z Ltd for the current year ended March 31

To Cost of sales	Rs 69,000	By Sales	Rs 1,00,000
To Gross profit c/f to P&L A/c	31,000		
	1,00,000		1,00,000

Profit and Loss a/c for the year ended March 31

To General Expenses	Rs 20,000	By Gross profit b/f from trading A/c	Rs 31,000
To Depreciation	3,000		
To Net profit c/f to capital A/c	8,000		
	31,000		31,000

Balance sheet as at March 31, current year

Liabilities		*Amount*	*Assets*		*Amount*
Capital	Rs 47,000		Fixed assets	Rs 30,000	
Add net profit	8,000		Less depreciation	3,000	Rs 27,000
	55,000				
Less drawings	5,000	Rs 50,000	Current assets		
			Cash	16,750	
Creditors		23,000	Debtors	12,000	
			Stock	17,250	46,000
		73,000			73,000

Working Notes

1. *Determination of current assets and current liabilities:*

$$CA - CL = Rs\ 23,000 \quad (1)$$

$$0.5\ CA - CL = 0 \quad (2)$$

Subtracting equation (2) from equation (1)

$$0.5\ CA = Rs\ 23,000$$

$$CA = Rs\ 46,000$$

CL = Rs 23,000 = Creditors as there are no other current liabilities.

2. *Determination of fixed assets:* Depreciation rate, 10 per cent = Rs 3,000

$$\text{Cost of fixed assets} = Rs\ 3,000 \times \frac{100}{10} = Rs\ 30,000$$

3. *Determination of sales:* $\dfrac{\text{Sales}}{\text{Fixed assets} + \text{Working capital}} = 2$

$$\frac{\text{Sales}}{Rs\ 27,000 + Rs\ 23,000} = 2$$

$$\text{Sales} = Rs\ 1,00,000$$

4. *Determination of liquid assets:* $\text{liquid ratio} = \dfrac{\text{Liquid assets}}{\text{Current liabilities}}, 1.25 = \dfrac{\text{Liquid assets}}{Rs\ 23,000}$

Rs 28,750 = Liquid assets (cash + debtors)

(a) Debtors are 12 per cent of annual sales = Rs 12,000 (0.12 × Rs 1,00,000)

(b) Cash = Rs 28,750 – Rs 12,000 = Rs 16,750

5. *Determination of stock:* Current assets – Liquid assets

Rs 46,000 – Rs 28,750 = Rs 17,250

6. *Determination of cost of sales:* Stock turnover ratio $= \dfrac{\text{Cost of sales}}{\text{Average stock}}$

$$4 = \frac{\text{Cost of sales}}{Rs\ 17,250}$$

Rs 69,000 = Cost of sales.

P.4.8 Using the following information, complete the balance sheet given below:

Total debt to net worth: 0.5 to 1.
Turnover of total assets (based on year-end sales figures):2.
Gross profit: 30 per cent
Average collection period (based on 360-day-year): 40 days
Inventory turnover (based on cost of goods sold and year-end inventory): 3 times.
Acid test ratio: 0.75:1.

Balance Sheet

Cash		*Notes and accounts payable*	
Accounts receivable		Common stock	Rs 2,00,000
Inventory		Retained earnings	3,00,000
Plant and equipment			
Total		Total	

SOLUTION

Balance sheet

Cash	*Rs 20,833*	*Notes and accounts payable*	*Rs 2,50,000*
Accounts receivable	1,66,667	Common stock	2,00,000
Inventory	3,50,000	Retained earnings	3,00,000
Plant and equipment	2,12,500		
Total	7,50,000	Total	7,50,000

Working Notes

1. Debt to net worth ratio $= \dfrac{\text{Total debt}}{\text{Net worth (Common stock + Retained earnings)}}$

$$0.5 = \frac{\text{Total debt}}{\text{Rs } 5,00,000}$$

Rs 2,50,000 = Total debt (notes and accounts payable)

2. Substituting the value of 'notes and accounts payable' on the liabilities side, we have Rs.7,50,000 as the total sum of liabilities and so the total assets will be Rs 7,50,000.

$$\text{Total assets turnover} = \frac{\text{Sales}}{\text{Total assets}}$$

$$2 = \frac{\text{Sales}}{\text{Rs } 7,50,000}$$

Rs 15,00,000 = Sales

3. Gross profit ratio $= \dfrac{\text{Gross profit}}{\text{Sales}} \times 100$

$$30 = \frac{\text{Gross profit}}{\text{Rs } 15,00,000} \times 100$$

Rs 4,50,000 = Gross profit

Cost of goods sold = Sales – Gross profit = Rs 15,00,000 – Rs 4,50,000 = Rs 10,50,000

4. Assuming all sales to be credit sales, the figure of accounts receivable would be determined as follows:

$$\text{Accounts receivable turnover ratio} = \frac{360 \text{ days}}{\text{Average collection period}} = \frac{360 \text{ days}}{40 \text{ days}} = 9$$

$$\text{Accounts receivable turnover ratio} = \frac{\text{Credit sales}}{\text{Average debtors}}$$

$$9 = \frac{\text{Rs } 15,00,000}{\text{Average debtors}}$$

$$\text{Average debtors} = \frac{\text{Rs } 15,00,000}{9} = \text{Rs } 1,66,667$$

In the absence of any figure of the opening debtors and closing debtors, it is assumed that accounts receivable ratio is calculated on the basis of year-end figures. Accordingly, the amount of Rs 1,66,667 represents the balance of accounts receivable at the end of the year.

5. $$\text{Inventory turnover ratio} = \frac{\text{Cost of goods sold}}{\text{Closing inventory}}$$

$$3 = \frac{\text{Rs } 10,50,000}{\text{Closing inventory}}$$

$$\text{Rs } 3,50,000 = \text{Closing inventory}$$

6. $$\text{Acid test ratio} = \frac{\text{Liquid assets}}{\text{Current liabilities}}$$

$$0.75 = \frac{\text{Liquid assets}}{\text{Rs } 2,50,000}$$

$$\text{Rs } 1,87,500 = \text{Liquid assets}$$

$$\text{Rs } 1,87,500 = \text{Cash} + \text{Accounts receivable}$$

$$\text{Rs } 1,87,500 - \text{Rs } 1,66,667 = \text{Rs } 20,833 = \text{Cash}$$

P.4.9 The financial statements of Good Luck Ltd, for the current year-end reveal the following information:

Ratio of current assets to current liabilities, 1.75:1.0
Liquidity ratio (debtors and bank balances to current liabilities), 1.25:1.0
Issued capital in equity shares of Rs 10 each, Rs 1,20,000
Net current assets (as over current liabilities), Rs 60,600
Fixed assets (net blocks) – Percentage of shareholder's equity as on the closing date, 60 per cent
Gross profit – Percentage of turnover, 20 per cent
Annual rate of turnover of stock (based on cost at March 31), 5.26 times
Average age of outstanding debtors for the current year, 2 months
Net profit – Percentage on issued share capital, 16 per cent
On March 31 the current assets consisted of stock, debtors and bank balances.

You are required to reconstruct, in as much detail as possible:

(1) The balance sheet as on March 31, current year, and
(2) The trading and profit and loss account, for the current year ended March 31.

SOLUTION

Trading A/c of Good Luck Ltd. for the year ending March 31

To Cost of goods sold (balancing figure)	*Rs 2,12,504*	*By Sales*	*Rs 2,65,630*
To Gross profit c/f to P&L A/c (0.20 × sales)	53,126		
	2,65,630		2,65,630

Profit and loss A/c of Good Luck Ltd for the year ending March 31

To Overheads (balancing figure)	*Rs 33,926*	*By Gross profit b/f from trading A/c*	*Rs 53,126*
To Net profit (0.16 × Rs 1,20,000)	*19,200*		
	53,126		53,126

Balance sheet of Good Luck Ltd. as on March 31

Liabilities		*Assets*	
Share capital (12,000 equity shares of Rs 10 each)	Rs 1,20,000	Fixed assets	Rs 90,900
Reserve and surplus		Current assets:	
	31,500	Cash	56,728
Current liabilities	80,800	Sundry debtors	44,272
		Stock	40,400
	2,32,300		2,32,300

Working Notes

1. *Determination of current assets and current liabilities:*

$$CA - CL = WC$$

$$CA - CL = \text{Rs } 60{,}600 \quad (1)$$

$$\frac{CA}{CL} = 1.75$$

$$CA - 1.75\ CL = 0 \quad (2)$$

Subtracting equation (2) from equation (1)

$$0.75\ CL = \text{Rs } 60{,}600$$

$$CL = \frac{\text{Rs } 60{,}600}{0.75} = \text{Rs.}80{,}800$$

$$CA = \text{Rs } 80{,}800 + \text{Rs } 60{,}600 = \text{Rs } 1{,}41{,}400$$

2. *Determination of liquid assets:* $\frac{\text{Liquid assets}}{\text{CL}} = 1.25$, LA = Rs 80,800 × 1.25 = Rs 1,01,000

3. *Determination of stock:* Current assets – Liquid assets = Rs 1,41,400 – Rs 1,01,000 = Rs 40,400

4. *Determination of fixed assets:* Fixed assets (net block) are 60 per cent of shareholders' equity. In other words, the net current asset block would be 40 per cent of shareholders' equity. Net current assets being Rs 60,600, fixed assets would be Rs 90,900 (Rs 60,600 × 60/40).

5. *Determination of shareholder's equity:* = Fixed assets + Net current assets = Rs 90,900 + Rs 60,600 = Rs 1,51,500

6. *Balance of reserves and surplus:* Shareholders' equity – Issued share capital = Rs 1,51,500 – Rs 1,20,000
= Rs 31,500

7. *Cost of goods sold can be ascertained directly also:* Stock turnover $= \frac{\text{Cost of goods sold}}{\text{Rs } 40,400}$: $5.26 \times$ Rs 40,400

$$= \text{Rs } 2,12,504$$

8. *Determination of debtors:* Debtors collection period is 2 months or debtors' turnover is 6 (12 months ÷ 2). Assuming all sales to be credit sales, debtors would be

$$6 = \frac{\text{Credit sales}}{\text{Debtors}}$$

$$6 \text{ Debtors} = \text{Rs } 2,65,630$$

$$\text{Debtors} = \text{Rs } 44,272$$

9. *Determination of cash:* Liquid assets – Debtors = Cash = Rs 1,01,000 – Rs 44,272 = Rs 56,728

P.4.10 You are presented with the following figures prepared from the audited balance sheet of Fair Dealings Ltd.

	Year 1	*Year 2*	*Year 3*
Assets			
Debtors	Rs 30,000	Rs 50,000	Rs 60,000
Stock	50,000	50,000	70,000
Plant and equipment	12,000	15,000	20,000
Buildings	10,000	10,000	10,000
	1,02,000	1,25,000	1,60,000
Liabilities			
Bank	11,000	26,000	39,000
Trade creditors	25,000	30,000	50,000
Profit and loss A/c	10,000	13,000	15,000
Paid up capital (Rs 10 per shares, Rs 7.50 paid)	56,000	56,000	56,000
	1,02,000	1,25,000	1,60,000
Sales	1,00,000	1,50,000	1,50,000
Gross profit	25,000	30,000	25,000
Net profit	5,000	7,000	5,000
Dividend paid	4,000	4,000	3,000

The opening stock at the beginning of year 1 was Rs 4,000. You are required to show in respect of each year the following ratios and comment on the changes in the profitability, liquidity and financial position of the company:

(i) Current ratio,
(ii) Ratio of debtors to turnover,
(iii) Stock turnover rate.

SOLUTION

(i) Current ratio $= \frac{\text{Current assets}}{\text{Current liabilities}}$

Year 1	Rs 80,000	÷ Rs 36,000	= 2.22
Year 2	1,00,000	÷ 56,000	= 1.80
Year 3	1,30,000	÷ 89,000	= 1.46

(ii) Ratio of debtors to turnover $= \frac{\text{Sales}}{\text{Average debtors}}$

Year 1 Rs 1,00,000 ÷ Rs 30,000 = 3.33
Year 2 1,50,000 ÷ 40,000 = 3.75
Year 3 1,50,000 ÷ 55,000 = 2.73

(*Note:* Since the opening balance of debtors is not given for year 1, the year-end figures are used).

(iii) Stock turnover rate $= \dfrac{\text{Cost of goods sold}}{\text{Average stock}}$

Year 1 Rs 75,000 ÷ Rs 27,000 = 2.78
Year 2 1,20,000 ÷ 50,000 = 2.40
Year 3 1,25,000 ÷ 60,000 = 2.08

In order to comment on the changes in the profitability, liquidity and financial position of the company, we have to compute some additional ratios:

(a) *Profitability ratios:*

(i) Gross profit ratio $= \dfrac{\text{Gross profit}}{\text{Sales}} \times 100$

Year 1 Rs 25,000 ÷ Rs 1,00,000 = 25 per cent
Year 2 30,000 ÷ 1,50,000 = 20 per cent
Year 3 25,000 ÷ 1,50,000 = 16.7 per cent

(ii) Net profit ratio $= \dfrac{\text{Net profit}}{\text{Sales}} \times 100$

Year 1 Rs 5,000 ÷ Rs 1,00,000 = 5.0 per cent
Year 2 7,000 ÷ 1,50,000 = 4.7 per cent
Year 3 5,000 ÷ 1,50,000 = 3.3 per cent

The profitability ratios show that the profitability of the company has been consistently declining since year 1. The margin of profit on sales has declined from 25 per cent in year 1 to 16.7 per cent in year 3, the corresponding figures for net profit margin on sales being 5 per cent and 3.3 per cent for year 1 and year 3 respectively.

(b) *Liquidity ratios:*

Acid test ratio $= \dfrac{\text{Quick assets}}{\text{Current liabilities}}$

Year 1 Rs 30,000 ÷ Rs 36,000 = 0.83
Year 2 50,000 ÷ 56,000 = 0.90s
Year 3 60,000 ÷ 89,000 = 0.67

The liquidity ratios (current ratio and acid test ratio) indicate that considerable deterioration has occurred in the liquidity position of the company. In year 1, the current ratio was 2.22 and the acid-test ratio 0.83. The current ratio was much higher than the standard requirement of 2 and the acid-test ratio was reasonably satisfactory. It was 0.83 compared to the requirement of 1.0. Thus, the company's ability to meet short-term liabilities was adequate in year 1. But, by year 3, both these ratios declined considerably in as much as they went much below the desired standard figures. Clearly, the company's ability to make payments for current liabilities is weak at present. It is also implicit in the increase in bank overdraft to Rs 39,000 from Rs 11,000. The decrease in the liquidity ratios is caused by (i) increase in the collection period of debtors to 134 days in year 3 from 110 days in year 1 and (ii) increase in the inventory holding period as reflected in the decrease in the inventory turnover figure, the relevant figures for year 1 and year 3 being 131 days and 182 days respectively. The deterioration in liquidity position is also reflected in the increase in the D/E as well as the D/A ratios.

(c) *Financial position:*

(i) Debt-equity (D/E) ratio $= \dfrac{\text{Debt}}{\text{Equity}} \times 100$

Year 1 (Rs 36,000 ÷ Rs 66,000) × 100 = 54.5 per cent
Year 2 (56,000 ÷ 69,000) × 100 = 81.2 per cent
Year 3 (89,000 ÷ 71,000) × 100 = 125.4 per cent

(ii) Debt to asset (D/A) ratio = $\frac{\text{Debt}}{\text{Assets}} \times 100$

Assets

Year 1 (Rs 36,000 ÷ Rs 1,02,000) × 100 = 35.0 per cent
Year 2 (56,000 ÷ 1,25,000) × 100 = 44.8 per cent
Year 3 (89,000 ÷ 1,60,000) × 100 = 55.6 per cent

P.4.11 From the ratios and other data set forth below for the Auto Accessories Ltd, indicate your interpretation of the company's financial condition:

	Year 3	*Year 2*	*Year 1*
Current ratio (per cent)	302	278	265
Acid-test ratio	99	110	155
Working capital turnover (times)	3.25	3.00	2.75
Receivable turnover (times)	7.2	8.41	9.83
Collection period (days)	50	43	37
Inventory to working capital (per cent)	110	100	95
Inventory turnover (times)	5.41	6.01	6.11
Income per equity share (Rs)	2.5	4.05	5.10
Net income to net worth (per cent)	7	8.5	11.07
Operating expenses to net sales (per cent)	25	23	22
Sales increase during the year (per cent)	23	16	10
Cost of goods sold to net sales (per cent)	73	71	70
Dividend per share (Rs)	3	3	3
Fixed assets to net worth (per cent)	22.7	18.0	16.4
Net profit on net sales (per cent)	2.0	5.09	7.03

SOLUTION

The interpretation of the financial condition of Auto Accessories Ltd, as revealed by the ratios and other data, yields the following inferences:

(i) Declining profitability is evident from the following:

(a) Decrease in gross profit ratio from 30 in year 1 to 27 per cent in year 3, (b) decrease in net profit ratio from 7 in year 1 to 2 in year 3 and (c) decrease in rate of return on net worth from 11.1 per cent in year 1 to 7 per cent in year 3. This is in spite of increase in sales from 10 per cent in year 1 to 23 per cent in year 3.

In interpreting the profitability of the company, another relevant factor is the expenses ratios. The ratio of cost of goods sold to net sales has gone up from 70 to 73 per cent during the period. Likewise, there has been an increase in operating expenses ratio from 22 to 25 per cent. The high inventories as reflected in lower inventory turnover ratio of 5.41 in year 3 as compared to 6.11 in year 1 have also adversely affected the profit margin.

As a consequence, the EPS has declined by more than 50 per cent during year 1-3 from Rs 5.1 in year 1 to Rs 2.5 in year 3.

(ii) The emerging liquidity position of the company appears to be highly satisfactory. The current ratio has increased from 2.65 in year 1 to 3.02 in year 3. Though, the acid-test ratio has declined from 1.55 1 to 0.99, it meets the standard. The company is unlikely to encounter any serious difficulty in paying the short-term obligations as and when they become due for payment.

However, the management should realise that the policy relating to collection of debt is not sound as reflected in the declining trend of receivables turnover from 9.83 in year 1 to 7.2 in year 3. In other words, the average debt collection

period has increased from 37 days to 50 days. There is carelessness either (i) in collecting the payments from debtors, or (ii) in extending credit sales to customers leading to an increase in bad debts and thereby an increase in the expenses ratio. Further, the inventory holding period requires investigation as the consistent increase in the current ratio and the consistent decrease in the acid-test ratio result from large accumulation of inventories. The excessive investment in current assets seem to be affecting the rate of return.

The investment in fixed assets appears excessive as shown by a consistent increase in the ratio of fixed assets to net worth. However, the overinvestment in fixed assets is not as clear as the overinvestment in working capital.

The stable dividend policy of the company is commendable and is likely to have a salutary effect on the market price of its shares.

In conclusion, the firm's financial position has not become so bad that it cannot be cured. What is required is a thorough probe into overinvestment in working capital, particularly inventories and fixed assets.

P.4.12 While working in a financial institution, you have come across the following statements. Give your views and comments on these statements with the necessary arguments.

(a) 'The sales of company A have been growing at a faster rate than those of company B. The profitability of company A must, therefore, be greater than that of Company B.'

(b) 'From the viewpoint of equity shareholders, debt in the capital structure affects both the risk and the profitability of the firm.'

(c) 'Firm X and Firm Y have the same expected sales volume for next year and they are identical in every respect except that the firm X has a greater proportion of fixed costs. If sales are expected to increase (decrease), firm X will have greater (lower) profit from operations than firm Y.'

(d) 'Assume Calico has a profit margin of 20 per cent and Mafatlal has a profit margin of 25 per cent. It is, therefore, obvious that Mafatlal is a better investment than Calico.'

(e) 'Firm A is aggressively making capital expenditure and firm B is not. Firm A is clearly more efficient and profitable than firm B.'

SOLUTION

(a) The profitability of a company is a product of two factors: (i) margin of profit on sales, and (ii) assets turnover. Symbolically, it is equal to $\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}$ or Margin of net profit × Assets turnover

Accordingly, the profitability of company A need not necessarily be greater than that of company B. The answer hinges on the margin of profit of company A. If the margin of profit on sales of both the companies is equal, the profitability of company A would certainly be greater than that of B; because of higher sales company A would cause a higher assets turnover *vis-a-vis* company B (assuming the size of total assets of companies A and B is equal). If the margin of profit of company B is greater than that of A, profitability of company B may be even greater than that of company A. For instance, the margin of profit on sales of company A is 2 per cent and that of company B is 4 per cent. Let us assume further the assets turnover of company A is 8 while that of company B is 5. Due to increased sales, the total rate of return would be 16 per cent of company A, while that of Company B would be 20 per cent.

(b) Debt in the capital structure certainly affects both the risk and profitability from the point of view of equity holders. If the company's earnings rate is greater than the interest rate paid on debt, the company is said to have favourable leverage as it enhances the rate of return available to equityholders. Conversely, if the rate of interest paid on debt exceeds the company's earning rate, the company is said to have unfavourable leverage as it will depress the rate of return available to equity holders. Let us take a simple example to make the point clear:

Total assets	Rs 20,000
Equity capital	10,000
10% Debt	10,000
Net income before interest and taxess	5,000
Tax rate	35 per cent

Profit and loss statement

Net income before interest and taxes	Rs 5,000
Less interest on debt	1,000
Net income	4,000
Less taxes (0.35)	1,400
Net income available to equityholders	2,600
Rate of return on equity capital (per cent)	26

The company is increasing the profitability of equity holders by employing debt in the capital structure. In the absence of debt, the rate of return would have been 16.25 per cent [(Rs 5,000 – Rs 1,750 taxes) ÷ Rs 20,000].

If the net income before interest and taxes is Rs 1,500 only, the use of debt would work against the interest of equityholders, as shown by the following calculations:

Net income before interest and taxes	Rs 1,500
Less interest on debt	1,000
Net income	500
Less taxes	175
Net income available to equityholders	325
Rate of return on equity capital (per cent)	3.25

In the absence of debt, the rate of return on equity capital would have been 4.9 per cent [Rs 1,500 – Rs 525] ÷ Rs 20,000.

The use of debt in the company's capital structure increases the financial risk of equityholders, as the use of debt increases the variability of the shareholders' returns and probability of insolvency if the firm fails to make the payment of interest and repayment of the principal in time.

(c) The profit of firm X need not necessarily be higher than that of Y. The answer hinges on the margin of safety and amount of fixed costs of firms X and Y. Let us take an example.

Firms

	X	*Y*
Sales	Rs 1,00,000	Rs 1,00,000
P/V ratio	50 per cent	50 per cent
Fixed cost	40,000	20,000
Net profit	10,000	30,000

Net profit X, (Sales, Rs 1,00,000 – Variable cost, Rs 50,000 – Fixed cost, Rs 40,000) = Rs 10,000. Net profit, Y (Sales, Rs 1,00,000 – Variable cost, Rs 50,000 – Fixed cost, Rs 20,000) = Rs 30,000. If sales increase by 20 per cent,

	X	*Y*
Sales	Rs 1,20,000	Rs 1,20,000
Less variable cost (1 – P/V ratio)	60,000	60,000
Contribution	60,000	60,000
Less fixed costs	40,000	40,000
	20,000	20,000

(d) Mafatlal need not necessarily be a better investment than Calico for the following reasons:

(i) Profitability is also affected by turnover of total assets and not by margin of profit only. The assets turnover of Calico may be greater than Mafatlal's.

(ii) The degree of financial risk in Mafatlal due to the use of debt may be more than that in Calico. Therefore, the required rate of return on equity capital of Mafatlal would be more than that of Calico affecting the market value of their shares.

(iii) Calico may be pursuing a stable dividend policy as against an unstable dividend policy by Mafatlal.
(iv) The future prospects of the two companies may be different.

The above factors taken together determine the quality of investments.

(e) The answer rests on the existing position of firm B and the rate of return earned by company A on capital expenditures. If company A is investing in such proposals which will add to the net present value of the shareholders' wealth, they will certainly add to the efficiency and profitability of firm A. But if the firm B has already made such investments in the past, the company A need not necessarily be more efficient and profitable than firm B.

P.4.13 Below is given the balance sheet of Best Ltd, as on March 31, of the current year:

Liabilities		*Assets*	
Equity share capital	Rs 20,00,000	Fixed assets (cost)	Rs 50,00,000
7.5% Preference share capital	10,00,000	Depreciation written-off	16,00,000
General reserve	4,00,000		
			34,00,000
6% Debentures	6,00,000	Stock	6,00,000
Sundry creditors	10,00,000	Sundry debtors	8,00,000
		Cash	2,00,000
	50,00,000		50,00,000

The following additional information is available:

(1) Fixed assets costing Rs 10,00,000 to be installed on April 1, and would become operative on that date, payment to be made on March 31 of next year.
(2) The fixed assets turnover ratio (on the cost of the fixed assets) would be 1.5.
(3) The stock turnover ratio would be 14.4 (calculated on the basis of the average of the opening and closing stocks).
(4) The break-up of cost and profit would be as follows (percentages):

Materials	40
Labour	25
Manufacturing expenses	10
Office and selling expenses	10
Depreciation	5
Profit	10
Sales	100

The profit is subject to debenture interest and taxation @ 35 per cent.

(5) Debtors would be 1/9 of turnover.
(6) Creditors would be 1/5 of materials consumed.
(7) In March next year a dividend of 10 per cent on equity capital would be paid.
(8) Rs 5,00,000, 6% debentures would be issued on April 1, next year.

You are required to prepare the forecast balance sheet as on March 31, next year and calculate the resultant:

(a) Current ratio;
(b) Fixed Assets/Net worth ratio; and
(c) Debt-equity ratio

(The turnover above refers to the value of sales).

SOLUTION

Forecast balance sheet of Best Ltd. as on March 31 next year

Liabilities	*Amount*	*Assets*		*Amount*
Equity share capital	Rs 20,00,000	Fixed assets:		
13.5% Preference		Cost	Rs 60,00,000	
share capital	10,00,000	*Less* Depreciation	20,50,000	Rs 39,50,000
General reserves	6,67,100	Sundry debtors		10,00,000
15% Debentures	11,00,000	Stock		6,50,000
Sundry creditors	7,20,000	Cash		1,79,000
Provision for taxation	2,91,900			
	57,79,000			57,79,000

Resultant ratio:

Ratio	*Formula*	*Computation*
(i) Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$	$\frac{\text{Rs } 18,29,00}{\text{Rs } 11,37,000} = 1.61$
(ii) Fixed assets to net worth	$\frac{\text{Fixed assets}}{\text{Net worth}}$	$\frac{\text{Rs } 39,50,000}{\text{Rs } 35,42\,000} = 1.12$
(iii) Debt-equity ratio(a)	$\frac{\text{External dept}}{\text{Internal equity}}$	$\frac{\text{Rs } 22,37,00}{\text{Rs } 35,42,000} = 0.63$
(b)	$\frac{\text{Long term debt}}{\text{Internal equity}}$	$\frac{\text{Rs } 11,00,000}{\text{Rs } 35,42,000} = 0.31$

Working Notes

1. *Determination of sales:*

$$\text{Fixed assets turnover ratio} = \frac{\text{Sale}}{\text{Fixed assets}}$$

Or $$1.5 = \frac{\text{Sale}}{\text{Rs } 60,00,000}$$

Or $$\text{Rs } 90,00,000 = \text{Sales}$$

2. *Determination of actual expenses*

	Percentage of sales	*Amount*
Materials	40	Rs 36,00,000
Manufacturing expenses	10	9,00,000
Labour	25	22,50,000
Office & selling expenses	10	9,00,000
Depreciation	5	4,50,000
Profit	10	9,00,000
	100	90,00,000

3. *Determination of net fixed assets:*

Opening balance		Rs 50,00,000
Add purchases		10,00,000
		60,00,000
Less depreciation:		
Accumulated	Rs 16,00,000	
Additional	4,50,000	20,50,000
Closing balance		39,50,000

4. *Determination of closing stock:*

$$\text{Average stock} = \frac{\text{Sale}}{\text{Stock turnover ratio}}$$

$$= \frac{\text{Rs } 90,00,000}{14.4} = \text{Rs } 6,25,000$$

$$\text{Average stock} = \frac{\text{Opening stock} + \text{closing stock}}{2}$$

Rs 12,50,000 = Rs 6,00,000 + Closing stock

Rs 6,50,000 = Closing stock

5. Determination of debtors:

$$\text{Debtors} = \frac{\text{Sale}}{9} = \frac{\text{Rs } 90,00,000}{9} = \text{Rs } 10,00,000$$

6. Determination of creditors:

$$\text{Creditors} = \frac{\text{Materials consumed}}{5} = \frac{\text{Rs } 36,00,000}{5} = \text{Rs } 7,20,000$$

7. *Determination of interest and provision for taxation:*

Net profit	Rs 9,00,000	
Less interest (0.06 × Rs 11,00,000)	66,000	
	8,34,000	
Less taxes (0.35 × Rs 8,34,000)	2,91,900	
	5,42,100	

8. Determination of amount to be transferred to general reserves:

Opening balance of general reserve		Rs 4,00,000
Transfer from the current year:		
Net profit	Rs 5,42,100	
Less preference dividend	(75,000)	
Less equity dividend	(2,00,000)	2,67,100
Closing balance		6,67,100

9. Determination of cash:

Cash flow statement

Sources of cash:		
Cash from operations:		
Profit after tax	Rs 5,42,100	
Add depreciation	4,50,000	
	9,52,100	

(*Contd.*)

(*Contd.*)

Add increase in current liabilities (provision for taxation):		2,91,900	
Less increase in current assets and decrease in current liabilities:			
Stock	Rs 50,000		
Debtors	2,00,000		
Creditors	2,80,000	(5,30,000)	Rs 7,54,000
Issue of debentures			5,00,000
Total cash (sources)			12,54,000
Uses of cash:			
Purchase of fixed assets			10,00,000
Payment of dividend:			
Preference		75,000	
Equity		2,00,000	2,75,000
Total cash (uses)			12,75,000
Net decrease in cash (Total uses – Total sources)			(21,000)
Opening balance of cash		2,00,000	
Less decrease in cash		21,000	
Closing balance of cash		1,79,000	

P.4.14 You have been supplied data for the Supreme Plastic Company Ltd, and its industry averages:

1. Determine the indicated ratios for the Supreme Plastic Company.
2. Indicate the company's strengths and weaknesses as shown by your analysis.

Balance sheet as at March 31

Liabilities	*Amount*	*Assets*	*Amount*
Equity share capital	Rs 12,00,000	Net fixed assets	Rs 6,05,000
10% Debentures	2,30,000	Cash	2,20,000
Sundry creditors	1,65,000	Sundry debtors	2,75,000
Bills payable	2,20,000	Stock	8,25,000
Other current liabilities	1,10,000		
	19,25,000		19,25,000

Statement of profit for the year ending March 31, current year

Sales		Rs 27,50,000
Less cost of goods sold:		
Materials	Rs 10,45,000	
Wages	6,60,000	
Factory overheads	3,24,500	20,29,500
Gross profit		7,20,500
Less selling and distribution expenses		2,75,000
Less administrative and general expenses		3,07,000
Earnings before interest and taxes		1,38,500
Less interest		23,000
Earnings before taxes		1,15,500
Less income taxes (0.35)		40,425
Net profit		75,075

Ratios

	Industry	*Supreme Plastic*
Current assets/current liabilities	2.4	
Sales/debtors	8.0	
Sales/stock	9.8	
Sales/total assets	2.0	
Net profit/sales (per cent)	3.3	
Net profit/total assets (per cent)	6.6	
Net profit/net worth (per cent)	12.7	
Total debt/total assets (per cent)	63.5	

SOLUTION

(1) *Determination of ratios:*

Ratios	*Computation*	*Indicated result*	*Industry*
$\frac{\text{Current assets}}{\text{Current liabilities}}$	$\frac{\text{Rs } 12,20,000}{\text{Rs } 4,95,000}$	2.7	2.4
$\frac{\text{Sales}}{\text{Debtors}}$	$\frac{27,50,000}{2,75,000}$	10.0	8.0
$\frac{\text{Sales}}{\text{Stock}}$	$\frac{27,50,000}{8,25,000}$	3.3	9.8
$\frac{\text{Sales}}{\text{Total assets}}$	$\frac{27,50,000}{19,25,000}$	1.4	2.0
$\frac{\text{Net profit}}{\text{Sales}}$ (per cent)	$\frac{75,075}{27,50,000}$	2.7	3.3
$\frac{\text{Net profit}}{\text{Total assets}}$ (per cent)	$\frac{75,075}{19,25,000}$	3.9	6.6
$\frac{\text{Net profit}}{\text{Equity share capital}}$	$\frac{75,075}{12,00,000}$	6.3	12.7
$\frac{\text{Total debt}}{\text{Total assets}}$	$\frac{7,25,000}{19,25,000}$	37.7	63.5

2. The level of stock maintained by Supreme Plastics is alarmingly high in that it is almost three times the industry average. The other turnover ratios are in conformity with that of the industry. In fact, current ratios and debtors turnover reflecting debt collection period of the company are better than those of the industry.

The greatest weakness of the company is the high level of inventories. It has caused a steep decline in the total assets turnover. The cost of carrying stocks is likely to adversely affect the profit margin. As a result of its low turnover and profit margin, the company's rate of return on net worth is less than one-half of the industry. The rate of return on equity capital of the company is also low because the company is using relatively less debt, i.e. 37.7 per cent as against the industry average of 63.5 per cent.

P.4.15 From the following particulars, prepare the balance sheet of Shri Mohan Ram and Co. Ltd as at March 31, current year.

Current ratio, 2
Working capital, Rs 4,00,000
Capital block to current asset, 3:2
Fixed asset to turnover, 1:3
Sales cash/credit, 1:2
Debentures/share capital, 1:2
Stock velocity, 2 months
Creditors velocity, 2 months
Debtors velocity, 2 months
Gross profit ratio, 25 per cent (to sales)
Capital block:
Net profit, 10 per cent of turnover
Reserve, 2.5 per cent of turnover

SOLUTION

Balance sheet as at March 31

Liabilities	*Amount*	*Assets*	*Amount*
Share capital	Rs 6,00,000	Fixed assets (net)	Rs 8,00,000
Reserves	60,000	Current assets:	
Profit and loss A/c	2,40,000	Stock	3,00,000
Debentures	3,00,000	Debtors	2,66,667
Creditors	3,50,000	Other current assets	2,33,333
Other current liabilities	50,000		
	16,00,000		16,00,000

Working Notes

1. Current ratio of 2 implies that CA_s = twice CL, i.e., CA - 2CL = 0
   Further, CA - CL = Rs 4,00,000 or, CL = Rs 4,00,000 and CA = Rs 8,00,000.
2. Capital block to current assets ratio of 3:2 implies that long-term capital funds (equity funds + debentures) are 1.5 times current assets, i.e., Rs 8,00,000 × 1.5 = Rs 12,00,000.
3. Total assets = Total liabilities = Rs 16,00,000 (Rs 12,00,000 long-term funds + Rs 4,00,000 CL).
4. Fixed assets = Rs 16,00,000, Total assets – Rs 8,00,000, CA = Rs 8,00,000.
5. FA/Turnover (sales) = 1/3 or Sales = Rs 8,00,000 × 3 = Rs 24,00,000.
6. Proportion of cash sales to credit sales is 1:2 or cash sales are one-third of total sales, i.e. 1/3 × Rs 24,00,000 = Rs 8,00,000; credit sales = Rs 16,00,000.
7. Gross profit = 0.25 × Rs 24,00,000 = Rs 6,00,000; cost of goods sold = Rs 18,00,000.
8. Debtors = Rs 16,00,000/6 (Debtors turnover ratio, 12 ÷ 2) = Rs 2,66,667.
9. Stock = Rs 18,00,000/6 (Stock turnover ratio, 12 ÷ 2) = Rs 3,00,000.
10. Other CAs = Rs 8,00,000 – (Rs 2,66,667 + Rs 3,00,00) = Rs 2,33,333.
11. Reserves = 0.025 × Rs 24,00,000 = Rs 60,000.
12. Credit purchases = Cost of goods sold + Closing stock = Rs 18,00,000 + Rs 3,00,000 = Rs 21,00,000.

13. Creditors = Rs 21,00,000 ÷ 6 (creditors turnover ratio, 12 ÷ 2) = Rs 3,50,000.
14. Other CLs = Total CL – Creditors, i.e. Rs 4,00,000 – Rs 3,50,000 = Rs 50,000.
15. Debentures to share capital ratio of 1:2 implies that debentures in value are equal to one-half of share capital (2 Debentures = Share capital). Further, capital block (as per working note 3) is Rs 12,00,000.
    Rs 12,00,000 = Debentures + Share capital + Net profit + Reserves
    Rs 12,00,000 = 3 Debentures + Rs 2,40,000 (10 per cent of sales) + Rs 60,000
    Rs 3,00,000 = Debentures; Share capital = Rs 6,00,000

P.4.16 As the manager of a financial services company, you have received a proposal seeking a term loan of Rs 300 lakh, from a firm planning an investment in fixed assets of Rs 500 lakh in a new project. The loan is indicated to be repayable in three annual instalments commencing from the end of the second year. The following information concerning the project is available: (Rs in lakhs)

	Year			
	1	*2*	*3*	*4*
Gross profit (before depreciation)	75	100	150	150
Depreciation	50	45	40	35
Interest on term loan	25	45	30	15
Working capital borrowing (interest)	10	15	20	20
Provision for tax	—	—	10	30

Assuming other *techno-economic* criteria to be satisfactory, you are required to:

(a) compute appropriate financial ratio which, in your opinion, would guide the financing decision, and

(b) interpret briefly the ratio so computed and give your views on the proposal.

SOLUTION

(a) Debt service coverage ratio is the most appropriate ratio for the lending company as it indicates relationship between the total cash funds available with the borrowing firm to service debt/instalment (consisting of principal repayment and interest).

Debt-Service Coverage Ratio (DSCR): (Amount in lakhs of rupees)

	Year			
	1	*2*	*3*	*4*
Gross profit (before depreciation)	75	100	150	150
Less interest on working capital borrowing	10	15	20	20
Less provision for tax	—	—	10	30
(i) Cash available to service term loan	65	85	120	100
Debt service obligations:				
Interest on term loan	25	45	30	15
Instalment payment	—	100	100	100
(ii) Total debt service obligations	25	145	130	115
(iii) DSCR (i ÷ ii) (Number of times)	2.6	0.59	0.92	0.87

(b) **Comment:** The DSCR is very unsatisfactory as it is less than one for all the three years in which instalmetns are to be paid. The firm will not have enough cash to service instalment and is likely to commit default. The proposal is not financially viable and term loan should not be sanctioned by the financial services company.

P.4.17 The following items appear in the accounts of XYZ Ltd as at March 31, current year:

Cash	Rs 4,860	Bank overdraft	Rs 5,200
Land and building	80,000	Equity shares (Rs10 each)	1,00,000
Deposits and payments in advance	6,200	Profit and loss A/c (Cr.)	21,700
Stock	37,280	Proposed equity dividend for current year	8,625
Trade creditors	40,575	Trade investments	2,000
General reserve	10,000	Provision for taxation	12,400
Debtors	52,300	Dividend reserve	14,000
Bills receivable	2,260	Bills payable	1,800
Plant and machinery	54,400	Net sales for current year	2,18,240
12% Debentures (secured)	25,000	Net profit for current year before taxation and dividend	32,783

Note: The values of all fixed assets reflect current price levels after provision of depreciation.

You are required to arrange the above items in the form of financial statement and find out the rate of return on capital employed (by using different ways).

SOLUTION

Financial statement of XYZ Ltd as at March 31

			Amount
Shareholders funds:			
Equity share capital			Rs 1,00,000
General reserve			10,000
Profit and loss account (credit)			21,700
Dividend reserve			14,000
			1,45,700
Add 12% Debentures (secured)			25,000
Long term funds (capital employed)			1,70,700
Investment of funds in:			
Fixed assets:			
Land and building		Rs 80,000	
Trade investments		2,000	
Plant and machinery		54,400	1,36,400
Working capital (net)			
Current assets:			
Cash	Rs 4,860		
Deposit and payments in advance	6,200		
Stock	37,280		
Debtors	52,300		
Bills receivable	2,260	1,02,900	
Less current liabilities:			
Trade creditors	40,575		
Bank overdraft	5,200		
Provision for taxation	12,400		
Bills payable	1,800		
Proposed equity dividends	8,625	(68,600)	34,300
			1,70,700

Rate of return on capital employed (ROCE)

$$\text{(i)}\quad \frac{\text{EBIT}}{\text{Capital employed}} \times 100 = \frac{\text{Rs } 32,783 + \text{Rs } 3,00\ ^{@}}{\text{Rs } 1,70,700} \times 100 = 21 \text{ per cent}$$

[@]Interest on 12% Debentures is Rs 25,000 × 0.12 = Rs 3,000

$$\text{(ii)}\quad \frac{\text{EAT} + \text{Interest}}{\text{Capital emploted}} \times 100 = \frac{\text{Rs } 32,783 - \text{Rs } 12,400 + \text{Rs } 3,000}{\text{Rs } 1,70,700} \times 100 = 13.7 \text{ per cent}$$

$$\text{(iii)}\quad \frac{\text{EAT} + \text{Interest} - \text{tax advantage on interest}\ ^{@@}}{\text{Capital employed}} \times 100 = \frac{\text{Rs } 20,383 + \text{Rs } 3,000 - \text{Rs } 1,134}{\text{Rs } 1,70,700} \times 100 = 13 \text{ per cent}$$

[@@](Effective tax rate = Rs 12,400/Rs 32,783 = 37.8 per cent)

REVIEW QUESTIONS

RQ.4.1 There are four groups of financial ratios; liquidity, leverage, activity, and profitability. Financial analysis is conducted by four types of analysts: management, equity investors, long-term creditors and short-term creditors. You are required to (a) explain each type of ratio, (b) explain the emphasis of each type of analyst, (c) state if the same basic approach to financial analysis should be taken by each group of analysts.

RQ.4.2 What is the importance of ratio analysis? Briefly discuss the importance of the following accounting ratios:
(a) Liquidity ratio, (b) Debt-equity ratio, (c) Stock-turnover rate, and (d) Ratio of debtors to turnover.

RQ.4.3 What procedure would you adopt to study the liquidity of a business firm?

RQ.4.4 How would you analyse the financial position of a company from the point of view of (a) an investor, (b) a creditor, and (c) a financial executive of the company?

RQ.4.5 Discuss the importance of ratio analysis for inter-firm and intra-firm comparisons, including circumstances responsible for its limitations. If any.

RQ.4.6 Distinguish between percentage analysis and ratio analysis relating to the interpretation of financial statements. What is the value of these two types of analysis?

RQ.4.7 How does the acid-test ratio differ from the current ratio? How are they similar? What is the usefulness of the defensive interval ratio?

RQ.4.8 What is the relationship of the assets turnover rate to the rate of return on total assets?

RQ.4.9 Two companies have the same amount of working capital. The current debt paying ability of one company is much weaker than that of the other. Explain how this could occur.

RQ.4.10 (a) Discuss some inherent limitations of single-year financial statements for purposes of analysis and interpretation.
(b) To what extent are these limitations overcome by the use of comparative statements?

RQ.4.11 What is indicated when the average age of accounts receivable for a firm is 45 days, but credit terms require customers to pay accounts within 30 days?

RQ.4.12 What are the limitations of financial ratios as a technique for appraising the financial position of a company?

RQ.4.13 'A uniform system of accounts, including identical forms for balance sheets and income statements is a prerequisite of inter-firm comparisons.' Elucidate.

RQ.4.14 Selected statistics for Best Ltd for 3 years are given below.

	Year 1	*Year 2*	*Year 3*
Gross profit (per cent)	36	33.33	30
Stock turnover (times)	20	25	14
Average stock (Rs)	38,400	36,000	70,000
Average debtors (Rs)	87,500	1,68,750	2,00,000
Income tax rate	50	50	50
Net income after tax as per cent of sales	6	7	12
Maximum credit period allowed to customers (days)	60	60	30

You are required to:

(i) prepare a statement of profits in comparative form of all the 3 years; and

(ii) evaluate the position of the company regarding profitability and liquidity on the basis of information supplied to you.

(iii) What additional information will you require to evaluate fully the position of the company on the liquidity front?

SOLUTION

(i) *Statement of profit of Best Ltd, for the years 1-3*

Particulars	*Year 1*	*Year 2*	*Year 3*
Sales	Rs 12,00,000	Rs 13,50,000	Rs 14,00,000
Less cost of goods sold	7,68,000	9,00,000	9,80,000
Gross profit	4,32,000	4,50,000	4,20,000
Less operating expenses	2,88,000	2,61,000	84,000
Profit before taxes	1,44,000	1,89,000	3,36,000
Less taxes	72,000	94,500	1,68,000
Net profit	72,000	94,500	1,68,000

Working Notes (for year 3)

Cost of goods sold = Stock turnover × Average stock

Rs 9,80,000 = 14 × Rs 70,000 = (Rs 9,80,000 × 100)/70 = Rs 14,00,000

Net income = 0.12 × Rs 14,00,000 = Rs 1,68,000

Net income before tax would be 24 per cent of sales, as income tax rate is 50 per cent, that is = 0.24 × Rs 14,00,000 = Rs 3,36,000.

Likewise, the figures for year 1 and year 2 have been determined.

(ii) The firm's profitability is consistently improving. Its liquidity position, judged in terms of debtors and stock turnover ratios, can be said to be very satisfactory - the stock turnover ratio being as high as 20 times. The debtors ratios for 3 consecutive years are also very high.

For year 1 = Rs 12,00,000 ÷ Rs 87,500 = 13.7 times

2 13,50,000 1,68,750 = 8

3 14,00,000 2,00,000 = 7

(iii) The amounts of current liabilities and current assets, other than debtors and stock, are required to evaluate the position of the company on the liquidity front.

RQ.4.15 The following is the summary of the financial ratios of a company relating to its liquidity position:

	Year 1	*Year 2*	*Year 3*
Current ratio	2	2.13	2.28
Acid test ratio	1.20	1.10	0.90
Debtors turnover	10	8	7
Stock turnover	6	5	4

The current ratio is increasing, while the acid-test ratio is decreasing. Explain the contributing factor(s) for this apparently divergent trend.

SOLUTION

The contributing factor for the divergent trend is the accumulation of stocks with the company over the years. It is clearly manifested in the stock turnover ratio, which has come down from 6 times in year 1 to 4 times in year 3.

RQ.4.16 The information below is taken from the records of two companies in the same industry. The companies are X Ltd and Y Ltd; and the data is as follows:

	X Ltd	*Y Ltd*
Cash	Rs 2,10,000	Rs 3,20,000
Debtors (net)	3,30,000	6,30,000
Stock	12,30,000	9,50,000
Plant and equipment	16,95,000	24,00,000
Total assets	34,65,000	43,00,000
Sundry creditors	9,00,000	10,50,000
8% Debentures	5,00,000	10,00,000
Equity share capital	11,00,000	17,50,000
Retained earnings	9,65,000	5,00,000
Total liabilities	34,65,000	43,00,000
Sales	56,00,000	82,00,000
Cost of goods sold	40,00,000	64,80,000
Other operating expenses	8,00,000	8,60,000
Interest expenses	40,000	80,000
Income taxes	2,66,000	2,73,000
Dividends	1,00,000	1,80,000

Answer each of the following questions by making a comparison of one, or more, relevant ratios.

(i) Which company is using the equity shareholders' money more profitably?

(ii) Which company is better able to meet its current debts?

(iii) If you were to purchase the debentures of one company, which company's debentures would you buy?

(iv) Which company collects its receivables faster, assuming all sales to be credit sales?

(v) Which company is extended credit for a longer period by the creditors, assuming all purchases (equivalent to cost of goods sold) to be credit purchases?

(vi) How long does it take each company to convert an investment in stock to cash?

(vii) Which company retains the larger proportion of income in the business?

SOLUTION

(i) *Rate of return (ROR) on shareholders' funds*

= (Rs 4,94,000*/Rs 20,65,000**) × 100 = 23.9 per cent (X Ltd)

= (Rs 5,07,000**/Rs 22,50,000) × 100 = 22.5 per cent (Y Ltd)

X Ltd is using the shareholders' money more profitably.

(ii) (a) *Current ratio* = Rs 17,70,000/Rs 9,00,000 = 1.97 (X), Rs 19,00,000/ Rs 10,50,000 = 1.81 (Y)

(b) *Acid test ratio* = Rs 5,40,000/Rs 9,00,000 = 0.6 (X), Rs 9,50,000/ Rs 10,50,000 = 0.9 (Y)

Y Ltd is better able to meet its current debts.

(iii) (a) *Debt-equity ratio* = Rs 14,00,000/Rs 20,65,000 = 0.68 (X), Rs 20,50,000/ Rs 22,50,000 = 0.91 (Y)

(b) *Interest coverage ratio* = Rs 8,00,000/Rs 40,000 = 20 times (X), Rs 8,60,000/ Rs 80,000 = 10.75 times (Y)

The debentures of X Ltd should be bought.

(iv) *Debtors collection period* = (360 × Rs 3,30,000)/Rs 56,00,000 = 21 days (X Ltd), (360 × Rs 6,30,000)/ Rs 82,00,000 = 28 days (Y Ltd)

X Ltd collects its receivables faster.

(v) *Creditors payment period* = (360 × Rs 9,00,000)/Rs 40,00,000 = 81 days (X Ltd), (360 × Rs 10,50,000)/ Rs 64,80,000 = 58 days (Y Ltd)

X Ltd is extended credit for a longer period by the creditors.

(vi) *Stock turnover ratio* = Rs 40,00,000/Rs 12,30,000 = 3.25 times (X), Rs 64,80,000/Rs 9,50,000 = 6.82 times (Y)

= 360 days/3.25 = 111 days (X), 360 days/6.82 = 53 days (Y)

Length of time required for conversion of investment in stock to cash:

111 days + 21 days = 132 days (X)

53 days + 28 days = 81 days (Y)

(vii) *Dividend payout ratio* = Rs 1,00,000/Rs 4,94,000 = 20.2 per cent (X), Rs 1,80,000/Rs 5,07,000 = 35.5 per cent (Y)

Retention ratio = 100 – 20.2 = 79.8 per cent (X), 100 – 35.5 = 64.5 per cent (Y)

X Ltd retains the larger proportion of its income in the business

* Rs 56,00,000 – Rs 51,06,000

** Rs 82,00,000 – Rs 76,93,000

RQ.4.17 The following information was taken from the financial statements of XYZ Ltd *(amount in thousand of rupees)*

Particulars	*Year 1*	*Year 2*	*Year 3*
Total assets	750	850	860
Credit sales	420	520	550
Cost of goods sold	450	595	645
Cash 50	60	55	
Debtors	150	165	180
Inventory	130	160	170
Net fixed assets	120	260	250
Creditors	75	85	100
Short-term debt	125	175	170
Long-term debt	125	185	175
Equity 125	200	210	

Calculate those ratios which indicate the efficient use of assets and discuss potential sources of trouble.

SOLUTION

The efficient use of assets is indicated by the following key ratios: (a) Current assets turnover, (b) Debtors' turnover, (c) Inventory turnover, (d) Fixed assets turnover, and (e) Total assets turnover.

Computation or ratios

	Year 1	*Year 2*	*Year 3*
(a) Current assets turnover ratio (cost of goods sold ÷ total current assets)	1.36	1.55	1.59
(b) Debtors' turnover (credit sales ÷ average debtors)	2.8*	3.30	3.19
(c) Inventory turnover (cost of goods sold ÷ average inventory)	3.46*	4.10	3.91
(d) Fixed assets turnover (cost of goods sold ÷ fixed assets)	3.75	2.29	2.58
(e) Total assets turnover (cost of goods sold ÷ total assets)	1.00	0.92	0.98

*Based on debtors and inventory at the end, as their opening balances are not available.

Comments: The first three ratios indicate the efficiency of current assets usage, and the latter two, namely, fixed assets turnover and total assets turnover ratio, show the efficacy of utilisation of these. Current assets utilisation appears to be very satisfactory as reflected in the first three types of ratios. No major change is noticeable in their values over a period of time, which is presumably indicative of consistency in debtors collection period and inventory turnover. There does not seem to be any significant problem regarding utilisation of current assets.

However, it appears that fixed assets are not being fully utilised. Investments in fixed assets have more than doubled during years 2 and 3. The fixed assets turnover ratio has sharply fallen to 2.58 in year 3 from 3.75 in year 1. Thus, investments in fixed assets are either excessive, or the capacity of the additional plant is under-utilised. This is corroborated by the fact that sales in the latter 2 years have increased by around 15 per cent. Therefore, the remedy lies in utilising the plant capacity by increasing production and sales.

RQ.4.18 Given the following information for ABC Ltd at the end of the current year, determine (i) balances for the income statement and (ii) the balance sheet.

Net sales	Rs 1,00,000
Debtors' turnover ratio (based on net sales)	2
Inventory turnover ratio	1.25
Fixed assets turnover ratio	0.8
Debt assets ratio	0.6
Net profit margin	0.065
Gross profit margin	0.250
Return on investment	0.025

Income statement for the year ending on March 31

Sales	Rs 1,00,000
Cost of goods sold	...
Gross profit	...
Other expenses	...
Earnings before tax	...
Taxes (0.35)	...
Earnings after tax	...

Balance sheet as on March 31

Liabilities	*Amount*	*Assets*	*Amount*
Equity	...	Net fixed assets	...
Long-term debt	...	Inventory	...
Short-term debt	Rs 50,000	Debtors	...
		Cash	...
Total	...	Total	...

SOLUTION

(i) *Income statement for the current year ending March 31*

Sales	Rs 1,00,000
Cost of goods sold (0.75 or 1.00 – 0.25, gross profit margin)	75,000
Gross profit	25,000
Other expenses	15,000 *
Earnings before tax	10,000
Taxes (0.35)	3,500
Earnings after tax	6,500 *

Working Notes

*Earnings after tax = Net profit margin (0.065 × Rs 1,00,000) = Rs 6,500. Hence, earnings before tax must be Rs 6,500 ÷ (1 – tax factor) = Rs 6,500 ÷ 0.65 = Rs 10,000. Therefore, other expenses would be = Rs 15,000 (Gross profit, Rs 25,000 – Earnings before tax, Rs 10,000).

(ii) *Balance sheet as on March 31*

Liabilities	*Amount*	*Assets*	*Amount*
Equity	Rs 1,00,000	Net fixed assets	Rs 93,750
Long-term debt	1,00,000	Inventory	60,000
Short-term debt	50,000	Debtors	50,000
		Cash (balancing figure)	46,250
	2,50,000		2,50,000

Working Notes

1 Debtors = Net sales/Debtors' turnover ratio = Rs 1,00,000/2 = Rs 50,000.

2 Inventory = Cost of goods sold/Inventory turnover ratio = Rs 75,000/1.25 = Rs 60,000.

3 Net fixed assets (based on cost of goods sold) = Cost of goods sold/Fixed assets turnover = Rs 75,000/0.8 = Rs 93,750.

4 Return on investment = [Net profit after taxes/Total investment (assets)] × 100

Total investment = (Rs 6,250/2.5) × 100 = Rs 2,50,000.

5 Debt/Asset ratio = 0.6, Debt = 0.6 × Rs 2,50,000 = Rs 1,50,000.

6 Total investment – Total debt = Equity = Rs 2,50,000 – Rs 1,50,000 = Rs 1,00,000.

7 Long-term debt = Total debt – Short-term debt = Rs 1,50,000 – Rs 50,000 = Rs 1,00,000.

RQ.4.19 You have been supplied data for Royal Plastic Company Ltd and its industry averages. (i) Determine the indicated ratios for the company; (ii) Indicate its strengths and weaknesses in terms of liquidity, solvency and profitability as revealed by your analysis.

Balance sheet as on March 31

Liabilities		*Assets*	
Equity share capital	Rs 1,00,000	Plant and equipment	Rs 1,51,000
10% Preference share capital	40,000	Cash	12,300
Retained earnings	27,400	Debtors	36,000
Long-term debt	34,000	Stock	60,800
Sundry creditors	31,500		
Outstanding expenses	1,200		
Other current liabilities	26,000		
	2,60,100		2,60,100

Statement of profit for the year ending March 31

Sales (net)		Rs 2,25,000
Less: cost of goods sold	Rs 1,52,500	
selling expenses	29,500	
administrative expenses	14,800	
research and development	6,500	
interest	2,900	2,06,200
Earnings before taxes		18,800
Less income taxes (0.35)		6,580
Net income		12,220
Dividends paid to equityholders		5,000

Financial ratios of industry

(a) Current ratio	2.2
(b) Stock turnover (times)	2.8
(c) Collection period (days)	56
(d) Total debt/Shareholders' equity	0.45
(e) Fixed charge coverage before tax (times)	10
(f) Turnover of assets (times)	1.35
(g) Income before tax/Sales	0.119
(h) Rate of return on equity funds	0.15

SOLUTION

(i) (a) Current ratio = Rs 1,09,100/Rs 58,700 = 1.86
(b) Stock turnover = Rs 1,52,500/Rs 60,800 = 2.51 times
(c) Collection period = (360 × Rs 36,000)/Rs 2,25,000 = 58 days
(d) Total debt/Shareholders' equity = (Rs 92,700/Rs 1,67,400) × 100 = 55 per cent.
(e) Fixed charge cover before tax = EBIT/Interest + Dividend on preference shares = Rs 21,700/Rs 6,900 = 3.14 times.
(f) Turnover of assets = Rs 1,52,500/Rs 2,60,100 = 0.59 times
(g) Income before tax/Sales = (Rs 18,800/Rs 2,25,100) × 100 = 8.36 per cent.
(h) Rate of return on shareholders' equity = (Rs 12,220/Rs 1,27,400) × 100 = 9.6 per cent.

(ii)

Financial ratios	*Industry*	*Company*
(a) Current ratio	2.2	1.86
(b) Stock turnover (times)	2.8	2.51
(c) Collection period (days)	56	58
(d) Total debt/Shareholders' equity	0.45	0.55
(e) Fixed charge coverage before tax (times)	10	3.14
(f) Turnover assets (times)	1.35	0.59
(g) Income before tax/Sales	0.119	0.0836
(h) Rate of return on equity funds	0.15	0.096

The financial position of Royal Plastics Ltd *vis-a-vis* industry is weaker both in terms of profitability and solvency. It is indicated by lower profitability ratios (g and h). The higher debt-equity ratio and lower fixed charge coverage before tax are indicative of weakness from the point of view of its solvency. Its liquidity position also does not seem to be very satisfactory. The acid test ratio is likely to be much below one as stock turnover ratio is very low.

RQ.4.20 Given below are the selected ratios for two companies, A and B, in the same industry, along with industry average:

Ratio	*A*	*B*	*Industry*
Current ratio (%)	221	561	241
Acid test ratio (%)	121	301	131
Debt to assets ratio (%)	36	5	35
Operating expenses ratio (%)	18	17.5	20
Number of times interest paid	6	12	5
Stock turnover	8.5	6.5	7
Debtors turnover	11	15	11.4
Rate of return on total assets (%)	17	10	13

Can we say, on the basis of the above ratios and information, that B is better than company A because its ratios are better in six out of eight areas (all except stock turnover and rate of return on total assets)? Company B is also better than the industry average in the same six categories.

SOLUTION

B need not necessarily be better than *A* only because its ratios are better in six out of eight areas for the following reasons:

(a) Profitability ratios of *A* are better than those of *B*. In fact, the rate of return on total assets of *B* is lower than that of the industry.

(b) Liquidity ratios of *B* cannot be considered to be better than those of *A*, merely on the ground that they are very high. In fact, these ratios reflect the excessive investment of the former in current assets, depressing its rate of return. After all, working capital investment involves cost. This is true particularly in the case of stock. Low stock turnover ratio reflects excessive investment in stock.

(c) Low debt-asset ratio and, consequently, higher interest coverage ratio may be indicative of *B* not availing of debt for enhancing the rate of return to the equityholders.

(d) Higher debtors' turnover ratio of *B* may be indicative of its rigorous credit sales as well as rigorous credit collection policy leading to low credit sales, eventually leading to low profits. The low operating ratio certainly goes to the credit of *B*.

RQ.4.21 Given below are selected ratios (percentages) for three years ending March 31 for Worst Ltd.

Ratio	*Year 1*	*Year 2*	*Year 3*
Current ratio	200	500	150
Acid test ratio	110	320	80
Debt-equity ratio	15	40	55
Operating expenses ratio	24	25	32
Number of times interest earned	6	6	(1)
Stock turnover (times)	5	4	3
Debtors' turnover (times)	12	10	6
Rate of return on total assets	15	10	5

Outline the possible explanations for the drastic changes in some of the ratios from year 1 to year 2 and 2 to 3.

SOLUTION

The company has made additional borrowings through the issue of debentures or by taking long-term loans in year 2, entailing an increase in the debt-equity ratio from 15 to 40 per cent in year 2. The amounts so obtained could have been invested either in stock, or remained in the form of idle cash balance with the company. This is likely to have resulted in higher current ratio, higher acid-test ratio, higher debt-equity ratio and low stock turnover. As a possible consequence, the rate of return on total assets has declined from 15 in year 1 to 10 per cent in year 2.

In year 3, the situation appears to have become worse. The reasons may be: (a) high operating expenses ratio not being matched by increase in sales price; (b) excessive interest cost due to large amount of borrowings; (c) higher inventory cost; (d) liberal grant of credit, as revealed by lower debtors' turnover ratio, resulting in bad debts.

RQ.4.22 From the following details, prepare a statement of proprietory funds with as many details as possible.

(a) Stock velocity turnover	6
(b) Capital turnover ratio	2
(c) Fixed assets turnover ratio	4
(d) Gross profit turnover ratio	0.20
(e) Debtor velocity (months)	2
(f) Creditors velocity (days)	73

The gross profit was Rs 60,000; reserves and surplus amounted to Rs 20,000; closing stock was Rs 5,000 in excess of opening stock.

SOLUTION

Statement of proprietory funds

Fixed assets		Rs 60,000
Net working capital:		
Current assets:		
Stock	Rs 42,500	
Debtors	50,000	
Cash	16,500	
	1,09,000	
Less Current liabilities	49,000	60,000
Proprietory funds		1,20,000
Share capital		1,00,000
Reserves and surplus		20,000

Working Notes

0.20 = (Gross profit/Sales) × 100 = Sales = (Rs 60,000 × 100)/20 = Rs 3,00,000

Cost of goods sold = Sales – Gross profit = Rs 3,00,000 – 60,000 = Rs 2,40,000

Average stock = Rs 2,40,000/6 = Rs 40,000

Opening stock + Closing stock = Rs 80,000

Closing stock – Opening stock = Rs 5,000

Closing stock = Rs 42,500

Debtors = Rs 3,00,000/6((12 ÷ 2 months) = Rs 50,000

Fixed assets = Rs 2,40,000 ÷ 4 = Rs 60,000

Creditors = Credit purchases/Creditors turnover = Rs 2,45,000/5 = Rs 49,000

Capital = Rs 2,40,000 ÷ 2 = Rs 1,20,000

Reserves and surplus = Rs 20,000

Share capital = Rs 1,00,000 (Rs 1,20,000 – Rs 20,000)

Net working capital = Rs 1,20,000 – Rs 60,000 = Rs 60,000

Stock + Debtors + Cash – Creditors = Rs 60,000

Rs 42,500 + Rs 50,000 + Cash – Rs 49,000 = Rs 60,000

Cash = Rs 16,500

RQ.4.23 Hypothetical Industries Ltd (HIL) has submitted the following projections. (Rs lakh) You are required to determine yearly debt service coverage ratio (DSCR) and the average DSCR and comment.

Year	*EAT*	*Interest on loan*	*Repayment of term loan*
1	20	19	11
2	35	17	18
3	40	15	18
4	20	12	18
5	18	10	18
6	18	7	8
7	16	5	8
8	16	2	8

The net profit (EAT) has been arrived at after charging depreciation of Rs 20 lakh every year.

SOLUTION

Determination of debt service coverage ratio (amount in lakh of rupees)

Year	*EAT*	*Depreciation*	*Interest*	*Cash available (Col. 2 + 3 + 4)*	*Principal instalment*	*Debt obligations*	*DSCR (Col. 5 ÷ Col. 7)*
1	2	3	4	5	6	7	8
1	20	20	19	59	11	30	1.97
2	35	20	17	72	18	35	2.06
3	40	20	15	75	18	33	2.27
4	20	20	12	52	18	30	1.73
5	18	20	10	48	18	28	1.71
6	18	20	7	45	8	15	3.00
7	16	20	5	41	8	13	3.15
8	16	20	2	38	8	10	3.80
Average DSCR (ΣDSCR/8) = 19.69/8 =							2.46

Comment: The DSCR of HIL is very satisfactory.

RQ.4.24 From the following information of a textile company, complete the proforma balance sheet if its sales are Rs 32,00,000.

Sales to net worth (times)	2.3
Current debt to net worth (%)	42
Total debt to net worth (%)	75
Current ratio (times)	2.9
Net sales to inventory (times)	4.7
Average collection period (days)	64
Fixed assets to net worth (%)	53.2

Proforma balance sheet

Net worth	...	Fixed assets	...
Long-term debt	...	Cash	...
Current debt	...	Stock	...
		Sundry debtors	...
	...		...

SOLUTION

Proforma balance sheet of the textile company

Liabilities	*Amount*	*Assets*	*Amount*
Net worth	Rs 13,91,304	Fixed assets	Rs 7,40,173
Long-term debt	4,59,130	Cash	4,44,869
Current debt	5,84,348	Stock	6,80,851
		Sundry debtors	5,68,889
	24,34,782		24,34,782

Working Notes

1 Net worth = Rs 32,00,000 ÷ 2.3 = Rs 13,91,304

2 Current debt = (Rs 13,91,304/100) × 42 = Rs 5,84,348

3 Total debt = (Rs 13,91,304/100) × 75 = Rs 10,43,478

4 Long-term debt = Rs 10,43,478 – Rs 5,84,348 = Rs 4,59,130

5 Fixed assets = (Rs 13,91,304/1,000) × 532 = Rs 7,40,173

6 Current assets = Rs 5,84,348 × 2.9 = Rs 16,94,609

7 Inventory = Rs 32,00,000 ÷ 4.7 = Rs 6,80,851

8 Debtors = (Rs 32,00,000/360) × 64 = Rs 5,68,889

9 Cash = Rs 16,94,609 – (Rs 6,80,851 + Rs 5,68,889) = Rs 4,44,869

RQ.4.25 Given below are summarised accounts of Alok Ltd for the years 1 and 2.

Balance sheet (Rs in lakh)

		Year 1		*Year 2*
Liabilities:				
Share capital		250		250
General reserves		100		172
Debentures		180		150
Term loan		30		30
Creditors		70		56
		630		658
Assets:				
Fixed assets (at cost)	500		500	
Less accumulated depreciation	80		115	
Net fixed assets		420		385
Cash		55		85
Debtors		65		75
Inventories		90		113
		630		658

Income statement (Rs in lakh)

	Year 1	*Year 2*
Net sales	350	450
Less cost of material	90	113
Less wages	70	70
Gross profit	190	267
Less selling, general and administrative costs	50	60
Earnings before depreciation, interest and tax	140	207
Less depreciation	30	35
Earnings before interest and tax	110	172
Less interest	25	27
Earnings before tax	85	145
Less tax	15	48
Earnings after tax	70	97
Less dividend	25	25
Retained earnings	45	72

Compute the (i) liquidity, (ii) leverage, (iii) activity and (iv) profitability ratios, and comment.

SOLUTION

Ratios	*Year 1*	*Year 2*
(i) *Liquidity Ratios*		
(a) Current ratio (CA ÷ CL)	$= \frac{\text{Rs } 210}{\text{Rs } 70} = 3$	$= \frac{\text{Rs } 273}{\text{Rs } 56} = 4.87$
(b) Acid test ratio (QA ÷ CL)	$= \frac{\text{Rs } 120}{\text{Rs } 70} = 1.71$	$= \frac{\text{Rs } 160}{\text{Rs } 56} = 2.86$

(*Contd.*)

(*Contd.*)

(ii) *Leverage Ratios*

(a) *Debt-equity ratios*

(1) $\frac{\text{Total debts}}{\text{Equity funds}} = \frac{\text{Rs } 280}{\text{Rs } 350} = 0.80 \quad \frac{\text{Rs } 236}{\text{Rs } 422} = 0.56$

(2) $\frac{\text{Long-term debts}}{\text{Equity funds}} = \frac{\text{Rs } 210}{\text{Rs } 350} = 0.60 \quad \frac{\text{Rs } 180}{\text{Rs } 422} = 0.43$

(b) *Interest coverage ratio*

EBIT/Interest charges $= \frac{\text{Rs } 110}{\text{Rs } 25} = 4.4 \text{ times} \quad \frac{\text{Rs } 172}{\text{Rs } 27} = 6.4 \text{ times}$

(iii) *Activity Ratios*

(a) Debtors' turnover $= \frac{\text{Rs } 350}{\text{Rs } 65} = 5.38 \text{ times} \quad \frac{\text{Rs } 450}{\text{Rs } 75} = 6 \text{ times}$

(asuming all sales as credit sales)

Credit collection period	67 days	60 days

(b) Stock turnover

$\frac{\text{Cost of goods sold}}{\text{Average stock}} = \frac{\text{Rs } 160}{\text{Rs } 90} = 1.78 \text{ times} \quad \frac{\text{Rs } 183}{\text{Rs } 113} = 1.62 \text{ times}$

(c) Fixed assets turnover

$\frac{\text{Cost of goods sold}}{\text{Fixed assets}} = \frac{\text{Rs } 160}{\text{Rs } 420} = 0.38 \text{ times} \quad \frac{\text{Rs } 183}{\text{Rs } 385} = 0.48 \text{ times}$

(d) Current assets turnover

$\frac{\text{Cost of goods sold}}{\text{Current assets}} = \frac{\text{Rs } 160}{\text{Rs } 210} = 0.76 \text{ times} \quad \frac{\text{Rs } 183}{\text{Rs } 273} = 0.67 \text{ times}$

(e) Total assets turnover

$\frac{\text{Cost of goods sold}}{\text{Total assets}} = \frac{\text{Rs } 160}{\text{Rs } 630} = 0.25 \text{ times} \quad \frac{\text{Rs } 183}{\text{Rs } 658} = 0.28 \text{ times}$

(iv) *Profitability Ratios*

(a) Gross profit ratio

(Gross profit ÷ Sales) × 100 $= \frac{\text{Rs } 190}{\text{Rs } 350} \times 100 = 54.3\% \quad \frac{\text{Rs } 267}{\text{Rs } 450} \times 100 = 59.3\%$

(b) Operating profit ratio

(Operating profit ÷ Sales) × 100 $= \frac{\text{Rs } 110}{\text{Rs } 350} \times 100 = 31.4\% \quad \frac{\text{Rs } 172}{\text{Rs } 450} \times 100 = 38.2\%$

(c) Net profit ratio

(Net profit ÷ Sales) × 100 $= \frac{\text{Rs } 70}{\text{Rs } 350} \times 100 = 20\% \quad \frac{\text{Rs } 97}{\text{Rs } 459} \times 100 = 21.5\%$

(d) Return on total assets

(Net profit ÷ Total assets) × 100 $= \frac{\text{Rs } 95}{\text{Rs } 630} \times 100 = 15.1\% \quad \frac{\text{Rs } 124}{\text{Rs } 658} \times 100 = 18.8\%$

(*Contd.*)

(*Contd.*)

(e) Return on capital employed

$$\frac{\text{Net profit after tax + interest}}{\text{Total capital employed}} \times 100 = \frac{\text{Rs } 95}{\text{Rs } 560} \times 100 = 16.9\% \quad \frac{\text{Rs } 124}{\text{Rs } 602} \times 100 = 20.6\%$$

(f) Return on owner's funds

$$\frac{\text{Net profit after tax}}{\text{Equity funds}} \times 100 = \frac{\text{Rs } 70}{\text{Rs } 350} \times 100 = 20\% \quad \frac{\text{Rs } 97}{\text{Rs } 422} \times 100 = 23\%$$

The company's position is quite sound from the point of view of liquidity, solvency and profitability. However, its activity ratios, particularly in terms of utilisation of fixed assets and stock, do not seem to be very satisfactory. The firm has excess liquidity than desired.

RQ.4.26 In connection with a proposal to secure additional finance for meeting its expansion as well as the working capital requirements, the following figures have been projected to a bank by a borrower. The figures have been adjusted for borrowal, debt redemption and interest payments.

Year		*1*	*2*	*3*	*4*	*5*	*6*	*7*
Current ratio	Borrower	2.0	2.0	2.5	2.2	2.0	2.5	2.0
	Industry's average	1.8	1.8	2.0	2.0	2.5	2.5	2.5
Debt equity ratio	Borrower	1.8	1.8	1.6	1.6	1.5	1.5	1.2
	Industry's average	1.5	1.5	1.8	1.8	1.8	1.6	1.8
Return on investment	Borrower	20	20	18	18	15	15	18
	Industry's average	18	18	20	20	18	18	18

You are required to ascertain the trend (base year = 1) and interpret the result. Kindly indicate how the bank would react to the proposal of financing put forward by the borrower.

SOLUTION

Trend statement (base = year 1)

Year	*Current ratio*		*Debt equity ratio*		*Return on investment*	
	Borrower	*Industry*	*Borrower*	*Industry*	*Borrower*	*Industry*
1	100	100	100	100	100	100
2	100	100	100	100	100	100
3	125	111	89	120	90	111
4	110	111	89	120	90	111
5	100	139	83	120	75	100
6	125	139	83	107	75	100
7	100	139	67	120	90	100

Interpretation

(i) *Current ratio*: While the projected industry trend is steadily upward (from 100 in base year 1 to 111 in years 3-4 and to 139 in years 5-7), it is likely to witness a fluctuating trend in the case of the borrower. In spite of oscillating position, however, the borrower's current ratio are not likely to decrease below 2:1. The borrower is not likely to encounter any major problems in meeting his short-term debt obligations.

(ii) *Debt-equity (D/E) ratio*: The D/E ratio of the borrower is likely to decrease at a steady pace by one-third over the projected 6-year period. In absolute terms also, D/E ratio of 1.5 or 1.2:1 is satisfactory. In contrast, the industry's D/E ratio is marked by an upward trend. The long-term solvency position of the borrower is stronger *vis-a-vis* industry. The margin of safety to the bank seems to be adequate.

(iii) *Return on investment (ROI)*: As per the projected trend, the industry figures appear to be better. The ROI is the lowest in years 5 and 6 (15 per cent) and is the highest in years 1 and 2 in the case of the borrower. In contrast, it is maximum (20 per cent) for the industry in years 3-4 and 18 per cent in all other years. The only positive feature for the borrower is that while industry trend reflects decline from year 4 onwards, it is upward for the former from year 7.

Thus, as the current ratios of the borrower are satisfactory in spite of decline, it is safe for the bank to lend for working capital requirements of the borrower. In the case of long-term (expansion) requirements, the bank can seek additional data to determine debt-service coverage ratio, (more appropriate measure), as the projected D/E ratios are satisfactory.

EXAMINATION QUESTIONS

EQ. 4.1 Discuss the impact of financial leverage on shareholders wealth by using return-on-assets (ROA) and return-on-equity (ROE) analytic framework. (*CA—May, 2003*)

EQ. 4.2 Discuss the Return on Assets (ROA) and Return on Equity (ROE) by bringing out clearly the impact of financial leverage. (*CA—May, 2004*)

EQ. 4.3 Explain the 'Ageing Schedule' in the context of monitoring of receivables. (*CA—November, 2004*)

EQ. 4.4 Discuss any three ratios computed for investment analysis. (*CA—November, 2004*)

EQ. 4.5 Discuss the financial ratios for evaluating company performance on operating efficiency and liquidity position aspects. (*CA—November, 2006*)

EQ. 4.6 Explain the need of debt-service coverage ratio. (*CA(PCE)—May, 2007*)

EQ. 4.7 Diagrammatically present the Du-pont chart to calculate return on equity. (*CA(PCE)—May, 2007*)

EQ. 4.8 From the following information, prepare a summarized balance sheet as at 31st March, 2002:

Working capital	Rs 2,40,000
Bank overdraft	40,000
Fixed assets to proprietary ratio	0.75
Reserves and surplus	1,60,000
Current ratio	2.5
Liquid ratio	1.5

(*CA—November, 2002*)

SOLUTION

Balance sheet as at 31st March 2002

Liabilities	*Amount*	*Assets*		*Amount*
Capital	8,00,000	Fixed assets		Rs 7,20,000
Reserves and surplus	1,60,000	Current assets:		
Sundry creditors	1,20,000	Stock	Rs 1,60,000	
Bank overdraft	40,000	Other CAs	2,40,000	4,00,000
	11,20,000			11,20,000

Working Notes

1. Current ratio of 2.5 implies that CAs are 2.5 times CL i.e., CA – 2.5CL = 0
   Further, working capital i.e., CA – CL = Rs 2,40,000
   Or 1.5 CL = 2,40,000. Therefore, CL = Rs 2,40,000/1.5 = Rs 1,60,000 and CA = 2.5 × Rs 1,60,000 = Rs 4,00,000

2. Liquid ratio = (CA – Stock)/CL
   1.5 = (Rs 4,00,000 – Stock)/Rs 1,60,000
   Or = Rs 2,40,000 = Rs 4,00,000- Stock or Stock = Rs 1,60,000
3. Fixed assets to proprietary ratio of 0.75 implies that fixed assets are 75 per cent of owners funds. In other words, working capital (net) is 25 per cent of owners funds. Therefore, owners/proprietary funds are Rs 2,40,000/0.25 = Rs 9,60,000
   Fixed assets = 0.75 × Rs 9,60,000 = Rs 7,20,000
4. Capital = Owners funds Rs 9,60,000 – Reserves and surplus Rs 1,60,000 = Rs 8,00,000
5. Sundry creditors = Total CL – Bank overdraft
   = Rs 1,60,000 – Rs 40,000 = Rs 1,20,000

EQ. 4.9 The financial statement of Excel AMP Graphics Limited are as under:

Balance sheet as at 31st December, 2001 *(Rs in crore)*

Sources of funds:	*2001*		*2000*
Shareholders' funds			
Share capital	Rs 1,121		Rs 931
Reserves and surplus	8,950	Rs 10,071	7,999
			8,930
Loan funds:			
Secured loans	—		259
Finance lease obligations	74		—
Unsecured loans	171	245	115
			374
		10,316	9,304
Application of funds:			
Fixed assets			
Gross block	6,667		5,747
Less: Depreciation	3,150		2,561
Net block	3,517		3,186
Capital work-in-progress	27	3,544	28
			3,214
Investments		288	222
Current assets, loans and advances:			
Inventories	2,709		2,540
Sundry debtors	9,468		9,428
Cash and bank balances	3,206		662
Loans and advances	2,043		1,712
	17,426		14,342
Less: Current liabilities and provisions:			
Current liabilities	10,109		7,902
Provisions	513		572
	10,622		8,474
Net current assets		6,804	5,868
Net deferred tax liability		(320)	—
		10,316	9,304

Profit and loss account for the year ended 31 December, 2001 *(Rs in crore)*

		2001		*2000*
Income:				
Sales and services			23,436	17,849
Other income			320	306
			23,756	18,155
Expenditure:				
Cost of materials		15,179		10,996
Personnel expenses		2,543		2,293
Other expenses		3,546		2,815
Depreciation	419		383	
Less: Transfer from revaluation reserve	7	412	6	377
Interest		164		88
			21,844	16,569
Profit before tax			1,912	1,586
Provision for tax:				
Current tax			450	371
Deferred tax			(6)	—
Profit after tax			1,468	1,215

Required:

(i) Compute and analyse the return on capital employed (ROCE) in a Du-Pont control chart framework. (ii) Compute and analyse the average inventory holding period and average collection period. (iii) Compute and analyse the return on equity (ROE) by bringing out clearly the impact of financial leverage. (*CA—November, 2003*)

SOLUTION

(i) *Determination of return on capital employed (ROCE) as per Du-Pont chart* *(Amount in Rs crore)*

Particulars	*2001*	*2000*
(a) Determination of EBIT:		
Profit before tax	Rs 1,912	Rs 1,586
Add back interest	164	88
Less other incomes	(320)	(306)
Earnings before interest and taxes (EBIT)	1,756	1,368
(b) Determination of capital employed		
Shareholders funds	10,071	8,930
Add loan funds	245	374
Less capital work-in-progress	(27)	(28)
Less investments	(288)	(222)
Less loans and advances	(2,043)	(1,712)
Capital employed in business	7,958	7,342
(c) Sales and services (operating revenues)	23,436	17,849
(d) EBIT/sales (%)	7.49	7.66
(e) Sales/capital employed (times)	2.945	2.431
(f) ROC/= (d × e) (%)	22.06	18.62

(ii) *Computation of average inventory holding period and average collection period* *(Amount in Rs crore)*

Particulars	*2001*	*2000*
Cost of materials used during the year	Rs 15,179	Rs 10,996
Inventories at year-end	2,709	2,540
Average inventory holding period (365 days × Closing inventory)/ Cost of materials used (days)	65	84
Sales and services (assumed to be on credit)	23,436	17,849
Debtors at year-end	9,468	9,428
Average collection period (365 days × Closing debtors)/ Credit sales (days)	147	193

Analysis: It is a matter of satisfaction for the firm that there has been a decrease in inventory holding period as well as debtors collection period in year 2001 *vis-à-vis* year 2000. There seems to be potentials of further reduction in debtors collection period. Debtors collection period of nearly 5 months (in 2001) *per-se* is high still.

(iii) *Return on equity and impact of financial leverage* *(Amount in Rs crore)*

Particulars	*2001*	*2000*
(a) Return on equity:		
Profit after tax (EAT)	Rs 1,468	Rs 1,215
Shareholders funds (SHF)	10,071	8,930
ROR on equity (EAT/SHF) × 100 (%)	14.58	13.61
(b) Return on capital employed (post-tax basis) (%)		
ROCE (before tax)	22.06	18.62
Tax rate	35	35
ROCE	14.34	12.1
(c) Debt funds to total funds:		
Loan funds	245	374
Total funds	10,316	9,304
Share of loan funds to total funds (%)	2.37	4.02

Analysis: The return on equity is marginally higher than the return on total assets/capital employed. The reason is loan funds constitute a meager portion of total funds. In other words, the impact of financial leverage (use of debt to magnify the ROE) is negligible.

EQ. 4.10 With the help of the following information complete the balance sheet of MNOP Ltd.:

Equity share capital	Rs 1,00,000
The relevant ratios of the company are as follows:	
Current debt to total debt	0.40
Total debt to owner's equity	0.60
Fixed assets to owner's equity	0.60
Total assets turnover	2 times
Inventory turnover	8 times

(*CA—May, 2005*)

SOLUTION

Balance sheet of MNOP Limited as at…

Liabilities		*Amount*	*Assets*		*Amount*
Equity share capital		Rs 1,00,000	Fixed assets		Rs 60,000
Current/short-term debt	Rs 24,000		Non-fixed assets:		
Long-term debt	36,000		Inventory	Rs 40,000	
Total debt		60,000	Other current assets	60,000	
			(balancing figure)		1,00,000
		1,60,000			1,60,000

Working Notes

1. Total debt to owner's equity of 0.6 implies that total debt (current plus long-term) is 60 per cent of equity funds (of Rs 1,00,000). Therefore, total debt is 0.60 × Rs 1,00,000 = Rs 60,000.
2. Current debt to total debt of 0.40 implies that current debt is 40 per cent of Rs 60,000. In other words, current/short-term debt is 0.4 × Rs 60,000 = Rs 24,000. Therefore, long-term debt (Rs 60,000 – Rs 24,000) = Rs 36,000.
3. Fixed assets to owner's equity of 0.6 implies that fixed assets are 60 per cent of owner's equity (i.e., Rs 1,00,000). Fixed assets are 0.60 × Rs 1,00,000 = Rs 60,000.
4. Total assets = Total liabilities (Rs 1,00,000 owner's equity + Rs 60,000 total debt) = Rs 1,60,000.
5. Non-fixed assets/current assets are Rs 1,60,000 total assets minus Rs 60,000 fixed assets = Rs 1,00,000.
6. Total assets turnover (Cost of goods sold/Total assets Rs 1,60,000) of 2 indicates that cost of goods sold is Rs 1,60,000 × 2 times = Rs 3,20,000.
7. Inventory turnover (Cost of goods sold, Rs 3,20,000/Inventory) of 8 times implies that inventory is Rs 3,20,000/8 = Rs 40,000.
8. Since total current assets are Rs 1,00,000, inventory is Rs 40,000, other current assets are Rs 1,00,000 minus Rs 40,000 = Rs 60,000.

EQ. 4.11 Using the following data, complete the balance sheet of a company as at March 31, current year.

Gross profits	Rs 54,000
Shareholders funds	Rs 6,00,000
Gross profit margin	20%
Credit sales to total sales	80%
Total assets turnover (based on sales)	0.3 times
Inventory turnover	4 times
Average collection period (a 360 days year)	20 days
Current ratio	1.8
Long-term debt as % of equity	40%

Balance sheet

Creditors	……	Cash	……
Long-term debt	……	Debtors	……
Shareholders' funds	……	Inventory	……
		Fixed assets	……

(*CA—November, 2005*)

SOLUTION

Balance sheet of a company as at March 31, current year

Liabilities	*Amount*	*Assets*	*Amount*
Creditors	Rs 60,000	Cash	Rs 42,000
Long-term debts	2,40,000	Debtors	12,000
Shareholders' funds	6,00,000	Inventory	54,000
		Fixed assets	7,92,000
	9,00,000		9,00,000

Working Notes

1. Total sales: Gross profit, Rs 54,000/Gross profit margin, 0.20 = Rs 2,70,000
2. Credit sales = 0.8 × Rs 2,70,000 = Rs 2,16,000
3. Debtors (Credit sales × 20 days)/360 = Rs 2,16,000/18 = Rs 12,000
4. Inventory = Cost of goods sold (Rs 2,70,000 – Rs 54,000)/Inventory turnover ratio, 4 = Rs 2,16,000/4 = Rs 54,000
5. Total assets turnover = Sales/Total assets
   Total assets = Sales Rs 2,70,000/Total assets turnover, 0.3 = Rs 9,00,000
6. Total liabilities = Total assets (Rs 9,00,000)
7. Long-term debt is 40% of equity = 0.4 × Rs 6,00,000 = Rs 2,40,000
8. Creditors = Total liabilities – Shareholders' funds – Long-term debt = Rs 9,00,000 – 6,00,000 – 2,40,000 = Rs 60,000
9. Current ratio of 1.8 implies that current assets are 1.8 times of current liabilities (creditors in the present context). Thus, CA = Rs 60,000 × 1.8 = Rs 1,08,000
10. Cash = Total current assets – Debtors – Inventory = Rs 1,08,000 – 12,000 – 54,000 = Rs 42,000
11. Fixed assets = Total assets – Current assets = Rs 9,00,000 – 1,08,000 = Rs 7,92,000.

EQ. 4.12 The income statement of the JKL Ltd for the current year ended March 31, 2008 is as follow: (Rs in Lakh)

	March 31, 2008	*March 31, 2007*
Sales	22,165	13,882
Less: Cost of goods sold	20,860	12,544
Gross profit	1,305	1,338
Less: Selling, general and administrative expenses	1,135	752
Earnings before Interest and Tax (EBIT)	170	586
Interest expense	113	105
Profits before tax	57	481
Tax (40%)	22.8	192.4
Profits after Tax (PAT)	34.2	288.6

Required:

(i) Calculate for the year 2007-08 (a) Inventory turnover ratio, (b) Financial Leverage, (c) Return on Investment (ROI), (d) Return on Enquity (ROE), and (e) Average Collection period.

(ii) Give a brief comment on the financial position of JKL Limited (*CA—May, 2006*)

SOLUTION

(i) Determination of select financial ratios of JKL Limited for 2007-8 (Amount in Rs lakh)

(a) Inventory turnover ratio = (Cost of goods sold/Average inventory)
Rs 20,860 lakh/(Rs 2,867 + 2,407) ÷ 2 = Rs 20,860/Rs 2,637 = 7.91 times

(b) Financial leverage = EBIT/(EBIT-I)
Rs 170/ Rs 57 = 2,982

(c) Return on investment (ROI) or (ROCE) = (EAT + Interest – Tax advantage on interest/Average capital employed or investments made) × 100
(Rs 34.2 + 113 – 45.2)/(Rs 5,947 + 4,555) ÷ 2 =. (Rs 102/Rs 5,251) × 100 =.1.94%

(d) Return on equity (ROE) = (EAT/Average equity funds) × 100
Rs 34.2/(Rs 2,377 + 1,472) ÷ 2 = (Rs 34.2/Rs 1,924.5) × 100 = 1.77 %

(e) Average collection period = (Average debtors × 365/credit sales
(Rs 1331.5 × 365)/Rs 22,165 (assumed all credit) = 22 days

(ii) *Financial position:* The company's financial postion is not satisfactory. It has alarmingly low rates of return both on capital employed and equity. The company has gone for expansion in 2007-8 (indicated by increase in equity funds, loan funds and fixed assets). While the expansion had augmented sales by 60%, sales did not contribute to higher profits. In fact, the gross profit amount as well as gross profit margin has declined and so the operating profits and net profit. As a result, the ROCE and ROE were low. There has been a substantial increase in operating expenses. There is a need to control operating expenses. Another disturbing aspect is that the company has very high debt-equity ratio (based on total external obligations) of 3.16. It is manifested in high degree of financial leverage also. However, the company has reasonably satisfactory liquidity ratios in terms of 1.5 current ratio, 46 days inventory holding period and 22 days debtors collection period.

EQ. 4.13 The following accounting information and financial ratios of PQR Ltd. relate to the current year ended 31st March:

I. Accounting information

Gross profit	15% of Sales
Net profit	8% of Sales
Raw materials consumed	20% of works cost
Direct wages	10% of works cost
Stock of raw materials	3 months' usage
Stock of finished goods	6% of works cost
Debtors collection period	60 days
All sales are on credit	

II. Financial Ratios:

Fixed assets to sales	1:3
Fixed assets to current assets	13:11
Current ratio	2:1
Long-term loans to current liabilities	2:1
Capital to reserves and surplus	1:4

If value of fixed assets as on 31st March, previous year amounted to Rs 26 lakh, prepare a summarised Profit and Loss Account of the company for the year ended 31st March and also the Balance Sheet as on 31st March.

(*CA(PE-II)—May, 2007*)

SOLUTION

Profit and loss account of PQR limited for the current year ended 31st March.

Particulars	*Dr. Amount*	*Particulars*	*Cr. Amount*
To Raw materials consumed	Rs 13,26,000	By sales	Rs 78,00,000
To Direct wages	6,63,000		
To Works/Factory overheads	46,41,000		
To Gross profit (78,00,000 × 0.15)	11,70,000		
	78,00,000		78,00,000
To Administrative and selling expenses	Rs 5,46,000	By Gross Profit	Rs 11,70,000
To Net Profit (Rs 78,00,000 × 0.08)	6,24,000		
	11,70,000		11,70,000

Balance sheet of PQR Limited as at March 31, current year

Liabilities	*Amount*	*Assets*	*Amount*
Share Capital	Rs 3,00,000	Fixed assets (net)	Rs 26,00,000
Reserves and surplus	12,00,000	*Current assets:*	
Long term loans	22,00,000	Cash and other current assets	1,70,700
Current liabilities	11,00,000	Stock of raw materials	3,31,500
		Stock of finished goods	3,97,800
		Debtors	13,00,000
	48,00,000		48,00,000

Working Notes

1. Total sales are 3 times of fixed assets = Rs 26,00,000 × 3 = Rs 78,00,000
2. Gross Profit = (Rs 78,00,000 × 0.15) = Rs 11,70,000
3. Net Profit = (Rs 78,00,000 × 0.08) = Rs 6,24,000
4. Determination of raw materials consumed, direct wages and factory overheads:

Sales	Rs 78,00,000
Less Gross Profit	11,70,000
Factory/Work cost	66,30,000
Raw materials consumed (Rs 66,30,000 × 0.2)	Rs 13,26,000
Direct Wages (Rs 66,30,000 × 0.1)	6,63,000
Factory overheads (Rs 66,30,000 – Rs 13,26,000 – Rs 6,63,000)	46,41,000

5. Determination of administrative and selling overheads:
   Gross profit – Net profit, i.e., (Rs 11,70,000 – Rs 6,24,000) = Rs 5,46,000
6. Current assets are 11/13 of fixed assets = (11/13 × Rs 26,00,000) = Rs 22,00,000
7. Stock of raw materials is equal to 3 months's usage implies that raw material turnover ratio is 4 times. Therefore, stock of raw materials is = Cost of raw materials consumed in year Rs 13,26,000/raw materials turnover ratio, 4 = Rs 3,31,500.
8. Stock of finished goods = (Rs 66,30,000 × 0.06) = Rs 3,97,800.
9. Debtors collection period of 60 days implies debtors turnover of 6. Therefore, debtors are credit sales, Rs 78,00,000/debtors turnover 6 = Rs 13,00,000 (assuming 360 days).
10. Cash and other current assets = Rs 22,00,000 – Rs 3,31,500 – Rs 3,97,800 – Rs 13,00,000 = Rs 1,70,700 (balancing figure).
11. Current ratio of 2:1 implies that current liabilities are 1/2 of current assets = 0.5 × Rs 22,00,000 = Rs 11,00,000
12. Long-term loans to current liabilities ratio of 2:1 implies that long-term loans are twice the amount of current liabilities (Rs 11,00,000 × 2) = Rs 22,00,000.
13. Equity funds/net worth = Total liabilities Rs 48,00,000 – Long-term loans, Rs 22,00,000 – Current liabilities Rs 11,00,000 = Rs 15,00,000 (balancing figure).
14. Capital to reserves and surplus ratio of 1:4 implies that share capital is 1/5th of equity funds (Rs 15,00,000) = Rs 3,00,000.
15. Reserves and surplus = Rs 15,00,000 – Rs 3,00,000 = Rs 12,00,000.

Part Three

It has been argued in Chapter 1 that financial management focuses not only on the procurement of funds but also on their efficient use with the objective of maximising the owner's wealth. The allocation of funds is, therefore, an important function of financial management. The allocation of funds involves the commitment of funds to assets and activities. It is also referred to as the investment decision, that is, making a choice regarding the assets in which funds will be invested. These assets fall into two broad categories:
(i) short-term or current assets, and (ii) long-term or fixed assets. Accordingly, there are two types of investment decisions. The first is the short-term investment decision. It is also known as management of current assets or working capital management. The second type of decision is the long-term investment decision. This is widely known as capital budgeting or the capital expenditure decision. The various dimensions of working capital management are covered in detail in Part V of this volume. This part is devoted to an in-depth and comprehensive discussion of capital budgeting/ capital expenditure management decisions. Chapter 5 is concerned with the general principles of capital budgeting and evaluation techniques. Cost of capital is examined subsequently in Chapters 6. Sources of long-term and medium-term finance are discussed in detail in Chapter 7.

5 Capital Budgeting: Principles and Techniques

Introduction

This chapter is devoted to a discussion of the principles and techniques of capital budgeting. The first section discusses the nature of capital budgeting in terms of meaning, importance, difficulties, rationale and types. The identification of relevant data for capital budgeting decisions is explained in section two. Section three of the chapter examines the evaluation techniques. It also outlines the choice of an appropriate method of appraisal in a given situation. The last section summarises the main points.

NATURE OF CAPITAL BUDGETING

Meaning

Capital budgeting decisions pertain to fixed/long-term assets which by definition refer to assets which are in operation, and yield a return, over a period of time, usually, exceeding one year. They therefore, involve a current outlay or series of outlays of cash resources in return for an anticipated flow of future benefits.[1] In other words, the system of capital budgeting is employed to evaluate expenditure decisions which involve current outlays but are likely to produce benefits over a period of time longer than one year. These benefits may be either in the form of increased revenues or reduced costs. Capital expenditure management, therefore, includes addition, disposition, modification and replacement of fixed assets. From the preceding discussion may be deduced the following basic features of capital budgeting[2]: (i) potentially large anticipated benefits; (ii) a relatively high degree of risk; and (iii) a relatively long time period between the initial outlay and the anticipated returns. The term capital budgeting is used interchangeably with capital expenditure decision, capital expenditure management, long-term investment decision, management of fixed assets and so on.

Importance

Capital budgeting decisions are of paramount importance in financial decision-making. In the first place, such decisions affect the profitability of a firm. They also have a bearing on the competitive position of the enterprise mainly because of the fact that they relate to fixed assets. The fixed assets represent, in a sense, the true earning assets of the firm. They enable the firm to generate finished goods that can ultimately be sold for profit. The current assets are not generally earning assets. Rather, they provide a buffer that allows the firms to make sales and extend credit. True, current assets are important to operations, but without fixed assets to generate finished products that can be converted into current assets, the firm would not be able to operate. Further, they are 'strategic' investment decisions as against 'tactical' —which involve a relatively small amount of funds. Therefore, such capital investment decisions may result in a major departure from what the company has been doing in the past. Acceptance of a strategic investment will involve a significant change in the company's expected profits and in the risks to which these profits will be subject. These changes are likely to lead stockholders and creditors to revise their evaluation of the company.[3] Thus, capital budgeting decisions determine the future destiny of the company. An opportune investment decision can yield spectacular returns. On the other hand, an ill-advised and incorrect decision can endanger the very survival even of the large firms. A few wrong decisions and the firm may be forced into bankruptcy.

Secondly, a capital expenditure decision has its effect over a long time span and inevitably affects the company's future cost structure. To illustrate, if a particular plant has been purchased by a company to start a new product, the company commits itself to a sizable amount of fixed costs, in terms of labour, supervisors' salary, insurance, rent of building, and so on. If the investment turns out to be unsuccessful in future or yields less profit than anticipated, the firm will have to bear the burden of fixed costs unless it writes off the investment completely. In short, future costs, break-even point, sales and profits will all be determined by the selection of assets.

Thirdly, capital investment decisions, once made, are not easily reversible without much financial loss to the firm because there may be no market for second-hand plant and equipment and their conversion to other uses may not be financially viable.

Finally, capital investment involves costs and the majority of the firms have scarce capital resources. This underlines the need for thoughtful, wise and correct investment decisions, as an incorrect decision would not only result in losses but also prevent the firm from earning profits from other investments which could not be undertaken for want of funds.

Difficulties

Capital expenditure decisions are of considerable significance as the future success and growth of the firm depends heavily on them. But, they are beset with a number of difficulties.

Firstly, the benefits from investments are received in some future period. The future is uncertain. Therefore, an element of risk is involved. For instance, a decision to acquire an asset that is going to last for 15 years requires a 15-year forecast. A failure to forecast correctly will lead to serious errors which can be corrected only at a considerable expense. Future revenue involves estimating the size of the market for a product and the expected share of the firm in that. These estimates depend on a variety of factors, including price, advertising and promotion, and sales effort and so on. Adding to the uncertainties are the possibilities of shifts in consumer preferences, the actions of competitors, technological developments and changes in the economic or political environment.

Secondly, costs incurred and benefits received from the capital budgeting decisions occur in different time periods. They are not logically comparable because of the time value of money.

Thirdly, it is not often possible to calculate in strict quantitative terms all the benefits or the costs relating to a particular investment decision.

Rationale

The rationale underlying the capital budgeting decision is efficiency. Thus, a firm must replace worn and obsolete plants and machinery, acquire fixed assets for current and new products and make strategic investment decisions. This will enable the firm to achieve its objective of maximising profits either by way of increased revenues or cost reductions. The quality of these decisions is improved by capital budgeting. Capital budgeting decision can be of two types: (i) those which expand revenues, and (ii) those which reduce costs.

Investment Decisions Affecting Revenues Such investment decisions are expected to bring in additional revenue, thereby raising the size of the firm's total revenue. They can be the result of either expansion of present operations or the development of new product lines. Both types of investment decisions involve acquisition of new fixed assets and are income-expansionary in nature in the case of manufacturing firms.

Investment Decisions Reducing Costs Such decisions, by reducing costs, add to the total earnings of the firm. A classic example of such investment decisions are the replacement proposals when an asset wears out or becomes outdated. The firm must decide whether to continue with the existing assets or replace them. The firm evaluates the benefits from the new machine in terms of lower operating cost and the outlay that would be needed to replace the machine. An expenditure on a new machine may be quite justifiable in the light of the total cost savings that result.

A fundamental difference between the above two categories of investment decision lies in the fact that cost-reduction investment decisions are subject to less uncertainty in comparison to the revenue-affecting investment decisions. This is so because the firm has a better 'feel' for potential cost savings as it can examine past production and cost data. However, it is difficult to precisely estimate the revenues and costs resulting from a new product line, particularly when the firm knows relatively little about the same.

Kinds

Capital budgeting refers to the total process of generating, evaluating, selecting and following up on capital expenditure alternatives.[4] The firm allocates or budgets financial resources to new investment proposals. Basically, the firm may be confronted with three types of capital budgeting decisions: (i) the accept-reject decision; (ii) the mutually exclusive choice decision; and (iii) the capital rationing decision.

Accept-reject Decision This is a fundamental decision in capital budgeting. If the project is accepted, the firm would invest in it; if the proposal is rejected, the firm does not invest in it. In general, all those proposals which yield a rate of return greater than a certain required rate of return or cost of capital are accepted and the rest are rejected. By applying this criterion, all independent projects are accepted. Independent projects are projects that do not compete with one another in such a way that the acceptance of one precludes the possibility of acceptance of another. Under the accept-reject decision, all independent projects that satisfy the minimum investment criterion should be implemented.

Mutually Exclusive Project Decisions Mutually exclusive projects are those which compete with other projects in such a way that the acceptance of one will exclude the acceptance of the other

projects. The alternatives are mutually exclusive and only one may be chosen. Suppose, a company is intending to buy a new folding machine. There are three competing brands, each with a different initial investment and operating costs. The three machines represent mutually exclusive alternatives, as only one of these can be selected. It may be noted here that the mutually exclusive project decisions are not independent of the accept-reject decisions. The project(s) should also be acceptable under the latter decision. In brief, in our example, if all the machines are rejected under the accept-reject decision, the firm should not buy a new machine. Mutually exclusive investment decisions acquire significance when more than one proposal is acceptable under the accept-reject decision. Then, some technique has to be used to determine the 'best' one. The acceptance of this 'best' alternative automatically eliminates the other alternatives.

Capital Rationing Decision In a situation where the firm has unlimited funds, all independent investment proposals yielding return greater than some predetermined level are accepted. However, this situation does not prevail in most of the business firms in actual practice. They have a fixed capital budget. A large number of investment proposals compete for these limited funds. The firm must, therefore, ration them. The firm allocates funds to projects in a manner that it maximises long-run returns. Thus, capital rationing refers to a situation in which a firm has more acceptable investments than it can finance. It is concerned with the selection of a group of investment proposals out of many investment proposals acceptable under the accept-reject decision. Capital rationing employs ranking of the acceptable investment projects. The projects can be ranked on the basis of a predetermined criterion such as the rate of return. The projects are ranked in the descending order of the rate of return.

DATA REQUIREMENT: IDENTIFYING RELEVANT CASH FLOWS

Cash Flows Vs Accounting Profit

Capital budgeting is concerned with investment decisions which yield return over a period of time in future. The foremost requirement for evaluation of any capital investment proposal is to estimate the future benefits accruing from the investment proposal. Theoretically, two alternative criteria are available to quantify the benefits: (i) accounting profit, and (ii) cash flows. The basic difference between them is primarily due to the inclusion of certain non-cash expenses in the profit and loss account, for instance, depreciation. Therefore, the accounting profit is to be adjusted for non-cash expenditures to determine the actual cash inflow. The cash flow approach of measuring future benefits of a project is superior to the accounting approach as cash flows are theoretically better measures of the net economic benefits of costs associated with a proposed project.

In the first place, while considering an investment proposal, a firm is interested in estimating its economic value. This economic value is determined by the economic outflows (costs) and inflows (benefits) related with the investment project. Only cash flows represent the cash transactions. The firm must pay for the purchase of an asset with cash. This cash outlay represents a foregone opportunity to use cash in some other productive alternatives. Consequently, the firm should measure the future net benefits in cash terms. On the other hand, under the accounting practices, the cost of the investment is allocated over its economic useful life in the nature of depreciation rather than at the time when costs are actually incurred. The accounting treatment clearly does not reflect the original need for cash at the time of inflows and outflows in later years. Only cash flows reflect the actual cash transactions associated with the project. Since investment analysis is concerned with finding out whether future economic inflows are sufficiently large to warrant the initial investment, only the cash flow method is appropriate for investment decision analysis.[5]

Secondly, the use of cash flows avoids accounting ambiguities. There are various ways to value inventory, allocate costs, calculate depreciation and amortise various other expenses. Obviously, different net incomes will be arrived at under different accounting procedures. But there is only one set of cash flows associated with the project. Clearly, the cash flow approach to project evaluation is better than the net income flow approach (accounting approach).

Thirdly, the cash flow approach takes cognisance of the time value of money whereas the accounting approach ignores it. Under the usual accounting practice, revenue is recognised as being generated when the product is sold, not when the cash is collected from the sale; revenue may remain a paper figure for months or years before payment of the invoice is received. Expenditure, too, is recognised as being made when incurred and not when the actual payment is made. Depreciation is deducted from the gross revenues to determine the before-tax earnings. Such a procedure ignores the increased flow of funds potentially available for other uses. In other words, accounting profits which are quite useful as *performance measures* often are less useful as *decision criteria*. Therefore, from the viewpoint of capital expenditure management, the cash flow approach can be said to be the basis of estimating future benefits from investment proposals. The data required for the purpose would be cash revenues and cash expenses. The difference between the cash flow approach and the accounting profit approach is depicted in Table 5.1.

Table 5.1 *A Comparison of Cash Flow and Accounting Profit Approaches*

Accounting approach towards 'benefits'			*Cash flow approach towards 'benefits'*	
Revenues		Rs 1,000		Rs 1,000
Less expenses:				
Cash expenses	Rs 500		Rs 500	
Depreciation	300	800		
Earnings before tax		200		
Taxes (0.35)		70	70	570
Net earnings after taxes/Cash flow		130		430

Table 5.1 shows that the accounting profits amounting to Rs 130 are less than the cash flow (Rs 430). This difference can be attributed to the depreciation charge of Rs 300. The cash available with the firm is Rs 430. This can be utilised for further investment. The accounting approach indicates that only Rs 130 is available and hence gives only a partial picture of the tangible benefits available. Clearly, such an approach does not bring out the total benefits of the project available for reinvesting. Therefore, in place of earnings, the cash flow information is employed in evaluating capital expenditure alternatives.

Incremental Cash Flow

The second aspect of the data required for capital budgeting relates to the basis on which the relevant cash outflows and inflows associated with proposed capital expenditure are to be estimated. The widely prevalent practice is to adopt incremental analysis. According to incremental analysis, only differences due to the decision need be considered. Other factors may be important but not to the decision at hand.[6] For purposes of estimating cash flows in the analysis of investments, incremental cash flows, that is, those cash flows (and only those cash flows) which are directly attributable to the investment are taken into account. It is for this reason that fixed overhead costs, which remain the same whether the proposal is accepted or rejected, are not considered. However, if there is an increase in them due to the new proposal, they must be considered.

Effect of Taxes

Finally, the incremental cash flows are adjusted for tax liability. In other words, taxes paid are deducted from the cash flows to estimate the benefits arising out of the investment decision.

To conclude the above discussion relating to the data required for the capital budgeting decision, the benefits to be considered are '*incremental after-tax cash flows*'. Table 5.2 summarises the relevant and irrelevant information in relation to asset selection decisions.

Table 5.2 *Relevant and Irrelevant Outflows*

Relevant cash outflows	*Irrelevant cash outflows*
1. Variable labour expenses	1. Fixed overhead expense
2. Variable material expenses	2. Sunk costs
3. Cost of the investment	
4. Marginal taxes	

Cash Flow Pattern

Cash flow pattern associated with capital investment projects can be classified as conventional or non-conventional.

Conventional Cash Flows They consist of an initial cash outlay followed by a series of cash inflows. Most of the capital expenditure decisions display this pattern of cash flow. To illustrate, the firm may spend Rs 1,500 in time period zero and as a result may expect to receive a Rs 300 cash inflow at the end of each year for the next 8 years. The conventional cash flow pattern is diagrammed in Fig. 5.1.

		Rs	*300*	*300*	*300*	*300*	*300*	*300*	*300*	*300*
			/	/	/	/	/	/	/	/
			/	/	/	/	/	/	/	/
Cash inflows	*0*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Cash outflows	|		*	*	*	*	*	*	*	*
	Rs 1,500				Years					

Figure 5.1 *Conventional Cash Flow Pattern*

Non-Conventional Cash Flows They refer to the cash flow pattern in which an initial cash outlay is not followed by a series of inflows. Alternating inflows and outflows and an inflow followed by outflows are examples of non-conventional cash flow patterns. A classic example of such cash flow patterns is that of the purchase of an asset that generates cash inflows for a period of years, is overhauled, and again generates a stream of cash inflows for a number of years. To illustrate, a machine purchased for Rs 1,000 generates cash inflows of Rs 250 each for five years. In the sixth year, an outlay of Rs 400 is required to overhaul the machine, after which it generates cash inflows of Rs 250 for four years. Such a non-conventional pattern of cash flows is shown in Fig. 5.2.

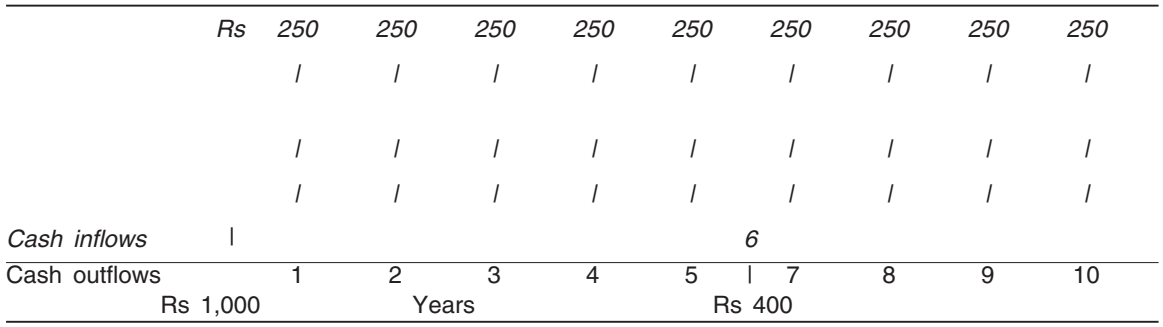

Figure 5.2 *Non-conventional Cash Flow Pattern*

Cash Flow Estimates

For capital budgeting cash flows have to be estimated. There are certain ingredients of cash flow streams.

Tax Effect It has been already observed that cash flows to be considered for purposes of capital budgeting are net of taxes. Special consideration needs to be given to tax effects on cash flows if the firm is incurring losses and, therefore, paying no taxes. The tax laws permit carrying losses forward to be set off against future income. In such cases, therefore, the benefits of tax savings would accrue in future years.

Effect on Other Projects Cash flow effects of the project under consideration, if it is not economically independent, on other existing projects of the firm must be taken into consideration. For instance, if a company is considering the production of a new product which competes with the existing products in the product line, it is likely that as a result of the new proposal, the cash flows related to the old product will be affected. Assume that there is a decline of Rs 5,000 in the actual flow from the existing product. This should be taken into consideration while estimating the cash streams from the new proposal. In operational terms, the cash flow from the new product should be reduced by Rs 5,000. This is in conformity with the general rule of the incremental cash flows which involves identifying changes in cash flows as a result of undertaking the project being evaluated. Clearly, the cash flow effects of the project should not be evaluated in isolation, if it affects other project(s) in any way.

Effect of Indirect Expenses Another factor which merits special consideration in estimating cash flows is the effect of overheads. The indirect expenses/overheads are allocated to the different products on the basis of wages paid, materials used, floor space occupied or some other similar common factor. The question that arises is: should such allocation of overheads be taken into account in the cash flows? The answer hinges upon whether the amount of overheads will change as a result of the investment decision. If yes, it should be taken into account. If, however, overheads will not change as a result of the investment decision, they are not relevant.

A company allocates overheads on the basis of the floor space used. Assume it intends to replace an old machine by a new one. Further assume that the new machine would occupy less space so that there would be a reduction in the overhead charged to it. Since there is no effect on cash flows, a change in the overhead is not relevant to the cash flow streams of the machine being acquired. But if the surplus space is used for an alternative use, and if any cash flow is generated, it will be relevant to the calculations. Thus, the deciding factor is whether there is any alternative use. The alternative use rule is a corollary of the incremental cash flow rule.[7]

Effect of Depreciation Depreciation, although a non-cash item of cost, is deductible expenditure in determining taxable income. Depreciation provisions are prescribed by the Companies Act for accounting purposes and by the Income Tax Act for taxation purposes.

The purpose of the provisions of depreciation contained in the Companies Act is the computation of managerial remuneration, dividend payment and disclosure in financial statements. Since companies in India are regulated by the Companies Act, they should provide depreciation in the books of accounts in accordance with Schedule XIV of the Act which prescribes the rate of depreciation for various types of depreciable assets on written down value (WDV) basis as well as straight line basis. It also permits companies to charge depreciation on any other basis provided it has the effect of writing off 95 per cent of the original cost of the asset on the expiry of the specified period and has the approval of the government. In actual practice, however, companies follow the provisions of the Income Tax Act with the basic objectives of its tax-deductibility.

The provisions of Income Tax Act relating to depreciation are contained in Section 32. The section envisages three important conditions for following depreciation, namely, (i) the asset is owned by the assessee, (ii) the asset is used by the assessee for the purpose of business and (iii) the asset is in the form of buildings, furniture, machinery and plants including ships, vehicles, books, scientific apparatus, surgical equipments and so on.

The amount of annual depreciation on an asset is determined by (a) the actual cost of the asset and (b) its classification in the relevant block of assets. The actual cost means the cost of acquisition of the asset and the expenses incidental thereto which are necessary to put the asset in a usable state, for instance, freight and carriage inwards, installation charges and expenses incurred to facilitate the use of the asset like expenses on the training of the operator or on essential construction work.

Depreciation is charged, with a view to simplify computation, not on an individual asset but on a block of assets. A block of assets defined as a group of assets falling within a class of assets, being building, machinery, plant or furniture in respect of which the same rate of depreciation is prescribed. Thus, assets which fall within the same class of assets and in respect of which the same percentage/rate of depreciation has been prescribed irrespective of their nature form one block of assets. For example, all assets under the category of plant and machinery which qualify for depreciation at 25 per cent will form one block and depreciation is computed with reference to the actual cost of the block. Similarly, assets depreciable at 40 per cent will constitute another block; a third block consists of assets depreciable at 50 per cent, and the fourth block comprises assets subject to a 100 per cent write-off.

Depreciation is computed at block-wise rates on the basis of written down value (WDV) method only. Presently, the block-wise rates for plant and machinery are at 25 per cent, 40 per cent and 100 per cent. The depreciation allowance on office buildings and furniture and fittings is 10 per cent. Where the actual cost of plant and machinery does not exceed Rs 5,000, the entire cost is allowed to be written off in the first year of its use. If an asset acquired during a year has been used for a period of less than 180 days during the year, depreciation on such assets is allowed only at 50 per cent of the computed depreciation according to the relevant rate.

Apart from the simplification of the computation of the amount of depreciation, a significant implication of categorising assets into blocks is that if an asset falling in a block is sold out, there is no capital gain or terminal depreciation or balancing charge. The sale proceeds of the asset are reduced from the WDV of the block. Capital gain/loss can arise in these situations:

(i) When the sale proceeds exceeds the WDV of the whole block;
(ii) When the entire block is sold out; and
(iii) In case of 100 per cent depreciable assets.

The terminal loss is not allowed in the relevant assessment year but is spread over a number of years to be allowed by way of depreciation.

In case of insufficiency/absence of profit, unabsorbed depreciation can be set off against income under any head against business income as in the case of unabsorbed loss. Effective 1996-97, it can be carried forward for a maximum period of eight years. However, it cannot be assigned/transferred/claimed by the transfer of business.

The mechanics of computation of depreciation is illustrated in Example 5.1.

EXAMPLE 5.1

Assume the following facts relating to Avon Ltd (AL):

Block of assets	*Depreciation rate (percentage)*	*WDV as on 1.4.19X5 (Rs lakh)*	*Addition during 19X5 - X6 (Rs lakh)*
A	25	500	250
B	40	300	150

Assets sold during 19X5–X6 amounted to Rs 35 lakh (Block A) and Rs 50 lakh (Block B). It is expected that fresh investments in assets during 19X6– X7 will be: Block A (Rs 160 lakh) and Block B (Rs 80 lakh). It is also projected by the AL that disinvestment proceeds from the assets will amount to Rs 45 lakh in case of Block A and Rs 25 lakh in case of Block B. Assume that about 50 per cent of additional investment during 19X6–X7 will be made after September 19X6.

Compute the relevant depreciation charge for 19X5–X6 and the projected depreciation charge for 19X6–X7.

SOLUTION

The relevant depreciation charge for 19X5–X6 and the projected depreciation charge for 19X6–X7 is calculated in Tables 5.3 and 5.4 respectively.

Table 5.3 *Computation of Depreciation Charge during 19X5 – X6 (Rs lakh)*

	Blocks	
	A	*B*
1. WDV as on 1.4.19 X5	500	300
2. Add cost of assets acquired during 19 X5 - X6	250	150
	750	450
3. Less sales during 19 X5 - X6	35	50
4. WDV (for depreciation)	715	400
5. Depreciation allowance	179	160
6. WDV as on 1.4. 19 X6	536	240

Table 5.4 *Computation of Depreciation Charge during 19X6–X7 (Rs lakh)*

	Blocks	
	A	*B*
1. WDV as on 1.4.19 X5	536	240
2. Add cost of assets acquired during 19 X6 - X7	160	80
	696	320

(*Contd.*)

(*Contd.*)

3. Less expected proceeds of sales during 19 X6 – X7	45	25
4. WDV (for depreciation)	651	295
5. Depreciation allowance[@]	153	110
6. WDV as on 1.4. 19 X7	498	185
[@]Normal depreciation allowance	163	118
Less depreciation allowance inadmissible in respect of assets acquired after 30.9.19 X6	10	8
	(80 × 0.25 × 0.5)	(40 × 0.4 × 0.5)
	153	110

Note: If the entire block of assets is sold during a year for an amount exceeding (1 + 2) or the sale proceeds of the block sold is higher than (1 + 2), the difference represents short-term capital gains subject to tax. Where the sale proceeds are lower than (1 + 2), the difference is short-term capital loss and the AL is entitled to tax shield.

Working Capital Effect Working capital constitutes another important ingredient of the cash flow stream which is directly related to an investment proposal. The term working capital is used here in net sense, that is, current assets minus current liabilities (net working capital). If an investment is expected to increase sales, it is likely that there will be an increase in current assets in the form of accounts receivable, inventory and cash. But part of this increase in current assets will be offset by an increase in current liabilities in the form of increased accounts and notes payable. Obviously, the sum equivalent to the difference between these additional current assets and current liabilities will be needed to carry out the investment proposal. Sometimes, it may constitute a significant part of the total investment in a project. The increased working capital forms part of the initial cash outlay. The additional net working capital will, however, be returned to the firm at the end of the project's life. Therefore, the recovery of working capital becomes part of the cash inflow stream in the terminal year. The initial investment in, and the subsequent recovery of, working capital do not balance out each other due to the time value of money.

The increase in the working capital may not only be in the zero time period, that is, at the time of initial investment. There can be continuous increase in the working capital as sales increase in later years. This increase in working capital should be considered as cash outflow of the year in which additional working capital is required.

Suppose,there is a project that requires an initial investment of Rs 20,000 and has a useful life of 5 years. The requirements of working capital are detailed in Table 5.5.

Table 5.5 *Working Capital Requirements*

		Year				
	0	*1*	*2*	*3*	*4*	*5*
(a) Initial investment	Rs 20,000					
Sales (Rs)		Rs 5,000	Rs 10,000	Rs 20,000	Rs 15,000	0
Expenses		1,000	2,000	5,000	4,000	500
(b) Changes in inventory (decrease)		1,000	2,000	6,000	(4,000)	(5,000)
(c) Changes in receivables		1,000	2,000	4,000	(2,000)	(5,000)
(d) Changes in payables		1,500	2,000	5,000	(3,500)	(5,500)
(e) Change in working capital (b + c – d)		500	2,000	5,000	(2,500)	(4,500)

The changes in the net working capital are given in the last row of Table 5.5. The net working capital has increased in years 1, 2 and 3 representing cash outflows, while it has decreased in years 4 and 5 showing cash inflows as working capital is recovered.

Almost all revenue-expansion capital investment proposals require additional working capital. Likewise, almost all cost-reduction capital investment projects release the existing amount of working capital. Such projects enhance the firm's efficiency in such a way that the amount of inventory on hand or accounts receivable can be reduced. Improved inventory control systems or improved billing and collection systems are some classic examples. From the point of view of evaluating an investment project, the amount of working capital so released should be seen as a cash inflow in the zero time period (when the investment proposal is being considered), reducing the net cash investment required for the project. In the terminating year of the project, it should be treated as a cash outflow and adjusted against the cash inflow of that year.

Determination of Relevant Cashflows

The data requirement for capital budgeting are cash flows, that is, outflows and inflows. Their computation depends on the nature of the proposal. Capital projects can be categorised into: (i) single proposal, (ii) replacement situations and (iii) mutually exclusive.

Single Proposal The cash outflows, comprising cash outlays required to carry out the proposed capital expenditure are depicted in Format 5.1, while the computation of the cash inflows after taxes (CFAT) is shown in Format 5.2. The computation is illustrated in Example 5.2 and Example 5.3.

FORMAT 5.1 *Cash Outflows of New Project [Beginning of the Period at Zero Time (t = 0)]*

(1) Cost of new project
(2) + Installation cost of plant and equipments
(3) ± Working capital requirements

FORMAT 5.2 *Determination of Cash Inflows: Single Investment Proposal (t = 1 – N)*

		Years					
		1	*2*	*3*	*4*	....	*N*
Cash	sales revenues						
Less	*Cash operating cost*						
Cash	inflows before taxes (CFBT)						
Less	*Depreciation*						
	Taxable income						
Less	Tax						
	Earning after taxes						
Plus	*Depreciation*						
	Cash inflows after tax (CFAT)						
Plus	Salvage value (in nth year)						
Plus	Recovery of working capital (in nth year)						

EXAMPLE 5.2

An iron ore compay is considering investing in a new processing facility. The company extracts ore from an open pit mine. During a year, 1,00,000 tons of ore is extracted. If the output from the extraction process is sold immediately upon removal of dirt, rocks and other impurities, a price of Rs 1,000 per ton of ore can be obtained. The company has estimated that its extraction costs amount to 70 per cent of the net realisable value of the ore.

As an alternative to selling all the ore at Rs 1,000 per ton, it is possible to process further 25 per cent of the output. The additional cash cost of further processing would be Rs 100 per ton. The proposed ore would yield 80 per cent final output, and can be sold at Rs 1,600 per ton.

For additional processing, the company would have to instal equipment costing Rs.100 lakh. The equipment is subject to 25 per cent depreciation per annum on reducing balance (WDV) basis/method. It is expected to have useful life of 5 years. Additional working capital requirement is estimated at Rs.10 lakh. The company's cut-off rate for such investments is 15 per cent. Corporate tax rate is 35 per cent.

Assuming there is no other plant and machinery subject to 25 per cent depreciation, should the company instal the equipment if (a) the expected salvage is Rs 10 lakh and (b) there would be no salvage value at the end of year 5.

SOLUTION

Financial Evaluation Whether to Instal Equipment for Further Processing of Iron Ore

(a) Cash outflows:	
Cost of equipment	Rs 1,00,00,000
Plus additional working capital	10,00,000
	1,10,00,000

(b) Cash inflows (CFAT)

	Year				
	1	*2*	*3*	*4*	*5*
Incremental revenue [(Rs 1,600 × 20,000) – Rs 1,000 × 25,000)]	Rs 70,00,000	Rs 70,00,000	Rs 70,00,000	Rs 70,00,000	Rs 70,00,000
Less incremental costs:					
Processing costs (Rs 100 × 25,000 tons)	25,00,000	25,00,000	25,00,000	25,00,000	25,00,000
Depreciation (working note 1)	25,00,000	18,75,000	14,06,250	10,54,688	—
Earnings before taxes	20,00,000	26,25,000	30,93,750	34,45,312	45,00,000
Less taxes (0.35)	7,00,000	9,18,750	10,82,813	12,05,859	15,75,000
Earnings after taxes (EAT)	13,00,000	17,06,250	20,10,937	22,39,453	29,25,000
Add depreciation	25,00,000	18,75,000	14,06,250	10,54,688	
CFAT	38,00,000	35,81,250	34,17,187	32,94,141	29,25,000

Working Note

1 Depreciation schedule

Year	*Depreciation base of equipment*	*Depreciation @ 25% on WDV*
1	*Rs 100,00,000*	*Rs 25,00,000*
2	75,00,000	18,75,000
3	56,25,000	14,06,250
4	42,18,750	10,54,688
5	31,64,062	Nil[@]

[@]As the block consists of a single asset, no depreciation is to be charged in the terminal year of the project.

(c) Determination of NPV (Salvage Value = Rs 10 lakh)

Year	*CFAT*	*PV factor (0.15)*	*Total PV*
1	Rs 38,00,000	0.870	Rs 33,06,000
2	35,81,250	0.756	27,07,425
3	34,17,187	0.658	22,48,509
4	32,94,141	0.572	18,84,249
5	29,25,000	0.497	14,53,725
Salvage value	10,00,000	0.497	4,97,000
Tax benefit on short-term capital loss	7,57,422 b	0.497	3,76,439
Recovery of working capital	10,00,000	0.497	4,97,000
			1,29,70,347
Less cash outflows			1,10,00,000
Net present value (NPV)			19,70,347

(b) 0.35 × (Rs 31,64,062 – Rs 10,00,000) = Rs 7,57,422.

Recommendation: The company is advised to instal the equipment as it promises a positive NPV.

(d) Determination of NPV (Salvage Value = Zero)

PV of operating CFAT (1 – 5 years)	Rs 1,15,78,421
Add PV of tax benefit on short term capital loss (Rs 31,64,062 × 0.35 = Rs 11,07,4,22 × 0.497, PV factor)	5,50,389
Add PV of recovery of working capital	4,97,000
Total present value	1,26,25,810
Less cash outflows	1,10,00,000
NPV	16,25,810

Since the NPV is still positive, the company is advised to instal the equipment.

EXAMPLE 5.3

For the company in Example 5.2, assume there are other plants and machinery subject to 25 per cent depreciation (i.e. in the same block of assets). What course of action should the company choose?

SOLUTION

(a) Cash outflows would remain unchanged.

(b) The annual depreciation will also remain the same for the first 4 yeas: In year 5, the depreciation = Rs 21,64,062 (opening WDV of equipment, Rs 31,64,062 – Rs 10,00,000, salvage value) × 0.25 = Rs 5,41,016.

(c) The CFAT (operating) for years, 1-4 will not change. In year 5, it will be shown as below:

Particulars	*CFAT (t = 5)*
Incremental revenue	Rs 70,00,000
Less incremental costs:	
Processing costs	25,00,000
Depreciation	5,41,016
Earning before taxes	39,58,984
Less taxes (0.35)	13,85,644
EAT	25,73,340
CFAT	31,14,356

Determination of NPV (Salvage Value = Rs 10 lakh)

Year	*CFAT*	*PV factor*	*Total PV*
1	Rs 38,00,000	0.870	Rs 33,06,000
2	35,81,250	0.756	27,07,425
3	34,17,187	0.658	22,48,509
4	32,94,141	0.572	18,84,249
5	31,14,356	0.497	15,47,835
Salvage value	10,00,000	0.497	4,97,000
Recovery of working capital	10,00,000	0.497	4,97,000
			1,26,88,018
Less cash outflows			1,10,00,000
Net present value (NPV)			16,88,018[@]

[@]In fact, the NPV of the equipment is likely to be higher as tax advantage will accrue on the eligible depreciation of Rs 16,23,046, i.e. (Rs 21,64,062 - Rs 5,41,016) in future years.
The company should instal the equipment.

Determination of NPV (Salvage Value = 0)

(i) For the first 4 years, depreciation amount will remain unchanged. In the fifth year, depreciation = Rs 31,64,062 (Rs 31,64,062, opening WDV less zero salvage value) × 0.25 = Rs 7,91,015.

(ii) Operating CFAT for years 1 – 4 will remain unchanged. The CFAT for 5th year would be Rs 32,01,855 as shown below:

Incremental revenues	Rs 70,00,000
Less incremental total costs (Rs 25,00,000 + Rs 7,91,015)	32,91,015
EBIT	37,08,985
Less taxes (0.35)	12,98,145
EAT	24,10,840
Add depreciation	7,91,015
CFAT	32,01,855

(iii)

PV of operating CFAT (1 – 4 years)	1,01,24,696
Add PV of operating CFAT (5th year) (Rs 32,01,855 × 0.497)	15,91,322
Add PV of recovery of working capital	4,97,000
Total PV	1,22,13,018
Less cash outflows	1,10,00,000 @
NPV	12,13,018

[@]In effect, NPV would be higher as tax advantage will accrue on depreciation of Rs 23,73,047 in future years.

Recommendation: The decision does not change, as NPV is positive.

Cash flows: Replacement Situation In the case of replacement of an existing machine (asset) by a new one, the relevant cash outflows are *after-tax incremental cash flows*. If a new machine is intended to replace an existing machine, the proceeds so obtained from its sale reduce cash outflows required to purchase the new machine and, hence, part of relevant cash flows. The calculation of after-tax incremental cash outflows is illustrated in Format 5.3 and Format 5.4 which provide depreciation base in the case of replacement situations.

FORMAT 5.3 *Cash Outflows in a Replacement Situation*

1. Cost of the new machine
2. + Installation Cost
3. ± Working Capital
4. – Sale proceeds of existing machine

FORMAT 5.4 *Depreciation Base of New Machine in a Replacement Situation*

1. WDV of the existing machine
2. + Cost of the acquisition of new machine (including installation costs)
3. – Sale proceeds of existing machine

The computation is illustrated in Example 5.4.

EXAMPLE 5.4

Royal Industries Ltd. is considering the replacement of one of its moulding machines. The existing machine is in good operating condition, but is smaller than required if the firm is to expand its operations. It is 4 years old, has a current salvage value of Rs 2,00,000 and a remaining life of 6 years. The machine was initially purchased for Rs 10 lakh and is being depreciated at 25 per cent on the basis of written down vlaue method.

The new machine will cost Rs 15 lakh and will be subject to the same method as well as the same rate of depreciation. It is expected to have a useful life of 6 years, salvage value of Rs 1,50,000 at the sixth year end. The managemnet anticipates that with the expanded operations, there will be a need of an additional net working capital of Rs 1 lakh.

The new machine will allow the firm to expand current operations and thereby increase annual revenues by Rs 5,00,000; variable cost to volume ratio is 30 per cent. Fixed costs (excluding depreciation) are likely to remain unchanged.

The corporte tax rate is 35 per cent. Its cost of capital is 10 per cent. The company has several machines in the block of 25 per cent depreciation.

Should the company replace its existing machine? What course of action would you suggest, if there is no salvage value?

SOLUTION

Financial Evaluation Whether to Replace Existing Machine

(a) Cash outflows (incremental):		
Cost of the new machine	Rs	15,00,000
Add additional working captial		1,00,000
Less sale value of existing machine		2,00,000
		14,00,000

(b) Determination of Incremental CFAT (Operating)

Year	*Incremental contribution*[a]	*Incremental depreciation*[b]	*Taxable income*	*Taxes (0.35)*	*EAT [Col.4 – Col.5]*	*CFAT [Col.6 + Col.3]*
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 3,50,000	Rs 3,25,000	Rs 25,000	Rs 8,750	Rs 16,250	Rs 3,41,250
2	3,50,000	2,43,750	1,06,250	37,188	69,062	3,12,812
3	3,50,000	1,82,813	1,67,187	58,515	1,08,672	2,91,485
4	3,50,000	1,37,109	2,12,891	74,512	1,38,379	2,75,488
5	3,50,000	1,02,832	2,47,168	86,509	1,60,659	2,63,491
6	3,50,000	39,624	3,10,376	1,08,632	2,01,744	2,41,368

[a]Rs 5,00,000 – [Rs 5,00,000 × 0.30, variable cost to value (V/V) ratio] = Rs 3,50,000
[b](Working note)

Working Note

1. Incremental depreciation (t = 1 – 6)

Year	*Incremental asset cost base*	*Depreciation (25% on WDV)*
1	Rs 13,00,000	Rs 3,25,000
2	9,75,000	2,43,750
3	7,31,250	1,82,813
4	5,48,437	1,37,109
5	4,11,328	1,02,832
6	3,08,496	39,624 [c]

[c]0.25 × (Rs 3,08,496 – Rs 1,50,000, salvage value) = Rs 39,624

(2) (i) Written down value (WDV) of existng machine at the beginning of the year 5	
Initial cost of machine	Rs 10,00,000
Less depreciation @ 25% in year 1	2,50,000
WDV at beginning of year 2	7,50,000
Less depreicaiton @ 25% on WDV	1,87,500
WDV at beginning of year 3	5,62,500
Less depreciation @ 25% on WDV	1,40,625
WDV at beginning of year 4	4,21,875
Less depreciation @ 25% on WDV	1,05,469
WDV at beginning of year 5	3,16,406
(ii) Depreciation base of new machine	
WDV of existing machine	3,16,406
Add cost of the new machine	15,00,000
Less sale proceeds of existing machine	2,00,000
	16,16,406
(iii) Base for incremental depreciation	
Depreciation base of a new machine	16,16,406
Less depreciation base of an exsiting machine	3,16,406
	13,00,000

(c) Determination of NPV (Salvage Value = Rs 1.50 lakh)

Year	*CFAT*	*PV factor (0.10)*	*Total PV*
1	Rs 3,41,250	0.909	Rs 3,10,196
2	3,12,812	0.826	2,58,383
3	2,91,485	0.751	2,18,905
4	2,75,488	0.683	1,88,158
5	2,63,491	0.621	1,63,628
6	2,41,368	0.564	1,36,132
6 Salvage value	1,50,000	0.564	84,600
6 Recovery of working capital	1,00,000	0.564	56,400
Gross present value			14,16,402
Less cash outflows			14,00,000
Net present value			16,402

Recommendation: Since the NPV is positive, the company is advised to replace the existing machine. The NPV is likely to be higher as tax advantage will accrue on the eligible depreciation of Rs 1,18,872 (Rs 3,08,496 – Rs 1,50,000 – Rs 39,624) in the future years.

Determination of NPV (Salvage Value = Zero)

(i) For the first 5 years, depreciation will remain unchanged. In the sixth year, it will be = Rs 3,08,496 × 0.25 = Rs 77,124.

(ii) Operating CFAT for years 1–5 will remain unchanged.

CFAT for year 6 would be:

Incremental contribution	Rs 3,50,000
Less incremental depreciation	77,124
Taxable income	2,72,876
Less taxes (0.35)	95,507
EAT	1,77,369
Add depreciation	77,124
CFAT	2,54,493
(iii) PV of operating CFAT (1 – 5 years)	11,39,270
Add PV of operating CFAT (6th year) (Rs 2,54,493 × 0.564)	1,43,534
Add PV of working capital	56,400
Total present value	13,39,204
Less cash outflows	14,00,000
NPV	(66,796)

Recommendation: Since the NPV is negative, the existing machine should not be replaced.

Mutually Exclusive Situations

In the case of mutually exclusive proposals, the selection of one proposal precludes the choice of other(s). The calculation of the cash outflows and inflows are on lines similar to the replacement situations. This is illustrated in Example 5.5.

EXAMPLE 5.5

A company is considering two mutually exclusive proposals, X and Y.

Proposal X will require the purchase of machine X, for Rs 1,50,000 with no salvage value but an increase in the level of working capital to the tune of Rs 50,000 over its life. The project will generate additional sales of Rs 1,30,000 and require cash expenses of Rs 30,000 in each of the 5 years of its life.

Proposal Y will require the purchase of machine Y for Rs 2,50,000 with no salvage value and additional working capital of Rs 70,000. The project is expected to generate additional sales of Rs 2,00,000 with cash expenses aggregating Rs 50,000.

Both the machines are subject to written down value method of depreciation at the rate of 25 per cent. Assuming the company does not have any other asset in the block of 25 per cent; has 12 per cent cost of capital and is subject to 35 per cent tax, advise which machine it should purchase?

What course of action would you suggest if Machine X and Machine Y have salvage values of Rs 10,000 and Rs 25,000 respectively?

SOLUTION

Financial Evaluation of Proposals, X and Y

Proposal X:

Cash outflows		
Cost price of machine		Rs 1,50,000
Additional working capital		50,000
Initial investment		2,00,000
CFAT and NPV		
(i) Incremental sales revenue		1,30,000
Less cash expenses		30,000
Incremental cash profit before taxes		1,00,000
Less taxes (0.35)		35,000
CFAT (t = 1 – 5)		65,000
(×) PV factor of annuity for 5 years (0.12)		× 3.605
Present value		2,34,325

(ii) PV of tax savings due to depreciation

Year	Depreciation	Tax savings	PVF	Present value	
1	Rs 37,500	Rs 13,125	0.893	Rs 11,721	
2	28,125	9,844	0.797	7,846	
3	21,094	7,383	0.712	5,257	
4	15,820	5,537	0.636	3,522	28,346

(iii) PV of tax savings on short-term capital loss (STCL): (Rs 47,461 STCL × 0.35 × 0.567)		9,419
(iv) Release of working capital (Rs 50,000 × 0.567)		28,350
Total present value		3,00,440
Less cash outflows		2,00,000
NPV		1,00,440

Proposal Y:

Cash outflows		
Cost price of machine		2,50,000
Additional working capital		70,000
Initial investment		3,20,000
CFAT and NPV		
(i) Incremental sales revenue		2,00,000
Less cash expenses		50,000
Incremental cash profits before taxes		1,50,000
Less taxes (0.35)		52,500
CFAT (t = 1 – 5)		97,500
(×) PV factor of annuity for 5 years (0.12)		× 3.605
Present value		3,51,488

(ii) *PV of tax savings due to depreciation:*

Year	*Depreciation*	*Tax savings*	*PVF*	*Present value*	
1	Rs 62,500	Rs 21,875	0.893	Rs 19,534	
2	46,875	16,406	0.797	13,076	
3	35,156	12,305	0.712	8,761	
4	26,367	9,229	0.636	5,869	47,240

(iii) PV of tax savings on short term capital loss (Rs 79,102 × 0.35 × 0.567)	15,698
(v) Release of working capital (Rs 70,000 × 0.567)	39,690
Total present value	4,54,116
Less cash outflows	3,20,000
NPV	1,34,116

Advice: Proposal Y is recommended in view of its higher NPV.

Alternatively, (Incremental Cash flow Approach)

Incremental cash outflows

Investment required in Proposal *Y*	Rs 3,20,000
Less investment required in Proposal *X*	2,00,000
	1,20,000

Incremental CFAT and NPV

(i) Incremental sales revenue (*Y* – *X*)	70,000
Less incremental cash expenses (*Y* – *X*)	20,000
Incremental cash profit before taxes	50,000
Less taxes (0.35)	17,500
Incremental CFAT (*t* = 1 – 5)	32,500
(×) PV of annuity for 5 years (0.12)	× 3.605
Incremental present value	1,17,162

(ii) PV of tax savings due to incremental depreciation

Year	*Incremental depreciation*	*Tax savings*	*PVF*	*Present value*	
1	Rs 25,000	Rs 8,750	0.893	Rs 7,814	
2	18,750	6,562	0.797	5,230	
3	14,062	4,922	0.712	3,504	
4	10,547	3,691	0.636	2,348	18,896

(iii) PV of tax savings on incremental (*Y* – *X*) short term capital loss (STCL): (Rs 79,102 – Rs 47,461) × 0.35 × 0.567	6,279
(iv) *Incremental (Y – X) working capital* (Rs 70,000 – Rs 50,000) × 0.567	11,340
Incremental present value	1,53,677
Less incremental cash outflows	1,20,000
Incremental NPV	33,677

Recommendation: Proposal *Y* is better.

Financial Evaluation of Proposals, Assuming Salvage Value of Machines *X* and *Y* (Incremental Approach)

(a) Sum of PV of items (i), (ii) and (iv) (Rs 1,17,162 + Rs 18,896 + Rs 11,340)@	Rs 1,47,398
(b) PV of incremental salvage value (Rs 15,000 × 0.567)	8,505
(c) PV of tax savings on incremental STCL@@ (Rs 54,102 – Rs 37,461) × 0.35 × 0.567	3,302
Incremental present value	1,59,205
Less incremental cash outflows	1,20,000
Incremental NPV	39,205

Decision: Decision (superiority of proposal *Y*) remains unchanged.

@Items (i), (ii) and (iv) when there is no salvage will not change due to salvage value.

@@As a result of salvage value, the amount of short-term capital loss (STCL) will change.

EVALUATION TECHNIQUES

This section discusses the important evaluation techniques for capital budgeting. Included in the methods of appraising an investment proposal are those which are objective, quantified and based on economic costs and benefits.

The methods of appraising capital expenditure proposals can be classified into two broad categories: (i) **non-discounted**/traditional, and (ii) time-adjusted. The latter are more popularly known as discounted cash flow (DCF) techniques as they take the time factor into account. The **non-discounted** category includes (i) average rate of return method and (ii) pay back period method. The second category includes (i) net present value method, (ii) internal rate of return method, (iii) net terminal value method, and (iv) profitability index.

Non-Discounted/Traditional Techniques

Average Rate of Return

Computation The average rate of return (ARR) method of evaluating proposed capital expenditure is also known as the accounting rate of return method. It is based upon accounting information rather than cash flows. There is no unanimity regarding the definition of the rate of return. There are a number of alternative methods for calculating the ARR. The most common usage of the average rate of return (ARR) expresses it as follows:

$$\text{ARR} = \frac{\text{Average annual profits after taxes}}{\text{Average investment over the life of the project}} \times 100 \tag{5.1}$$

The average profits after taxes are determined by adding up the after-tax profits expected for each year of the project's life and dividing the result by the number of years. In the case of annuity, the average after-tax profits are equal to any year's profits.

The average investment is determined by dividing the net investment by two. This averaging process assumes that the firm is using straight line depreciation, in which case the book value of the asset declines at a constant rate from its purchase price to zero at the end of its depreciable life. This means that, on the average, firms will have one-half of their initial purchase price in the books.[8] Consequently, if the machine has salvage value, then only the depreciable cost (cost-salvage value) of the machine should be divided by two in order to ascertain the average net investment, as the salvage money will be recovered only at the end

of the life of the project. Therefore, an amount equivalent to the salvage value remains tied up in the project throughout its life time. Hence, no adjustment is required to the sum of salvage value to determine the average investment.[9] Likewise, if any additional net working capital is required in the initial year which is likely to be released only at the end of the project's life, the full amount of working capital should be taken in determining relevant investment for the purpose of calculating ARR. Thus,

Average investment = Net working capital + Salvage value + 1/2 (Initial cost of machine – Salvage value) (5.2)

For instance, given the information: initial investment (purchase of machine), Rs 11,000, salvage value, Rs 1,000, working capital, Rs 2,000, service life (years) 5 and that the straight line method of depreciation is adopted, the average investment is: Rs 1,000 + Rs 2,000 + 1/2 (Rs 11,000 – Rs.1,000) = Rs 8,000.

EXAMPLE 5.6

Determine the average rate of return from the following data of two machines, A and B.

	Machine A	*Machine B*
Cost	Rs 56,125	Rs 56,125
Annual estimated income after depreciation and income tax:		
Year 1	3,375	11,375
2	5,375	9,375
3	7,375	7,375
4	9,375	5,375
5	11,375	3,375
	36,875	36,875
Estimated life (years)	5	5
Estimated salvage value	3,000	3,000

Depreciation has been charged on straight line basis.

SOLUTION

$$\text{ARR} = \frac{\text{Average income}}{\text{Average investment}} \times 100$$

$$\text{Average income of Machines A and B} = \frac{\text{Rs } 36{,}875}{5} = \text{Rs } 7{,}375$$

Average investment = Salvage value + 1/2 (Cost of machine – Salvage value)
= Rs 3,000 + 1/2 (Rs 56,125 – Rs 3,000) = Rs 29,562.50

$$\text{ARR (for machines A and B)} = \frac{\text{Rs } 7{,}375}{\text{Rs } 29{,}562.50} \times 100 = 24.9 \text{ per cent}$$

In addition to the above, there are other approaches to calculate the average rate of return (ARR). One approach, which is a variation of the above, involves using original rather than the average cost of the project. In the case of this alternative approach, the ARR for both the machines would be 13.1 per cent (Rs 7,375 ÷ Rs 56,125).

Accept-reject Rule With the help of the ARR, the financial decision maker can decide whether to accept or reject the investment proposal. As an accept-reject criterion, the actual ARR would be compared with a predetermined or a minimum required rate of return or cut-off rate. A project would qualify to be accepted if the actual ARR is higher than the minimum desired ARR. Otherwise, it is liable to be rejected. Alternatively, the ranking method can be used to select or reject proposals. Thus, the alternative proposals under consideration may be arranged in the descending order of magnitude, starting with the proposal with the highest ARR and ending with the proposal having the lowest ARR. Obviously, projects having higher ARR would be preferred to projects with lower ARR.

Evaluation of ARR In evaluating the ARR, as a criterion to select/reject investment projects, its merits and drawbacks need to be considered. The most favourable attribute of the ARR method is its easy calculation. What is required is only the figure of accounting profits after taxes which should be easily obtainable. Moreover, it is simple to understand and use. In contrast to this, the discounted flow techniques involve tedious calculations and are difficult to understand. Finally, the total benefits associated with the project are taken into account while calculating the ARR. Some methods, pay back for instance, do not use the entire stream of incomes.

However, this method of evaluating investment proposals suffers from serious deficiencies. The principal shortcoming of the ARR approach aries from the use of accounting income instead of cash flows. The cash flow approach is markedly superior to accounting earnings for project evaluation. The earnings calculations ignore the reinvestment potential of a project's benefits while the cash flow takes into account this potential and, hence, the total benefits of the project.

The second principal shortcoming of ARR is that it does not take into account the time value of money. The timing of cash inflows and outflows is a major decision variable in financial decision making. Accordingly, benefits in the earlier years and later years cannot be valued at par. To the extent the ARR method treats these benefits at par and fails to take account of the differences in the time value of money, it suffers from a serious deficiency. Thus, in Example 5.6, the ARR in case of both machines, A and B is the same, although machine B should be preferred since its returns in the early years of its life are greater. Clearly, the ARR method of evaluating investment proposals fails to consider this.

Thirdly, the ARR criterion of measuring the worth of investment does not differentiate between the size of the investment required for each project. Competing investment proposals may have the same ARR, but may require different average investments, as shown in Table 5.6. The ARR method, in such a situation, will leave the firm in an indeterminate position.

Table 5.6

Machines	*Average annual earnings*	*Average investment*	*ARR (per cent)*
1	*2*	*3*	*4*
A	Rs 6,000	Rs 30,000	20
B	2,000	10,000	20
C	4,000	20,000	20

Finally, this method does not take into consideration any benefits which can accrue to the firm from the sale or abandonment of equipment which is replaced by the new investment. The 'new' investment, from the point of view of correct financial decision making, should be measured in terms of incremental cash outflows due to new investments, that is, new investment minus sale proceeds of the existing equipment ± tax adjustment. But the ARR method does not make any adjustment in this regard to determine the level of average investments. Investments in fixed assets are determined at their acquisition cost.

For these reason, the ARR leaves much to be desired as a method for project selection.

Pay Back Method

Computation The pay back method (PB) is the second traditional method of capital budgeting. It is the simplest and, perhaps, the most widely employed, quantitative method for appraising capital expenditure decisions. This method answers the question: How many years will it take for the cash benefits to pay the original cost of an investment, normally disregarding salvage value? Cash benefits here represent CFAT ignoring interest payment. Thus, the pay back method (PB) measures the number of years required for the CFAT to pay back the original outlay required in an investment proposal.

There are two ways of calculating the PB period. The first method can be applied when the cash flow stream is in the nature of annuity for each year of the project's life, that is, CFAT are uniform. In such a situation, the initial cost of the investment is divided by the constant annual cash flow:

$$\text{PB} = \frac{\text{Investment}}{\text{Constant annual cash flow}} \tag{5.3}$$

For example, an investment of Rs 40,000 in a machine is expected to produce CFAT of Rs 8,000 for 10 years,

$$\text{PB} = \frac{\text{Rs } 40,000}{\text{Rs } 8,000} = 5 \text{ years}$$

The second method is used when a project's cash flows are not uniform (mixed stream) but vary from year to year. In such a situation, PB is calculated by the process of cumulating cash flows till the time when cumulative cash flows become equal to the original investment outlay. Table 5.7 presents the calculations of pay back period for Example 5.6.

Table 5.7

Year	*Annual CFAT*		*Cumulative CFAT*	
	A	*B*	*A*	*B*
1	Rs 14,000	Rs 22,000	Rs 14,000	Rs 22,000
2	16,000	20,000	30,000	42,000
3	18,000	18,000	48,000	60,000
4	20,000	16,000	68,000	76,000
5	25,000 *	17,000 *	93,000	93,000

* CFAT in the fifth year includes Rs.3,000 salvage value also.

The initial investment of Rs 56,125 on machine A will be recovered between years 3 and 4.

The pay back period would be a fraction more than 3 years. The sum of Rs 48,000 is recovered by the end of the third year. The balance Rs 8,125 is needed to be recovered in the fourth year. In the fourth year CFAT is Rs 20,000. The pay back fraction is, therefore, 0.406 (Rs 8,125/Rs 20,000). The pay back period for machine A is 3.406 years. Similarly, for machine B the pay back period would be 2 years and a fraction of a year. As Rs 42,000 is recovered by the end of the second year, the balance of Rs 14,125 needs to be recovered in the third year. In the third year CFAT is Rs 18,000. The pay back fraction is 0.785 (Rs 14,125/ Rs 18,000). Thus, the PB period for machine B is 2.785 years.

Accept-Reject Criterion The pay back period can be used as a decision criterion to accept or reject investment proposals. One application of this technique is to compare the actual pay back with a predetermined pay back, that is, the pay back set up by the management in terms of the maximum period during which the initial investment must be recovered. If the actual pay back period is less than the

predetermined pay back, the project would be accepted; if not, it would be rejected. Alternatively, the pay back can be used as a ranking method. When mutually exclusive projects are under consideration, they may be ranked according to the length of the pay back period. Thus, the project having the shortest pay back may be assigned rank one, followed in that order so that the project with the longest pay back would be ranked last. Obviously, projects with shorter pay back period will be selected.

Evaluation The pay back method has certain merits. It is easy to calculate and simple to understand. Moreover, the pay back method is an improvement over the ARR approach. Its superiority arises due to the fact that it is based on cash flow analysis. The results of Example 5.6 illustrated in Table 5.10 can be cited in support of this. Thus, though the average cash flows for both the machines under the ARR method were the same, the pay back method shows that the pay back period for machine B is shorter than for machine A. The pay back period approach shows that machine B should be preferred as it refunds the capital outlay earlier than machine A.

The pay back approach, however, suffers from serious limitations. Its major shortcomings are as follows:

The first major shortcoming of the pay back method is that it completely ignores all cash inflows after the pay back period. This can be very misleading in capital budgeting evaluations. Table 5.8 reveals alternative projects with the same pay back period (3 years).

Table 5.8

	Project X	*Project Y*
Total cost of the project	Rs 15,000	Rs 15,000
Cash inflows (CFAT)		
Year 1	5,000	4,000
2	6,000	5,000
3	4,000	6,000
4	0	6,000
5	0	3,000
6	0	3,000
Pay back period (years)	3	3

In fact, the projects differs widely in respect of cash inflows generated after the pay back period. The cash flow for project X stops at the end of the third year, while that of Y continues up to the sixth year. Obviously, the firm would prefer project Y because it makes available to the firm cash inflows of Rs 12,000, in years 4 through 6, whereas project X does not yield any cash inflow after the third year. Under the pay back method, however, both the projects would be given equal ranking, which is apparently incorrect. Therefore, it cannot be regarded as a measure of profitability. Its failure lies in the fact that it does not consider the total benefits accruing from the project.

Another deficiency of the pay back method is that it does not measure correctly even the cash flows expected to be received within the pay back period as it does not differentiate between projects in terms of the timing or the magnitude of cash flows. It considers only the recovery period as a whole. This happens because it does not discount the future cash inflows but rather treats a rupee received in the second or third year as valuable as a rupee received in the first year. In other words, to the extent the pay back method fails to consider the pattern of cash inflows, it ignores the time value of money.

Table 5.9 shows that both the projects A and B have (i) the same cash outlays in the zero time period; (ii) the same total cash inflows of Rs 15,000; and (iii) the same pay back period of 3 years. But project A would be acceptable to the firm because it returns cash earlier than project B, enabling A to repay a loan or reinvest it and earn a return. A possible solution to this problem is provided by determining the pay back period of discounted cash flows. This is illustrated in the subsequent section of this chapter.

Table 5.9 *Cashflows of Projects*

	Project A	*Project B*
Total cost of the project	Rs 15,000	Rs 15,000
Cash inflows (CFAT)		
Year 1	10,000	1,000
2	4,000	4,000
3	1,000	10,000

Another flaw of the pay back method is that it does not take into consideration the entire life of the project during which cash flows are generated. As a result, projects with large cash inflows in the latter part of their lives may be rejected in favour of less profitable projects which happen to generate a larger proportion of their cash inflows in the earlier part of their lives. Table 5.10 presents the comparison of two such projects. On the basis of the pay back criterion, project A will be adjudged superior to project B.

Table 5.10

	Project A	*Project B*
Total cost of the project	Rs 40,000	Rs 40,000
Cash inflows (CFAT)		
Year 1	14,000	10,000
2	16,000	10,000
3	10,000	10,000
4	4,000	10,000
5	2,000	12,000
6	1,000	16,000
7	Nil	17,000
Pay back period (years)	3	4

It is quite evident just from a casual inspection that project B is more profitable than project A, since the cash inflows of the former amount to Rs 45,000 after the expiry of the pay back period and the cash flows of the latter beyond the pay back period are only Rs 7,000.

The above weaknesses notwithstanding, the pay back method can be gainfully employed under certain circumstances.[10] In the first place, where the long-term outlook, say in excess of three years, is extremely hazy, the pay back method may be useful. In a politically unstable country, for instance, a quick return to recover the investment is the primary goal, and subsequent profits are almost unexpected surprises. Likewise, this method may be very appropriate for firms suffering from liquidity crisis. A firm with limited liquid assets and no ability to raise additional funds, which nevertheless wishes to undertake capital projects in the hope of easing the crisis, might use pay back as a selection criterion because it emphasises quick recovery of the firm's original outlay and little impairment of the already critical liquidity situation. Thirdly, the payback method may also be beneficial in taking capital budgeting decisions for firms which lay more emphasis on short-run earning performance rather than its long-term growth. The pay back period is a measure of liquidity of investments rather than their profitability. Thus, the pay back period should more appropriately be treated as a constraint to be *satisfied* than as a profitability measure to be *maximised*.[11] Finally, the pay back period is useful, apart from measuring liquidity, in making calculations in certain situations. For instance, the internal rate of return can be computed easily from the pay back period. The pay back method is a good approximation of the internal rate of return which otherwise requires a trial and error approach.

To conclude the discussion of the traditional methods of appraising capital investment decisions, there are two major drawbacks of these techniques. They do not consider the total benefits in terms of (i) the magnitude and (ii) the timing of cash flows. For these reasons,the traditional methods are unsatisfactory as capital budgeting decision criteria. The two essential ingredients of a theoretically sound appraisal method, therefore, are that (i) it should be based on a consideration of the total cash stream, and (ii) it should consider the time value of money as reflected in both the magnitude and the timing of expected cash flows in each period of a project's life. The time-adjusted (also known as discounted cash flow) techniques satisfy these requirements and, to that extent, provide a more objective basis for selecting and evaluating investment projects.

Discounted Cashflow (DCF)/Time-Adjusted (TA) Techniques

The distinguishing characteristics of the DCF capital budgeting techniques is that they take into consideration the time value of money while evaluating the costs and benefits of a project. In one form or another, all these methods require cash flows to be discounted at a certain rate, that is, the cost of capital. The cost of capital (K) is the minimum discount rate earned on a project that leaves the market value unchanged.

The second commendable feature of these techniques is that they take into account all benefits and costs occurring during the entire life of the project.

In the discussions that follow, we have attempted to discuss the DCF evaluation methods. First, we have explained the general procedure behind DCF. This is followed by a discussion of the first DCF technique, namely, net present value (NPV). We have then covered the internal rate of return (IRR) method. The two variations of the NPV method, that is, terminal value and profitability index (PI) or benefit-cost ratio are also discussed. An attempt has also been made to compare the NPV method with IRR and the PI.

Present Value (PV)/Discounted Cash Flow (DCF)

General Procedure The present value or the discounted cash flow procedure recognises that cash flow streams at different time periods differ in value and can be compared only when they are expressed in terms of a common denominator, that is, present values. It, thus, takes into account the time value of money. In this method, all cash flows are expressed in terms of their present values. The procedure to determine present value is comprehensively covered in Chapter 2.

The present value of the cash flows in Example 5.6 are illustrated in Table 5.11.

Table 5.11 *Calculations of Present Value of CFAT*

	Machine A			*Machine B*		
Year	*CFAT*	*PV factor (0.10)*	*Present value*	*CFAT*	*PV factor (0.10)*	*Present value*
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 14,000	0.909	Rs 12,726	Rs 22,000	0.909	Rs 19,998
2	16,000	0.826	13,216	20,000	0.826	16,520
3	18,000	0.751	13,518	18,000	0.751	13,518
4	20,000	0.683	14,660	16,000	0.683	10,928
5	25,000*	0.621	15,525	17,000*	0.621	10,557
			69,645			71,521

*includes salvage value.

The PV so determined is compared with the PV of cash outflows. The present values of cash inflows of both the machines are higher than cash outflows, and, therefore both are acceptable.

The PV of CFAT (Col. 4 and Col. 7 of Table 5.11) now can be used to determine the 'discounted' pay back period. It is determined on the basis of discounted present value of CFAT vis-a-vis unadjusted cash flows (Col .2 and Col .5 of Table 5.11) used in the 'simple' pay back method. The relevant values of the 'discounted' pay back period are 4.2 and 3.66 years for Machines A and B respectively in Example 5.6.

Net Present Value (NPV) Method

The first DCF/PV technique is the NPV. NPV may be described as the summation of the present values of cash proceeds (CFAT) in each year minus the summation of present values of the net cash outflows in each year. Symbolically, the NPV for projects having conventional cash flows would be:

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} + \frac{S_n + W_n}{(1+K)^n} - CO_0 \tag{5.4}$$

If cash outflow is also expected to occur at some time other than at initial investment (non-conventional cash flows) the formula would be:

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} + \frac{S_n + W_n}{(1+K)^n} - \sum_{t=0}^{n} \frac{CO_t}{(1+K)^t} \tag{5.5}$$

The decision rule for a project under NPV is to accept the project if the NPV is positive and reject if it is negative. Symbolically, (i) NPV > zero, *accept*, (ii) NPV < zero, reject (5.6)

Zero NPV implies that the firm is indifferent to accepting or rejecting the project. However, in practice it is rare if ever such a project will be accepted, as such a situation simply implies that only the original investment has been recovered.

In Example 5.6 we would accept the proposals of purchasing machines A and B as their net present values are positive. The positive NPV of machine A is Rs 13,520 (R 69,645 – Rs 56,125) and that of B is Rs 15,396 (Rs 71,521 – Rs 56,125).

In Example 5.6, if we incorporate cash outflows of Rs 25,000 at the end of the third year in respect of overhauling of the machine, we shall find the proposals to purchase either of the machines are unacceptable as their net present values are negative. The negative NPV of machine A is Rs 6,255 (Rs 68,645 – Rs 74,900) and of machine B is Rs 3,379 (Rs 71,521 – Rs 74,900).

As a decision criterion, this method can also be used to make a choice between mutually exclusive projects. On the basis of the NPV method, the various proposals would be ranked in order of the net present values. The project with the highest NPV would be assigned the first rank, followed by others in the descending order. If, in our example, a choice is to be made between machine A and machine B on the basis of the NPV method, machine B having larger NPV (Rs 15,396) would be preferred to machine A (NPV being Rs 12,520).

Evaluation The present value method including the NPV variation possesses several merits. The first, and probably the most significant, advantage is that it explicitly recognises the time value of money. In Example 5.6, for instance (Table 5.11), the total cash inflows (CFAT) pertaining to the two machines (A and B) are equal. But the present value as well as the NPV is different. As can be seen from Table 5.11, this is primarily because of the differences in the pattern of the cash streams. The magnitude of CFAT in the case of machine A is lower in the earlier years as compared to the machine B while it is greater in the latter years. Because of larger inflows in the first two years, the NPV of machine B is larger than that of machine A. The need for recognising the time value of money is, thus, satisfied by this method.

Secondly, it also fulfills the second attribute of a sound method of appraisal in that it considers the total benefits arising out of the proposal over its lifetime.

Thirdly, a changing discount rate can be built into the NPV calculations by altering the denominator. This feature becomes important as this rate normally changes because the longer the time span, the lower is the value of money and the higher is the discount rate.

Fourthly, this method is particularly useful for the selection of mutually exclusive projects. This aspect will be discussed in detail in the latter part of the chapter, where it is shown that for mutually exclusive choice problems, the NPV method is the best decision-criterion.

Finally, this method of asset selection is instrumental in achieving the objective of financial management which is the maximisation of the shareholders' wealth. The rationale behind this contention is the effect on the market price of shares as a result of the acceptance of a proposal having present value exceeding the initial outlay or, as a variation having NPV greater than zero. The market price of the shares will be affected by the relative force of what the investors expect and what actual return is earned on the funds. The discount rate that is used to convert benefits into present values is the minimum rate or the rate of interest is that when the present values of cash inflows is equal to the initial outlay or when the NPV = 0, the return on investment just equals the expected or required rate by investors. There would, therefore, be no change in the market price of shares. When the present value exceeds the outlay or the NPV > 0, the return would be higher than expected by the investors. It would, therefore, lead to an increase in share prices. The present value method is, thus, logically consistent with the goal of maximising shareholders' wealth in terms of maximising the market price of the shares.

In brief, the present value method is a theoretically correct technique for the selection of investment projects. Nevertheless, it has certain limitations also.

In the first place, it is difficult to calculate as well as understand and use in comparison with the pay back method or even the ARR method. This, of course, is a minor flaw.

The second, and a more serious problem associated with the present value method, involves the calculation of the required rate of return to discount the cash flows. The discount rate is the most important element used in the calculation of the present values because different discount rates will give different present values. The relative desirability of a proposal will change with a change in the discount rate. For instance, for a proposal involving an initial outlay of Rs 9,000, having annuity of Rs 2,800 for 5 years, the net present values for different required rates of return are given in Table 5.12.

Table 5.12 *Net Present Value with Different Discount Rates*

Discount rate (percent)	*Net present value*
Zero	Rs 5,000.00
4	3,465.00
8	2,179.50
10	1,614.00
12	1,093.50
16	168.00
20	(626.50)

The importance of the discount rate is, thus, obvious. But the calculation of the required rate of return presents serious problems. The cost of capital is generally the basis of the discount rate. The calculation of the cost of capital is very complicated. In fact, there is a difference of opinion even regarding the exact method of calculating it.

Another shortcoming of the present value method is that it is an absolute measure. *Prima facie* between two projects, this method will favour the project which has higher present value (or NPV). But it is likely

that this project may also involve a larger initial outlay. Thus, in case of projects involving different outlays, the present value method may not give dependable results.

Finally, the present value method may also not give satisfactory results in the case of two projects having different effective lives. In general, the project with a shorter economic life would be preferable, other things being equal. A project which has a higher present value may also have a larger economic life so that the funds will remain invested for a longer period, while the alternative proposal may have shorter life but smaller present value. In such situations, the present value method may not reflect the true worth of the alternative proposals.

Internal Rate of Return (IRR) Method

The second discounted cash flow (DCF) or time-adjusted method for appraising capital investment decisions is the internal rate of return (IRR) method. This technique is also known *as yield on investment, marginal efficiency of capital, marginal productivity of capital, rate of return, time-adjusted rate of return* and so on. Like the present value method, the IRR method also considers the time value of money by discounting the cash streams. The basis of the discount factor, however, is different in both cases. In the case of the net present value method, the discount rate is the required rate of return and being a predetermined rate, usually the cost of capital, its determinants are external to the proposal under consideration. The IRR, on the other hand, is based on facts which are internal to the proposal. In other words, while arriving at the required rate of return for finding out present values the cash flows—inflows as well as outflows—are not considered. But the IRR depends entirely on the initial outlay and the cash proceeds of the project which is being evaluated for acceptance or rejection. It is, therefore, appropriately referred to as internal rate of return.

The internal rate of return is usually the rate of return that a project earns. It is defined as the discount rate (r) which equates the aggregate present value of the net cash inflows (CFAT) with the aggregate present value of cash outflows of a project. In other words, it is that rate which gives the project NPV of zero.

Assuming conventional cash flows, mathematically, the IRR is represented by the rate, r, such that

$$\mathrm{CO}_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} + \frac{S_n + W_n}{(1+r)^n} \tag{5.7}$$

$$\text{Zero} = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} + \frac{S_n + W_n}{(1+r)^n} - \mathrm{CO}_0 \tag{5.8}$$

For unconventional cash flows, the equation would be:

$$= \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} + \frac{S_n + W_n}{(1+r)^n} - \sum_{t=1}^{n} \frac{\mathrm{CO}_0}{(1+r)^t} \tag{5.9}$$

$$= \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} + \frac{S_n + W_n}{(1+r)^n} - \sum_{t=0}^{n} \frac{\mathrm{CO}_t}{(1+r)^t} = \text{Zero} \tag{5.10}$$

where r = The internal rate of return
CF_t = Cash inflows at different time periods
S_n = Salvage value
W_n = Working capital adjustments
CO_t = Cash outlay at different time periods

Accept-Reject Decision The use of the IRR, as a criterion to accept capital investment decisions, involves a comparison of the actual IRR with the required rate of return also known as the cut-off rate or hurdle rate. The project would qualify to be accepted if the IRR (r) exceeds the cut-off rate (k). If the IRR and the required rate of return are equal, the firm is indifferent as to whether to accept or reject the project.

Computation Unlike the NPV method, calculating the value of IRR is more difficult. The procedure will depend on whether the cash flows are annuity or mixed stream.

Annuities The following steps are taken in determining IRR for an annuity:

- Determine the pay back period of the proposed investment.
- In Table A-4 (present value of an annuity) look for the pay back period that is equal to or closest to the life of the project.
- In the year row, find two PV values or discount factor (DFr) closest to PB period but one bigger and other smaller than it.
- From the top row of the table, note interest rate (r) corresponding to these PV values (DFr).
- Determine actual IRR by interpolation. This can be done either directly using equation 5.11 or indirectly by finding present values of annuity (Equation 5.12).

$$\text{IRR} = r - \left(\frac{\text{PB} - \text{DF}_r}{\text{DF}_{rL} - \text{DF}_{rH}} \right) \tag{5.11}$$

where PB = Pay back period

DF_r = Discount factor for interest rate r.

DF_{rL} = Discount factor for lower interest rate

DF_{rH} = Discount factor for higher interest rate.

r = Either of the two interest rates used in the formula

Alternatively,

$$\text{IRR} = r - \left(\frac{\text{PV}_{\text{CO}} - \text{PV}_{\text{CFAT}}}{\Delta \text{PV}} \right) \times \Delta r \tag{5.12}$$

where PV_{CO} = Present value of cash outlay

PV_{CFAT} = Present value of cash inflows (DFr x annuity)

r = Either of the two interest rates used in the formula

Δr = Difference in interest rates

Δ PV = Difference in calculated present values of inflows

The computations are shown in Example 5.7.

EXAMPLE 5.7

A project costs Rs.36,000 and is expected to generate cash inflows of Rs.11,200 annually for 5 years. Calculate the IRR of the project.

SOLUTION

(1) The pay back period is 3.214 (Rs 36,000/Rs 11,200)

(2) According to Table A-4, discount factors closest to 3.214 for 5 years are 3.274 (16 per cent rate of interest) and 3.199 (17 per cent rate of interest). The actual value of IRR which lies between 16 per cent and 17 per cent can, now, be determined using Equations 5.11 and 5.12.

Substituting the values in Equation 5.11 we get: $\text{IRR} = 16 + \left(\frac{3.274 - 3.214}{3.274 - 3.199}\right) = 16.8 \text{ per cent}$

Alternatively (starting with the higher rate), $\text{IRR} = 17 - \left(\frac{3.214 - 3.199}{3.274 - 3.199}\right) = 16.8 \text{ per cent}$

Instead of using the direct method, we may find the actual IRR by applying the interpolation formula to the present values of cash inflows and outflows (Equation 5.12). Here, again, it is immaterial whether we start with the lower or the higher rate.

$$PV_{CFAT}\,(0.16) = \text{Rs } 11{,}200 \times 3.274 = \text{Rs } 36{,}668.8$$
$$PV_{CFAT}\,(0.17) = \text{Rs } 11{,}200 \times 3.199 = \text{Rs } 35{,}828.8$$

$$\text{IRR} = 16 + \left(\frac{36{,}668.8 - 36{,}000}{36{,}668.8 - 35{,}828.8}\right) \times 1 = 16.8 \text{ per cent}$$

Alternatively (starting with the higher rate), $\text{IRR} = r - \frac{(PV_{CO} - PV_{CFAT})}{\Delta PV} \times \Delta r$

$$\text{IRR} = 17 - \left(\frac{36{,}000 - 35{,}828.8}{840}\right) \times 1 = 16.8 \text{ per cent}$$

For a Mixed Stream of Cash Flows Calculating the IRR for a mixed stream of cash flows is more tedious. In a mixed stream of cash flows, the inflows in various years are uneven or unequal. One way to simplify the process is to use 'fake annuity' as a starting point.[12] The following procedure is a useful guide to calculating IRR:

1. Calculate the average annual cash inflow to get a 'fake annuity'.
2. Determine 'fake pay back period' dividing the initial outlay by the average annual CFAT determined in step 1.
3. Look for the factor, in Table A-4, closest to the fake pay back value in the same manner as in the case of annuity. The result will be a rough approximation of the IRR, based on the assumption that the mixed stream is an annuity (fake annuity).
4. Adjust subjectively the IRR obtained in step 3 by comparing the pattern of average annual cash inflows (as per step 1) to the actual mixed stream of cash flows. If the actual cash flows stream happens to be higher in the initial years of the project's life than the average stream, adjust the IRR a few percentage points upward. The reason is obvious as the greater recovery of funds in the earlier years is likely to give a higher yield rate (IRR). Conversely, if in the early years the actual cash inflows are below the average, adjust the IRR a few percentage points downward. If the average cash flows pattern seems fairly close to the actual pattern, no adjustment is to be made.
5. Find out the present value (using Table A-3) of the mixed cash flows, taking the IRR as the discount rate as estimated in step 4.
6. Calculate the PV, using the discount rate. If the PV of CFAT equals the initial outlay, that is, NPV is zero, it is the IRR. Otherwise, repeat step 5. Stop, once two consecutive discount rates that cause the NPV to be positive and negative, respectively have been calculated. Whichever of these two rates causes the NPV to be closest to zero is the IRR to the nearest 1 per cent.

7. The actual value can be ascertained by the method of interpolation as in the case of an annuity.

Let us apply this procedure for determining the IRR of Example 5.6 of a mixed stream of CFAT for machines A and B. The cash flows associated with the machines are given in Table 5.7.

SOLUTION

1. The sum of cash inflows of both the machines is Rs 93,000 which when divided by the economic life of the machine (5 years), results in a 'fake annuity' of Rs 18,600.
2. Dividing the initial outlay of Rs 56,125 by Rs 18,600, we have 'fake average pay back period' of 3.017 years.
3. In Table A-4, the factor closest to 3.017 for 5 years is 2.991 for a rate of 20 per cent.
4. Since the actual cash flows in the earlier years are greater than the average cash flows of Rs 18,600 in machine B, a subjective increase of, say, 1 per cent is made. This makes an estimated rate of IRR 21 per cent for machine B. In the case of machine A, since cash inflows in the initial years are smaller than the average cash flows, a subjective decrease of, say, 2 per cent is made. This makes the estimated IRR rate 18 per cent for machine A.
5. Using the PV factors for 21 per cent (Machine B) and 18 per cent (Machine A) from Table A-3 for years 1-5, the PVs are calculated in Table 5.13.

Table 5.13

	Machine A			*Machine B*		
Year	*CFAT*	*PV factor (0.18)*	*Total PV*	*CFAT*	*PV factor (0.21)*	*Total PV*
1	Rs 14,000	0.847	Rs 11,858	Rs 22,000	0.826	Rs 18,172
2	16,000	0.718	11,488	20,000	0.683	13,660
3	18,000	0.609	10,962	18,000	0.564	10,152
4	20,000	0.516	10,320	16,000	0.467	7,472
5	25,000	0.437	10,925	17,000	0.386	6,562
			55,553			56,018
Less initial investment			56,125			56,125
NPV			(572)			(107)

6. Since the NPV is negative for both the machines, the discount rate should be subsequently lowered. In the case of machine A the difference is of Rs 572 whereas in machine B the difference is Rs 107. Therefore, in the former case the discount rate is lowered by 1 per cent in both the cases. As a result, the new discount rate would be 17 per cent for A and 20 per cent for B.

The calculations given in Table 5.14 shows that the NPV at discount rate of 17 per cent is Rs.853 (machine A) and Rs 1,049 for machine B at 20 per cent dicount.

Table 5.14

	Machine A			*Machine B*		
Year	*CFAT*	*PV factor (0.17)*	*Total PV*	*CFAT*	*PV factor (0.20)*	*Total PV*
1	Rs 14,000	0.855	Rs 11,970	Rs 22,000	0.833	Rs 18,326
2	16,000	0.731	11,69	20,000	0.694	13,880
3	18,000	0.624	10,232	18,000	0.579	10,422
4	20,000	0.534	10,680	16,000	0.484	7,712
5	25,000	0.456	11,400	17,000	0.442	6,834
PV of cash inflows			56,978			57,174
Less initial outlay			56,125			56,125
Net present value			853			1,049

(a) For Machine A: Since 17 per cent and 18 per cent are consecutive discount rates that give positive and negative net present values, interpolation method can be applied to find the actual IRR which will be between 17 and 18 per cent.

$$\text{IRR} = 17 + \left[\frac{\text{Rs } 56,978 - \text{Rs } 56,125}{\text{Rs } 56,978 - \text{Rs } 55,553}\right] \times 1 = 17.6 \text{ per cent}$$

(b) For Machine B: $\text{IRR} = 20 + \left[\frac{\text{Rs } 57,174 - \text{Rs } 56\,125}{\text{Rs } 57,174 - \text{Rs } 56,018}\right] \times 1 = 20.9 \text{ per cent}$

Evaluation of IRR The IRR method is a theoretically correct technique to evaluate capital expenditure decisions. It has the advantages which are offered by the NPV criterion such as: (i) it considers the time value of money, and (ii) it takes into account the total cash inflows and outflows.

In addition, the IRR is easier to understand. Business executives and non-technical people understand the concept of IRR much more readily than they understand the concept of NPV. They may not be following the definition of IRR in terms of the equation but they are well aware of its usual meaning in terms of the rate of return on investment. For instance, business executives will understand the investment proposal in a better way if told that IRR of machine B is 21 per cent and k is 10 per cent instead of saying that the NPV of machine B is Rs 15,396.

Another merit of IRR is that it does not use the concept of the required rate of return/the cost of capital. It itself provides a rate of return which is indicative of the profitability of the proposal. The cost of capital, of course, enters the calculations later on.

Finally, it is consistent with the overall objective of maximising shareholders' wealth. According to IRR, as a decision-criterion, the acceptance or otherwise of a project is based on a comparison of the IRR with the required rate of return. The required rate of return is, by definition, the minimum rate which investors expect on their investment. In other words, if the actual IRR of an investment proposal is equal to the rate expected by the investors, the share prices will remain unchanged. Since, with IRR, only such projects are accepted as have IRR > required rate, the share prices will tend to rise. This will naturally lead to the maximisation of shareholders' wealth.

Its theoretical soundness notwithstanding, the IRR suffers from serious limitations.

First, it involves tedious calculations. As shown above, it generally involves complicated computational problems.

Secondly, it produces multiple rates which can be confusing. This aspect is further developed later in this chapter.

Thirdly, in evaluating mutually exclusive proposals, the project with the highest IRR would be picked up to the exclusion of all others. However, in practice, it may not turn out to be the one which is the most profitable and consistent with the objectives of the firm, that is, maximisation of the shareholders' wealth. This aspect also has been discussed in detail later in this chapter.

Finally, under the IRR method, it is assumed that all intermediate cash flows are reinvested at the IRR. In our example, the IRR rates for machines A and B are 17.6 per cent and 20.9 per cent respectively. In operational terms, 17.6 per cent IRR signifies that all cash inflows of machine A can be reinvested at 17.6 per cent whereas that of B at 20.9 per cent. It is rather ridiculous to think that the same firm has the ability to reinvest the cash flows at different rates.

There is no difference in the 'quality of cash' received either from project A or B. The reinvestment rate assumption under the IRR method is, therefore, very unrealistic. Moreover, it is not safe to assume always that intermediate cash flows from the project will be reinvested at all. A portion of cash inflows may be paid

out as dividends. Likewise, a portion of it may be tied up in current assets such as stocks, debtors or cash. Clearly, the firm will get a wrong picture of the capital project if it assumes that it invests the entire intermediate cash proceeds. Further, it is not safe to assume, as is often done, that they will be reinvested at the same rate of return as the company is currently earning on its capital (IRR) or at the current cost of capital, *k*. In order to have correct and reliable results it is obvious, therefore, that they should be based on realistic estimates of the interest rate (if any) at which income will be reinvested. Terminal value takes care of this aspect.

Terminal Value Method

The terminal value approach (TV) even more distinctly separates the timing of the cash inflows and outflows. The assumption behind the TV approach is that each cash inflow is reinvested in another asset at a certain rate of return from the moment it is received until the termination of the project. Consider Example 5.8.

EXAMPLE 5.8

Original outlay, Rs 10,000
Life of the project, 5 years
Cash inflows, Rs 4,000 each for 5 years
Cost of capital (k), 10 per cent

Expected interest rates at which cash inflows will be reinvested:

Year-end	Per cent
1	6
2	6
3	8
4	8
5	8

SOLUTION

We would reinvest Rs 4,000 received at the end of the year 1 for 4 years at the rate of 6 per cent. The cash inflows in year 2 will be re-invested for 3 years at 6 per cent, the cash inflows of year 3 for 2 years and so on.

There will be no reinvestment of cash inflows received at the end of the fifth year. The total sum of these compounded cash inflows is then discounted back for 5 years at 10 per cent and compared with the present value of the cash outlays, that is, Rs 10,000 (in this case).

The PV of the terminal sum is given in Table 5.15.

Table 5.15

Year	*Cash inflows*	*Rate of interest*	*Years for investment*	*Compounding factor*	*Total compounded sum*
1	*2*	*3*	*4*	*5*	*6*
1	Rs 4,000	6	4	1.262	Rs 5,048
2	4,000	6	3	1.191	4,764
3	4,000	8	2	1.166	4,664
4	4,000	8	1	1.080	4,320
5	4,000	8	0	1.000	4,000
					22,796

Now, we have to find out the present value of Rs 22,796. The discount rate would be the cost of capital, k (0.10). The sum of Rs.22,796 would be received at the end of year 5. Its present value = Rs 22,796 × 0.621 = Rs 14,156.3.

Accept-reject Rule The decision rule is that if the present value of the sum total of the compounded reinvested cash inflows (PVTS) is greater than the present value of the outflows (PVO), the proposed project is accepted otherwise not. Symbolically,

$$\begin{aligned} &\text{PVTS} > \text{PVO accept} \\ &\text{PVTS} < \text{PVO reject} \end{aligned} \tag{5.13}$$

The firm would be indifferent if both the values are equal. Thus, since the PVTS of Rs 14,156.31 exceeds the original outlay of Rs 10,000, we would accept the assumed project under the TV criterion.

A variation of the terminal value method (TV) is the net terminal value (NTV). Symbolically it can be represented as NTV = (PVTS – PVO). If the NTV is positive, accept the project, if the NTV is negative, reject the project. In the above example, the NTV is positive. Its value is Rs 4,156.31. Therefore, the project is acceptable.

The NTV method is similar to NPV method, with the difference that while in the former, values are compounded, in the latter, they are discounted. Both the methods will give the same results provided of course the same figures have been discounted as have been compounded and the same interest rate (rates) is used for both discounting and compounding.

Evaluation The NTV (or TV) method has a number of advantages.

Firstly, these methods explicitly incorporate the assumption about how the cash inflows are reinvested once they are received and avoid any influence of the cost of capital on the cash inflow stream itself.

Secondly, it is mathematically easier, making simple the process of evaluating the investment worth of alternative capital projects.

Thirdly, this method would be easier to understand for business executives who are not trained in accountancy or economics than NPV for IRR, as the 'compounding technique', appeals more than 'discounting'.

Fourthly, it is better suited to cash budgeting requirements. The NPV computation in spite of being a cash flow approach does not explicitly show all the cash inflows. It does not take into account cash inflows in respect of interest earnings.

The major practical problem of this method lies in projecting the future rates of interest at which the intermediate cash inflows received will be reinvested.

Profitability Index (PI) or Benefit-Cost Ratio (B/C Ratio)

Yet another time-adjusted capital budgeting technique is profitability index (PI) or benefit-cost ratio (B/C). It is similar to the NPV approach. The profitability index approach measures the present value of returns per rupee invested, while the NPV is based on the difference between the present value of future cash inflows and the present value of cash outlays. A major shortcoming of the NPV method is that, being an absolute measure, it is not a reliable method to evaluate projects requiring different initial investments. The PI method provides a solution to this kind of problem. It is, in other words, a relative measure. It may be defined as the ratio which is obtained dividing the present value of future cash inflows by the present value of cash outlays. Symbolically,

$$\text{PI} = \frac{\text{Present value cash inflows}}{\text{Present value of cash outflows}} \tag{5.14}$$

This method is also known as the B/C ratio because the numerator measures benefits and the denominator costs. A more appropriate description would be *present value index*.

Accept-Reject Rule Using the B/C ratio or the PI, a project will qualify for acceptance if its PI exceeds one. When PI equals 1, the firm is indifferent to the project.

When PI is greater than, equal to or less than 1, the net present value is greater than, equal to or less than zero respectively. In other words, the NPV will be positive when the PI is greater than 1; will be negative when the PI is less than one. Thus, the NPV and PI approaches give the same results regarding the investment proposals.

The selection of projects with the PI method can also be done on the basis of ranking. The highest rank will be given to the project with the highest PI, followed by others in the same order.

In Example 5.6 (Table 5.15) of machine A and B, the PI would be 1.22 for machine A and 1.27 for machine B:

$$\text{PI (Machine A)} = \frac{\text{Rs } 68,645}{\text{Rs } 56,125} = 1.22$$

$$\text{PI (Machine B)} = \frac{\text{Rs } 71,521}{\text{Rs } 56,125} = 1.27$$

Since the PI for both the machines is greater than 1, both the machines are acceptable.

Though it is common to define PI as the ratio of the PV of the cash inflows divided by the PV of cash outflows, the PI may also be measured on the basis of the net benefits of a project against its current cash outlay rather than measure its gross benefits against its total cost over the life of the project. This aspect becomes very important in situations of capital rationing.[13] In such a situation,the decision rule would be to accept the project if the PI is positive and reject the project it it is negative.

Evaluation Like the other discounted cash flow techniques, the PI satisfies almost all the requirements of a sound investment criterion. It considers all the elements of capital budgeting, such as the time value of money, totality of benefits and so on. Conceptually, it is a sound method of capital budgeting. Although based on the NPV, it is a better evaluation technique than NPV in a situation of capital rationing. For instance, two projects may have the same NPV of Rs 10,000 but project A requires an initial investment of Rs 50,000 whereas B only of Rs 25,000. Project B should be preferred as will be suggested by the PI method. The NPV method, however, will give identical rankings of both the projects. Thus, the PI method is superior to the NPV method as the former evaluates the worth of projects in terms of their relative rather than absolute magnitudes. However, in some problems of a mutually exclusive nature, the NPV method would be superior to the PI method. The comparison of PI and NPV is further explored subsequently.

This method is, however, more difficult to understand. Also, it involves more computation than the traditional methods but less then IRR.

The discussion in the preceding sections have explained the various time-adjusted methods of appraising investment projects. We now propose to present a comparative view of these. First, the two widely used methods–NPV and IRR–are compared to evaluate their relative suitability. We subsequently compare NPV with PI.

NPV and IRR Methods—A Comparison

The NPV and IRR methods are similar in certain respects. For instance, in certain situations, they would give the same accept-reject decision. But they also differ in the sense that the results regarding the choice of

an asset are under certain circumstances mutually contradictory. The comparison of these methods, therefore, involves a discussion of (i) the similarities between the methods, and (ii) their differences, as also the factors which are likely to cause differences.

NPV and IRR: Similarities The two methods–IRR and NPV–would give consistent results in terms of acceptance or rejection of investment proposals in certain situations. That is, if a project is sound, it will be indicated by both the methods. If, however, it does not qualify for acceptance, both the methods will indicate that it should be rejected.

The situations in which the two methods will give a concurrent accept-reject decision will be in respect of conventional and independent projects. A conventional investment is one in which the cash flow pattern is such that an initial investment (outlay or cash outflow) is followed by a series of cash inflows. Thus, in the case of such investments, cash outflows are confined to the initial period. The independent proposals refer to investments the acceptance of which does not preclude the acceptance of others so that all profitable proposals can be accepted and there are no constraints in accepting all profitable projects. The reason why both the methods are equivalent and support or reject a proposal is simple. The decision-criterion with these methods may be recalled here. According to the NPV method, the decision rule is that a project will be accepted if it has a positive NPV, that is, NPV exceeds zero. The IRR method would support projects in whose case the IRR is more than the required rate of return (*r* exceeds *k*). When the NPV = zero or the IRR = *k*, the project may be accepted or rejected. The projects which have positive net present values will also have an IRR higher than the required rate of return.

Thus, Fig. 5.3 portrays NPV as (i) positive; (ii) zero; and (iii) negative corresponding to three situations (a) IRR > K; (b) IRR = K; (c) IRR < K.

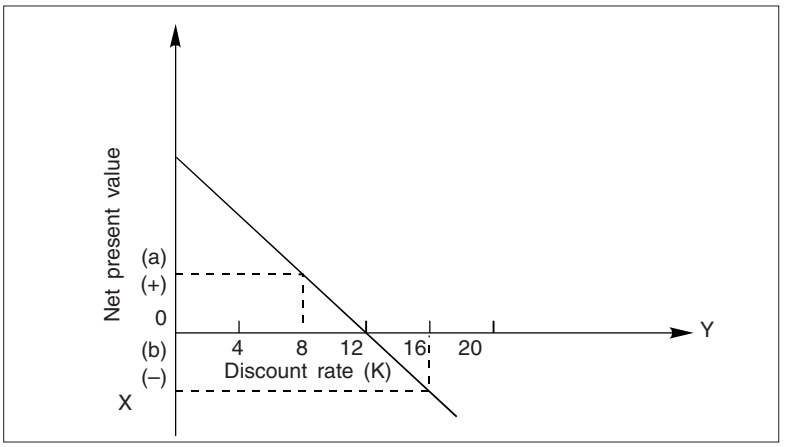

Figure 5.3 *NPV and Discount Rate*

Figure 5.3 shows the relationship between the NPV of a project and the discount rate. If there is no *K*, or discount rate is zero (a very unreal situation), NPV is maximum. As the value of *K* increases, the NPV starts declining. At 12 per cent rate of discount, the NPV is zero. This is the IRR also because by definition it is that rate of discount which reduces the NPV to zero. Assuming cost of capital to be 8 per cent, we find that NPV is positive by amount (a) and the project is acceptable and so is it under IRR as its value is > *K* (0.12 > 0.08). If we assume *K* to be 16 per cent, the project is unacceptable as the NPV is negative by amount (b) and so is it under IRR as IRR < *K* (0.12 < 0.16). The two approaches lead to identical results with regard to the accept-reject decision.

NPV and IRR Methods: Differences Thus, in the case of independent conventional investments, the NPV and IRR methods will give concurrent results. However, in certain situations they will give contradictory results such that if the NPV method finds one proposal acceptable, IRR favours another. This is so in the case of mutually exclusive investment projects. If there are alternative courses of action, only one can be accepted. Such alternatives are mutually exclusive. The mutual exclusiveness of the investment projects may be of two types: (i) technical, and (ii) financial. The term *technical exclusiveness* refers to alternatives having different profitabilities and the selection of that alternative which is the most profitable. Thus, in the case of a purchase or lease decision the more profitable out of the two will be selected. The mutual exclusiveness may also be financial. If there are resource constraints, a firm will be forced to select that project which is the most profitable rather than accept all projects which exceed a minimum acceptable level (say, k). The exclusiveness due to limited funds is popularly known as *capital rationing*.

The different ranking given by the NPV and IRR methods can be illustrated under the following heads:

1. Size-disparity problem;
2. Time-disparity problem; and
3. Unequal expected lives.

Size-disparity Problem This arises when the initial investment in projects under consideration, that is, mutually exclusive projects, is different. The cash outlay of some projects is larger than that of others. In such a situation, the NPV and IRR will give a different ranking. Consider Example 5.9.

EXAMPLE 5.9

A and B are two mutually exclusive investments involving different outlays. The details are:

	Project A	*Project B*	*Project B-A*
Cash outlays	(Rs 5,000)	(Rs 7,500)	(Rs 2,500)
Cash inflows at the end of year, 1	6,250	9,150	2,900
IRR	25 per cent	22 per cent	16 per cent
k	10		
NPV	681.25	817.35	

Thus, the two methods rank the projects differently. Project A has a higher IRR (0.25) than project B (0.22) but the NPV of project B (Rs 817.35) is more than that of A (Rs 681.25). The important question is which method, in such a situation, gives better results? The answer should be related to the effect of the decision on the maximisation of the shareholders' wealth. The IRR method is not compatible with the goal of wealth maximisation. It is concerned with the rate of return on investment or yield rather than the total yield on the investment. In the above example, assuming 10 per cent to be the required rate of return, the firm would be left with Rs 750 [Rs 6,250 – (Rs 5,000 + 0.10 × Rs 5,000)] after one year in case project A is accepted and Rs 900 [Rs 9,150 – (Rs 7,500) + 0.10 × Rs 7,500] in case project B is accepted. The NPV method suggests that project B is better. This recommendation is consistent with the goal of the firm of maximising shareholders' wealth. When faced with mutually exclusive projects, each having a positive NPV, the one with the largest NPV will have the most beneficial effect on shareholders wealth. Since the selection criterion under the NPV method is to pick up the project with the largest NPV, the NPV is the best operational criterion. As long as the firm accepts the mutually exclusive investment proposal with the largest NPV, it will be acting consistently with the goal of maximising shareholders' wealth. This is because the project with the largest NPV will cause the share price and shareholders' wealth to increase more than will be possible with any of the other projects.[14]

Modified IRR/Incremental Approach The conflict between the NPV and IRR in the above situation can be resolved by modifying the IRR so that it is based on incremental analysis. According to the modified IRR/incremental approach, when the IRR of two mutually exclusive projects whose initial outlays are different exceeds the required rate of return, the IRR of the incremental outlay of the project requiring a bigger initial investment should be calculated. This involves the following steps:

1. Find out the differential cash flows between the two proposals.
2. Calculate the IRR of the incremental cash flows.
3. If the IRR of the differential cash flows exceeds the required rate of return, the project having greater investment outlays should be selected, otherwise it should be rejected.

The logic behind the incremental approach is that the firm would get the profits promised by the project involving smaller outlay plus a profit on the incremental outlay. In general, projects requiring larger outlay would be more profitable if IRR on differential cash outlays exceeds the required rate or return. The modified IRR for mutually exclusive proposals involving size-disparity problem would provide an accept-reject decision identical to that given by the NPV method.

In Example 5.9, the IRR of the differential cash outlay of Project B is 16 per cent. The required rate of return is 10 per cent. Thus, project B is better than project A in spite of the fact that IRR in the latter is lower because it offers the benefits offered by project A plus a return in excess of the required return on Rs 2,500, that is, differential cash outlays.

To summarise the above discussion, the NPV method is superior to the IRR because the former supports projects which are compatible with the goal of maximisation of shareholders' wealth while the latter does not. On modifying the IRR method by adopting the incremental approach, IRR would give results identical to the NPV method. The modified IRR method has other merits also. It is easier to interpret and apply than the NPV measure. However, it requires additional computation, whereas the NPV method provides the correct answer in the first instance itself.

Time-disparity Problem The mutually-exclusive proposals may differ on the basis of the pattern of cash flows generated, although their initial investments may be the same. This may be called the time-disparity problem. The time-disparity problem may be defined as the conflict in ranking of proposals by the NPV and IRR methods which have different patterns of cash inflows. In such a situation, like the size-disparity problem, the NPV method would give results superior to the IRR method. This is illustrated in Example 5.10.

EXAMPLE 5.10

Year	*Cashflows*	
	Project A	*Project B*
0	Rs 1,05,000	Rs 1,05,000
1	60,000	15,000
2	45,000	30,000
3	30,000	45,000
4	15,000	75,000
IRR	20 per cent	16 per cent
NPV (0.08)	23,970	25,455

We find on the basis of a comparison of the internal rate of returns that project A is better, but the NPV method suggests that project B is better. Since the cost of capital is 8 per cent, given the objective of the firm to maximise wealth, project B is definitely better.

Under the time-disparity problem it is the cost of capital which will determine the ranking of projects. If we take $k = 0.10$, we shall find project A is better as its net present value would be Rs 19,185 compared to

Rs 18,435 of B. Its IRR is also more than that of B. Both the methods give identical prescription. But it does not imply that the IRR is superior to the NPV method, as the NPV is giving the same ranking as the IRR. In the event of conflicting rankings, the firm should rely on the rankings given by the NPV method.

Projects with Unequal Lives Another situation in which the IRR and NPV methods would give a conflicting ranking to mutually exclusive projects is when the projects have different expected lives. This is shown in Example 5.11.

EXAMPLE 5.11

There are two projects A and B. A has a service life of one year, while B's useful life is five years. The initial cash outlay for both the projects may be assumed to be Rs 20,000 each. The cash proceeds from project A (at the end of the first year) amount to Rs 24,000. The cash generated by project B at the end of the fifth year is likely to be Rs 40,200. Assume that the required rate of return is 10 per cent. Compute the NPV and the IRR of the two projects.

SOLUTION

The IRR and NPV of the two projects would be as follows:

	IRR (per cent)	*NPV*
Project A	20	Rs 1,816
Project B	15	4,900

Obviously, the ranking given by the IRR and NPV methods is different. According to the IRR method, the recommendation would favour project A while the NPV method would support project B. The conflict in the ranking by the two methods in such cases may be resolved by adopting a modified procedure. There are two approaches to do this: (i) common time horizon approach and (ii) equivalent annual value/cost approach.

According to the first appraoch, in order to have valid comparisons between the projects, they must be compared over the same period of time. The comparison may, thus, extend over multiples of the lives of each. Thus, if the service life of one project is 3 years and of another 4 years, the comparison must be over a 12 year period with replacements occurring for each.[15] Consider Example 5.12.

EXAMPLE 5.12

	Project A	*Project B*
Initial outlay	Rs 10,000	Rs 20,000
Cash inflows after taxes		
Year-end 1	8,000	8,000
2	7,000	9,000
3	Nil	7,000
4	Nil	6,000
Service life (years)	2	4
Required rate of return	0.10	

SOLUTION

Project A

Year	*Cash flows*	*PV factor*	*Total present value*
0	Rs 10,000	1.000	(Rs 10,000)
1	8,000	0.909	7,272
2	7,000	0.826	5,782
3	(10,000) [a]	0.826	(8,260)
3	8,000	0.751	6,008
4	7,000	0.683	4,781
NPV			5,583

[a] Machine replaced at the end of year 2.

Project B

Year	*Cash flows*	*PV factor*	*Total present value*
0	Rs 20,000	1.000	Rs 20,000
1	8,000	0.909	7,272
2	9,000	0.826	7,434
3	7,000	0.751	5,257
4	6,000	0.683	4,098
Net present value			4,061

Decision Project A should be preferred to project B because of its larger NPV. If we had compared the two projects without incorporating the consequences of replacing the machine at the end of year 2, the decision would have been the reverse, because the net present value of project A then would be Rs 3,054 [Rs 7,272 + Rs 5,782 – Rs 10,000].

The implicit assumption of this approach is that the investment which is being replaced will produce cash flows of a similar pattern in future as it has done in the past.

We have taken a very simple situation where the project's life was only 2 years. But in actual practice, the competing alternatives may have much longer lives, say 15 years and 20 years. In such circumstances, it would probably not be possible to apply strictly the criterion mentioned above, that is, replacing the investment of the shorter-period project 4 times and longer-period project 3 times, in all having a 60 year life. It will obviously not be possible to make correct estimates for these projects for such a distant future.

The application of the *common time horizon approach* encounters operational difficulty in terms of assumptions of the same technology, price of the capital asset, and operating costs and revenues.

The *equivalent annual value/cost* method obviates these difficulties. According to this method, equivalent annual value/cost of all mutually exclusive investment projects under consideration is determined. The equivalent annual net present value (EANPV) is determined by dividing the NPV of cash flows of the project by the annuity factor corresponding to the life of the project at the given cost of capital. The decision-criterion, in the case of revenue-expanding proposals, is the maximisation of EANPV and minimisation of equivalent annual cost (EAC) in the case of cost-reduction proposals. This is illustrated in Examples 5.13 and 5.14.

EXAMPLE 5.13 *(Revenue-expanding Investment Proposal)*

A firm is considering to buy one of the following two mutually exclusive investment projects:
Project A: Buy a machine that requires an initial investment outlay of Rs 1,00,000 and will generate the CFAT of Rs 30,000 per year for 5 years.

Project B: Buy a machine that requires an initial investment outlay of Rs 1,25,000 and will generate the CFAT of Rs 27,000 per year for 8 years.

Which project should be undertaken by the firm? Assume 10 per cent as cost of capital.

SOLUTION

(i) Determination of NPV of Projects A and B

Project	*Years*	*CFAT*	*PV factor (0.10)*	*Total PV*	*NPV*
A	1-5	Rs 30,000	3.791	Rs 1,13,730	Rs 13,730
B	1-8	27,000	5.335	1,44,045	19,045

(ii) Determination of EANPV:

$$\text{EANPV} = \frac{\text{Net present value of the project}}{\text{PV of annuity corresponding to life of the project at given cost of capital}} \quad (5.15)$$

$$\text{EANPV (A)} = \frac{\text{Rs } 13,730}{3.791} = \text{Rs } 3,621.74$$

$$\text{EANPV (B)} = \frac{\text{Rs } 19,045}{5.335} = \text{Rs } 3,569.82$$

On the basis of NPV criterion, Project B is preferred. However, on the basis of EANPV, project A becomes more desirable, with higher EANPV. In fact, acceptance of project A would be a right decision.

EXAMPLE 5.14 *(Cost-reduction Investment Proposal)*

A firm is considering to instal a large stamping machine. Two machines currently being marketed will do the job satisfactorily. Machine A costs Rs 50,000 and will require cash running expenses of Rs 15,000 per year. It has a useful life of 6 years and is expected to yield Rs 2,000 salvage value at the end of its useful life. Machine B costs Rs 65,000 but cash running expenses are expected to be Rs 12,000. This machine is expected to have a useful life of 10 years with salvage value of Rs 5,000. Assume both the machines would be depreciated on straight line basis for tax purposes.

If the corporate tax rate is 35 per cent and cost of capital is 10 per cent, which machine should be bought by the company?

SOLUTION

Equivalent Annual Costs of Machines A and B

	Costs		*PV factor (0.10)*	*Adjusted PV*	
	Machine A	*Machine B*		*Machine A*	*Machine B*
0 (Initial cost)	Rs 50,000	Rs 65,000	1.000	Rs 50,000	Rs 65,000
(Operating cost):					
1-6 years (A)	6,950		4.355	30,267.25	
1-10 years (B)	—	5,700	6.145		35,026.50
				80,267.25	1,00,026.50

(*Contd.*)

(*Contd.*)

Less salvage value:					
6th year (A)	2,000		0.564	1,128.00	—
10th year (B)		5,000	0.386	—	1,930
Present value of total costs				79,139.25	98,096.50
Divided by annuity PV factor for 10 per cent corresponding to the life of the project (capital recovery factor)				4.355	6.145
Equivalent annual cost (EAC)				18,172	15,963.63

Recommendation: Since Machine B has a lower equivalent annual cost, it is preferred investment.

Working Notes:

Determination of operating costs:

	Machine A	*Machine B*
Cash running cost	Rs 15,000	Rs 12,000
Less tax shield @35 per cent (assuming profitable operations)	5,250	4,200
Less tax advantage on depreciation *charged every year*:		
Machine A (Rs 8000 × 0.35)	2,800	—
Machine B (Rs 6,000 × 0.35)	—	2,100
Effective operating cash outflows	6,950	5,700

Reinvestment Rate Assumption The preceding discussions have revealed that in the case of mutually exclusive projects, the NPV and IRR methods would rank projects differently where (a) the projects have different cash outlays initially, (b) the pattern of cash inflows is different, and (c) the service lives of the projects are unequal. It has also been found that the ranking given by the NPV method in such cases is theoretically more correct. The conflict between these two methods is mainly due to different assumptions with regard to the reinvestment rate on funds released from the proposal. The assumption underlying the IRR method seems to be incorrect and deficient. The IRR criterion implicitly assumes that the cash flow generated by the projects will be reinvested at the internal rate of return, that is, the same rate as the proposal itself offers. With the NPV method, the assumption is that the funds released can be reinvested at a rate equal to the cost of capital, that is, the required rate of return. The crucial factor is which assumption is correct? The assumption of the NPV method is considered to be superior theoretically because it has the virtue of having a rate which can consistently be applied to all investment proposals. Moreover, the rate of return (k) represents an opportunity rate of investment. In contrast to the NPV method, the IRR method assumes a high reinvestment rate for investment proposals having a high IRR and a low investment rate for investment proposals having a low IRR. The implicit reinvestment rate will differ depending upon the cash flow stream for each investment proposal. Obviously, under the IRR method, there can be as many rates of reinvestment as there are investment proposals to be evaluated unless some investment proposals turn out to have an IRR which is equal to that of some other project(s).

The superficiality of the reinvestment rate under the IRR method can be demonstrated by comparing the following two investment projects.[16]

EXAMPLE 5.15

Project	*Initial investment*	*Cash inflows*	
		Year 1	*Year 2*
A	Rs 100	Rs 200	0
B	100	0	Rs 400

Under the IRR method, both projects have a rate of return of 100 per cent. If Rs 100 were invested for one year at 100 per cent, it would grow to Rs 200, and if invested for two years, to Rs 400. Since both the projects have the same IRR, the firm should be indifferent regarding their acceptability, if only one of two projects is to be picked up as both the projects are equally profitable. For this to be true, it is necessary that Rs 200 received at the end of year 1 in case of project A should be equal to Rs 400 at the end of year 2. In order to achieve this, it necessarily follows that the firm must be able to reinvest the first year's earnings at 100 per cent. If not, it would be unable to transform Rs 200 at the end of the first year into Rs 400 at the end of the second. And if it cannot transform Rs 200 into Rs 400 in a year's time, the two projects A and B cannot be ranked equal. There is no reason to believe that a firm can find other investment opportunities at precisely the required rate.

In contrast, the present value method does not pose any problem. Let us calculate the present value of Example 5.15, assuming cost of capital (k) as 10 per cent.

Year	*Project A*			*Project B*		
	Cashflows	*PV factor*	*Total PV*	*Cashflows*	*PV factor*	*Total PV*
1	Rs 200	0.909	Rs 181.80	0	—	—
2	0	—		Rs 400	0.826	Rs 330.40
			181.80			330.40
Less initial outlay			100.00			100.00
Net present value			81.80			230.40

The PV method indicates that project B is preferable to project A as its net present value is greater. The reinvestment rate in the PV method seems more realistic and reasonable. It assumes that earnings are reinvested at the same rate as the market cost of capital.

However, the IRR can be modified assuming the cost of capital to be the reinvestment rate. The intermediate cash inflows will be compounded by using the cost of capital. The compounded sum so arrived at and the initial cost outflows can be used as the basis of determining the IRR. The limitation of IRR arising out of the inconsistency in the reinvestment rate assumption can be obviated through the modified approach.

Thus, the assumption regarding the reinvestment rate of the cash inflows generated at the intermediate stage is theoretically more correct in the case of NPV as compared to the IRR. This is mainly because the rate is a consistent figure for the NPV but it can widely vary for the IRR according to the cash flow patterns.

Computational Problems Apart from inconsistency in the application of the reinvestment rate, the IRR method also suffers from computational problems. These may be discussed with reference to two aspects.

Computation in Conventional Cash Flows It has been shown while computing the IRR that the calculation of the IRR involves a trial-and-error procedure as a result of which complicated computation has to be done. In conventional proposals having a constant cash inflow stream (i.e. annuity) the computation,

is not so tedious. But when the cash inflows are unequal over the years, laborious calculations are involved. The calculations of the NPV, on the other hand, is relatively simple and presents no special problems.

Computation in Non-conventional Flows The problem of computation of IRR gets accentuated when cash flow patterns are non-conventional. The complications in such cases are (a) that the IRR is indeterminate, and (b) there may be multiple IRRs.

Indeterminate IRR For the following pattern of cash flows of an investment proposal, the IRR cannot be determined.[17]

EXAMPLE 5.16

CO_0	= Rs 1
$CFAT_1$	2
CO_2	2

Where subscripts 0, 1, 2 refer to respective time periods, CFAT = cash inflows, CO = cash outflows

The required equation to solve the IRR is:

$$1 + \frac{2}{(1+r)^2} = \frac{2}{(1+r)}, \qquad \text{which leads to } r^2 = -1$$

Clearly, the value of IRR is intermediate. On the other hand, the NPV of this project, given k as 10 per cent, can be easily ascertained. This would be negative (Rs –0.834), as shown below:

Year	*Cash flows*	*PV factor*	*Total present value*
0	Rs (1)	1.000	Rs 1.000
1	+2	0.909	1.818
2	(2)	0.826	(1.652)
			(0.834)

Multiple Rates of IRR Another serious computational deficiency of IRR method is that it can yield multiple internal rates of return. This is illustrated in Example 5.17.[18]

EXAMPLE 5.17

Initial cost	Year 0	(Rs 20,000)
Net cash flow	1	90,000
Net cash flow	2	(80,000)

The required equation is : Rs 20,000 $= \dfrac{\text{Rs } 90{,}000}{(1+\text{r})} - \left(\dfrac{\text{Rs } 80{,}000}{(1+\text{r})^2}\right)$

Let $(1 + r)$ be $= X$ and divide both sides of equation by Rs 10,000, $2 = \dfrac{9}{X} - \dfrac{8}{X^2} = 0$

Multiplying by X^2, we can transform the equation into the quadratic form,

$$2X^2 - 9X + 8 = 0$$

Such an equation with a variable to the second power has 2 roots which can be identified as:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{5.16}$$

where a = coefficient of the variable raised to the second power
b = coefficient of the variable raised to the first power
c = constant or coefficient of the variable raised to the zero power

Substituting the values for *a, b,* and *c* into the quadratic formula produces value for X of 1.21. Since $X = (1 + r)$, the internal rates for this project are 21.9 and 228 per cent.

Thus, the project yields a dual IRR. This kind of problem does not arise when the NPV method is used. The problem with the IRR is that if two rates of return make the present value of the project zero, (21.9 and 228 per cent respectively in our example), which rate should be used for decision-making purposes?

To conclude the discussion relating to the comparison of NPV and IRR methods, the two methods would give similar accept-reject decisions in the case of independent conventional investments. They would, however, rank mutually exclusive projects differently in the case of the (i) size-disparity problem, (ii) time-disparity problem, and (iii) unequal service life of projects. The ranking by the NPV decision criterion would be theoretically correct as it is consistent with the goal of maximisation of shareholders' wealth. Further, the reinvestment rate of funds released by the project is based on assumptions which can be consistently applied. The IRR can, of course, be modified by adopting the incremental approach to resolve the conflict in ranking. But it involves additional computation. Another deficiency of the IRR is that it may be indeterminate and give multiple rates in the case of a non-conventional cash flow pattern. In sum, therefore, the NPV emerges as a superior evaluation technique.

Net Present Value v. Profitability Index In most situations, the NPV and PI, as investment criteria, provide the same accept and reject decision, because both the methods are closely related to each other. Under the PI method, the investment proposal will be acceptable if the PI is greater than one; it will be greater than one only when the proposal has a positive net present value. Likewise, PI will be less than one when the investment proposal has negative net present value under the NPV method. However, while evaluating mutually exclusive investment proposals, these methods may give different rankings. Example 5.18 presents such a case.

EXAMPLE 5.18

Year	*Project A*	*Project B*
0	(Rs 50,000)	(Rs 35,000)
1	40,000	30,000
2	40,000	30,000
Present value of cash inflow (0.10)	69,440	52,080
NPV	19,440	17,080
	69,440	52,080
PI	50,000 = 1.39	35,000 = 1.49

Thus, project A is acceptable under the NPV method, while project B under the PI method. Which project should the firm accept? The NPV technique is superior and so project A should be accepted. The reasons for the superiority of NPV method are the same as given in comparing NPV and IRR techniques. The best project is the one which adds the most, among available alternatives, to the shareholders' wealth. The NPV method, by its very definition, will always select such projects. Therefore, the NPV method gives a better mutually exclusive choice than PI. The NPV method guarantees the choice of the best alternative.

Project Selection Under Capital Rationing

The capital rationing situation refers to the choice of investment proposals under financial constraints in terms of a given size of capital expenditure budget. The objective to select the combination of projects would be the maximisation of the total NPV. The project selection under capital rationing involves two stages: (i) identification of the acceptable projects. (ii) selection of the combination of projects. The acceptability of projects can be based either on profitability index or IRR. The method of selecting investment projects under capital rationing situation will depend upon whether the projects are indivisible or divisible. In case the project is to be accepted/rejected in its entirety, it is called an indivisible project; a divisible project, on the other hand, can be accepted/rejected in part. These are illustrated in examples 5.19 and 5.20 respectively.

EXAMPLE 5.19 *(Divisible Project)*

A company has Rs 7 crore available for investment. It has evaluated its options and has found that only 4 investment projects given below have positive NPV. All these investments are divisible. Advise the management which investment(s)/ projects it should select.

Project	*Initial investment (Rs crore)*	*NPV (Rs crore)*	*PI*
X	3.00	0.60	1.20
Y	2.00	0.50	1.25
Z	2.50	1.50	1.60
W	6.00	1.80	1.30

SOLUTION

Ranking of the Projects in Descending Order of Profitability Index

Project and (rank)	*Investment outlay (Rs crore)*	*Profitability index*	*NPV (Rs crore)*
Z (1)	2.50	1.60	1.50
W (2)	6.00	1.30	1.80
Y (3)	2.00	1.25	0.50
X (4)	3.00	1.20	0.60

Accept Project Z in *full* and W in part (Rs 4,50,000) as it will maximise the NPV.
A similar kind of exercise can be done using the IRR instead of the PI.

EXAMPLE 5.20 *(Indivisible Project)*

A company working against a self-imposed capital budgeting constraint of Rs 70 crore is trying to decide which of the following investment proposals should be undertaken by it. All these investment proposals are indivisible as well as independent. The list of investments along with the investment required and the NPV of the projected cash flows are given as below:

Project	*Initial investment (Rs crore)*	*NPV (Rs crore)*
A	10	6
B	24	18
C	32	20
D	22	30
E	18	20

Which investment should be acquired by the company?

SOLUTION

NPV from investments D, E and B is Rs 68 crore with Rs 64 crore utilised leaving Rs 6 crore to be invested in some other investment outlet. No other investment package would yield an NPV of this amount. The company is advised to invest in D, E and B projects.

SUMMARY

- Capital budgeting decisions relate to long-term assets which are in operation and yield a return over a period of time. They, therefore. involve current outlays in return for series of anticipated flow of future benefits.
- Such decisions are of paramount importance as they affect the profitability of a firm, and are the major determinants of its efficiency and competing power. While an opportune investment decision can yield spectacular returns, an ill-advised/incorrect decision can endanger the very survival of a firm. A few wrong decisions and the firm may be forced into bankruptcy.
- Capital expenditure decisions are beset with a number of difficulties. The two major difficulties are: (i) The benefits from long-term investments are received in some future period which is uncertain. Therefore, an element of risk is involved in forecasting future sales revenues as well as the associated costs of production and sales; (ii) It is not often possible to calculate in strict quantitative terms all the benefits or the costs relating to a specific investment decision.
- Such decisions are of two types, namely, revenue expanding investment decisions and cost reducing investment decisions. The latter types of decisions are subject to less risk as the potential cash saving can be estimated better from the past production and cost data. It is more difficult to estimate revenues and costs of a new product line.
- The capital outlays and revenue benefits associated with such decisions are measured in terms of cash flows after taxes. The cash flow approach for measuring benefits is theoretically superior to the accounting profit approach as it (i) avoids the ambiguities of the accounting profits concept, (ii) measures the total benefits and (iii) takes into account the time value of money.
- The major difference between the cash flow and the accounting profit approaches relates to the treatment of depreciation. While the accounting approach considers depreciation in cost computation, it is recognised, on the contrary, as a source of cash to the extent of tax advan-tage in the cash flow approach.
- For taxation purposes, depreciation is charged (on the basis of written down value method) on a block of assets and not on an individual asset. A block of assets is a group of assets (say, of plant and machinery) in respect of which the same rate of depreciation is prescribed by the Income-Tax Act.

  Depreciation is charged on the year-end balance of the block which is equal to the opening balance plus purchases made during the year (in the block considered) minus sale proceeds of the assets during the year.

  In case the entire block of assets is sold during the year (the block ceases to exist at year-end), no depreciation is charged at the year-end. If the sale proceeds of the block sold is higher than the opening balance, the difference represents short-term capital gain which is subject to tax. Where the scale proceeds are less than the opening balance, the firm is entitled to tax shield on short-term capital loss. The adjustment related to the payment of taxes/tax shield is made in terminal cash inflows of the project.

- The data requirement for capital budgeting are after tax cash outflows and cash inflows. Besides, they should be incremental in that they are directly attributable to the proposed investment project. The existing fixed costs, therefore, are ignored. In brief, incremental after-tax cash flows are the only relevant cash flows in the analysis of new investment projects.
- The investment in new capital projects can be categorised into (i) a single proposal, (ii) a re-placement proposal and (iii) mutually exclusive proposals.
- In the case of single/independent investment proposal, cash outflows primarily consist of (i) purchase cost of the new plant and machinery, (ii) its installation costs and (iii) working capital requirement to support production and sales (in the case of revenue expanding proposals/release of working capital in cost reduction proposals.

  The cash inflows after taxes (CFAT) are computed by adding depreciation (D) to the projected earnings after taxes (EAT) from the proposal. In the terminal year of the project, apart from operating CFAT, the cash inflows include salvage value (if any, net of removal costs), recovery of working capital and tax advantage\taxes paid on short-term capital loss\gain on sale of machine (if the block ceases to exist).
- In the case of replacement situation, the sale proceeds from the existing machine reduce the cash outflows required to purchase the new machine. The relevant CFAT are *incremental* after-tax cash inflows.
- In the case of mutually exclusive proposals, the selection of one proposal precludes the sele-ction of the other(s). The computation of the cash outflows and cash inflows are on lines similar to the replacement situation.
- The capital budgeting evaluation techniques are: (i) traditional, comprising (a) average/accounting rate of return (ARR) and (b) pay back (PB) period; (ii) discounted cash flow (DCF), primarily consisting of (a) net present value (NPV), (b) internal rate of return (IRR) and (iii) profitability/ present value index (PI).
- The ARR is obtained dividing annual average profits after taxes by average investments. Average investment = 1/2 (Initial cost of machine – Salvage value) + Salvage value + net working capital. Annual average profits after taxes = Total expected after tax profits/Number of years

  The ARR is unsatisfactory method as it is based on accounting profits and ignores time value of money.
- The pay back method measures the number of years required for the CFAT to pay back the initial capital investment outlay, ignoring interest payment. It is determined as follows:
  (i) In the case of annuity CFAT: Initial investment/Annual CFAT.
  (ii) In the case of mixed CFAT: It is obtained by cumulating CFAT till the cumulative CFAT equal the initial investment.

  Although the pay back method is superior to the ARR method in that it is based on cash flows, it also ignores time value of money and disregards the total benefits associated with the investment proposal.
- The DCF methods satisfy all the attributes of a good measure of appraisal as they consider the total benefits (CFAT) as well as the timing of benefits.
- The NPV may be described as the summation of the present values of (i) operating CFAT (CF) in each year and (ii) salvages value(S) and working capital(W) in the terminal year(n) minus the summation of present values of the cash outflows(CO) in each year. The present value is computed using cost of capital (k) as a discount rate. Symbolically,

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} + \frac{S_n + W_n}{(1+k)^n} - \sum_{t=0}^{n} \frac{CO_t}{(1+k)^t}$$

  The project will be accepted in case the NPV is positive.

- The IRR is defined as the discount rate (r) which equates the aggregate present value of the operating CFTA received each year and terminal cash flows (working capital recovery and salvage value) with aggregate present value of cash outflows of an investment proposal. Symbolically,

$$\text{IRR} = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} + \frac{S_n + W_n}{(1+r)^n} - \sum_{t=1}^{n} \frac{CO_t}{(1+r)^t}$$

  The project will be accepted when IRR exceeds the required rate of return.
- The profitability index/present value index measures the present value of returns per rupee invested. It is obtained dividing the present value of future cash inflows (bot operating CFAT and terminal) by the present value of capital cash outflows. The proposal will be worth accepting if the PI exceeds one.
- In case of independent investment proposals, all the discounted cash flow (DCF) methods provide consistent results in terms of acceptance or rejection of capital budgeting proposal(s). The independent proposals refer to investment projects, the acceptance of which does not preclude the acceptance of other profitable proposal (s). The reason is that all the DCF methods are based on cash flows and take into account total benefits as well as time value of money. The data inputs in terms of cash outflows, CFAT, cost of capital and so on is the same for all these methods. As a result, the investment projects which have positive NPV will also have (i) an IRR> required rate of return, (k) and (ii) a present value index >one
- In the case of mutually exclusive proposals, the DCF methods may provide conflicting rankings. The reason is while the NPV method is based on the *total* yield/earnings/NPV, the other two methods (IRR and PI) are concerned with the *rate* of return/earnings on investment.
- While IRR and PI methods are not compatible with the objective of financial decision making of the firm, that is, maximising shareholders' wealth, the recommendation of NPV method is consistent with the goal of the firm of maximising shareholders' wealth.
- The IRR and PI methods can be modified (by adopting the incremental approach) to give results identical to the NPV method. The logic behind the incremental approach is that the firm would get the profits promised by the smaller outlay investment project plus the profit on the incremental investments required in the project involving larger outlay.
- The conflict between the NPV and IRR methods is mainly ascribed to the different reinvestment rate assumptions of intermediate cash inflows accruing from projects. The IRR method implicitly assumes that the cash flows generated from the projects are subject to reinvestment at IRR. In contrast, the reinvestment rate assumption under the NPV method is the cost of capital. The assumption of the NPV method is conceptually superior to that of the IRR as the former has the virtue of having a uniform rate which can consistently be applied to all investment proposals.
- The IRR can be modified (to overcome the deficiency of the reinvestment rate assumption) assuming the cost of capital to be the reinvestment rate.
- The IRR method is beset with computational and other operational difficulties. In the case of mixed-stream of cash flows, it involves a trial-and-error procedure. When cash flows are non-conventional, its value is either indeterminate or it has multiple values. In contrast, the NPV calculations do not present any such problems.
- The NPV method continues to be the best alternative under capital rationing situations. For these reasons, therefore, the NPV emerges as a theoretically correct and better technique for evaluation of capital projects.
- There are two approaches to deal with investment projects of unequal/varying lives: (i) common time horizon approach and (ii) equivalent annual value, (EANPV)/cost approach (EAC). The first

approach requires that the projects must be compared over the same period of time (by taking the LCM of the lives of the capital projects). The implicit assumption of this approach is that the investment which is being replaced will produce cash flows of a similar pattern in future as it has done in the past. Therefore, the approach lacks realism and presents operational difficulties to be used in the real business world.

- The EANPV/EAC is a better approach. The EANPV is determined dividing the NPV of cash flows of the project by the annuity factor corresponding to the life of the project at the given cost of capital. The EAC is obtained dividing the total PV of cash outflows by the relevant annuity factor. While the maximisation of EANPV is the decision-criterion in the case of revenue-expanding proposals, the minimisation of EAC is the guiding criterion for cost reduction proposals.
- Capital rationing involves the choice of combination of available projects maximise the total NPV, given the capital budget constraints. The ranking of investment projects can be done either on the basis of present value index or the IRR. The procedure to select the package of investment projects will relate to whether the project is divisible or indivisible, the objective being the maximisation of total NPV by exhausting the capital budget as far as possible.

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SOLVED PROBLEMS

P.5.1 A company is considering an investment proposal to instal new milling controls at a cost of Rs.50,000. The facility has a life expectancy of 5 years and no salvage value. The tax rate is 35 per cent. Assume the firm uses straight line depreciation and the same is allowed for tax purposes. The estimated cash flows before depreciation and tax (CFBT) from the investment proposal are as follows:

Year	*CFBT*
1	Rs 10,000
2	10,692
3	12,769
4	13,462
5	20,385

Compute the following:

(i) Pay back period,
(ii) Average rate of return,
(iii) Internal rate of return,
(iv) Net present value at 10 per cent discount rate,
(v) Profitability index at 10 per cent discount rate.

SOLUTION

Determination of cashflows after taxes (CFAT)

Year	*CFBT*	*Depreciation (Rs 50,000/5)*	*Profits before tax (Col.2 – Col.3)*	*Taxes (0.35)*	*EAT (Col.4 – Col.5)*	*CFAT (Col.6+Col.3)*
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 10,000	Rs 10,000	Nil	Nil	Nil	Rs 10,000
2	10,692	10,000	Rs 692	Rs 242	Rs 450	10,450
3	12,769	10,000	2,769	969	1,800	11,800
4	13,462	10,000	3,462	1,212	2,250	12,250
5	20,385	10,000	10,385	3,635	6,750	16,750
					11,250	61,250

(i) *Pay back (PB) period*:

Year	*CFAT*	*Cumulative CFAT*
1	Rs 10,000	Rs 10,000
2	10,450	20,450
3	11,800	32,250
4	12,250	44,500
5	16,750	61,250

The recovery of the investment falls between the fourth and fifth years. Therefore, the PB is 4 years plus a fraction of the fifth year. The fractional value = Rs 5,500 ÷ Rs 16,750 = 0.328. Thus, the PB is 4.328 years.

(ii) *Average rate of return (ARR)*: $= \frac{\text{Average income}}{\text{Average investment}} \times 100 = \frac{\text{Rs } 2,250\ (\text{Rs } 11,250 \div 5)}{\text{Rs } 25,000\ (\text{Rs } 50,000 \div 2)} \times 100 = 9 \text{ per cent}$

(iii) *Internal rate of return (IRR)*: $\text{Rs } 50,000 = \frac{\text{Rs } 10,000}{(1+r)^1} + \frac{\text{Rs } 10,450}{(1+r)^2} + \frac{\text{Rs } 11,800}{(1+r)^3} + \frac{\text{Rs } 12,250}{(1+r)^4} + \frac{\text{Rs } 16,750}{(1+r)^5}$

The fake pay back period = 4.0816 (Rs 50,000/Rs 12,250). From Table A-4, the value closest to the fake pay back period of 4.0816 against 5 years is 4.100 against 7 per cent. Since the actual cash flow stream is the initial years is slightly below the average cash flow stream, the IRR is likely to be lower than 7 per cent. Let us try with 6 per cent.

		PV factor		*Total PV*	
Year	*CFAT*	*(0.06)*	*(0.07)*	*(0.06)*	*(0.07)*
1	Rs 10,000	0.943	0.935	Rs 9,430	Rs 9,350
2	10,450	0.890	0.873	9,300	9,123
3	11,800	0.840	0.816	9,912	9,629
4	12,250	0.792	0.763	9,702	9,347
5	16,750	0.747	0.713	12,512	11,942
Total PV				50,856	49,391
Less initial outlay				50,000	50,000
NPV				856	(609)

The IRR is between 6 and 7 per cent. By interpolation, IRR = 6.6 per cent.

(iv) *Net present value (NPV)*

Year	*CFAT*	*PV factor (0.10)*	*Total PV*
1	Rs 10,000	0.909	Rs 9,090
2	10,450	0.826	8,632
3	11,800	0.751	8,862
4	12,250	0.683	8,367
5	16,750	0.621	10,401
Total PV			45,352
Less initial outlay			50,000
NPV			(4,648)

(v) *Profitability index (PI)* $= \frac{\text{PV of cash inflows}}{\text{PV of cash outflows}} = \frac{\text{Rs } 45,352}{\text{Rs } 50,000} = 0.907$

P.5.2 A project costing Rs 5,60,000 is expected to produce annual net cash benefits (CFAT) of Rs 80,000 over a period of 15 years. Estimate the internal rate of return (IRR). Also, find the pay back period and obtain the IRR from it. How do you compare this IRR with the one directly estimated?

SOLUTION

$$\text{PB value} = \frac{\text{Rs } 5,60,000}{\text{Rs } 80,000} = 7.000$$

The factors closet to 7.000 are 7.191 at 11 per cent rate of discount and 6.811 at 12 per cent rate of discount against 15 years (Table A-4). The actual IRR would be between 11 and 12 per cent.

Using interpolation, the IRR would be 0.11 + 0.005 (0.19 ÷ 0.38) = 11.5 per cent.

IRR determination through PB period The reciprocal of the PB period is a good approximation of the IRR if, (i) the life of the project is at least twice the PB period, and (ii) the project generates annuity cash inflows. Accordingly, IRR would be the reciprocal of the PB period, i.e. 1/7 = 0.1428 = 14.28 per cent.

Comparison: The two IRRs are different. But the IRR which is directly estimated is correct as at this rate of discount, NPV of cash flow stream of the project would be zero. The NPV cannot be zero at 14.28 per cent. The IRR through the PB period is only an approximate measure.

P.5.3 Band-Box is considering the purchase of a new wash and dry equipment in order to expand its operations. Two types of options are available: a low-speed system (LSS) with a Rs 20,000 initial cost and a high speed system (HSS) with an initial cost of Rs 30,000. Each system has a fifteen year life and no salvage value. The net cash flows after taxes (CFAT) associated with each investment proposal are:

	Low speed system (LSS)	*High speed system (HSS)*
CFAT for years 1 through 15	Rs 4,000	Rs 6,000

Which speed system should be chosen by Band-Box, assuming 14 per cent cost of capital?

SOLUTION

Determination of NPV

Years	*CFAT*		*PV factor (0.14)*	*Total PV*	
	LSS	*HSS*		*LSS*	*HSS*
1-15	Rs 4,000	Rs 6,000	6.142	Rs 24,568	Rs 36,852
Less initial cost				20,000	30,000
NPV				4,568	6,852

The high speed system should be chosen by Band-Box as its NPV is greater.

P.5.4 Modern Enterprises Ltd is considering the purchase of a new computer system for its research and development division, which would cost Rs 35 lakh. The operation and maintenance costs (excluding depreciation) are expected to be Rs 7 lakh per annum. It is estimated that the useful life of the system would be 6 years, at the end of which the disposal value is expected to be Rs 1 lakh.

The tangible benefits expected from the system in the form of reduction in design and draftmanship costs would be Rs 12 lakh per annum. The disposal of used drawing office equipment and furniture initially is anticipated to net Rs 9 lakh.

As capital expenditure in research and development, the proposal would attract a 100 per cent write-off for tax purposes. The gains arising from disposal of used assets may be considered tax free. The effective tax rate is 35 per cent. The average cost of capital of the company is 12 per cent.

After appropriate analysis of cash flows, advise the company of the financial viability of the proposal. Ignore tax on salvage value.

SOLUTION

Assessment of financial viability of proposal: (Amount in lakhs of rupees)

Incremental cash outflows	
Cost of new computer system	35
Less sale proceeds from drawing office equipment and furniture	9
	26
Incremental CFAT and NPV:	
(a) *Cost savings (years 1 - 6)*	
Reduction in design and draftmanship costs	12
Less operation and maintenance costs	7
Cost savings (earnings) before taxes	5
Less taxes (0.35)	1.75
Earnings after taxes (CFAT)	3.25
(×) PV factor of annuity for 6 years (0.12)	× 4.111
Total PV of cost savings	13.36

(*Contd.*)

(*Contd.*)

(b) *Tax savings on account of depreciation*	
Cost of new computer system (Rs 35 lakhs × 0.35)	12.25
(×) PV factor for year 1	× 0.892
Total PV	10.93
(c) *Terminal salvage value at the end of year, 6* (Rs 1 lakh × 0.507)	0.507
(d) Gross PV of CFAT [(a) + (b) + (c)]	24.797
Less cash outflows	26.000
NPV	(1.203)

Recommendation: Since NPV is negative, the proposal is not financially viable.

P.5.5 Techtronics Ltd is considering a new project for manufacture of pocket video games involving a capital expenditure of Rs 600 lakh and working capital of Rs 150 lakh. The capacity of the plant is for an annual production of 12 lakh units and capacity utilisation during the 6 year working life of the project is expected to be as indicated below:

Year	Capacity utilisation (per cent)
1	33.33
2	66.67
3	90
4-6	100

The average price per unit of the product is expected to be Rs 200 netting a contribution of 40 per cent. The annual fixed costs, excluding depreciation, are estimated to be Rs 480 lakh per annum from the third year onwards; for the first and second year, it would be Rs 240 lakh and Rs 360 lakh respectively. The average rate of depreciation for tax purposes is 33.33 per cent on the capital assets. The rate of income tax may be taken at 35 per cent. Cost of capital is 15 per cent.

At the end of the third year, an additional investment of Rs 100 lakh would be required for working capital.

Terminal value for the fixed assets may be taken at 10 per cent and for the current assets at 100 per cent. For the purpose of your calculations, the recent amendments to tax laws with regard to balancing charge may be ignored.

SOLUTION

Cash outflows	(Amount in lakhs of rupees)
Cost of capital expenditure	600.00
Add working capital required:	
At the beginning of the project life	150.00
At the end of year 3, (Rs 100 × 0.658)	65.80
	815.80 = 816

Cash inflows (CFAT) and NPV

	Year					
Particulars	*1*	*2*	*3*	*4*	*5*	*6*
Sales revenue	800	1,600	2,160	2,400	2,400	2,400
Less variable costs	480	960	1,296	1,440	1,440	1,440
Less fixed costs	240	360	480	480	480	480
Less depreciation (D) (working note 1)	200	133	89	59	40	26
Earnings before taxes	(120)	147	295	421	440	454
Less taxes (0.35)	(42)	51	103	147	154	159
EAT	(78)	96	192	274	286	295

(*Contd.*)

(*Contd.*)

CFAT (EAT + D)	122 [@]	229	281	333	326	321	
Add recovery of working capital						250	
Add effective sale proceeds of fixed assets (Working note 2)						58	
						629	
Multiplied by PV factor	0.87	0.756	0.657	0.571	0.497	0.432	
Total PV (t = 1 – 6)	106	173	185	190	162	272	1,089
Less PV of outflows							816
NPV							273

Recommendation: Since the NPV is positive, the project should be accepted.

[@] There will be tax savings of Rs 42 lakh on the loss of Rs 120 lakh. Therefore CFAT would be = Rs 80 Lakh + Rs 42 lakh = Rs 122 lakh.

Working Notes

(1) Determination of depreciation as per written down value method:

Year	*Cost/Written down value (Rs lakh)*	*Depreciation (Rs lakh)*
1	600	200
2	400	133
3	267	89
4	178	59
5	119	40
6	79	26

(2) Sales proceeds of fixed assets	60
Less written down value (Rs 79 – Rs 26)	53
Profit on sale of fixed assets	7
Less taxes on profit (7 × 0.35)	2.45
Effective sale proceeds (60 – 2.45)	57.55

P.5.6 A plastic manufacturer has under consideration the proposal of production of high quality plastic glasses. The necessary equipment to manufacture the glasses would cost Rs 1 lakh and would last 5 years. The tax relevant rate of depreciation is 25 per cent on written down value. There is no other asset in this block. The expected salvage value is Rs 10,000. The glasses can be sold at Rs 4 each. Regardless of the level of production, the manufacturer will incur cash cost of Rs 25,000 each year if the project is undertaken. The overhead costs allocated to this new line would be Rs 5,000. The variable costs are estimated at Rs 2 per glass. The manufacturer estimates it will sell about 75,000 glasses per year; the tax rate is 35 per cent. Should the proposed equipment be purchased? Assume 20 per cent cost of capital and additional working requirement, Rs 50,000.

SOLUTION

Cash outflows	
Cost of production equipment	Rs 1,00,000
Additional working capital requirement	50,000
	1,50,000

Determination of CFAT and NPV

Particulars	Years				
	1	*2*	*3*	*4*	*5*
Sales revenue (75,000 × 4)	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000
Less costs:					
Variable costs (75,000 × 2)	1,50,000	1,50,000	1,50,000	1,50,000	1,50,000
Additional fixed costs	25,000	25,000	25,000	25,000	25,000
Depreciation (D)	25,000	18,750	14,062	10,547	Nil[@]
Earnings before taxes	1,00,000	1,06,250	1,10,938	1,14,453	1,25,000
Less taxes	35,000	37,187	38,828	40,059	43,750
Earnings after taxes (EAT)	65,000	69,063	72,110	74,394	81,250
CFAT (EAT + D)	90,000	87,813	86,172	84,941	81,250
Add recovery of WC					50,000
Add salvage value (SV)					10,000
Add tax benefit on short term capital loss[@@]					7,574
					1,48,824
Multiplied by PV factor 0.20	0.833	0.694	0.579	0.482	0.402
PV (CFAT × PV factor)	74,970	60,942	49,894	40,942	59,827
Total PV (t = 1 – 5)					2,86,575
Less cash outflows					1,50,000
NPV					1,36,575

[@]As the block consists of single asset, no depreciation is to be charged in the terminating year as the asset has been sold in the year.

[@@](Rs 1,00,000 – Rs 68,359 accumulated depreciation – Rs 10,000, SV) × 0.35 = Rs 7,574.

Recommendation: The company is advised to buy the proposed equipment.

P.5.7 Welcome Limited is considering the manufacture of a new product. They have prepared the following estimate of profit in the first year of manufacture:

Sales, 9,000 units @ Rs 32		Rs 2,88,000
Cost of goods sold:		
Labour 40,000 hours @ Rs 3.50 per hour	Rs 1,40,000	
Materials and other variable costs	65,000	
Depreciation	45,000	
	2,50,000	
Less closing stock	25,000	2,25,000
Net profit		63,000

The product is expected to have a life of four years. Annual sales volume is expected to be constant over the period at 9,000 units. Production which was estimated at 10,000 units in the first year would be only 9,000 units each in year two and three and 8,000 units in year four. Debtors at the end of each year would be 20 per cent of sales during the year; creditors would be 10 per cent of materials and other variable costs. If sales differed from the forecast level, stocks would be adjusted in proportion.

Depreciation relates to machinery which would be purchased especially for the manufacture of the new product and is calculated on the straight line basis assuming that the machinery would last for four years and have no terminal scrap value. Fixed costs are included in labour cost.

There is high level of confidence concerning the accuracy of all the above estimates except the annual sales volume. Cost of capital is 20 per cent per annum. You may assume that debtors are realised and creditors are paid in the following year. No changes in the prices of inputs or outputs are expected over the next four years.

You are required to show whether the manufacture of the new product is worthwhile. Ignore taxes.

SOLUTION

Cash outflows:	
Cost of the machine	
(Depreciation per year × years of useful life of the machine, i.e. Rs 45,000 × 4)	Rs 1,80,000

Cash inflows and NPV:

	Year				
	1	*2*	*3*	*4*	*5*
Sales revenue	Rs 2,88,000	Rs 2,88,000	Rs 2,88,000	Rs 2,88,000	
Less expenses:					
Labour cost	1,40,000	1,26,000	1,26,000	1,12,000	
Materials and other variable costs	65,000	58,500	58,500	52,000	
Funds inflows	83,000	1,03,500	1,03,500	1,24,000	
Less debtors outstanding	57,600	57,600	57,600	57,600	
Add receipts from debtors	—	57,600	57,600	57,600	Rs 57,600
Add creditors outstanding	6,500	5,850	5,850	5,200	
Less payments to creditors	—	6,500	5,850	5,850	5,200
Cash inflows	31,900	1,02,850	1,03,500	1,23,300	52,400
(x) PV factor	0.833	0.694	0.579	0.482	0.402
Present Value	26,573	71,378	59,927	59,455	21,065
Total PV (year, t = 1-5)					2,38,398
Less cash outflows					1,80,000
NPV					58,398

Since the NPV is positive, the manufacture of new product is worthwhile.

P.5.8 A plastic manufacturing company is considering replacing an older machine which was fully depreciated for tax purposes with a new machine costing Rs 40,000. The new machine will be depreciated over its eight-year life. It is estimated that the new machine will reduce labour costs by Rs 8,000 per year. The management believes that there will be no change in other expenses and revenues of the firm due to the machine. The company requires an after-tax return on investment of 10 per cent. Its rate of tax is 35 per cent. The company's income statement for the current year is given for other informations.

Income statement for the current year:

Sales		Rs 5,00,000
Costs:		
Materials	Rs 1,50,000	
Labour	2,00,000	
Factory and administrative	40,000	
Depreciation	40,000	4,30,000
Net income before taxes		70,000
Taxes (0.35)		24,500
Earnings after taxes		45,500

Should the company buy the new machine? You may assume the company follows straight line method of depreciation and the same is allowed for tax purposes.

SOLUTION

Cash inflows:		
(i) Present: Earnings after taxes		Rs 45,500
Add depreciation		40,000
CFAT (present)		85,500
(ii) Estimated CFAT, if the new machine is purchased:		
Sales		5,00,000
Costs:		
Material	Rs 1,50,000	
Labour	1,92,000	
Factory and administrative	40,000	
Depreciation (including Rs 5,000 on new machine)	45,000	4,27,000
Net income before taxes		73,000
Taxes		25,550
Earnings after taxes		47,450
Add depreciation		45,000
CFAT (expected)		92,450
(iii) Differential cash flow: Rs 92,450 – Rs 85,500		6,950

(iv) *Determination of NPV*:

Years	*CFAT*	*PV factor (0.10)*	*Total PV*
1-8	Rs 6,950	5.335	Rs 37,078
Less cost of new machine			40,000
NPV			(2,922)

Since the NPV is negative, the new machine should not be purchased.

P.5.9 A company is currently considering modernisation of a machine originally costing Rs 50,000 (current book value zero). However, it is in a good working condition and can be sold for Rs 25,000. Two choices are available. One is to rehabilitate the existing machine at a total cost of Rs 1,80,000; and the other is to replace the existing machine with a new machine costing Rs 2,10,000 and requiring Rs 30,000 to install. The rehabilitated machine as well as the new machine would have a six year life and no salvage value. The projected after-tax profits under the various alternatives are:

	Expected after-tax profits		
Year	*Existing machine*	*Rehabilitated machine*	*New machine*
1	Rs 2,00,000	Rs 2,20,000	Rs 2,40,000
2	2,50,000	2,90,000	3,10,000
3	3,10,000	3,50,000	3,50,000
4	3,60,000	4,00,000	4,10,000
5	4,10,000	4,50,000	4,30,000
6	5,00,000	5,40,000	5,10,000

The firm is taxed at 35 per cent. The company uses the straight line depreciation method and the same is allowed for tax purposes. Ignore block assets concept. The cost of capital is 12 per cent.

Advise the company whether it should rehabilitate the existing machine or should replace it with the new machine. Also, state the situation in which the company would like to continue with the existing machine.

SOLUTION

Cash outflows

(i) *If machine is rehabilitated*:	
Rehabilitation costs	Rs 1,80,000
(ii) *If machine is purchased*:	
Cost of new machine	2,10,000
Add Installation cost	30,000
Less effective sale value of old machine (Rs 25,000 – Rs 8,750, tax)	(16,250)
Incremental cash outflows	2,23,750

Cash inflows after taxes

	Existing machine	*Rehabilitated machine*			*New machine*		
Year	*EAT/ CFAT*[a]	*EAT*	*D*	*CFAT*	*EAT*	*D*	*CFAT*
1	Rs 2,00,000	Rs 2,20,000	Rs 30,000	Rs 2,50,000	Rs 2,40,000	Rs 40,000	Rs 2,80,000
2	2,50,000	2,90,000	30,000	3,20,000	3,10,000	40,000	3,50,000
3	3,10,000	3,50,000	30,000	3,80,000	3,50,000	40,000	3,90,000
4	3,60,000	4,00,000	30,000	4,30,000	4,10,000	40,000	4,50,000
5	4,10,000	4,50,000	30,000	4,80,000	4,30,000	40,000	4,70,000
6	5,00,000	5,40,000	30,000	5,70,000	5,10,000	40,000	5,50,000

[a]Since the existing machine has been fully depreciated (book value being zero), no depreciation would be added to determine CFAT.

Determination of NPV

Year	*Incremental CFAT*		*PV factor (0.12)*	*Total PV*	
	Rehabilitated machine	*New machine*		*Rehabilitated machine*	*New machine*
1	Rs 50,000	Rs 80,000	0.893	Rs 44,650	Rs 71,440
2	70,000	1,00,000	0.797	55,790	79,700
3	70,000	80,000	0.712	49,840	56,960
4	70,000	90,000	0.636	44,520	57,240
5	70,000	60,000	0.567	39,690	34,020
6	70,000	50,000	0.507	35,490	25,350
Total present value				2,69,980	3,24,710
Less initial cash outflows				1,80,000	2,23,750
NPV				89,980	1,00,960

Recommendation: Since NPV of the new machine is more, the company should buy it. If the NPV of incremental CFAT of both the alternatives were negative, the company would have continued with the existing machine.

P.5.10 BS Electronics is considering a proposal to replace one of its machines. In this connection, the following information is available.

The existing machine was bought 3 years ago for Rs 10 lakh. It was depreciated at 25 per cent per annum on reducing balance basis. It has remaining useful life of 5 years, but its annual maintenance cost is expected to increase by Rs 50,000 from the sixth year of its installation. Its present realisable value is Rs 6 lakh. The company has several machines, having 25 per cent depreciation.

The new machine costs Rs 15 lakhs and is subject to the same rate of depreciation. On sale after 5 years, it is expected to net Rs 9 lakh. With the new machine, the annual operating costs (excluding depreciation) are expected to

decrease by Rs 1 lakh. In addition, the new machine would increase productivity on account of which net revenues would increase by Rs 1.5 lakh annually.

The tax rate applicable to the firm is 35 per cent and the cost of capital is 10 per cent.

Is the proposal financially viable? Advise the firm on the basis of NPV of the proposal.

SOLUTION

Financial evaluation whether to replace an existing machine (using NPV method)

(a) Incremental cash outflows	
Cost of new machine	Rs 15,00,000
Less sale value of existing machine	6,00,000
	9,00,000

(b) Determination of CFAT (operating)

Year	Incremental cash profits before taxes	Incremental depreciation	Taxable income (col. 2 – col. 3)	Taxes (0.35)	EAT (col. 4 – col. 5)	CFAT (col. 6 + col. 3)
1	2	3	4	5	6	7
1	Rs 2,50,000	Rs 2,25,000	Rs 25,000	Rs 8,750	Rs 16,250	Rs 2,41,250
2	2,50,000	1,68,750	81,250	28,438	52,812	2,21,562
3	3,00,000	1,26,563	1,73,437	60,703	1,12,734	2,39,297
4	3,00,000	94,922	2,05,078	71,777	1,33,301	2,28,223
5	3,00,000	71,191	2,28,809	8,0083	1,48,726	2,19,917

(c) Determination of net present value

Year	*CFAT*	*PV factor (0.10)*	*Total present value*
1	Rs 2,41,250	0.909	Rs 2,19,296
2	2,21,562	0.826	1,83,010
3	2,39,297	0.751	1,79,712
4	2,28,223	0.683	1,55,876
5	2,19,917	0.620	1,36,349
5	9,00,000 (Net salvage value)*	0.620	5,58,000
Total present value			14,32,243
Less incremental cash outflows			9,00,000
Net present value			5,32,243

*at the beginning of year 6.

It is important to note that machine is sold after 5 years and not at the end of year 5.

Recommendation: Since NPV is positive, the company is advised to replace the existing machine.

Working Note

(i) *WDV of existing machine in the beginning of year 4*

Initial cost of machine	Rs 10,00,000
Less depreciation @ 25% in year 1	2,50,000
WDV at beginning of year 2	7,50,000
Less depreciation @ 25% on WDV	1,87,500
WDV at beginning of year 3	5,62,500
Less depreciation @ 25% on WDV	1,40,625
WDV at beginning of year 4	4,21,875

(ii) *Depreciation base of new machine*

WDV of existing machine	4,21,875
Plus cost of the new machine	15,00,000
Less sale proceeds of existing machine	(6,00,000)
	13,21,875

(iii) *Base for incremental depreciation*

Depreciation base of new machine	13,21,875
Less depreciation base of existing machine	(4,21,875)
	9,00,000

(iv) *Incremental depreciation (T = 1 – 5)*

Year	*Incremental asset cost base*	*Depreciation @ 25% on WDV*
1	Rs 9,00,000	Rs 2,25,000
2	6,75,000	1,68,750
3	5,06,250	1,26,563
4	3,79,687	94,922
5	2,84,765	71,191

(v) *Incremental cash profits before taxes (in terms of decrease in operating costs and increase in revenues) owing to the new machine*

Year	*Savings in operating costs*	*Increase in revenue*	*Incremental cash profit before taxes*
1	Rs 1,00,000	Rs 1,50,000	Rs 2,50,000
2	1,00,000	1,50,000	2,50,000
3	1,50,000 [@]	1,50,000	3,00,000
4	1,50,000	1,50,000	3,00,000
5	1,50,000	1,50,000	3,00,000

[@]Maintenance expenses of existing machine are expected to increase by Rs 50,000 from sixth year of installation.

P.5.11 Seshasayee Industries Ltd is considering replacing a hand-operated weaving machine with a new fully automated machine. Given the following information, advise the management whether the machine should be replaced or not. Assume the company has only this machine in 25 per cent block of assets and the block will cease to exist after the useful life of the automated machine.

Existing situation:
- One full-time operator's salary, Rs 36,000
- Variable oertime, Rs 3,000
- Fringe benefits, Rs 3,000
- Cost of defects, Rs 3,000
- Original price of hand-operated machine, Rs 60,000
- Expected life, (years), 10
- Age, (years) 5
- Depreciation method, written down value
- Current salvage value of old machine, Rs 36,000
- Marginal tax rate, 35
- Required rate of return, 15

Proposed situation:
- Fully-automated operation, No operator is necessary
- Cost of machine, Rs 1,80,000
- Transportation charges, Rs, 3,000

(*Contd.*)

(*Contd.*)

Installation costs, Rs 15,000
Expected economic life (years), 5
Depreciation method, written down value
Annual maintenance, Rs 3,000
Cost of defects, Rs 3,000
Salvage after 5 years, Rs 20,000.

SOLUTION

Incremental cash outflows:

Cost of machine	Rs 1,80,000
Add transportation charges	3,000
Add installation costs	15,000
Less cash inflow from the sale of old machine	36,000
	1,62,000

Determination of CFAT and NPV

Particulars	*Years*				
	1	*2*	*3*	*4*	*5*
Cost savings	Rs 39,000	Rs 39,000	Rs 39,000	Rs 39,000	Rs 39,000
Less incremental depreciation	40,500	30,375	22,781	17,086	—
Earnings before taxes	(1,500)	8,625	16,219	21914	39,000
Less taxes (0.35)	(525)	3,019	5,677	7,670	13,650
Earnings after taxes	(975)	5,606	10,542	14,244	25,350
CFAT (EAT + D)	39,525	35,981	33,323	31,330	25,350
Add salvage value					20,000
Add tax advantage[@]					10,940
(×) PV factor (0.15)	0.870	0.756	0.656	0.572	0.497
Present value	34,387	27,202	21,860	17,921	27,976
Total PV (t = 1 – 5)					1,29,346
Less cash outflows					1,62,000
Net present value					(32,654)

[@] on short-term capital loss (Rs 51,258 – Rs 20,000) × 0.35 = Rs 10,940.

Recommendation: Since the NPV is negative, the machine is not recommended for purchase.

Working Notes

(i) *Incremental depreciation (if machine is purchased)*

(a) *WDV of existing machine in the beginning of year 6*:

Initial cost of machine		Rs 60,000
Less depreciation charges (year 1 to 5)		
Year 1 (Rs 60,000 × 0.25)	Rs 15,000	
2 (45,000 × 0.25)	11,250	
3 (33,750 × 0.25)	8,438	
4 (25,312 × 0.25)	6, 328	
5 (18,984 × 0.25)	4, 746	45,762
		14,238

(b) *Depreciation base of new machine:*

WDV of existing machine	14,238
Add cost of new machine (Rs 1,80,000 + Rs 3,000 + Rs 15,000)	1,98,000

Less sale of existing machine	(36,000)
	1,76,238
(c) *Base of incremental depreciation* (Rs 1,76,238 – Rs 14,238)	1,62,000

(d) *Incremental depreciation (t = 1 – 5)*

Year	*Incremental WDV base*	*Depreciation*
1	Rs 1,62,000	Rs 40,500
2	1,21,500	30,375
3	91,125	22,781
4	68,344	17,086
5	51,258	Nil (as machine is sold)

(ii) *Cost savings (if machine is purchased)*

	Existing situation	*Proposed situation*	*Differential cost savings*
Salary	Rs 36,000	—	Rs 36,000
Variable overtime	3,000	—	3,000
Fringe benefits	3,000	—	3,000
Cost of defects	3,000	Rs 3,000	Nil
Annual maintenance	—	3,000	(3,000)
	45,000	6,000	39,000

P.5.12 An existing company has a machine which has been in operation for 2 years; its estimated remaining useful life is 4 years with no salvage value in the end. Its current market value is Rs 25,000. The management is considering a proposal to purchase an improvement model of the machine which gives increased output. The relevant particulars are as follows:

	Existing machine	*New machine*
Purchase price (Rs)	60,000	1,07,500
Estimated life (years)	6	4
Salvage value	0	0
Annual operating hours	1,000	1,000
Selling price per unit (Rs)	3	3
Material per unit (Rs)	0.40	0.40
Output per hour (Rs)	15	30
Labour cost per hour (Rs)	11	16
Consumable stores per year (Rs)	2,000	1,000
Repairs and maintenance per year (Rs)	3,000	2,000
Working capital (Rs)	10,000	20,000
Income-tax rate	35	35

Should the existing machine be replaced? Assume that (i) required rate of return in 10 per cent, and (ii) the company uses written down value method of depreciation @ 25 per cent and it has several machines in the 25 per cent block.

SOLUTION

Incremental cash outflows:

Purchase price of new machine	Rs 1,07,500
Add additional working capital	10,000
Less sale value of old machine	25,000
	92,500

Determination of CFAT and NPV:

Particulars	*Years*			
	1	*2*	*3*	*4*
Incremental revenues	Rs 36,000	Rs 36,000	Rs 36,000	Rs 36,000
Less incremental depreciation	20,625	15,469	11,601	8,701
Earnings before taxes	15,375	20,531	24,399	27,299
Less taxes (0.35)	5,381	7,186	8,540	9,555
Earnings after taxes	9,994	13,345	15,859	17,744
CFAT (EAT + D)	30,619	28,814	27,460	26,445
Add recovery of working capital				10,000
(x) PV factor (0.10)	0.909	0.826	0.751	0.683
Present value	27,833	23,800	20,623	24,892
Total present value (t = 1 – 4)				97,148
Less incremental cash outflows				92,500
NPV				4,648

Recommendation: Since NPV is positive, the company is advised to replace the existing machine.

Working Notes

(i) Incremental revenues

Particulars	*Existing machine*	*New machine*	*Differential (1) – (2)*
	(1)	*(2)*	*(3)*
1. Annual operating hours	1,000	1,000	—
2. Output per hour (units)	15	30	15
3. Total output (units)	15,000	30,000	15,000
4. Selling price per unit (Rs)	3	3	3
5. Total sales revenue (3 × 4)	Rs 45,000	Rs 90,000	Rs 45,000
6. *Less* expenses:			
Material	6,000	12,000	6,000
Labour	11,000	16,000	5,000
Consumable stores	2,000	1,000	1,000
Repairs and maintenance	3,000	2,000	1,000
Incremental revenues	23,000	59,000	36,000

(ii) Incremental depreciation (if machine is purchased)

(a) *WDV of existing machine in the beginning of year 3*		
Initial cost of machine		Rs 60,000
Less depreciation charges (years 1 and 2):		
Year 1 (Rs 60,000 × 0.25)	Rs 15,000	
2 (Rs 45,000 × 0.25)	11,250	26,250
		33,750
(b) *Depreciation base of new machine*:		
WDV of existing machine		33,750
Add cost of new machine		1,07,500
Less sale value of existing machine		(25,000)
		1,16,250
(c) *Base for incremental depreciation*: (Rs 1,16,250 – Rs 33,750)		82,500

(d) *Incremental depreciation* (t = 1 – 4)

Year	*WDV*	*Depreciation*
1	Rs 82,500	Rs 20,625
2	61,785	15,469
3	46,406	11,601
4	34,805	8,701

Note: There will be an additional tax advantage on depreciation of Rs 26,104 (Rs 34,805 – Rs 8,701) in the future years.

P.5.13 Nine Gems Ltd has just installed Machine-R at a cost of Rs 2,00,000. The machine has a five year life with no residual value. The annual volume of production is estimated at 1,50,000 units, which can be sold at Rs 6 per unit. Annual operating costs are estimated at Rs 2,00,000 (excluding depreciation) at this output level. Fixed costs are estimated at Rs 3 per unit for the same level of production.

Nine Gems Ltd has just come across another model called Machine-S capable of giving the same output at an annual operating cost of Rs 1,80,000 (exclusive of depreciation). There will be no change in fixed costs. Capital cost of this machine is Rs 2,50,000 and the estimated life is for 5 years with no residual value.

The company has an offer for sale of Machine-R at Rs 1,00,000. The cost of dismantling and removal will be Rs 30,000. As the company has not yet commenced operations, it wants to sell Machine-R and purchase Machine-S.

Nine Gems Ltd will be a zero-tax company, for seven years in view of several incentives and allowances available. The cost of capital may be assumed at 14 per cent.

(i) Advise whether the company should opt for replacement.

(ii) Will there be any change in your view if Machine-R has not been installed but the company is in the process of selecting one or the other machine?

SOLUTION

(i) *Financial evaluation of whether to replace Machine-R*

Incremental cash outflows:		
Cost of Machine-S		Rs 2,50,000
Less effective sale proceeds of Machine-R (Rs 1,00,000 – Rs 30,000, dismantling/removal costs)		70,000
		1,80,000
Incremental cash inflows and NPV (for years t = 1 – 5)		
Savings in annual operating costs:		
Annual cash operating costs (R)	Rs 2,00,000	
Annual cash operating costs (S)	1,80,000	20,000
(x) PV factor of annuity for 5 years (0.14)		× 3.433
Total present value		68,660
Less incremental cash outflows		1,80,000
NPV		(1,11,340)

Recommendation: Since NPV is negative, the company is advised not to replace Machine-R.

(ii) *Financial evaluation of Machine-R and S (determination of NPV).*

Particulars	Machine-R	Machine-S
Sales revenue (1,50,000 × Rs 6)	Rs 9,00,000	Rs 9,00,000
Less operating costs	2,00,000	1,80,000

(*Contd.*)

(*Contd.*)

Less fixed costs (1,50,000 × Rs 3)	4,50,000	4,50,000
Annual cash inflows	2,50,000	2,70,000
(x) PV factor of annuity for 5 years (0.14)	(×) 3.433	(×) 3.433
Total present value	8,58,250	9,26,910
Less cash outflows	2,00,000	2,50,000
Net present value	6,58,250	6,76,910

Recommendation: As NPV of Machine-S is higher, the company is advised to opt for Machine-S

Note: As the company is a zero-tax company for seven yerars and life of both the machines is five years only, depreciation aspect is not relevant.

P.5.14 Excel Ltd manufactures a special chemical for sale at Rs 30 per kg. The variable cost of manufacture is Rs 15 per kg. Fixed cost excluding depreciation is Rs 2,50,000. Excel Ltd is currently operating at 50 per cent capacity. It can produce a maximum of 1,00,000 kg at full capacity.

The production manager suggests that if the existing machines are replaced, the company can achieve maximum capacity in the next 5 years gradually increasing the production by 10 per cent a year.

The finance manager estimates that for each 10 per cent increase in capacity, the additional increase in fixed cost will be Rs 50,000. The existing machinesa with a current book value of Rs 10,00,000 and remaining useful life of 5 years can be disposed of for Rs 5,00,000. The vice-president (finance) is willing to replace the existing machines provided the NPV on replacement is Rs 4,53,000 at 15 per cent cost of capital. PV factor may be used up to two digits only.

(i) You are required to compute the total value of machines necessary for replacement. For your exercise you may assume the following:
   (a) All the assets are in the same block. Depreciation will be on straight line basis and the same is allowed for tax purposes.
   (b) There will be no slavage value for the new machines. The entire cost of the assets will be depreciated over a five year period.
   (c) Tax rate is 40 per cent.
   (d) Cash inflows will accrue at the end of the year.
   (e) Replacement outflow will be at the beginning of the year (year 0).

(ii) On the basis of data given above, the managing director feels that the replacement, if carried out, would at least yield a post-tax return of 15 per cent in three years provided the capacity build up is 60, 80 and 100 per cent respectively. Do you agree?

SOLUTION

(a) Determination of total replacement value of machines

(a) *Incremental cash outflows*:	
Cost of replacement of new machines	Rs X
Less disposal value of existing machines	5,00,000
Cash outflows required	(X – Rs 5,00,000)

(b) Determination of CFAT and NPV (excluding depreciation)

	Years				
	1	*2*	*3*	*4*	*5*
Increased production and sales (Kg)	10,000	20,000	30,000	40,000	50,000
(x) contribution per unit (Rs 30 – Rs 15) (Rs)	15	15	15	15	15
Incremental contribution	1,50,000	3,00,000	4,50,000	6,00,000	7,50,000
Less incremental fixed costs	50,000	1,00,000	1,50,000	2,00,000	2,50,000
Incremental profit before taxes	1,00,000	2,00,000	3,00,000	4,00,000	5,00,000

(*Contd.*)

(*Contd.*)

Less taxes (0.40)	40,000	80,000	1,20,000	1,60,000	2,00,000
Earnings after taxes	60,000	1,20,000	1,80,000	2,40,000	3,00,000
(x) PV factor (0.15)	0.87	0.76	0.66	0.57	0.49
Present value	52,200	91,200	1,18,800	136,800	1,47,000
Total PV for 5 years (t = 1 – 5)					5,46,000

(c) Base for incremental depreciation:

Current book value of existing machine	Rs 10,00,000
Add cost of new machine	X
Less sale proceeds of existing machine	5,00,000
Depreciation base of new machine	X + 5,00,000
Less depreciation base of existing machine	10,00,000
Base for incremental depreciation	X – 5,00,000

(d) PV of tax savings on incremental depreciation for years 1 - 5

Incremental depreciation per year	
(X – Rs 5,00,000) ÷ 5	0.2X – Rs 1,00,000
(x) Tax rate	0.40
(x) PV factor of annuity for 5 years	3.35

(0.2 X – Rs 1,00,000) × 0.40 × 3.35 = 0.268X – Rs 1,34,000

(e) Total PV (b + d) = Rs 5,46,000 + 0.268X – Rs 1,34,000

(f) Desired NPV = PV of CFAT – PV of outflows

Rs 4,53,000 = (Rs 4,12,000 + 0.268X) – (X – Rs 5,00,000)

Rs 4,53,000 = Rs 4,12,000 + 0.268X – X + Rs 5,00,000

Or 0.732X = Rs 4,59,000 Or X = Rs 4,59,000/0.732 = Rs 6,27,049

Total value of machines required for replacement is Rs 6,27,049.

(ii) *Financial evaluation whether replacement would yield post-tax return of 15 per cent in 3 years*

	Year		
	1	*2*	*3*
Increased capacity (per cent)	10	30	50
Increased sales (kg)	10,000	30,000	50,000
Incremental contribution (@ Rs 15 per kg)	Rs 1,50,000	Rs 4,50,000	Rs 7,50,000
Less incremental fixed cost	50,000	1,50,000	2,50,000
Less incremental depreciation (Rs 11,27,049 – Rs 10,00,000) ÷ 5 years	25,410	25,410	25,410
Earnings before taxes	74,590	2,74,590	4,74,590
Less taxes (0.40)	29,836	1,09,836	1,89,836
Earnings after taxes	44,754	1,64,754	2,84,754
CFAT	70,164	1,90,164	3,10,164
(x) PV factor (0.15)	0.87	0.76	0.66
Present value	61,043	1,44,525	2,04,708
Total present value (t = 1 – 3)			4,10,276
Less incremental cash outflows			1,27,049
NPV			2,83,227

The assessment of the managing director is correct as the NPV is positive.

P.5.15 XYZ Company manufactures several different products. One of the principal products sells for Rs 20 per unit. The sales manager of XYZ has stated repeated that he could sell more units of this product if they were available. To substantiate his claim, he counducted a market research study last year at a cost of Rs 35,000. The study indicated that XYZ could sell 18,000 units of this product annually for the next five years.

The equipment currently in use has the capacity to produce 11,000 units annually. The variable production costs are Rs 9 per unit. The equipment has a value of Rs 60,000 for tax purposes and a remaining useful life of five years. The salvage value of the equipment is negligible now and will be zero in five years.

A maximum of 20,000 units could be produced annually on the new machinery which can be purchased. The new equipment costs Rs 2,50,000 and has an estimated useful life of five years with no salvage value. The production manager estimates that the new equipment would provide increased production efficiencies that would reduce the variable production costs to Rs 7 per unit.

XYZ Company uses straight line depreciation on all of its equipments. The firm is subject to a 35 per cent tax and its after-tax cost of capital is 15 per cent.

The sales manager felt so strongly about the need for additional capacity that he attempted to prepare an economic justification for the equipment although this was not one of his responsibilities. His analysis, presented below, disappointed him because it did not justify acquiring the equipment.

Purchase price of new equipment		Rs 2,50,000
Disposal of existing equipment:		
Loss on disposal	Rs 60,000	
Less tax benefit (0.35)	(21,000)	39,000
Cost of market research study		35,000
Total investment		3,24,000
Contribution margin from product:		
Using the new equipment [18,000 × (Rs 20-7)]		2,34,000
Using the existing equipment [11,000 × (Rs 20-9)]		1,21,000
Increase in contribution		1,13,000
Less depreciation		50,000
Increase in before-tax income		63,000
Income tax (0.35)		22,050
Increase in income		40,950
Less cost of capital on the additional investment required (0.15 × Rs 3,24,000)		48,600
Net annual return of proposed investment in new equipment		(7,650)

The controller of XYZ Company plans to prepare a discounted cash flow analysis for this investment proposal. He has asked you to prepare corrected calculations of: (a) the required investment in new equipment, and (b) the recurring annual cash flows. Give your recommendation on the basis of above information and assuming 25 per cent depreciation on the block of assets to which the machine belongs.

SOLUTION

Financial evaluation whether to replace existing equipment

(a)	Required investment in new equipment:	
	Purchase price of new equipment	Rs 2,50,000
(b)	Recurring annual cash flows:	
	(i) Depreciation base of new machine:	
	Book value of existing machine	60,000
	Add cost of new machine	2,50,000
		3,10,000
	(ii) Base for incremental depreciation:	
	Depreciation base of new machine	3,10,000
	Less book value of existing machine	60,000
		2,50,000

(iii) *Incremental depreciation (t = 1 – 5):*

Year	*Incremental WDV base*	*Depreciation*
1	Rs 2,50,000	Rs 62,500
2	1,87,500	46,875
3	1,40,625	35,156
4	1,05,469	26,367
5	79,102	19,775

Note: Unabsorbed depreciation is Rs 59,327 (Rs 79,102 – 19,775); tax advantage on this will be available in future years.

(ii) *Determination of CFAT and NPV*

Particulars	*Years*				
	1	*2*	*3*	*4*	*5*
Incremental contribution	Rs 1,13,000	Rs 1,13,000	Rs 1,13,000	Rs 1,13,000	Rs 1,13,000
Less incremental depreciation	62,500	46,875	35,156	26,367	19,775
Incremental taxable income	50,500	66,125	77,844	86,633	93,225
Less taxes	17,675	23,144	27,245	30,322	32,629
Earnings after taxes	32,825	42,981	50,599	56,311	60,596
CFAT (EAT + Depreciation)	95,325	89,856	85,755	82,678	80,371
(x) PV factor (0.15)	0.870	0.756	0.658	0.572	0.497
Present value	82,933	67,931	56,427	47,292	39,944
Total present value (t = 1 – 5)					2,94,527
Less purchase price of new equipment					2,50,000
Net present value					44,527

Recommendation: The company is advised to replace the existing equipment.

P.5.16 The capital budgeting department of a company has suggested 3 investment proposals. The after-tax cash flows for each are tabulated below. If the cost of capital is 12 per cent, rank them on the basis of the profitability index.

Year	*After-tax cash flows*		
	Project A	*Project B*	*Project C*
0	Rs 20,000	Rs 60,000	Rs 36,000
1	5,600	12,000	13,000
2	6,000	20,000	13,000
3	8,000	24,000	13,000
4	8,000	32,000	13,000

SOLUTION

Determination of present values

Year	*CFAT*			*PV factor*	*Total PV*		
	A	*B*	*C*		*A*	*B*	*C*
1	Rs 5,600	Rs 12,000	Rs 13,000	0.893	Rs 5,001	Rs 10,716	Rs 11,609
2	6,000	20,000	13,000	0.797	4,782	15,940	10,361
3	8,000	24,000	13,000	0.712	5,696	17,088	9,256
4	8,000	32,000	13,000	0.636	5,088	20,352	8,268
					20,567	64,096	39,494

Profitability index = PV of cash inflows/PV of cash outflows

$PI_{(A)}$ = Rs 20,567/Rs 20,000 = 1.028

$PI_{(B)}$ = Rs 64,096/Rs 60,000 = 1.068

$PI_{(C)}$ = Rs 39,494/Rs 36,000 = 1.097

The projects in descending order of profitability are: C, B and A.

P.5.17 Company X is forced to choose between two machines A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A costs Rs 1,50,000 and will last for 3 years. It costs Rs 40,000 per year to run. Machine B is an 'economy' model costing only Rs 1,00,000, but will last only for 2 years, and cost Rs 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

SOLUTION

Determination of equivalent annual cost (EAC)

Particulars	*Year*	*Machine A*			*Machine B*		
		Cost	*PV factor at 10%*	*PV adjusted cost*	*Cost*	*PV factor at 10%*	*PV adjusted cost*
Purchase cost	0	Rs 1,50,000	1.000	Rs 1,50,000	Rs 1,00,000	1.000	Rs 1,00,000
Operating cost	1	40,000	0.909	36,360	60,000	0.909	54,540
	2	40,000	0.826	33,040	60,000	0.826	49,560
	3	40,000	0.751	30,040	-	-	-
Total cost				2,49,440			2,04,100
Divided by annuity PV factor for 10 per cent corresponding to the life of the machine				÷ 2.487			÷ 1.736
Equivalent annual cost				Rs 1,00,297.55			Rs 1,17,569.12

Recommendation: Company X is advised to buy Machine A as it has lower equivalent annual cost.

P.5.18 Company Y is operating an elderly machine that is expected to produce a net cash inflow of Rs 40,000 in the coming year and Rs 40,000 next year. Current salvage value is Rs.80,000 and next year's value is Rs 70,000. The machine can be replaced now with a new machine, Which costs Rs 1,50,000, but is much more efficient and will provide a cash inflow of Rs 80,000 a year for 3 years. Company Y wants to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is the best of the available alternatives and that it in turn be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10 per cent. Advise with reasons.

SOLUTION

(i)Determination of equivalent annual NPV if an elderly (existing) machine is replaced now (at time = 0 period)

(a) Cash outflows (incremental)

Cost of new machine	Rs 1,50,000
Less salvage value of an elderly machine	80,000
	70,000

(b) NPV of cash inflows

Year	*Incremental cash inflows*	*PV factor at 10%*	*Total PV*
1	Rs 40,000	0.909	Rs 36,360
2	40,000	0.826	33,040
3	80,000	0.751	60,080
Total PV of incremental cash inflows			1,29,480
Less incremental cash outflows			70,000
Net present value			59,480

(c) Equivalent annual net present value (Rs 59,480 ÷ 2.487 PVF for 3 years at 10 per cent)	*23,916.37*

(ii) Determination of equivalent annual NPV if an elderly machine is replaced next year (at time = 0 period)

(a) Incremental cash outflows

Cost of new machine (Rs 1,50,000 × 0.909)	Rs 1,36,350
Less salvage value of an elderly machine (Rs 70,000 × 0.909)	63,630
	72,720

(b) NPV of cash inflows

Year	*Incremental cash inflows*	*PV factor at 10%*	*Total PV*
2	Rs 40,000	0.826	Rs 33,040
3	80,000	0.751	60,080
4	80,000	0.683	54,640
Total PV of incremental cash inflows			1,47,760
Less PV of cash outflows at t = 0			72,720
NPV at t = 0			75,040

(c) Equivalent annual NPV (Rs 75,040 ÷ 2.487)	Rs 30,172.90

Recommendation: Company Y is advised to replace machine one year from now as it promises higher equivalent annual NPV.

P.5.19 A large profit making company is considering the installation of a machine to process the waste produced by one of its existing manufacturing process to be converted into a marketable product. At present, the waste is removed by a contractor for disposal on payment by the company of Rs 50 lacs per annum for the next four years. The contract can be terminated upon installation of the aforesaid machine on payment of a compensation of Rs 30 lacs before the processing operation starts. This compensation is not allowed as deduction for tax purposes.

The machine required for carrying out the processing will cost Rs 200 lacs to be financed by a loan repayable in 4 equal installments commencing from the end of year 1. The interest rate is 16 per cent per annum. At the end of the 4th year, the machine can be sold for Rs 20 lacs and the cost of dismantling and removal will be Rs 15 lacs.

Sales and direct costs of the product emerging from waste processing for 4 years are estimated as under:

Rs (lacs)

Year	*1*	*2*	*3*	*4*
Sales	322	322	418	418
Material consumption	30	40	85	85
Wages	75	75	85	100
Other expenses	40	45	54	70
Factory overheads	55	60	110	145
Depreciation (as per income-tax rules)	50	38	28	21

Initial stock of materials required before commencement of the processing operations is Rs 20 lacs at the start of year 1. The stock levels of materials to be maintained at the end of year 1, 2 and 3 will be Rs 55 lacs and the stocks at the end of year 4 will be nil. The storage of materials will utilize space which would otherwise have been rented out for Rs 10 lakh per annum. Labour costs include wages of 40 workers, whose transfer to this process will reduce idle time payments of Rs 15 lacs in year 1 and Rs 10 lacs in year 2. Factory overheads include apportionment of general factory overheads except to the extent of insurance charges of Rs 30 lacs per annum payable on this venture. The company's tax rate is 50 per cent.

Present value factors for 4 years are as under:

Year	*1*	*2*	*3*	*4*
Present value factors at 15%	0.870	0.756	0.658	0.572

Advise the management on the desirability of installing the machine for processing the waste. All calculations should form part of the answer.

SOLUTION

Determination of cash outflows *(Amount in Rs lakh)*

Particulars	*Time*	
	Year 0	*1*
Cost of new machine	200	—
Compensation for cancellation of contract	30	—
Working capital required (in terms of carrying stock of materials)	20	35
	250	35
Multiply by PVIF at 15 per cent	1.000	0.870
PV of cash outflows	250.00	30.45
Total cash outflows at t = 0	280.45	

Determination of CFAT and NPV *(Amount in Rs lakh)*

Particuclars	*Year 1*	*2*	*3*	*4*
Sales	322	322	418	418
Add cost savings (reduction in waste disposal costs)	50	50	50	50
	372	372	468	468
Less incremental costs:				
Material consumption	30	40	85	85
Wages (net of idle time)	60	65	85	100
Other expenses	40	45	54	70
Insurance charges	30	30	30	30
Loss of rent	10	10	10	10
Depreciation	50	38	28	21
	220	228	292	316
Earnings before taxes	152	144	176	152
Less taxes	76	72	88	76
Earnings after taxes	76	72	88	76
CFAT	126	110	116	97
Salvage value (net of removal costs)	—	—	—	5
Release of working capital				55
PV factor at 15%	0.870	0.756	0.658	0.572
Present value	109.62	83.16	76.33	89.80
Total present value				358.91
Less present value of cash outflows				280.45
Net present value				78.46

Note: (i) Interest has not been treated as expenses as CFAT are to be discounted at cost of capital (which includes after-tax cost of debt). (ii) Since cost of machine has been shown as cash outflow at t = 0, repayment of instalment has not been shown as cash outflow .

(iii) As question has specifically stated depreciation as per income-tax rules, no tax treatment has been made in terminating year 4 due to unabsorbed depreciation.

Recommendation: The company is advised to buy machine for processing waste (since NPV is positive)

P.5.20 Following are the data on a capital project being evaluated by the management of X Ltd.:

	Project M
Annual cost saving	Rs 40,000
Useful life	4 years
I.R.R	15%
Profitability index (PI)	1.064
NPV	?
Cost of capital	?
Cost of project	?
Payback	?
Salvage value	0

Find the missing values considering the following table of discount factors only:

Discount factor	*15%*	*14%*	*13%*	*12%*
1 year	0.869	0.877	0.885	0.893
2 years	0.756	0.769	0.783	0.797
3 years	0.658	0.675	0.693	0.712
4 years	0.572	0.592	0.613	0.636
	2.855	2.913	2.974	3.038

SOLUTION

(i) *Cost of project*: At IRR of 15 per cent, PV of CFAT (annual cost savings) is equal to cost of project (x)
x = (Rs 40,000 × PVIF of annuity for 4 years at 15% i.e., 2.855) = 1,14,200

(ii) *Payback period*: Cost of the project Rs 1,14,200/Annual CFAT (cost saving) Rs 40,000 = 2.855 years

(iii) *Profitability index* = (PV of CFAT /PV of cash outflows, or cost of project)

1.064 = PV of CFAT/ Rs 1,14,200

PV of CFAT = Rs 1,14,200 × 1.064 = Rs 1,21,509

(iv) NPV = PV of CFAT – Cost of project = Rs 1,21,509 – Rs 1,14,200 = Rs 7,309

(v) *Cost of capital*: PV of CFAT = Annual CFAT × PVIF of annuity for 4 years at cost of capital PVIF (Relevant) = Rs 1,21,509/Rs 40,000 = 3.0377

As per annuity table, cumulative PVIF of 3.0377/3.038 corresponds to 12 per cent. This is cost of capital.

P.5.21 XYZ Ltd., an infrastructure company, is evaluating a proposal to build, operate and transfer a section of 35 kms. of road at a project cost of Rs 200 crore to be financed as follows:

Equity share capital Rs 50 crore, loans at the rate of interest of 15 per cent per annum from financial institutions Rs 150 crore. The project after completion will be opened to traffic and a toll will be collected for a period of 15 years from the vehicles using the road. The company is also required to maintain the road during the above 15 years and after the completion of that period, it will be handed over to the Highway authorities at zero value. It is estimated that the toll revenue will be Rs.50 crore per annum and the annual toll collection expenses including maintenance of the roads will amount to 5 per cent of the project cost. The company considers to write off the total cost of the project in 15 years on a straight line basis. For corporate income-tax purposes the company is allowed to take depreciation @ 10 per cent on WDV basis. The financial institutions are agreeable for the repayment of the loan in 15 equal annual installments– consisting of principal and interest.

Calculate project IRR and equity IRR. ignore corporate taxation.

SOLUTION

(i) Determination of project IRR

Cash outflow/Project cost :	Rs 200 crore
Cash inflows (t = 1 – 15 years):	
Toll revenue	Rs 50 crore
Less toll collection expenses, maintenance of the roads, etc (Rs 200 crore × 0.05)	10
Net cash inflows	40

$$CO_0 = \sum_{t=1}^{15} \frac{CI_t}{(1+r)^t} = \text{Rs } 200 \text{ crore} = \frac{\text{Rs } 40 \text{ crore}}{(1+r)^{15}}$$

To determine IRR, payback is determined i.e., 5 years (Rs 200 crore/ Rs 40 crore). Then PV table of annuity is referred to look for a PV factor which is equal to or closest to the payback period, corresponding to the life of the project (15 years). As per PV table, the two closest figures are 5.092 (at 18 per cent) and 4.876 (at 19 per cent); evidently, the IRR is likely to be between the range of 18-19 per cent. Its value is 18% + (0.092 ÷ 0.216) = 18.43 per cent.

(ii) Determination of Equity IRR: It may be defined as a rate of discount which discounts future cash inflows available to equityholders in such a way so that the PV of these cash inflows is equal to equity owners' investment. Accordingly, the relevant values are:

(a) Equity share capital Rs 50 crore and (b) cash inflows available to equity holders are Rs 14.35 crore as shown below:

Net cash inflow of the project	Rs 40 crore
Less equated instalment of the project (Rs 150 crore/PVIF at 15% for 15 years i.e., 5.847)	25.65
Cash inflows for equityholders	14.35

$$\text{Rs } 50 \text{ crore} = \frac{\text{Rs } 14.35 \text{ crore}}{(1+r)^{15}}$$

Payback period is Rs 50 crore/Rs 14.35 crore = 3.484

The PV factor closest to 3.484 (as per PV annuity table corresponding to 15 years) is 3.483 at 28 per cent rate of discount. In other words, 28 per cent is equity IRR.

Note: Depreciation is considered in capital budgeting decisions as it yields tax savings (depreciation *per-se* does not cause cash outflows). Since taxes are to be ignored in the present question, depreciation is not taken into account.

P.5.22 The following statements give quantitative considerations relevant for the ranking of projects A and B:

Criteria	*Project A*	*Project B*
Investment	Rs 400	Rs 300
Internal rate of return	0.18	0.20
Present value at 6 per cent discount factor (DF)	542.7	421.2
Net present value at 6 per cent DF	142.7	121.2
Net present value at 12 per cent DF	60.5	60.5

Project A required an investment of Rs 400 and was expected to have cash inflow of Rs 110, Rs 120, Rs 130, Rs 140 and Rs 150 over its 5 years economic life. Project B involved an investment of Rs 300 and was expected to have a cash inflows of Rs 100 each over its five year economic life.

Which of the two projects will you select if cost of capital is (i) 10 per cent (ii) 12 per cent and (iii) 15 per cent? Give reasons in support of your decision.

SOLUTION

Determination of NPV (project A):

Year	*Net cash inflow*	*PV factor*		*Total PV*	
		(0.10)	*(0.15)*	*(0.10)*	*(0.15)*
1	Rs 110	0.909	0.870	Rs 99.99	Rs 95.70
2	120	0.826	0.756	99.12	90.72
3	130	0.751	0.658	97.63	85.54
4	140	0.683	0.572	95.62	80.08
5	150	0.621	0.497	93.15	74.55
				485.51	426.59
Less Initial cash outlays				400.00	400.00
NPV				85.51	26.59

Determination of NPV (project B)

Year	*Net cash inflow*	*PV factor*		*Total PV*	
		(0.10)	*(0.15)*	*(0.10)*	*(0.15)*
1-5	Rs 100	3.790	3.335	Rs 379	Rs 335.30
Less initial cash outlays				300	300.00
NPV				79	35.30

Project A should be preferred if the cost of capital is 10 per cent. If the cost of capital is 12 per cent, project B should be preferred as it involves a smaller outlay but promises the same NPV as project A. Project B is recommended if the cost of capital is 15 per cent.

REVIEW QUESTIONS

RQ.5.1 Why is it important to evaluate capital budgeting projects on the basis of after-tax cash incremental flows? Why not use accounting data instead of cash flow?

RQ.5.2 What are the components of net cash outlay in the capital budgeting decision? At what time is such an outlay incurred in the case of conventional cash flows?

RQ.5.3 How should working capital and sunk costs be treated in analysing investment opportunities? Explain with suitable examples.

RQ.5.4 Explain clearly the concept of block of assets vis-a-vis depreciation in the context of replacement situations of capital budgeting.

RQ.5.5 Suppose a firm is considering replacing an old machine with a new one. The firm does not anticipate that any new revenues will be created by the replacement since demand for the product generation by both the machines is the same. However, in the CFAT work sheet used in evaluating the proposal, the analyst shows positive CFBT in the operating cash flow section. What creates operating CFBT in this situation?

RQ.5.6 It is said that only cash costs are relevant for capital budgeting decision. However, depreciation which is a non-cash cost is a prominent part of cash flow analysis for such an investment decision. How do you explain this paradox?

RQ.5.7 What is pay back period? Also, discuss the utility of the pay back period in determining the internal rate of return.

RQ.5.8 Contrast the IRR and the NPV methods. Under what circumstance may they lead to (a) comparable recommendations, and (b) give conflicting recommendations? In circumstances in which they give contradictory results, which criteria should be used to select the project and why?

RQ.5.9 What are the critical factors to be observed while making (a) replacement investment decision, and (b) capital budgeting decisions under capital rationing?

RQ.5.10 What does the profitability index signify? What is the criterion for judging the worth of investments in the capital budgeting technique based on the profitability index? What is its value, when its NPV is (a) zero, (b) negative and (c) positive? Also indicate the relationship between IRR and cost of capital in these situations.

RQ.5.11 Do the profitability index and the NPV criterion of evaluating investment proposals lead to the same acceptance-rejection and ranking decisions? In what situations will they give conflicting results?

RQ.5.12 'For most investment decisions that the firm faces, net present value is either a superior decision criterion, or is at least as good as the competing techniques.' In what investment situation is the profitability index better than the net present value?

RQ.5.13 Discuss the problems of ranking projects with varying economic lives, sizes and patterns of cash outflows and inflows.

RQ.5.14 (a) What are the situations in which rate of return analysis would not be very useful?

(b) Give the sequence of steps in a comprehensive capital budgeting process.

(c) Why is it possible for the internal rate of return and present value methods to result in different ranking of investment proposals?

(d) Since pay back period does not really measure profitability at all, of what value is it in capital budgeting?

RQ.5.15 ABC Ltd is considering investing in a project that costs Rs 5,00,000. The estimated salvage value is zero; tax rate is 35 per cent. The company uses straight line depreciation for tax purposes and the proposed project has cash flows before tax (CFBT) as follows:

Year	*CFBT*
1	Rs 1,00,000
2	1,00,000
3	1,50,000
4	1,50,000
5	2,50,000

Determine the following: (i) Pay back period, and (ii) Average rate of return.

SOLUTION

Cash inflows

Year	*CFBT*	*Depreciation*	*Taxable earnings*	*Tax*	*EAT*	*CFAT [Col 2 – 5]*	*Cumulative CFAT*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	Rs 1,00,000	Rs 1,00,000	—	—	—	Rs 1,00,000	Rs 1,00,000
2	1,00,000	1,00,000	—	—	—	1,00,000	2,00,000
3	1,50,000	1,00,000	Rs 50,000	Rs 17,500	Rs 32,500	1,32,500	3,32,500
4	1,50,000	1,00,000	50,000	17,500	32,500	1,32,500	4,65,000
5	2,50,000	1,00,000	1,50,000	52,500	97,500	1,97,500	6,62,500
		2,50,000		1,62,500	6,62,500		

(i) *Pay back period*

The pay back period is four years plus a fraction of the fifth year. The fraction value will be equal to 0.18, that is, Rs 35,000 ÷ Rs 1,97,500. The payback period is 4.18 years.

(ii) *Average rate of return (ARR)*

(a) ARR= (Average income/Average investment) × 100 = (Rs 32,500*/2,50,000) × 100 = 13 per cent *Rs 1,62,500, EAT/5 years = Rs 32,500.

(b) ARR = (Average cash flow/Average investment) × 100 = (Rs 1,32,500/2,50,000) × 100 = 53 per cent.

RQ.5.16 XYZ Ltd, whose cost of capital is 10 per cent, is considering two mutually exclusive projects, X and Y, the details of which are:

	Project X	*Project Y*
Investment	Rs 70,000	Rs 70,000
Cash inflow: year 1	10,000	50,000
2	20,000	40,000
3	30,000	20,000
4	45,000	10,000
5	60,000	10,000
	1,65,000	1,30,000

Compute the NPV, profitability index, and IRR for the two projects.

SOLUTION

Determination of NPV

Year	*CFAT*		*PV factor (at 0.10)*	*Total PV*	
	X	*Y*		*X*	*Y*
1	Rs 10,000	Rs 50,000	0.909	Rs 9,090	Rs 45,450
2	20,000	40,000	0.826	16,520	33,040
3	30,000	20,000	0.751	22,530	15,020
4	45,000	10,000	0.683	30,735	6,830
5	60,000	10,000	0.621	37,260	6,210
Total				1,16,135	1,06,550
Less cash outflows				70,000	70,000
NPV				46,135	36,550
PI = Gross PV of CFAT/PV of cash outlays				1.659	1.522

Determination of IRR:

Fake pay back value = Initial cash outlays/Average cash inflows

Project X = Rs 70,000/33,000 = 2.121

Project Y = Rs 70,000/26,000 = 2.692

Total A-4 indicates that the PV factor closet to 2.121 against 5 years is 2.143 at 37 per cent (project X) and to 2.692 is 2.689 at 25 per cent (project Y). In the case of project X, since CFATs in the initial years are considerably smaller than the average cash flows, the IRR is likely to be much smaller than 37 per cent. Let us try 27 and 28 per cent. In the case of project Y, CFATs in the initial years are considerably larger than the average cash flows, the IRR is likely to be much higher than 25 per cent. Let us try 36 and 37 per cent.

Project X

Year	*CFAT*	*PV factor at*		*Total PV at*	
		(0.27)	*(0.28)*	*(0.27)*	*(0.28)*
1	Rs 10,000	0.787	0.781	Rs 7,870	Rs 7,810
2	20,000	0.620	0.610	12,400	12,200
3	30,000	0.488	0.477	14,640	14,310
4	45,000	0.384	0.373	17,280	16,785
5	60,000	0.303	0.291	18,180	17,460
				70,370	68,565

IRR = 0.27 + (Rs 370/Rs 1,805) = 27.2 per cent.

Project Y

Year	CFAT	PV factor at		Total PV at	
		(0.36)	(0.37)	(0.36)	(0.37)
1	Rs 50,000	0.735	0.730	Rs 36,750	Rs 36,500
2	40,000	0.541	0.533	21,640	21,320
3	20,000	0.398	0.389	7,960	7,780
4	10,000	0.292	0.284	2,920	2,840
5	10,000	0.215	0.207	2,150	2,070
				71,420	70,510

IRR = 37 per cent.

RQ.5.17 ABC Ltd is planning to purchase a machine to meet the increased demand for its product in the market. The machine costs Rs 50,000 and has no salvage value. The expected life of the machine is 5 years, and the company employs the straight line method of depreciation. The estimated earnings after taxes are Rs 5,000 each year for 5 years. The after tax required rate of return of the company is 12 per cent.

Determine the IRR. Also, find the pay back period and obtain the IRR from it. How do you compare the IRR with the one directly estimated? What are the reasons for the differences between the two IRRs so estimated?

SOLUTION

Earnings after taxes (EAT)	Rs 5,000
Add depreciation (D)	10,000
CFAT	15,000

PB period = 3.333 (Rs 50,000 ÷ Rs 15,000). The PV factors closest to 3.333 as per Table A-4 are 3.373 (0.15) and 3.274 (0.16) against five years.

IRR = 0.15 + (0.040/0.099) = 15.4 per cent.

Determination of IRR with the help of PB period:

IRR = 1.000/3.333 = 0.30 = 30 per cent.

The reciprocal of the PB period is a good approximation of IRR if (a) the life of the project is large or at least twice the PB period, and (b) the project generates equal annual cash inflows. In this case, the former condition is not satisfied. Therefore, the value of the IRR determined with the help of PB period is nowhere near the actual value of IRR, 15.4 per cent.

RQ.5.18 One project of XYZ Ltd is doing poorly and is being considered for replacement. Three mutually exclusive projects A, B and C have been proposed. The projects are expected to require Rs 2,00,000 each, and have an estimated life of 5 years, 4 years and 3 years, respectively, and have no salvage value. The company's required rate of return is 10 per cent. The anticipated cash inflows after taxes (CFAT) for the three projects are as follows:

Year	CFAT		
	A	B	C
1	Rs 50,000	Rs 80,000	Rs 1,00,000
2	50,000	80,000	1,00,000
3	50,000	80,000	10,000
4	50,000	30,000	—
5	1,90,000	—	—

(i) Rank each project applying the methods of PB, NPV, IRR and profitability index.

(ii) What would the profitability index be if the IRR equalled the required return on investment? What is the significance of a profitability index less than one?

(iii) Recommend the project to be adopted and give reasons.

SOLUTION

(i) *Ranking of projects*

Year	CFAT			PV factor	Total PV		
	A	B	C	(at 0.10)	A	B	C
1	Rs 50,000	Rs 80,000	Rs 1,00,000	0.909	Rs 45,450	Rs 72,720	Rs 90,900
2	50,000	80,000	1,00,000	0.826	41,300	66,080	82,600
3	50,000	80,000	10,000	0.751	37,550	60,080	7,510
4	50,000	30,000	—	0.683	34,150	20,490	—
5	1,90,000	—	—	0.621	1,17,990	—	—
	3,90,000	2,70,000	2,10,000		2,76,440	2,19,370	1,81,010

NPV (Gross present value – Cash outflows):

(A) (Rs 2,76,440 – Rs 2,00,000) = Rs 76,440

(B) (Rs 2,19,370 – Rs 2,00,000) = Rs 19,370

(C) (Rs 1,81,010 – Rs 2,00,000) = Rs (18,990)

Pay back period: Project A = 4 years
Project B = 2.5 years
Project C = 2 years

Internal rate of return (IRR):

	A	B	C
Fake pay back value	2.564	2.963	2.857
Factors closest to payback period (as per Table A-4)	2.532(0.28)	2.974(0.13)	2.829(0.03)
corresponding to the varying lives of the project	2.583(0.27)	2.914(0.14)	2.884(0.02)

Project A: In Project A, CFAT in the initial years are substantially smaller than the average CFAT; therefore, lower discount rates of 21 and 20 per cent are applied.

Project A

Year	CFAT	PV factor at		Total PV at	
		(0.21)	(0.20)	(0.21)	(0.20)
1	Rs 50,000	0.826	0.833	Rs 41,300	Rs 41,650
2	50,000	0.683	0.694	34,150	34,700
3	50,000	0.564	0.579	28,200	28,950
4	50,000	0.467	0.482	23,350	24,100
5	1,90,000	0.386	0.402	73,340	76,380
$IRR_{(A)}$ = 21 per cent				2,00,340	2,05,780

Project B

Year	CFAT	PV factor at		Total PV at	
		(0.21)	(0.20)	(0.21)	(0.20)
1	Rs 80,000	0.877	0.870	Rs 70,160	Rs 69,600
2	80,000	0.769	0.756	61,520	60,480
3	80,000	0.675	0.658	54,000	52,640
4	30,000	0.592	0.572	17,760	17,160
				2,03,440	1,99,880
$IRR_{(B)}$ = 15 per cent					

Project C

Year	*CFAT*	*PV factor (at 0.03)*	*Total PV*
1	Rs 1,00,000	0.971	Rs 97,100
2	1,00,000	0.943	94,300
3	10,000	0.915	9,150
			2,00,550

$IRR_{(C)}$ = 3 per cent

Ranking of the projects

Name of the method	*A*	*B*	*C*
PB	3	2	1
NPV	1	2	No rank
IRR	1	2	No rank

(ii) The profitability index (PI) would be 1 if the IRR equalled the required return on investment. The significance of a PI less than 1 is that NPV is negative and the project should not be undertaken.

(iii) Project A should be adopted because its NPV is the highest among all the projects.

RQ.5.19 ABC Ltd manufactures toys and other short-lived fad items. The research and development department has come up with an item that would make a good promotional gift for office equipment dealers. As a result of efforts by the sales personnel, the firm has commitments for this product.

To produce the quantity demanded, ABC Ltd will need to buy additional machinery and rent additional space. It appears that about 25,000 sq. ft. will be needed; 12,500 sq. ft. of presently unused space, but leased at the rate of Rs 3 per sq. ft. per year, is available. There is another 12,500 sq. ft. adjoining the facility available at the annual rent of Rs 4 per sq. ft.

The equipment will be purchased for Rs 9,00,000. It will require Rs 30,000 in modifications and Rs 1,50,000 for installation. The equipment will have a salvage value of about Rs 2,80,000 at the end of the third year. It is subject to 25 per cent depreciation on reducing balance basis. The firm has no other assets in this block. No additional general overhead costs are expected to be incurred.

The estimates of revenues and costs for this product for the 3 years have been developed as follows:

Particulars	*Year 1*	*Year 2*	*Year 3*
Sales	Rs 10,00,000	Rs 20,00,000	Rs 8,00,000
Less costs:			
Material, labour and overhead incurred	4,00,000	7,50,000	3,50,000
Overheads allocated	40,000	75,000	35,000
Rent	50,000	50,000	50,000
Depreciation	2,70,000	2,02,500	Nil
Total costs	7,60,000	10,77,500	4,35,000
Earnings before taxes	2,40,000	9,22,500	3,65,000
Less taxes	84,000	3,22,875	1,27,750
Earnings after taxes	1,56,000	5,99,625	2,37,250

If the company sets a required rate of return of 20 per cent after taxes, should this project be accepted?

SOLUTION

Cash outflows

Cost of equipment	Rs 9,00,000
Modification cost	30,000
Installation cost	1,50,000
	10,80,000

Cash inflows-operating

Particulars	*Year 1*	*Year 2*	*Year 3*
Sales revenue	Rs 10,00,000	Rs 20,00,000	Rs 8,00,000
Less relevant/incremental cost:			
Material, labour and overhead incurred	4,00,000	7,50,000	3,50,000
Rent payable	50,000	50,000	50,000
Rent sacrificed	37,500	37,500	37,500
Depreciation	2,70,000	2,02,500	Nil
Earnings before taxes	2,42,500	9,60,000	3,62,500
Less taxes	84,875	3,36,000	1,26,875
Earnings after taxes	1,57,625	6,24,000	2,35,625
Add depreciation	2,70,000	2,02,500	Nil
CFAT	4,27,625	8,26,500	2,35,625

Net present value

Particulars	*Year*	*Amount (at 0.20)*	*PV factor*	*Total PV*
Cash outflows	$t = 0$	Rs (10,80,000)	1.000	Rs (10,80,000)
Operating CFAT	1	4,27,625	0.833	3,56,212
Operating CFAT	2	8,26,500	0.694	5,73,591
Operating CFAT	3	2,35,625	0.579	1,36,427
Salvage value	3	2,80,000	0.579	1,62,120
Tax advantage on short-term capital loss (Rs 3,27,500 × 0.35)	3	1,14,625	0.579	66,368
NPV				2,14,718

Recommendation: The projected should be accepted.

RQ.5.20 Arvind Mills Ltd is considering two mutually exclusive investment proposals for its expansion programme. Proposal A requires an initial investment of Rs 7,50,000 and yearly cash operating costs of Rs 50,000. Proposal B requires an initial investment of Rs 5,00,000 and yearly cash operating costs of Rs 1,00,000. The life of the equipment used in both the investment proposals will be 12 years, with no salvage value; depreciation is on the straight line basis for tax purposes. The anticipated increase in revenues is Rs 1,50,000 per year in both the investment proposals. The firm's tax rate is 35 per cent and its cost of capital is 15 per cent. Which investment proposal should be undertaken by the company?

SOLUTION

Economics of proposal A requiring Rs 2,50,000 more than proposal B

		Amount before tax	*Amount after tax*
Cash inflows:			
Cost savings	Rs 50,000	Rs 32,500	
Differential depreciation			
Proposal A	Rs 62,500		
Proposal B	41,667	20,883	7,309
CFAT			39,809
PVIFA (15,12)			× 5.421
Total present value			2,15,805
Less additional outlay			2,50,000
NPV			(34,195)

Since the NPV is negative, equipment under proposal *B* should be accepted.

RQ.5.21 Royal Industries Ltd requires more machinery for a manufacturing process that will be carried out for the next 8 years. Two machines that meet the firm's needs are available. The relevant data regarding these two machines are as follows:

	Machine X	*Machine Y*
Purchase cost	Rs 43,600	Rs 72,000
Annual cash operating expenses	25,000	25,000
Salvage value at the end of the useful life	4,000	8,000
Useful life (years)	4	8

The company makes use of the straight line method of depreciation and the same is accepted for tax purposes. In determining the amount of depreciation, provision would be made for salvage value. It is estimated that the firm would need Rs 48,000 to replace machine X at the end of 4 years, if that machine is selected. The other data applicable to machine X given above apply to the replacement model as well.

Cost of capital is 15 per cent and tax rate is 35 per cent. You are required to determine the course of action that the firm should take.

SOLUTION

PV of total cost

		Present value
Machine Y:		
Purchase cost		Rs 78,400
Annual operating cost after taxes (Rs 25,000 × 0.65)	Rs 16,250	
Less tax advantage on depreciation (Rs 8,000 × 0.35)	2,800	
Net cash outflows	13,450	
(×) PV factor, annuity of 8 years	(×) 4.487	60,350
Less salvage value	(8,000)	
(×) PV factor, for 8th year	× 0.351	(2,808)
Total PV		1,35,942

(*Contd.*)

(*Contd.*)

Machine X:		
Purchase cost		43,600
Annual operating cost after taxes (Rs 20,000 × 0.65)	13,000	
Less tax advantage on depreciation (Rs 9,900 × 0.35)	3,465	
Net cash outflows	9,535	
(×) PV factor, annuity of 4th years, 15%	(×) 2.855	27,222
Less salvage value	(4,000)	
(×) PV factor, for 4th year	× 0.572	(2,888)
Purchase price of replacement machine	48,000	
(×) PV factor for 4th year	× 0.572	27,456
Annual operating costs after taxes	13,000	
Less tax advantage on depreciation	3,500	
Net cash outflows	9,500	
(×) PV factor, for 4 years (0.497 + 0.432 + 0.376 + 0.327)	× 1.632	15,504
Less salvage value	(4,000)	
(×) PV factor, for 8th year	× 0.327	(1,308)
Total		1,09,586

Recommendation: The firm should buy machine X and replace it at the end of 4 years.

RQ.5.22 Indian Oil Ltd proposes to install a pipeline for transport of crude oil from wells to refinery. Investments and operating costs of the pipeline vary from different diameters of pipes. The following details have been collected:

Pipeline diameter	*3"*	*4"*	*5"*	*6"*	*7"*
Investment required (Rs in lakh)	16	24	36	64	150
Gross annual savings in operating costs before depreciation	5	8	15	30	50

Estimated life of the installation is 10 years. Tax rate is 35 per cent. Calculate the net savings after tax, and the cash flow generation; from these recommend the largest pipeline to be installed if the company desires a 15 per cent after tax return and follows straight line method of depreciation for tax purposes.

SOLUTION

Determination of CFAT (Rs in lakh)

Pipeline diameter	*3"*	*4"*	*5"*	*6"*	*7"*
Gross annual savings	5	8	15	30	50
Less depreciation	1.6	2.4	3.6	6.4	15
Earnings before taxes	3.4	5.6	11.4	23.6	35
Less taxes (0.35)	1.19	1.96	3.99	8.26	12.25
Earnings after taxes	2.21	3.64	7.41	15.34	22.75
CFAT (EAT + Depreciation)	3.81	6.04	11.01	21.74	37.75
(×) PV factor of annuity for 10 years (at 0.15)	5.019	5.019	5.019	5.019	5.019
PV 19.12	30.31	55.26	109.11	189.47	
Less investment	16	24	36	64	150
NPV	3.12	6.31	19.26	45.11	39.47

Recommendation: Pipeline diameter 6" is recommended for installation as it has the highest NPV.

RQ.5.23 A toy manufacturing company is considering replacing an existing piece of equipment with one of the two new, more sophisticated machines. The old machine was purchased 3 years ago at a cost of Rs 70,000. The machine originally had a projected life of 7 years and was to be depreciated straight line to zero salvage value. The two new pieces of equipment being considered are machine X and machine Y.

Machine X would cost Rs 80,000 to purchase, and Rs 20,000 to install. Due to expansion in operation, the management estimates the net working capital requirement of machine X at Rs 10,000. It has a 4-year life with no salvage value. It will be depreciated straight line.

Machine Y would cost Rs 1,15,000 and Rs 25,000 to install. It also has 4-year life with no salvage value. This machine would require a net working capital of Rs 20,000.

The old machine can be sold for Rs 25,000 on 1 year credit. The firm is taxed at 35 per cent. Assuming the cost of capital to be 10 per cent, which machine, if either, should the company acquire? The projected profits before depreciation and taxes currently and with each of the new machines are as follows:

Year	*With present Machine*	*With Machine X*	*With Machine Y*
1	Rs 25,000	Rs 50,000	Rs 90,000
2	25,000	50,000	90,000
3	25,000	50,000	90,000
4	25,000	50,000	90,000

What would be your answer, if the company has under consideration only the proposal to purchase machine X?

SOLUTION

Cash outflows

Particulars	*Machine X*	*Machine Y*
Cost of the machine	Rs 80,000	Rs 1,15,000
Add installation cost	20,000	25,000
Add net working capital	10,000	20,000
Less cash inflows from the sale of the present machine	27,975*	27,975*
Net cash outflows	82,025	1,32,025

Working Notes

**Cash inflows from the sale of the present machine*:

Book value of the machine (Rs 70,000 – Rs 30,000, accumulated depreciation)	Rs 40,000
Less sale value	25,000
Short-term capital loss on the sale of the machine	15,000
Tax savings on loss (0.35)	5,250
PV of Rs 25,000 to be received at (t = 1) = (Rs 25,000 x 0.909)	22,725
	27,975

Cash inflows (t = 1 – 4)

Particulars	*Present machine*	*Machine X*	*Machine Y*
Earning befor depreciation and taxes	Rs 25,000	Rs 50,000	Rs 90,000
Less depreciation	10,000	25,000	35,000
Net earnings	15,000	25,000	55,000
Less Taxes	5,250	8,750	19,250
EAT 9,750	16,250	35,750	
Add depreciation	10,000	25,000	35,000

(*Contd.*)

(*Contd.*)

CFAT19,750	41,250	70,750	
× PV factor	3.170	3.170	3.170
Total PV of CFAT	62,607	1,30,762	2,24,277
PV of the release of WC (PV factor = 0.683)	—	6,830	13,660
Total PV	62,607	1,37,592	2,37,937
Less cash outflows	—	82,025	1,32,025
NPV	62,607	55,567	1,05,912

The company should acquire machine Y. If the company has the proposal to buy machine X only, then it should continue with the existing machine.

RQ.5.24 The management of X Ltd is considering the replacement of a machine which has a current written down value of Rs 25,000 and a present sale value of Rs 8,000. The machine is still usable for 5 years, but will have no scarp value at the end of 5 years.

A new machine having a useful life of 5 years, and a scrap value of Rs 10,000 at the end of this, is available for Rs 1,00,000. The installation of the new machine, it is estimated, would result in a saving of Rs 20,000 per annum in operating costs at the present level of production. The capacity of the new machine is more than that of the old, and, since sales are no problem, utilisation of the additional capacity would bring in an additional contribution of Rs 25,000 per annum (after meeting incremental costs of production and sale). The machine would be depreciated @ 25 per cent on written down value basis. The company has other assets in the block. Current income tax is 35 per cent. Considering the firm's estimated cost of capital, it will not pay to purchase the new machine unless the net savings are 20 per cent, or more, on the added investment. Should the company replace the existing machine?

SOLUTION

Cash outflows

Cost of the new machine	Rs 1,00,000
Less sale value of the old machine	8,000
	92,000

Incremental CFAT and NPV

Particulars	*Years*				
	1	*2*	*3*	*4*	*5*
Increased contribution	Rs 25,000	Rs 25,000	Rs 25,000	Rs 25,000	Rs 25,000
Savings in operating costs	20,000	20,000	20,000	20,000	20,000
Gross earnings	45,000	45,000	45,000	45,000	45,000
Less incremental depreciation	23,000	17,250	12,937	9,703	4,777*
EBT	22,000	27,750	32,063	35,297	40,223
Less taxes	7,700	9,712	11,222	12,354	14,078
EAT	14,300	18,038	20,841	22,943	26,145
CFAT (EAT + Depreciation)	37,300	35,288	33,778	32,646	30,922
Salvage value of new machine					10,000
× PV factor (at 0.20)	0.833	0.694	0.579	0.482	0.402
PV	31,071	24,490	19,557	15,735	16,451
Total present value (t = 1 – 5)					1,07,304
Less cash outflows					92,000
NPV					15,304

* 0.25 × (Rs 29,110 – Rs 10,000) = Rs 4,777

Recommendation: Since NPV is positive, the management is advised to replace the existing machine.

Working Notes

Depreciation base of new machine

WDV of existing machine	Rs 25,000
Cost of new machine	1,00,000
Less sale value of existing machine	8,000
	1,17,000

Base for incremental depreciation: (Rs 1,17,000 – Rs 25,000, WDV of existing machine) = Rs 92,000

EXAMINATION QUESTIONS

EQ. 5.1 Define modified internal rate of return method. (*CA(PE-II)—May, 2007*)

EQ. 5.2 Acompany proposes to install a machine involving a capital cost of Rs 3,60,000. The life of the machine is 5 years and its salvage value at the end of the life is nil. The machine will produce the net operating income after depreciation of Rs 68,000 per annum. The company's tax rate is 45 per cent.

The net present value factors for 5 years are as under:

Discounting rate (%)	*14*	*15*	*16*	*17*	*18*
Cumulative factor	3.43	3.35	3.27	3.20	3.13

You are required to calculate the internal rate of return of the proposal. (*CA—November, 2002*)

SOLUTION

(i) Determination of CFAT for 5 years (t = 1 – 5)

Net operating income per annum	Rs 68,000
Less taxes (0.45)	30,600
Earnings after taxes	37,400
Add depreciation (Rs 3,60,000/5 years)	72,000
Cash inflows after taxes (CFAT)	1,09,400

(ii) Determination of internal rate of return:

(a) Determination of payback period (Rs 3,60,000/1,09,400) = 3.29.

(b) The factors closest to 3.29 are 3.35 at 15 per cent rate of discount and 3.27 at 16 per cent rate of discount. The actual IRR would be between 15 and 16 per cent. Using interpolation the IRR would be 15 per cent + 0.75 i.e., (3.35 – 3.29 = 0.06)/(3.35 – 3.27 = 0.08) = 15.75 per cent

EQ. 5.3 A company has to make a choice between two projects, namely, A and B. The initial capital outlay of the two projects are Rs 1,35,000 and Rs 2,40,000 respectively for A and B. There will be no scrap value at the end of the life of both the projects. The opportunity cost of capital of the company is 16 per cent. The annual incomes are as under:

Year	*Project A*	*Project B*	*Discounting factor @ 16%*
1	—	Rs 60,000	0.862
2	Rs 30,000	84,000	0.743
3	1,32,000	96,000	0.641
4	84,000	1,02,000	0.552
5	84,000	90,000	0.476

You are required to calculate for each project:

(i) Discounted payback period
(ii) Profitability index
(iii) Net present value (*CA—November, 2002*)

SOLUTION

Computation of net present value and discounted payback period

Year	*CFAT**		*Discount factor 0.16*	*Total PV*		*Cumulative PV*	
	Project A	*Project B*		*Project A*	*Project B*	*Project A*	*Project B*
1	Nil	Rs 60,000	0.862	Nil	Rs 51,720	—	Rs 51,720
2	Rs 30,000	84,000	0.743	Rs 22,290	62,412	Rs 22,290	1,14,132
3	1,32,000	96,000	0.641	84,612	61,536	1,06,902	1,75,668
4	84,000	1,02,000	0.552	46,368	56,304	1,53,270	2,31,972
5	84,000	90,000	0.476	39,984	42,840	1,93,254	2,74,812
Gross present value				1,93,254	2,74,812		
Less capital/cash outlay				1,35,000	2,40,000		
Net present value				58,254	34,812		

* Annual incomes are assumed as CFAT. The reasons are: (a) method of depreciation is not given and (b) annual incomes are substantial in amount and hence assumed to be duly adjusted for depreciation.

(i) *Discounted payback period:*
Project A: 3 years plus a fraction of 4th year
(Rs 1,35,000 – Rs 1,06,902 = Rs 28,098)/(Rs 1,53,270 – Rs 1,06,902 = Rs 46,368)
= 0.61 = 3.61 years
Project B: 4 years plus a fraction of 4th year
(Rs 2,40,000 – Rs 2,31,972)/(Rs 2,74,812 – Rs 2,31,972) = 0.19 = 4.19 years.

(ii) *Profitability index: (PV of CFAT)/Initial cash outflows*
Project A: Rs 1,93,254/Rs 1,35,000 = 1.432
Project B: Rs 2,74,812/Rs 2,40,000 = 1.145

(iii) *Net present value*
Project A: Rs 58,254
Project B: Rs 34, 812

EQ. 5.4 The cash flows of projects C and D are reproduced below:

Project	*Cash flow*				*NPV at 10%*	*IRR*
		C_0	C_1	C_2 C_3		
C	–Rs 10,000	+2,000	+4,000	+12,000	+Rs 4,139	26.5%
D	–Rs 10,000	+ 10,000	+ 3,000	+ 3,000	+ Rs 3,823	37.6%

(i) Why there is a conflict of rankings?
(ii) Why should you recommend project C in spite of lower internal rate of return?

Time	*1*	*2 Period*	*3*
$PVIF_{0.10,}t$	0.9090	0.8264	0.7513
$PVIF_{0.14,}t$	0.8772	0.7695	0.6750
$PVIF_{0.15,}t$	0.8696	0.7561	0.6575
$PVIF_{0.30,}t$	0.7692	9.5917	0.4552
$PVIF_{0.40,}t$	0.7143	0.5102	0.3644

(*CA—May, 2003*)

SOLUTION

(i) There is a conflict of rankings by the NPV and IRR methods of projects C and D on account of wide variations in the pattern their cash inflows (CFAT). While more than 60 per cent (62.5%) of total cash flows occur in year 1 in the case of project D, substantial cash inflows (66.67%) accrue in year 3 in project C. At the lower rate of discount/cost of capital, NPV of the project C would be higher *vis-à-vis* project D. As the discount rate increases, NPV of project C falls at a faster rate compared to project D due to compounding factor as shown in Table below. In fact, project D is preferred to project C at all discount rates (14% to 30%). It has higher NPV as well as higher IRR. At 40% discount rate, neither of the projects is acceptable.

NPV at varying discount rates of projects C and D

Year	*CFAT*	*PV factor at*				*Total PV at*			
		14%	*15%*	*30%*	*40%*	*14%*	*15%*	*30%*	*40%*
Project C:									
0	(Rs 10,000)	(1.000)	(1.000)	(1.000)	(1.000)	(Rs 10,000)	(Rs 10,000)	(Rs 10,000)	(Rs 10,000)
1	2,000	0.877	0.869	0.769	0.714	1,754	1,738	1,538	1,428
2	4,000	0.769	0.756	0.591	0.510	3,076	3,024	2,364	2,040
3	12,000	0.675	0.657	0.455	0.364	8,100	7,884	5,460	4,368
Net present value						2,930	2,646	(638)	(2,164)
Ranking (relative to project D)						II	II	Not acceptable	Not accepted
Project D									
0	(Rs 10,000)	(1.0)	(1.0)	(1.0)	(1.0)	(Rs 10,000)	(Rs 10,000)	(Rs 10,000)	(Rs 10,000)
1	10,000	0.877	0.869	0.769	0.714	8,770	8,690	7,690	7,140
2	3,000	0.769	0.756	0.591	0.510	2,307	2,268	1,773	1,530
3	3,000	0.675	0.657	0.455	0.364	2,025	1,971	1,365	1,092
Net present value						3,102	2,929	828	(238)
Ranking (relative to project C)						I	I	I	Not acceptable

(ii) Project C should be preferred to project D if the cost of capital is 10 per cent. The reason is it adds more (Rs 4,139) to the shareholders wealth than project D (Rs 3,823). However, if the cost of funds is higher (say, 14 per cent or more), project D would be preferred due to its potential of higher NPV. In brief, the decision criterion of accepting/ranking of investment projects is NPV and not IRR. The IRR is a means to the end but not an end in itself.

EQ. 5.5 Beta company limited is considering replacement of its existing machine by a new machine, which is expected to cost Rs 2,64,000. The new machine will have a life of five years and will yield annual cash revenues of Rs 5,68,750 and incur annual cash expenses of Rs 2,95,750. The estimated salvage value of the new machine is Rs 18,200. The existing machine has a book value of Rs 91,000 and can be sold for Rs 45,500 today.

The existing machine has a remaining useful life of five years. The cash revenues will be Rs 4,55,000 and associated cash expenses will be Rs 3,18,500. The existing machine will have a salvage value of Rs 4,550, at the end of five years.

The Beta company is in 35 per cent tax-bracket, and writes off depreciation at 25 per cent on written-down value method.

The Beta company has a target debt to value ratio of 15 per cent. The company in the past has raised debt at 11 per cent and it can raise fresh debt at 10.5 per cent.

Beta company plans to follow dividend discount model to estimate the cost of equity capital. The company plans to pay a dividend of Rs 2 per share in the next year. The current market price of Company's equity share is Rs 20 per equity share. The dividend per equity share of the company is expected to grow at 8 per cent per annum.

Required:
(i) Compute the incremental cash flows of the replacement decision. (ii) Compute the weighted average cost of capital of the company. (iii) Find out the net present value of the replacement decision. (iv) Estimate the discounted payback period of the replacement decision. (v) Should the company replace the existing machine? Advise.

(*CA—November, 2003*)

SOLUTION

(i) Computation of incremental cash flows:
(a) Cash outflows

Cost of new machine	Rs 2,64,000
Less sale proceeds of existing machine	45,500
	2,18,500

(b) Cash inflows after taxes

Particulars		*Years*				
		1	*2*	*3*	*4*	*5*
Incremental cash revenues (Rs 5,68,750 – Rs 4,55,000)		Rs 1,13,750	Rs 1,13,750	Rs 1,13,750	Rs 1,13,750	Rs 1,13,750
Add savings in cash expenses (Rs 3,18,500 – Rs 2,95,750)		22,750	22,750	22,750	22,750	22,750
Less incremental depreciation						
New machine		66,000	49,500	37,125	27,844	20,883
Existing machine		22,750	17,063	12,797	9,598	7,198
		43,250	32,437	24,328	18,246	13,685
Incremental earnings before taxes		93,250	1,04,063	1,12,172	1,18,254	1,22,815
Less taxes (0.35)		32,638	36,422	39,260	41,389	42,985
Earnings after taxes (EAT)		60,612	67,641	72,912	76,865	79,830
EAT + Depreciation (incremental)		1,03,862	1,00,078	97,240	95,111	93,515
Incremental salvage value (t = 5)						(+)
New machine	Rs 18,200					
Existing machine	4,550					13,650
Incremental tax savings on loss due to sale of machine (t = 5)						
New machine	Rs 44,448 @					(+)
Existing machine	17,045 @@					
Loss	27,403					
Tax savings (0.35)	× 0.35					9,591

@ Rs 2,64,000 – (Depreciation, Rs 66,000 + 49,500 + 37,125 + 27,844 + Rs 20,883) – Salvage value, Rs 18,200 = Rs 44,448
@@ Rs 91,000 – (Depreciation, Rs 22,750 + 17,063 + 12,797 + 9,598 + 7,198) – Salvage value, Rs 4,550 = Rs 17,045

(ii) Computation of weighted average cost of capital (K_0)

Source of finance	*Proportion*	*After-tax cost (%)*	*Total cost (%)*
Equity	0.85	18.00%[1]	15.3
Debt	0.15	6.825[2]	1.023
K_0			16.323%

1. Cost of equity (k_e) = (Rs 2/Rs 20) + 0.08 = 18 per cent
2. Cost of debt (k_d) = 10.5% (1 – 0.35) = 6.825 per cent

(iii) and (iv) Determination of NPV and discounted payback period

Year	CFAT	PV factor at 16.32*	Total PV	Cumulative PV
1	Rs 1,03,862	0.860	Rs 89,321	Rs 89,321
2	1,00,078	0.739	73,958	1,63,279
3	97,240	0.636	61,845	2,25,124
4	95,111	0.547	52,026	Not required
5	1,16,756**	0.470	54,875	Not required
Gross PV			3,32,025	
Less cash outflows			2,18,500	
NPV			1,13,525	

* Based on interpolation of 16 per cent and 17 per cent rates of discount.
** (Rs 93,515 + Rs 13,650 + Rs 9,591)

Discounted PB period: The discounted payback period is 2 years plus a fraction of the third year. The fraction value = Rs 55,221/Rs 61,845 = 0.893. Thus, the PB is 2.893 years.
(v) Advise: Since the NPV is positive, the company is advised to replace the existing machine.
EQ. 5.6 The cash flows of two mutually exclusive projects are as under:

		t_0	t_1	t_2	t_3	t_4	t_5	t_6
Project 'P'	(Rs)	(40,000)	13,000	8,000	14,000	12,000	11,000	15,000
Project 'J'	(Rs)	(20,000)	7,000	13,000	12,000	—	—	—

Required:
(i) Estimate the net present value (NPV) of the Project 'P' and 'J' using 15 per cent as the hurdle rate. (ii) Estimate the internal rate of return (IRR) of the Project 'P' and 'J'. (iii) Why there is a conflict in the project choice by using NPV and IRR criterion? (iv) Which criteria you will use in such a situation? Estimate the value at that criterion. Make a project choice.
The present value interest factor values at different rates of discount are as under:

	t_0	t_1	t_2	t_3	t_4	t_5	t_6
0.15	1.00	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323
0.18	1.00	0.8475	0.7182	0.6086	0.5158	0.4371	0.3704
0.20	1.00	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349
0.24	1.00	0.8065	0.6504	0.5245	0.4230	0.3411	0.2751
0.26	1.00	0.7937	0.6299	0.4999	0.3968	0.3149	0.2499

(*CA—May, 2004*)

SOLUTION

(i) Determination of NPV of projects P and J

Year (t)	CFAT		PV factor	Total PV	
	Project P	Project J	at 0.15	Project P	Project J
1	Rs 13,000	7,000	0.8696	Rs 11,304.8	Rs 6,087.2
2	8,000	13,000	0.7561	6,048.8	9,829.3
3	14,000	12,000	0.6575	9,205.0	7.890.0
4	12,000	—	0.5718	6,861.6	—
5	11,000	—	0.4972	5,469.2	—
6	15,000	—	0.4323	6,484.5	—
Gross present value				45,363.9	23,806.5
Less cash outflows				40,000.0	20,000.0
Net present value				5,363.9	3,806.5

(ii) Determination of IRR

Project P: Rs 40,000 = Rs 13,000/$(1 + r)^1$ + Rs 8,000/$(1 + r)^2$ + Rs 14,000//$(1 + r)^3$ + Rs 12,000/$(1 + r)^4$ + Rs 11,000/ /$(1 + r)^5$ + Rs 15,000//$(1 + r)^6$

The fake pay back period is (Rs 40,000/Rs 12,167 Average CFAT) = 3.287. From Table A-4, the value closest to the fake pay back of 3.287 against 6 years is 3.245 against 21 per cent. Since the actual cash flow stream in the year 2 is lower than the average CFAT, the IRR is likely to be marginally lower than 21 per cent. Let us try with 20 and 19 per cent.

Year	*CFAT*	*PV factor*		*Total PV*	
		(0.19)	*(0.20)*	*(0.19)*	*(0.20)*
1	Rs 13,000	0.840	0.833	Rs 10,920	10,829
2	8,000	0.706	0.694	5,648	5,552
3	14,000	0.593	0.579	8,302	8,106
4	12,000	0.499	0.482	5,988	5,784
5	11,000	0.419	0.402	4,609	4,422
6	15,000	0.352	0.335	5,280	5,025
Gross present value				40,747	39,718
Less cash outflows				40,000	40,000
Net present value				747	(282)

IRR is between 19 and 20 per cent. By interpolation IRR is 19 per cent + (Rs 747/Rs 1,029) i.e., 0.726 = 19.73 per cent

Project J: Rs 20,000 = Rs 7,000/(1 + r)1 + Rs 13,000/(1 + r)2 + Rs 12,000/(1 + r)3

The fake pay back period is (Rs 20,000/Rs 10,667 Average CFAT) = 1.875. From Table A-4 the value closest to the fake pay back of 1.875 against 3 years is 1.896 against 27 per cent. Since the actual cash flows in the initial year is lower than the average CFAT, the IRR is likely to be lower than 27 per cent. Let us try at 25 and 26 per cent.

Year	*CFAT*	*PV factor*		*Total PV*	
		(0.25)	*(0.26)*	*(0.25)*	*(0.26)*
1	Rs 7,000	0.800	0.794	Rs 5,600	Rs 5,558
2	13,000	0.640	0.630	8.320	8,190
3	12,000	0.512	0.500	6,144	6,000
Gross present value				20,064	19,748
Less cash outflows				20,000	20,000
Net present value				64	(252)

IRR is 25 per cent + (Rs 64/Rs 316) i.e., = 0.2 = 25.2 per cent

(iii) There is conflict in the ranking of projects between NPV and IRR methods. While project 'P' is ranked first under the NPV method, IRR ranks Project J first. The reason of conflict is due to reinvestment rate assumption. IRR method assumes that the intermediate CFAT are reinvested at IRR. With the NPV method, the assumption is that the funds released are reinvested at the rate of cost of capital. The assumption of the NPV method is considered to be superior (for details refer to text).

(iv) In general, NPV ranking is preferred to that of IRR. The present situation is unequal project lives. In projects of unequal expected lives, the computation of equivalent annual net present value (EANPV) is appropriate. The EANPV is determined dividing the NPV of project by the annuity factor corresponding to the life of the project at the given cost of capital. The project with higher EANPV is preferred.

Determination of EANPV:

Project P = Rs 5,363.9/3.784 = Rs 1,417.52

Project J = Rs 3,806.5/2.283 = Rs 1,667.32

Since the EANPV of Project J is higher than that of project P, Project P is recommended.

EQ.5.7 MNP Limited is thinking of replacing its existing machine by a new machine, which would cost Rs 60 lakh. The company's current production is 80,000 units, and is expected to increase to 1,00,000 units, if the new machine is bought. The selling price of the product would remain unchanged at Rs 200 per unit. The following is the cost of producing one unit of product using both the existing and new machine:

Unit cost (Rs)

	Existing Machine (80,000 units)	*New Machine (1,00,000 units)*	*Difference*
Materials	75.0	63.75	(11.25)
Wages and salaies	51.25	37.50	(13.75)
Supervision	20.0	25.0	5.0
Repairs and maintenance	11.25	7.50	(3.75)
Power and fuel	15.50	14.25	(1.25)
Depreciation	0.25	5.0	4.75
Allocated corporate overheads	10.0	12.50	2.50
	183.25	165.50	(17.75)

The existing machine has an accounting book value of Rs 1,00,000, and it has been fully depreciated for tax purpose. It is estimated that machine will be useful for 5 years. The supplier of the new machine has offered to accept the old machine for Rs 2,50,000. However, the market price of old machine today is Rs 1,50,000 and it is expected to be Rs 35,000 after 5 years. The new machine has a life of 5 years and a salvage value of Rs 2,50,000 at the end of its economic life. Assume corporate income-tax rate at 40%, and depreciation is charged on straight line basis for Income-tax purposes. Further assume that book profit is treated as ordinary income for tax purpose. The opportunity cost of capital of the Company is 15%. Is the proposal financially viable? Advise the firm on the basis of net present value.

(*CA—November, 2005*)

SOLUTION

Financial evaluation whether to replace existing machine (using NPV method)

Incremental cash outflows:		
Cost of new machine		Rs 60,00,000
Less effective sale proceeds from old machine		
Exchange value	Rs 2,50,000	
Less tax on profit (Rs 2,50,000 – zero value) × 0.4	1,00,000	1,50,000
		58,50,000

Increment CFAT (operating) *(Amount in Rs lakh)*

Particulars	*Existing machine*	*New machine*
Sales revenue (at Rs 200 per unit)	Rs 160.00	Rs 200.00
Less costs (Materials + Wages and salaries + Supervision + Repairs and maintenance + Power and fuel); Rs 173 and Rs 148 per unit respectively	138.40	148.00
Less depreciation (Rs 60 – Rs 2.5)/5 years	—	11.50
Earnings before taxes	21.60	40.50
Less taxes (0.40)	8.64	16.20
Earnings after taxes (EAT)	12.96	24.30
CFET (EAT + Depreciation)	12.96	35.80
Incremental CFAT (Rs 35.80 – Rs 12.96)		22.84

Determination of NPV *(Amount in Rs lakh)*

Years	*CFAT*	*PV factor (0.15)*	*Total PV*
1–5	Rs 22.84	3.352	Rs 76.56
5 (Incremental salvage value Rs 2.5 – 0.35)	2.15	0.497	1.07
Total present value			77.63
Less incremental cash outflows			58.50
Net present value			19.13

Recommendation: Since NPV is positive, the company is advised to replace the existing machine.

Working Notes:

(1) The company would prefer an exchange offer to sell the machine as it is higher (at Rs 2,50,000) compared to market price of Rs 1,50,000.

(2) Allocated corporate overheads are not additional costs and therefore ignored.

EQ.5.8 A Company is considering a proposal of installing a drying equipment. The equipment would involve a cash outlay of Rs 6,00,000 and net working capital of Rs 80,000. The expected life of the project is 5 years without any salvage value. Assume that the company is allowed to charge depreciation on straight-line basis for income-tax purpose. The estimated before-tax cashinflows are given below:

	Before-tax cash-inflows (Rs '000)				
Year	1	2	3	4	5
	240	275	210	180	160

The applicable income-tax rate to the Company is 35%. If the Company's opportunity cost of capital is 12%, calculate the equipment's discounted payback period, payback period, net present value and internal rate of return.

(*CA—May, 2006*)

SOLUTION

Determination of cash inflows after taxes (CFAT)

Year	*CFBT*	*Depreciation (Rs 6,00,000/5)*	*EBT*	*Taxes (0.35)*	*EAT*	*CFAT (EAT + D)*
1	Rs 2,40,000	Rs 1,20,000	Rs 1,20,000	Rs 42,000	Rs 78,000	Rs 1,98,000
2	2,75,000	1,20,000	1,55,000	54,250	1,00,750	2,20,750
3	2,10,000	1,20,000	90,000	31,500	58,500	1,78,500
4	1,80,000	1,20,000	60,000	21,000	39,000	1,59,000
5	1,60,000	1,20,000	40,000	14,000	26,000	1,46,000
5	Release of net working capital					+ 80,000

Determination of pay back period, discounted pay back period and net present value (NPV).

Year	*CFAT*	*Cumulative CFAT*	*PVIF (0.12)*	*Total PV (CFAT × PVIF)*	*Cumulative present value*
1	Rs 1,98,000	Rs 1,98,000	0.893	Rs 1,76,814	Rs 1,76,814
2	2,20,750	4,18,750	0.797	1,75,938	3,52,752
3	1,78,500	5,97,250	0.712	1,27,092	4,79,844
4	1,59,000	7,56,250	0.636	1,01,124	5,80,968
5	2,26,000	9,82,250	0.567	1,28,142	7,09,110
Total present value				7,09,110	
Less cash outflows				6,80,000	
NPV				29,110	

(i) *Pay back (PB) period:* The recovery of investment (Rs 6,80,000) falls between the third and fourth years. Therefore the PB is 3 years plus a fraction of 4th year. The fractional value is = Rs 82,750/Rs 1,59,000 = 0.52. Thus, the PB period is 3.52 years.

(ii) *Disconnected PB period* is 4 years plus a fraction of 5th year. The fractional value is = (Rs 99,032/Rs 1,28,142) = 0.77. Thus, the discounted PB period is 4.77 years.

(iii) Net present value is Rs 29,110.

(iv) *Determination of IRR:* Since the NPV is positive at 12%, the IRR is likely to be higher. The computation of IRR involves interpolation also. Let us try discount rates of 13% and 14%. Computation of Total PV and NPV at 13% and 14%.

Year	*CFAT*	*PV factor at*		*Total PV at*	
		13%	*14%*	*13%*	*14%*
1	Rs 1,98,000	0.885	0.877	Rs 1,75,230	Rs 1,73,646
2	2,20,750	0.783	0.769	1,72,847	1,69,757
3	1,78,500	0.693	0.675	1,23,700	1,20,487
4	1,59,000	0.613	0.592	97,467	94,128
5	2,26,000	0.543	0.519	1,22,718	1,17,294
Total present value				6,91,962	6,75,312
Les cash outflows				6,80,000	6,80,000
Net present value				11,962	(4,688)

The IRR is between 13% and 14%. By interpolation it is 13% + (Rs 11,962/Rs 16,650) = 0.72 = 13.72%.

EQ.5.9 Company UVW has to make a choice between two identical machines, in terms of capacity, '*A*' and '*B*'. They have been designed differently, but do exactly the same job. Machine '*A*' costs Rs 7,50,000 and will last for three year. It costs Rs 2,00,000 per year to run. Machine '*B*' is an economy model costing only Rs 5,00,000, but will last for only two years. It costs Rs 3,00,000 per year to run. The cash flows of Machine '*A*' and '*B*' are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore taxes. The opportunity cost of capital is 9%.

Required: Which mahcine the company UVW should buy? (*CA—November, 2006*)

SOLUTION

Determination of equivalent annual cost of machines A and B.

Year	*Particuars*	*Machine* A			*Machine* B	
		Amount	*PV factor*	*Total PV*	*Amount*	*Total PV*
0	Cost of machine	Rs 7,50,000	1.000	Rs 7,50,000	Rs 5,00,000	Rs 5,00,000
1	Running costs	2,00,000	0.917	1,83,400	3,00,000	2,75,100
2	Running costs	2,00,000	0.842	1,68,400	3,00,000	2,52,600
3	Running costs	2,00,000	0.772	1,54,400	—	
Total cost				12,56,200		10,27,700
Divided by present a value annuity factor for 3 years (*A*) and for 2 years (*B*)				2.531		1.759
Equivalent annual cost				Rs 4,96,326		Rs 5,84,252

Recommendation: Since equivalent annual costs are lower for machine A, the company should opt for this machine.

EQ. 5.10 A company is considering the proposal of taking up a new project which requires an invetment of Rs 400 lakh on machinery and other assets. The project is expected to yield the following earnings (before depreciation and taxes) over the next five years:

Year	Earnings (Rs in lakh)
1	160
2	160
3	180
4	180
5	150

The cost of raising the additional capital is 12% and assets have to be depreciated at 20% on 'Written Down Value' basis. The scrap value at the end of the five years' period may be taken as zero. Income-tax applicable to the company is 50%.

You are required to calculate the net present value of the project and advise the management to take appropriate decision. *(CA(PE-II)—May, 2007)*

SOLUTION

Determination of net present value (NPV) of new project (Rs in lakh)

(I) Cash outflows:
Investment/Cost of machinery and other assets — Rs 400.00

(II) (a) CFAT

Year	*EBDT*	*Depreciation (D) (20% of WDV)*	*EBT*	*EAT (EBT × 0.5)*	*CFAT (EAT + D)*
1	Rs 160	Rs 80.00	Rs 80	Rs 40	Rs 120
2	160	64.00	96	48	112
3	180	51.20	128.8	64.4	115.6
4	180	40.96	139.04	69.52	110.48
5	150	32.77			
5	Loss on disposal of assets*	131.07	(13.84)	(6.92)	156.92

*alternatively, Rs 163.84 can be shown as short-term capital loss (assuming block of assets ceases to exist).

(b) Net present value

Year	*CFAT*	*PV factor (0.12)*	*Total PV*
1	Rs 120	0.893	Rs 107.16
2	112	0.797	89.26
3	115.6	0.712	82.31
4	110.48	0.636	70.27
5	156.92	0.567	88.97
Total present value			437.97
Less cash outflows			400.00
Net present value			37.97

Advise: The company is advised to take-up the new project as the NPV is positive.

6 Concept and Measurement of Cost of Capital

Introduction

The discussions in Chapter 5 relating to capital budgeting have shown the relevance of a certain required rate of return as a decision criterion. Such a rate is the cost of capital of a firm. Apart from its usefulness as an operational criterion to accept/reject an investment proposal, cost of capital is also an important factor in designing capital structure. The relationship of cost of capital and capital structure of the firm is explored in part four. This Chapter is devoted to a discussion of the concept and measurement of cost of capital. The first section covers the importance of, and elaborates on the concept of, cost of capital. The measurement of the specific cost of capital is examined in section two. Section three deals with the measurement of overall cost of capital and the related issues of determining the relative weights. The major points are summarised in the last section.

IMPORTANCE AND CONCEPT

Importance

As mentioned above, the cost of capital is an important element, as a basic input information, in capital investment decisions. In the present value method of discounted cash flow technique, the cost of capital is used as the discount rate to calculate the NPV. The profitability index or benefit-cost ratio method similarly employs it to determine the present value of future cash inflows. When the internal rate of return method is used, the computed IRR is compared with the cost of capital. The cost of capital, thus, constitutes an integral part of investment decisions. It provides a yardstick to measure the worth of investment proposal and, thus, performs the role of accept-reject criterion. This underlines the crucial significance of cost of capital. It is also referred to as *cut-off rate, target rate, hurdle rate, minimum required rate of return, standard return* and so on.

The cost of capital, as an operational criterion, is related to the firms' objective of wealth maximisation. The accept-reject rules require that a firm should avail of only such investment opportunities as promise a rate of return higher than the cost of capital. Conversely, the firm would be well advised to reject proposals whose rates of return are less than the cost of capital. If the firm accepts a proposal having a rate of return higher than the cost of capital, it implies that the proposal yields returns higher than the minimum required by the investors and the prices of shares will increase and, thus, the shareholders' wealth. By virtue of the same logic, the shareholders' wealth will decline on the acceptance of a proposal in which the actual return is less than the cost of capital. The cost of capital, thus, provides a rational mechanism for making optimum investment decisions. In brief, the cost of capital is important because of its practical utility as an acceptance-rejection decision criterion.

The considerable significance of cost of capital in terms of its practical utility notwithstanding, it is probably the most controversial topic in financial management. There are varying opinions as to how this can be computed. In view of the crucial operational significance of this concept, our focus is on the general framework for the computation of cost of capital. We first define the term cost of capital in general terms. This is followed by a detailed account of the measurement of cost of capital—both specific as well as overall—of different sources of financing.

Definition

In operational terms, cost of capital refers to the discount rate that is used in determining the present value of the estimated future cash proceeds and eventually deciding whether the project is worth undertaking or not. In this sense, it is defined as the *minimum rate of return that a firm must earn on its investment for the market value of the firm to remain unchanged.*

The cost of capital is visualised as being composed of several elements. These elements are the cost of each component of capital. The term 'component' means the different sources from which funds are raised by a firm. Obviously, each source of funds or each component of capital has its cost. For example, equity capital has a cost, so also preference share capital and so on. The cost of each source or component is called *specific cost* of capital. When these specific costs are combined to arrive at overall cost of capital, it is referred to as the *weighted cost of capital*. The terms, *cost of capital, weighted cost of capital, composite cost of capital and combined cost of capital* are used interchangeably in this book. In other words, the term, cost of capital, as the acceptance criterion for investment proposals, is used in the sense of the combined cost of all sources of financing. This is mainly because our focus is on the valuation of the firm as a whole.[1]

Assumptions

The theory of cost of capital is based on certain assumptions. A basic assumption of traditional cost of capital analysis is that the firm's business and financial risks are unaffected by the acceptance and financing of projects.[2] Business risk measures the variability in operating profits [earnings before interest and taxes (EBIT)] due to change in sales. If a firm accepts a project that is considerably more risky than the average, the suppliers of the funds are quite likely to increase the cost of funds as there is an increased probability of committing default on the part of the firm in making payments of their money. A debenture holder will charge a higher rate of interest to compensate for increased risk. There is similarly an increased uncertainty from the point of equity holders of getting dividend from the firm. Therefore, they will also require a higher return as a compensation for the increased risk. In analysing the cost of capital in this chapter, we assume that there would be no change whatsoever in the business risk complexion of the firm as a result of acceptance of new investment proposals.

The capital budgeting decision determines the business risk complexion of the firm. The financing decision determines its financial risk. In general, the greater the proportion of long-term debt in the capital structure of the firm, the greater is the financial risk because there is a need for a larger amount of periodic interest payment and principal repayment at the time of maturity. In such a situation, obviously, the firm requires higher operating profits to cover these charges. If it fails to earn adequate operating profits to cover such financial charges, it may be forced into cash insolvency. Thus, with the increase in the proportion of debt commitments and preference shares in its capital structure, fixed charges increase. All other things being the same, the probability that the firm will be unable to meet these fixed charges also increases. As the firm continues to lever itself, the probability of cash insolvency, which may lead to legal bankruptcy, increases.[3] Clearly, therefore, as a firm's financial structure shifts towards a more highly levered position, the increased financial risk associated with the firm is recognized by the suppliers of funds. They compensate for this increased risk by charging higher rates of interest or requiring greater returns. In short, they react in much the same way as they would in the case of increasing business risks.[4] In the analysis of the cost of capital in this Chapter, however, the firm's financial structure is assumed to remain fixed. In the absence of such an assumption, it would be quite difficult to find its cost of capital, as the selection of a particular source of financing would change the cost of other sources of financing. In operational terms, the assumption of a constant capital structure implies that the additional funds required to finance the new project are to be raised in the same proportion as the firm's existing financing.

For the purpose of capital budgeting decisions, benefits from undertaking a proposed project are evaluated on an after-tax basis. In fact, only the cost of debt requires tax adjustment as interest paid on debt is deductible expense from the point of view of determining taxable income whereas dividends paid either to preference shareholders or to equity holders are not eligible items as a source of deduction to determine taxable income.

To sum up, it may be said that cost of capital (k) consists of the following three components:

(i) the riskless cost of the particular type of financing, r_j;
(ii) the business risk premium, b; and
(iii) the financial risk premium, f

Or $k = r_j + b + f$

Since the business and financial risks are assumed to be constant, the changing cost of each type of capital, j, over time should be affected by the change in the supply of, and demand for, each type of funds.

Explicit and Implicit Costs

The cost of capital can be either *explicit* or *implicit*. The distinction between explicit and implicit costs is important from the point of view of the computation of the cost of capital.

> The explicit cost of any source of capital is the discount rate that equates the present value of the cash inflows that are incremental to the taking of the financing opportunity with the present value of its incremental cash outflows.[5]

When firms raise funds from different sources, there is a series of cash flows. Initially, there is cash inflow to the extent of the amount raised. This is followed by a series of cash outflows in respect of interest payments, repayment of principal, or payment of dividends. For example, a firm raises Rs 5,00,000 through the sale of 10 per cent perpetual debentures. There will be a cash inflow of Rs 5,00,000 followed by an annual cash outflow of Rs 50,000. The rate of return that equates the present value of cash inflows (Rs 5,00,000) with the present value of cash outflows (Rs 50,000) would be the explicit cost.

The determination of the explicit cost of capital is similar to the determination of the IRR, with one difference. While in the computation of the IRR, the cash outflows (assuming conventional flows) are involved in the beginning, followed by cash inflows subsequently, it is exactly opposite with the explicit cost of capital. Here, as shown above, the cash flows take place only once and there is a series of cash outflows subsequently.

The general formula for the explicit cost of capital of any source of raising finance would be as follows:

$$CI_0 = \sum_{t=1}^{n} \frac{CO^t}{(1+C)^t} \tag{6.1}$$

Where CI_0 = initial cash inflow, that is, net cash proceeds received by the firm from the capital source at time O, $CO_1 + CO_2 \ldots + CO_n$ = cash outflows at times 1, 2 ... n, that is, cash payment from the firm to the capital source. If CI_0 is received in instalments, then, CI_0

$$CI_0 + \frac{CI_1}{(1+C)^1} + \frac{CI_2}{(1+C)^2} + \frac{CI_3}{(1+C)^3} + \ldots + \frac{CI_{n-1}}{(1+C)^n}$$

$$= \frac{CO_1}{(1+C)^1} + \frac{CO_2}{(1+C)^2} + \frac{CO_3}{(1+C)^3} + \ldots + \frac{CO_n}{(1+C)^n} \tag{6.2}$$

It is evident from the above mathematical formulation that the explicit cost of capital is the '*rate of return of the cash flows of the financing opportunity*.'[6] In other words, it is the internal rate of return that the firm pays to procure financing. On the basis of the above formula, we can easily find out that the explicit cost of an interest-free loan is zero per cent because the discount rate that equates the present value of a future sum with an equivalent sum received today is zero. The explicit cost of capital of a loan being interest is that discount rate which equates the present value of the future cash outflows with the net amount of funds initially provided by the loan. The explicit cost of capital of a gift is minus 100 per cent. The explicit cost of capital derived from the sale of an asset is a discount rate that equates the present value of the future cash flows foregone by the asset's sale with the net proceeds to the firm resulting from its liquidation. The explicit cost of funds supplied by increases in certain liabilities such as accounts payable and accrued taxes is zero per cent unless, of course, penalties are incurred or discounts lost owing to the increase in these liabilities.[7]

The explicit cost of capital is concerned with the incremental cash flows that result directly from raising funds. Retained earnings used in the firm involve no future cash flows to, or from, the firm. Therefore, the explicit cost of retained earnings is minus 100 per cent. There are no future interest or principal payments imposed by the retention of earnings. There are no additional shares created and sold to outsiders on which dividends will be paid. From this, it should, however, not be concluded that retained earnings have no cost. (In fact, they also have costs like other sources of raising finance have). The retained earnings are undistributed profits of the company belonging to the shareholdeRs Given the ultimate objective of the firm to maximise the wealth of shareholders, the cost of retained earning would be equivalent to the *opportunity cost* of earning by investing elsewhere by the shareholders themselves or by the company itself. Opportunity costs are technically referred to as *implicit cost of capital*. The implicit cost of capital of funds raised and invested by the firm may, therefore, be defined as '*the rate of return associated with the best investment opportunity for the firm and its shareholders that would be foregone, if the projects presently under consideration by the firm were accepted.*'[8] The cost of retained earnings is an opportunity cost or implicit capital cost, in the sense that it is the rate of return at which the shareholders could have invested these funds had they been distributed to them.[9] However, other forms of financing also have implicit cost once

they are invested. The explicit cost arises when funds are *raised*, whereas the implicit costs arise when funds are *used*. Viewed in this perspective, implicit costs are ubiquitous. They arise whenever funds are used no matter what the source. Funds raised by any form of financing have implicit capital costs once they are invested.[10] Moreover, in appraising a proposed investment, one opportunity that is always available to the firm is not to raise the funds that would be needed to finance it. Thus, in a sense, explicit capital costs may also be viewed as opportunity costs.[11] This implies that a project should be rejected if it has a negative present value when its cash flows are discounted by the explicit cost of capital. The explicit cost is the minimum standard below which no proposal is desirable. For purposes of capital budgeting decisions, therefore, the cost of capital is the explicit cost of capital.

MEASUREMENT OF SPECIFIC COSTS

The term cost of capital, as a decision criterion, is the overall cost. This is the combined cost of the specific costs associated with specific sources of financing. The cost of the different sources of financing represents the components of the combined cost. The computation of the cost of capital, therefore, involves two steps: (i) the computation of the different elements of the cost in terms of the cost of the different sources of finance (specific costs), and (ii) the calculation of the overall cost by combining the specific costs into a composite cost.

The first step in the measurement of the cost of capital of the firm is the calculation of the cost of individual sources of raising funds. Apart from its relevance to the measurement of the combined cost, the specific cost will also indicate the relative cost of pursuing one line of financing rather than another. From the viewpoint of capital budgeting decision, the long-term sources of funds are relevant as they constitute the major sources of financing of fixed assets. In calculating the cost of capital, therefore, the focus is on long-term funds. In other words, the specific costs have to be calculated for (i) long-term debt (including debentures); (ii) preference shares; (iii) equity capital; and (iv) retained earnings.

Cost of Debt

The calculation of the cost of debt is relatively easy. The cost of funds raised through debt in the form of debentures or loan from financial institutions can be determined from Eq. 6.1. To apply the formulation of explicit cost of debt, we need data regarding: (i) the net cash proceeds/inflows (the issue price of debentures/amount of loan minus all floatation costs) from specific source of debt, and (ii) the net cash outflows in terms of the amount of periodic interest payment and repayment of principal in instalments or in lump sum on maturity. The interest payments made by the firm on debt issues qualify for tax deduction in determining net taxable income. Therefore, the effective cash outflows is less than the actual payment of interest made by the firm to the debt holders by the amount of tax shield on interest payment.[12] The debt can be either perpetual/irredeemable or redeemable.

Cost of Perpetual Debt The measurement of the cost of perpetual debt is conceptually relatively easy. It is the rate of return which the lenders expect. The debt carries a certain rate of interest. The coupon interest rate or the market yield on debt can be said to represent an approximation of the cost of debt. The nominal/coupon rate of interest on debt is the before-tax cost of debt. Since the effective cost of debt is the tax-adjusted rate of interest, the before-tax cost of debt should be adjusted for the tax effect. Finally, the bonds and debentures (debt) can be issued at (i) par, (ii) discount, and (iii) premium. The coupon rate of interest will require adjustment to find out the true cost of debt. Symbolically,

$$k_i = \frac{I}{SV} \tag{6.3}$$

$$k_d = \frac{I}{SV}(1 - t) \tag{6.4}$$

k_i = Before-tax cost of debt
k_d = Tax-adjusted cost of debt
I = Annual interest payment
SV = Sale proceeds of the bond/debenture
t = Tax rate

The calculation is illustrated in Example 6.1.

EXAMPLE 6.1

A company has 15 per cent perpetual debt of Rs 1,00,000. The tax rate is 35 per cent. Determine the cost of capital (before tax as well as after tax) assuming the debt is issued at (i) par, (ii) 10 per cent discount, and (iii) 10 per cent premium.

SOLUTION

(i) Debt issued at par

Before-tax cost, $k_i = \text{Rs}\,\frac{15,000}{1,00,000} = 15$ per cent

After-tax cost, $k_d = k_i\,(1 - t) = 15\%\ (1 - 0.35) = 9.75$ per cent

(ii) Issued at discount

Before-tax cost, $k_i = \text{Rs}\,\frac{15,000}{90,000} = 16.7$ per cent

After-tax cost, $k_d = 16.7\%\ (1 - 0.35) = 10.85$ per cent

(iii) Issued at premium

Before-tax cost, $k_i = \text{Rs}\,\frac{15,000}{1,10,000} = 13.6$ per cent

After-tax cost, $k_d = 13.6\%\ (1 - 0.35) = 8.84$ per cent

Cost of Redeemable Debt In the case of calculation of cost of redeemable debt, account has to be taken, in addition to interest payments, of the repayment of the principal. When the amount of principal is repaid in one lump sum at the time of maturity, the cost of debt would be given by solving Eq. 6.5. If, however, the repayments are in a number of instalments, the cost of debt can be calculated on the basis of Eq. 6.6.

$$CI_0 = \sum_{t=1}^{n} \frac{COI_t}{(1 + k_d)^t} + \frac{COP_n}{(1 + k_d)^n} \tag{6.5}$$

where CI_0 = Net cash proceeds from issue of debentures or from raising debt

$COI_1 + COI_2 + ... + COI_n$ = Cash outflow on interest paymentsin time period 1,2 and so on up to the year of maturity *after adjusting tax savings on interest payment.*

COP_n = Principal repayment in the year of maturity

k_d = Cost of debt.

If the repayment of debt is in a number of instalments instead of one lump sum payment, the equation would be:

$$CI_0 = \sum_{t=1}^{n} \frac{COI_t + COP_t}{(1 + k_d)^t} \tag{6.6}$$

EXAMPLE 6.2

A company issues a new 15 per cent debentures of Rs 1,000 face value to be redeemed after 10 years The debenture is expected to be sold at 5 per cent discount. It will also involve floatation costs of 2.5 per cent of face value. The company's tax rate is 35 per cent. What would the cost of debt be? Illustrate the computations using (i) trial and error approach and (ii) shortcut method.

SOLUTION

(i) Trial and Error/Long Approach

Cash flow pattern of the debenture would be as follows:

Years	Cash flow
0	+ Rs 925 (Rs 1,000 – Rs 75, that is, par value *less* flotation cost less discount)
1 – 10	– Rs 150 (interest outgo)
10	– Rs 1,000 (repayment of principal at maturity).

We are to determine the value of k_d in the following equation:

$$\text{Rs } 925 = \sum_{t=1}^{10} \frac{\text{Rs } 97.5}{(1 + k_d)^t} + \frac{\text{Rs } 1{,}000}{(1 + k_d)^{10}}$$

The value of k_d for this equation would be the cost of debt. The value of k_d can be obtained, as in the case of IRR, by trial and error.

Determination of PV at 10% and 11% rates of interest

Year(s)	*Cash outflows*	*PV factor at*		*Total PV at*	
		10%	*11%*	*10%*	*11%*
1-10	Rs 97.5	6.145	5.889 (Table A-4)	Rs 599.14	Rs 574.18
10	1,000	0.386	0.352 (Table A-3)	386.00	352.00
				985.14	926.18

The value of k_d would be 11 per cent.

(ii) Shortcut Method: The formula for approximating the effective cost of debt can, as a shortcut, be shown in the Equation (6.7):

$$k_d = \frac{I(1-t) + (f + d + pr - pi)/N_m}{(RV + SV)/2} \tag{6.7}$$

where I = Annual interest payment

RV = Redeemable value of debentures/debt

SV = Net sales proceeds from the issue of debenture/debt (face value of debt minus issue expenses)

N_m = Term of debt

f = Flotation cost

d = Discount on issue of debentures

pi = Premium on issue of debentures

pr = Premium on redemption of debentures

t = Tax rate

$$k_d = \frac{Rs\,150\,(1-0.35) + (\text{Rs}\,50 + \text{Rs}\,25)/10}{(\text{Rs}\,925 + \text{Rs}\,1,000)/2} = 10.9\ \text{per cent}$$

EXAMPLE 6.3

A company issues 15 per cent debentures of Rs 100 for an amount aggregating Rs 1,00,000 at 10 per cent premium, redeemable at par after five yeaRs The company's tax rate is 35 per cent. Determine the cost of debt, using the shortcut method.

SOLUTION

$$k_i = \frac{[\text{Rs}\,15(1-0.35) - \text{Rs}\,(10/5)]}{(\text{Rs}\,110 + \text{Rs}\,100)/2} = 7.4\ \text{per cent}$$

The shortcut, however, cannot be applied when the principal is repaid in a number of instalments in lieu of one lump sum repayment. We can compute the value of k_d with the help of Eq. 6.6.

EXAMPLE 6.4

A company has issued 15 per cent debentures aggregating Rs 1,00,000. The flotation cost is 5 per cent. The company has agreed to repay the debentures at par in 5 equal annual instalments starting at the end of year 1. The company's rate of tax is 35 per cent. Find the cost of debt.

SOLUTION

Net proceeds from the sale of debenture = Rs 95,000.

Since the cash outflows are higher in the initial years than the average (Rs 24,500), let us try to determine PV at 11 per cent and 12 per cent.

Cash outflows	PV factor at		Total PV at	
	11%	12%	11%	12%
29,750 [@]	0.901	0.893	Rs 26,805	Rs 26,567
27,800	0.812	0.797	22,574	22,157
25,850	0.731	0.712	18,896	18,405
23,900	0.659	0.636	15,750	15,200
21,950	0.593	0.567	13,016	12,446
			97,041	94,775

[@]Rs 20,000 principal + Rs 15,000 interest (1 – 0.35)

The value of k_d = 12 per cent.

To conclude, conceptually speaking, the calculation of the cost of debt is relatively easy. Moreover, debt is the cheapest source of long-term funds from the point of view of the company. In the first place, it is the safest form of investment from the point of view of the creditors because they are the first claimants on the company's assets at the time of its liquidation. Likewise, they are the first to be paid their interest before any dividend is paid to preference and equity shareholders. In fact, they are to be paid the interest even if the company incurs losses. Therefore, the suppliers' required rate of return on debt instruments is lower *vis-a-vis* other financial instruments, and, hence, lower cost of debt to the firm. Another, and more important, reason for debt having the lowest cost is the tax-deductibility of interest payments. The tax benefit would, however, be available only when the firm is profitable and pay taxes. A firm which suffers losses would not be required to pay any tax and its cost of debt would be before-tax cost (k_i) and not after-tax cost (k_d).

Cost of Preference Shares

The computation of the cost of preference shares is conceptually difficult as compared to the cost of debt. In the case of debt, as shown above, the interest rate is the basis of calculating cost, as payment of a specific amount of interest is legal commitment on the part of the firm. There is no such obligation in regard to preference dividend. It is true that a fixed dividend rate is stipulated on preference shares. It is also true that holders of such shares have a preferential right as regards payments of dividend as well as return of principal, as compared to the ordinary shareholdeRs But, unlike debt, there is no risk of legal bankruptcy if the firm does not pay the dividends due to the holders of such shares. Nevertheless, firms can be expected to pay the stipulated dividend, if there are sufficient profits, for a number of reasons. First, the preference shareholders, as already observed, carry a prior right to receive dividends over the equity shareholdeRs Unless, therefore, the firm pays out the dividend to its preference shareholders, it will not be able to pay anything to its ordinary shareholders. Moreover, the preference shares are usually cumulative which means that preference dividend will get accumulated till it is paid. As long as it remains in arrears, nothing can be paid to the equity holders. Further, non-payment of preference dividend may entitle their holders to participate in the management of the firm as voting rights are conferred on them in such cases. Above all, the firm may encounter difficulty in raising further equity capital mainly because the non-payment of preference dividend adversely affects the prospects of ordinary shareholders. Therefore, the stipulated dividend on preference shares, like the interest on debt, constitutes the basis for the calculation of the cost of preference shares. The cost of preference capital may be defined as the dividend expected by the preference shareholders.

However, unlike interest payments on debt, dividend payable on preference shares is not tax-deducible because preference dividend is not a charge on earnings or an item of expenditure; it is an appropriation of

earnings. In other words, they are paid out of after-tax earnings of the company. Therefore, no adjustment is required for taxes while computing the cost of preference capital.

There are two types of preference shares: (i) irredeemable, and (ii) redeemable. The first category is a kind of perpetual security in that the principal is not to be returned for a long time or is likely to be available till the life of the company. The redeemable preference shares are issued with a maturity date so that the principal will be repaid at some future date. Accordingly, the cost of preference is calculated separately for these situations.

Perpetual Security The cost of preference shares which has no specific maturity date is given by Eq. (6.8) and Eq. (6.8A):

$$k_p = \frac{d}{P_0 (1 - f)} \tag{6.8}$$

$$k_p = \frac{d(1 + Dt)}{P_0 (1 - f)} \tag{6.8A}$$

where k_p = Cost of preference capital
d = Constant annual dividend payment
P_0 = Expected sales price of preference shares
f = Flotation costs as a percentage of sales price
Dt = Tax on preference dividend

EXAMPLE 6.5

A company issues 14 per cent irredeemable preference shares of the face value of Rs 100 each. Flotation costs are estimated at 5 per cent of the expected sale price. (a) What is the k_p, if preference shares are issued at (i) par value, (ii) 10 per cent premium, and (iii) 5 per cent discount? (b) Also, compute k_p in these situations assuming 10 per cent dividend tax.

SOLUTION

(a) (i) Issued at par

$$k_p = \frac{\text{Rs } 14}{\text{Rs } 100\,(1 - 0.05)} = 14.7 \text{ per cent}$$

(ii) Issued at premium

$$k_p = \frac{\text{Rs } 14}{\text{Rs } 110\,(1 - 0.05)} = 13.4 \text{ per cent}$$

(iii) Issued at discount

$$k_p = \frac{\text{Rs } 14}{\text{Rs } 95\,(1 - 0.05)} = 15.5 \text{ per cent}$$

(b) (i) Issued at par

$$k_p = \frac{\text{Rs } 14(1.1) = \text{Rs } 15.4}{\text{Rs } 95} = 16.2 \text{ per cent}$$

(ii) Issued at premium

$$k_p = \frac{\text{Rs } 15.4}{\text{Rs } 104.5} = 14.7 \text{ per cent}$$

(iii) Issued at discount

$$k_p = \frac{\text{Rs } 15.4}{\text{Rs } 90.25} = 17.1 \text{ per cent}$$

Cost of Redeemable Preference Capital The explicit cost of preference shares in such a situation is the discount rate that equates the net proceeds of the sale of preference shares with the present value of the future dividends and principal repayments. The appropriate formulsa to calculate cost is given by Eq.(6.9).

$$P_0(1 - f) = \frac{d_1}{(1 + k_p)^1} + \frac{d_2}{(1 + k_p)^2} + \ldots + \frac{d_n}{(1 + k_p)^n} + \frac{P_n}{(1 + k_p)^n}$$

$$P_0(1-f) = \sum_{t=1}^{n} \frac{d_t}{(1+k_p)^t} + \frac{P_n}{(1+k_p)^n} \tag{6.9}$$

where P_0 = Expected sale price of preference shares
f = Floatation cost as percentage of P_0
d = Dividends paid on preference shares
P_n = Repayment of preference capital amount

EXAMPLE 6.6

ABC Ltd has issued 14 per cent preference shares of the face value of Rs 100 each to be redeemed after 10 yeaRs Flotation cost is expected to be 5 per cent. Determine the cost of preference shares (k_p).

SOLUTION

$$\text{Rs } 95 = \sum_{t=1}^{10} \frac{\text{Rs } 14}{(1+k_p)^t} + \frac{\text{Rs } 100}{(1+k_p)^{10}}$$

The value of k_p is likley to be between 14 and 15 per cent as the rate of dividend is 14 per cent.

Determination of the PV at 14 percent and 15 percent

Year	*Cash outflows*	*PV factor at*		*Total PV at*	
		14%	*15%*	*14%*	*15%*
1-10	Rs 14	5.216	5.019	Rs 73	Rs 70.30
10	100	0.270	0.247	27	24.70
				100	95.00

k_p = 15 per cent

Cost of Equity Capital

The cost of equity capital is by far, conceptually speaking, the most difficult and controversial cost to measure. It has been shown in the preceding discussions that the coupon rate of interest which forms the basis of calculation of cost of debt can be estimated with a high degree of accuracy since interest payments as well as the return of the principal are contractual obligations. The return on preference shares, although not a contractual obligation, can also be estimated fairly accurately as they are fixed in terms of the stipulations governing the issue of such shares. In contrast, the return to the equity holders solely depends upon the discretion of the company management. Apart from the absence of any definite commitment to receive dividend, the equity shareholders rank at the bottom as claimants on the assets of the company at the time of its liquidation. It may, therefore, *prima facie*, appear that equity capital does not carry any cost. But this is not true. Equity capital, like other sources of funds, does certainly involve a cost to the firm. It may be recalled that the objective of financial management is to maximise shareholders' wealth and the maximisation of market price of shares is the operational substitute for wealth maximisation. When equity holders invest their funds they also expect returns in the form of dividends. The market value of shares is a function of the return that the shareholders expect and get. If the company does not meet the requirements of its shareholders and pay dividends, it will have an adverse effect on the market price of shares. A policy of not paying dividends by a firm would be in conflict, in other words, with its basic objective, namely, net present value maximisation. The equity shares, thus, implicitly involve a return in terms of the dividend expected by the investors and, therefore, carry a cost.

In fact, the cost of equity capital is relatively the highest among all the sources of funds. The investors purchase the shares, as already mentioned, in the expectation of a certain rate of return. The quantum of the rate of return, depends, *inter alia*, on the business risk and financial risk of a company. The equity shares involve the highest degree of financial risk since they are entitled to receive dividend and return of principal after all other obligations of the firm are met. As a compensation to the higher risk exposure, holders of such securities expect a higher return and, therefore, higher cost is associated with them.

Conceptually, the cost of equity capital, k_e, may be defined as *the minimum rate of return that a firm must earn on the equity-financed portion of an investment project in order to leave unchanged the market price of the shares.*[13] To illustrate, suppose the required rate of return on equity (ordinary) shares of a firm is 12 per cent and the cost of debt is 8 per cent. Further assume that the policy of the firm is to use equity and debt respectively in the proportion of 75 : 25. The required rate of return for the project as a whole would be 11 per cent:

$$\begin{aligned} 0.75 \times 0.12 &= \quad 9 \text{ per cent} \\ 0.25 \times 0.08 &= \quad 2 \\ &\quad\ 11 \end{aligned}$$

In other words, if the firm accepts an investment project involving an outlay of Rs 1,000 that was expected to continuously earn Rs 110 per year, the project would provide a return just sufficient to leave unchanged the market price of its shares. With the assumption of no taxes, the rate of return on the equity-financed portion would be:

Total return	Rs 110.00
Less interest on debt (0.08 × Rs 250)	20.00
Amount available to equity holders	90.00
Rate of return on equity (Rs 90 ÷ Rs 750) 12 per cent	

Thus, the expected rate of return on equity shares is just equal to the required rate of return of investoRs If the project earns less than Rs 110 yearly, it would give a return on the equity-financed portion less than that required by the investors so that the market price of shares would decline. This rate of return is the cost of equity capital in theory.[14]

The measurement of the above required rate of return is the measurement of the cost of equity capital. There are two possible approaches that can be employed to calculate the cost of equity capital: (i) dividend approach, and (ii) capital asset pricing model approach.

Dividend Approach One approach to calculate the cost of equity capital is based on the dividend valuation model. According to this approach, the cost of equity capital is calculated on the basis of a required rate of return in terms of the future dividends to be paid on the shares. The cost of equity capital, *ke*, is, accordingly, defined as *the discount rate that equates the present value of all expected future dividends per share with the net proceeds of the sale (or the current market price) of a share.*

The process of determining k_e is similar to that used in calculating the explicit before-tax cost of debt (k_d) and cost of preference capital (k_p). The two elements of the calculation of ke on the basis of the dividend approach are (i) net proceeds from the sale of a share/current market price of a share, and (ii) dividends and capital gains expected on the share. In arriving at the first, that is, the sale proceeds/current price, adjustments for flotation cost and discount/premium are necessary. In the case of dividends, the investors expect a rate of dividend which will not be constant over the years but will grow. The growth in expected dividends in future may be either at a uniform normal rate perpetually or it may vary so that for a few years it may be at level higher than in subsequent years after which it will increase at a normal rate. While calculating the cost of equity capital, therefore, the dividend approach takes into account expected dividends under different growth assumptions.

The cost of equity capital can be measured with the following equations:

(A) When dividends are expected to grow at a uniform rate perpetually:

$$P_0(1-f) = \frac{D_0(1+g)^1}{(1+k_e)^1} + \frac{D_0(1+g)^2}{(1+k_e)^2} + \ldots + \frac{D_0(1+g)^n}{(1+k_e)^n}$$

$$= \sum_{t=1}^{n} \frac{D_1(1+g)^{t-1}}{(1+k_e)^t} \tag{6.10}$$

k_e in Eq. 6.10 is the rate of return (discount rate) which equates the two sides of the equation.

Simplifying Eq. 6.10, we get

$$P_0 = \frac{D_1}{k_e - g} \tag{6.11}$$

$$k_e = \frac{D_1}{P_0} + g \tag{6.12}$$

where D_1 = Expected dividend per share
P_0 = Net proceeds per share/current market price
g = Growth in expected dividends

The calculation of k_e on the basis of Eq. 6.12 is based on certain assumptions with respect to the behaviour of investors and their ability to forecast future values:

- the market value of shares depends upon the expected dividends;
- investors can formulate subjective probability distribution of dividends per share expected to be paid in various future periods;
- the initial dividend, D_0, is greater than zero ($D_0 > 0$);
- the dividend pay-out ratio is constant;
- investors can accurately measure the riskiness of the firm so as to agree on the rate at which to discount the dividends.

Note: Under the provisions of Section 115(O/P/Q), of the Income Tax Act, 1961, a domestic company was liable to pay tax at a flat rate of 10 per cent on dividends declared/ distributed/paid on/after June 1, 1997. The payment of the dividend tax will reduce the growth (g) in dividends:

$g = b.r$, where b = retention rate, r = rate of return.

$$b = 1 - \left[\frac{DPS(1+Dt)}{EPS}\right] = \left[\frac{EPS - DPS(1+Dt)}{EPS}\right]$$

where Dt = Dividend tax
$r = EPS/P_0$

$$\therefore \quad g = b \cdot r = \frac{EPS}{P_0} \times \frac{EPS - [DPS(1+Dt)]}{EPS} = \left[\frac{EPS - DPS(1+Dt)}{P_0}\right] \tag{6.12A}$$

Obviously, g without Dt would be higher. The dividend payment tax has been withdrawn from April 1, 2002.

(B) Under different growth assumptions of dividends over the years;

Equation 6.12 will have to be modified to take into account two (or more, if necessary) growth rates. The solution in the following equation (6.13) for k_e would give the cost of equity capital:

$$P_0 = \sum_{t=1}^{n} \frac{D_0 (1 + g_h)^{t-1}}{(1 + k_e)^t} + \sum_{t=n+1}^{\infty} \frac{D_n (1 + g_c)^{t-1}}{(1 + k_e)^t} \tag{6.13}$$

where g_h = Rate of growth in earlier years
g_c = Constant growth in later years

EXAMPLE 6.7

Suppose that dividend per share of a firm is expected to be Re 1 per share next year and is expected to grow at 6 per cent per year perpetually. Determine the cost of equity capital, assuming the market price per share is Rs 25.

SOLUTION

This is a case of constant growth of expected dividends. The k_e can be calculated by using Eq. 6.12. Thus,

$$k_e = \frac{D_1}{P_0} + g = \frac{\text{Rs } 1}{\text{Rs } 25} + 0.06 = 10 \text{ per cent}$$

The dividend approach can be used to determine the expected market value of a share in different years The expected value of a share of the hypothetical firm in Example 6.7 at the end of years 1 and 2 would be as follows, applying Eq. 6.12.

(i) Price at the end of the first year $(P_1) = \frac{D_2}{k_e - g} = \frac{\text{Rs } 1.06}{0.10 - 0.06} = \text{Rs } 26.50$

(ii) $P_2 = \frac{D_3}{k_e - g} = \frac{\text{Rs } 1.124}{0.10 - 0.06} = \text{Rs } 28$

EXAMPLE 6.8

From the undermentioned facts determine the cost of equity shares of company X:

(i) Current market price of a share = Rs 150.
(ii) Cost of floatation per share on new shares, Rs 3.
(iii) Dividend paid on the outstanding shares over the past five years:

Year	*Dividend per share*
1	Rs 10.50
2	11.02
3	11.58
4	12.16
5	12.76
6	13.40

(iv) Assume a fixed dividend pay out ratio.
(v) Expected dividend on the new shares at the end of the current year is Rs 14.10 per share.

SOLUTION

As a first step, we have to estimate the growth rate in dividends. Using the compound interest table (Table A-1), the annual growth rate of dividends would be approximately 5 per cent. (During the five years the dividends have increased from Rs 10.50 to Rs 13.40, giving a compound factor of 1.276, that is, Rs 13.40/ Rs 10.50. The sum of Re 1 would accumulate to Rs 1.276 in five years @ 5 per cent interest).

$$k_e = \frac{\text{Rs } 14.10}{\text{Rs } 147\ (\text{Rs } 150 - \text{Rs } 3)} + 5\% = 14.6 \text{ per cent}$$

EXAMPLE 6.9

The following information is available in respect of company X:

(i) Current dividend per share, Rs 2.
(ii) Current market price per share, Rs 75.
(iii) Compound growth rates of dividends:

1 - 5 years	15 per cent
6 - 10 years	10 per cent
11 years and beyond	5 per cent

What would the cost of its equity capital be, assuming a fixed dividend pay out ratio?

SOLUTION

The cost of equity capital would be obtained by solving for k_e in the following equation, as it is a case of different growth rates in expected dividends:

$$P_0 = \sum_{t=1}^{5} \frac{D_0\,(1.15)^t}{(1+k_e)^t} + \sum_{t=6}^{10} \frac{D_5\,(1.10)^{t-5}}{(1+k_e)^t} + \sum_{t=11}^{\infty} \frac{D_{10}\,(1.05)^{t-10}}{(1+k_e)^t} = k_e = 9.5 \text{ per cent.}$$

Capital Asset Pricing Model Approach Another technique that can be used to estimate the cost of equity is the capital asset pricing model (CAPM) approach. We first discuss the CAPM.[15] As an approach to measure the cost of equity capital, it is described subsequently.

The CAPM explains the behaviour of security prices and provides a mechanism whereby investors could assess the impact of proposed security investment on their overall portfolio risk and return. In other words, it formally describes the risk-return trade-off for securities. It is based on certain assumptions. The basic assumptions of CAPM are related to (a) the efficiency of the security markets and (b) investor preferences.

The efficient market assumption implies that (i) all investors have common (homogeneous) expectations regarding the expected returns, variances and correlation of returns among all securities; (ii) all investors have the same information about securities; (iii) there are no restrictions on investments; (iv) there are no taxes; (v) there are no transaction costs; and (vi) no single investor can affect market price significantly.

The implication of investors' preference assumption is that all investors prefer the security that provides the highest return for a given level of risk or the lowest amount of risk for a given level of return, that is, the investors are risk averse.

The risk to which security investment is exposed falls into two groups: (i) diversifiable/unsystematic, and (ii) non-diversifiable/systematic. The first represents that portion of the total risk of an investment that can be eliminated/minimised through diversification. The events/factors that cause such risks vary from firm to

firm. The sources of such risks include management capabilities and decisions, strikes, unique government regulations, availability or otherwise of raw materials, competition, level of operating and financial leverage of the firm, and so on.

The systematic/non-diversifiable risk is attributable to factors that affect all firms. Illustrative sources of such risks are interest rate changes, inflation or purchasing power change, changes in investor expectations about the overall performance of the economy and political changes, and so on. As unsystematic risk can be eliminated by an investor through diversification, the systematic risk is the only relevant risk. Therefore, an investor (firm) should be concerned, according to CAPM, solely with the non-diversifiable (systematic) risk.

Systematic risk can be measured in relation to the risk of a diversified portfolio which is commonly referred to as the *market portfolio* or *the market*. According to CAPM, the non-diversifiable risk of an investment/security/ asset is assessed in terms of the *beta* coefficient. *Beta* is a measure of the volatility of a security's return relative to the returns of a broad-based market portfolio. Alternatively, it is an index of the degree of responsiveness or *co-movement* of return on an investment with the market return. The beta for the market portfolio as measured by the broad-based market index equals one. Beta coefficient of 1 would imply that the risk of the specified security is equal to the market; the interpretation of zero coefficient is that there is no market-related risk to the investment. A negative coefficient would indicate a relationship in the opposite direction. The 'going' required rate of return in the market for a given amount of systematic risk is called the Security Market Line (SML).

With reference to the cost of capital perspective, the CAPM describes the *relationship between the required rate of return, or the cost of equity capital, and the non-diversifiable or relevant risk, of the firm as reflected in its index of non-diversifiable risk, that is, beta.* Symbolically,

$$K_e = R_f + b\,(K_m - R_f) \tag{6.14}$$

Where K_e = cost of equity capital

R_f = the rate of return required on a risk-free asset/security/investment

K_m = the required rate of return on the market portfolio of assets that can be viewed as the average rate of return on all assets.

b = the beta coefficient

The computation of the cost of equity capital using the CAPM approach is shown in Example 6.10.

EXAMPLE 6.10

The Hypothetical Ltd wishes to calculate its cost of equity capital using the capital asset pricing model approach. From the information provided to the firm by its investment advisors along with the firms' own analysis, it is found that the risk-free rate of return equals 10 per cent; the firm's beta equals 1.50 and the return on the market portfolio equals 12.5 per cent. Compute the cost of equity capital.

SOLUTION

Substituting the values in Eq. 6.14

$$K_e = 10\% + [1.5 \times (12.5\% - 10\%)] = 13.75 \text{ per cent}$$

EXAMPLE 6.11

As an investment manager you are given the following information

Investment in equity shares of	*Initial price*	*Dividends*	*Year-end market price*	*Beta risk factor*
A Cement Ltd	Rs 25	Rs 2	Rs 50	0.80
Steel Ltd	35	2	60	0.70
Liquor Ltd	45	2	135	0.50
B Government of India Bonds	1,000	140	1,005	0.99
Risk-free return, 14 per cent				

You are required to calculate (i) expected rate of returns of market portfolio, and (ii) expected return in each security, using capital asset pricing model.

SOLUTION

(i) Expected Returns on Market Portfolio

	Return			*Investment*
Security	*Dividends*	*Capital appreciation*	*Total*	
A Cement Ltd	Rs 2	Rs 25	Rs 27	Rs 25
Steel Ltd	2	25	27	35
Liquor Ltd	2	90	92	45
B Government of India Bonds	140	5	145	1,000
	146	145	291	1,105

Rate of return (expected) on market portfolio = Rs 291/Rs 1,105 = 26.33 per cent

(ii) Expected Returns on Individual Security

$k_e = R_f + b(km - R_f)$	
Cement Ltd = 14% + 0.8 (26.33% – 14%)	23.86 per cent
Steel Ltd = 14% + 0.7 (26.33% – 14%)	22.63
Liquor Ltd = 14% + 0.5 (26.33% – 14%)	20.16
Government of India Bonds = 14% + 0.99 (26.33% – 14%)	26.21

The capital assets pricing model (CAPM) approach to calculate the cost of equity capital is different from the dividend valuation approach in some respects. In the first place, the CAPM approach directly considers the risk as reflected in beta in order to determine the K_e. The valuation model does not consider the risk; it rather uses the market price as a reflection of the expected risk-return preference of investors in the market. Secondly, the dividend model can be adjusted for flotation cost to estimate the cost of the new equity shares. The CAPM approach is incapable of such adjustment as the model does not include the market price which has to be adjusted.

Both the dividend and CAPM approaches are theoretically sound. But major problems are encountered in the practical application of the CAPM approach in collecting data—which may not be readily available or in a country like India may be altogether absent—regarding expected future returns, the most appropriate estimate of the risk-free rate and the best estimates of the security's *beta*. Moreover, beta measure of risk considers only the systematic risk. Poorly diversified investors may be more interested in total risk rather than in systematic risk only. In such cases the CAPM may tend to underestimate the required rate of such investor. For these reasons, the use of the dividend approach would appear to be more appropriate to measure the cost of equity capital.

Cost of Retained Earnings

Retained earnings, as a source of finance for investment proposals, differ from other sources like debt, preference shares and equities. The use of debt is associated with a contractual obligation to pay a fixed rate of interest to the suppliers of funds and, often, repayment of principal at some predetermined date. An almost similar kind of stipulation applies to the use of preference shares also. In the case of ordinary shares, although there is no provision for any predetermined payment to the shareholders, yet a certain expected rate of dividend provides a starting point for the computation of cost of equity capital. That retained earnings do not involve any formal arrangement to become a source of funds is obvious. In other words, there is no obligation, formal or implied, on a firm to pay a return on retained earnings. Apparently, retained earnings may appear to carry no cost since they represent funds which have not been raised from outside. The contention that retained earnings are free of cost, however, is not correct. On the contrary, they do involve cost like any other source.

It is true that a firm is not obliged to pay a return (dividend or interest) on retained earnings. But retention of earnings does have implications for the shareholders of the firm. If earnings were not retained, they would have been paid out to the ordinary shareholders as dividends. In other words, retention of earnings implies withholding of dividends from holders of ordinary shares. When earnings are, thus, retained, shareholders are forced to forego dividends. The dividends foregone by the equity holders are, in fact, an opportunity cost. Thus, retained earnings involve opportunity cost. In other words, the firm is implicitly required to earn on the retained earnings at least equal to the rate that would have been earned by the shareholders if they were distributed to them. This is the cost of retained earnings. Therefore, the cost of retained earnings may be defined as *opportunity cost in terms of dividends foregone by/withheld from the equity shareholders*.

The alternative use of retained earnings is based on 'external-yield criterion'.[16] According to this approach, the alternative to retained earnings is external investment of funds by the firm itself. In other words the opportunity cost of retention of earnings is the rate of return that could be earned by investing the funds in another enterprise by the firm instead of what would be obtained by the shareholders on other investments. The firm should estimate the yield it can earn from external investment opportunities by investing its retained earnings there. While doing so, the firm should bear in mind that it selects such investment opportunities as have the same degree of risk as that of the firm itself. The rate of return that could be thus earned constitutes the opportunity cost of retained earnings. Such a return would give the cost of retained earnings, k_r. The k_r under the assumption of external-yield criterion would be approximately k_e. The merits of this approach are obvious. The k_r here is simply the return on direct investment by the firm itself. Since the investments of funds are assumed to be made by the firm itself, the return would not be affected by the tax brackets in which the various shareholders of the firm are. The approach, in other words, can be consistently applied. The external-yield criterion, therefore, represents an economically justifiable opportunity cost.

In brief, the cost of retained earnings represents an opportunity cost in terms of the return on their investment in another enterprise by the firm whose cost of retained earnings is being considered. The opportunity cost given by the external-yield criterion which can be consistently applied can be said to measure the k_r, which is likely to be equal to the k_e. Therefore, k_e should be used as k_r but the latter would be slightly lower than the former due to differences in flotation cost.

COMPUTATION OF OVERALL COST OF CAPITAL

The calculations of the cost of specific sources, namely, debt, preference shares, equity shares and retained earnings have been shown in the preceding discussions. In this section we propose to dwell on the computation of the overall cost of capital. The term cost of capital means the overall composite cost of capital defined *as weighted average of the cost of each specific type of fund*. The use of *weighted* average and not the *simple* average is warranted by the fact that the proportions of various sources of funds in the capital structure of a firm are different. To be representative, therefore, the overall cost of capital should take into account the relative proportions of different sources and hence the *weighted* average.

The computation of the overall cost of capital (represented symbolically by k_o) involves the following steps:

1. Assigning weights to specific costs.
2. Multiplying the cost of each of the sources by the appropriate weights.
3. Dividing the total weighted cost by the total weights.

The crucial part of the exercise is the decision regarding appropriate weights and the related aspects. We first illustrate the relevant aspects of the choice of the weights. This is followed by the mechanics of computation of k_0 which is relatively simple.

Assignment of Weights

The aspects relevant to the selection of appropriate weights are (i) Historical weights versus Marginal weights; (ii) Historical weights can be—(a) Book value weights or (b) Market value weights.

Historical Versus Marginal Weights The first aspect of the decision regarding the selection of appropriate weights for computing the overall cost of capital is: which system of weighting—marginal or historical—is preferable? The critical assumption in any weighting system is that *the firm will raise capital in the specified proportions.*

Marginal Weights The use of marginal weights involves weighting the specific costs by the proportion of each type of fund to the total funds to be raised. The marginal weights represent the percentage share of different financing sources the firm intends to raise/employ. The basis of assigning relative weights is, therefore, new/additional/incremental issue of funds and, hence, marginal weights.

In using marginal weights, we are concerned with the actual amounts of each type of financing used in raising additional funds to finance new projects by the company. In fact, the use of marginal weights is more attuned to the actual process of financing projects. Another merit of marginal weights is that their use also reflects the fact that the firm does not have a great deal of control over the amount of financing obtained through retained earnings or other sources which are influenced by several factors, such as, temper of the market, investors' preference and so on.

What is the relative suitability of marginal weights to compute the overall cost of capital? The composite cost of capital is computed, it would be recalled, to be used as an investment criterion. The capital budgeting decision is concerned with the selection of new investment proposals. As already mentioned, the cost of capital, conceptually speaking, which is relevant is the cost of the new capital to be raised to finance the current capital expenditure decision, that is, marginal cost. It is, therefore, argued that the weights must correspond to the proportions of financing inputs the firm intends to employ, that is, the combined cost of capital should be calculated by employing marginal weights. If marginal weights are not used, the implication is that new capital is raised in proportions other than those used to calculate this cost. As a result, the

real overall cost of capital will be different from that calculated and used for asset-selection decision. There is obviously a bias in the exercise. If the real cost is more than the calculated one, certain investment proposals will be accepted that will have the effect of leaving the investor worse off than before because the potential profitability has been overestimated. On the other hand, if the real cost is less than the measured cost, projects that could increase the shareholders' wealth would be rejected. Finally, the problem of choosing between book-value weights and market value weights does not arise in the case of marginal weights.

However, the marginal weighting system suffers from serious limitations. One major criticism[17] of the use of marginal weights is that this approach does not consider the long-term implications of the firm's current financing. Since capital expenditure decisions are long-term investments of the firm, attention should be given to the long-term implications of any financing strategy. Using cheaper sources of funds to finance a given project may place the firm in a position where more expensive equity financing will have to be raised to finance a future project. For example, a firm may be able to sell debt at an after-tax cost of 9 per cent. If the best investment project has currently available returns of 10 per cent and the weighted average cost of capital based on marginal weights is used as a decision criterion, the project will be accepted. If next year, the firm must raise equity at a cost of 16 per cent, it will have to reject a project, returning 15 per cent. Thus, *the fact that today's financing affects tomorrow's cost is not considered in using marginal weights*.[18] In other words, the interrelationship among the various methods of financing is ignored if marginal weights are used to calculate the cost of capital.

Historical Weights The alternative to the use of marginal weights is to use historical weights. Here, the relative proportions of various sources to the existing capital structure are used to assign weights. In other words, the basis of the weighting system is the funds already employed by the firm. The use of the historical weights is based on the assumption that the firm's existing capital structure is optimal and, therefore, should be maintained in the future. That is, the firm should raise additional funds for financing investments in the same proportion as they are in the existing capital structure. In other words, the existing proportion of various sources of long-term funds will be followed whenever the firm raises additional long-term funds to finance new investment projects. For instance, if the present capital structure of firm has 30 per cent debts, 20 per cent preference shares, 40 per cent equity capital and 10 per cent retained earnings, the company will be assumed to raise incremental funds in the same proportion as it has done in the past. Assume further, that the firm requires additional funds amounting to Rs 1,00,000 to finance a new project. It should be expected, according to the historical weighting system, to raise this sum from different sources in the proportion of 30 per cent (debt), 20 per cent (preference shares), 40 per cent (ordinary shares) and 10 per cent (retained earnings). The break-up of the amount source-wise would be: debt, Rs 30,000; preference capital, Rs 20,000; equity capital, Rs 40,000 and retained earnings, Rs 10,000.

The problem with historical weighting is that the validity of the assumptions on which it is based is open to question. That firms should raise additional funds from different sources in the same proportion in which they are in the existing capital structure implies that there are no constraints on raising funds from these sources. This is not correct. For instance, the amount of retained earnings may actually fall short of its required share in financing new projects because firms cannot have control over the retained earnings. Similarly, raising funds from the capital market depends on several factors such as the state of the economy, requirements of investors, temper of the market and so on, over which the firms have obviously no control. There are, thus, practical difficulties in applying historical weights. Yet another problem with the application of the historical weights is that a choice has to be made between the book value weights and market value weights.

As against the above limitations, the system of assigning weights on the basis of the existing capital structure has one outstanding merit. As a decision criterion, the weighted cost of capital based on historical

weights takes into account a long-term view. If the cost thus calculated is 12 per cent, using it as a decision-criterion for capital budgeting decision, a project returning 13 per cent next year will be accepted. While it is true that firms actually raise funds in lump sum amounts from one or two sources at a time instead of all the available sources, the use of historical weights to calculate the overall weighted average cost of capital is more consistent with the firm's long-term goal of maximising the owner's wealth. Therefore, the use of historical weights is much more likely to lead to an optimal selection of capital investment projects in the long run.[19] It is probably for this reason that historical weights are commonly used to calculate the weighted cost of capital, and are treated as superior to marginal weights, which, as already indicated, ignore the long-term implications of the firm's current financing.

Book Value and Market Value Weights The second aspect of assigning weights to various sources of finance in calculating the composite cost of capital relates to the choice between book value weights and market value weights. This problem will arise only in the case of historical weights.

Both these methods have their own merits. In theory, the use of market value weights for calculating the cost of capital is more appealing than the use of book value weights because: (i) market values of securities closely approximate the actual amount to be received from their sale; (ii) the costs of the specific sources of finance which constitute the capital structure of the firm are calculated using prevailing market prices. However, there are practical difficulties in its use as calculating the market value of securities may present difficulties, particularly the market values of retained earnings. Moreover, weights based on market values are likely to fluctuate widely.

On the other hand, the merits of book value weights are operational in nature. For one thing, book values are readily available from the published records of the firm. Also, firms set their capital structure targets in terms of book values rather than market values. Finally, the analysis of capital structure in terms of debt-equity ratio is based on book value.

In brief, the alternatives—book values and market values of securities—have their own commendable features. While the book value is operationally convenient, the market value basis is theoretically consistent and sound, and therefore a better indicator of a firm's true capital structure.

Mechanics of Computation

We now illustrate the mechanics of computation of the weighted average cost of capital.

EXAMPLE 6.12 (Book Value Weights)

(a) A firm's after-tax cost of capital of the specific sources is as follows:

Cost of debt	8 per cent
Cost of preference shares	14
Cost of equity funds	17

(b) The following is the capital structure:

Source	*Amount*
Debt	Rs 3,00,000
Preference capital	2,00,000
Equity capital	5,00,000
	10,00,000

(c) Calculate the weighted average cost of capital, k_0, using book value weights.

SOLUTION

Table 6.2 *Computation of Weighted Average Cost of Capital (Book Value Weights)*

Sources of funds	*Amount*	*Proportion*	*Cost (%)*	*Weighted cost (3 × 4)*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
Debt	Rs 3,00,000	0.3 (30)	0.08	0.024
Preference capital	2,00,000	0.2 (20)	0.14	0.028
Equity capital	5,00,000	0.5 (50)	0.17	0.085
	10,00,000	1.00 (100)		0.137
Weighted average cost of capital = 13.7 per cent				

An alternative method of determining the k_0 is to compute, as shown in Table 6.3, the total cost of capital and then divide this figure by the total capital. This procedure obviously avoids fractional calculations.

Table 6.3 *Computation of Weighted Average Cost of Capital (Alternative Method)*

Sources	*Amount*	*Cost (%)*	*Total cost (2 × 3)*
(1)	*(2)*	*(3)*	*(4)*
Debt	Rs 3,00,000	8	Rs 24,000
Preference capital	2,00,000	14	28,000
Equity capital	5,00,000	17	85,000
Total	10,00,000		1,37,000

Weighted average cost of capital = $\frac{\text{Rs } 1,37,000}{\text{Rs } 10,00,000} \times 100 = 13.7$ per cent

EXAMPLE 6.13 (Market Value Weights)

From the information contained in Example 6.12, calculate the weighted average cost of capital, assuming that the market values of different sources of funds are as follows:

Source	*Market value*
Debt	Rs 2,70,000
Preference shares	2,30,000
Equity and retained earnings	7,50,000
Total	12,50,000

SOLUTION

(1) The determination of the market value of retained earnings presents operational difficulties. The market value of retained earnings can be indirectly estimated. A possible criterion has been suggested by Gitman,[20] according to which, since retained earnings are treated as equity capital for purpose of calculation of cost of specific source of funds, the market value of the ordinary shares may be taken to represent the combined market value of equity shares and retained earnings. The separate market values of retained earnings and ordinary shares may be found by allocating to each of these a percentage of the total market value equal to their percentage share of the total based on book values.

On the basis of the foregoing criterion, the sum of Rs 7,50,000 in Example 6.13 is allocated between equity capital and retained earnings as follows:

Source of funds	*Book value*	*Per cent of book value*	*Market value*
(1)	*(2)*	*(3)*	*(4)*
Equity shares	Rs 4,00,000	80	6,00,000 (0.8 × Rs 7,50,000)
Retained earnings	1,00,000	20	1,50,000 (0.20 × Rs 7,50,000)

(2) After the determination of market value, k_0 is calculated as shown in Table 6.4.

Table 6.4 *Computation of Weighted Average Cost of Capital (Market Value Weights)*

Sources	*Market value*	*Cost (per cent)*	*Total cost (3 × 2)*
(1)	*(2)*	*(3)*	*(4)*
Debt	Rs 2,70,000	8	Rs 21,600
Preference shares	2,30,000	14	32,200
Equity capital	6,00,000	17	1,02,000
Retained earnings	1,50,000	17	25,500
Total	12,50,000		1,81,300

$$k_0 = \frac{\text{Rs } 1,81,300}{\text{Rs } 12,50,000} \times 100 = 14.5 \text{ per cent}$$

One notable point that emerges from the computation of the weighted average cost of capital based respectively on book value weights and market value weights is that the k_0 with market value weights is higher. This is mainly due to the fact that preference shares and equity shares have market values considerably greater than their book values. Since these sources of long-term funds have higher specific costs, the overall cost increases.

In operational terms, if book value weighted average cost of capital is used, some projects would be accepted that would not be acceptable based on the market value approach. The results given by the market value based weights are obviously better as a decision criterion.

EXAMPLE 6.14 (Marginal Weights)

The firm of Example 6.12 wishes to raise Rs 5,00,000 for expansion of its plant. It estimates that Rs 1,00,000 will be available as retained earnings and the balance of the additional funds will be raised as follows:

Long-term debt	Rs 3,00,000
Preference shares	1,00,000

Using marginal weights, compute the weighted average cost of capital.

SOLUTION

The computation is illustrated in Table 6.5.

Table 6.5 *Weighted Average Cost of Capital (Marginal Weights)*

Sources of funds	*Amount*	*Proportion*	*Cost (%)*	*Total cost (3 × 4)*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
Debt	Rs 3,00,000	0.60 (60)	8	Rs 24,000
Preference shares	1,00,000	0.20 (20)	14	14,000
Retained earnings	1,00,000	0.20 (20)	17	17,000
	5,00,000	1.00 (100)		55,000

Weighted average cost of capital = $\frac{\text{Rs } 55,000}{\text{Rs } 5,00,000} \times 100 = 11 \text{ per cent}$

This cost is substantially lower than the weighted cost calculated using either book values or market values of historical weights. This is because debt finance has been used in large amount. Since only a limited amount of debt financing can be raised for a given equity base, it is quite likely that the firm will have to use primarily expensive equity financing for future projects. Obviously, this is not a happy situation because a project which gives a return of, say, 12 per cent this year will be accepted as the k_0 is only 11 per cent but next year another project which may give a higher return might have to be rejected because equity financing will imply/entail a higher k_0. The use of historical market value weights in calculating k_0 is much more likely to lead to an optimal selection of capital investment projects in the long run and, therefore, it should be preferred as the basis of assigning weights to calculate the composite cost of capital.

SUMMARY

- The cost of capital is an integral part of investment decisions as it is used to measure the worth of investment proposal. It is used as a discount rate in determining the present value of future cash flows associated with capital projects. Conceptually, it is the minimum rate of return that a firm must earn on its investments so as to leave market price of its shares unchanged. It is also referred to as cut-off rate, target rate, hurdle rate, required rate of return and so on.
- In operational terms, it is defined as the weighted average cost of capital (k_0) of all long-term sources of finance. The major long-term sources of funds are (i) debt, (ii) preference shares, (iii) equity capital, and (iv) retained earnings. Thus, it comprises of several components in terms of specific cost of each source of finance. When these specific costs are combined, it results in the weighted average cost of capital.
- The cost of capital can be explicit or implicit. The explicit cost of capital is associated with the raising of funds (from debt, preference shares and equity). The explicit cost of any source of capital (C) is the discount rate that equates the present value of the cash inflows (CI_o) that are incremental to the taking of financing opportunity with the present value of its incremental cash outflows (CO_t). Symbolically,

$$CI_o = \sum_{t=1}^{n} \frac{CO_t}{(1+C)^t}$$

  Its determination is similar to the determination of the internal rate of return (IRR). It is the internal rate of return that the firm pays to procure financing.
- Retained earnings involve no future cash flows to, or from, the firm. Therefore, the retained earnings do not have explicit cost. However, they carry implicit cost in terms of the opportunity cost of the

foregone alternative (s) in terms of the rate of return at which the shareholders could have invested these funds had they been distributed to them/or not retained by the firm.

- There are four types of specific costs, namely, cost of debt (k_d), cost of preference shares (k_p), cost of equity capital (k_e) and cost of retained earnings (k_r).
- The debt carries a certain rate of interest. Interest qualifies for tax deduction in determining tax liability. Therefore, the effective cost of debt is less than the actual interest payment made by the firm by the amount of tax shield it provides. The debt can be either perpetual or redeemable.
- In the case of perpetual debt, it is computed dividing effective interest payment, i.e., $I\ (1 - t)$ by the amount of debt/sale proceeds of debentures or bonds (SV). Symbolically,

$$K_d = \frac{I\,(1-t)}{SV}$$

- In the case of redeemable debt, the repayment of debt principal (COP) either in instalments or in lump sum (besides interest, COI) is also taken into account. k_d is computed based on the following equations:

$$CI_0 = \sum_{t=1}^{n} \frac{COI_t}{(1+k_d)^t}(1-t) + \frac{COP_n}{(1+k_d)^n} \quad \text{(When principal is paid in lump sum)}$$

Alternatively, $K_d = \dfrac{I\,(1-t) + (\text{Redeemable value}, RV - SV/N)}{(RV + SV)/2}$

$$CI_0 = \sum_{t=1}^{n} \frac{COI_t}{(1+k_d)^t}(1-t) + \frac{COP_t}{(1+k_d)^t} \quad \text{(When debt is paid in instalments)}$$

- The cost of debt is generally the lowest among all sources partly because the risk involved is low but mainly because interest paid on debt is tax deductible.
- The cost of preference share (k_p) is akin to k_d. However, unlike interest payment on debt, dividend payable on preference shares is not tax deductible from the point of view assessing tax liability. On the contrary, tax (Dt) may be required to be paid on the payment of preference dividend.
- The k_p in the case of irredeemable preference shares is based on dividends payable on them and the sale proceeds obtained by issuing such preference shares, $P_0\ (1 - f)$. In terms of equation:

$$K_p = \frac{D_p(1+Dt)}{P_0(1-f)}$$

- The k_p for redeemable preference shares requiring lump sum repayment (P) is determined on the basis of the following equation:

$$P_0\ (1-f) = \sum_{t=1}^{n} \frac{D_p(1+Dt)}{(1+k_p)^t} + \frac{P_n}{(1+k_p)}$$

In the case of repayment required in instalments:

$$P_0\ (1-f) = \sum_{t=1}^{n} \frac{D_p(1+Dt)}{(1+k_p)^t} + \frac{P_t}{(1+k_p)^t}$$

- The computation of cost of equity capital (k_e) is conceptually more difficult as the return to the equity-holders solely depends upon the discretion of the company management. It is defined as the minimum rate of return that a corporate must earn on the equity-financed portion of an investment project in order to leave unchanged the market price of the shares.

- There are two approaches to measure k_e: (i) the dividend valuation model approach and (ii) capital asset pricing model (CAPM) approach.
  As per the dividend approach, k_e is defined as the discount rate that equates the present value of all expected future dividends per share with the net proceeds of the sale (or the current market price) of a share. In equation terms,

$$P_0 (1 - f) = \sum_{t=1}^{n} \frac{D_1 (1 + g)^{t-1}}{(1 + k_e)^t}$$

$$\text{Or, } k_e = \frac{D_1}{P_0 (1 - f)} + g$$

- The CAPM describes the relationship between the required rate of return or the cost of equity capital and the non-diversifiable or relevant risk of the firm as reflected in its index of non-diversifiable risk, that is, beta. Symbolically,

$$K_e = R_f + b (K_m - R_f)$$

R_f = Required rate of return on risk-free investment
b = Beta coefficient**
K_m = Required rate of return on market portfolio, that is, the average rate or return on all assets

$$** = \frac{\sum MJ - N \overline{M}\,\overline{J}}{\sum M^2 - (N \overline{M})^2}, \text{where}$$

M = Excess in market return over risk-free rate
J = Excess in security returns over risk-free rate
MJ = Cross product of M and J
N = Number of years

- The cost of retained earning (k_r) is equally difficult to calculate in theoretical terms. Since retained earnings essentially involves use of funds, it is associated with an opportunity/implicit cost. The alternative to retained earnings is the investment of the funds by the firm itself in a homogeneous outside investment. Therefore, k_r is equal to k_e. However, it might be slightly lower than k_e in the case of new equity issue due to flotation costs.
- The measurement of the weighted average/overall cost of capital (k_0) involves the choice of appropriate weights. The two systems of assigning weights, namely, historical and marginal, have their own suitability but historical weights appear to be superior to marginal weights as the former take into account the long-term implications of the firm's current financing. With historical weights, a choice is to be made between book value and market value weights. While the book value weights are operationally convenient, the market value basis is theoretically consistent and sound, and therefore, a better indicator of firm's capital structure.
- The k_0 is computed based on the following equation:

$$K_0 = K_d W_d + K_p W_p + K_e W_e + K_r W_r$$

W_d = Percentage of debt to total capital
W_p = Percentage of preference shares to total capital
W_e = Percentage of external equity to total capital
W_r = Percentage of retained earnings to total capital

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6. *Ibid.,* p. 46.
7. *Ibid.,* p. 46-51.
8. *Ibid.,* p. 61.
9. *Ibid.*
10. *Ibid*.
11. *Ibid*., p. 62.
12. This apart, there may be additional tax advantage on account of amortisation of flotation costs. For instance, Sec. 35D of the Indian Income Tax Act provides that the aggregate amount of qualifying expenditure under the head of preliminary expenses (of which flotation cost is only one part) is available for amortisation in 10 equal instalments over a period of 10 years, subject to the limit 2.5 per cent of the cost of the project or capital employed. To keep the discussion simple, we have ignored these adjustments. However, in practice, cost of capital should be calculated after providing for the tax benefits accruing out of amortisation of flotation costs.
13. Van Horne, *op. cit*., p. 93.
14. *Ibid.*, p. 93.
15. For a comprehensive account reference may be made to Moyer, R C, et al., *Contemporary Financial Management*, West Publishing Co., New York, 1984, pp. 123-28.
16. Suggested by Solomon, E, *op. cit*., pp. 53-55.
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18. *Ibid*.
19. *Ibid*.
20. *Ibid*., p. 353.

SOLVED PROBLEMS

P.6.1 Calculate the explicit cost of debt for each of the following situations:

(a) Debentures are sold at par and flotation costs are 5 per cent.

(b) Debentures are sold at premium of 10 per cent and flotation costs are 5 per cent of issue price.

(c) Debentures are sold at discount of 5 per cent and flotation costs are 5 per cent of issue price.

Assume: (i) coupon rate of interest on debenturs is 15 per cent; (ii) face value of debentures is Rs 100; (iii) maturity period is 10 years; and (iv) tax rate is 35 per cent.

SOLUTION

(a) $$k_d = \frac{I(1-t) + (RV - SV)/N}{(RV + SV)/2} = \frac{\text{Rs}\,15(1 - 0.35) + (\text{Rs}\,100 - \text{Rs}\,95)/10}{(\text{Rs}\,100 + 95)/2} = 10.5 \text{ per cent}$$

Alternatively, $$CI_o = \sum_{t=1}^{n} \frac{COI_t}{(1 + k_d)^t} + \frac{COP_n}{(1 + k_d)^n}$$

$$\text{Rs } 95 = \sum_{t=1}^{10} \frac{\text{Rs } 15\,(1 - 0.35)}{(1 + k_d)^t} + \frac{\text{Rs } 100}{(1 + k_d)^{10}}$$

Year	*CO*	*PVIFA at*		*Total* PV *at*	
		10%	*11%*	*10%*	*11%*
1-10	Rs 9.75	6.145	5.889	Rs 59.91	Rs 57.42
10	100	0.386	0.352	38.60	35.20
				98.51	92.62

By interpolation, k_d= 11% – (Rs 2.38/5.89 = 0.4041) = 10.59 per cent

(b) $$k_d = \frac{\text{Rs } 9.75 + (\text{Rs } 100 - \text{Rs } 104.50)/10}{(\text{Rs } 100 + 104.50)/2} = 9.1 \text{ per cent}$$

Alternatively, $$\text{Rs } 104.50 = \sum_{t=1}^{n} \frac{\text{Rs } 9.75}{(1 + k_d)^t} + \frac{\text{Rs } 100}{(1 + k_d)^{10}}$$

Year	*CO*	*PVIFA at*		*Total PV at*	
		8%	*9%*	*8%*	*9%*
1-10	Rs 9.75	6.710	6.418	Rs 65.42	Rs 62.58
10	100	0.463	0.422	46.30	42.20
				111.72	104.78

k_d = 9 per cent

(c) $$k_d = \frac{\text{Rs } 9.75 + (\text{Rs } 100 - \text{Rs } 90.25)/10}{(\text{Rs } 100 + 90.25)/2} = 11.3 \text{ per cent}$$

Alternatively, $$\text{Rs } 90.25 = \sum_{t=1}^{10} \frac{\text{Rs } 9.75}{(1 + k_d)^t} + \frac{\text{Rs } 100}{(1 + k_d)^{10}}$$

Year	*CO*	*PVIFA at*		*Total PV at*	
		11%	*12%*	*11%*	*12%*
1-10	Rs 9.75	5.889	5.650	Rs 57.42	Rs 55.09
10	100	0.352	0.322	35.20	32.20
				92.62	87.29

k_d = 11.44 per cent

P.6.2 (a) A company's debentures of the face value of Rs 100 bear an 8 per cent coupon rate. Debentures of this type currently yield 10 per cent. What is the market price of debentures of the company?

(b) What would happen to the market price of the debentures if interest rises to (i) 16 per cent, and (ii) drops to 12 per cent?

(c) What would be the market price of the debentures in situation (a) if it is assumed that debentures were originally having a 15 year maturity period and the maturity period is 4 years away from now?

(d) Would you pay Rs 90 to purchase debentures specified in situation (c)? Explain.

SOLUTION

(a) The market price of the debenture, $V_d = \dfrac{\text{Interest on debentures } (I)}{\text{Current interest rate } (k_i)} = \dfrac{\text{Rs } 8}{0.10} = \text{Rs } 80.$

(b) (i) $V_d = \frac{\text{Rs } 8}{0.16} = \text{Rs } 50$, (ii) $V_d = \frac{\text{Rs } 8}{0.12} = \text{Rs } 66.67$

(c) Determine the PV of (i) interest to be received on these debentures for a period of 4 years and (ii) principal repayment of Rs 100 at the end of the fourth year using the current interest rate, that is, 10 per cent as discount rate.

Year	*Cash outflows before taxes*	PV *factor at 10%*	*Total* PV
1-4	Rs 8	3.170 (Table A-4)	Rs 25.36
4	100	0.683 (Table A-3)	68.30
			93.66

The market price of the debentures = Rs 93.66.

(d) Yes, we would pay Rs 90 for the purchase of debentures because its current worth (Rs 93.66) is more than the purchase price.

P.6.3 The Elu Ltd is contemplating a debenture issue on the following terms:

Face value	:	Rs 100 per debenture
Term of maturity	:	7 years
Yearly coupon rate of interest		
Years 1 - 2	:	8 per cent
3 - 4	:	12
5 - 7	:	15

The current market rate on similar debenturs is 15 per cent per annum. The company proposes to price the issue so as to yield a (compounded) return of 16 per cent per annum to the investoRs Determine the issue price. Assume redemption at a premium of 5 per cent on face value.

SOLUTION

The issue price of debenture will be the sum of (i) *PV* of intereset payments during 1-7 years and (ii) PV of maturity value of debenture in the seventh year:

Years	*Cash outflows*	*PVIF at 16%*	*Total PV*
1	Rs 8	0.862	Rs 6.896
2	8	0.743	5.944
3	12	0.641	7.692
4	12	0.552	6.624
5	15	0.476	7.140
6	15	0.410	6.150
7	120 *	0.354	42.480
			82.926

*Inclusive of Rs 105 maturity value of debentures.

P.6.4 XYZ company has debentures outstanding with 5 years left before maturity. The debentures are currently selling for Rs 90 (the face value is Rs 100). The debentures are to be redeemed at 5 per cent premium. The interest is paid annually at a rate of interest of 12 per cent. The firm's tax rate is 35 per cent. Calculate k_d, using both methods.

SOLUTION

(i) $k_d = \frac{I(1-t) + (\text{Redemption value} - \text{Market value}) \div 5}{(\text{Redemption value} + \text{Market value}) \div 2}$

$$= \frac{\text{Rs } 12\,(1 - 0.35) + (\text{Rs } 105 - \text{Rs } 90) \div 5}{(\text{Rs } 105 + \text{Rs } 90) \div 2} \times 100 = 11.1 \text{ per cent}$$

(ii) $$\text{Rs } 90 = \sum_{t=1}^{5} \frac{\text{Rs } 12\,(1 - 0.35)}{(1 + k_d)^t} + \frac{\text{Rs } 105}{(1 + k_d)^5}$$

The value of k_d is to be determined by trial and error.

Determination of PV at 11% and 12% rates of interest

Year	*Cash outflows after taxes*	*PV factor at*		*Total PV at*	
		11%	*12%*	*11%*	*12%*
1-5	Rs 7.8	3.696	3.605	Rs 28.83	Rs 28.12
5	105	0.593	0.567	62.27	59.54
				91.10	87.66

By interpolation, the value of k_d would be 11% + (Rs 1.10/Rs 3.44 = 0.32) = 11.32 per cent

P.6.5 A company is considering raising Rs 100 lakh by one of the two alternative methods, viz. 14 per cent institutional term loan and 13 per cent non-convertible debentures. The term loan option would attract no major incidental cost. The debentures would have to be issued at a discount of 2.5 per cent and would involve Rs 1 lakh as cost of issue.

Advise the company as to the better option based on the effective cost of capital in each case. Assume a tax rate of 35 per cent.

SOLUTION

(i) Cost of 14 per cent institutional term loan: Rs 14 lakh (1 – 0.35)/Rs 100 lakh = 9.1 per cent

(ii) Cost of 13 per cent non-convertible debentures: Rs 13 lakh (1 – 0.35)/Rs 96.50 lakh* = 8.76 per cent

(*Rs 100 lakhs – Rs 2.5 lakh discount – Rs 1 lakh cost of issue).

Recommendation: Raising of funds through non-convertible debentures is a better option.

P.6.6 From the following information, determine the cost of equity capital using the CAPM approach.

(a) Required rate of return on risk-free security, 12 per cent.

(b) Required rate of return on market portfolio of investment is 15 per cent.

(c) The firm's beta is 1.6.

SOLUTION

$$k_e = R_f + b(K_m - R_f)$$

$$= 0.12 + 1.6(0.15 - 0.12) = 16.8 \text{ per cent}$$

P.6.7 The beta coefficient of Target Ltd is 1.4. The company has been maintaining 8 per cent rate of growth in dividends and earnings. The last dividend paid was Rs 4 per share. The return on government securities is 10 per cent while the return on market portfolio is 15 per cent. The current market price of one share of Target Ltd. is Rs 36.

(a) What will be the equilibrium price per share of Target Ltd?

(b) Would you advise purchasing the share?

SOLUTION

(a) The required rate of return $(k_e) = R_f + b(k_m - R_f) = 10\% + 1.4(15\% - 10\%) = 17$ per cent

Equilibrium price per share $(P_o) = \frac{D_1}{k_e - g} = \frac{\text{Rs } 4\,(1.08)}{17\% - 8\%} = \text{Rs } 48$

(b) The share of Target Ltd is worth buying as it is undervalued.

P.6.8 Consider the following figures pertainig to risk free rate, market rate and return rate of a security of A Ltd during the last 6 years.

Year	*Risk-free rate* (R_f)	*Market rate* (R_m)	*Security return* (R_j)
1	0.06	0.14	0.08
2	0.05	0.03	0.11
3	0.07	0.21	0.29
4	0.08	0.26	0.25
5	0.09	0.03	0.07
6	0.07	0.11	0.04

On the basis of the above information, you are required to determine the cost of equity capital in the context of CAPM. Past data may be taken as proxy for the future.

SOLUTION

Determination of various required values under CAPM approach

Year	*Risk-free rate* (R_f)	*Market return* (K_m)	*Excess in market returns* (M) *[col.3 − col.2]*	$(M)^2$	*Security return* (R_j)	*Excess in security return* (J) *[col.6 − col.2]*	*Cross product* (MJ) *[col.4 × col.7]*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	0.06	0.14	0.08	0.0064	0.08	0.02	0.0016
2	0.05	0.03	(0.02)	0.0004	0.11	0.06	(0.0012)
3	0.07	0.21	0.14	0.0196	0.29	0.22	0.0308
4	0.08	0.26	0.18	0.0324	0.25	0.17	0.0306
5	0.09	0.03	(0.06)	0.0036	0.07	(0.02)	0.0012
6	0.07	0.11	0.04	0.0016	0.04	(0.03)	(0.0012)
Total	0.42	0.78	0.36	0.0640		0.42	0.0618
Average return	0.07	0.13	0.06	—		0.07	—

Figures in brackets represent negative returns.

$$b = \frac{\Sigma M\dot{J} - N\bar{M}\bar{\dot{J}}}{\Sigma M^2 - N\bar{M}^2} = \frac{0.0618 - 6(0.06 \times 0.07)}{0.0640 - 6 \times (0.06)^2} = \frac{0.0366}{0.0424} = 0.863$$

$$k_e = R_f + b(k_m - R_f) = 0.07 + 0.863\ (0.13 - 0.07) = 12.18 \text{ per cent}$$

P.6.9 Investors require a 12 per cent rate of return on equity shares of company Y. What would be the market price of the shares if the previous dividend (D_0) was Rs 2 and investors expect dividends to grow at a constant rate of (a) 4% (b) 0% (c) -4% (d) 11% (e) 12% and (f) 14%?

SOLUTION

$$\text{(a)}\quad P_0 = \frac{\text{Rs } 2.08}{12\% - 4\%} = \text{Rs } 26$$

$$\text{(b)}\quad = \frac{\text{Rs } 2.00}{12\%} = 16.67$$

$$\text{(c)}\quad = \frac{\text{Rs } 1.92}{12\% - (-4\%)} = 12$$

(d) $= \dfrac{\text{Rs } 2.22}{12\% - 11\%} = 222$

(e) $= \dfrac{\text{Rs } 2.24}{12\% - 12\%} = \text{Undefined}$

(f) $= \dfrac{\text{Rs } 2.28}{12\% - 14\%} = (114),$ which is ridiculous (price cannot be negative).

The results in situation (e) and (f) show that the formula does not make sense if k_e is less than or equal to the growth rate.

P.6.10 An investor is contemplating the purchase of equity shares of a company which had paid a dividend of Rs 5 per share last year. The dividends are expected to grow at 6 per cent for ever. The required rate of return on the shares of this company in the capital market is 12 per cent. What will be the maximum price you will recommend the investor to pay for an equity share of the company? Will your answer be different if he wants to hold the equity share for 3 years and 6 years?

SOLUTION

$$P_0 = \frac{\text{Rs } 5.30}{12\% - 6\%} = \text{Rs } 88.33$$

The maximum price we shall recommend the investor to pay for an equity share of the company is Rs 88.33.

The value of the share is not dependent upon the holding period. The value of the share would be the same whether he holds the share for 3 years or 6 years.

P.6.11 A mining company's iron ore reserves are being depleted, and its cost of recovering a declining quantity of iron ore are rising each year. As a consequence, the company's earnings and dividends are declining, at a rate of 8 per cent per year. If the previous year's dividend was Rs 10 and the required rate of return is 15 per cent, what would be the current price of the equity share of the company?

SOLUTION

$$P_0 = \frac{\text{Rs } 9.20}{15\% + 8\%} = \text{Rs } 40$$

The current price of the equity shares of the mining company would be Rs 40.

P.6.12 A large sized chemical company has been expected to grow at 14 per cent per year for the next 4 years and then to grow indefinitely at the same rate as that of the national economy, that is, 5 per cent. The required rate of return on the equity shares is 12 per cent. Assume that the company paid a dividend of Rs 2 per share last year. Determine the market price of the shares today.

SOLUTION

The value of equity share = the sum of: (i) *PV* of dividend payments during years 1-4 and (ii) *PV* of expected market price at the end of year 4 based on growth rate of 5 per cent.

Year	$D_t = D_0 (1 + g)^t$	PV *factor at 12%*	*Total* PV
1	Rs $2(1 + 0.14)^1 = 2.28$	0.893	Rs 2.036
2	$2(1 + 0.14)^2 = 2.60$	0.797	2.072
3	$2(1 + 0.14)^3 = 2.96$	0.712	2.108
4	$2(1 + 0.14)^4 = 3.38$	0.636	2.150
			8.37

$$P_4 = \frac{D_5}{(k_e - g_n)} = \frac{(\text{Rs } 3.38)\,(1 + 0.05)}{12\% - 5\%} = \text{Rs } 50.71$$

g_n = normal growth rate

PV of market price of the share at the end of year 4 = Rs 50.71 × *PV* factor at 12 per cent at the end of year 4 (0.636) = Rs 32.25.

$$P_0 = \text{Rs } 8.37 + \text{Rs } 32.25 = \text{Rs } 40.62$$

The market price of the share would be Rs 40.62.

P.6.13 Mahendrao is a shareholder in the Central India Ltd. Although earnings for Central have varied considerably, Mahendrao has determined that the long run average dividends for the firm have been Rs 2 per share. He expects a similar pattern to prevail in the future. Given the volatility of Central's dividends, Mahendrao has decided that a minimum rate of 20 per cent should be earned on this share. What price would Mahendrao be willing to pay for Central's shares?

SOLUTION

$$P_0 = \frac{\text{Rs } 2}{20\%} = \text{Rs } 10$$

P.6.14 A company is contemplating an issue of new equity shares. The firm's equity shares are currently selling at Rs 125 a share. The historical pattern of dividend payments per share, for the last 5 years is given below:

Year	*Dividend*
1	Rs 10.70
2	11.45
3	12.25
4	13.11
5	14.03

The flotation costs are expected to be 3 per cent of the current selling price of the shares. You are required to determine the following:

(a) growth rate in dividends;
(b) cost of equity capital, assuming growth rate determined under situation (i) continues for ever;
(c) cost of new equity shares.

SOLUTION

(a) *Growth rate in dividends* $= D_0(1 + r)^n \quad = D_n = \text{Rs } 10.70(1 + r)^4 = \text{Rs } 14.03$

$$(1 + r)^4 = \frac{\text{Rs } 14.03}{\text{Rs } 10.70} = 1.311$$

Table A-1 (Sum of Re 1) suggests that Re 1 compounds to Rs 1.311 in 4 years at the compound rate of 7 per cent. Therefore, growth rate in dividends is 7 per cent.

(b) $$\textit{Cost of equity shares} = \frac{\text{Rs } 14.03(1.07)}{\text{Rs } 125} + 0.07 = 19 \text{ per cent}$$

(c) $$\textit{Cost of new equity shares} = \frac{D_1}{P_0\,(1 - f)} + g = \frac{\text{Rs } 15.01}{\text{Rs } 125(1 - 0.03)} + 7\% = 19.4 \text{ per cent}$$

P.6.15 The shares of a chemical company are selling at Rs 20 per share. The firm had paid dividend @ Rs 2 per share last year. The estimated growth of the company is approximately 5 per cent per year.

(a) Determine the cost of equity capital of the company.
(b) Determine the estimated market price of the equity shares if the anticipated growth rate of the firm (i) rises to 8 per cent, and (ii) falls to 3 per cent.

SOLUTION

(a) $k_e = (D_1/P_o) + g$ = (Rs 2.10/Rs 20) + 0.05 = 15.5 per cent
(b) (i) $P_0 = D/(k_e - g)$ = Rs 2.16/0.075 = Rs 28.80
(ii) P_0 = Rs 1.94/0.125 = Rs 15.52

P.6.16 An investor has invested in a comapny which is growing at an above average rate, translated to an annual increase in dividends of 20 per cent for 15 yeaRs Thereafter, dividend growth returns to an average rate of 7 per cent. The capitalisation rate of the company is 9 per cent and the current dividend per equity share is Re 1 per share. Determine the value of the equity shares.

SOLUTION

The value of the equity shares will be the sum of: (i) *PV* of divdiend payments during 1-15 years and (ii) *PV* of expected market price at the end of the fifteenth year, based on a constant growth of 7 per cent.
Present value of dividends, years 1-15

Years	*Dividend*	*PVIF (0.09)*	*Total PV*
1	Rs 1.20	0.917	Rs 1.100
2	1.44	0.842	1.212
3	1.728	0.772	1.334
4	2.074	0.708	1.468
5	2.488	0.650	1.617
6	2.986	0.596	1.780
7	3.583	0.547	1.960
8	4.300	0.502	2.159
9	5.160	0.460	2.374
10	6.192	0.422	2.613
11	7.430	0.388	2.883
12	8.916	0.356	3.174
13	10.700	0.326	3.488
14	12.839	0.299	3.839
15	15.407	0.275	4.237
			35.238

$$P_{15} = D_{16}/(k_e - g) = \frac{\text{Rs } 15.407\ (1.07)}{9\% - 7\%} = \text{Rs } 824.25$$

PV of Rs 824.25 at $t = 0$ = Rs 824.25 × 0.275 = Rs 226.67
Value of equity shars = Rs 35.24 + Rs 226.67 = Rs 261.91.

P.6.17 Z Ltd is foreseeing a growth rate of 12 per cent per annum in the next 2 yeaRs The growth rate is likely to fall to 10 per cent for the third year and the fourth year. After that, the growth rate is expected to stabilise at 8 per cent per annum. If the last dividend was Rs 1.50 per share and the investors' required rate of return is 16 per cent, find out the intrinsic value per share of Z Ltd as of date.

SOLUTION

Intrinsic value of *Z* Ltd = the sum of: (i) *PV* of dividends payments during 1-4 years and (ii) *PV* of expected market price at the end of the fourth year based on a constant growth of 8 per cent.

Present value of dividends, year 1-4

Years	*Dividend*	*PVIF (0.16)*	*Total* PV
1	Rs 1.68	0.862	Rs 1.45
2	1.88	0.743	1.40
3	2.07	0.641	1.33
4	2.28	0.552	1.26
			5.44

$$P_4 = D_5/(k_e - g) = \frac{\text{Rs } 2.28\,(1.08)}{16\% - 8\%} = \text{Rs } 30.78$$

PV of Rs 30.78 = Rs 30.78 × 0.552 = Rs 16.99

Intrinsic value of share = Rs 5.44 + Rs 16.99 = Rs 22.43

P.6.18 A company has on its books the following amounts and specific costs of each type of capital.

Type of capital	*Book value*	*Market value*	*Specific costs (%)*
Debt	Rs 4,00,000	Rs 3,80,000	5
Preference	1,00,000	1,10,000	8
Equity	6,00,000		15
Retained earnings	2,00,000	12,00,000	13
	13,00,000	16,90,000	

Determine the weighted average cost of capital using (a) Book value weights and, (b) Market value weights. How are they different? Can you think of a situation where the weighted average cost of capital would be the same using either of the weights?

SOLUTION

(a) Determination of the weighted average cost of capital using book value weights:

Source of capital	*Amount of book value (*BV*)*	*Specific cost (%)*	*Total costs* BV *(×)* k
Debt	Rs 4,00,000	5	Rs 20,000
Preference	1,00,000	8	8,000
Equity	6,00,000	15	90,000
Retained earnings	2,00,000	13	26,000
	13,00,000		1,44,000

$$k_0 = \frac{\text{Total cost (Rs 1,44,000)}}{\text{Total amount of capital (Rs 13,00,000)}} \times 100 = 11.1 \text{ per cent}$$

(b) Determination of the weighted average cost of capital using market value weights:

Source of capital	*Market value (*MV*)*	*Specific cost (%)*	*Total costs* MV *(×)* k
Debt	Rs 3,80,000	5	Rs 19,000
Preference	1,10,000	8	8,800
Equity	9,00,000 [a]	15	1,35,000
Retained earnings	3,00,000 [a]	13	39,000
	16,90,000		2,01,800

$$k_0 = \frac{\text{Rs } 2,01,800}{\text{Rs } 16,90,000} \times 100 = 11.9 \text{ per cent}$$

[a]The total market value of equity shares and retained earnings is apportioned three-fourths and one-four respectively on the basis of their book values.

The k_0 based upon market value is greater than k_0 based upon book value because the market value of equity funds is considerably larger than their book value and since these sources of long-term funds have higher specific costs, the overall cost of capital increases.

The weighted average cost of capital would be the same with both the book value weights and market value weights when there is no difference between the book value and the market value of securities used in raising the capital.

P.6.19 Aries Limited wishes to raise additional finance of Rs 10 lakh for meeting its investment plans. It has Rs 2,10,000 in the form of retained earnings available for investment purposes. The following are the further details:

1. Debt-equity mix, 30:70
2. Cost of debt: Upto Rs 1,80,000, 10 per cent (before tax); Beyond Rs 1,80,000, 16 per cent (before tax)
3. Earnings per share, Rs 4
4. Dividend payout, 50 per cent of earnings
5. Expected growth rate in dividend, 10 per cent
6. Current market price per share, Rs 44
7. Tax rate, 35 per cent

You are required:

(a) To determine the pattern for raising the additional finance, assuming the firm intends to maintain existing debt/equity mix.
(b) To determine the post-tax average cost of additional debt.
(c) To determine the cost of retained earnings and cost of equity.
(d) Compute the overall weighted average after tax cost of additional finance.

SOLUTION

(a) Pattern for raising additional finance:
Debt = 0.30 × Rs 10 lakh = Rs 3 lakh,
Equity = 0.70 × Rs 10 lakh = Rs 7 lakh
In specific terms:
Equity funds (Rs 7,00,000):

Retained earnings	Rs 2,10,000	
Equity share capital (additional)	4,90,000	Rs 7,00,000
Debt funds (Rs 3,00,000)		
10% Debt	1,80,000	
16% Debt	1,20,000	3,00,000
		10,00,000

(b) k_d = Total interest $(1 - t)$/Rs 3,00,000 = Rs 18,000 + Rs 19,200 = Rs 37,200 (1 – 0.35)/Rs 3,00,000 = 8.1 per cent

(c) (i) $k_e = \frac{D_t}{P_0} + g, \frac{\text{Rs } 4(50\%) + 10\%}{\text{Rs } 44} + 10\% = 15$ per cent

(ii) $k_r = k_e = 15$ per cent

(d) Overall cost of capital (k_0) of additional finance

Source	*Amount*	*After-tax cost*	*Total cost*
Equity share capital	Rs 4,90,000	0.15	Rs 73,500
Retained earnings	2,10,000	0.15	31,500
Debt	3,00,000	0.081	24,180
			1,29,180

k_0 = Rs 1,29,180/Rs 10,00,000 = 12.92 per cent

P.6.20 ZED Limited is presently financed entirely by equity shares. The current market vlaue is Rs 6,00,000. A dividend totalling Rs 1,20,000 has just been paid. This level of dividend is expected to be paid indefinitely. The

company is thinking of investing in a new project involving an outlay of Rs 5,00,000 now which is expected to generate net cash receipts of Rs 1,05,000 per annum indefinitely. The project would be financed by issuing Rs 5,00,000 debentures at the market rate of 18 per cent.

Ignoring tax consideration:

(a) Calculate the value of equity shares and the gain made by the shareholders if the cost of equity rises to 21.6 per cent.

(b) Prove that the weighted average cost of capital is not affected by gearing.

SOLUTION

(a) Value of equity shares

Net cash inflows	Rs 1,05,000
Less interest (0.18 × Rs 5,00,000)	90,000
Surplus available as dividend for equity holders	15,000
Existing dividend	1,20,000
Enhanced dividend	1,35,000
Cost of equity	21.6%
Value of equity (Rs 1,35,000/21.6%) = Rs 6,25,000	
Gain to shareholders (Rs 6,25,000 – Rs 6,00,000) = Rs 25,000	
Value of equity (Rs 1,35,000/0.216)	6,25,000
Gain to shareholders (Rs 6,25,000 – Rs 6,00,000)	25,000

(b) Current overall cost of capital (consisting of equity) = 20 per cent (Rs 1,20,000 ÷ Rs 6,00,000)

Overall cost of capital after issue of debentures

Source	*Amount*	*Cost*	*Total cost*
Equity share capital	Rs 6,25,000	0.216	Rs 1,35,000
Debentures	5,00,000	0.18	90,000
	11,25,000		2,25,000

k_0 = Rs 2,25,000/Rs 11,25,000 = 20 per cent

It is apparent that gearing does not affect overall cost of capital as k_0 before and after the issue of debt is the same (20 per cent).

P.6.21 A fast growing foreign company wants to expand its total assets by 50 per cent by the end of the current year. Given below are the company's capital structure which it considers to be optimal. There are no short-term debts.

8% Debentures	Rs 4,00,000
9% Preference shares	1,00,000
Equity shares	5,00,000
	10,00,000

New debentures would be sold at 14 per cent coupon rate and will be sold at par. Preference shares will have a 15 per cent rate and will also be sold at par. Equity shares currently selling at Rs 100 can be sold to net the company Rs 95. The shareholders' required rate of return is to be 17 per cent consisting of a dividend yield of 10 per cent and an expected growth rate of 7 per cent. Retained earnings for the year are estimated to be Rs 50,000 (ignore depreciation). The corporate tax is 35 per cent. You are required to calculate the following values:

(a) Assuming all asset expansion (gross expenditure for fixed assets plus related working capital) is included in the capital budget, what is the required amount of capital budget?

(b) How much of the capital budget must be financed by external equity (that is, issue of new equity shares) to maintain the optimal capital structure?

(c) Calculate the cost of (i) new issues of equity shares and (ii) retained earnings.

(d) Calculate the weighted average cost of capital using marginal weights.

SOLUTION

(a)	(i) Desired level of asset at the end of year	Rs 15,00,000
	(ii) Present level of assets	10,00,000
	Required amount of capital budget (a) – (b)	5,00,000

(b) The optimal capital structure of the company requires financing of capital budget in the following proportions: Debts, 40 per cent, preference shares, 10 per cent and equity funds, 50 per cent. In order to maintain the proportion of equity funds at the level of 50 per cent, Rs 2,50,000 (50 per cent of Rs 5,00,000 additional capital budget) should be financed by equity funds. Internal equity funds (retained earnings) of the company are estimated at Rs 50,000. Therefore, Rs 2,00,000 is required to be financed through external equity by issuing new shares.

(c) (i) Cost of new equity shares, $k_e = \frac{0.10}{\text{Rs } 95} + 0.07 = 17.5$ per cent

(ii) Cost of retained earnings, $k_r = \frac{10}{\text{Rs } 100} + 0.07 = 17$ per cent

(d) Weighted average cost of capital using marginal weights:
(i) Cost of debt (k_d) = 14% (1 – 0.35) = 9.1 per cent
(ii) Cost of preference shares would be 15 per cent as they will be sold at par and no flotation costs are to be incurred.

Source of capital	*Amount (A)*	*Specific cost (k) (%)*	*Total costs [A (×) k]*
Debt	Rs 2,00,000	9.1	Rs 18,200
Preference shares	50,000	15	7,500
Equity	2,00,000	17.5	35,000
Retained earnings	50,000	17	8,500
	5,00,000		69,200

$$k_0 = \frac{\text{Rs } 69,200}{\text{Rs } 5,00,000} \times 100 = 13.84 \text{ per cent}$$

P.6.22 As a financial analyst of a large electronics company, you are required to determine the weighted average cost of capital of the company using (a) book value weights and (b) market value weights. The following information is available for your perusal.

The company's present book value capital structure is:

Debentures (Rs 100 per debenture)	Rs 8,00,000
Preference shares (Rs 100 per share)	2,00,000
Equity shares (Rs 10 per share)	10,00,000
	20,00,000

All these securities are traded in the capital markets. Recent prices are:

Debentures, Rs 110 per debenture
Preference shares, Rs 120 per share
Equity shares, Rs 22 per share

Anticipated external financing opportunities are:

(i) Rs 100 per debenture redeemable at par; 10 year maturity, 13 per cent coupon rate, 4 per cent flotation costs, sale price, Rs 100.
(ii) Rs 100 preference share redeemable at par; 10 year maturity, 14 per cent dividend rate, 5 per cent flotation costs, sale price, Rs 100.
(iii) Equity shares: Rs 2 per share flotation costs, sale price = Rs 22.

In addition , the dividend expected on the equity share at the end of the year is Rs 2 per share; the anticipated growth rate in dividends is 7 per cent and the firm has the practice of paying all its earnings in the form of dividends. The corporate tax rate is 35 per cent.

SOLUTION

Determination of specific costs:

(i) Cost of debt, $(k_d) = \dfrac{I(1-t)+(f \div N_m)}{(RV+SV) \div 2} = \dfrac{\text{Rs } 13\,(0.35)+(\text{Rs } 4 \div 10)}{(\text{Rs } 100+\text{Rs } 96) \div 2} \times 100 = 9 \text{ per cent}$

(ii) Cost of preference shares $(k_p) = \dfrac{D+(f \div N_m)}{(RV+SV) \div 2} = \dfrac{\text{Rs } 14+(\text{Rs } 5 \div 10)}{(\text{Rs } 100+\text{Rs } 95) \div 2} \times 100 = 14.9 \text{ per cent}$

(iii) Cost of equity shares $(k_e) = \dfrac{D_1}{P_0\,(1-f)} + g = \dfrac{\text{Rs } 2}{\text{Rs } 20} + 0.07 = 17 \text{ per cent}$

Using these specific costs we can calculate the book value and market value weights as follows:

(a) k_0 *based on book value weights*

Source of capital	*Book value (*BV*)*	*Specific cost (*k*) (%)*	*Total costs* BV *(×)* k
Debentures	Rs 8,00,000	9.0	Rs 72,000
Preference shares	2,00,000	14.9	29,800
Equity shares	10,00,000	17.0	1,70,000
	20,00,000		2,71,800

$$k_0 = \frac{\text{Rs } 2,71,800}{\text{Rs } 20,00,000} \times 100 = 13.59 \text{ per cent}$$

(b) k_0 *based on market value weights*

Source of capital	*Market value (*MV*)*	*Specific cost (*k*) (%)*	*Total costs* MV *(×)* k
Debentures	Rs 8,80,000	9.0	Rs 79,200
Preference shares	2,40,000	14.9	35,760
Equity shares	22,00,000	17.0	3,74,000
Total capital	33,20,000		4,88,960

$$k_0 = \frac{\text{Rs } 4,88,960}{\text{Rs } 33,20,000} \times 100 = 14.73 \text{ per cent}$$

P.6.23 The following is the capital structure of Simons company Ltd. as on 31st March, current year

Equity share: 10,000 shares (of Rs 100 each)	Rs 10,00,000
10 % Preference shares (of Rs 100 each)	4,00,000
12 % Debentures	6,00,000
	20,00,000

The market price of the company's share is Rs 110 and it is expected that a dividend of Rs 10 per share would be declared at the end of the current year. The dividend growth rate is 6 per cent.

(i) If the company is in the 50 per cent tax bracket, compute the weighted average cost of capital.

(ii) Assuming that in order to finance an expansion plan, the company intends to borrow a fund of Rs 10 lakh bearing 14 per cent rate of interest, what will be the company's revised weighted average cost of capital? This financing decision is expected to increase dividend from Rs 10 to Rs 12 per share. However, the market price of equity share is expected to decline from Rs 110 to Rs 105 per share.

SOLUTION

(i) *Statement showing determination of weighted average cost of capital, k_0 (market value weights)*

Source	*Amount*	*After-tax cost (in %)*	*Total Cost*
Equity	Rs 11,00,000	15.09%[1]	Rs 1,65,990
10% Preference shares	4,00,000	10.00	40,000
12% Debentures	6,00,000	6.00[2]	36,000
	21,00,000		2,41,990

K_0 = Rs.2,41,990/Rs 21,00,000 = 11.52 per cent

Statement showing determination of Ko (book-value weights)

Source	*Amount*	*After-tax cost (in %)*	*Total Cost*
Equity	Rs 10,00,000	15.09%	Rs 1,50,900
Preference shares	4,00,000	10.00	40,000
Debentures	6,00,000	6.00	36,000
	20,00,000		2,26,900

K_0 = Rs.2,26,900 / Rs 20,00,000 = 11.35 per cent

Note: Conceptually, market value weights are preferred.

(ii) *Statement showing revised Ko (book value as well as market value weights)*

Source	*Amount*		*After-tax cost (%)*	*Total cost*	
	Book value	*Market value*		*Book value*	*Market value*
Equity	Rs 10,00,000	10,50,000	17.43[3]	Rs 1,74,300	1,83,015
10% Preference shares	4,00,000	4,00,000	10.00	40,000	40,000
12% Debentures	6,00,000	6,00,000	6.00	36,000	36,000
14% Loan	10,00,000	10,00,000	7.00[4]	70,000	70,000
	30,00,000	30,50,000		3,20,300	3,29,015

Ko (market value weights) = Rs 3,29,015/Rs 30,50,000 = 10.79 per cent
Ko (book value weights) = Rs 3,20,300/Rs 30,00,000 = 10.68 per cent

1. K_e = (Rs 10/Rs 110) + 6% = 15.09 per cent
2. K_d = 12% (1 – 0.5) = 6 per cent
3. Ke (revised) = (Rs 12/ Rs 105) + 6% = 17.43 per cent
4. Cost of loan = 14% (1 – 0.5) = 7 per cent

It is assumed that the market values and book values of preference shares and debentures are equal.

P.6.24(a) XYZ Ltd., has the following book value capital structure:

Equity capital (in shares of Rs 10 each, fully paid up–at par)	Rs 15	crore
11% Preference capital (in shares of Rs 100 each, fully paid up–at par)	1	
Retained earnings	20	
13.5% Debentures (of Rs.100 each)	10	
15% Term loans	12.5	

The next expected dividend on equity shares per share is Rs 3.60; the dividend per share is expected to grow at the rate of 7 per cent. The market price per share is Rs 40.

Preference stock, redeemable after ten years, is currently selling at Rs 75 per share.

Debentures, redeemable after six years, are selling at Rs 80 per debenture.

The Income-tax rate for the company is 40 per cent.

(i) Required:

Calculate the weighted average cost of capital using:

(a) Book value proportions; and

(b) Market value proportions.

SOLUTION

(a) *Statement Showing Determination of Ko (using Book Value Proportions)*

Source of finance	*Amount*	*Proportion*	*After-tax cost (%)*	*Total cost (%)*
Equity capital	Rs 15,00,00,000	0.256	16%[1]	4.096
11% Preference capital	1,00,00,000	0.017	15.43[2]	0.262
Retained earnings	20,00,00,000	0.342	16[3]	5.472
13.5% Debentures	10,00,00,000	0.171	12.7[4]	2.172
15% Term loans	12,50,00,000	0.214	9.0[5]	1.926
	58,50,00,000			13.928
Overall cost of capital is 13.93 per cent approximately				

1. Ke = (Rs 3.60/Rs 40) + 7% = 16 per cent

2. $\text{Kp} = \left(D_p + \frac{RV - MV}{N}\right) \Big/ (RV + MV) \div 2 = \left(\text{Rs}\,11 + \frac{\text{Rs}\,100 - 75}{10 \text{ years}}\right) / \text{Rs}\,87.5 = 15.43$ per cent

3. Cost of retained earnings is equal to Ke

4. $\text{K}_\text{d} = \left(I(1-t) + \frac{RV - MV}{N}\right) \Big/ (RV + MV) \div 2$

$= \left(\text{Rs}\,13.5(1 - 0.4) + \frac{Rs\ 20}{6}\right) \Big/ \text{Rs}\,90$ = (Rs 8.1 + Rs 3.33)/ Rs 90 = 12.7 per cent

5. Cost of term-loan = 15% (1 – 0.4) = 9 per cent

(b) Statement showing determination of Ko (using market value proportions) (amount in Rs crore)

Source of finance	*Amount*	*Proportion*	*After-tax cost (%)*	*Total cost (%)*
Equity capital	Rs 25.71	0.316	16%	5.056
11% Preference capital	0.75	0.009	15.43	0.139
Retained earnings	34.29	0.422	16.0	6.752
13.5% Debentures	8.00	0.098	12.7	1.245
15% Term loans	12.50	0.154	9.0	1.386
	81.25			14.578
Overall cost of capital is 14.58 per cent approximately				

Note: The total market value of equity shares Rs 60 crore (1.5 crore shares x Rs 40) is apportioned between equity capital and retained earnings in the ratio of 15 : 20 based on their book values.

P.6.24(b) Determine the weighted marginal cost of capital schedule for the above company, if it raises Rs 10 crore next year, given the following information:

(a) The amount will be raised by equity and debt in equal proportions;

(b) The company expects to retain Rs 1.5 crore earnings next year;

(c) The additional issue of equity shares will result in the net price per share being fixed at Rs 32;

(d) The debt capital raised by way of term loans will cost 15 per cent for the first Rs 2.5 crore and 16 per cent for the next Rs 2.5 crore.

SOLUTION

Statement showing weighted marginal cost of capital of Rs 10 crore funds

Source of finance	*Weight*	*After-tax cost (%)*	*Total cost (%)*
Equity:			
Retained earnings	0.15[1]	16.0%[2]	2.4%
Equity share capital	0.35[3]	18.25[4]	6.39
Debt:			
15% Loan	0.25	9.00[5]	2.25
16% Loan	0.25	9.60[6]	2.40
			13.44
Weighted marginal cost of capital 13.44 per cent			

1. Rs 1.5 crore/Rs 10 crore = 0.15
2. Cost of retained earnings is equivalent to existing cost of equity.
3. Rs 3.5 crore external equity share capital to be raised/ Rs 10 crore total funds = 0.35
4. Ke = (Rs 3.60/Rs 32) + 7% = 18.25 per cent
5. Cost of 15% Loan = 15% (1 – 0.4) = 9 per cent
6. Cost of 16% Loan = 16% (1 – 0.4) = 9.6 per cent

REVIEW QUESTIONS

RQ.6.1 Discuss how the cost of capital enters into the process of evaluating capital budgeting proposals? Particularly, how is it related to the various discounted cash flow techniques for determining a project's acceptability?

RQ.6.2 What is financial risk? Is it necessary to assume that firm's financial structure remains unchanged when evaluating the firm's cost of capital? Why is this assumption impractical?

RQ.6.3 Explain why:

(a) Debt is usually considered the cheapest source of financing available to the firm.
(b) The cost of preference shares is less than the cost of equity.
(c) The cost of retained earnings is less than the cost of new equity.
(d) The cost of equity and retained earnings is not zero.
(e) The cost of capital is dependent only on the cost of long-term funds.
(f) The cost of capital is a hurdle for new investment projects.
(g) The cost of capital is most appropriately measured on an after-tax basis.

RQ.6.4 Explain the problems faced in determining the cost of capital. How is the cost of capital relevant in capital budgeting decisions?

RQ.6.5 Examine critically the different approaches to the calculation of cost of equity capital.

RQ.6.6 Explain the CAPM approach for computing the cost of equity. Discuss the merits and demerits of the approach.

RQ.6.7 The determination of any explicit cost of capital requires two things: (i) the net proceeds the firm will receive from the particular capital source and (ii) the expected future payments the firm will make to the investors In spite of the similarity of estimation problems, it is recognised that the cost of equity (both internal and external) is the most difficult cost to estimate. Briefly explain why this is so.

RQ.6.8 State briefly the assumptions on which the Gordon (valuation) Model for the cost of equity is based. What does each component of the equation represent?

RQ.6.9 Discuss the approach to determine the cost of retained earnings. Also explain the rationale behind treating retained earnings as a fully subscribed issue of equity shares.

RQ.6.10 Other things being equal, explain how the following events would affect the company's weighted average cost of capital:

(a) The corporate income tax rate is increased/ decreased.
(b) The company has started making substantial new investments in assets that are considerably riskier than the company's presently owned assets.
(c) The company begins to make use of substantial amounts of debt to finance its new projects.
(d) The company has repaid its long-term debts.
(e) Flotation costs of issuing new securities increase/ decrease.

RQ.6.11 What is the weighted average cost of capital? Examine the rationale behind the use of weighted average cost of capital.

RQ.6.12 The weighted average cost of capital (k_0) may be determined using 'book' or 'market' weights. Compare the pros and cons of using market value weights rather than book value weights in calculating the value of k_0.

RQ.6.13 Compare the advantages and disadvantages of using marginal as opposed to historical weights for calculating the weighted average cost of capital. Which of the weights are more consistent with the company's goal of wealth maximisation?

RQ.6.14 ABC Ltd had sold Rs 1,000, 12% Debentures 10 years ago. Interest rates have risen since then, so that debentures of this company are now selling at 15 per cent yield basis.

(i) Determine the current indicated and expected market price of the debentures. Would you buy the debentures for Rs 700?
(ii) Assume that the debentures of the company are selling at Rs 825 and have 8 years to run to maturity, compute the approximate effective yield an investor would earn on his investment?

SOLUTION

(i) Current expected market price of debenture (V_d) = Interest on debenture/Current interest rate = Rs 120/0.15 = Rs 800.
Yes, I would buy the debenture for Rs 700.

(ii) $$\text{Rs } 825 = \sum_{t=1}^{8} \frac{\text{Rs } 120}{(1+K_d)^t} + \frac{\text{Rs } 1{,}000}{(1+K_d)^8}$$

Using trial and error approach and discount rates of 15 and 16 per cent:

Years	*Cash flow*	*PV factor at*		*Total PV at*	
		0.15	*0.16*	*0.15*	*0.16*
1-8	Rs 120	4.487	4.344	Rs 538.44	Rs 521.28
8	1,000	0.327	0.305	327.00	305.00
				865.44	826.28

K_d = 0.16. Thus, an investor would earn an effective yield of 16 per cent.

RQ.6.15 The Fincon Ltd is planning an equity issue in the current year. It has an earning per share (EPS) of Rs 25 and proposes to pay a dividend of Rs 15 per share at the current year-end. With a P/E ratio of 8, it wants to offer the issue at market price. The flotation cost is expected to be 10 per cent of the issue price.

Determine the required rate of return for equity shares (cost of equity) before issue and after the issue.

SOLUTION

(A) *Cost of equity (before issue)*:

K_e = Reciprocal of P/E ratio = 1/8 or 12.5 per cent

Alternatively, $K_e = D_1/P_0 + g$, $g = br$ = (EPS – DPS)/P_0, P_0 = EPS × P/E ratio

P_0 = Rs 25 × 8 = Rs 200

g = (Rs 25 – Rs 15)/Rs 200 = 5 per cent

K_e = (Rs 15/Rs 200) + 0.05 = 12.5 per cent

(B) *Cost of new equity (after issue)*:

$D_1/P_0(1 - f) + g$, g = (EPS – DPS)/$P_0(1 - f)$ or g = Rs 10/ Rs 180 = 5.6 per cent

K_e = (Rs 15/Rs 180) + 0.056 = 13.9 per cent.

RQ.6.16 Assuming the corporate tax rate of 35 per cent, compute the after tax cost of capital in the following situations:

(i) Perpetual 15% Debentures of Rs 1,000, sold at a premium of 10 per cent with no flotation costs.

(ii) 10-year 14% Debentures of Rs 2,000, redeemable at par, with 5 per cent flotation costs.

(iii) 10-year 14% Preference shares of Rs 100, redeemable at premium of 5 per cent with 5 per cent flotation costs. Dividend tax is 10 per cent.

(iv) An equity share selling at Rs 50 and paying a dividend of Rs 6 per share, which is expected to continue indefinitely.

(v) The above equity share if dividends are expected to grow at the rate of 5 per cent.

(vi) An equity share of a company is selling at Rs 120 per share. The earnings per share is Rs 20 of which 50 per cent is paid in dividends. The shareholders expect the company to earn a constant after tax rate of 10 per cent on its investment of retained earnings.

SOLUTION

(i) K_d = [Interest (I)/Sale value of debentures] $(1 - t)$ = [Rs 150/Rs 1,100] (1 – 0.35) = 8.9 per cent.

(ii) K_d = [I$(1 - t)$ + $(RV - SV)/N_m$] ÷ $(RV + SV)/2$ = [Rs 280 (0.65) + (Rs 2,000 – Rs 1,900)/10] ÷ Rs 1,950
= 9.85 per cent.

(iii) $K_p = D_p(1 + D_t) + (RV - SV)/N_m \div (RV + SV)/2$ = [Rs 14 (1 + 0.1) + (Rs 105 – Rs 95)/10] × 100
= 16.4 per cent

(iv) $K_e = D_t/P$ = Rs 6/50 = 12 per cent

(v) $K_e = 0.12 + g = 0.12 + 0.05\%$ = 17 per cent

(vi) $K_e = [E(1 - b)/P_0] + br$ = [(Rs 20 (1 – 0.5)/Rs 120)] + 0.5 × 0.1 = 13.33 per cent.

RQ.6.17 The following facts relate to Hypothetical Ltd:

(i) Risk-free interest in the market is 10 per cent.

(ii) The firm's beta coefficient, b, is 1.5.

Determine the cost of equity capital using the capital asset pricing model, assuming an expected return on the market of 14 per cent for next year. What would be the K_e, if the b (a) rises to 2, (b) falls to 1.

SOLUTION

When b is 1.50, $K_e = R_f + b(K_m - R_f)$ = 0.10 + 1.5 (0.14 – 0.10) = 16 per cent.

K_e When b = 2, = 0.10 + 2 (0.14 – 0.10) = 18 per cent.

K_e When b = 1, = 0.10 + 1 (0.14 – 0.10) = 14 per cent.

RQ.6.18 A financial consultant of Hypothetical Ltd recommends that the firm should estimate its cost of equity capital by applying the capital asset pricing model rather than the dividend yield plus growth model. He has assembled the following facts:

(i) Systematic risk of the firm is 1.4.

(ii) 182-days treasury bills currently yield, 8 per cent.

(iii) Expected yield on the market portfolio of assets is 13 per cent.

Determine the cost of equity capital based on the above data

SOLUTION

$$K_e = R_f + b(K_m - R_f) = 0.08 + 1.4(0.13 - 0.08) = 15 \text{ per cent.}$$

Note: Yield on treasury bills is taken as a proxy for risk-free required rate of return.

RQ.6.19 The shares of Century Textile Ltd are selling at Rs 20 per share. It had paid Rs 2 per share dividend last year. The estimated growth of the company is approximately 5 per cent per year.

(i) Determine the cost of equity capital of the company.
(ii) Determine the estimated market price of the equity shares if the anticipated growth rate (a) rises to 8 per cent, and (b) falls to 3 per cent. Ignore dividend tax.
(iii) Determine the market price of the shares, assuming the growth rate of 20 per cent. Are you satisfied with your calculations?

SOLUTION

(i) $K_e = (D_1/P_0) + g$ = (Rs 2.10/Rs 20) + 0.05 = 15.5 per cent.
(ii) (a) Rs 2.16/0.155 – 0.08 = Rs 28.80
(b) Rs 2.06/0.155 – 0.03 = Rs 16.48
(iii) P_0 = Rs 2.40/0.155 – 0.20 = – Rs 53.33

In situation (iii), the formula does not give the correct results as it is developed on the assumption that $K_e > g$ while in the present situation, $g > K_e$.

RQ.6.20 Hypothetical Ltd is planning to raise Rs 20,00,000 additional long-term funds to finance its additional capital budget of the current year. The debentures of the company are to be sold on a 14 per cent net yield basis to the company, and equity shares to be sold at Rs 50 per share net to the company, are the alternatives being considered by the company. It expects to pay dividend of Rs 5 per share at the end of coming year. The expansion is expected to carry the company to a new, higher risk class. The required rate of return expected from the point of view of the investment community is 16 per cent.

(i) Determine the growth rate of the company which the market is anticipating.
(ii) On the basis of 8 per cent growth, at what price should the equity share be sold by the company? Ignore dividend tax.
(iii) Assuming that the management is anticipating growth rate of only 4 per cent per year, what form of financing would you recommend?

SOLUTION

(i) K_e = 0.16 = (Rs 5/Rs 50) + g, 0.16 = 0.10 + g or g = 0.16 – 0.10 = 6 per cent
(ii) $P_0 = D_1/(K_e - g)$ = Rs 5/(0.16 – 0.08) = Rs 62.50
(iii) P_0 = Rs 5/(0.16 – 0.04) = Rs 41.67

We shall recommend to the company debt financing as the equity financing alternative would depress the market value of shares of the company.

RQ.6.21 The Chemicals and Fertilisers Ltd has been growing at a rate of 18 per cent per year in recent years. This abnormal growth rate is expected to continue for another 4 years; then, it is likely to grow at the normal rate (g_n) of 6 per cent . The required rate of return on the shares by the investment community is 12 per cent, and the dividend paid per share last year was Rs 3 (D_0 = Rs 3). At what price, would you, as an investor, be ready to buy the shares of this company now (t = 0), and at the end of years 1, 2, 3 and 4, respectively? Will there be any extra advantage by buying at t = 0, or in any of the subsequent four years, assuming all other things remain unchanged?

SOLUTION

Year	$D_0(1 + g)^t - D_t$	*PV factor (0.12)*	*Total PV*
1	Rs $3(1 + 0.18)^1$ = Rs 3.54	0.893	Rs 3.161
2	$3(1 + 0.18)^2$ = 4.176	0.797	3.328
3	$3(1 + 0.18)^3$ = 4.929	0.712	3.509
4	$3(1 + 0.18)^4$ = 5.817	0.636	3.7
Total PV of dividends			13.7

$P_4 = D_5/(K_e - g) = D_4(1 + g_n)/0.06$ = Rs 5.817(1.06)/0.06 = Rs 102.76.

PV of Rs 102.76 would be Rs 102.76 × 0.636 (*PV* factor at 0.12 for four years) = Rs 65.36

P_0 = Rs 65.36 + Rs 13.7 = Rs 79

I, as an investor, would be prepared to buy the shares of this company at a price less than Rs 79 at $t = 0$.

Price of share at year-end 1, $P_1 = PVD_2 + PVD_3 + PVD_4 + PVP_4$

Year	*Dividends*	*PV factor (0.12)*	*Total PV*
2	D_2 = Rs 4.176	0.893	Rs 3.729
3	D_3 = 4.929	0.797	3.928
4	D_4 = 5.817	0.712	4.142
Total PV of dividends			11.80

PV of share at the end of year 1 would be: Rs 102.76 × 0.712 (PV factor for 3 years) = Rs 73.17.

P_1= Rs 11.80 + Rs 73.17 = Rs 84.97

Price of share at year-end 2, $P_2 = PVD_3 + PVD_4 + PVP_4$:

Year	*Dividends*	*PV factor (0.12)*	*Total PV*
3	D_3 = Rs 4.929	0.893	Rs 4.402
4	D_4 = 5.817	0.797	4.636
Total PV of dividends			9.04

PV of share at the end of year 2 would be = Rs 102.76 × 0.797 (PV factor for 2 years) = Rs 81.90.

P_2 = Rs 81.90 + Rs 9.04 = 90.94

Price of share at year-end 3 $P_3 = PVD_4 + PVP_4$:

Year	*Cash flows*	*PV factor (0.12)*	*Total PV*
3	D_4 = Rs 5.817	0.893	Rs 5.195
4	P_4 = 102.76	0.893	91.764
	P_3 =		96.96
	P_4 =		102.76

There will be no extra advantage by buying shares in any of the subsequent 4 years.

RQ.6.22 An investor has invested in Fast Growth Ltd company which is growing at an above average rate, translated to an annual increase in dividends of 20 per cent for 10 years. Thereafter, dividend growth returns to an average rate of 6 per cent. The current dividend per equity share is Rs 10. Assuming no dividend tax and equity capitalisation rate of 15 per cent, determine the value of equity shares.

SOLUTION

The value of equity share will be the sum of (i) PV of dividend payment during 1 – 10 years and (ii) PV of expected market price at the end of the 10th year, based on growth of six per cent.

Present value of dividends, years 1 – 10

Years	*Dividend*	*PVIF (0.15)*	*Total PV*
1	Rs 12	0.870	Rs 10.44
2	14.4	0.756	10.88
3	17.28	0.658	11.37
4	20.74	0.572	11.86
5	24.88	0.497	12.37
6	29.86	0.432	12.90
7	35.83	0.376	13.47
8	43.00	0.327	14.06
9	51.60	0.284	14.65
10	61.92	0.247	15.29
			127.29

$P_{10} = D_{11}/(K_e - g)$ = [Rs 61.92(1.06)]/(0.15 – 0.06) = Rs 729.3

PV of Rs 729.3 at $t = 0$ = Rs 729.3 × 0.247 = Rs 180.13

Value of equity share = Rs 127.29 + Rs 180.13 = Rs 307.42.

RQ.6.23 The Well Established Ltd is contemplating a preference issue on the following terms:

Face value per share : Rs 100

Terms of maturity (years) : 8

Yearly coupon rate of dividend (%)

Year 1 – 2 : 12

3 – 5 : 14

6 – 8 : 16

The current market rate of dividend on similar preference shares is 17 per cent per annum. The company proposes to price the issue so as to yield a (compounded) return of 18 per cent per annum to attract the investors.

Determine the issue price. Assume redemption of preference share at a premium of 10 per cent on the face value.

SOLUTION

The issue price of preference share will be sum of (i) PV of preference dividend payments during 1 – 8 years and (ii) PV of maturity value of preference shares in the eighth year, the discount rate being 18 per cent.

Determination of issue price of preference share

Years	*Cash outflows*	*PVIF (0.18)*	*Total PV*
1	Rs 12	0.847	Rs 10.16
2	12	0.718	8.62
3	14	0.609	8.53
4	14	0.516	7.22
5	14	0.437	6.12
6	16	0.370	5.92
7	16	0.314	5.02
8	126*	0.266	33.52
Issue price			85.11

*Inclusive of Rs 110 maturity value of preference shares.

RQ.6.24 The CMD Ltd has the following specific cost of capital along with the indicated book and market value weights:

Type of capital	*Cost*	*Book value weights*	*Market value weights*
Equity 0.18	0.50	0.58	
Preference shares	0.15	0.20	0.17
Long-term debt	0.07	0.30	0.25
		1.00	1.00

(i) Calculate the weighted cost of capital, using book and market value weights.

(ii) Calculate the weighted average cost of capital, using marginal weights, if the company intends to raise the needed funds using 50 per cent long-term debt, 35 per cent preference shares and 15 per cent retained earnings.

SOLUTION

(i) *K_o based on book value (BV) weights and market value (MV) weights*

Sources of capital	*Weights*		*Cost*	*Total cost*	
	BV	*MV*		*(BV × K)*	*(MV × K)*
Equity funds	0.50	0.58	0.18	0.090	0.1044
Preference shares	0.20	0.17	0.15	0.030	0.0255
Long-term debt	0.30	0.25	0.07	0.021	0.0175
				0.141	0.1474

K_o based on BV weights—14.1 per cent.
K_o based on MV weights—14.7 per cent.

(ii) *K_o using marginal weights*

Sources of capital	*Weights (W)*	*Cost (K)*	*Total cost (W × K)*
Long-term debt	0.50	0.07	0.0350
Preference shares	0.35	0.15	0.0525
Retained earnings	0.15	0.18	0.0270
			0.1145

K_o = 11.45 per cent

RQ.6.25 From the following information, determine the appropriate weighted average cost of capital, relevant for evaluating long-term investment projects of the company.

Cost of equity	0.18
After tax cost of long-term debt	0.08
After tax cost of short-term debt	0.09

Sources of capital	*Book value (BV)*	*Market value (MV)*
Equity	Rs 5,00,000	Rs 7,50,000
Long-term debt	4,00,000	3,75,000
Short-term debt	1,00,000	1,00,000
	10,00,000	12,25,000

SOLUTION

Determination of weighted average cost of capital

Sources of capital	*Market value*	*Specific cost (K)*	*Total costs (MV × K)*
Equity	Rs 7,50,000	0.18	Rs 1,35,000
Long-term debt	3,75,000	0.08	30,000
	11,25,000		1,65,000

K_0 = (Rs 1,65,000/11,25,000) × 100 = 14.7 per cent.

RQ.6.26 From the following capital structure of XYZ Ltd, determine appropriate weighted average cost of capital.

Equity shares (1,00,000)	Rs 38,00,000
Preference shares	8,00,000
Debentures	50,00,000
Bank loan (long-term)	18,00,000
Bank loan (short-term)	14,00,000
Trade creditors	6,00,000

Additional information:

(i) Equity shares include the existing 60,000 shares having current market value of Rs 40 per share and the balance is net proceeds from the new issue in the current year (issue price of the share, Rs 40; flotation cost per share, Rs 5). The projected EPS and DPS for the current year are Rs 8 and Rs 5 respectively.
(ii) Dividend indicated on preference shares is 16 per cent.
(iii) Pre-tax cost of debentures—15.5 per cent.
(iv) Interest on bank loan—15 per cent (long-term) and14 per cent (short-term).
(v) Corporate tax: 35 per cent. Dividend tax: 10 per cent.
(vi) Market value of preference shares is Rs 8,50,000.

SOLUTION

Determination of cost of specific sources:

(i) *Equity (existing)*: g = [EPS – DPS $(1 + t)$]/P_0 = [Rs 8 – Rs 5(1 + 0.1)]/Rs 40 = 6.25 per cent.

$k_e = (D_1/P_0) + g$ = (Rs 5/40) + 0.0625 = 18.75 per cent.

Equity (new issue) = (Rs 5/35) + 0.0625 = 20.54 per cent.

(ii) *Cost of debentures* = 0.155 (1 – 0.35) = 10.1 per cent.

(iii) *Cost of bank loan* = 0.15 (1 – 0.35) = 9.75 per cent.

(iv) *Cost of preference shares* = (Total dividends on preference shares + Dividend tax) ÷ Market value of preference shares = (Rs 1,28,000 + Rs 12,800)/Rs 8,50,000 = 16.56 per cent.

Determination of overall cost of capital (based on market value, MV weights)

Sources of capital	*MV*	*Cost (per cent)*	*Total cost*
Equity capital (existing)	Rs 24,00,000	0.1875	Rs 4,50,000
Equity capital (new)	14,00,000	0.2054	2,87,560
Preference shares	8,50,000	0.1656	1,40,760
Debentures	50,00,000	0.101	5,05,000
Long-term bank loan	18,00,000	0.0975	1,75,500
	1,14,50,000		15,58,820

K_0 = Rs 15,58,820/1,14,50,000 = 13.61 per cent.

EXAMINATION QUESTIONS

EQ. 6.1 Write a note on explicit and implicit cost. (*CA(PE-II)—May, 2007*)

EQ. 6.2 JKL Ltd. has the following book-value capital structure as on March 31, 2003.

Equity share capital (2,00,000 shares)	Rs 40,00,000
11.5% preference shares	10,00,000
10% debentures	30,00,000
	80,00,000

The equity share of the company sells for Rs 20. It is expected that the company will pay next year a dividend of Rs 2 per equity share, which is expected to grow at 5 per cent per annum forever. Assume a 35 per cent corporate tax rate.

Required:

(i) Compute weighted average cost of capital (WACC) of the company based on the existing capital structure. (ii) Compute the new WACC, if the company raises an additional Rs 20 lakhs debt by issuing 12 per cent debentures. This would result in increasing the expected equity dividend to Rs 2.40 and leave the growth rate unchanged, but the price of equity share will fall to Rs 16 per share. (iii) Comment on the use of weights in the computation of weighted average cost of capital. (*CA—May, 2003*)

SOLUTION

(i) *Computation of weighted average cost of capital (using book value weights)*

Source of finance	*Amount*	*After-tax cost (%)*	*Total cost*
Equity share capital	Rs 40,00,000	15%[1]	Rs 6,00,000
11.5% Preference shares	10,00,000	11.5*	1,15,000
10% Debentures	30,00,000	6.5[2]	1,95,000
Total funds	80,00,000		9,10,000
K_0 = (Rs 9,10,000/Rs 80,00,000) × 100 = 11.375%			

* Coupon rate

1. Cost of equity (K_e) = (Rs 2/ Rs 20) + 0.05 = 15 per cent
2. Cost of debt (k_d) = 10% (1-0.35) = 6.5 per cent

(ii) *Computation of new/revised weighted average cost of capital (using book value weights)*

Source of finance	*Amount*	*After-tax cost (%)*	*Total cost*
Equity share capital	Rs 40,00,000	20%[3]	Rs 8,00,000
11.5% Preference share	10,00,000	11.5	1,15,000
10% Debentures	30,00,000	6.5	1,95,000
12% Debentures	20,00,000	7.8[4]	1,56,000
Total funds	1,00,00,000		12,66,000
K_0 = (Rs 12,66,000/Rs 1,00,00,000) × 100 = 12.66 per cent			

3 Cost of equity = (Rs 2.40/Rs 16) + 0.05 = 20 per cent

4 Cost of 12 per cent Debentures = 12% (1 − 0.35) = 7.8 per cent

(iii) *Comment:* The k_0 is computed using book-value weights, in view of non-availability of market value of preference shares and debentures. While the book value weights are operationally convenient, the market value weights are conceptually more sound, and, therefore, better basis of determining cost of capital.

EQ. 6.3 ABC Limited has the following book value capital structure:

Equity share capital (150 million shares, Rs 10 par)	Rs 1,500 million
Reserves and surplus	2,250 million
10.5% Preference share capital (1million shares, Rs 100 par)	
9.5% Debentures (1.5 million debentures, Rs 1,000 par)	100 million
8.5% Term-loans from financial institutions	1,500 million
	500 million

The debentures of ABC Limited are redeemable after three years and are quoting at Rs 981.05 per debenture. The applicable income tax rate for the company is 35 per cent.

The current market price per equity share is Rs 60. The prevailing default-risk free interest rate on 10-year GOI Treasury Bonds is 5.5 per cent. The average market risk premium is 8 per cent. The beta of the company is 1.1875.

The preferred stock of the company is redeemable after 5 years is currently selling at Rs 98.15 per preference share.

Required:

(i) Calculate weighted average cost of capital of the company using market value weights. (ii) Define the marginal cost of capital schedule for the firm if it raises Rs 750 million for a new project. The firm plans to have a target debt to value ratio of 20 per cent. The beta of new project is 1.4375. The debt capital will be raised through term loans. It will carry interest rate of 9.5 per cent for the first 100 million and 10 per cent for the next Rs 50 million.

(*CA—May, 2004*)

SOLUTION

(i) *Determination of weighted average cost of capital using market value weights* *(Amount in Rs million)*

Source	*Amount*	*After-tax cost (%)*	*Total cost*
Equity share capital (150 million shares × Rs 60)	Rs 9,000.000	15%[1]	Rs 1,350.0
10.5% Preference share capital (1 million shares × Rs 98.15)	98.150	11.0[2]	10.7965
9.5% Debentures (1.5 million debentures × Rs 981.05)	1,471.575	6.5[3]	95.6524
8.5% Term loans	500.000	5.525[4]	27.625
	11,069.725		1,484.0739
K_0 = (Rs 1,484.0739/Rs 11,069.725) × 100 = 13.41 per cent			

1. *Cost of equity* $= R_f$ + (Beta × Average market risk premium)
   = 5.5 per cent + (1.1875 × 8%) = 15 per cent.

2. *Cost of preference shares:* Rs 98.15 $= \sum_{t-1}^{5} \frac{\text{Rs } 10.5}{(1+k_p)} + \frac{\text{Rs } 100}{(1+k_p)^5}$

The value of k_p is likely to be between 10 and 11 per cent as the rate of dividend is 10.5 per cent.

Determination of k_p at 10 and 11 per cent

Year	*Cash outflows*	*PV factor at*		*Total PV at*	
		10%	*11%*	*10%*	*11%*
1 – 5	Rs 10.5	3.791	3.696	39.81	38.81
5	100.0	0.621	0.593	62.10	59.30
				101.91	98.11

Cost of preference shares is 11 per cent approximately.

(3) *Cost of debentures:*

$$\text{Rs } 981.05 = \sum_{t=1}^{3} \frac{\text{Rs } 95}{(1+k_i)^t} + \frac{\text{Rs } 1{,}000}{(1+k_i)^3}$$

The value of k_i is likely to be between 9 per cent and 10 per cent as the rate of interest is 9.5 per cent.
Determination of K_i at 9 and 10 per cent

Year	*Cash outflows*	*PV factor at*		*Total PV at*	
		9%	*10%*	*9%*	*10%*
1 – 3	Rs 95	2.531	2.487	Rs 240.44	Rs 236.27
3	1,000	0.772	0.751	772	751
				1,012.44	987.27

K_i = 10 per cent approximately
K_d = 10% (1 – 0.35) = 6.5 per cent

(4) ***Cost of term loans:*** *8.5% (1 – 0.35) = 5.525 per cent*

(ii) *Marginal cost of capital schedule*

Equity requirement: Rs 750 million × 80% = Rs 600 million
Debt/Term loans: Rs 750 million × 20% = 150 million

Determination of marginal cost of capital using marginal weights *(Amount in Rs million)*

Source	*Amount*	*After-tax cost (%)*	*Total cost*
Equity share capital	Rs 600	17%[1]	Rs 102.000
9.5% Term loan	100	6.175[2]	6.175
10% Term loan	50	6.5[3]	3.250
	750		111.425

K_0 = (Rs 111.425/Rs 750) × 100 = 14.86 per cent

1. Cost of equity: 5.5% + (1.4375 × 8%) = 17 per cent
2. Cost of 9.5% Term loan = 9.5% (1 – 0.35) = 6.175 per cent
3. Cost of 10% Term loan = 10% (1 – 0.35) = 6.5 per cent

EQ. 6.4 D Ltd. is foreseeing a growth rate of 12 per cent per annum in the next two years. The growth rate is likely to be 10 per cent for the third and fourth years. After that the growth rate is expected to stabilise at 8 per cent per annum. If the last dividend was Rs 1.50 per share and the investor's required rate of return is 16 per cent, determine the current value of equity share of the company.
The P.V. factors at 16 per cent

Year	*1*	*2*	*3*	*4*
P.V factor	.862	.743	.641	.552

(CA—May, 2005)

SOLUTION

The current value of the equity share will be the sum of:
(i) PV of dividend payments during 1-4 years and (ii) PV of expected market price at the end of the fourth year based on a constant growth of 8 per cent.

Present value of dividends, year 1-4

Year	*Dividend*	*PVIF (0.16)*	*Total PV*
1	Rs 1.68	0.862	Rs 1.45
2	1.88	0.743	1.40
3	2.07	0.641	1.33
4	2.28	0.552	1.26
			5.44

$P_4 = D_5/(k_e - g)$ = Rs 2.28 (1.08)/16% – 8%) = Rs 30.78
PV of Rs 30.78 = Rs 30.78 × 0.552 = Rs 16.99
Current value of equity share = Rs 5.44 + Rs 16.99 = Rs 22.43

EQ. 6.5 The R & G Company has following capital structure at 31st March, 2004, which is considered to be optimum:

13% debenture	Rs 3,60,000
11% preference share capital	1,20,000
Equity share capital (2,00,000 shares)	19,20,000

The company's share has a current market price of Rs 27.75 per share. The expected dividend per share in next year is 50 per cent of the 2004 EPS. The EPS of last 10 years is as follows. The past trends are expected to continue:

Year	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
EPS (Rs)	1.00	1.120	1.254	1.405	1.574	1.762	1.974	2.211	2.476	2.773

The company can issue 14 per cent new debentures. The company's debentures are currently selling at Rs 98. The new preference issue can be sold at a net price of Rs 9.80, paying a dividend of Rs 1.20 per share. The company's marginal tax rate is 50 per cent.

(i) Calculate the after tax cost (a) of anew debts and new preference share capital, (b) or ordinary equity, assuming new equity comes from retained earnings. (ii) Calculate the marginal cost of capital. (iii) How much can be spent for capital investment before new ordinary share must be sold? assuming that retained earning available for next year's investment are 50 per cent of 2004 earnings. (iii) What will be marginal cost of capital (cost of fund raised in excess of the amount calculated in part (iii)if the company can sell new ordinary shares to net Rs 20 per share? The cost of debt and of preference capital is constant. (*CA—May, 2005*)

SOLUTION

(i) (a) Cost of new debt $(k_d) = \frac{I}{SV}(1-t)$

K_d = (Rs 14/Rs 98) (1 – 0.5) = 14.286 (1 – 0.5) = 7.143 per cent
Cost of new preference shares $(k_p) = D/P_0 (1 - f)$
K_p = Rs 1.20/Rs 9.80 = 12.245 per cent

(b) Cost of ordinary equity $(k_e) = (D_1/P_0) + g^*$.
K_e = (Rs 1.3865/Rs 27.75) + 12% = 5.00% + 12% = 17 per cent
*g = Re 1.00 $(1 + r)^9$ = Rs 2.773. Re 1 compounds to Rs 2.773 in 9 years. Table A – 1 provides the compounded value of Re 1 at various rates of interest (for our purpose growth rate, g) corresponding to varied number of years. Looking across year 9 of Table A–1 shows that the factor for 12 per cent is exactly 2.773. Therefore the rate of growth associated with the dividend payment is 12 per cent.

(ii) *Computation of marginal cost of capital*

Source of funds	*Amount*	*Proportion**	*Cost (%)*	*Total cost*
14% Debt	Rs 3,60,000	0.15	7.143	1.0715
Preference shares	1,20,000	0.05	12.245	0.6123
Equity	19,20,000	0.80	17.000	13.60
	24,00,000	1.00		15.2838

Marginal cost of capital is 15.28 per cent approximately.
*Represents the percentage share of different financing sources the company intends to raise/employ.

(iii) *Retained earnings available for investment in 2005*

Total earnings in 2004 (EPS, Rs 2.773 × 2,00,000 shares)	Rs 5,54,600
Less expected dividends (Rs 5,54,600 × 0.5)	2,77,300
Retained earnings available for investment	2,77,300

(iv) *Cost of new equity shares* = $(D_1/P_0) + g$

K_e = (Rs 1.3865/Rs 20) + 12% = 6.93% + 12% = 18.93%.

Calculation of marginal cost of capital

Source of funds	*Proportion*	*Cost (%)*	*Total cost*
Debt	0.15	7.143	1.0715
Preference shares	0.05	12.245	0.6123
Equity	0.80	18.930	15.144
	1.00		16.782

Marginal cost of capital is 16.78 per cent.

EQ. 6.6 A company issues Rs 10,00,000 12% debentures of Rs 100 each. Debentures are redeemable after the expiry of fixed period of 7 years. The company is in 35% tax bracket. You are required to (i) calculate the cost of debt after tax, if debentures are issued at (a) par, (b) 10% discount and (c) 10% premium. (ii) If brokerage is paid at 2%, what will be the cost of debentures, if issue is at par. (*CA—May, 2006*)

SOLUTION

(i) Cost of debt $(k_d) = \dfrac{I(1-t)+(RV-SV)/N}{(RV+SV)/2}$

(a) Issued at par: $k_d = \dfrac{12(1-0.35)}{100} = 7.8\%$

(b) Issued at discount: $k_d = \dfrac{12(1-0.35)+(100-90)/7}{(100+90)/2} = (7.8 + 1.43)/95 = 9.23/95 = 9.72\%$

(c) Issued at 10% permium: $k_d = \dfrac{12(1-0.35)+(100-110)/7}{(100+110)/2} = (7.8 - 1.43)/105 = 6.37/1.05 = 6.07\%$

(ii) k_d when brokerage is paid at 2% $= \dfrac{12(1-0.35)+(100-98)/7}{(100+98)/2} = (7.8 + 0.29)/99 = 8.17\%$

7 Sources of Long and Medium-term Finance

Introduction

The long-term investment decision of a firm involves the acquisition of long-term/fixed assets. They have to be financed with long-term sources of finance. This chapter describes the features of the sources typically employed by firms and evaluates them from the point of view of both the investors and the firm. The main sources of medium and long-term finance fall into two broad groups: (a) Internal comprising of retained earnings and depreciation charges and (b) External, consisting of (i) Equity capital, (ii) Project finance (term loans), their negotiation and appraisal, (iii) Debentures/ bonds, (iv) Hybrid instruments, (v) Loan securitisation, (vi) Venture capital, (vii) Lease financing and (viii) Euro issues (ADRs/GDRs).

RETAINED EARNINGS

The internal sources of long-term funds of an existing company consist of depreciation charges and retained earnings (**ploughing back of profits**). The depreciation charges are normally used to replace the concerned asset(s). In a way, therefore, the only internal source of financing expansion/growth/ diversification for such companies are retained earnings. In fact, they are an important source of long-term finance for corporate enterprises.

As a source of long-term finance, retained earnings have some commendable features. They are readily available to the firm. Flotation/issue costs and losses on account of underpricing associated with external equity are avoided/ eliminated. There is also no dilution of control of the firm. However, the magnitude of financing through retained earnings may be limited and variable/unstable/fluctuating primarily as a result of the quantum and variability of profits after tax. It has, moreover, high opportunity costs in terms of dividends foregone by the shareholders

For the shareholders, retention of profits by the firm is a convenient way of reinvestment of their profits. But shareholders who want a current income would find it inconvenient to the extent that they will be constrained to sell some shares to convert them into income. Moreover, the easy availability of retained

earnings coupled with the notion of low cost may result in its investment in submarginal/unprofitable projects which would have serious implications for, and hurt the interest, of the shareholders.

Thus, retained earnings have both positive and negative attributes from the viewpoint of the firm as well as shareholders/investors and should be employed with caution. *They involve high cost and no risk, and put no restraint in management freedom and do not dilute control.*

EQUITY/ORDINARY SHARE CAPITAL

Equity capital represents ownership capital and its owners–ordinary shareholders/equity holders–share the reward and risk associated with ownership of corporate enterprises. It is also called ordinary share capital in contrast with preference share capital which carries certain preferences/prior rights in regard to income and redemption.

Types

Authorised equity/share capital represents the maximum amount which a company can raise from the ordinary shareholders and can be changed in the prescribed manner. The portion of the authorised capital offered by the company to the investors is the *Issued* capital. *Subscribed* share capital is that part of the issued capital which has been accepted/subscribed by the investors. The actual amount paid by the shareholders is the *Paid-up capital*. The issued, subscribed and *paid-up* capitals are generally the same.

Ordinary shares have typically a *par/face value* in terms of the price for each share, the most popular denomination being Rs 10. The price at which the equity shares are issued is the *Issue* price. The issue price for new companies is generally equal to the face value. It may be higher for existing companies, the difference/excess being *share premium*. The *book value* of ordinary shares refers to the paid-up capital plus reserves and surplus (net worth) divided by the number of outstanding shares. The price at which equity shares are traded in the stock market is their *market value*. However, the market value of unlisted/thinly traded shares is not available.

Features

The ordinary shares have some special features in terms of the rights and claims of their holders.

Residual Claim to Income The equity shareholders have a residual claim to the income of the company. They are entitled to the remaining income/profits of the company after all outside claims are met. The earnings/income available to the shareholders (EAS) equals profit after tax (PAT) minus preference dividend; the PAT is equal to operating profits (EBIT) less taxes. However, the residual claim is only a theoretical entitlement as the amount actually received by the shareholders in the form of dividend will depend on the decision of the board of directors. The directors have the right to decide what portion of the EAS will be distributed to the shareholders as cash dividend and what portion will be ploughed back as retained earnings which the shareholders will receive later in the form of capital appreciation/bonus shares. In other words, the payment of dividends depends on the discretion of management and the shareholders have no legal right to receive/the company has no legal obligation to distribute, dividends out of EAS. This is in sharp contrast to the claims of debenture holders which as a contractual obligation of the company must always be honoured irrespective of its financial position.

Residual Claim on Assets The ordinary shareholders' claim in the assets of the company is also residual in that their claim would rank after the claims of the creditors and preference shareholders in the event of liquidation. If the liquidation value of assets is insufficient, their claims may remain unpaid.

Right to Control As owners of the company, the equity holders have the right to control the operations of/ participate in the management of, the company. Their control is, however, indirect. The major policies/decisions are approved by the board of directors and the board-appointed management carries out the day-to-day operations. The shareholders have the legal right/power to elect the board of directors as well as vote on every resolution placed in various meetings of the company. Though, in theory, they have indirect right to control/participate in management, in actual practice, it is weak and ineffective partly because of the apathy and indifference of the majority of the shareholders who rarely bother to cast their votes and partly because scattered and by and large unorganised equity holders are unable to exercise their collective power effectively.

Voting System The ordinary shareholders exercise their right to control through voting in the meetings of the company. According to the most commonly used system of voting in India, namely, *Majority rule voting*, each share carries one vote and each director is elected individually. Therefore, a shareholder can cast the total number of shares held by him for the election of each director separately. As a result, shareholders/group holding more than 50 per cent of the outstanding equity shares would be able to elect all the directors of their choice. An alternative is *Proportionate rule voting* under which the number of votes held by a shareholder/group equals the number of shares held by him multiplied by/times the number of directors to be elected. The total votes held may be cast/spread in any manner: all just for one candidate or spread over as many candidates as the shareholders wishes to vote for. The proportionate voting system may enable even minority shareholders some representation on the board while all the members of the board may be elected by the holders of the majority of ordinary shares.

Pre-emptive Right The ordinary shareholders of a company enjoy pre-emptive rights in the sense that they have a legal right to be offered by the company the first opportunity to purchase additional issue of equity capital in proportion to/pro rata basis their existing/current holdings/ownership. A shareholder owning 2 per cent of the existing issued capital is entitled/has a pre-emptive right to acquire 2 per cent of additional shares to be issued by the company. The option to the shareholders to purchase a specified number of equity shares at a stated price during a given period is called *'rights'*. The shareholders can (i) exercise, (ii) sell in the market and (iii) renounce/ forfeit their pre-emptive right partially or completely. The shares available as a result of non-exercise of right would be allotted on a *pro rata* basis to shareholders exercising the right. Any balance of shares can be offered to the public for subscription.

While the pre-emptive rights ensure that management cannot issue additional shares to strengthen its control by selling them to persons/groups favourably inclined to it, on one hand, it protects the existing shareholders from dilution of their financial interest as a result of new equity issues, on the other.

Assume Avon Industries Ltd (AIL) has currently 30,00,000 shares outstanding. The market price is Rs 65 per share. The AIL plans to issue 10,00,000 additional shares at a subscription/issue price of Rs 40 per share. The number of rights to buy a new share $= \frac{30,00,000}{10,00,000} = 3$. The market price of a share after right issue

$= \frac{(30,00,000 \times \text{Rs } 65) + (10,00,000 \times \text{Rs } 40)}{(30,00,000 + 10,00,000)} = \text{Rs } 58.75$. A shareholder can buy one new share for Rs 40

plus 3 rights. The total value of 3 rights = Rs 58.75 – Rs 40 = Rs 18.75. The value of each right $= \frac{\text{Rs } 18.75}{3} = \text{Rs } 6.25$. Thus, the *ex-right* price of a share drops by Rs 6.25 from the *cum-right* (rights-on) price of Rs 65 to the ex-rights price of Rs 58.75. The existing shareholders do not gain/lose from rights issue. What he receives in the form of value of a right, he loses in the form of a decline in the share price. His financial interest remains unaffected when he exercises his right or sells his rights. In case he does not exercise his right, there will a dilution of his financial interest.

Assume further, Mr X owns 300 shares of AIL. His total wealth/financial interest is Rs 19,500 (300 × Rs 65). After the exercise of his right, his holdings will be 400 shares. His total wealth would be Rs 23,500 (400 × Rs 58.75). But he has spent Rs 4,000 (Rs 40 ´ 100) to acquire additional shares. So his net financial interest = Rs 23,500 – Rs 4,000 = Rs 19,500, that is, equal to before rights issue.

In case Mr X sells his right @ Rs 6.25, his total financial position in AIL would be Rs 19,500 [(Rs 58.75 × 300) + (Rs 6.25 × 300)]: the same as before the rights issue.

If he does not exercise his right to buy/sell, his financial interest will suffer a dilution as his total wealth = Rs 17,625 (Rs 58.75 × 300), that is, a dilution of Rs 1,875 (Rs 19,500 – Rs 17,625).

In brief, *an investor suffers dilution of financial interest when he does not exercise his pre-emptive rights.*

Limited Liability Although the equity holders share the ownership risk, their liability is limited to the extent of their investment in the share capital of the company.

Evaluation

As the single most important source of long term funds, equity capital has merits as well demerits from the viewpoint of the company as well as the shareholders.

Merits The advantages of equity capital to a company are: first, it is a permanent source of funds without any repayment liability; second, it does not involve obligatory dividend payment and, thirdly, it forms the basis of further long-term financing in the form of borrowing related to the creditworthiness of the firm. The shareholders with limited liability exercise control and share other ownership rights in the income/assets of the firm.

Demerits The disadvantages of equity capital from the viewpoint of a company are: (i) High cost of funds reflecting the high required rate of return of investors as a compensation for higher risk as also the fact that equity dividends are not tax-deductible payments. They are paid out of post-tax profits; (ii) High flotation cost in terms of underwriting, brokerage and other issue expenses compared to other securities; (iv) Dilution of control of existing shareholders on sale of new shares to outsiders/public. The disadvantages associated with equity capital for the shareholders are: (i) The equity capital is in reality risk capital as it ranks the last as a claimant to income as well as the assets of the company. (ii) The scattered and unorganised shareholders are unable to exercise effective and real control over the company. (iii) The shareholders cannot claim dividend as a matter of right. (iv) There is a wide fluctuation in share prices with attendant risk for the investors.

In brief, equity capital is a high risk-high reward permanent source of long-term finance for corporate enterprises. The shareholders who desire to share the risk, return and control associated with ownership of

companies would invest in corporate equity. *As a source of long-term fund, it has high cost, low/nil risk, does not dilute control and puts no restraint on managerial freedom.*

PROJECT FINANCING (TERM LOANS), TERM LOANS NEGOTIATION AND APPRAISAL

This section discusses (i) features and evaluation of term loans provided by financial institutions, as an important source of project finance, (ii) negotiation of term loans with banks and financial institutions and (iii) their appraisal by financial institutions.

Term Loans: Features and Evaluation

Term loans are also known as term/**project finance**. The primary source of such loans are financial institutions. Commercial banks also provide term finance in a limited way. The financial institutions provide project finance for new projects as also for expansion/diversification and modernisation whereas the bulk of term loans extended by banks is in the form of working capital term loan to finance the working capital gap. Though they are permitted to finance infrastructure projects on a long-term basis, the quantum of such financing is marginal.

Features of Term Loans: **Maturity** The maturity period of term loans is typically longer in case of sanctions by financial institutions in the range of 6-10 years in comparison to 3-5 years of bank advances. However, they are rescheduled to enable corporates/borrowers tide over temporary financial exigencies.

Negotiated The term loans are negotiated loans between the borrowers and the lenders. They are akin to private placement of debentures in contrast to their public offering to investors.

Security All term loans are **secured**. While the assets financed by term loans serve as primary security, all the other present and future assets of the company provide **collateral/secondary** security for the term loan. Generally, all the present as well as the future immovable properties of the borrower constitute a general mortgage/ first equitable mortgage/floating charges for the entire institutional loan including commitment charges, interest, liquidated damages and so on. They are additionally secured by hypothetication of all movable properties subject to prior charge in favour of banks in respect of working capital finance/ advance.

Covenants: ***Negative*** To protect their interest, the financial institutions reinforce the asset security stipulation with a number of restrictive terms and conditions. These are known as **covenants**. They are both positive/affirmative and negative in the sense of what the borrower should and should not do in the conduct of its operations and fall broadly into four sets as respectively related to assets, liabilities, cashflows and control. *Some negetive covenants are discussed as under:*

Asset-Related Covenants are intended to ensure the maintenance of a minimum asset base by the borrowers. Included in this set of covenants are:

- Maintenance of working capital position in terms of a minimum current ratio,

- Restriction on creation of further charge on asset,
- Ban on sale of fixed assets without the lenders concurrence/approval.

Liability-Related Covenants may, *inter alia*, include:

- Restrain on the incurrence of additional debt/repayment of existing loan, say, without the concurrence/prior approval of the lender/financial institution,
- Reduction in debt-equity ratio by issue of additional capital, and
- Prohibition on disposal of promoters shareholding.

Cashflow Related Covenants which are intended to restrain cash outflows of the borrowers may include:

- Restriction on new projects/expansion without prior approval of the financial institution,
- Limitation on dividend payment to a certain amount/rate and prior approval of the financial institutions for declaration of higher amount/rate,
- Arrangement to bring additional funds as unsecured loans/deposits to meet overrun/shortfall, and
- Ceiling on managerial salary and perks.

Control Related Covenants aim at ensuring competent management for the borrowers. This set of covenants may include

- Boroadbasing of board of directors and finalisation of management set-up in consultation with the financial institution,
- Effective organisational changes and appointment of suitable professional staff, and
- Appointment of nominee directors to represent the financial institutions and safeguard their interests.

Positive In addition to the foregoing negative covenants, certain positive/affirmative covenants stating what the borrowing firm should do during the term of a loan are also included in a loan agreement. They provide, *inter alia*, for (i) furnishing of periodical reports/financial statements to the lenders, (ii) maintenance of a minimum level of working capital, (iii) creation of sinking fund for redemption of debt and (iv) maintenance of certain net worth.

Repayment Schedule/Loan Amortisation The term loans have to be amortised according to predetermined schedule. The payment/repayment has two components: (i) interest and (ii) repayment of principal.

The interest component of loan amortisation is a legally enforceable contractual obligation. The borrowers have to pay a commitment charge on the unutilised amount. The interest on term loans by the financial institutions, subject to a minimum prime lending/floor rate (PLR), is risk-related and varies with the credit risk of the borrower. In case of default in respect of both the interest and principal components, liquidated damages/penal interest at a specified rate for the period of default on the default amount has to be paid.

Typically, the principal is repayable over 6-10 years period after an initial grace period of 1-2 years. Whereas the mode of repayment of term loans is equal semi-annual instalments in case of institutional borrowings, the term loans from banks are repayable in equal quarterly instalments. With this type of loan amortisation pattern, the total debt servicing burden declines over time, the interest burden declining and principal repayment remaining constant. In other words, the common practice in India to amortise loan is repayment of principal in equal instalments (semi-annual/annual) and payment of interest on the unpaid/outstanding loans. A loan amortisation schedule is illustrated in Table 7.1.

Table 7.1 *Loan Amortisation Schedule (Equal Principal Repayment)*

(Rs thousands)

Year	*Beginning loan*	*Principal repayment*	*Interest (0.14)*	*Loan payment*	*Ending loan*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1	60.00	7.50	8.40	15.90	52.50
2	52.50	7.50	7.35	14.85	45.00
3	45.00	7.50	6.30	13.80	37.50
4	37.50	7.50	5.25	12.75	30.00
5	30.00	7.50	4.20	11.70	22.50
6	22.50	7.50	3.15	10.65	15.00
7	15.00	7.50	2.10	9.60	7.50
8	7.60	7.50	1.05	8.55	0.00

The debt servicing/loan amortisation pattern involving equal instalment (interest + repayment of principal) is portrayed in Table 7.2.

Table 7.2 *Loan Amortisation Schedule (Equal Instalment)*

Year	*Beginning loan*	*Payment instalment*[@]	*Interest (0.14)*	*Principal repayment [3 – 4]*	*Ending loan [2 – 5]*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1	Rs 60,000	Rs 12,934	Rs 8,400	Rs 4,535	Rs 55,466
2	55,466	12,934	7,776	5,168	50,298
3	50,298	12,934	7,042	5,896	44,406
4	44,406	12,934	6,216	6,718	37,688
5	37,688	12,934	5,276	7,658	30,030
6	30,030	12,934	4,204	8,730	21,300
7	21,300	12,934	2,982	9,952	11,348
8	11,348	12,934	1,588	11,346	0

[@] Payment instalment $= \frac{\text{Rs } 60,000}{\text{PVIFA } 8,14} = \frac{\text{Rs } 60,000}{4.6389} = \text{Rs } 12,934$

Evaluation Term loans have merits as well demerits both for the borrower and the lenders.

From the perspective of borrowers, term loan offer all the advantages and disadvantages associated with debenture financing. An additional demerit is that term loan contracts contain restrictive covenants restricting managerial freedom. The right of lenders to nominate directors on the board of the borrowing company may further restrict managerial discretion.

Similarly, the term loans provide all the advantages and disadvantages of debenture financing to the lending institutions together with the additional benefit of restrictive covenants to protect their interests. However, term loans are not represented by negotiable securities. Debt securitisation would go a long way in removing this limitation of term loans *vis-a-vis* debentures.

To conclude, *term loans carry low cost and involve high risk. There is no adverse effect on control but there is moderate restraint on managerial freedom.*

Term Loan Negotiations

The steps involved in negotiating term loans with financial institutions are outlined below. Borrowers have to apply in the prescribed application forms, giving complete details of the project, including the financial assistance required. Here we will briefly discuss (i) the contents of the application form for financial assistance, (ii) the details of the project, (iii) documentation and disbursement of loan, (iv) utilisation of loan, (v) charging of securities and (vi) registration of charges.

Application for Financial Assistance Financial institutions have prescribed a common application form, which seeks information along the following lines.

General Name Form of organisation; date of incorporation/registration; date of commencement of business, sector business house to which the concern belongs, applicability of the MRTP Act; location; nature of project (new/expansion/ modernisation/diversification); brief particulars of the project; nature of industry and products; financial assistance applied for and foreign currency loan/guarantee applied for.

Promoter The bio-data of the main promoter, a brief write-up of other companies promoted by the promoter; in case the promoter is a limited company, a brief write-up on the activities and past performance of the company.

Particulars of the Industrial Concern Brief history; list of subsidiaries; particulars of holding company; details of directors; certified copies of audited balance sheets and profit and loss account for the last five years and brief explanations for year-to-year variations in production, sales, stocks, profits, etc, and contingent liabilities; details of asset revaluation, if any, during the existence of the company and the reasons thereof; list and bio-data of existing key technical and executive staff and number of supervisory, skilled, semi-skilled and unskilled personnel; organisation chart showing the lines of authority; existing long-term and short-term borrowings as set out in Forms II and III; distribution of shareholding as per Form IV; company's tax status; manufacturing facilities available (separately at each plant); figures of licensed capacity, installed capacity, production and sales (quantities and value net of excise duty) of each major product/product group; requirement of various utilities and services and the arrangements for their supply; details of insurance; details of pending litigation; details of research and development activities of the company; preventive maintenance adopted by the company.

Particulars of the Project Details of the project for which financial assistance is required in terms of the following (copy of the project report/feasibility report, if any, to be enclosed).

Capacity Present installed capacity maximum production achieved, proposed installed capacity and maximum production envisaged for various products; section-wise capacities for the major sections of the plant; specifications of major products and by-products.

Process Details of the technical process; labour intensiveness of the process; advantages/disadvantages of the alternative process, with reference to employment potential; reasons for choosing the particular process; copy of process flow chart with material balance, utilities and process parameters; application of the proposed process in the country.

Technical Arrangements Technical arrangements made/proposed; write-up on the collaborator, in case of collaboration; copy of collaboration agreement, copy of government approval of the collaboration, copy of government approval for availing of the services of foreign technicians, particulars of consultants.

Management Proposed arrangements for executive management, particulars of proposed key technical, administrative and accounting personnel; proposed organisation chart; proposed cost and budgetary control system, management reporting and inventory control system, purchase of raw materials, components etc.

Location and Land Location of plant, land requirement and the arrangements thereof, locational advantages; particulars in respect of the land acquired/proposed to be acquired; copy of sale/lease deed, copy of soil test report, copy of government order converting the land into industrial land if applicable, location map, site plan.

Buildings Arrangements made/proposed for constructing the buildings (particulars of buildings as per Form V); copy of master plan showing location of buildings and roads, power receiving station, railway siding, tube well, etc, copy of equipment layout or plan of buildings indicating the flow of materials; particulars of architect, copy of arrangement with architect, copy of published write-up/brochure on architects.

Plant and Machinery Basis of selection of equipment, list of imported and indigenous plant and machinery acquired/to be acquired along with detailed specifications as per Forms VI and VII, layout of the plant and machinery indicating the flow of material.

Raw Materials Requirement of raw materials, components, chemicals, etc, as per Form VIII; price or distribution controls, if any, on any of the items listed above, detailed note on the arrangements made for obtaining the raw materials/chemicals; mining lease, if any, and details thereof; copy of agreement for mining lease and expert's report regarding the quantity and value of reserves.

Utilities Details about power (source of power and supply voltage, maximum demand, connected load, peak hour requirements, contracted load, power tariff, cost of power), copy of letter of sanction for power, copy of agreement with electricity board, copy of electrical layout of the plant, a note on power generation, demand and supply of power in the state, present and projected; details about water (requirement for various purposes, sources of water, sources of water arrangements proposed and water charges payable, capacities of tanks, reservoirs, water treatment arrangements proposed), layout of water system, copy of letter of sanction of water by municipal/local authorities, where applicable, copy of water analysis report; details for steam (steam requirement and steam balance, capacity and type of the boiler with detailed specifications), layout of the steam system; details for compressed air, fuel, etc, copies of the letter of allotment of coal/furnace oil from the concerned authorities, details of transport (arrangements proposed for carrying raw materials and finished goods, provision for own trucks, railway siding etc, and arrangements with private truck operators indicating rates, subsidy available, if any).

Effluents Details of the nature of atmosphere, soil and water pollution likely to be created by the project and the measures proposed for control of pollution, permissions for the disposal of effluents, where necessary; copy of approval from concerned authorities for the proposed arrangements.

Labour Estimates of total requirements and availability of skilled and unskilled labour, plans for training of personnel, manpower development programme, category-wise classification of total personnel requirements.

Quarters and Labour Housing Existing and proposed arrangements for housing staff and workers, classified as follows: senior executives, other executives, supervisors, labour.

Schedule of Implementation Manner in which the design, engineering, erection, installation and commissioning of projects will be carried out; progress made so far in the implementation of the project; schedule of implementation showing the commencement and completion following the acquisition of land, development of land, civil work; placement of order and delivery of plant and machinery (imported, and indigenous) at site; arrangements for power; arrangements for water; erection of equipment; commissioning; procurement of raw material and chemicals; training of personnel; trial runs and commercial production; a PERT chart.

Other Projects of the Concern Details of any other new/expansion/modernisation, etc; projects that are under implementation or those that the company/promoters propose to implement, giving the estimated cost, means of financing and the present status.

Cost of the Project Estimate of cost of project under the following heads (details may be furnished as per Form IX): (i) land and site development, (ii) buildings, (iii) plant and machinery (imported and indigenous), (iv) technical know-how fees, (v) expenses on foreign technicians and training of Indian technicians abroad, (vi) miscellaneous fixed assets, (vii) preliminary and pre-operative expenses, (viii) provision for contingencies and (ix) margin money for working capital; basis of cost estimate (such as quotations, orders placed etc) bringing out the built-up provision for cost escalation, if any; estimates of contingency/escalation provisions as per Form IX–A and margin money for working capital as per Form IX–B.

Means of Financing Means of financing envisaged, divided as follows: share capital (equity and preference), rupee loans, foreign currency loans, debentures, internal cash accruals, and others; details of the means of financing envisaged and the proposals for raising share capital as per Form X and Form X-A, respectively; basis of estimation of internal accruals; arrangement of letter sanctioning assistance; source of foreign exchange and arrangements, if any, made for obtaining foreign exchange; sources from which expenditure already incurred has been financed as per Form X-B; promoters' contribution to project cost; list of persons/firms who would be contributing to the promoters' share of the capital and the respective amounts; details of security proposed to be offered for loan and/or guarantee for deferred payments on plant and machinery or guarantee for foreign currency loans; copy of letter from bank indicating its willingness to guarantee a loan, in case a bank guarantee is proposed to be offered instead of mortgage of fixed assets.

Marketing and Selling Arrangements Copy of market survey report, if any, conducted by the company or independent consultants; brief notes on the products, their major uses, scope of the market, possible competition from substitute products, etc., special features (regarding quality, price, etc) of the product, which would result in consumer preference in relation to competitive products; detailed notes on the existing and future demand and supply of the products proposed to be manufactured; assessment of likely competition in the future and special features of the project that may enable it to meet the competition; export possibilities and the nature of competition to be faced in foreign countries—comparative data on manufacturing costs and prices of selected competing countries; export commitments of the company, as part of government requirements and arrangements proposed for meeting the same, export incentives available; international CIF, FOB prices and landed costs of the proposed products; list of principal customers and particulars of any firm arrangements entered into with them; particulars of government controls, restrictions, etc, if any, on sale price, distribution, import, export and so forth, with respect to products proposed to be manufactured; nature of selling arrangement (direct, through distributors, or through selling agents), nature of proposed selling organisation for direct sales, particulars of proposed selling arrangements both in India and abroad and commission proposed to be paid, brief note on the selling agent's organisation; copy of agreement with selling agent; particulars of any sole selling agency, where proposed, for any of its

products; details regarding the trend in prices during the last five years; the basis on which prices are fixed, if the prices are controlled by the government or on a voluntary basis; in case of agro based/agriculture input industries, the company's scheme for educating farmers to use the product/to grow the produce required.

Profitability and Cash Flow Estimates of cost of production and working results for the first ten years of operation as per Forms XI and XII, respectively (for expansion/diversification of existing companies two sets of profitability statements may be prepared—one for the project and the other for the existing operations only); cash flow statement for the company as a whole for ten operating years of the project in Form XIV, based on working results in Form XII, projected balance sheet for ten operating years for the company as a whole as per Form XV; break-even capacity level.

Economic Considerations Prices of competing import/export products, giving a break up as FOB, CIF, landed cost (including import duty) and selling price; detailed explanation for differences in selling prices of the products and those of imported goods, with quantitative data on differences in cost of production (such as scale of operation, differences in cost of inputs and various local duties and taxes); international/CIF/FOB prices of all inputs that can either be imported/exported; details of duties, taxes and incentives (excise duty, export duty, export assistance in the form of replenishment license, duty drawback, cash subsidy, any other); brief write-up on the economic benefits to the country in general and the region in particular, on account of the proposed project; contribution of the unit to the establishment of ancillary industries in the region.

Government Consents Details of the following licenses/consents required for the project in terms of date of issue, validity period, and present issue, if not already issued; (i) letter of intent, (ii) industrial license, (iii) capital goods clearance, (iv) import license, (v) foreign exchange permission, (vi) approval of technical/financial collaboration, (vii) clearance under MRTP Act, (viii) any other (specify); copies of licenses/consents etc, received; special conditions attached to the licenses/consents and the undertakings given by the company in connection with them.

Declaration A declaration by the applicant that the information, statements and papers furnished are true and correct.

List of Forms The following is the list of forms to be submitted along with the application for financial assistance.

I. Letter addressed to the Bankers
II. Existing Long-term Borrowings
III. Existing Short-term Borrowings
IV. Distribution of Shareholdings
V. Particulars of Buildings
VI. Particulars of Imported Machinery
VII. Particulars of Indigenous Machinery
VIII. Raw Materials Requirements
IX. Estimates of the Cost of Project
IX-A. Calculation of Cost of Project
IX-B. Calculation of Margin Money
X. Means of Financing
X-A. Proposal for Raising Share Capital
X-B. Sources of Expenditure Incurred

XI. Estimates of Cost of Production
XII. Estimates of Working Results
XII-A. Estimates of Production and Sales
XII-B. Calculation of Wages and Salaries
XIII. Unit Cost of Production
XIV. Cash Flow of Statement
XI. Projected Balance Sheet
XII. Break-even Point

Documentation and Disbursement of Term Loans After the project has been approved by the financial institutions, a formal financial letter of intent is issued in favour of the applicant. The letter of intent is issued to the applicant in the prescribed form enclosing therein the following other papers:

- Special terms and conditions as applicable to the financial assistance.
- General conditions as applicable to financial assistance.
- Specimen copy of common loan agreement.
- Draft of the resolution to be passed by the Board of Directors of the borrower for accepting the letter of intent.

On receipt of the letter of intent, the applicant must scrutinise the papers and may seek any additional clarification from the lending institution, if necessary. If the terms of sanction are acceptable, the company should simultaneously take the following steps:

- Convene a board meeting for acceptance of letter of intent and passing the board resolution. The formal acceptance, to the lending institution, is to be conveyed within 30 days from the date of intent letter.
- Finalise a final drawal schedule depending upon the progress of project implementation. The drawal schedule is also to be intimated to the lending institution along with the acceptance.
- Convene the General Body Meeting of the company, if necessary, to pass a resolution for availing the loan under Section 293(1)(d) of the Companies Act, 1956.
- Obtain draft copies of other loan documents such as deed of hypothetication and/or letter of guarantees, an undertaking for the disposal of shareholding acquired for meeting any shortfall in the project cost, a declaration for creation of joint mortgage by deposit of title deed etc, as required, as per the terms of sanction.
- Convene a board meeting to approve all the loan documents and get the necessary authority of the board for execution of documents.
- The disbursement of loan is further subject to prep-disbursement conditions, as stated in the general conditions applicable to financial assistance, being complied with. Necessary undertakings, certificates from legal advisors and/or statutory auditors, wherever necessary, must be prepared and submitted to the lending institution.
- All loans are subject to creation of a valid mortgage of all immovable properties in favour of the lending institutions. Creation of mortgage generally involves a lengthy procedure and the lending institution may agree to release the loan against a personal guarantee of the promoters, pending creation of final charge over the security. The matter, in this regard, must be cleared and a draft for personal guarantee must be obtained from the lending institution.
- All the documents are then to be executed by authorised persons in the legal department of the lending institution.

Disbursement and Utilisation of Loan The procedure for disbursement and utilisation of loan is as follows:

- The lending institution would get all the documents executed.
- The disbursement of the loan by the lending institution would be in stages depending upon the progress in project implementation and would be subject to compliance of pre-disbursement and other special conditions. The promoter has to first bring in a substantial part of his contribution (generally a minimum of 50 per cent) before any disbursement of loan by the financial institution. An auditor's certificate may also be required for this purpose, certifying the paid-up capital of the company at the time of disbursement.

A progress report on project implementation must also be submitted to the lending institution giving details of expenditure already incurred under various heads and a funds flow statement showing therein the phased requirement of funds for the timely execution of the project. The lending institution would evaluate these reports and finalise a disbursement schedule, which would further be subject to review from time to time on the basis of progress in project implementation.

- All the disbursements are made by cheques drawn in favour of the borrower and the date of cheque is taken as the date of disbursement of the loan.
- All these cheques are required to be deposited in a 'special bank account' to be maintained for this purpose. The funds lying in this account are not subject to the right of set-off or lien by the bank. For this purpose, a letter from the bank must be obtained from the bank forgoing its right of set-off or lien and deposited with lending institution.
- The borrower must keep a proper record of withdrawals from this special account and also authorise his bank to reveal all the information, as required, to the lending institution regarding operations in this account. The borrower is also required to furnish a statement showing the manner in which the loan already disbursed has been utilised. The statement is to be submitted to the lending institution at the end of each month following the month in which the loan monies are disbursed.
- The entire loan is not disbursed as long as the final security by way of mortgage of immovable property is not created. Usually 10 per cent of the sanctioned loan is withheld and disbursed only when all the formalities in this regard are completed.

Charging of Securities All loans by financial institutions are secured by:

- A first mortgage and charge in favour of the lending institutions of all the borrower's immovable properties, both present and future; and
- A first charge by way of hypothecation in favour of the lending institution of all borrower's movables (except book debts), including movable machinery, machinery spares, tools and accessories, present and future, subject to prior charges created and/or to be created;
  - in favour of the borrower's bankers on the borrower's stocks of raw materials, semi-finished and finished goods, consumables stores and such other movables as may be agreed by the lending institution for securing the borrowings for working capital requirements in the ordinary course of business; and
  - on specific items of machinery purchased/to be purchased under deferred payment facilities to the borrower, as permitted by lending institutions.

The hypothecation agreement is invariably executed before any disbursement. The borrowers should, however, take immediate steps for the creation of mortgage to entitle himself to avail the entire sanctioned loan. Creation of mortgage would involve the following steps:

- Scrutiny of title deeds of all immovable properties and mutation certificates by the legal department of the lending institution, to determine the ownership and clear marketable title of the borrower over

these properties. Copies of all title deeds, mutation certificates and other relevant documents should be promptly made available to the lending institution to enable it to carry out these verifications.

- Investigating the records of the local land authorities/Registrar's office is relevant to ensure that the property under investigation is free from all encumbrances. This exercise would also be conducted by the legal department of the lending institution.
- Obtaining the authority of the board for creation of mortgage and signing the declaration in the prescribed form. The board's resolution in this regard should also authorise the person(s) who has to deposit the original title deeds with the lending institution for creation of the mortgage.
- Obtaining of income-tax clearance under Section 281(1) of the Income tax Act for the creation of mortgage. The income-tax clearance certificate is also to be submitted to the legal department of the lending institution.
- Depositing of all the title deeds, mutation certificates etc with the legal department of the lending institution and furnishing the necessary declaration in the prescribed form duly signed by authorised person(s).

With the completion of all the above formalities, the mortgage charge is created. Nevertheless, the legal department of the lending institution would communicate to the borrower regarding the final creation of security and the date from which the mortgage is deemed to be created.

Once again it may be emphasised here that all the steps for creation of mortgage charge must be completed as early as possible. However, a penal rate of interest @ 1 per cent higher than the normal rate would be charged by the lending institution on the entire outstanding loan till the date of creation of mortgage.

Registration of Charge Particulars of all charges created over the assets of the company are required to be registered with the Registrar of Companies, under Section 125 of Companies Act, 1956, within 30 days of the creation of charge. The company should, therefore, arrange to file particulars of charge created by it in the prescribed Form 8 and Form 13 with the Registrar of Companies, within the stipulated time. Particulars of both the hypothecation charge over the movable properties as created by the Deed of Hypothecation and the mortgage charge over immovable properties are required to be submitted and registered with the Registrar of Companies.

Project Appraisal

Financial institutions/carry out a thorough scrutiny of a project submitted to them for financing. The appraisal covers the following aspects of a proposal: (i) Technical feasibility, (ii) Managerial competence, (iii) Commercial and financial viability and (iv) Economic and environmental viability. The main elements of these aspects of a project evaluation by financial institutions and banks are briefly outlined in this Section.

Technical Feasibility All factors relating to infrastructural needs, technology, availability of machine, material and so on are scrutinised under this head. Broadly speaking, the factors that are covered under this aspect include: availability of basic infrastructure, licensing/registration requirements, selection of technology/technical process, availability of suitable machinery/raw material/skilled labour and so forth.

Basic Infrastructure The main points to be examined under this head are as discussed below.

Land and its Location Land is the most basic requirement for the setting up of any project. The size of the available land should not only meet the present requirements but take care of future expansion plans as well. The location of land is also vital in as much as to determine the transport facilities available in the

area. Projects located in well developed industrial areas enjoy the benefits of developed basic infrastructure readily available to them.

Buildings Necessary plans for factory buildings, plant room, workshops, administrative blocks, residential blocks etc, as considered necessary, are to be finalised and provided in the project cost.

Availability of Water and Power Water and power are other two very vital requirements. Some projects may consume large quantities of water, which would be available either through municipal supply or from underground sources. Storage tanks of adequate capacity may also be required and should be provided for in the project. Many projects have, of late, suffered due to the erratic supply of power in many states. Arrangements for getting the required power load sanctioned from the electricity boards and the necessity of providing alternative captive power generation capacity need to be very closely examined in all the cases.

Availability of Labour The availability of labour is mainly dependent on the location of the project. The cheap and abundant supply of labour makes a lot of difference to project implementation. For projects to be set up in far flung areas, special incentives might be necessary to induce the labour to shift to that area, which may add to the cost of project and its implementation.

Licensing The Government of India has recently liberalised provisions relating to the licensing of industries. Certain industries are, however, subject to licensing. The exact position in this regard has to be ascertained and necessary arrangement should be made for obtaining industrial licenses.

A few manufacturing industries, where more than adequate capacity has already been created, in the country, are discouraged and are put in the negative list. This list is amended from time to time and industries included in the list are generally not extended any financial assistance by financial institutions. Special efforts would, therefore, be necessary and some cogent reasons would have to be given to justify setting up of such projects.

Technology/Technical Process An important aspect of project evaluation is the critical examination of the technology/technical process selected for the project. The main points considered in this regard are as under.

Availability The technical process/technology selected for the project must be readily available either indigenously or necessary arrangements for foreign collaboration must be finalised. Foreign collaboration, if not covered under the automatic route of RBI, requires prior permission from the Government of India and is generally permitted in the following cases: (a) Where indigenous technology is too closely held in India and is not available, or (b) Where foreign collaboration is necessary for updation of the existing industry and modernisation thereof, or (c) Where the project is for import substitution or for setting up of an export oriented unit.

The provisions regarding foreign technical collaboration with or without financial collaboration have also been liberalised recently. Many foreign collaborations can be now approved by the Reserve Bank of India and approval from the Government of India is not necessary. Full provisions in this regard must be elaborated and form the subject matter of the project report.

The technical process selected is to be briefly stated in the project report and is to be critically compared with other technical processes in operation for manufacture of similar products, to establish its superiority over the other processes.

Application The selected technology must find successful application in the Indian environment and the management (promoter) should be capable of fully absorbing the technology. This is an important factor

and many projects have failed because of the wrong selection of technology, which could not be successfully implemented in Indian environments.

Continuous Updating The selected technology should not only be modern but the underlying technical arrangement must provide for its constant updation as a necessary safeguard against the process becoming obsolete. The R&D (Research and Development) facilities required to be created for complete absorption and continuous updation of technology need to be very closely examined to ensure good long-term prospects for the proejct.

Availability of Skilled Technical Personnel/Training Facilities The foreign technical collaboration should provide necessary training facilities to Indian personnel who would be involved in project implementation and the subsequent running of the project. The availability of technically trained persons for the selected technical process, indigenous or foreign, has to be ensured in any case.

Plant Size and Production Capacity The selection of plant size and production capacity is mainly dependent on the total capital outlay by the promoter and also on the available market for the product. This aspect is, however, very important in selecting the right technology that would be suitable for the envisaged scale of production. Creation of capacity for over production may increase the capital cost with consequent interest load, which may ultimately effect the working of the project. The project may fail solely on this ground despite selecting the best technology.

Availability of Machinery The availability of plant and machinery required for setting up of the project, after the selection of technology, is to be ensured. Some plants may require a long lead time, which may result in delay and consequent cost overrun, upsetting the financial planning in the beginning itself. It is also desirable that the plant suppliers give a suitable guarantee for its performance up to the rated capacity. Necessary arrangements for servicing of the machinery, supply of spare parts and consumables are also to be examined so that there are no production bottlenecks due to failure of plant and machinery in the long run.

Availability of Raw Material and Consumables The easy availability of raw materials and consumables is a precondition for the successful operation of any project. This aspect, therefore, needs considerable attention at the planning stage itself. Tie-up arrangements with the raw material suppliers may be necessary if the suppliers are few.

Import of raw material may be necessary in a bunch requiring storing of excess inventory for a long time, forcing the unit to arrange for additional working capital, thus, increasing the project cost. Import of a particular type of raw material may also be subject to licensing by the Import Trade Control Authorities; thus, bringing into a sense of uncertainty on its availability due to change in governments policy. All these factors are very important and detailed planning is necessary to ensure easy availability of the required raw material. Financial institutions, lending for the project, have to be satisfied on this score as it may prove vital for the successful implementation and running of the project.

Managerial Competence The ultimate success of even a very well conceived and viable project may depend on how competently it is managed. Besides project implementation, other important functions required to be controlled can broadly be classified as under: Production, Finance, Marketing, and Personnel.

A complete integration of all these functions within an organisation may be the first step towards an effective management.

The promoter of the project is to provide necessary leadership and his qualification, experience and track record would be closely examined by the lending institution. The details of other projects successfully

implemented by the same promoter may provide the necessary confidence to these institutions and help in the final approval of the project.

It is also necessary to provide an organisation chart clearly defining the responsibility and decision-making levels and the details of the arrangements already made/to be made to man these positions by well qualified professionals. Proper planning and budgeting, participation of workers in the management, decentralising decision making, developing an effective internal control system etc are some of the factors that would help in the better management of any project.

Commercial Viability Any project can be commercially viable only if it is able to sell its production at a profit. For this purpose, it would be necessary to study the demand and supply pattern of that particular product to determine its marketability.

Various methods such as the trend method and the regression method for estimation of demand are employed, which is then to be matched with the available supply of a particular product. The prospects of exporting the product may also be examined while assessing the demand. If the selling of the product has already been tied up with foreign collaborators or with some other users, the fact needs to be highlighted. This factor should definitely have a positive influence on the commercial viability of a project. Necessary factors that may influence the supply position, such as licensing of new projects, introduction of new products, change in import policy etc should also be taken into cognizance while estimating the marketing potential of any product. This exercise should be conducted for a sufficiently long period, say, 5 to 10 years to determine the continued demand of the product during the currency of the loan granted by financial institutions.

This factor would also help the promoter to take a right decision in selecting the size of the plant and determining the capacity utilisation.

Financial Viability Various steps are involved in determining the financial viability of a project as under:

Determination of Project Cost A realistic assessment of project cost is necessary to determine its source of financing and to properly evaluate the financial aspects of the project. For this purpose, the various items of cost may be sub-divided into as many sub-heads as possible so that all factors are taken into account while arriving at the total cost. Sufficient cushions may also be provided for any inflationary increase expected during the course of project implementation. The major items of cost are as under.

Land and Site Development The various sub-heads for estimation of cost of land and its development that are to be taken into consideration include:

(i) Cost of land or premium payable on leasehold land
(ii) Registration and other conveyancing charges
(iii) Cost of levelling and development, if any
(iv) Cost of laying approach road connecting the factory site to main road
(v) Cost of internal roads in the factory
(vi) Cost of fencing/compound wall
(vii) Cost of gates

Any other expenditure required for the development of land to make it suitable for the project is also to be specifically provided to arrive at the final cost under this item.

Buildings Various sub-heads for estimation of expenditure under this item include:

(i) Factory building for the main plant and machinery

(ii) Factory building for auxiliary services like steam supply, water supply, laboratory, workshop etc
(iii) Godowns, warehouses and open year facilities
(iv) Administrative buildings and other miscellaneous non-factory buildings such as canteen, guest house, time office etc
(v) Silos, tanks, basins, cisterns and such other structures that are necessary for the installation of plant and equipment and other civil engineering works
(vi) Garages
(vii) Cost of sewer, drainage etc
(viii) Residential quarters for essential staff
(ix) Architects' fee

The cost of construction would mainly depend on the type of construction envisaged and also, to some extent, on the type of soil and its load bearing capacity. The construction of residential quarters for workers and other key staff may be permitted only if the project is situated in a less developed area. Detailed estimation of cost under the various sub-heads given above may preferably be obtained from a reputed firm of civil engineers/architects to avoid any cost overrun at a later stage.

Plant and Machinery The cost of plant and machinery must include transportation and other charges up to the site and also the erection charges. Full details with broad specifications and number of equipments to be purchased, with respect to imported as well as indigenous machinery, are to be given separately. The name of the manufacturer and whether orders have already been placed or not is also to be specified. The various sub-heads under this major head include:

(i) Cost of imported machinery, including freight, insurance, loading and unloading charges, customs duty and transportation charges up to site
(ii) Cost of indigenous machinery, including transportation charges upto the project site
(iii) Machinery stores and spares
(iv) Foundation and erection charges

Technical Know-How Fees This should also include any expenses on drawings etc payable to foreign collaborators.

Expenses on Foreign Technicians and Training of Indian Technicians Abroad

Miscellaneous Fixed Asset This includes:

(i) Furniture
(ii) Office machinery and equipment
(iii) Vehicles such as cars and trucks
(iv) Railway siding
(v) Laboratory, workshop and fire-fighting equipment
(vi) Equipment for supply of power, supply and treatment of water etc

This is not an exhaustive list of miscellaneous assets, the requirement of which will differ from project to project. A reasonable assessment of all the miscellaneous fixed assets essentially required shall be made to determine the actual cost under this head.

It is important to note here that expenses may sometimes be incurred to acquire patents, trade marks, copyrights etc, the cost of which is to be included in the project cost under this head.

Preliminary and Capital Issue Expenses Some expenditure is to be incurred by the promoter for flotation of the company, preparation of the project report and so forth. Initial disbursement by way of advertising and publicity, printing of stationery and also as underwriting commission and brokerage towards the capital issue would be necessary as such expenditure would form a part of the project cost. Reasonable estimation of such expenses would, therefore, be necessary and should be shown under this head.

Pre-operative Expenses A few expenses would have to be incurred in the pre-operative stage, during the course of project implementation, and shall form a part of the project cost. Such expenses include outlay on:

(i) Establishment, including salary to staff
(ii) Rent, rates and taxes
(iii) Travelling expenses
(iv) Insurance during construction
(v) Mortgage charges, if any
(vi) Interest on deferred payments and commitment charges on borrowings, if any
(vii) Other miscellaneous start up expenses

Provisions for Contingencies No estimation of cost, even if done after a very detailed examination of all the relevant aspects, may be perfect and it is necessary that a reasonable cushion may be provided in the estimation of the total cost of the project to meet any contingencies in the future and avoid over-run. Estimates of cost under various heads, as already discussed, might have been made either on the basis of firm contracts already entered into at current market rates that may change due to inflation or due to other reasons at the time of placement of firm orders. Some items of expenditure might have been overlooked at the time of estimation of preliminary and pre-operative expenses.

Suitable provisions for such contingencies must be made, supported by valid reasons. The basis of calculation of provision also needs to be clarified to justify the overall cost of the project.

Margin Money for Working Capital Working capital requirements of any project are met by commercial banks. The part of working capital is, however, required to be financed from long-term resources. This part is generally referred to as margin for working capital and is included in the cost of the project. The necessary estimation for margin money required for the working capital should be made and included in the cost of project.

Sources of Funds/Means of Financing After estimating the cost of a project, the next step obviously would be to find out the sources of funds by means of which the project will be financed. The project would be financed by contribution of funds by the promoter himself and also raising loans from others, including term loans from financial institutions. The means of financing would include:

- Issue of share capital, including ordinary/preference shares
- Issue of secured debentures
- Secured long-term and medium-term loans (including the loans for which the application is being put up to the term lending institutions)
- Unsecured loans and deposits from promoters, directors etc
- Deferred payments
- Capital subsidy from the Central/State Governments

If any additional funds are to be raised from an alternative source, the details thereof may also be provided. The promoters contribution way of share capital and/or loans is required to be shown separately.

Profitability Analysis After determining the cost of project and means of financing, the viability of the project will depend on its capacity to earn profits to service the debts and capital. To undertake a profitability analysis, it would be necessary to draw estimates of the cost of production and working results. These estimates are made for a period of 10 years and the projected profit and loss account for 10 years is prepared to draw inference regarding the expected profit.

Break-even Analysis Estimation of working results pre-supposes a definite level of production and sales and all calculations are based on this level. It may, however, not be possible to realise those levels at all times. The minimum level of production and sale at which the unit will run on 'no profit-no loss' basis is known as the break-even point and the first goal of any project would be to reach that level. The break-even point can be expressed in terms of the volume of production or as a percentage of plant capacity utilisation. The cost of production may be divided into two parts as under.

Fixed Costs These costs are not related to the volume of production and remain constant within a relevant range for a given period of time. Examples of such costs include rent of building, depreciation, interest on term loans, salaries of permanent employees etc.

Variable Costs These costs have a direct relationship with the volume of production. This will increase with any increase in the level of production. Examples of such costs include raw material, fuel and power, wages, packaging and so on.

Cash Flow After carrying out the profitability analysis and determining the expected profits, a project cash flow statement for a period of 10 years is drawn. Cash flow statement is, in fact, a narration of all the sources of cash available during the course of operation within a period of time (generally one operative year) and its possible use (development) during that period. This helps to find out the total surplus funds created during the operational year. This information helps to determine the capacity of the project to service its debts and fix the repayment periods of loans granted for a particular project as well as determine the moratorium period for repayment of the loan. The loan is repaid from the surplus cash generated during the operations in a year.

Debt Service Coverage Ratio Debt service coverage ratio is calculated to find out the capacity of the project to service its debt, that is, the repayment of term borrowings and interest. The debt service coverage ratio (DSCR) is worked out in the following manner:

$$\text{DSCR} = \frac{\text{Net Profit after tax + Depreciation + Interest on long-term borrowings}}{\text{Repayment of term borrowings during the year + Interest on long-term borrowings}}$$

A higher DSCR would impart intrinsic strength to the project to repay its term borrowings and interest as per the schedule, even if some of the projections are not fully realised. Normally a minimum DSCR of 2:1 is insisted upon by term lending institutions and repayment is fixed on that basis.

Sensitivity Analysis Sometimes it may also be necessary to carry out a sensitivity analysis to identify elements affecting the viability of a project, taking into account the different sets of assumptions. While evaluating profitability projections, the sensitivity analysis may be carried in relation to changes in the sale price and raw material costs. For instance, if the sale price is reduced by 5 per cent to 10 per cent and raw materials costs increased by 5 per cent to 10 per cent the resultant impact of these changes on the DSCR most be ascertained. If the new DSCR, so calculated after changes, still proves that the project is viable, the financial institution may go ahead in funding the project.

Projected Balance Sheet On the basis of profitability and cash flow statements already drawn, the projected balance sheet for a period of 10 years is also prepared to know the financial position of the project at any given point of time.

Environmental and Economic Viability The performance of a project may not only be influenced by the financial factors stated earlier. Other external environmental factors, which may be economic, social or cultural, may have a positive impact as well. The larger projects may be critically evaluated by lending institutions by taking into consideration the following factors:

- Employment potential
- Utilisation of domestically available raw materials and other facilities
- Development of an industrially backward area as per government policy
- Effects of the project on the environment, with particular emphasis on the pollution of water and air that will be caused by it
- The arrangements for effective disposal of effluent, as per government policy.
- Energy conservation devices etc employed for the project

Other economic factors that influence the final approval of a particular project are, Net Present Value based on DCF, Internal Rate of Return (IRR) and Domestic Resources Cost (DRC).

SCBA by Financial Institutions Apart from financial assistance, financial institutions in India also scrutinise projects from the large social point of view. They basically focus on three aspects of a project, namely, economic rate of return, effective rate of protection and domestic resource cost.

Economic Rate of Return The method followed by financial institutions in India to compute the economic rate of return is based on the L-M method discussed in the preceding chapter. However, the L-M method is followed only partially, presumably to reflect the prevailing situation in the country. The main elements of the method used by financial institutions are as follows.

- It uses international/border prices as a substitute for market price for valuation of non-labour tradeable inputs/outputs.
- Where international prices are directly available, it uses CIF prices for inputs (imports) and FOB prices for outputs (exports).
- If border prices are not readily available for tradeable items, as also for non-tradeable items such as electricity, transportation and so on, social conversion factors are used to convert actual (rupee) cost into social cost. While in some cases like land, a social conversion factor is applied directly to the actual domestic (rupees) cost, in other cases like transport, the domestic cost is broken down into three components: (i) tradeable, (ii) labour and (iii) residual. These components are in turn converted separately into social cost. For instance, the social cost of each component is obtained by multiplying it by a factor of (i) 1/1.5, for a tradeable component, (ii) 0.5, for labour component, assuming that the shadow price of labour is 50 per cent of the actual, and (iii) 0.5 for residual component.

Effective Rate of Protection (ERP) The ERP is a measure of the shelter/protection available to a project in terms of tariffs, import restrictions, and subsidies to encourage domestic industries and protect them against foreign competition. It is computed according to Equation 7.1.

$$\text{EPR } (\%) = \frac{\text{Value added at domestic price} - \text{Value added at world price}}{\text{Value added at world prices}} \times 100 \qquad \textbf{(7.1)}$$

The higher the value of ERP, the higher is the implied protection available to the project. When ERP is zero the project does not enjoy any protection. The extent of protection to a project generally does not exceed 30 per cent. The data required to compute ERP are: (a) selling price (1) at domestic prices net of taxes/excise duties but inclusive of reasonable selling commission, (2) at world prices, that is, CIF price for imports and FOB price for exports; (b) If input cost is divided into (i) traded and (ii) non-traded and (c) value added (a – b) represents payments to capital and labour. The import cost includes cost of raw materials/stores; power, fuel and water; repairs and maintenance; part of administrative overheads/expenses and selling expenses. The traded inputs are valued both at domestic and world prices, while non-traded inputs are valued at domestic prices only. The raw material/stores input is generally a traded item. But raw materials that have (1) low value-to-volume ratio and involve disproportionately high transport and (2) are not imported are treated as no non-traded items. Power, fuel and water are normally treated as non-traded. However, when fuel costs are significant, as in the case of oil/coal, it is treated as traded and valued at both domestic and world prices. Unless it entails substantial consumption, repairs and maintenance are treated as non-traded items. Selling expenses are regarded as non-traded. Part of the administrative overheads/expenses included here are exclusive of labour costs, which are a part of value added category. Included in them are expenses like rent, insurance charges, telephone tariff and so on, and are treated as non-traded.

Domestic Resource Cost (DRC) The DRC shows the domestic cost incurred per unit of foreign exchange saved/earned. The financial institution in India calculates DRC according to Equation 7.2.

$$DRC = \frac{A + B + C}{P - (Q + R + S + T)} \times \text{Exchange rate} \qquad \textbf{(7.2)}$$

where

A = Annual charge on domestic capital at 10 per cent. The domestic capital consists of (a) cost of domestic plant, machinery, miscellaneous fixed assets, excluding excise duty/sales tax, (b) preliminary/pre-operative expenses, exclusive of interest during construction, (c) clearing and local transport cost of imported machinery, (d) working capital investment other than investment in imported and tradeable raw material inventory.

B = Annual description on domestic capital assets (other than land) at 10 per cent.

P = Sales realisation at international prices, i.e, CIF (cost, insurance and freight) price for an imported/importable/import substitute good and FOB (free on board) price for an export/exportable good.

Q = Annual charge on imported capital asset at 10 per cent. This consists of (a) cost of imported plant, machinery and miscellaneous fixed assets (excluding import duties), (b) working capital investment in imported and tradeable raw material inventory, net of all taxes/duties.

R = Annual depreciation on imported capital assets at 8 per cent.

S = Annual cost of imported operating inputs valued at actual price paid for them, excluding import duty. Local transportation cost is treated as a domestic cost.

T = Annual cost of domestically procured but tradeable inputs. They are divided into two parts: (a) traded/tradeable inputs at international prices and (b) non-traded inputs valued at their domestic cost, excluding transfer payments like taxes, duties and subsidies.

Since taxes, duties and subsidies are mere transfer payments to, or from, the government and do not represent a cost/gain to the economy as a whole, they are excluded from the valuation of all items. If the DRC per US dollar saved is lower than the prevailing exchange rate, it is desirable to manufacture the product in the country rather than import it.

DEBENTURES/BONDS/NOTES

Akin to a promissory note, **debentures/bonds** represent creditorship securities and debenture-holders are long-term creditors of the company. As a secured instrument, it is a promise to pay interest and repay principal at stipulated times. In contrast to equity capital which is a variable income (dividend) security, the debentures/notes are fixed income (interest) security.

Attributes

As a long-term source of borrowing, debentures have some contrasting features compared to equities.

Trust Indenture When a debenture is sold to investing public, a trustee is appointed through an **indenture/trust deed**. It is a legal agreement between the issuing company and the trustee who is usually a financial institution/bank/ insurance company/firm of attorneys. The trust deed provides the specific terms of agreement such as description of debentures, rights of debenture-holders, rights of the issuing company and responsibilities of the **trustee**. The trustee is responsible to ensure that the borrower/company fulfills all its contractual obligations.

Interest The debentures carry a fixed (coupon) rate of interest, the payment of which is legally binding/ enforceable. The debenture interest is tax-deductible and is payable annually/semi-annually/quarterly. Some public sector undertakings issue tax-free bonds the income from which is exempted from tax in the hands of the investors. A company is free to choose the coupon rate which may be fixed or floated, being determined in relation to some benchmark rate. It is also related to the credit rating of the debenture as an instrument.

Maturity It indicates the length of time for redemption of par value. A company can choose the maturity period, though the redemption period for non-convertible debentures is typically 7-10 years. The redemption of debentures can be accomplished in either of two ways: (i) debentures redemption reserve (sinking fund) and (ii) call and put (buy-back) provision.

Debenture Redemption Reserve (DRR) A DRR has to be created for the redemption of all debentures with a maturity period exceeding 18 months equivalent to at least 50 per cent of the amount of issue/redemption before commencement of redemption.

Call and Put Provision The call/buy-back provision provides an option to the issuing company to redeem the debentures at a specified price before maturity. The **call price** may be more than the par/face value by usually 5 per cent, the difference being **call premium**. The put option is a right to the debenture-holder to seek redemption at specified time at predetermined prices.

Security Debentures are generally secured by a charge on the present and future immovable assets of the company by way of an equitable mortgage.

Convertibility Apart from pure non-convertible debentures (NCDs), debentures can also be converted into equity shares at the option of the debenture-holders. The conversion ratio and the period during which conversion can be affected are specified at the time of the issue of the debenture itself. The convertible debentures may be fully convertible (FCDs) or partly convertible (PCDs). The FCDs carry interest rates lower than the normal rate on NCDs; they may even have a zero rate of interest. The PCDs have two parts: (a) convertible part, (b) non-convertible part. Typically, the convertible portion is converted into equity share at a specified premium after a specified date from the date of allotment,while the non-convertible portion is payable/ redeemable in specified equal instalments on the expiry of specified years from the date of allotment.

Credit Rating To ensure timely payment of interest and redemption of principal by a borrower, all debentures must be compulsorily rated by one or more of the four credit rating agencies, namely, Crisil, Icra, Care and FITCH India.

Claim on Income and Assets The payment of interest and repayment of principal is a contractual obligation enforceable by law. Failure/default would lead to bankruptcy of the company. The claim of debenture-holders on income and assets ranks *pari passu* with other secured debt and higher than that of shareholders–preference as well as equity.

Evaluation

The merits and demerits of debentures as a source of long-term funds from the point of view of the company and investors/debenture-holders are as follows:

Advantages The advantages for company are (i) lower cost due to lower risk and tax-deductibility of interest payments, (ii) no dilution of control as debentures do not carry voting rights. For the investors, debentures offer stable return, have a fixed maturity, are protected by the debenture trust deed and enjoy preferential claim on the assets in relation to shareholders.

Disadvantages The disadvantages for the company are the restrictive covenants in the trust deed, legally enforceable contractual obligations in respect of interest payments and repayments, increased financial risk and the associated high cost of equity. The debenture-holders have no voting rights and debenture prices are vulnerable to change in interest rates.

To summarise*, debentures, as long-term source of funds, have low cost, do not dilute control, involve high risk and put some restraint on managerial freedom.*

Innovative Debt Instruments

In order to improve the attractiveness of bonds/debentures, some new features are added. As a result, a wide range of innovative debt instruments have emerged in India in recent years. Some of the important ones among these are discussed below.

Zero Interest Bonds/Debentures (ZIB/D) Also known as zero coupon bonds/debentures, ZIBs do not carry any explicit/coupon rate of interest. They are sold at a discount from their maturity value. The difference between the face value of the bond and the acquisition cost is the gain/return to the investors. The implicit rate of return/interest on such bonds can be computed by Equation 7.1.

$$\text{Acquisition price} = \text{Maturity (face) value}/(1 + i)^n \quad \textbf{(7.3)}$$

Where i = rate of interest

n = maturity period (years)

Deep Discount Bond (DDB) A deep discount bond is a form of ZIB. It is issued at a deep/steep discount over its face value. It implies that the interest (coupon) rate is far less than the yield to maturity. The DDB appreciates to its face value over the maturity period.

The DDBs are being issued by the public financial institutions in India, namely, IDBI, SIDBI and so on. For instance, IBDI sold in 1992 a DDB of face value of Rs 1 lakh at a deep discount price of Rs 2,700 with a maturity period of 25 years. If the investor could hold the DDB for 25 years, the annualised rate of return would work out to 15.54 per cent. The investor had the option to withdraw (put option) at the end of every five years with a specified maturity/deemed face value ranging between Rs 5,700 (after 5 years) and Rs 50,000 (after 20 years), the implicit annual rate of interest being 16.12 and 15.71 per cent respectively.

The investors could also sell the DDBs in the market. The IBDI had also the option to redeem them (call option) at the end of every 5 years presumably to take advantage of prevailing interest rates. A second series of DDBs was issued by the IDBI in 1996 with a face value of Rs 2 lakh and a maturity period of 25 years, the deep discount issue price being Rs 5,300.

The merit of DDBs/ZIDs is that they enable the issuing companies to conserve cash during their maturity. They protect the investors against the reinvestment risk to the extent the implicit interest on such bonds is automatically reinvested at a rate equal to its yield to maturity. However, they are exposed to high repayment risk as they entail a balloon payment on maturity.

Secured Premium Notes (SPNs) The SPN is a secured debenture redeemable at a premium over the face value/purchase price. It resembles a ZIB. There is a lock-in period for SPN during which no interest is paid. The holder has the option to sell back the SPN to the issuing company at par after the lock-in-period. The redemption is made in instalments. The SPN is a tradeable instrument. A typical example is the SPN issued by TISCO in 1992. Its salient features were:

- Each SPN had a face value of Rs 300. No interest would accrue during the first year after allotment.
- During years 4-7, principal will be repaid in annual instalment of Rs 75. In addition, Rs 75 will be paid each year as interest and redemption premium. The investor could choose a mix of low interest/high premium or high interest/low premium from three options: (i) interest, Rs 37.5, premium, Rs 37.50; (ii) interest, Rs 25 and premium, Rs 50 and (iii) interest, Rs 50 and premium, Rs 25.
- A warrant was attached to the SPN entitling the holder to acquire one equity share for cash by payment of Rs 100. The option could be exercised between first year and one-and-a-half year after allotment by which time the SPN will be fully paid up.
- The holder was given an option to sell back the SPN at the par value of Rs 300.

Although the SPN is akin to a ZIB to the extent it has no coupon rate of interest, the interest payment and principal repayment are spread over a period of 4 years whereas in case of ZIBs the entire payment is made in lump sum on maturity.

The before tax rate of return on the SPN = 13.65 per cent, that is,

$$300 = \frac{0}{(1+r)} + \frac{0}{(1+r)^2} + \frac{0}{(1+r)^3} + \frac{150}{(1+r)^4} + \frac{150}{(1+r)^5} + \frac{150}{(1+r)^6} + \frac{150}{(1+r)^6}$$

Floating Rate Bonds (FRBs) The interest on such bonds is not fixed. It is floating and is linked to a benchmark rate such as interest on treasury bills, bank rate, maximum rate on term deposits. It is typically a certain percentage point higher than the benchmark rate. The prices of FRBs tend to be fairly stable and close to par value in comparison with fixed interest bonds. They provide a protection against inflation risk to investors, particularly banks and financial institutions.

Callable/Puttable Bonds/Debentures/Bond Refunding Beginning from 1992 when the Industrial Development Bank of India issued bonds with **call features**, several callable/puttable bonds have emerged in the country in recent years. The call provisions provide flexibility to the company to redeem them prematurely. Generally, firms issue bonds presumably at lower rate of interest when market conditions are favourable to redeem such bonds. In other words, the firm refunds its debt.

Evaluation The bond refunding decision can be analysed as a capital budgeting decision. **If the present value of the stream of net cash savings exceeds the initial cash outlay, the debt should be refunded**.

Consider Example 7.1.

EXAMPLE 7.1

The 11 per cent outstanding bonds of the Bharat Industries Ltd (BIL) amount to Rs 50 crores, with a remaining maturity of 5 years. It can now issue fresh bonds of 5 year maturity at a coupon rate of 10 per

cent. The existing bonds can be refunded at a premium (call premium) of 5 per cent. The flotation costs (issue expenses + discount) on new bonds are expected to be 5 per cent. The unamortised portion of the issue expenses on existing bonds is 1.5 crore. They would be written off as soon as the existing bonds are called/refunded.

If the BIL is in 35 per cent tax bracket, would you advise it to call the bond?

SOLUTION

(Amount in Rs crore)

Annual net cash savings (Working note 2)	0.36
PVIFA (10,13) (Working note 3)	3.517
Present value of annual net cash savings	1.266
Less: Initial outlay ((Working note 1)	3.600
NPV (bond refunding)	(2.334)

It is not advisable to call the bond as the NPV is negative.

Working Notes

(1) (a) Cost of calling/refunding existing bonds

Face value			50.0
Plus: Call premium (5 per cent)			2.5
			52.5
(b) Net proceeds of new bonds			
Gross proceeds			50.0
Less: Flotation costs			2.5
			47.5
(c) Tax savings on expenses			
Call premium	2.5		
Plus: Unamortised issue costs	1.5		
	4.0 × (0.35 tax)		1.40
Initial outlay [(1a) – (1b) – (1c)]			3.60

(2) (a) Annual net cash outflow on existing bonds

Interest expenses	5.50	
Less: Tax savings on interest expenses and amortisation of issue costs : 0.35 [11.0 + (1.5/5)]	1.98	3.52
(b) Annual net cash outflow on new bonds		
Interest expenses	5.00	
Less: Tax savings on interest expenses and amortisation of issue costs : 0.35 [11.0 + (2.5/5)]	1.88	3.16
Annual net cash savings [(2a) – (2b)]		0.36

(3) Present value interest factor of 5 year annuity, using a 13 per cent after tax [0.20 (1 – 0.35)] cost of new bonds = 3.517

HYBRID FINANCING/INSTRUMENTS

As hybrid source of financing has characteristics of both straight debt and straight equity falling somewhere in between. The important hybrid instruments/sources of financing are: (i) preference shares/capital, (ii) convertible/exchangeable debentures/bonds, and (iii) warrants. These are covered in this Section. The focus is on their features and valuation.

Preference Share Capital

Preference capital is a unique type of long-term financing in that it combines some of the features of equity as well as debentures. As a *hybrid* security/form of financing, it is similar to debenture insofar as: (i) it carries a fixed/stated rate of dividend, (ii) it ranks higher than equity as a claimant to the income/assets, (iii) it normally does not have voting rights and (iv) it does not have a share in residual earnings/assets. It also partakes some of the attributes of equity capital, namely, (i) dividend on preference capital is paid out of divisible/after tax profit, that is, it is not tax-deductible, (ii) payment of preference dividend depends on the discretion of management, that is, it is not an obligatory payment and non-payment does not force insolvency/liquidation and (iii) irredeemable type of preference shares have no fixed maturity date.

Features/Attributes

The main attributes of preference shares/capital are discussed below.

Prior Claim on Income/Assets Preference capital has a prior claim/preference over equity capital both on the income and assets of the company. In other words, preference dividend must be paid in full before payment of any dividend on the equity capital and in the event of liquidation, the whole of preference capital must be paid before anything is paid to the equity capital. Thus, preference capital stands midway between debentures and equity as regards claim on income and assets of the company. It is also referred to as a *senior security*. Stated in terms of risk perspective, preference capital is less risky than ordinary shares but more risky than debentures.

Cumulative Dividends Preference capital is cumulative in the sense that all unpaid dividends are carried forward and payable before any ordinary dividend is paid.

Redeemability Preference capital has a limited life/specified/fixed maturity after which it must be retired. However, there are no serious penalties for breach of redemption stipulation.

The preference shares have a stated call price which is above the original issue price and decreases over time. Like the call feature on bonds, the call feature on preference shares provides flexibility to the issuer company. Since the market price of **straight preference shares** tends to fluctuate with changes in interest rate, the value of the preference share call feature is determined by the same considerations as is the call feature for bonds (discussed in Section 3 of this Chapter). The refund of preference share is illustrated in Example 7.2.

EXAMPLE 7.2

Delhi Manufacturing Company (DMC) is considering refunding its preference shares. They have a par value of Rs 100 and a stated dividend of 12 per cent. The call price is Rs 104 per share and 5,00,000 shares are outstanding. The DMC can issue new preference shares at 11 per cent. The new issue can be sold at par, the total par value being Rs 5 crore. Flotation costs would be Rs 13,60,000. Marginal tax rate is 35 per cent. A 90-day period of overlap is expected between the time the new preferences share are issued and the time the existing preference shares are retired. Should the DMC refund its preference shares?

SOLUTION

Analysis of Preference Shares Refund Using Capital Budgeting Analysis

Net Cash Outflow:	
1 Cost of calling old preference shares (5,00,000 × Rs 104)	Rs 5,20,00,000
2 Net proceeds of new issues (Rs 5 crore – Rs 13,60,000)	4,86,40,000

(*Contd.*)

(*Contd.*)

3	Difference (1 – 2)	33,60,000
4	Preference share dividend on old preference shares during overlap (5,00,000 × Rs 104 × 3/12)	15,60,000
5	Net cash outlay (3 + 4)	49,20,000
6	Annual net cash outflow on old preference shares: Preference share dividend	60,00,000
7	Annual net cash outflow on new preference share: Preference share dividend	55,00,000
8	Difference (6 – 7)	5,00,000
9	Present value (Rs 5,00,000 ÷ 0.11[@])	45,45,454
10	Net benefit (Rs 45,45,454 – Rs 49,20,000)	(3,74,454)

[@]Discounted at 11 per cent for a perpetuity.

Decision The preference share issue should not be refunded as the benefit is negative.

Fixed Dividend Preference dividend is fixed and is expressed as a percentage of par value. Yet, it is not a legal obligation and failure to pay will not force bankruptcy. Preference capital is also called a *fixed income* security.

Convertibility Preference share capital may sometimes be convertible partly/fully into equity shares/ debentures at a certain ratio during a specified period. A variant in India is cumulative convertible preference shares which combine the cumulative and convertibility features. It has, however, been a non-starter so far.

Voting Rights Preference capital ordinarily does not carry voting rights. It is, however, entitled to vote on every resolution if (i) the preference dividend is in arrears for two years in respect of cumulative preference shares or (ii) the preference dividend has not been paid for a period of two/more consecutive preceding years or for an aggregate period of three/more years in the preceding six years ending with the expiry of the immediately preceding financial year.

Participation Features Preference capital may be participating, entitling **participation** in surplus profits, if any, that is, profits after payment of preference dividend and equity dividend at a certain specified rate. Similarly, it may be entitled to participate in the residual assets after the payment of their normal claim according to a specific formula in the event of liquidation of the company.

Evaluation Preference capital, as a source of long-term financing, has merits and demerits from the point of view of the investors/ shareholders as well as the company.

Merits The advantages for the investors are: (i) stable dividend, (ii) the exemption to corporate investors on preference income to the extent of dividend paid out. The issuing companies enjoy several advantages, namely, (i) no legal obligation to pay preference dividend and skipping of dividend without facing legal action/bankruptcy, (ii) redemption can be delayed without significant penalties, (iii) as a part of net worth, it improves the credit-worthiness/ borrowing capacity and, (iv) no dilution of control.

Demerits The shareholders suffer serious disadvantages such as (a) vulnerability to arbitrary managerial action as they cannot enforce their right to dividend/right to payment in case of rede-mption, and (b) modest dividend in the context of the associated risk. For the company, the preference capital is an expensive source of finance due to non-tax deductibility of preference dividend.

In brief, preference capital (i) involves high cost; (ii) does not dilute control, (iii) has negligible risk and (iv), puts no restraint on managerial freedom. The shareholders receive modest returns and are vulnerable to arbitrary managerial actions. It is not a popular source of long-term finance in India.

Convertible Debentures/Bonds

Features **Convertible debentures** give the debentureholders the right (option) to convert them into equity shares on certain terms. The holders are entitled to a fixed income till the conversion option is exercised and would share the benefits associated with equity shares after the conversion. The operational features of convertible debentures in India at present are as follows.

All the details about conversion terms, namely, conversion ratio, conversion premium/price and conversion timing are specified in the offer document/prospectus. The companies can issue fully convertible debentures (FCDs) or partly convertible debentures (PCDs). The number of ordinary shares for each convertible debenture is the **conversion ratio**. The **conversion price** is the price paid for the ordinary share at the time of conversion. Thus, conversion ratio equals par value of convertible debentures divided by the conversion price. The **conversion time** refers to the period from the date of allotment of convertible debentures after which the option to convert can be exercised. If the conversion is to take place between 18-36 months, the holder will have the option to exercise his rights in full or part. A conversion period exceeding 36 months is not permitted without put and call options. The call options give the issuer the right to redeem the debentures/bonds prematurely on stated terms. The investor has the right to prematurely sell them back to the issuer on specified terms. In addition, compulsory credit rating is necessary for fully convertible debentures.

Valuation The convertible debentures presently in India can be of three types: (i) compulsorily convertible within 18 months, (ii) optionally convertible within 36 months and (iii) convertible after 36 months with *call* and *put* features. However, only the first two types are popular.

Compulsory Partly/Fully Convertible Debentures: ***Value*** The holders of PCDs receive interest at a specified rate over the term of the debenture plus equity share(s) on part conversion and repayment of unconverted part of principal. Symbolically,

$$V_0 = \sum_{t=1}^{n} \frac{I_t}{(1+k_d)^t} + \frac{aP_i}{(1+k_e)^i} + \sum_{j=m} \frac{F_j}{(1+k_d)^j} \qquad \textbf{(7.4)}$$

where V_0 = Value of the convertible debenture at the time of issue
I_t = Interest receivable at the end of period, t
n = Term of debentures
a = Equity shares on part conversion at the end of period, i
P_i = Expected pre-equity share price at the end of period, i
F_j = Instalment of principal payment at the end of period, j
k_d = Required rate of return on debt
k_e = Required rate of return on equity.

EXAMPLE 7.3

The Tata Iron & Steel Ltd (TISCO) had offered in June 1989, Rs 30 lakh partly convertible debentures of Rs 1,200 each at par. The conversion terms were: (i) compulsory conversion of Rs 600 par value into an equity share of Rs 100 at a premium of Rs 500 within six months of the date of allotment, that is, on February 1, 1990. (ii) 12 per cent per annum interest payable half-yearly and (iii) redemption of non-

convertible portion of the debentures at the end of 8 years.

It had also simultaneously issued 32, 54, 167, 12 per cent FCDs of Rs 600 each at par on rights basis to the existing shareholders. Each debenture was fully convertible into one share of Rs 600, that is, Rs 100 par plus a premium of Rs 500 within six months from the date of allotment of debentures.

Assuming 8 and 10 per cent as the half-yearly required rate of return on debt and equity respectively, find the value of a TISCO convertible debenture at the time of issue.

SOLUTION

$$\text{Value of the PCD} = \left[\frac{\text{Rs } 72}{1.08}\right] + \sum_{t=2}^{16}\left[\frac{36}{(1.08)^t}\right] + \left[\frac{1 \times \text{Rs } 1{,}200}{(1.10)^1}\right] + \left[\frac{\text{Rs } 600}{(1.08)^{16}}\right]$$

$$= \text{Rs } 352.03 + \text{Rs } 1{,}090.91 + \text{Rs } 175.20 = \text{Rs } 1{,}618.14$$

Cost The cost of partly convertible debenture (k_c) is given by Equation 18.3.

$$S_0 = \sum_{t=1}^{n}\frac{I_t(1-T)}{(1+k_c)^t} + \frac{aP_i b}{(1+k_c)^i} + \sum_{j=m}^{n}\frac{F_j}{(1+k_c)^j} \qquad \textbf{(7.5)}$$

S_0 = net subscription price of debentures at the time of issue
I_t = interest payable at the end of period, t
T = tax rate
a = number of equity shares offered on the occurrence of conversion at the end of period, i
P_i = per equity share price at the end of period i
b = proportion of net realisable proportion of Pi on the equity share issues to the public
F_j = principal repayment instalment at the end of period, j
k_c = cost of capital/discount rate

For the TISCO convertible issue as detailed in Example 20.1, assuming further issue expenses, Rs 80, 35 per cent tax rate and 75 per cent as the net realisable proportion of equity shares issued to public, the cost of capital (convertible debenture) on a semi-annual basis is the discount rate by solving the following equation:

$$1{,}120 = \frac{72(1-0.35)}{(1+k_c)} + \sum_{t=2}^{16}\frac{36(1-0.35)}{(1+k_c)^t} + \frac{1 \times 1{,}200 \times 0.75}{(1+k_c)} + \frac{600}{(1+k_c)^{16}}$$

k_c = 11.5 per cent

Optionally Convertible Debentures The value of a debenture depends upon three factors: (i) straight debenture value, (ii) conversion value and (iii) option value.

Straight Debenture Value (SDV) equals the discounted value of the receivable interest and principal repayment, if retained as a straight debt instrument. The discount factor would depend upon the credit rating of the debenture.

$$\text{Symbolically SDV} = \sum_{t=1}^{n}\frac{I}{(1+k_d)} + \frac{P}{(1+k_d)^{16}} = \sum_{t=1}^{8}\frac{12}{(1.16)^t} + \frac{100}{(1.16)^8} \qquad \textbf{(7.6)}$$

where,
Maturity period = 8 years, Discount factor = 0.16, Interest = 0.12 payable annually and Face value of debenture = Rs 100.

Conversion Value (CV) if the holders opt for conversion, is equal to the share price multiplied by the conversion ratio, that is, the number of equity share offered for each debenture.

If the price of share is, Rs 50 and one debenture is convertible into 5 shares (conversion ratio = 5), the CV = Rs 250 (Rs 50 × 5).

The value of a convertible debenture cannot be less than the SDV and CV which, in a sense, represent its two floor values. In other words, the value of convertible debenture would be the higher of the SDV and CV.

Option Value (OV) The investors have an option, that is, they may not exercise the right/exercise the right at a time of their choosing and select the most profitable alternative. Thus, the option has value in the sense that the value of debenture will be higher than the floor values. Therefore, the value of the convertible debentures = Max [SDV, CV] + OV.

Evaluation Convertible debentures/bonds have emerged as fairly popular instruments of long-term finance in India in recent years. In the first place, they improve *cash flow matching* of firms. With the invariably lower initial interest burden, a growing/expanding firm would be in a better position to service the debt/debenture. Subsequently, when it would do well, it can afford the servicing of the financing instrument after conversion.

Secondly, they generate *financial synergy*. The assessment of risk characteristics of a new firm is costly and difficult. Convertible debentures provide a measure of protection against error of risk assessment. They have two components: straight debentures and call option. In case the firm turns out risky, the former will have a low value while the latter will have a high value and *vice versa* if the firm turns out to be relatively risk free. As a result, the required yield will not be very sensitive to default risk. In other words, firms with widely varying risks can issue convertible debentures on similar terms whereas the cost for straight debentures would be substantially different. Thus, convertible debentures offer a combination/financial synergy/risk synergy to companies to obtain capital on more favourable terms.

Finally, convertible debentures can mitigate agency problems associated with financing arising out of conflicting demand of equity-holders and debenture-holders/lenders. The focus of the latter is on minimising default risk whereas the former would like the firm to undertake high risk projects. This conflict can be resolved by the issue of convertible debentures/bonds. The debenture-holders would not impose highly restrictive covenants to protect the interest and firms cane undertake profitable investment opportunities.

Warrants

A **warrant** entitles its holders to subscribe to the equity capital of a company during a specified period at a stated/particular/certain price. The holder acquires only the right (option) but he has no obligation to acquire the equity shares. Warrants are generally issued in conjunction with/tied to other instruments, for example, attached to (i) secured premium notes of TISCO in 1992, (ii) de-bentures of Deepak Fertilisers & Petrochemical Corporation Ltd in 1987, Ranbaxy and Reliance in 1995. They can be/are issued independently also.

Difference with Convertible Debentures Warrants are akin to convertible debentures to the extent that both give the holder the option/right to buy ordinary shares but there are differences between the two. While the debenture and conversion option are inseparable, a warrant can be detached. Similarly, conversion option is tied to the debenture but warrants can be offered independently also. Warrant are typically exercisable for cash.

Features The important features of warrants are as follows:

Exercise Price It is the price at which the holder of a warrant is entitled to acquire the ordinary shares of the firm. Generally, it is set higher than the market price of the shares at the time of the issue.

Exercise Ratio It reflects the number of shares that can be acquired per warrant. Typically, the ratio is 1:1 which implies that one equity share can be purchased for each warrant.

Expiry Date It means the date after which the option to buy shares expires, that is, the life of the warrant. Usually, the life of warrants is 5-10 years although theoretically perpetual warrants can also be issued.

Types Warrants can be (i) detachable, and (ii) non-detachable. A detachable warrant can be sold separately in the sense that the holder can continue to retain the instrument to which the warrant was tied and at the same time sell it to take advantage of price increases. Separate sale independent of the instrument is not possible in case of non-detachable warrants. The detachable warrants are listed independently for stock exchange trading but non-detachable warrants are not.

Implied Price of an Attached Warrant The **implied price of a warrant** is the price effectively paid for each warrant attached to a bond. It can be computed using Equation 7.5

$$\text{Implied price of all warrants} = \text{Price of bond with warrants attached} - \text{Straight bond/debenture value} \quad \textbf{(7.7)}$$

The straight debenture value can be computed using the method to value convertible debentures.

$$\text{The implied price of each warrant} = \frac{\text{Implied price of all warrants}}{\text{Number of warrants attached to each bond}}.$$

The procedure is illustrated in Example 17.4.

EXAMPLE 17.4

Delhi Traders (TD) has issued 10 per cent, Rs 1,000 at par, 10-year bond paying annual interest and having 15 warrants attached for the purchase of its shares. The bonds were initially sold for their par value. Similar-risk straight bonds were selling to yield 12 per cent rate of return. Determine the implied price of an attached warrant.

SOLUTION

Computation of Straight Bond Value

Years	*Payments (1)*	*PVIF (0.12) (2)*	*Total present value (3) [(1) × (2)]*
1 – 10	Rs 100	5.650	Rs 565
20	1,000	0.322	322
Straight bond value			887

Implied price of all warrants = Rs 1,000 – Rs 887 = Rs 113

Implied price of each warrant = Rs 113 ÷ 15 = Rs 7.53

The implication is that an investor is effectively paying Rs 7.53 each warrant while purchasing bonds with attached warrants for Rs 1,000.

The implied price of each warrant would be useful to estimate the true market value of each warrant if compared with the specific features of each warrant such as (i) number of shares that can be purchased and (ii) the specified exercise price. If the implied price is more than the esti-mated market value, the price of the bond with attached warrants may be too high. The bond may be quite attractive in case estimated market value exceeds the implied price.

Value of Warrants Like convertible bonds, a warrant has a (i) market value and (ii) and a theoretical value. The diffe-rence between them is known as the warrant premium.

Theoretical Value of Warrant (TVW) The theoretical value of a warrant is the amount for which the warrant can be expected to be sold in the market. Symbolically, theoretical value of a warrant (TVW)

$$= (P_0 - E) \times N \quad \textbf{(7.8)}$$

Where, P_o = current market of a share
E = exercise price of the warrant
N = number of shares obtainable with one warrant.

EXAMPLE 7.5

Avon Manufacturers (AM) has outstanding warrants that are exercisable at Rs 100 per share. They entitle the holders to purchase 2 shares. The shares of AM are currently selling for Rs 112.50 per share. What is the theoretical value of the warrants of AM?

SOLUTION

$$\text{Theoretical value of warrants} = (P_0 - E) \times N$$
$$= [(\text{Rs } 11.250 - \text{Rs } 100) \times 2] = \text{Rs } 25$$

The warrants should sell for Rs 25 in the market.

Market Value of Warrant (MVW) The MVW is generally more than the TVW. The two values are close only when (i) the TVW is very high or (ii) the warrant is near its expiration date. The max-imum excess of MVW over the TVW generally is when the market price of shares is close to the exercise price of the warrant per share. The amount of time until expiration also effects the MVW. In general, the closer the warrant is to its expiration date, the more likely the MVW would equal the TVW.

Warrant Premium The warrant premium is the amount by which MVW exceeds the TVW. It results from a combination of (i) positive investor expectations and (ii) the ability of the investor to obtain larger potential return/risk by trading in warrants instead of the underlying shares (i.e. lev-erage opportunities). Consider Example 7.6.

EXAMPLE 7.6

An investor has Rs 24,300 to invest in Avon Manufacturers (AM). Its shares are currently selling for Rs 112.50 per share. The MVW is Rs 45 per warrant. Each warrant entitles the holder to purchase 2 shares of AM at Rs 100 per share. Compute the warrant premium for the investor.

SOLUTION

The investor could invest his Rs 24,300 in either of two ways. Assuming no transaction costs, he could purchase (i) 216 shares of AM at Rs 112.50 per share or (ii) 540 warrants at Rs 45 per warrant. Assuming

the market price of shares of AM increase by Rs 7.50 to Rs 120. If the investor sells his shares, his gain (Rs 7.50 × 216) = Rs 1,620. His total gain on the sale of warrants = Rs 8,100 [(Rs 7.50 × 2 shares) × 540 warrants. Thus, warrant premium = Rs 6,480 (Rs 18,100 – Rs 1,620).

If the market price of shares decline by Rs 7.50 per share, the loss to the investor would be: (i) on sale of shares, (Rs 7.50 × 216) = Rs 1,620; (ii) on sale of warrants [(Rs 7.50 × 2) × 540) = Rs 8,100. Thus, the use of warrants by the investor is more risky than trading the underlying shares of AM.

Options

Option is a **derivative security** and derives its value from an underlying security/asset. An option is an instrument that provides to its holders an opportunity to purchase/sell a specified security/asset at a stated price on/before a specified expiration date. The focus in options is on options related to shares. They are traded in India on the NSE and the BSE as securities. There are three basic forms of options: (i) rights, (ii) warrants, and (iii) calls and puts. While rights are discussed in Chapter 18, warrants are described and illustrated in the preceding section. This section explains the call and put option As an investment vehicle, however, they are not a source of financing. The options are issued by investors and not by firms. They are used to earn a return or to protect/lock-in returns already earned on securities by fund managers. But they do stabilise market prices of shares by increasing trading activity in them. Unlike shareholders, buyers of option have no voting rights. The finance managers do not deal with them as a part of fund-raising activities.

Calls and Puts A **call option** is an option to purchase a specified number of shares on/before a specified future date at stated/strike price. The **striking price** is the price at which the holder of the option can buy the shares at any time prior to the expiration date of the option. It is set at/near the prevailing market price of the shares at the time the option is issued.

A **put option** is an option to sell a given number of shares on/before a specified future date at a stated striking price. Like the call option, the striking price of the put is also set close to the market price of the underlying stock at the time of the deal.

Options transactions are done on futures and options (F&O) segment of the NSE/BSE. The call and put option contracts have one month, two months and three months expiry cycles. All co-ntracts expire on the last Thursday of every month. Thus, a January expiration contract would expire on the last Thursday of January. On the Friday following the last Thursday, a new contract having a 3-month expiry would be introduced for trading. Thus, at any point of time, three contracts would be available for trading with the first contract expiring on the last Thursday of that month. The contract size is 100 or multiples thereof, minimum value being Rs 2,00,000. The minimum tick size for a contract is Rs 0.05. A single move in option trading would imply a res-ultant gain/loss of Rs 10 (i.e. Rs 0.05 × 200 units) on an open position of 200 units.

Call options are purchased in the expectation that the market price of the underlying shares will rise while put options are purchased in the expectation that the share price would decline over the life of the option. The logic underlying the purchase of a put is exactly the opposite of that underlying the use of call options.

EXAMPLE 7.7

Assume an investor pays Rs 2,500 for a 3-month call option on Reliance Industries (RI) at a striking price of Rs 500. By paying Rs 2,500, the investor is entitled to purchase 100 shares of RI at Rs 500 per share at any time during the next 3 months. It implies that the share price must rise to Rs 525, that is, Rs 5 per share (Rs 500 ÷ 100 shares) to cover the cost of option (Rs 2,500), assuming no transaction costs. Suppose the

share prices of RI increase to Rs 600 during the 3-month period, the net profit to the investor would be Rs 7,500 [(100 shares × Rs 600) – (Rs 500 × 100 shares) – Rs 2,500]. Thus, option offers a very high return on investment of Rs 2,500. However, if the share prices do not rise above Rs 500 per share, the investor would lose Rs 2,500 as he would not exercise the option. If the share prices increase between Rs 500 and Rs 525, he would exercise the option to reduce loss to below Rs 2,500.

EXAMPLE 7.8

Assume an investor pays Rs 3,250 for a 3-month put option on Reliance Industries (RI) at a striking price of Rs 400. The investor is sure that he can sell 100 shares at Rs 400 at any time during the next 3 months by paying option money of Rs 3,250. Assuming no transaction cost, the price of shares of RI must decline by (Rs 3,250 ÷ 100 shares) Rs 32.5 to Rs 367.5 per share to cover the cost of option (Rs 3,250) of the investor. In case the share prices drop to Rs 300 during the 3-month period, the net profit to the investor would be [(100 shares × Rs 400) – (100 shares × Rs 300) – Rs 3,250] Rs 6,750. Thus, on an investment of Rs 3,250, option offer a very high potential profit (Rs 6,750) to the investor. If the share price fall to between Rs 367.5 and Rs 400 per share, the investor should exercise the option to reduce his loss below Rs 3,250. However, if the prices rise above Rs 400, the investor would not exercise his option and lose Rs 3,250.

LOAN SECURITISATION

Securitisation is the process of pooling and repackaging of homogeneous illiquid financial assets (loans/advances) into marketable securities that can be sold to investors. The process leads to the creation of financial instruments that represent ownership interest in, or are secured by a segregated income producing asset or pool, of assets. The pool of assets collateralises securities. These assets are generally secured by personal or real property such as automobiles, real estate, or equipment loans but in some cases are unsecured, for example, credit card debt and consumer loans.

Securitisation Process

1. Asset are originated through receivables, leases, housing loans or any other form of debt by a company and funded on its balance sheet. The company is normally referred to as the "originator".
2. Once a suitably large portfolio of assets has been originated, the assets are analysed as a portfolio and then sold or assigned to a third party, which is normally a special purpose vehicle company ("SPV") formed for the specific purpose of funding the assets. It issues debt and purchases receivables from the originator. The SPV is owned by a trust/the originator.
3. The administration of the asset is then subcontracted back to the originator by the SPV. It is responsible for collecting interest and principal payments on the loans in the underlying pool of assets and transfer to the SPV.
4. The SPV issues tradable securities to fund the purchase of assets. The performance of these securities is directly linked to the performance of the assets and there is no recourse (other than in the event of breach of contract) back to the originator.
5. The investors purchase the securities because they are satisfied that the securities would be paid in full and on time from the cash flows available in the asset pool. The proceeds from the sale of securities are used to pay the originator.

6. The SPV agrees to pay any surpluses which, may arise during its funding of the assets, back to the originator. Thus, the originator, for all practical purposes, retains its existing relationship with the borrowers and all of the economies of funding the assets.
7. As cash flow arise on the assets, these are used by the SPV to repay funds to the investors in the securities.

Credit Enhancement

Investors in securitised instruments take a direct exposure on the performance of the underlying collateral and have limited or no recourse to the originator. Hence, they seek additional comfort in the form of credit enhancement. It refers to the various means that attempt to buffer investors against losses on the asset collateralising their investment. These losses may vary in frequency, severity and timing, and depend on the asset characteristics, how they are originated and how they are administered. The credit enhancements are often essential to secure a high level of credit rating and for low cost funding. By shifting the credit risk from a less-known borrower to a well-known, strong, and larger credit enhancer, credit enhancements correct the imbalance of information between the lender(s) and the borrowers. They are either external (third party) or internal (structural or cash-flow-driven).

External Credit Enhancements They include insurance, third party guarantee and letter of credit.

Insurance Full insurance is provided against losses on the assets. This tantamounts to a 100 per cent guarantee of a transaction's principal and interest payments. The issuer of the insurance looks to an initial premium or other support to cover credit losses.

Third-Party Guarantee This method involves a limited/full guarantee by a third party to cover losses that may arise on the non-performance of the collateral.

Letter of Credit For structures with credit ratings below the level sought for the issue, a third party provides a letter of credit for a nominal amount. This may provide either full or partial cover of the issuer's obligation.

Internal Credit Enhancements Such form of credit enhancement comprise the following:

Credit Trenching (Senior/Subordinate Structure) The SPV issues two (or more) tranches of securities and establishes a predetermined priority in their servicing, whereby first losses are borne by the holders of the subordinate tranches (at times the originator itself). Apart from providing comfort to holders of senior debt, credit tranching also permits targeting investors with specific risk-return preferences.

Over-collateralisation The originator sets aside assets in excess of the collateral required to be assigned to the SPV. The cash flows from these assets must first meet any overdue payments in the main pool, before they can be routed back to the originator.

Cash Collateral This works in much the same way as the over-collateralisation. But since the quality of cash is self-evidently higher and more stable than the quality of assets yet to be turned into cash, the quantum of cash required to meet the desired rating would be lower than asset over-collateral to that extent.

Spread Account The difference between the yield on the assets and the yield to the investors from the securities is called *excess spread*. In its simplest form, a spread account traps the excess spread (net of all running costs of securitisation) within the SPV up to a specified amount sufficient to satisfy a given rating or credit equity requirement. Only realisations in excess of this specified amount are routed back to the originator. This amount is returned to the originator after the payment of principal and interest to the investors.

Triggered Amortisation This works only in structures that permit substitution (for example, rapidly revolving assets such as credit cards). When certain preset levels of collateral performance are breached, all further collections are applied to repay the funding. Once amortisation is triggered, substitution is stopped and the early repayment becomes an irreversible process. The triggered amortisation is typically applied in future flow securitisation.

Parties to a Securitisation Transaction

The parties to securitisation deal are (i) primary and (ii) others. There are three primary parties to a securitisation deal, namely, originators, special purpose vehicle (SPV) and investors. The other parties involved are obligors, rating agency, administrator/servicer, agent and trustee, and structurer.

Originator This is the entity on whose books the assets to be securitised exist. It is the prime mover of the deal, that is, it sets up the necessary structures to execute the deal. It sells the assets on its books and receives the funds generated from such sale. In a true sale, the originator transfers both the legal and the beneficial interest in the assets to the SPV.

SPV An issuer, also known as the SPV, is the entity, which would typically buy the assets to be securitised from the originator. An SPV is typically a low-capitalised entity with narrowly defined purposes and activities, and usually has independent trustees/Directors. As one of the main objectives of securitisation is to remove the assets from the balance sheet of the originator, the SPV plays a very important role in as much as it holds the assets in its books and makes the upfront payment for them to the originator.

Investors The investors may be in the form of individuals or institutional investors like FIs, mutual funds, provident funds, pension funds, insurance companies and so on. They buy a participating interest in the total pool of receivables and receive their payment in the form of interest and principal as per agreed pattern.

Obligor(s) The obligors are the originators debtors (borrowers of the original loan). The amount outstanding from an obligor is the asset that is transferred to an SPV. The credit standing of an obligor(s) is of paramount importance in a securitisation transaction.

Rating Agency Since the investors take on the risk of the asset pool rather than the originator, an external credit rating plays an important role. The rating process would assess the strength of the cash flow and the mechanism designed to ensure full and timely payment by the process of selection of loans of appropriate credit quality, the extent of credit and liquidity support provided and the strength of the legal framework.

Administrator or Servicer It collects the payment due from the obligor(s) and passes it to the SPV, follows up with delinquent borrowers and pursues legal remedies available against the defaulting

borrowers. Since it receives the instalments and pays it to the SPV, it is also called the Receiving and Paying Agent (RPA).

Agent and Trustee It accepts the responsibility for overseeing that all the parties to the securitisation deal perform in accordance with the securitisation trust agreement. Basically, it is appointed to look after the interest of the investors.

Structurer Normally, an investment banker is responsible as structurer for bringing together the originator, the credit enhancer(s), the investors and other partners to a securitisation deal. It also works with the originator and helps in structuring deals.

The different parties to a securitisation deal have very different roles to play. In fact, firms specialise in those areas in which they enjoy competitive advantage. The entire process is broken up into separate parts with different parties specialising in origination of loans, raising funds from the capital markets, servicing of loans and so on. It is this kind of segmentation of market roles that introduces several efficiencies securitisation is so often credited with.

The securitisation process is depicted in Fig. 7.1.

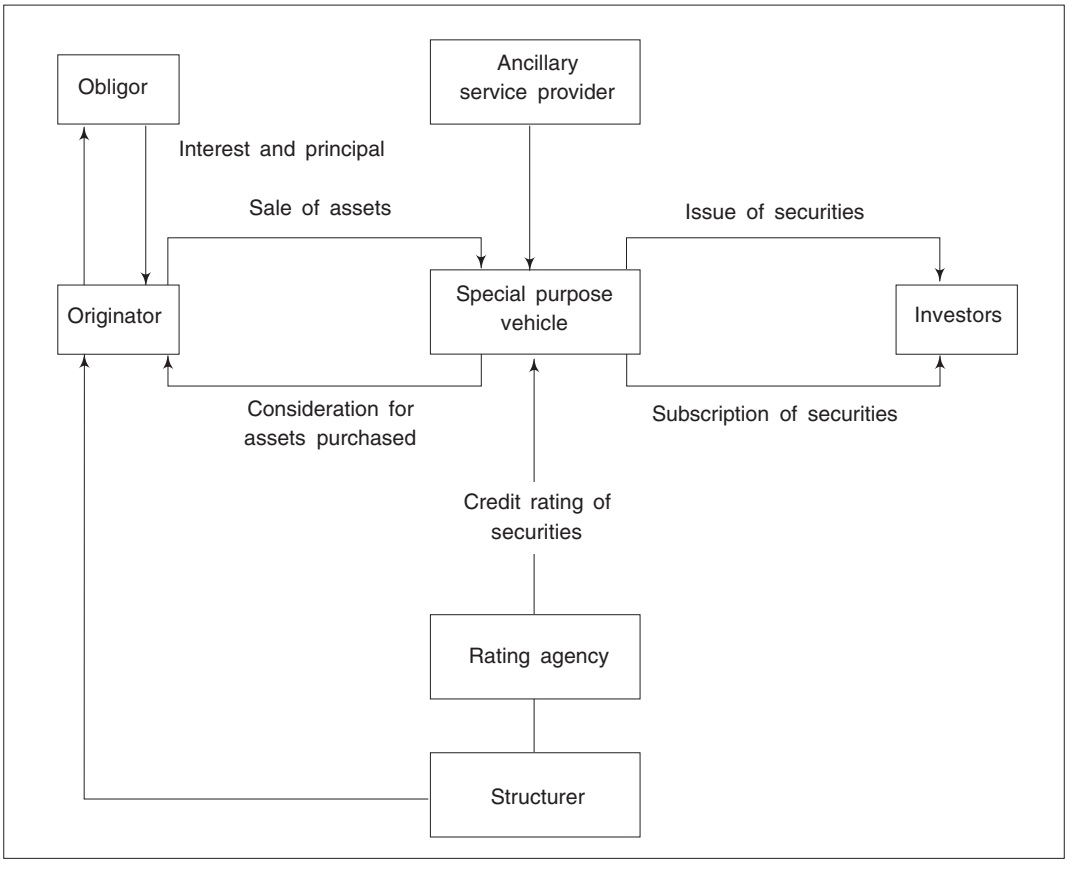

Figure 7.1 *Securitisation Process*

Asset Characteristics

The assets to be securities should have the following characteristics.

Cash Flow A principal part of the assets should be the right to receive from the debtor(s) on certain dates, that is, the asset can be analysed as a series of cash flows.

Security If the security available to collateralise the cash flows is valuable, then this security can be realised by a SPV.

Distributed Risk Assets either have to have a distributed risk characteristic or be backed by suitably-rated credit support.

Homogeneity Assets have to relatively homogenous, that is, there should not be wide variations in documentation, product type or origination methodology.

No Executory Clauses The contracts to be securitised must work even if the originator goes bankrupt.

Independence From the Originator The ongoing performance of the assets must be independent of the existence of the originator.

Instruments of Securitisation

Securitisation can be implemented by three kinds of instruments differing mainly in their maturity characteristics. They are: **(i)** Pass through certificates, **(ii)** Pay through securities, **(iii)** Stripped securities.

Pass Through Certificates (PTCs) The cash flows from the underlying collateral are "passed through" to the holders of the securities in the form of monthly payment of interest, principal and pre-payments. In other words, the cash flows are distributed on a pro-rata basis to the holders of the securities. The pre-payments occur when the holder of the underlying asset prepays the remaining principal before the final scheduled payment month. Any pre-payment is also proportionately passed on to the security holders leading to the quicker retirement of their underlying principal. Critical to pricing of pass through are the specific features of that particular collateral. All the securities are terminated simultaneously as the last payment on the pool leads to its complete amortisation. Some of the main features of PTCs are:

- They reflect ownership rights in the assets backing the securities.
- Pre-payment precisely reflects the payment on the underlying mortgage. If it is a home loan with monthly payments, the payments on securities would also be monthly but at a slightly less coupon rate than the loan.
- As underlying mortgage is self-amortising. Thus, by whatever amount it is amortised, it is passed on to the security holders with repayment.
- Pre-payment occurs when a debtor makes a payment, which exceeds the minimum scheduled amount. It shortens the life of the instrument and skews the cash flows towards the earlier years.

Pay Through Security (PTS) The PTS structure overcomes the single maturity limitations of the pass through certificates. Its structure permits the issuer to restructure receivables flow to offer a range of investment maturities to the investors associated with different yields and risks. The issuer of assets-backed

debt are thus freed from the limitations imposed by the pass through structure which simply provides a conduit for sale of ownership interest in the receivables. By contrast, in a PTS structure, the issuer typically owns the receivables and simply sells the debt that is backed by the assets. As a result, the issuer of debt is free to restructure the cash flow from the receivable into payments on several debt tranches with varying maturities.

A key difference between PTC and PTS is the mechanics of principal repayment process. In PTC, each investor receives a *pro-rata* distribution of any principal and interest payment made by the borrower. Because these assets are self-amortising assets, a pass through, however, does not occur until the final asset in the pool is retired. This results in large difference between average life and final maturity as well as a great deal of uncertainty with regard to the timing of the return of the principal. The PTS structure, on the other hand, substitutes a sequential retirement of bonds for the pro-rata principal return process found in pass through. Cash flows generated by the underlying collateral is used to retire bonds. Only one class of bonds at a time receives principal. All principal payments go first to the fastest pay trance in the sequence then becomes the exclusive recipients of principal. This sequence continues till the last tranches of bonds is retired.

Stripped Securities Under this instrument, securities are classifies as "Interest only" (IO) or Principally only (PO) securities. The IO holders are paid back out of the interest income only while the PO holders are paid out of principal repayments only. However, these securities are highly volatile by nature and are least preferred by the investors. Normally, PO securities increase in value when interest rates go down because it becomes lucrative to prepay existing mortgagor and undertake fresh loans at lower interest rates. As a result of prepayment of mortgages, the maturity period of these securities goes down and investors are returned the money earlier than they anticipated. In contrast, IOs increase in value when interest rates go up because more interest is collected on underlying mortgages. However, in anticipation of a decline in the interest rates, prepayments of mortgages declines and maturities lengthen. These are normally traded by speculators who make money by speculating about interest rate changes.

Types of Securities

The securities fall into two groups:

Asset Backed Securities (ABS) The investors rely on the performance of the assets that collateralise the securities. They do not take an exposure either on the previous owner of the assets (the originator), or the entity issuing the securities (the SPV). Clearly, classifying securities as 'asset-backed' seeks to differentiate them from regular securities, which are the liabilities of the entity issuing them. An example of ABS is credit card receivables. Securitisation of credit card receivables is an innovation that has found wide acceptance. Although the average tenure of credit available to a credit card holder is generally very short, it is revolving by nature. The lacuna of short tenor of the receivables is, hence, overcome by 'substitution', whereby collections are used for fresh purchases of receivables. Thus, a securitisable asset of marketable tenure comes into being. The structure in the case is generally 'Pay Through', since it is impossible to match the payment made by the card-holder with the payment to the investor.

Mortgage Backed Securities (MBS) The securities are backed by the mortgage loans, that is, loans secured by specified real estate property, wherein the lender has the right to sell the property, if the borrower defaults.

VENTURE CAPITAL FINANCING

Venture capital institutions which emerged the world over to fill gaps in the conventional financial mechanism focused on new entrepreneurs, commercialisation of new technologies and support to small and medium enterprises in the manufacturing and the service sectors. Over the years, the concept of venture capital has undergone significant changes. The *modus operandi* has shifted from technology-oriented manufacturing organisations to being very close to "private equity class" for unlisted new companies in all sectors of the economy, irrespective of the nature of their projects. They also maintain a close rapport and a '**hands-on**' approach in nurturing investments during their association with the assisted/investee companies as active partners rather than as passive investors. The theoretical aspects of the venture capital institutions are briefly described in this section. The aspects covered below include features and selection of investments.

Features

Venture capital has, somehow, come to acquire various connotations. It is defined as an equity/equity-related investment in a growth-oriented small/medium business to enable investees to accomplish corporate objectives, in return for minority shareholding in the business or the irrevocable right to acquire it.

Venture capital is a way in which investors support entrepreneurial talent with finance and business skills to exploit market opportunities and, thus, to obtain long-term capital gains. It is the provision of risk-bearing capital, usually in the form of participation in equity, to companies with high-growth potential.

In addition, it provides some value addition in the form of management advice and contribution to overall strategy. The relatively high risks are compensated by the possibility of high return, usually through substantial capital gains in the medium term.

According to a very widely-accepted definition, venture capital is described as a separate asset class, often labelled as private equity. Private equity investment sits at the furthest end of the risk-reward spectrum from Government bonds and can broadly describe equity investment in private companies not quoted on the stock market.

Based on the above description of venture capital, then, some of its distinguishing features as against other capital investments are:

- Venture capital is basically equity finance in relatively new companies when it is too early to go to the capital market to raise funds. However, such investment is not exclusively equity investment. It can also be made in the form of loan finance/convertible debt to ensure a running yield on the portfolio of venture capitalists. Nonetheless, the basic objective of venture capital financing is to earn capital gain on equity investment at the time of exist and debt financing is only supplementary.
- It is a long-term investment in growth-oriented small/medium firms. The acquisition of outstanding shares from other shareholders cannot be considered venture capital investment. It is new, long-term capital that is injected to enable the business to grow rapidly.
- There is a substantial degree of active involvement of the venture capital institutions with the promoters of the venture capital undertakings. It means such finance also provides business skills to the investee firms which is termed as '**hands-on**' approach/management. However, venture capitalists do not seek/acquire a majority/controlling interest in the investees, though under special circumstances and for a limited period, they might have a controlling interest. But the objective is to provide business/managerial skill only and not interfere in management.
- Venture capital financing involves high risk-return spectrum. Some of the ventures yield very high returns to more than compensate for heavy losses on others which also may have had potential of

profitable returns. The returns in such financing are essentially through capital gains at the time of exits from disinvestments in the capital market.

- Venture capital is not technology finance though technology finance may form a sub-set of venture capital financing. The concept of venture capital embraces much more than financing new, high technology-oriented companies. It essentially involves the financing of small and medium-sized firms through early stages of their development until they are established and are able to raise finance from the conventional, industrial finance market. The scope of venture capital activity is fairly wide.

In brief, a venture capital institution is a financial intermediary between investors looking for high potential returns and entrepreneurs who need institutional capital as they are yet not ready/able to go to the public.

Selection of Investment

The first step in the venture capital financing decision is the selection of investment. The starting point of the evaluation process by the venture capital institution (VCI) is the business plan of the venture capital undertaking (promoter). The appraisal is akin to the feasibility studies of the development finance institutions for grant of term loans and other financial assistance.

In addition to the project history, if any, track record of the entrepreneur, market potential study and projections of future turnover, profitability and so on, it also covers a review of the likely threats from technological obsolescence/competing technologies and preliminary views on preferred exits.

The selection of the investment proposal includes, *inter alia*, stages of financing, methods to evaluate deals and the financial instruments to structure a deal.

Stages of Financing The selection of investment by a VCI is closely related to the stages and type of investment. From analytical angle, the different stages of investments are recognised and vary as regards the time-scale, risk perceptions and other related characteristics of the investment decision process of the VCIs. The stages of financing, as differentiated in the venture capital industry, broadly fall into two categories: (a) early stage, and (b) later stage.

Early Stage Financing This stage includes **(i)** seed capital/pre-start-up, **(ii)** start-up and **(iii)** second-round financing.

Seed Capital This stage is essentially an '*applied research*' phase where the concepts and ideas of the promoters constitute the basis of a pre-commercialisation research project usually expected to end in a prototype which may or may not lead to a business launch. This phase gradually moves towards the development phase leading to a prototype product testing and then to commercialisation. The evaluation of the project by the VCIs has to ensure that the technology skills of the entrepreneur matches with market opportunities.

The main risk at this stage is marketing related. The commercial acumen of the promoter to take advantage of the market opportunity, awareness of competition, the timing of launching the product and so on, are important elements of the appraisal. The risk perception of investment at this stage is extremely high. However, very few VCIs invest in this pre-commercialisation/seed stage of product development.

Start-Up This is the stage when commercial manufacturing has to commence. Venture capital financing here is provided for product development and initial marketing. The essence of this stage is that the product/service is being commercialised for the first time in association with the VCIs. It includes several types of

new projects such as **(i)** greenfield based on a relatively new or high technology, **(ii)** new business in which the entrepreneur has good knowledge and working experience, **(iii)** new projects by established companies and **(iv)** a new company promoted by an existing company with limited finance to commercialise new technology.

At this stage, some indication of the potential market for the new product/service is available. Partly because of the equity dilution syndrome, in the sense of resistance from the promoters to the dilution of control of the business, and partly due to the unviability of the small amount of equity investment, the involvement of VCIs in start-up projects is generally and relatively low. The risk perception is very high.

Second Round Financing This represents the stage at which the product has already been launched in the market but the business has not, yet, become profitable enough for public offering to attract new investors. The promoter has invested his own funds but further infusion of funds by the VCIs is necessary. The time-scale for the investment is shorter than in the case of start-ups. The VCIs provide larger funds at this stage than at other early-stage financing. This financing is partly in the form of debt to also provide some income to them.

Later Stage Financing This stage of venture capital financing involves established businesses which require additional financial support but cannot take recourse to public issues of capital. It includes mezzanine/development capital, bridge/expansion, buyouts and turnarounds.

Mezzanine/Development Capital This is financing of established businesses which have overcome the extremely high-risk early stage, have recorded profits for a few years but are yet to reach a stage when they can go public and raise money from the capital market/conventional sources.

Among the uses of such types of venture capital financing are purchase of new equipment/plant, expansion of marketing and distribution facilities, re-finance of existing debt, penetration into new regions, induction of new management and so on. The development finance stage has a time-frame of one to three years and falls in the medium risk category. It constitutes a significant part of the activities of many VCIs.

Bridge/Expansion This finance by VCIs involves low risk perception and a time-frame of one to three years. Venture capital undertakings use such finance to expand business by way of growth of their own productive asset or by the acquisition of other firms/assets of other firms. In a way, it represents the last round of financing before a planned exit.

BuyOuts These refer to the transfer of management control. They fall into two categories: (a) management buyouts (MBOs) and management buyins (MBIs).

Management BuyOuts In MBOs, VCIs provide funds to enable the current operating management/investors to acquire an existing product line/business. They represent an important part of the activity of VCIs.

Management BuyIns MBIs are funds provided to enable an outside group [of manager(s)] to buy an ongoing company. They usually bring three elements together: a management team, a target company and an investor (VCI). MBIs are less popular than MBOs. An MBI is inherently more risky because the management comes from outside and finds it difficult to assess the actual potential of the target company. Generally, MBIs are able to target only the weaker/underperforming companies.

Buyouts involve a time-frame from investment to public offering of one to three years with low risk perception.

Turnarounds These are a sub-set of buyouts and involve buying the control of a sick company. Two kinds of inputs are required in a turnaround—namely, money and management. The VCIs have to identify good management and operations leadership. Such form of venture capital financing involves medium to high risk and a time-frame of three to five years. It is gaining widespread acceptance and increasingly becoming the focus of attention of VCIs.

To conclude, venture capital firms finance both early and later stage investments to maintain a trade-off between risk and profitability. In early stage investment, particularly start-ups in high-technology industries, the technology is often untried at a commercial level of operation, market is undeveloped and potential competition is unknown as the product itself is new. Apart from the evaluation of the technology and the likely market, the most important factor to be considered by VCIs is the capability of the promoter/entrepreneur to implement the project with a reasonable chance of success.

In later stage investments, the technology has already been tried out commercially, the products have been introduced in the market and the business/entrepreneur has a track record which is closely examined by the VCIs.

Structuring the Deal/Financial Instruments

The structuring of the deal refers to the financial instruments through which venture capital investment is made. The availability of a wide variety of financial instruments provides considerable flexibility in structuring a venture capital deal. From the point of view of nature, the financial instruments a VCI can choose from, can be broadly divided into equity and debt instruments.

Equity Instruments **(1)** Ordinary equity shares; **(2)** Non-voting equity shares which are entitled to a higher dividend but carry no voting rights; **(3)** Deferred ordinary shares on which the ordinary share rights are deferred for a specified period/until the happening of a certain event such as listing of shares on the stock exchange or the sale of the company; **(4)** Preferred ordinary shares. In addition to the voting rights, such shares also carry rights to a modest fixed dividend; **(5)** Equity warrants entitle investors in debentures/bonds to acquire ordinary shares at a future date; **(6)** Preference shares; **(7)** Cumulative convertible preference shares which are converted into equity shares after a specified time; **(8)** Participating preference shares which, in addition to the preference dividend, are entitled to an extra dividend after the payment of dividend to the equity shareholders; **(9)** Cumulative convertible participatory preferred ordinary shares combine the benefit of preferred dividend and cumulative as well as participative features and **(10)** Convertible cumulative redeemable preference shares have two elements, namely, convertibility into equity at specified point of time and redeemability on the expiry of a certain period. The redeemable part carries a fixed coupon rate by way of preference dividend. Of the types of equity-linked financial instruments, the equity warrants, non-voting equity shares and cumulative convertible participating preferred ordinary shares can be used to structure a flexible venture capital deal.

Debt Instruments To ensure that the entrepreneur retains managerial control and the VCI receives a running yield during the early years when the equity portion is unlikely to yield any return, debt instruments are also used by VCIs. They include, in addition to conventional loans, income notes, non-convertible debentures, partly convertible debentures, fully convertible debentures, zero interest bonds, secured premium notes and deep discount bonds.

Conditional Loan This is a form of loan finance without any pre-determined repayment schedule or interest rate. The suppliers of such loans recover a specified percentage of sales towards the recovery of the principal as well as revenue in a pre-determined ratio, usually 50:50. The *charges on sales* is known as

royalty. The investor stands to gain/lose depending on whether the actual sales are higher/lower than the projected sales. Conditional loan, in a sense, is *quasi-equity* instrument.

Conventional Loans These are modified to the requirements of venture capital financing. They carries lower interest initially which increases after commercial production commences. A small royalty is additionally charged to cover the interest foregone during the initial years. Although the repayment of the principal is based on a pre-stipulated schedule, VCIs usually do not insist upon mortgage/other security.

Income Notes These fall between the conventional and the conditional loans and carry a uniform low rate of interest plus a royalty on sales. The principal is repaid according to a stipulated schedule.

Non-convertible Debentures (NCDs) These carry a fixed/variable rate of interest, are redeemable at par/premium, are secured, and can be cumulative/non-cumulative.

Partly Convertible Debentures (PCDs) These have two components: **(i)** a convertible portion and **(ii)** a non-convertible portion. The convertible portion is converted into equity shares at par/premium. The non-convertible portion earns interest till redemption generally at par. Such instruments are best suited to second round venture capital financing.

Zero Interest/Coupon Bonds/Debentures These can be either convertible or non-convertible with zero/no interest rate. The non-convertible bonds are sold at a discount from their maturity value while the convertible ones are converted into equity shares at a stipulated price and time. They offer considerable flexibility and are an appropriate instrument for later stage venture capital financing.

Secured Premium Notes These are secured, redeemable at premium in lumpsum/instalments, have zero interest and carry a warrant against which equity shares can be acquired. This instrument is also useful for later stage financing.

Deep Discount Bonds These are issued at a large discount to their maturity value. As a long-term instrument, these are not suited to venture capital investment.

LEASE FINANCING

This section explains the concept and classification of leasing as a source of long-term finance. It also discusses the financial evaluation of leasing.

Concept and Classification

Concept

Included in conceptual aspect of leasing are its meaning and essential elements.

Meaning Conceptually, a lease may be defined as a contractual arrangement/transaction in which a party owning an asset/equipment (lessor) provides the asset for use to another/transfer the right to use the equipment to the user (lessee) over a certain/for an agreed period of time for consideration in form of/in return for periodic payment (rentals) with or without a further payment (premium). At the end of the period of contract (lease period), the asset/equipment reverts back to the lessor unless there is a provision for the renewal of the contract. Leasing essentially involves the **divorce of ownership from the economic use of**

an asset/equipment. It is a device of financing the cost of an asset. It is a contract in which a specific equipment required by the lessee is purchased by the lessor (financier) from a manufacturer/vendor selected by the lessee. The lessee has possession and use of the asset on payment of the specified rentals over a predetermined period of time. Lease financing is, thus, a device of financing/money lending. The position of a lessee is akin to that of a person who owns the same asset with borrowed money. The real function of a lessor is not renting of asset but lending of funds/finance/credit, and lease financing is, in effect, a contract of lending money. The **lessor** (financier) is the nominal owner of the asset as the possession and economic use of the equipment vests in the lessee. The lessee is free to choose the asset according to his requirements and the lessor does not take recourse to the equipment as long as the rentals are regularly paid to him.

Essential Elements The essential elements of leasing are the following:

Parties to the Contract There are essentially two parties to a contract of lease financing, namely, the owner and the user, called the lessor and the lessee respectively. Lessors as well as lessees may be individuals, partnerships, joint stock companies, corporations or financial institutions. Sometimes there may be joint lessors or joint lessees, particularly where the properties or the amount of finance involved is enormous. Besides, there may be a lease-broker who acts as an intermediary in arranging lease deals. Merchant banking divisions of certain foreign banks in India, subsidiaries of some Indian banks and even some private merchant bankers are acting as lease-brokers. They charge certain percentage of fees for their services, ranging between 0.5 to 1 percent. Besides, a lease contract may involve a **lease financier**, who refinances the lessor, either by providing term loans or by subscribing to equity or under a specific refinance scheme.

Asset The asset, property or equipment to be leased is the subject-matter of a contract of lease financing. The asset may be an automobile, plant and machinery, equipment, land and building, factory, a running business, aircraft, and so on. The asset must, however, be of the lessee's choice suitable for his business needs.

Ownership Separated From User The essence of a lease financing contract is that during the lease-tenure, ownership of the asset vests with the lessor and its use is allowed to the lessee. On the expiry of the lease tenure, the asset reverts to the lessor.

Term of Lease The term of lease is the period for which the agreement of lease remains in operation. Every lease should have a definite period otherwise it will be legally inoperative. The lease period may sometimes stretch over the entire economic life of the asset (i.e. financial lease) or a period shorter than the useful life of the asset (i.e. operating lease). The lease may be perpetual, that is, with an option at the end of lease period to renew the lease for the further specific period.

Lease Rentals The consideration which the lessee pays to the lessor for the lease transaction is the lease rental. The lease rentals are so structured as to compensate the lessor for the investment made in the asset (in the form of depreciation), the interest on the investment, repairs and so forth—borne by the lessor, and servicing charges over the lease period.

Modes of Terminating Lease The lease is terminated at the end of the lease period and various courses are possible, namely,

(a) The lease is renewed on a perpetual basis or for a definite period, or
(b) The asset reverts to the lessor, or

(c) The asset reverts to the lessor and the lessor sells it to a third party, or
(d) The lessor sells the asset to the lessee.

The parties may mutually agree to, and choose, any of the aforesaid alternatives at the beginning of the lease term.

Classification An equipment lease transaction can differ on the basis of the extent to which the risks and rewards of ownership are transferred. **Risk** with reference to leasing refers to the possibility of loss arising on account of under-utilisation or technological obsolescence of the equipment while **reward** means the incremental net cash flows that are generated from the usage of the equipment over its economic life and the realisation of the anticipated residual value on expiry of the economic life. On the basis of these variations, leasing can be classified into **(a)** Finance lease and **(b)** Operating lease.

Finance Lease According to the **Accounting Standard (AS)-19: Leases** issued by the Institute of Chartered Accountants of India (ICAI) in January, 2001, the classification of leases is based on the extent to which risks and rewards incidental to ownership of a leased asset lie with the lessor or the lessee. **Risks** include the possibilities of losses from idle capacity or technological obsolescence and of variations in return due to changing economic conditions. **Rewards** may be represented by the expectations of profitable operation over the economic life of the asset and of gain from appreciation in value of realisation of residual value.

A lease is classified as a finance lease if it transfers substantially all the risk and rewards incidental to ownership. Title may or may not eventually be transferred. A lease is classified as an operating lease if it does not transfer substantially all the risks and rewards incidental to ownership.

Since the transaction between a lessor and lessee is based on a lease agreement common to both parties, it is appropriate to use consistent definitions. The application of these definitions to the differing circumstances of the two parties may sometimes result in the same lease being classified differently by the lessor and the lessee.

Whether a lease is a finance lease or an operating lease depends on the substance of the transaction rather than its form. Examples of situations which would normally lead to a lease being classified as a finance lease are:

(a) The lease transfers ownership of the asset to the lessee by the end of the lease term;
(b) The lessee has the option to purchase the asset at a price which is expected to be sufficiently lower than the fair value at the date the option becomes exercisable such that, at the inception of the lease, it is reasonably certain that the option will be exercised;
(c) The lease term is for the major part of the economic life of the asset even if its title is not transferred;
(d) At the inception of the lease, the present value of the minimum lease payments amounts to at least substantially all of the fair value of the leased asset; and
(e) The leased asset is of a specialised natures such that only the lessee can use it without major modifications being made.

Indicators of situations which individually or in combination could also lead to a lease being classified as a finance lease are:

(a) If the lessee can cancel the lease, the lessor's losses associated with the cancellation are borne by the lessee;
(b) Gains or losses from the fluctuation in the fair value of the residual fall to the lessee (for example in the form of a rent rebate equalling most of the sales proceeds at the end of the lease); and
(c) The lessee can continue the lease for a secondary period at a rent which is substantially lower than market rent.

Lease classification is made at the inception of the lease. If at any time the lessee and the lessor agree to change the provisions of the lease, other than by renewing the lease, in a manner that would have resulted in a different classification of the lease under the criteria outlined above had a changed terms been in effect at the inception of the lease, the revised agreement is considered as a new agreement over its revised term. Changes in estimates (for example, changes in estimates of the economic life or of the residual value of the leased asset) or changes in circumstances (for example, default by the lessee), however, do not give rise to a new classification of a lease for accounting purposes.

A finance lease is structured to include the following features:

(i) The lessee (the intending buyer) selects the equipment according to his requirements, from its manufacturer or distributor,

(ii) The lessee negotiates and settles with the manufacturer or distributor, the price, the delivery schedule, installation, terms of warranties, maintenance and payment and so on,

(iii) The lessor purchases the equipment either directly from the manufacturer or distributor (under straightforward leasing) or from the lessee after the equipment is delivered (under sale and lease back),

(iv) The lessor then leases out the equipment to the lessee. The lessor retains the ownership while lessee is allowed to use the equipment,

(v) A finance lease may provide a right or option, to the lessee, to purchase the equipment at a future date, However, this practice is rarely found in India,

(vi) The lease period spreads over the expected economic life of the asset. The lease is originally for a non-cancellable period called the **primary lease period** during which the lessor seeks to recover his investment alongwith some profit. During this period, cancellation of lease is possible only at a very heavy cost. Thereafter, the lease is subject to renewal for the **secondary lease period**, during which the rentals are substantially low,

(vii) The lessee is entitled to exclusive and peaceful use of the equipment during the entire lease period provided he pays the rentals and complies with the terms of the lease,

(viii) As the equipment is chosen by the lessee, the responsibility of its suitability, the risk of obsolescence and the liability for repair, maintenance and insurance of the equipment rest with the lessee.

Operating Lease According to the AS-19, an operating lease is one which is not a finance lease. In an operating lease, the lessor does not transfer all the risks and rewards incidental to the ownership of the asset and the cost of the asset is not fully amortised during the primary lease period. The lessor provides services (other than the financing of the purchase price) attached to the leased asset, such as maintenance, repair and technical advice. For this reason, operating lease is also called '**service lease**'. The lease rentals in an operating lease include a cost for the 'services' provided, and the lessor does not depend on a single lessee for recovery of his cost. Operating lease is generally used for computers, office equipments, automobiles, trucks, some other equipments, telephones, and so on.

A operating lease is structured with the following features:

(i) An operating lease is generally for a period significantly shorter than the economic life of the leased asset. In some cases it may be even on hourly, daily, weekly or monthly basis. The lease is cancellable by either party during the lease period;

(ii) Since the lease periods are shorter than the expected life of the asset, the lease rentals are not sufficient to totally amortise the cost of the assets;

(iii) The lessor does not rely on the single lessee for recovery of his investment. He has the ultimate interest in the residual value of the asset. The lessor bears the risk of obsolescence, since the lessee is free to cancel the lease at any time;

(iv) Operating leases normally include maintenance clause requiring the lessor to maintain the leased asset and provide services such as insurance, support staff, fuel, and so on.

Examples of operating leases are:

(a) Providing mobile cranes with operators,
(b) Chartering of aircrafts and ships, including the provision of crew, fuel and support services,
(c) Hiring of computers with operators,
(d) Hiring a taxi for a particular travel, which includes service of driver, provision for maintenance, fuel, immediate repairs, and so on.

Financial Evaluation

The process of financial appraisal in a lease transaction generally involves three steps: **(i)** appraisal of the client in terms of financial strength and credit worthiness; **(ii)** evaluation of the security/collateral security offered and **(iii)** financial evaluation of the proposal. The most critical part of a leasing transaction is the financial evaluation of the proposal both to the lessor and lessee. The analytical framework/technique to evaluate the financial terms of a leasing proposal is discussed below. The objective of the evaluation is to identify the cheaper source of finance to a lessee and better investment alternative to the lessor.

Lessee's Perspective Finance lease effectively transfers the risks and rewards associated with the ownership of an equipment from the lessor to the lessee. A lease can be evaluated either as an investment decision or as a financing alternative. Given that an investment decision has already been made, a firm (lessee) has to evaluate whether it will purchase the asset/equipment or acquire it on lease basis. Since lease rental payments are similar to payments of interest on debt, leasing in essence is an alternative to borrowing. The lease evaluation from the lessee's point of view, thus, essentially involves a choice between debt financing *versus* lease financing. It is in this context that an evaluation of lease financing from the view point of lessee is presented in this Section. The decision-criterion used is the Net Present Value of Leasing [NPV(L)]/Net Advantage of Leasing (NAL). The discount rate used is the marginal cost of capital for all cashflows other than lease payments and the tax cost of debt for lease payments. The value of the interest tax shield is included as a foregone cash flow in the computation of NPV(L)/NAL.

NPV(L)/NAL = Investment cost
Less : Present value of lease payment (discounted by K_d),
Plus : Present value of tax shield on lease payment (discounted by K_c)
Less : Management fee
Plus : Present value of tax shield on management fee (discounted by K_c)
Minus : Present value of depreciation shield (discounted by K_c)
Minus : Present value of interest shield (discounted by K_c)
Minus : Present value of residual/salvage value (discounted by K_c)

where K_c = Post-tax marginal cost of capital
K_d = Pre-tax cost of long-term debt

If the NAL/NPV(L) is positive, the leasing alternative should be used, otherwise the borrowing alternative would be preferable.

An alternative approach is to determine the present values of the cash outflows after taxes under the leasing and the borrowing alternatives. The decision-criterion is to select the alternative with the lower present value of cash outflows.

The mechanics of computation of (i) present value of cash outflows associated with the leasing and the borrowing alternatives and (ii) the NAL/NPV(L) is illustrated below.

EXAMPLE 7.9

XYZ Ltd is in the business of manufacturing steel utensils. The firm is planning to diversify and add a new product line. The firm either can buy the required machinery or get it on lease.

The machine can be purchased for Rs 15,00,000. It is expected to have a useful life of 5 years with salvage value of Rs 1,00,000 after the expiry of 5 years. The purchase can be financed by 20 per cent loan repayable in 5 equal annual instalments (inclusive of interest) becoming due at the end of each year. Alternatively, the machine can be taken on year-end lease rentals of Rs 4,50,000 for 5 years. Advise the company, which option it should choose. For your exercise, you may assume the following:

(i) The machine will constitute a separate block for depreciation purposes. The company follows written down value method of depreciation, the rate of depreciation being 25 per cent.
(ii) Tax rate is 35 per cent and cost of capital is 18 per cent.
(iii) Lease rents are to be paid at the end of the year.
(iv) Maintenance expenses estimated at Rs 30,000 per year are to be borne by the lessee.

SOLUTION

PV of Cash Outflows Under Leasing Alternative

Year-end	*Lease rent after taxes [R (1 – t)] [Rs 4,50,000 (1 – 0.35)]*	*PVIFA at 13% [20%(1 – 0.35)]*	*Total PV*
1-5	Rs 2,92,500	3.517	Rs 10,28,723

PV of Cash Outflows Under Buying Alternative

Year -end	*Loan instalment**	*Tax advantage on*		*Net cash outflows (col. 2 – col. 3 + col. 4)*	*PVIF at 13%*	*Total PV*
		Interest (I × 0.35)	*Depreciation (D × 0.35)*			
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 5,01,505	Rs 1,05,000	Rs 1,31,250	Rs 2,65,255	0.885	Rs 2,34,751
2	5,01,505	90,895	98,437	3,12,173	0.783	2,44,431
3	5,01,505	73,968	73,828	3,53,709	0.693	2,45,120
4	5,01,505	53,656	55,371	3,92,478	0.613	2,40,589
5	5,01,505	29,114	41,528	4,30,863	0.543	2,33,959
						11,98,850
Less: PV of salvage value (Rs 1,00,000 × 0.543)						54,300
Less: PV of tax savings on short-term capital loss: (Rs 3,55,958 – Rs 1,00,00) × 0.35 = (Rs 89,585 × 0.543)						48,645
NPV of cash outflows						10,95,905

*Equivalent annual loan instalment = Rs 15,00,000/2.991 (PVIFA for 5 years at 20% i.e. 20,5) = Rs 5,01,505.

Recommendation: The company is advised to go for leasing as the PV of cash outflows under leasing option is lower than under buy/borrowing alternative.

Working Notes

Schedule of Debt Payment

Year-end	*Loan instalment*	*Loan at the beginning of the year*	*Payments*		*Loan outstanding at the end of the year (col. 3 – col. 5)*
			Interest (col. 3 × 0.20)	*Principal repayment (col. 2 – col. 4)*	
1	*2*	*3*	*4*	*5*	*6*
1	Rs 5,01,505	Rs 15,00,000	Rs 3,00,000	Rs 2,01,505	Rs 12,98,495
2	5,01,505	12,98,495	2,59,699	2,41,806	10,56,689
3	5,01,505	10,56,689	2,11,338	2,90,167	7,66,522
4	5,01,505	7,66,522	1,53,304	3,48,201	4,18,321
5	5,01,505	4,18,321	83,184*	4,18,321	—

*Difference between loan instalment and loan outstanding.

Schedule of Depreciation

Year	*Depreciation*	*Balance at the end of the year*
1	Rs 15,00,000 × 0.25 = Rs 3,75,000	Rs 11,25,000
2	11,25,000 × 0.25 = 2,81,250	8,43,750
3	8,43,750 × 0.25 = 2,10,937	6,32,813
4	6,32,813 × 0.25 = 1,58,203	4,74,610
5	4,74,610 × 0.25 = 1,18,652	3,55,958

EXAMPLE 7.10 *(Annual Lease Rentals)*

The following details relate to an investment proposal of the Hypothetical Industries Ltd (HIL):

- Investment outlay, Rs 180 lakh
- Useful life, 4 years
- Net salvage value after 4 years, Rs 18 lakh
- Annual tax relevant rate of depreciation, 40 per cent
- Net salvage after 3 years, Rs 30 lakh

The HIL has two alternatives to choose from to finance the investment:

Alternative I : Borrow and buy the equipment. The cost of capital of the HIL, 0.12; marginal rate of tax, 0.35; cost of debt, 0.17 per annum.

Alternative II : Lease the equipment from the Hypothetical Leasing Ltd on a 3-year full-payout basis @ Rs 444/Rs 1,000 payable annually in arrear. The lease can be renewed for a further period of 3 years at a rental of Rs 18/Rs 1,000 payable annually in arrear.

Which alternative should the HIL choose? Why?

SOLUTION

Decision Analysis *(Rs lakh)*

1. Investment outlay	Rs 180.00
2. *Less:* Present value of lease rentals (working note 1)	176.61
3. *Plus:* Present value of tax shield on lease rentals (2)	67.19
4. *Less:* Present value of tax shield on depreciation (3)	41.01
5. *Less:* Present value of interest shield on displaced debt (4)	18.29
6. *Less:* Present value of net salvage value (5)	12.81
NAL/NPV(L)	(1.53)

Since the NAL is negative, the lease is not economically viable. The HIL should opt for the alternative to borrow and buy.

Working Notes

1. Present value of lease rentals: = Rs (180 lakh × 0.444) × PVIFA (17,3) = Rs 79.92 lakh × 2.210
   = Rs 176.61 lakh
2. Present value of tax shield on lease rentals: = Rs (180 lakh × 0.444 × 0.35) × PVIFA (12,3)
   = Rs 27.972 lakh × 2.402 = Rs 67.19 lakh
3. Present value of tax shield on depreciation: = [72 × PVIF (12,1) + 43.2 × PVIF (12,2) + 25.92 × PVIF (12,3)] × 0.35 = [72 × 0.893) + (43.2 × 0.797) + (25.92 × 0.712)] × 0.35 = Rs 41.01 lakh
4. Present value of interest tax shield on displaced debt: = [30.03 × PVIF (12,1) + 4.54 × PVIF (12,2) + 11.61 × PVIF (12,3)] × 0.35 = [(30.03 × 0.893) + (4.54 × 0.797) + (11.61 × 0.712)] × 0.35 = Rs 18.29 lakh

(Displaced) Debt (Present Value of Lease Rentals) Amortisation Schedule *(Rs lakh)*

Year	*Loan outstanding at the beginning**	*Interest content (at 17%)*	*Capital content*	*Instalment amount (176.61 ÷ 2.210)*
1	176.61	30.03	49.89	79.92
2	126.72	4.54	58.38	79.92
3	68.34	11.61	68.34	79.92

*Equal to the present value of lease rentals

5. Present value of net salvage value: = 18 × PVIF (12,3) = 18 × 0.712 = Rs 12.81 lakh

Lessor's Viewpoint The lease evaluation from the point of view of the lessor aims at ascertaining whether to accept a lease proposal or to choose from alternative proposals. As in the case of the evaluation by a lessee, the appraisal method used is the discounted cash flow technique based on the lessor's cash flows. The lease-related cash flow from his angle consist of (a) outflows in terms of the initial investment/ acquisition cost of the asset at the inception of the lease; income-tax on lease payments, sales-tax on lease transaction, if any; lease administration expenses such as rental collection charges, expenses on suits for recovery and other direct cost and so on, (b) inflows such as lease rentals, management fee, tax shield on depreciation, residual value and security deposit, if any and so on. This Section illustrates lease evaluation from the point of view of a lessor.

EXAMPLE 7.11

For Example 7.9, assume further that: (i) the lessor's weighted average cost of capital is 14 per cent. Is it financially profitable for leasing company to lease out the machine?

SOLUTION

Determination of NPV of Cash Inflows

	Years				
	1	*2*	*3*	*4*	*5*
Lease rent	Rs 4,50,000	Rs 4,50,000	Rs 4,50,000	Rs 4,50,000	Rs 4,50,000
Less: Depreciation	3,75,000	2,81,250	2,10,937	1,58,203	1,18,652
Earnings before taxes	75,000	1,68,750	2,93,063	2,91,797	3,31,348
Less: Taxes (0.35)	26,250	59,062	83,672	1,02,129	1,15,972
Earnings after taxes	48,750	1,09,688	1,55,391	1,89,668	2,15,376
Cash inflows after taxes × PV factor at (0.14)	4,23,750	3,90,938	3,66,328	3,47,871	3,34,028
	0.877	0.769	0.675	0.592	0.519
Total PV	3,71,629	3,00,631	2,47,271	2,05,940	1,73,361
Total PV (operations) [1-5]					12,98,832
Add: PV of salvage value of machine (1,00,000 × 0.519)					51,900
Add: PV of tax savings on short-term capital loss (Rs 89,585 × 0.519)					46,495
Gross PV					13,97,227
Less: Cost of machine					15,00,000
NPV					(1,02,773)

It is not financially profitable to let out machine on lease by the leasing company, as NPV is negative.

EURO—ISSUES

As a part of globalising the Indian economy after 1991, Indian corporates are now permitted to float their securities in, and raise funds from, the Euro markets. The two long-term primary instruments of Euro issues are Foreign Currency Bonds (FCCBs) and Global Depository Receipts (GDRs)/American Depository Receipts (ADRs). A FCCB means a bond subscribed by a non-resident in foreign currency and convertible into ordinary shares of the issuing company in India in any manner, wholly or in part, on the basis of any equity related warrants attached to the debt instruments. A GDR/ADR means any instrument in the form of a depository receipt/certificate, by whatever name called, created by the Overseas Depository Bank (ODB) outside India and issued to non-resident investors against the issue of ordinary shares or FCCBs of the issuing company. A bank authorised by the issuing company to issue GDRs/ADRs against the issue of FCCBs/ordinary shares of the issuing company is known as an ODB. The scheme for facilitating issue of FCCBs and ordinary shares through the GDR/ADR mechanism by Indian companies is discussed in this Section.

Eligibility for Issue of Convertible Bonds or Ordinary Shares of Issuing Company

An issuing company desirous of raising funds by issuing FCCBs or ordinary shares for equity issues through GDR/ADR is required to obtain the prior permission of the Department of Economic Affairs, Ministry of Finance, Government of India. It may sponsor an issue of ADRs /GDRs with an overseas depository against shares held by its shareholders, at a price determined by the lead manager with respect to disinvestment of their holdings by shareholders of Indian companies that are (i) listed in India, (ii) not listed in India, but listed overseas. Such a facility would be available *pari passu* to all categories of shareholders of the company whose shares are being sold in the ADR/GDR market overseas. An approved intermediary under the scheme would be an investment banker registered with the Securities and Exchange Commission in the USA, or under the Financial Services Authority in UK, or the appropriate regulatory authority in Germany, France, Singapore or in Japan. Such issues would need to conform to the foreign direct investment policy and other mandatory statutory requirements and detailed guidelines issued in this regard.

The issuing company seeking permission from the Government should have a consistent track record of good performance (financial or otherwise) for a minimum period of three years, on the basis of which an approval for finalising the issue structure would be issued to the company. On finalising the issue structure in consultation with the lead manager to the issue, the issuing company should obtain the final approval from the Government for proceeding ahead with the issue. The requirements included in the issue structure are discussed below.

Issue Structure of the GDRs/ADRs A GDR/ADR may be issued for one or more underlying shares or bonds held with the domestic custodian bank (DCB). GDRs/FCCBs may be denominated in any freely convertible foreign currency. The ordinary shares underlying the GDRs and the shares issued upon conversion of the FCCBs should be denominated only in Indian currency. The following issues would be decided by the issuing company with the lead manager to the issue, namely: (a) public or private placement; (b) number of GDRs/ADRs to be issued; (c) the issue price; (d) the rate of interest payable on FCCBs; and (e) the conversion price, coupon rate, and the pricing of the conversion options of the FCCRs. There would be no lock-in period for GDRs/ADRs.

FCCBs should be denominated in any convertible foreign currency and ordinary shares of an issuing company should be denominated in Indian rupees. The issued ordinary shares or bonds should be delivered to a DCB who would, in the terms of agreement, instruct the ODB to issue GDR/ADR certificates to non-resident investors against the shares or bonds held by it. A DCB means a banking company that acts as a custodian for ordinary shares/FCCBs of an Indian company, which are issued by it against GDRs/ADRs certificates. A GDR may be issued in negotiable form and may be listed on any international stock exchange for trading outside India. The provision of any law relating to the issue of capital by an Indian company would apply in relation to the issue of FCCBs or ordinary shares of an issuing company and it should obtain the necessary permission or exemption from the appropriate authority, under the relevant law, in this regard.

Limits of Foreign Investment in the Issuing Company

The ordinary shares and FCCBs issued against GDRs/ADRs should be treated as direct foreign investment in the issuing company. The aggregate of the foreign investment, made either directly or indirectly through GDR/ADR mechanism, should not exceed 51 per cent of the issue and the subscribed capital of the issuing company. However, investments made through offshore funds or by foreign institutional investors would not form part of the limit.

Listing

GDRs/ADRs may be listed on any of the overseas stock exchanges, or over the counter exchanges or through the book entry transfer system prevalent abroad. They may be purchased, possessed and freely transferable by a person who is a non-resident. A listed company may sponsor an issue of ADRs/GDRs with an overseas depository against shares held by its shareholders. Such a facility would be available *pari passu* to all categories of the company shareholders whose shares are being sold in the ADR/GDR market overseas. Such issues would need to conform to the FDI policy and other mandatory statutory requirements. The provisions of FEMA would also need to be adhered to.

Transfer and Redemption

A non-resident holder of GDRs/ADRs may transfer them, or may ask the ODB to redeem them. In the case of redemption, the ODB should request the DCB to get the corresponding underlying shares released in favour of the non-resident investor, for being sold directly on his behalf, or transferring them in the name of the non-resident in the books of account of the issuing company. The redeemed GDRs and underlying shares sold may be re-issued to the extent of such redemption and sale made in the domestic market. Such re-issuance should be in terms of the Foreign Exchange Management (transfer or issue of security by a person resident outside India) Regulations, 2000, as amended from time to time, and the guidelines issued in this regard. In case of redemption of the GDRs/ADRs into underlying shares, a request for the same should be transmitted by the ODB to the DCB in India, with a copy of the same being sent to the issuing company for information and record. On redemption, the cost of acquisition of the shares underlying the GDRs/ADRs would be reckoned as the cost on the date on which the ODB advises the DCB regarding redemption. The price of the ordinary shares of the issuing company prevailing in the Bombay Stock Exchange or the National Stock Exchange on the date of the advice of redemption should he taken as the cost of acquisition of the underlying ordinary shares. For the purpose of conversion of FCCBs, the cost of acquisition in the hands of non-resident investors would be the conversion price which is determined on the basis of the price of the shares at the Bombay Stock Exchange or the National Stock Exchange on the date of conversion into shares.

Taxation on Foreign Currency Convertible Bonds

Interest payments on bonds, until the conversion option is exercised, would be subject to deduction of tax at source at the rate of ten per cent. Tax on dividend on the converted portion of the FCCB would be subject to deduction of tax at source at the rate often percent. Conversion of FCCBs into shares would not give rise to any capital gains liable to income tax in India. Transfers of FCCBs made outside India by a non-resident investor to another non-resident investor would not give rise to any capital gains liable to tax in India.

Taxation

Under the provisions of the Income tax Act, income by way of dividend on shares issued under the GDR/ADR mechanism would be taxed at the rate of 10 per cent. The issuing company should transfer the net dividend payments after remitting tax at source to the ODB. On receipt of these payments, the ODB should distribute them to non-resident investors, proportionate to their holdings of GDRs/ADRs evidencing relevant shares. The holders may take credit for the tax deducted at source on the basis of certification by the

ODB, if permitted by the country of their residence. All trading transactions of GDRs/ADRs outside India, among non-resident investors, would be free from any liability to income-tax in India on capital gains therefrom. If any capital gains arise from the transfer of the aforesaid shares in India to the non-resident investor, he would be liable to income tax under the provisions of the Income tax Act. If the aforesaid shares are held by the non-resident investor for a period of more than twelve months from the date of advice of their redemption by the ODB, the capital gains arising from the sale thereof would be treated as long-term capital gains and would be subject to income tax at the rate of 10 per cent under the provisions of Section 115-AC of the Income tax Act. If such shares are held for a period of less than twelve months from the date of redemption advice, the capital gains arising from the sale thereof would be treated as short-term capital gains and would be subject to tax at the normal rates of income tax applicable to non-residents under the provisions of the Income tax Act. After the redemption of GDRs/ADRs into underlying shares, during the period, if any, in which these shares are held by the redeeming non-resident foreign investor who has paid for them in foreign exchange at the time of its purchase, the rate of taxation of income by way of dividend on these shares would continue to be at the rate of 10 per cent, in accordance with Section 115-AC(1) of the Income tax Act. The long-term capital gains on the sale of these redeemed underlying shares held by non-resident investors in the domestic market would also be charged tax at the rate of 10 per cent, in accordance with the provisions of Section 115-AC(1). When the redeemed shares are sold on Indian stock exchanges against payment in rupees, these shares would go out of the purview of Section 115-AC of the Income tax Act and income therefrom would not be eligible for concessional tax treatment provided thereunder. After the transfer of shares, where consideration is in terms of rupees payment, normal tax rates would apply to the income arising or accruing from these shares. Deduction of tax at source on the amount of capital gains accruing from transfer of the shares would be made in accordance with Sections 195 and 196-C of the Income tax Act.

Application of Avoidance of Double Taxation Agreement in Case of Global/ American Depository Receipts

During the period of fiduciary ownership of shares in the hands of the ODB, the provisions of Avoidance of Double Taxation Agreement, entered into by the Government of India with the country of residence of the ODB, would be applicable in the matter of taxation of income from dividends from underlying shares and interest on FCCBs. During the period, if any, when the redeemed underlying shares are held by the non-resident investor on transfer from the fiduciary ownership of the ODB, before they are sold to resident purchasers, the Avoidance of Double Taxation Agreement entered into by the Government of India with the country of residence of the non-resident investor would be applicable in the matter of taxation of income from the dividends of the said underlying shares, or interest on FCCBs, or any capital gain arising out of transfer of underlying shares.

Gift tax and Wealth Tax

Holding of GDRs/ADRs in the hands of non-resident investors and holding of the underlying shares by the ODB in a fiduciary capacity and the transfer of the GDRs/ADRs between non-resident investors and the ODB would be exempt from wealth tax under the Wealth tax Act, 1957, and from gift tax under the Gift tax Act, 1958.

SUMMARY

- Equity/ordinary share capital represents ownership capital and its owners—equity-holders/ordinary shareholders—share the reward and risk associated with the ownership of corporate enterprises.
- The ordinary shares have some special features in terms of the rights and claims of their holders: (i) residual claim to income, (ii) residual claim on assets, (iii) right to control, (iv) pre-emptive rights and (v) limited liability.
- A shareholder can (1) exercise (2) sell in the market and (3) renounce/forfeit his pre-emptive right partially/completely. He does not gain/lose from rights issues. However, he would suffer dilution of financial interest if he does not exercise his pre-emptive right.
- Ordinary share capital is a high-risk-high-reward source of finance for corporates. The shareholders share the risk, return and control associated with ownership of companies.
- A project requires two types of funds: long-term to finance purchase of immovable assets and working capital funds. A major source of long-term funds is term loan from banks and financial institutions. The relevant aspects of term loans are their features/evaluation, negotiations and appraisal.
- The main features of term loan/project finance are maturity, negotiation, security, covenants, repayment/amortisation.
- The maturity period of a term loan is typically 3-10 years. Term loans are negotiated between borrowers and lenders. While the assets financed by term loan serve as primary security, all the other assets of the borrower provide collateral security.
- To protect their interest, lenders reinforce the asset security stipulations with positive and negative covenants. The negative covenants relate to assets, liabilities, cash flows and control. The assets-related covenants are intended to ensure the maintenance of a minimum asset base while the cash-related covenants are intended to restrain cash outflows of the borrower. The control-related covenants aim at ensuring competent management for the borrowers. The positive covenants include maintenance of minimum working capital and networth and creation of loan redemption fund and so on.
- Term loans have to be amortised according to a repayment schedule. The repayment has two components: interest and repayment of principal. There are two modes for loan amortisation: (i) equal principal payment and (ii) equal instalment.
- The term loan negotiation include the contents of the application form for loan, details of the project, documentation and disbursement of loan, utilisation of loan, charging of securities and registration of charges.
- Lenders carrying out a thorough scrutiny of a project submitted to them for financing. The appraisal covers the following aspects of the project: technical feasibility, managerial compliance, commercial and financial viability and economic and environmental viability. The focus of appraisal by the lenders is on verifying the details included in the project report submitted by the borrowers.
- The financial institutions also scrutinise projects from the larger social point of view. They basically focus on three aspects of a project, namely, economic rate of return based on the L-M approach to SCBA, effective rate of protection and domestic resource cost.
- Debentures represent creditorship securities and debenture-holders are long-term creditors of the company. As long-term source of finance, debentures have some contrasting features compared to equity shares. When they are sold to public, a trustee is appointed through a trust deed/indenture to ensure that the borrower fulfills all contractual obligations. The coupon rate of interest is legally enforceable as well as tax-deductible. A typical non-convertible debenture (NCD) has a maturity of 7-10 years. The redemption of debentures can be accomplished in either of the two ways: (i) debenture

redemption reserves (sinking fund) and (ii) call and put (buy-back) provision. They are generally secured by way of an equitable mortgage. The convertible debentures can be partly/fully converted into equity shares. All debentures must be rated by a rating agency. As long-term source of funds, debentures (i) have low cost, (ii) do not dilute control, (iii) involve high risk and (iv) put some restraint on managerial freedom. To improve the attractiveness of debentures, a wide range of innovative instruments have emerged such as deep discount bonds, secured premium notes and floating rate bonds.

- A hybrid source of financing partakes some features of equity shares and some features of debt instruments. The important hybrid instruments are: preference shares, convertible debentures/bonds, warrants and options. The issue procedure for these instruments is similar to the raising of equity shares.
- The main attributes of preference shares (i) prior claim on income/assets, (ii) cumulative dividends, (iii) redeemability, (iv) voting rights when preference dividend is in arrears, (v) participation in surplus profits/excess assets and so on.
- Preference capital involves high cost, does not dilute owners control of the company, has negligible risk and puts no restraint on managerial freedom. The shareholders receive modest return and are vulnerable to arbitrary managerial actions. It is not a popular source of long-term finance in India.
- Convertible debentures (CDs) confer on their holders the right/option to convert them partly (PCDs)/ fully (FCDs) into equity at a later date on specified terms/conditions.
- Their operational features, namely, conversion ratio, conversion premium and conversion timing are specified in advance. The call option gives the issuer the right to redeem to redeem the debentures prematurely. The investor has also the right to prematurely sell them back.
- The value of a compulsorily/fully/partly CDs,

$$V_0 = \sum_{t=1}^{n} \frac{I_t}{(1+K_d)^t} + \frac{aP_i}{(1+K_e)^i} + \sum_{j=m} \frac{F_j}{(1+K_d)^j}$$

- The cost of a PCDs, $Kc = S_0 = \sum_{t=1}^{n} \frac{I_t\,(1-T)}{(1+K_c)^t} + \frac{aP_i b}{(1+K_c)^I} + \sum_{j=m}^{n} \frac{F_j}{(1+K_c)^j}$
- The value of optionally CDs depends upon three factors: (i) straight debenture value, (ii) conversion value and (iii) option value.
- The reasons for the popularity of CDs are (1) cashflow matching of firms, (2) financial synergy and (3) mitigation of agency problem.
- A warrant entitles its holders to subscribe to the equity capital of a company during a specified period at a stated/particular/striking price. It differs from a CD in that while debenture and conversion option are irreparable a warrant can be detached. Unlike CDs, warrants can be offered independently also.
- The important features of warrants are (1) exercise, price, (2) exercise ratio and (3) expiry date.
- The implied price of an attached warrant is the price effectively paid for each warrant. It is equal to price of bond with attached warrants less straight debenture/warrant value.
- A warrant has a market value and a theoretical value. The difference between them is the warrant premium.
- The theoretical value of a warrant = $(P_0 - E) \times N$.
- A warrant premium results from a combination of (1) positive investor expectation and (ii) the ability of the investor to obtain larger potential return by trading in warrants instead of under-lying shares.
- Options are not a source of financing like shares, debentures, CDs and warrants. But they do stabilise prices of shares by increasing trading activity in them.
- An option is an instrument that provides to its holders an opportunity to purchase (call option)/sell (put option) specified security/asset at a stated striking price on/before a specified expiration date.

- Securitisation is the process of pooling and repackaging of homogenous illiquid financial assets (debt) into marketable securities that can be sold to investors. The assets could be receivables, leases, housing loan and so on.
- The parties to a securitisation deal are: originator, SPV, investors, obligors, rating agency, administrator/servicer, agent and trustee and structurer.
- Originator is the entity on whose books the assets to be securitised exist. The SPV is the entity which would typically buy the assets to be securitised from the originator. The investors buy a participating interest in the total pool of receivables and receive their payment in the form of interest and principal as per agreed pattern.
- The obligors and the borrowers of the original loan. The amount outstanding from the obligors is the asset that is transferred to the SPV. The rating agency assesses the strength of the cash flow and the mechanism designed to ensure full and timely payment. The administrator collects the payment from the obligor(s) and passes it on to the SPV. The agent/trustee accepts the responsibility for overseeing that all the parties to the securitisation deal perform in accordance with the securitisation trust agreement. The structurer brings together the originator, the investors and other parties to the deal.
- The instruments of securitisation are: pass through certificates (PTCs), pay through securities (PTS) and stripped securities.
- In case of the PTCs, the cash flows are distributed on a pro rata basis to the holders of the securities. The PTS permits the issuer to structure receivables flows to offer a range of investment maturities to investors associated with different yields and risks.
- The securities fall into two groups: asset backed securities (ABS) and mortgage backed securities (MBS).
- Venture capital, as a fund-based financial service, has emerged the world over to fill gaps in the conventional financial mechanism, focusing on new entrepreneurs, commercialisation of new technologies and support to small/medium enterprises in the manufacturing and the service sectors. Venture capital has undergone significant changes.
- The characteristics features of venture capital differentiate it from other capital investments. It is basically equity finance in relation to new listed companies and debt financing is only supplementary to ensure running yield on the portfolio of the venture capitalists/capital institution (VCIs). It is long-term investment in growth-oriented small/medium firms. There is a substantial degree of active involvement of VCIs with the promoters of venture capital undertakings (VCUs) to provide, through a hands-on approach, managerial skills without interfering in the management. The venture capital financing involves high risk-return spectrum. It is not technology finance, though technology finance may form a sub-set of such financing. Its scope is much wider.
- The first step in venture capital financing is the selection of the investment. It includes stages of financing, methods to evaluate deals and the financial instruments to structure a deal. The stages of financing as differentiated in venture capital industry are early stage and later stage. Included in early stage are seed capital/pre-start-up, start-up and second-round financing. The later stage of venture capital financing covers mezzanine/development capital, bridge/expansion, buyouts and turnarounds. The venture investments are generally **idea-based and growth-based**.
- The structuring of venture capital deals is a mix of the available financial instruments: equity and debt. The equity instruments include ordinary, non-voting, deferred ordinary, preference, warrants, cumulative convertible preference, participating preference and so on. The main types of debt instruments are conventional loan, conditional loan, income notes, NCDs, PCDs, zero interest bonds, secured premium notes and deep discount bonds.
- Lease is a contractual arrangement under which the owner of an asset (lessor) allows the use of the asset to the user (lessee) for an agreed period of time (lease period) in consideration for the periodic payment (lease rent). At the end of the lease period, the asset reverts back to the owner, unless there is a provision for the renewal of the lease contract.

- Leasing can be classified into finance lease and operating lease.
- Short-term or cancelable leases (at the option of the lessee) are referred to as operating leases while long-term or non-cancellable leases are known as financial leases. The distinction between the two is based on the extent to which the risks and rewards of ownership are trans-ferred from the lessor to the lessee. If a lease transfers a substantial part of the risks and rewards, it is called finance lease; otherwise, it is operating lease.
- Finance lease can be evaluated from the point of view of both the lessee and the lessor. From the perspective of the lessee, leasing should be evaluated as a financing alternative to borrow and buy. The decision-criterion requires comparison of the present value (PV) of cash outflows after taxes under the leasing option *vis-á-vis* borrowing-buy alternative. The alternative with the lower PV should be selected.
- The Net Advantage of Leasing (NAL) approach is the alternate approach to evaluate finance lease. The benefits from leasing are compared with cost of leasing.

  The benefits from leasing are: (i) Investment cost of asset (saved), (ii) Plus PV of tax shield on lease payment, discounted by k_c and (iii) Plus PV of tax shield on management fee, discounted by k_c.

  The cost of leasing are: (i) Present value of lease rentals, discounted by k_d, (ii) Plus management fee, (iii) Plus PV of depreciation shield foregone, discounted by k_c, (iv) Plus PV of salvage value of asset, discounted by k_c and (v) Plus PV of interest shield, discounted by k_c.

  In case NAL is positive (benefits > costs), leasing alternative is preferred.
- For the lessor, lease decision is akin to a capital budgeting decision. The leasing is viable when the PV of cash inflows after taxes (CFAT) accruing to him exceeds the cost of asset. The CFAT are discounted at the weighted average cost of capital.
- The NAL approach can also be used by the lessor to assess the financial viability of the lease decision. The NAL to a lessor = Present value of lease payment *plus* (i) Present value of management fee, (ii) Present value of depreciation tax shield, (iii) Present value of net salvage value, (iv) Present value of tax shield on initial direct costs, *minus*, (i) Initial investment, (ii) Present value of tax on lease payments, (iii) Present value of tax on management fee, and (iv) Present value of initial direct cost.
- A GDR is an instrument which allows Indian corporates, banks, financial institutions and NBFCs to raise funds through equity issues abroad. A dollar denominated instrument, it is traded in stock exchange(s) outside the country of origin. It represents a certain number of underlying equity shares denominated in rupees. An ADR is a negotiable instrument denominated in US dollars, representing a non-US corporate's local currency equity shares (known as depository receipts).
- Instead of issuing in the name of individual shareholders, the shares are issued to an intermediary (overseas depository bank) in whose name the shares are registered. The overseas depository bank subsequently issues GDRs/ADRs to the subscribing public. The physical possession of the equity share will be with another intermediary (i.e. custodian) who is an agent of the overseas depository bank. The custodian is a domestic depository bank.
- Though GDRs/ADRs represent equity shares, they have distinct identity and do not figure in the books of the company.
- While the GDR market is an institutional market with lower liquidity, an ADR listing allows US retail investors to participate in the offering.
- The holders of GDRs/ADRs may exercise their voting rights through the overseas depository bank.
- The disclosure requirements of GDR issues are less stringent *vis-a-vis* ADRs.
- The benefits of ADR/GDR issues to an Indian corporate are: (i) better corporate image, (b) exposure to international capital markets, (iii) means of raising capital abroad in foreign exchange, (iv) no risk of foreign exchange fluctuations as the company will pay interest/dividends in rupees to the domestic depository bank and (v) use of proceeds for overseas acquisitions, setting-up offices overseas and other capital expenditure.
- The holders of GDRs/ADRs enjoy tax concessions specified from time to time by Government.

SOLVED PROBLEMS

P.7.1 Delhi Manufacturers (DMs) intend to raise Rs 40,00,000 of equity capital through a rights offering. It currently has 10,00,000 shares outstanding which have been most recently selling/trading for Rs 50 and Rs 56 per share. In consultation with the SEBI Caps, the DM has set the subscription price for the rights at Rs 50 per share.

Required:

1. Determine the number of new shares DM should sell to raise the desired amount of capital.
2. Ascertain the number of shares each right would entitle a holder of one share to purchase. How many additional shares can an investor who holds 10,000 shares of DM purchase?
3. Compute the theoretical value of a right if the current market price is Rs 54 **with rights** and the subscription price is Rs 50 for both shares selling **with rights** and shares selling **ex-rights** (i.e. the value of the right is not included in the market price of shares).

SOLUTION

1. Number of new shares $= \dfrac{\text{Rs } 40,00,000 \text{ (to be raised)}}{\text{Rs } 50 \text{ (subscription price)}} = 80{,}000 \text{ shares}$

2. Number of shares per right $= \dfrac{80{,}000 \text{ (new shares)}}{10{,}00{,}000 \text{ (shares outstanding)}} = 0.08 \text{ share}$

   Additional shares = 0.08 shares/right × 1 right/share × 10,000 shares = 800 shares

3. Theoretical value of right with rights, Rw:

$$R_w = \frac{M_w - S}{N + 1}$$

Where

R_w = theoretical value of a right when the share is selling with rights/cum rights
M_w = market value of the stock with rights/cum-rights
S = subscription price of the shares
N = number of rights needed to purchase one share

Substituting the values,

$$R_w = \frac{\text{Rs } 54 - \text{Rs } 50}{12.5^{@} + 1} = \frac{\text{Rs } 4}{13.5} = \text{Rs } 0.296$$

$^{@}N = \dfrac{1}{0.08} = 12.5$ rights need to purchase one new share.

Theoretical value of right ex-right,

$$R_e = \frac{M_e - S}{N}$$

Where

R_e = theoretical value of a right when the share is trading **ex-right**
M_e = market value of shares trading ex-right.

Substituting the values,

$$\frac{\text{Rs } 53.704^{@@} - \text{Rs } 50}{12.5} = \frac{\text{Rs } 3.704}{12.5} = \text{Rs } 0.296$$

$^{@@}M_w - R_w$ = Rs 54 – Rs 0.296 = Rs 53.704

The investor would receive at least the theoretical value of Rs 0.296 per right × 10,000 shares = Rs 2,960. If he expects the price of DMs shares to increase during the period the rights are exercisable, the market value of the rights would be more than their theoretical value.

P.7.2 The Standard Company (SC) wishes to raise Rs 30,00,000 through a rights offering. It has currently 2,40,000 shares outstanding which have been most recently trading between Rs 106 and Rs 116 per share. On the advice of the SBI Caps, the SC has set the subscription price for the rights at Rs 100 per share on the assumption that they will be fully subscribed.

Required:

(a) How many new shares should SC sell to raise the desired amount?

(b) How many shares will each right entitle a holder of one share to purchase?

(c) What is the theoretical value of a right if the current market price is Rs 109 with rights and the subscription price is Rs 100? Answer for both shares selling with rights and shares selling ex-rights?

SOLUTION

(a) Number of new shares = $\frac{\text{Rs } 30,00,000}{\text{Rs } 100}$ = 30,000 shares

(b) Number of shares per right = $\frac{2,40,000}{30,000}$ = 8, that is, 8 shares rights are needed to purchase a new share at Rs 100. Each right entitles its holder to purchase one- right of a share.

(c) Value of a right, with rights

$$= \frac{\text{Rs } 109 - \text{Rs } 100}{8 + 1} = \text{Re } 1$$

Value of a right, ex-right

$$= \frac{\text{Rs } 108^{@} - \text{Rs } 100}{8} = \text{Re } 1$$

[@] Rs 109 – Re 1

Thus, the theoretical value of the right when the share is selling with rights or ex-rights is the same.

P.7.3 Hindustan Copper Industries (HCI) manufactures copper pipe. It is contemplating calling Rs 3 crore of 30-year, Rs 1,000 bonds (30,000 bonds) issued 5 years ago with a coupon interest rate of 14 per cent. The bonds have a call price of Rs 1,140 and had initially collected proceeds of Rs 2.91 crore due to a discount of Rs 30 per bond. The initial flotation cost was Rs 3,60,000. The HCI intends to sell Rs 3 crore of 12 per cent coupon interest rate, 25-year bonds to raise funds for retiring the old bonds. It intends to sell the new bonds at their par value of Rs 1,000. The estimated flotation costs are Rs 4,40,000. The HCI is in 35 per cent tax bracket and its after cost of debt is 8 per cent. As the new bonds must first be sold and their proceeds then used to retire the old bonds, the HCI expects a 2-month period of overlapping interest during which interest must be paid on both the old and the new bonds. Analyse the feasibility of the bond refunding by the HCI.

SOLUTION

Decision analysis for bond refunding decision

Present value of annual cashflow savings (*Refer working note 2*):	
Rs 3,81,460 × 10.675 ($PVIF_{8,25}$)	Rs 40,72,086
Less: Initial investment (*Refer working note 1*)	32,57,500
NPV	8,14,586

Decision: The proposed refunding is recommended as it has a positive NPV.

Working notes

1. Initial investment:

(a) Call premium:			
Before tax [(Rs 1,140 – Rs 1,000) × 30,000 bonds]		Rs 42,00,000	
Less: Tax (0.35 × Rs 42,00,000)		14,70,000	
After tax cost of call premium			Rs 27,30,000
(b) Flotation cost of new bond			4,40,000
(c) Overlapping interest:			
Before tax (0.14 × 2/12/ × Rs 3 crore)		7,00,000	
Less: Tax (0.35 × 7,00,000)		2,45,000	4,55,000
(d) Tax savings from unamortised discount on old bond [25/30 × (Rs 3 crore – 2.91 crore) × 0.35]			(2,62,500)
(e) Tax savings from unamortised flotation cost of old bond (25/30 × Rs 3,60,000 × 0.35)			(10,5,000)
			32,57,500

2. Annual cash flow savings

(a) Old bond			
(i) Interest cost:			
Before tax (0.14 × 3 crore)	Rs 42,00,000		
Less: Tax (0.35 × Rs 42,00,000)	14,70,000	27,30,000	
(ii) Tax savings from amortisation of discount [(Rs 9,00,000[@] ÷ 30) × 0.35]		(10,500)	
(iii) Tax savings from amortisation of flotation cost [(Rs 3,60,000 ÷ 30) × 0.40)		(4,200)	
Annual after tax debt payment (a)			27,15,300
(b) New bond			
(i) Interest cost:			
Before tax (0.12 × 3 crore)	36,00,000		
Less: Taxes (0.35 × Rs 36,00,000)	12,60,000		
After tax interest cost		23,40,000	
(ii) Tax savings from amortisation of flotation cost [Rs 4,40,000 ÷ 25) × 0.35		(6,160)	
Annual after-tax debt payment (b)			23,33,840
Annual cash flow savings [(a) – (b)]			3,81,460

[@]Par value – net proceeds for sale.

P.7.4 Dua Manufacturing (DM) has under consideration refunding of Rs 2 crore out- outstanding bonds at Rs 1,000 par value as a result of recent decline in long-term interest rates. The bond-refunding plan involves issue of Rs 2 crore of new bonds at the lower interest and the proceeds to call and retire the Rs 2 crore outstanding bonds. The DM is in 35 per cent tax bracket.

The details of the new bonds are: (i) sale at par value of Rs 1,000 each, (ii) 11 per cent coupon rate, (iii) 20-year maturity, (iv) flotation costs, Rs 4,00,000, and (iv) a 3-month period of overlapping interest.

DMs outstanding bonds were initially issued 10 years ago with a 30-year maturity and 13 per cent coupon rate of interest. They were sold at Rs 12 par bond discount from par value with flotation costs amounting to Rs 1,50,000 and their call at Rs 1,130.

Assuming 7 per cent after-tax cost of debt, analyse the bond-refunding proposal. Would you recommend it? Why?

SOLUTION

Decision analysis for bond refunding decision

Present value of annual cashflow savings (*Refer working note 2*):	
Rs 2,62,450 × 10.594 ($PVIF_{7,20}$)	Rs 27,80,395
Less: Initial investment (*Refer working note 1*)	24,21,500
Net present value of refunding	3,58,895

Decision: As the NPV is positive, the proposed bond-refunding is recommended.

Working notes

1. Initial investment:

(a) Call premium:			
Before tax [(Rs 1,130 – Rs 1,000) × 20,000 bonds]		Rs 26,00,000	
Less: Tax (0.35 × Rs 26,00,000)		9,10,000	
After-tax cost of call premium			Rs 16,90,000
(b) Flotation cost of new bond			4,00,000
(c) Overlapping interest:			
Before tax (0.13 × 3/12[@] × Rs 2 crore)		6,50,000	
Less: Tax (0.35 × 6,50,000)		2,27,500	
After-tax cost of overlapping interest			4,22,500
(d) Tax savings from unamortised discount on old bond [25/30[@@] × (20,000 bonds × Rs 12/bond discount) × 0.35]			(56,000)
(e) Tax savings from unamortised flotation cost of old bond (20/30[@@] × Rs 1,50,000 × 0.35)			(35,000)
			24,21,500

[@]3 months ÷12 months

[@@]20 years maturity ÷ 30 years maturity

2. Annual cash flow savings

(a) Old bond			
(i) Interest cost:			
Before tax (0.13 × Rs 2 crore)	Rs 26,00,000		
Less: Tax (0.35 × Rs 26,00,000)	9,10,000		
After tax interest cost		16,90,000	
(ii) Tax savings from amortisation of discount [(Rs 2,40,000[*] ÷30) × 0.35]		(2,800)	
(iii) Tax savings from amortisation of flotation cost [(Rs 1,50,000 ÷ 30) × 0.35]		(1,750)	
Annual after-tax debt payment (a)			16,85,450
(b) New bond			
(i) Interest cost:			
Before tax (0.11 × 2,00,00,000)	22,00,000		
Less: Taxes (0.35 × Rs 22,00,000)	7,70,000		
After tax interest cost		14,30,000	
(ii) Tax savings from amortisation of flotation cost [Rs 4,00,000 ÷ 20) × 0.35]		(7,000)	

Annual after tax debt payment (b)	14,23,000
*20,000 bonds × Rs 12 per bond	
Annual cash flow savings [(a) – (b)]	2,62,450

P.7.5 Allied Manufacturers (AM) has an outstanding issue of convertible debentures with a Rs 1,000 par value. They are convertible into 100 ordinary shares. They have 10 per cent annual coupon rate and 10-year maturity. The interest rate on straight bond of similar risk is 12 per cent.

Required

(a) Calculate the (i) straight debenture value of the debentures, (ii) conversion (or share) values of the debenture when the market price of the ordinary shares is Rs 20, 25, 28, 35 and 50 per share.
(b) For each of the price given in (a) (ii), at what price would you expect the debenture to sell?
(c) What is the lowest price you would expect the debentures to sell for irrespective of the behaviour of the price of the ordinary shares?

SOLUTION

(a) *(i) Computation of straight debenture value*

Years	*Payments (1)*	*PVIFA (0.12) (2)*	*Present value (3) [(1) × (2)]*
1 – 10	Rs 100*	5.650	Rs 565
10	1,000	0.322	322
			887

*(Rs 1,000 × 0.10)

(ii) Computation of conversion value of debentures

Market price of shares (1)	*Conversion ratio (2)*	*Conversion value (3) [(1) × (2)]*
Rs 8.0	100	Rs 800
10.0 (conversion price)	100	1,000 (par value)
11.2	100	1,120
14.0	100	1,400
20.0	100	2,000

(b) The debenture would be expected to sell at the higher of the conversion value and straight value. In no case it would sell for less than the straight value (i.e. Rs 887). At a price of Rs 8, the debenture would sell for its straight value of Rs 887. At other prices, it would be expected to sell at the associated conversion values respectively [as calculated in (a) (ii)].

(c) The lowest price would be the straight debenture value (i.e. Rs 887).

P.7.6 Delhi Manufacturing Company (DMC) is planning to issue Rs 10 crore in 10 per cent convertible debentures. Currently, the market price of its shares is Rs 40 per share. The DMC expects to obtain a conversion premium, that is, excess of issue price over conversion value, of 10 per cent. The call price of the debentures in the first 5 years is Rs 1,050 per debenture, after which it drops to Rs 1,020 in the next 5 years and to Rs 1,000 in the last 5 years. To allow for fluctuation in market price of shares, DMC does not want to call the debentures until their conversion value is at least 12 per cent higher than the call price. Earnings per share are expected to grow at 6 per cent compound annual rate and DMC does not envisage any change in its P/E ratio.

Required

Determine the length of time when DMC would be in a position to force conversion.

SOLUTION

Expected length of time to force conversion

Conversion price = Rs 40 × 1.10 = Rs 44

Call price per share in the first 5 years = Rs 44 × 1.05 = Rs 46.2

Price to which the shares must increase when the DMC would be in a position to force conversion = Rs 46.2 × 1.12 = Rs 51.74.

Increase from present price = Rs 51.74 ÷ Rs 40 = 1.294.

At 6 per cent compound growth rate, EPS would grow to 1.262 in 4 years and 1.338 in 5 years (Table A-1). If the P/E ratio remains the same, it would take 4-5 years before the DMC can force conversion.

P.7.7 New Delhi Manufacturers has current earnings of Rs 6 per shares with 5,00,000 shares outstanding. It is planning to issue 40,000 shares of 9 per cent, Rs 100 par value convertible preference shares at par. The preference share is convertible into 2 ordinary shares for each preference share held. The current market price of ordinary shares is Rs 42 per share.

Required

(a) Compute the conversion value of preference shares.
(b) Compute the conversion premium.
(c) Assuming total earnings remain the same, determine the effect of issue on basic earnings per share (i) before conversion (ii) on a fully diluted basis.
(d) If profits after taxes increases by Rs 10 lakh, determine the basic earnings per share (i) before conversion and (ii) on a fully diluted basis.

SOLUTION

(a) Conversion value = Conversion ratio × market price per share = 2 × Rs 42 = Rs 84.

(b) Conversion premium = (Rs 100 ÷ Rs 84) – 1 = 19.05 per cent.

(c) Earnings per share effect

(i)	Total after-tax earnings (Rs 6 × 5,00,000 shares)	Rs 30,00,000
	Preference share dividend (0.09 × 40,000 × Rs 100)	3,60,000
	Earnings available to ordinary shareholders (NI)	26,40,000
	Number of shares (N)	5,00,000
	EPS (basic) (Rs 26,40,000 ÷ 5,00,000)	5.28
(ii)	Total earnings	30,00,000
	Number of shares (5,00,000 + 80,000)	5,80,000
	EPS (diluted) (Rs 30,00,000 ÷ 5,80,000)	5.17

(d) Earnings per share effect with increase in profit

(i)	Total after-tax earnings	Rs 40,00,000
	Preference dividend	3,60,000
	NI	36,40,000
	N	5,00,000
	EPS (NI ÷ N)	7.28
(ii)	Total earnings (NI)	40,00,000
	N (5,00,000 + 80,000)	5,80,000
	EPS (NI ÷ N)	6.90

P.7.8 ABC Machine Tool Company Ltd is considering the acquisition of a large equipment to set up its factory in a backward region for Rs 12,00,000. The equipment is expected to have an economic useful life of 8 years. The equipment can be financed either with an 8-year term loan at 14 per cent interest, repayable in equal instalments of

Rs 2,58,676 per year, or by an equivalent amount of lease rent per year. In both cases, payments are due at the end of the year. The equipment is subject to the straight line method of depreciation for tax purposes. Assuming no salvage value after the 8-year useful life and 50 per cent tax rate, which of the financing alternatives should it select?

SOLUTION

PV of cash inflows under leasing alternative

Year end	*Lease payment after taxes (L) (1 – 0.5)*	*PV factor at 0.07 (K_d)*	*Total PV*
1–8	Rs 1,29,338	5.971	Rs 7,72,277

Determination of interest and principal components of loan instalment

Year end	*Loan instalment*	*Loan at the beginning of the year*	*Payment of*		*Principal outstanding at the end of the year (Col 3 – Col 5)*
			interest (Col 3 × 0.14)	*principal (Col 2 – Col 4)*	
1	*2*	*3*	*4*	*5*	*6*
1	Rs 2,58,676	Rs 12,00,000	Rs 1,68,000	Rs 90,676	Rs 11,09,324
2	2,58,676	11,09,324	1,55,305	1,03,371	10,05,953
3	2,58,676	10,05,953	1,40,833	1,17,843	8,88,110
4	2,58,676	8,88,110	1,24,335	1,34,341	7,53,769
5	2,58,676	7,53,769	1,05,528	1,53,148	6,00,621
6	2,58,676	6,00,621	84,087	1,74,589	4,26,032
7	2,58,676	4,26,032	59,644	1,99,032	2,27,000
8	2,58,676	2,27,000	31,676	2,27,000	—

PV of cash outflows under buying alternative

Year	*Loan instalment*	*Tax advantage on*		*Cash outflows after taxes [Col 2 – (Col 3 + Col 4)]*	*PV factor at 0.07*	*Total PV*
		interest (I × t)	*depreciation (D × t)*			
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 2,58,676	Rs 84,000	Rs 75,000	Rs 99,676	0.935	Rs 93,197
2	2,58,676	77,652	75,000	1,06,024	0.873	92,559
3	2,58,676	70,416	75,000	1,13,260	0.816	92,420
4	2,58,676	62,167	75,000	1,21,509	0.763	92,711
5	2,58,676	52,764	75,000	1,30,912	0.713	93,340
6	2,58,676	42,043	75,000	1,41,633	0.666	94,328
7	2,58,676	29,822	75,000	1,53,854	0.623	95,851
8	2,58,676	15,838	75,000	1,67,838	0.582	97,682
						7,52,088

Recommendation: The borrowing (buying) alternative of financing the purchase of the large equipment should be selected.

P.7.9 For **P.7.8** compute the net advantage of leasing (NAL) to the lessee assuming (i) The company follows written down value method of depreciation, the deprecation rate being 25 per cent; (ii) The corporate tax is 35 per cent;

(iii) Post-tax marginal cost of capital (K_c) is 12 per cent and (iv) The company has several assets in the asset block of 25 per cent.

SOLUTION

Computation of NAL to the lessee

Benefits from lease:	
Cost of the equipment (investment saved)	Rs 12,00,000
PV of tax shield on lease rentals (working note **2**)	4,49,786
Total	16,49,786
Cost of lease:	
PV of lease rental **(1)**	11,99,998
PV of tax shield foregone on depreciation **(3)**	2,72,333
PV of interest tax shield foregone on debt **(4)**	2,08,381
Total	16,80,712
NAL	(30,926)

Recommendation: The lease is not financially viable.

Working notes

(1) PV of lease rentals: Lease rentals × PVIFA (14,8) = Rs 2,58,676 × 4.639 = Rs 11,99,998.

(2) PV of tax shield on lease rentals: Lease rentals × tax rate × PVIFA (12,8) = Rs 2,58,676 × 0.35 × 4.968 = Rs 4,49,786

(3) **PV of tax shield foregone on depreciation**

Year	*Depreciation*	*Tax shield*	*PV factor (at 0.12)*	*Total PV*
1	Rs 3,00,000	Rs 1,05,000	0.893	Rs 93,765
2	2,25,000	78,750	0.797	62,764
3	1,68,750	59,062	0.712	42,052
4	1,26,562	44,297	0.636	28,173
5	94,922	33,223	0.567	18,837
6	71,191	24,917	0.507	12,633
7	53,393	18,688	0.452	8,447
8	40,045	14,016	0.404	5,662
				2,72,333

(4) **PV of interest tax shield**

Year	*Interest*	*Tax shield*	*PV factor (at 0.12)*	*Total PV*
1	Rs 1,68,000	Rs 58,800	0.893	Rs 52,508
2	1,55,305	54,357	0.797	43,322
3	1,40,833	49,292	0.712	35,096
4	1,24,335	43,517	0.636	27,677
5	1,05,528	36,935	0.567	20,942
6	84,087	29,430	0.507	14,921
7	59,644	20,875	0.452	9,436
8	31,676	11,087	0.404	4,479
				2,08,381

P.7.10 Hypothetical Limited is contemplating having an access to a machine for a period of 5 years Discussions with various financial institutions have shown that the company can have the use of machine for the stipulated period through leasing arrangement, or the requisite amount can be borrowed at 14 per cent to buy the machine. The firm is in the 50 per cent tax bracket. In case of leasing, the firm would be required to pay an annual end-of-year rent of Rs 1,20,000 for 5 years. All maintenance, insurance and other costs are to be borne by the lessee.

In the case of purchase of the machine (which costs Rs 3,43,300), the firm would have a 14 per cent, 5-year loan, to be paid in 5 equal instalments, each instalment becoming due at the end of each year. The machine would be depreciated on a straight line basis for tax purposes, with no salvage value.

Advise the company regarding the option it should go for, assuming lease rentals are paid (a) at the end of the year (b) in advance.

SOLUTION

(a) PV of cash outflows under leasing alternative (year-end payment of lease rentals)

Year-end	*Lease payment (L) after tax*	*PV factor at after tax cost of debt (0.07)*	*Total PV of lease payments Col (2) × Col (3)*
1	*2*	*3*	*4*
1–5	Rs 60,000	4.100	Rs 2,46,000

Determination of the interest and principal components of loan instalment

Year-end	*Loan instalment*	*Loan at the beginning of the year*	*Payment*		*Principal out-standing at the end of the year (Col 3 – Col 5)*
			interest on loan (Col 3 × 0.14)	*principal re-payment (Col 2 – Col 4)*	
1	*2*	*3*	*4*	*5*	*6*
1	Rs 1,00,000*	Rs 3,43,300	Rs 48,062	Rs 51,938	Rs 2,91,362
2	1,00,000	2,91,362	40,791	59,209	2,32,153
3	1,00,000	2,32,153	32,501	67,499	1,64,654
4	1,00,000	1,64,654	23,052	76,948	87,706
5	1,00,000	87,706	12,294	87,706	—

**Determination of loan instalment:* Amount of loan/PVIFA(14,5) = Rs 3,43,300/3.433 = Rs 1,00,000

PV of cash outflows after tax under buying (borrowing) alternative

Year-end	*Loan instalment*	*Tax advantage on interest payment*	*Tax advantage on depreciation*	*Net cash outflows (Col 2 – Col 3 + 4)*	*PV factor at after-tax cost of debt (0.07)*	*PV of buying alternative*
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 1,00,000	Rs 24,031	Rs 34,330	Rs 41,639	0.935	Rs 38,932
2	1,00,000	20,395	34,330	45,275	0.873	39,525
3	1,00,000	16,250	34,330	49,420	0.816	40,327
4	1,00,000	11,526	34,330	54,144	0.763	41,312
5	1,00,000	6,147	34,330	59,523	0.713	42,440
Total						2,02,536

Recommendation: Since the PV of cash outflows for buying/borrowing (Rs 2,02,536) is lower than that of leasing (Rs 2,46,000), the buying alternative is preferred.

(b) PV of cash outflows under leasing alternative, when lease rental is paid in advance

Year-end	*Lease payment*	*Tax shield*	*Cash outflows after taxes*	*PV factor (0.07)*	*Total PV*
1	*2*	*3*	*4*	*5*	*6*
0	Rs 1,20,000	—	Rs 1,20,000	1.000	Rs 1,20,000
1–4	1,20,000	Rs 60,000	60,000	3.387	2,03,220
5	—	60,000	(60,000)	0.713	(42,780)
					2,80,440

Recommendation: Buying alternative is better.

P.7.11 For the Hypothetical Ltd in **P.7.10**, assume: (i) The company follows written down value method of depreciation, the depreciation rate being 25 per cent. There is no other asset in this asset block; (ii) The corporate tax rate is 35 per cent; (iii) Post-tax marginal cost of capital is 10 per cent; (iv) Salvage value, Rs 40,000 at the end of 5th year.

Compute the NAL to the lessee if lease rentals are paid (a) at the end of the year (b) in advance.

SOLUTION

(a) *Computation of NAL (lease rentals are paid in arrear, that is, at the year-end)*

Benefits from leasing:	
Cost of the machine	Rs 3,43,300
PV of tax shield on lease rentals (working note 2)	1,59,222
Total	5,02,522
Cost of leasing:	
PV of lease rentals (1)	4,11,960
PV of tax shield foregone on depreciation (3)	67,259
PV of interest tax shield foregone on debt (4)	43,810
PV of salvage proceeds (Rs 40,0000 × 0.621)	24,840
PV of tax shield on short-term capital loss (5)	24,018
Total	5,71,887
NAL	(69,365)

Recommendation: Leasing is not financially viable.

Working notes

(1) PV of lease rentals: Lease rentals × PVIFA (14,5) = Rs 1,20,000 × 3.433 = Rs 4,11,960

(2) PV of tax shield on lease rentals: Rs 1,20,000 × 0.35 × 3.791 = Rs 1,59,222

(3) PV of shield foregone on depreciation

Year	*Depreciation**	*Tax shield*	*PV factor* (at 0.10)	*Total PV*
1	Rs 85,825	Rs 30,039	0.909	Rs 27,305
2	64,369	22,529	0.826	18,609
3	48,277	16,897	0.751	12,690
4	36,207	12,672	0.683	8,655
				67,259

*No depreciation is to be charged in 5th year as the block of assets ceases to exist.

(4) **PV of interest tax shield**

Year	*Interest*	*Tax shield*	*PV factor (at 0.12)*	*Total PV*
1	Rs 48,062	Rs 16,822	0.909	Rs 15,291
2	40,791	14,277	0.826	11,793
3	32,501	11,375	0.751	8,543
4	23,052	8,068	0.683	5,511
5	12,294	4,303	0.621	2,672
				43,810

(5) *PV of tax shield on short-term capital loss*: (Cost of machine – Accumulated depreciation – Salvage value) × t = (Rs 3,43,000 – Rs 2,34,678 – Rs 40,000) = Rs 68,622 × 0.35 = Rs 24,018.

(b) *Computation of NAL (lease rentals are paid in advance)*

Benefits from leasing:	
Cost of the machine	Rs 3,43,300
PV of tax shield on lease rentals	1,59,222
Total	5,02,522
Cost of leasing:	
PV of lease rentals (1)	4,69,680
PV of tax shield foregone on depreciation	67,259
PV of interest tax shield foregone on debt	43,810
PV of salvage proceeds	24,840
PV of tax shield on short-term capital loss	24,018
Total	6,29,607
NAL	(1,27,085)

Recommendation: Leasing is not financially viable.

Working notes

(1) **PV of lease rentals**

Year	*Lease payment*	*PV factor (at 0.14)*	*Total PV*
0	Rs 1,20,000	1.000	Rs 1,20,000
1–4	1,20,000	2.914	3,49,680
			4,69,680

P.7.12 Hypothetical Ltd is expanding its facilities. In the coming year, the company will either purchase or lease equipment which it plans to use for 4 years and then replace it with a new one. Its current tax bracket is 50 per cent. The other data are as follows:

Purchase: (i) The purchase price of the equipment is Rs 40,00,000, (ii) The expected salvage value after 4 years is Rs 10,00,000, (iii) The equipment is subject to the straight line method of depreciation, (iv) Funds to finance the equipment can be obtained at 16 per cent, (v) The loan is to be repaid in four equal annual instalments due at the end of each year, (vi) The equipment will increase the annual revenues by Rs 30,00,000, and increase annual cash operating costs by Rs 20,00,000.

Leasing: (i) The annual lease rental is Rs 10,00,000, (ii) The lease rent is payable at the end of each year for 4 years, (iii) The equipment will increase annual revenues by Rs 30,00,000 and increase annual non-depreciation operating costs by Rs 19,00,000, as the lessor will pay Rs 1,00,000 for the maintenance costs associated with the equipment.

Determine whether the company should purchase or lease the equipment.

SOLUTION

PV of cash outflows under leasing alternative

Year-end	Effective lease payment					PV factor (0.08)	PV
	Gross	Savings in maintenance costs	Net (Col 2 – Col 3)	Tax shield (Col 4 × 0.50)	Cash outflows after taxes		
1	2	3	4	5	6	7	8
1–4	Rs 10,00,000	Rs 1,00,000	Rs 9,00,000	Rs 4,50,000	Rs 4,50,000	3.312	Rs 14,90,400

Determination of interest and principal components of loan instalment

Year-end	Loan instalment	Loan at the beginning	Payment of		Principal outstanding at the end of the year
			interest (Col 3 × 0.16)	principal (Col 2 – Col 4)	
1	2	3	4	5	6
1	Rs 14,29,593*	Rs 40,00,000	Rs 6,40,000	Rs 7,89,593	Rs 32,10,407
2	14,29,593	32,10,407	5,13,665	9,15,928	22,94,497
3	14,29,593	22,94,479	3,67,117	10,62,476	12,32,003
4	14,29,593	12,32,003	1,97,590	12,32,003	—

*Rs 40,00,000 ÷ 2.798, that is, PV annuity factor of 4 years at 16 per cent.

PV of cash outflows under buying alternative

Year	Loan instalment	Interest (I × t)	Depreciation (D × t)	Cash outflows after taxes [Col 2 – (Col 3 + Col 4)]	PV factor (0.08)	Total PV
1	2	3	4	5	6	7
1	Rs 14,29,593	Rs 3,20,000	Rs 3,75,000	Rs 7,34,593	0.926	Rs 6,80,233
2	14,29,593	2,56,832	3,75,000	7,97,761	0.857	6,83,681
3	14,29,593	1,83,558	3,75,000	8,71,035	0.794	6,91,602
4	14,29,593	98,795	3,75,000	9,55,798	0.735	7,02,512
4 Salvage value		—	—	(10,00,000)	0.735	(7,35,000)
						20,23,028

Recommendation: The lease alternative is better, as it is a cheaper source of finance than debt in terms of the NPV of the cash outflows.

REVIEW QUESTIONS

RQ.7.1 Describe the main features of retained earnings as a source of long-term finance.

RQ.7.2 What are the distinguishing features of equity share capital? Explain the pre-emptive rights of the owners of equity shares? How is their interest affected by the issue of rights shares.

RQ.7.3 Write a brief note on term loans as a sourc e of medium-term finance.
RQ.7.3-A Outline the steps involved in negotiation of project finance with financial institutions.
RQ.7.3-B How do financial institutions appraise a term loan proposal?
RQ.7.4 Explain briefly the main attributes of debentures.
RQ.7.5 "Preference share capital is considered a hybrid security." Elucidate.
RQ.7.6 Explain briefly
- — Zero interest bonds
- — Deep discount bonds
- — Floating rate bonds
- — Secured premium notes

RQ.7.7 Enumerate the financial framework which should be considered by corporate finance managers in refunding bonds, having callable features.
RQ.7.8 What are convertible debentures? How are compulsory and optionally convertible debentures valued?
RQ.7.9 Define warrants. Explain the value of warrants, giving examples.
RQ.7.10 Write a brief note on options.
RQ.7.11 Explain briefly securitisation process. Which different parties are involved in a securitisation deal? What are the instruments of securitisation?
RQ.7.12 Explain briefly venture capital financing.
RQ.7.13 Write a brief note on lease financing.
RQ.7.14 What are GDRs and ADRs? How are they issued?

EXAMINATION QUESTIONS

EQ. 7.1 Write a note on venture capital financing. (*CA—November, 2002*)
EQ. 7.2 Distinguish between the following:
(i) Global depository receipts and American depository receipts.
(ii) Debt securitization and bridge finance. (*CA—May, 2003*)
EQ. 7.3 Write short notes on the following:
(a) American depository receipts vs. Global depository receipts.
(b) Deep discount bonds vs. Zero coupon bonds
(c) Factoring vs. Debt securitization (*CA—May, 2004*)
EQ. 7.4 What is debt securitization? Explain the basic debt securitization process. (*CA—November, 2004*)
EQ. 7.5 Write notes on (i) Venture capital financing (ii) Seed capital assistance. (*CA—May -2005*)
EQ. 7.6 Write short notes on the following:
(i) Debt securitisation
(ii) American Depository Receipts
(iii) Bridge finance (*CA—May 2006*)
EQ. 7.7 Discuss the need for social cost-benefit analysis. (*CA—Nov. 2006*)
EQ. 7.8 State the differences between Global Depository Receipts and American Depository Receipts. (*CA—May 2007*)
EQ. 7.9 What is debt securitisation? State the basic debt securitisation process. (*CA—May 2007*)
EQ. 7.10 Explain the term "ploughing back of profits". (*CA—May 2007*)
EQ. 7.11 PQR Limited has decided to go in for a new model of Mercedes Car. The cost of the vehicle is Rs 40 lakh. The company has two alternatives:
(i) Taking the car on finance lease; or
(ii) Borrowing and purchasing the car.

LMN Limited is willing to provide the car on finance lease of PQR Limited for five years at an annual rental of Rs 8.75 lakh, payable at the end of the year.

The vehicle is expected to have useful life of 5 years, and it will fetch a net salvage value of Rs 10 lakh at the end of year five. The depreciation rate for tax purpose is 40 per cent on written-down value basis. The applicable tax rate for the company is 35 per cent. The applicable before tax borrowing rate for the company is 13.8462 per cent.

What is the net advantage of leasing for the PQR limited?

The values of present value interest factor at different rates of discount are as under

Rate of discount	t_1	t_2	t_3	t_4	t_5
0.138462	0.8784	0.7715	0.6777	0.5953	0.5229
0.09	0.9174	0.8417	0.7722	0.7084	0.6499

(*CA—May, 2004*)

SOLUTION

Determination of advantage of leasing (NAL)

(I) Benefits from leasing	
Investment outlay/Cost of car saved	Rs 40,00,000
Plus present value of tax shield on lease rentals (2)	11,91,190
	51,91,190
(II) Cost of leasing	
Less present value of lease rentals (Working note 1)	34,03,400
Less present value of tax shield on depreciation (3)	10,85,086
Less present value of salvage value (4)	6,49,900
	51,38,386
(III) Net advantage of leasing (I – II)	52,804

1. PV of lease rentals (Rs 8.75 lakh × PVIFA at 9% for 5 years, 3.8896) = Rs 34.034 lakh
2. PV of tax shield on lease rentals (Rs 8.75 lakh × 0.35 × 3.8896) = 11.9119 lakh
3. *PV of tax shield on depreciation*

Year	*Depreciation*	*Tax shield*	*PVIF (0.09)*	*Total PV*
1	Rs 16,00,000	Rs 5,60,000	0.9174	Rs 5,13,744
2	9,60,000	3,36,000	0.8417	2,82,811
3	5,76,000	2,01,600	0.7722	1,55,676
4	3,45,600	1,20,960	0.7084	85,688
5	2,07,360	72,576	0.6499	47,167
				10,85,086

4. PV of salvage value: Rs 10 lakh × 0.6499 = Rs 6,49,900
5. The NAL approach to evaluate lease decision requires all the parameters (except PV of lease payments, to be discounted at pre-tax cost of debt) to be discounted by post-tax marginal cos tof capital (k_e). Since the information related to k_e is missing in the question, after-tax cost of debt (k_d) has been used to arrive at a decision. Since the discount rate (k_d) has already reckoned the tax advantage due to debt, PV on tax shield on interest has been ignored.

Part Four

The second major area in financial management is the financing/capital structure decision. The financing decision involves the choice of an appropriate mix of different sources of financing, namely, owners' funds and outsiders'/lenders' funds. The selection of the capital structure will obviously depend on the bearing that it has on the firm's objective of maximisation of shareholders' wealth. A financing mix which will lead to maximisation of shareholders' wealth as reflected in the market price of shares is termed as an optimum capital structure. This Part of the Volume II is devoted to a comprehensive discussion of the important dimensions of the financing decision of a firm. Chapter 8 discusses operating, financial and combined leverage as a setting to the in-depth analysis of the relationship between the composition of the source of financing and the value of the firm. The theoretical relationship between capital structure and the valuation of a firm is examined in Chapter 9. The appropriateness of a capital structure will vary from firm to firm and, therefore, an optimum capital structure should be designed in the light of facts and circumstances of each firm. The factors having a bearing on designing a suitable capital structure are outlined in Chapter 10.

8 Operating, Financial and Combined Leverage

Introduction

The purpose of this chapter is to set forth a framework for the financing decision of a firm. It discusses the principles and types of leverage. As mentioned earlier, a firm can make use of different sources of financing whose costs are different. These sources may be, for purposes of exposition, classified into those which carry a fixed rate of return and those on which the returns vary. The fixed returns on some sources of finance have implications for those who are entitled to a variable return. Thus, since debt involves the payment of a stated rate of interest, the return to the ordinary shareholders is affected by the magnitude of debt in the capital structure of a firm.

The employment of an asset or source of funds for which the firm has to pay a fixed cost or fixed return may be termed as *leverage*. Consequently, the earnings available to the shareholders as also the risk are affected. If earnings less the variable costs exceed the fixed cost, or earnings before interest and taxes exceed the fixed return requirement, the leverage is called favourable. When they do not, the result is unfavourable leverage.

There are two types of leverage—'operating' and 'financial'. The leverage associated with investment (asset acquisition) activities is referred to as operating leverage, while leverage associated with financing activities is called financial leverage.[1] While we are basically concerned with financial leverage for purposes of the financing decision of a firm, the discussion of operating leverage is to serve as a background to the understanding of financial leverage because the two types of leverage are closely related.

Operating leverage is determined by the relationship between the firm's sales revenues and its earnings before interest and taxes (EBIT). The earnings before interest and taxes are also generally called as operating profits. Financial leverage represents the relationship between the firm's earnings before interest and taxes (operating profits) and the earnings available for ordinary shareholdeRs The operating profits (EBIT) are, thus, used as the pivotal point in defining operating and financial leverage. In a way, operating and financial leverage represent two stages in the process of determining the earnings available to the equity shareholders and, hence, their discussion in this chapter. Apart from the elaboration of the return-risk implications, their combined effect has also been discussed.

The first Section of the chapter discusses the operating leverage while financial leverage is covered in Section two. The combined leverage is illustrated in Section three and major points are summarised in Section four.

OPERATING LEVERAGE

Operating leverage results from the existence of fixed operating expenses in the firm's income stream. The operating costs of a firm fall into three categories: (i) fixed costs which may be defined as those which do not vary with sales volume; they are a function of time and are typically contractual; they must be paid regardless of the amount of revenues available; (ii) variable costs which vary directly with the sales volume; and (iii) semi-variable or semi-fixed costs are those which are partly fixed and partly variable. They are fixed over a certain range of sales volume and increase to higher levels for higher sales volumes. Since the last category of costs can be broken down into fixed and variable components, the costs of a firm, in operational terms, can be divided into (a) fixed, and (b) variable.

The operating leverage may be defined as the *firm's ability to use fixed operating costs to magnify the effects of changes in sales on its earnings before interest and taxes*. Operating leverage occurs any time a firm has fixed costs that must be met regardless of volume. We employ assets with fixed cost in the hope that volume will produce revenues more than sufficient to cover all fixed and variable costs. In other words, with fixed costs, the percentage change in profits accompanying a change in volume is greater than the percentage change in volume. This occurrence is known as operating leverage. Consider Example 8.1.

EXAMPLE 8.1

A firm sells products for Rs 100 per unit, has variable operating costs of Rs 50 per unit and fixed operating costs of Rs 50,000 per year. Show the various levels of EBIT that would result from sale of (i) 1,000 units (ii) 2,000 units and (iii) 3,000 units.

SOLUTION

If sales level of 2,000 units are used as a base for comparison, the operating leverage is illustrated in Table 8.1

Table 8.1 *EBIT for Various Sales Levels*

	Case 2 *– 50%*	*Base*	*Case 1* *+ 50%*
1. Sales in units	1,000	2,000	3,000
2. Sales revenue	Rs 1,00,000	Rs 2,00,000	Rs 3,00,000
3. *Less* variable operating cost	50,000	1,00,000	1,50,000
4. Contribution	50,000	1,00,000	1,50,000
5. *Less* fixed operating cost	50,000	50,000	50,000
6. EBIT	Zero	50,000	1,00,000
	–100%		+100%

From the results contained in Table 8.1, certain generalisations follow:

(i) **Case 1:** A 50 per cent increase in sales (from 2,000 to 3,000 units) results in a 100 per cent increase in EBIT (from Rs 50,000 to Rs 1,00,000).

(ii) **Case 2:** A 50 per cent decrease in sales (from 2,000 to 1,000 units) results in a 100 per cent decrease in EBIT (from Rs 50,000 to zero).

EXAMPLE 8.2

A firm sells its products for Rs 50 per unit, has variable operating costs of Rs 30 per unit and fixed operating costs of Rs 5,000 per year. Its current level of sales is 300 units. Determine the degree of operationg leverage. What will happen to EBIT if sales change: (a) rise to 350 units, and (b) decrease to 250 units?

SOLUTION

The EBIT for various sales levels is computed in Table 8.2.

Table 8.2 *EBIT at Various Sales Levels*

	Case 2 *−16.7%*	*Base*	*Case 1* *+16.7%*
1. Sales in units	250	300	350
2. Sales revenue	Rs 12,500	Rs 15,000	Rs 17,500
3. *Less* variable cost	7,500	9,000	10,500
4. Contribution	5,000	6,000	7,000
5. *Less* fixed operating cost	5,000	5,000	5,000
6. EBIT	Zero	1,000	2,000
	− 100%		+ 100%

Interpretation In case 2, 16.7 per cent decrease in sales volume (from 300 units to 250 units) leads to 100 per cent decline in the EBIT (from Rs 1,000 to zero). On the other hand, a 16.7 per cent increase in the sales level in case 1 (from 300 units to 350 units) results in 100 per cent increase in EBIT (from Rs 1,000 to Rs 2,000).

The two illustrations (Tables 8.1 and 8.2) clearly show that when a firm has fixed operating costs, an increase in sales volume results in a more than proportionate increase in EBIT. Similarly, a decrease in the level of sales has an exactly opposite effect. This is operating leverage; the former being favourable leverage, while the latter is unfavourable. Leverage, thus, works in both directions.

Alternative Definition of Operating Leverage

Operating leverage can also be defined and illustrated in another way. This is a more precise measurement in terms of degree of operating leverage (DOL). The DOL measures in quantitative terms the extent or degree of operating leverage.

When proportionate change in EBIT as a result of a given change in sales is more than the proportionate change in sales, operating leverage exists. The greater the DOL, the higher is the operating leverage. Symbolically,

$$\text{DOL} = \frac{\text{Percentage change in EBIT}}{\text{Percentage change in sales}} > 1 \qquad (8.1)$$

Alternatively, $$\text{DOL} = \frac{\Delta \text{EBIT} \div \text{EBIT}}{\Delta Q \div Q}$$

$$\text{EBIT} = Q(S - V) - F, \Delta \text{ EBIT} = \Delta\, Q(S - V)$$

Where Q = Sales quantity in units
S = Selling price per unit
V = Variable cost per unit
F = Total fixed costs.

$$= \frac{\Delta Q(S - V)}{Q(S - V) - F} \times \frac{Q}{\Delta Q} = \frac{Q(S - V)}{Q(S - V) - F} = \frac{\text{Total Contribution (at base level)}}{\text{EBIT (at base level)}} \quad (8.2)$$

Applying Equations 8.1 and 8.2 to Example 8.1 we get,

$$\text{DOL} = \frac{+100\%}{+50\%} = 2 \text{ (Case 1)}, \quad \frac{-100\%}{-50\%} = 2 \text{ (Case 2)}$$

or $$= \frac{\text{Rs } 1,00,000}{\text{Rs } 50,000} = 2$$

Similarly, in Example 8.2,

$$\text{DOL} = \frac{+100\%}{+16.7\%} = 6 \text{ (Case 1)}, \quad \frac{-100\%}{-16.7\%} = 6 \text{ (Case 2)}$$

or $$= \frac{\text{Rs } 6,000}{\text{Rs } 1,000} = 6$$

Since the DOL exceeds 1 in both the illustrations, operating leverage exists. However, the degree of operating leverage is higher (3 times) in the case of the firm in Example 8.2 as compared to the firm in Example 8.1, the respective quotients being 6 and 2. The quotients mean that for every 1 per cent change in sales, there will be 6 per cent (Examples 8.2) and 2 per cent (Example 8.1) change in EBIT in the direction the sales change.

However, operating leverage exists only when there are fixed operating costs. If there are no fixed operating costs, there will be no operating leverage. Consider Example 8.3.

EXAMPLE 8.3

	Base Level	*New Level*
1. Units sold	1,000	1,100
2. Sales price per unit	Rs 10	Rs 10
3. Variable cost per unit	6	6
4. Fixed operating cost	Nil	Nil

SOLUTION

The relevant computations are given in Table 8.3.

Table 8.3 *EBIT for Various Sales Volume*

	Base Level	*New Level*
1. Sales revenues	Rs 10,000	Rs 11,000
2. *Less* variable costs	6,000	6,600
3. *Less* fixed costs	—	—
4. EBIT	4,000	4,400

Applying Equation 8.1, DOL = 1. Since the quotient is 1, there is no operating leverage.

Break-even Analysis

Since operating leverage (magnifying the effects of a change in sales) can be favourable or unfavourable, higher levels of risk are attached to higher degrees of leverage. Since DOL depends on fixed operating costs, it logically follows that the larger the fixed operating cost, the higher is the firm's operating leverage and its operating risk. High operating leverage is good when revenues are rising and bad when they are falling. Operating risk is the risk of the firm not being able to cover its fixed operating costs. The larger the magnitude, the larger the volume of sales required to cover all fixed costs.

FINANCIAL LEVERAGE

As already indicated, financial leverage relates to the financing activities of a firm. The sources from which funds can be raised by a firm, from the point of view of the cost/charges, can be categorised into (i) those which carry a fixed financial charge, and (ii) those which do not involve any fixed charge. The sources of funds in the first category consist of various types of long-term debt, including bonds, debentures, and preference shares. Long-term debts carry a fixed rate of interest which is a contractual obligation for the firm. Although the dividend on preference shares is not a contractual obligation, it is a fixed charge and must be paid before anything is paid to the ordinary shareholders. The equity shareholders are entitled to the remainder of the operating profits of the firm after all the prior obligations are met. We assume in the subsequent discussions that all preference dividends are paid in order to ascertain the operating profits available for distribution to ordinary shareholders.

Financial leverage results from the presence of fixed financial charges in the firm's income stream. These fixed charges do not vary with the earnings before interest and taxes (EBIT) or operating profits. They are to be paid regardless of the amount of EBIT available to pay them. After paying them, the operating profits (EBIT) belong to the ordinary shareholders. Financial leverage is concerned with the effects of changes in EBIT on the earnings available to equityholders. It is defined as the *ability of a firm to use fixed financial charges to magnify the effects of changes in EBIT on the earnings per share*[2]. In other words, financial leverage involves the use of funds obtained at a fixed cost in the hope of increasing the return to the shareholders.

Favourable or positive leverage occurs when the firm earns more on the assets purchased with the funds, than the fixed cost of their use. Unfavourable or negative leverage occurs when the firm does not earn as much as the funds cost. Thus, financial leverage is based on the assumption that the firm is to earn more on the assets that are acquired by the use of funds on which a fixed rate of interest/dividend is to be paid. The

difference between the earnings from the assets and the fixed cost on the use of the funds goes to the equity holders. In a way, therefore, use of fixed-interest sources of funds provides increased return on equity investment without additional requirement of funds from the shareholders. Financial leverage is also, therefore, called as 'trading on equity'. However, in periods of persisting adversity when earnings are not adequate, the presence of fixed charges will imply that the shareholders will have to bear the burden. Thus, the leverage/trading on equity will operate in the opposite direction such that the earnings per share, instead of increasing, will actually fall as a result of the use of funds carrying fixed cost.

The financial leverage is illustrated in Example 8.4.

EXAMPLE 8.4

The financial manager of the Hypothetical Ltd expects that its earnings before interest and taxes (EBIT) in the current year would amount to Rs 10,000. The firm has 5 per cent bonds aggregating Rs 40,000, while the 10 per cent preference shares amount to Rs 20,000. What would be the earnings per share (EPS)? Assuming the EBIT being (i) Rs 6,000, and (ii) Rs 14,000, how would the EPS be affected? The firm can be assumed to be in the 35 per cent tax bracket. The number of outstanding ordinary shares is 1,000.

SOLUTION

Table 8.4 *EPS for Various EBIT Levels*

	Case 2 *–40%*	*Base*	*Case 1* *+40%*
EBIT	Rs 6,000	Rs 10,000	Rs 14,000
Less interest on bonds	2,000	2,000	2,000
Earnings before taxes (EBT)	4,000	8,000	12,000
Less taxes (35%)	1,400	2,800	4,200
Earning after taxes (EAT)	2,600	5,200	7,800
Less preference dividend	2,000	2,000	2,000
Earnings available for ordinary shareholders	600	3,200	5,800
Earnings per share (EPS)	0.6	3.2	5.8
	– 81.25%		+81.25%

The interpretation of Table 8.4 is as follows:

Case 1: A 40 per cent increase in EBIT (from Rs 10,000 to Rs 14,000) results in 81.25 per cent increase in EPS (from Rs 3.2 to Rs 5.8).

Case 2: A 40 per cent decrease in EBIT (from Rs 10,000 to Rs 6,000) leads to 81.25 per cent decrease in EPS (from Rs 3.2 to Re 0.6).

EXAMPLE 8.5

A company has Rs 1,00,000, 10% debentures and 5,000 equity shares outstanding. It is in the 35 per cent tax-bracket. Assuming three levels of EBIT (i) Rs 50,000, (ii) Rs 30,000, and (iii) Rs 70,000, calculate the change in EPS (base level of EBIT = Rs 50,000).

SOLUTION

Table 8.5 *EPS at Various EBIT Levels*

	Case 2 –40%	*Base*	*Case 1 +40%*
EBIT	Rs 30,000	Rs 50,000	Rs 70,000
Less interest	10,000	10,000	10,000
Earnings before taxes	20,000	40,000	60,000
Less taxes	7,000	14,000	21,000
Earning after taxes	13,000	26,000	39,000
Earnings per share (EPS)	2.6	5.2	7.8
	– 50%		+50%

Thus, a 40 per cent increase in EBIT in Case 2 from the base level of EBIT has led to 50 per cent increase in EPS. And a decrease of 40 per cent in EBIT has decreased the EPS by 50 per cent.

The preceding examples show that the presence of fixed-interest sources funds leads to a more than proportionate change in EPS as a result of change in EBIT level. Whenever a firm has fixed cost in its capital structure, financial leverage is present. The greater the amount of fixed-interest sources of funds (and, therefore, the larger is the fixed-financial cost), the higher is the financial leverage. For instance, in Example 8.4, the amount of fixed financial cost is higher than in Example 8.5 owing to the preference dividend. As a result of this difference, the proportionate change in EPS was much higher (± 81.25 per cent) for Example 8.4 as compared to Example 8.5 (± 50 per cent) although the changes in EBIT in both cases are the same (± 40 per cent).

Alternative Definition of Financial Leverage

The procedure outlined above is merely indicative of the presence or absence of financial leverage. Financial leverage can be more precisely expressed in terms of the degree of financial leverage (DFL). The DFL can be calculated by Eq.(8.3)

$$\text{DFL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}} > 1 \tag{8.3}$$

$$\text{Alternatively, DFL} = \frac{\Delta\,\text{EPS} \div \text{EPS}}{\Delta\,\text{EBIT} \div \text{EBIT}}$$

$$\text{EPS} = \frac{[(\text{EBIT} - \text{I})\,(1 - \text{t}) - \text{D}_\text{P}}{\text{N}}$$

$$= \frac{[Q(S - V) - F - I]\,(1 - t) - D_P}{N}$$

Since, F, I and D_p are constants,

$$\Delta\text{EPS} = [\Delta\, Q(S - V)]\,(1 - t)]/N$$

$$\frac{\Delta EPS}{EPS} = \frac{[\Delta Q(S-V)](1-t)}{[Q(S-V)-F-I](1-t)-D_P}$$

Dividing numerator and denominator by $(1 - t)$

$$\text{DFL} = \frac{\dfrac{\Delta Q(S-V)}{[Q(S-V)-F-I]-D_P/(1-t)}}{\dfrac{\Delta Q(S-V)}{[Q(S-V)-F-I]-D_P/(1-t)} \times \dfrac{Q(S-V)-F}{\Delta Q(S-V)}}$$

$$= \frac{Q(S-V)-F}{[Q(S-V)-F-I]-D_P/(1-t)} = \frac{\text{EBIT}}{\text{EBIT}-I-D_P/(1-t)} \tag{8.4}$$

Applying Equations 8.3 to Case 1 and Case 2 in Examples 8.4 and 8.5,

(i) For Example 8.4: *Case 1* $= \dfrac{+81.25\%}{+40\%} = 2.03$, *Case 2* $= \dfrac{-81.25\%}{-40\%} = 2.03$

$$= \frac{\text{Rs } 10,000}{\text{Rs } 10,000 - \text{Rs } 2,000 - [\text{Rs } 2,000/(1-0.35)]} = 2.03$$

(ii) Example 8.5: *Case 1* $= \dfrac{+50\%}{+40\%} = 1.25$, *Case 2* $= \dfrac{-50\%}{-40\%} = 1.25$

$$= \frac{\text{Rs } 50,000}{\text{Rs } 50,000 - \text{Rs } 10,000} = 1.2.5$$

As a rule, when a percentage change in EPS resulting from a given percentage change in EBIT is greater than the percentage change in EBIT, financial leverage exists. In other words, financial leverage occurs when the quotient in Equation 8.3 is more than one.

In both the examples, the relevant quotient is larger than one. Therefore, financial leverage exists. But the degree of financial leverage is higher in Example 8.4 (2.03) than in Example 8.5 (1.25). The higher the quotient of percentage change in EPS due to percentage change in EBIT, the greater is the degree of financial leverage. The quotient of 2.03 implies that 1 per cent change in EBIT will cause 2.03 per cent change in EPS in the same direction (± increase/decrease) in which the EBIT changes. With 1.25 quotient the proportionate change in EPS as a result of 1 per cent change in EBIT will be comparatively less, that is, 1.25 per cent in either direction.

There will be, however, no financial leverage, if there is no fixed-charged financing. (Table 8.6).

Table 8.6 *EPS at Various EBIT Levels*

	Case 2 *−40%*	*Base*	*Case 1* *+40%*
EBIT	Rs 30,000	Rs 50,000	Rs 70,000
Less taxes (0.35)	10,500	17,500	24,500
Earnings available for equity holders	19,500	32,500	45,500
Number of shares	10,000	10,000	10,000
EPS	1.95	3.25	4.55
	−40%		+40%

Degree of financial leverage (DFL): Applying Eq. (8.3)

(i) **Case 1** $= \dfrac{+40\%}{+40\%} = 1$

(ii) **Case 2** $= \dfrac{-40\%}{-40\%} = 1$

Thus, the quotient is 1. Its implication is that 1 per cent change in EBIT will result in 1 per cent change in EPS, that is, proportionate. There is, therefore, no magnification in the EPS.

Like operating leverage, higher levels of risks are attached to higher degrees of financial leverage also. High fixed financial costs increase the financial leverage and, thus, financial risk. The financial risk refers to the *risk of the firm not being able to cover its fixed financial costs*. With the increase in financial charges, the firm is also required to raise the level of EBIT necessary to meet financial charges. If the firm cannot cover these financial payments, it can be technically forced into liquidation. Therefore, the very existence of the business is at stake. Obviously, the financial manager should take into consideration all such factors while formulating the firm's financing plan in terms of the mix of various sources of long-term funds, viz. long-term debts, preference shares, equity funds including retained earnings. One of the objectives of planning an appropriate capital structure is to provide a high income for the equity owners, that is, to increase the EPS. To devise an appropriate capital structure or financing plan, the amount of EBIT under various financing plans should be related to EPS. Thus, one widely used means of examining the effect of leverage is to analyse the relationship between EBIT and EPS.

EBIT-EPS Analysis

The *EBIT-EPS analysis*, as a method to study the effect of leverage, essentially involves the comparison of alternative methods of financing under various *assumptions* of EBIT. A firm has the choice to raise funds for financing its investment proposals from different sources in different proportions. For instance, it can (i) exclusively use equity capital (ii) exclusively use debt, (iii) exclusively use preference capital, (iv) use a combination of (i) and (ii) in different proportions; (v) a combination of (i), (ii) and (iii) in different proportions, (vi) a combination of (i) and (iii) in different proportions, and so on. The choice of the combination of the various sources would be one which, *given the level of earnings before interest and taxes*, would ensure the largest EPS. Consider Example 8.6.

EXAMPLE 8.6

Suppose a firm has a capital structure exclusively comprising of ordinary shares amounting to Rs 10,00,000. The firm now wishes to raise additional Rs 10,00,000 for expansion. The firm has four alternative financial plans:

(A) It can raise the entire amount in the form of equity capital.
(B) It can raise 50 per cent as equity capital and 50 per cent as 5% debentures.
(C) It can raise the entire amount as 6% debentures.
(D) It can raise 50 per cent as equity capital and 50 per cent as 5% preference capital.

Further assume that the existing EBIT are Rs 1,20,000, the tax rate is 35 per cent, outstanding ordinary shares 10,000 and the market price per share is Rs 100 under all the four alternatives.

Which financing plan should the firm select?

SOLUTION

Table 8.7 *EPS Under Various Financial Plans*

	Financing plans			
	A	*B*	*C*	*D*
EBIT	Rs 1,20,000	Rs 1,20,000	Rs 1,20,000	Rs 1,20,000
Less interest	—	25,000	60,000	—
Earnings before taxes	1,20,000	95,000	60,000	1,20,000
Taxes	42,000	33,250	21,000	42,000
Earnings after taxes	78,000	61,750	39,000	78,000
Less preference dividend	—	—	—	25,000
Earnings available to ordinary shareholders	78,000	61,750	39,000	53,000
Number of shares	20,000	15,000	10,000	15,000
Earnings per share (EPS)	3.9	4.1	3.9	3.5

The calculations in Table 8.7 reveal that given a level of EBIT of Rs 1,20,000, the financing alternative B, which involves 50 per cent ordinary shares and 50 per cent debt, is the most favourable with respect to EPS. Another disclosure of the table is that although the proportion of ordinary shares in the total capitalisation under the financing plan D is also 50 per cent, that is, equal to plan B, EPS is considerably different (lowest). The difference in the plans B and D is due to the fact that interest on debt is tax-deductible while the dividend on preference shares is not. With 35 per cent income tax, the explicit cost of preference shares would be higher than the cost of debt.

Table 8.7 also indicates that the annual before-tax costs of the various financing plans are:

1. Financing Plan B	Rs 25,000
2. Financing Plan C	60,000
3. Financing Plan D	38,462

Financing plan A involves no cost as there is no fixed financial charge. That the financing plan involves a specific amount of cost, is another way of saying that an equal amount of earnings before interest and taxes is necessary to cover the fixed financial charges. Since preference dividend is not tax-deductible, we must divide the total dividends by one, minus the tax rate, in order to obtain the EBIT necessary to cover these dividends as a financial charge. Assuming a 35 per cent tax rate, preference dividend of Rs 25,000 can be paid on EBIT of Rs 38,462. The fixed financial charge would, therefore, be higher. Earnings per share would be zero for plans B, C and D for the EBIT level of Rs 25,000, Rs 60,000 and Rs 38,462 respectively. This level of EBIT may be termed as *financial break even* level of earnings before interest and taxes because it represents the level of EBIT necessary for the firm to break even on its fixed financial charge. In other words, it is the level of EBIT at which the firm can satisfy all fixed financial charges (i.e. interest and preference dividend). EBIT less than this level will result in negative EPS. The financial break-even point can be determined by Eq. (8.5).

$$\text{Financial break-even point} = I + \frac{\text{PD}}{1 - \text{t}} \tag{8.5}$$

where I = Annual interest charges
PD = Preference dividend
t = Tax rate

Equation 8.5 gives before-tax earnings necessary to cover the firm's fixed financial obligations.

As fixed financial charges are added, the break-even point for zero EPS is increased by the amount of the additional fixed cost. Beyond the financial break-even point, increase in EPS is more than the proportionate increase in EBIT. This is illustrated in Table 8.8, which presents the EBIT-EPS relationship for the data in Example 8.6 under the various EBIT assumptions given in the box:

(i) Rs 80,000 (4 per cent return on total assets)
(ii) 1,00,000 (5 per cent return on total assets)
(iii) 1,30,000 (6.5 per cent return on total assets)
(iv) 1,60,000 (8 per cent return on total assets)
(v) 2,00,000 (10 per cent return on total assets)

Table 8.8 *EBIT-EPS Analysis under Various EBIT Assumptions for the four Financing Plans of Example 8.6*

(i) EBIT = Rs 80,000 (4 per cent return on investments)	*Financing Plans*			
	A	*B*	*C*	*D*
EBIT	80,000	80,000	80,000	80,000
Less interest	—	25,000	60,000	—
EBT	80,000	55,000	20,000	80,000
Less taxes	28,000	19,250	7,000	28,000
EAT	52,000	35,750	13,000	52,000
Less preference dividend	—	—	—	25,000
EAT for equity holders	52,000	35,750	13,000	27,000
EPS	2.6	2.38	1.3	1.8
(ii) EBIT = Rs 1,00,000 (5 per cent return)				
EBIT	1,00,000	1,00,000	1,00,000	1,00,000
Less interest	—	25,000	60,000	—
EBT	1,00,000	75,000	40,000	1,00,000
Less taxes	35,000	26,250	14,000	35,000
EAT	65,000	48,750	26,000	65,000
Less preference dividend	—	—	—	25,000
EAT for equity holders	65,000	48,750	26,000	40,000
EPS	3.25	3.25	2.6	2.67
(iii) EBIT = Rs 1,30,000 (6.5 per cent return)				
EBIT	1,30,000	1,30,000	1,30,000	1,30,000
Less interest	—	25,000	60,000	—
EBT	1,30,000	1,05,000	70,000	1,30,000
Less taxes	45,500	36,750	24,500	45,500
EAT	84,500	68,250	45,500	84,500
Less preference dividend	—	—	—	25,000
EAT for equity holders	84,500	68,250	45,500	59,500
EPS	4.22	4.55	4.55	3.97

(iv) EBIT = Rs 1,60,000 (8 per cent return)

EBIT	1,60,000	1,60,000	1,60,000	1,60,000
Less interest	—	25,000	60,000	—
EBT	1,60,000	1,35,000	1,00,000	1,60,000
Less taxes	56,000	47,250	35,000	56,000
EAT	1,04,000	87,750	65,000	1,04,000
Less preference dividend	—	—	—	25,000
EAT for equity holders	1,04,000	87,750	65,000	79,000
EPS	5.2	5.8	6.5	5.3

(v) EBIT = Rs 2,00,000 (10 per cent return)

EBIT	2,00,000	2,00,000	2,00,000	2,00,000
Less interest	—	25,000	60,000	—
EBT	2,00,000	1,75,000	1,40,000	2,00,000
Less taxes	70,000	61,250	49,000	70,000
EAT	1,30,000	1,13,750	91,000	1,30,000
Less preference dividend	—	—	—	25,000
EAT for equity holders	1,30,000	1,13,750	91,000	1,05,000
EPS	6.5	7.6	9.1	7

It can be seen from Table 8.8 that when the EBIT level exceeds the financial break-even level (Rs 25,000, Rs 60,000 and Rs 38,462 for financing alternatives, B, C and D respectively) EPS increases. The percentage increase in EPS is the greatest when EBIT is nearest the break-even point. Thus, in Plan C, an increase of 25 per cent in EBIT (from Rs 80,000 to Rs 1,00,000) results in a 100 per cent increase in EPS (from Re 1.3 to Rs 2.6), whereas the percentage increase in EPS is only 40 per cent (from Rs 6.5 to Rs 9.1) as a result of the change in EBIT at higher levels from Rs 1,60,000 to Rs 2,00,000 (i.e. 25 per cent increase).

We can also see from Tables 8.7 and 8.8 that the EPS for different financing plans at a given level of EBIT is equal. At EBIT levels above or below the given level, the EPS is higher or lower. Thus, for alternatives A and C at the EBIT level of Rs 1,20,000 (Table 8.7) the EPS is the same, that is, Rs 3.9. If EBIT is below this level, alternative A (ordinary shares) will provide higher EPS; above this level, the debt alternative (C) is better from the viewpoint of EPS.

Between preference share (D) and ordinary share (A) alternatives, the EPS is equal (Rs 5.2) at Rs 1,60,000 EBIT level. Above this level, alternative D will give better EPS; while below it, alternative A would provide higher EPS.

The earnings per share (EPS) in alternatives A and B are the same at EBIT level of Rs 1,00,000. Above this, B plan would lead to higher EPS; at levels lower than this, financing plan A would provide higher EPS.

The debt alternative (B) gives higher EPS for all levels of EBIT as compared to the preference share alternative (D).

Indifference Point

The EBIT level at which the EPS is the same for two alternative financial plans is referred to as the *indifference point/level*. The indifference point may be defined as the *level of* EBIT *beyond which the benefits of financial leverage begin to operate with respect to earnings per share* (EPS). In operational terms, if the expected level is to exceed the indifference level of EBIT, the use of fixed-charge source of funds (debt) would be advantageous from the viewpoint of EPS, that is, financial leverage will be favourable

and lead to an increase in the EPS available to the shareholders. The capital structure should include debt. If, however, the expected level of the EBIT is less than the indifference point, the advantage of EPS would be available from the use of equity capital.

The indifference point between two methods of financing can be obtained mathematically (algebraic approach) as well as graphically.

Algebraic Approach Mathematically, the indifference point can be obtained by using the following symbols:

X = earnings before interest and taxes (EBIT) at the indifference point
N_1 = number of equity shares outstanding if only equity shares are issued
N_2 = number of equity shares outstanding if both debentures and equity shares are issued
N_3 = number of equity shares outstanding if both preference and equity shares are issued
N_4 = number of equity shares outstanding if both preference shares and debentures are issued
I = the amount of interest on debentures
P = the amount of dividend on preference shares
t = corporate income tax rate
Dt = tax on preferance dividend

For a New Company The indifference point can be determined by using the following equations:

(i) Equity shares versus debentures:

$$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)}{N_2} \tag{8.6}$$

(ii) (a) Equity shares versus preference shares:

$$\frac{X(1-t)}{N_1} = \frac{X(1-t)-P}{N_3} \tag{8.7}$$

(ii) (b) Equity shares versus preference shares with tax on preference dividend

$$\frac{X(1-t)}{N_1} = \frac{X(1-t)-P(1+Dt)}{N_3} \tag{8.7A}$$

(iii) Equity shares versus preference shares and debentures:

$$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)-P}{N_4} \tag{8.8}$$

For an Existing Company If the debentures are already outstanding, let us assume I_1 = interest paid on existing debt, and I_2 = interest payable on additional debt, then the indifference point would be determined by Equation (10.9).

$$\frac{(X-I_1)(1-t)}{N_1} = \frac{(X-I_1-I_2)(1-t)}{N_2} \tag{8.9}$$

EXAMPLE 8.7

The financial manager of a company has formulated various financial plans to finance Rs 30,00,000 required to implement various capital budgeting projects:

(i) Either equity capital of Rs 30,00,000 or Rs 15,00,000 10% debentures and Rs 15,00,000 equity;
(ii) Either equity capital of Rs 30,00,000 or 13% preference shares of Rs 10,00,000 and Rs 20,00,000 equity;
(iii) Either equity capital of Rs 30,00,000 or 13% preference capital of Rs 10,00,000, (subject to dividend tax of 10 per cent), Rs 10,00,000 10% debentures and Rs 10,00,000 equity; and
(iv) Either equity share capital of Rs 20,00,000 and 10% debentures of Rs 10,00,000 or 13% preference capital of Rs 10,00,000, 10% debentures of Rs 8,00,000 and Rs 12,00,000 equity.

You are required to determine the indifference point for each financial plan, assuming 35 per cent corporate tax rate and the face value of equity shares as Rs 100.

SOLUTION

Table 8.9 *Determination of Indifference Point*

(i) $$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)}{N_2}$$

Or $$\frac{X(1-0.35)}{30,000} = \frac{(X - \text{Rs } 1,50,000)(1-0.35)}{15,000}$$

Or $$\frac{0.65X}{30,000} = \frac{0.65X - \text{Rs } 97,500}{15,000}$$

Or $$0.65X = 1.3X - \text{Rs } 1,95,000$$

Or $$-0.65X = -\text{Rs } 1,95,000$$

$$X = \frac{\text{Rs } 1,95,000}{0.65} = \text{Rs } 3,00,000$$

Confirmation table

	Equity financing	*Equity + debt financing*
EBIT	Rs 3,00,000	Rs 3,00,000
Less interest	—	1,50,000
Earning before taxes	3,00,000	1,50,000
Less taxes	1,05,000	52,500
Earnings for equityholders	1,95,000	97,500
Number of equity shares	30,000	15,000
EPS	6.5	6.5

(ii) $$\frac{X(1-t)}{N_1} = \frac{X(1-t)-P}{N_3}$$

Or $$\frac{X(1-0.35)}{N_1} = \frac{X(1-0.35) - \text{Rs } 1,30,000}{20,000}$$

Or $$\frac{0.65X}{30,000} = \frac{0.65X - \text{Rs } 1,30,000}{20,000}$$

$$X = \text{Rs } 6,00,000$$

(*Contd.*)

(*Contd.*)

Confirmation table

	Equity financing	*Equity + Preference financing*
EBIT	Rs 6,00,000	Rs 6,00,000
Less taxes	2,10,000	2,10,000
Earning after taxes	3,90,000	3,90,000
Less dividends on preference shares	—	1,30,000
Earnings for equityholders	3,90,000	2,60,000
Number of equity shares	30,000	20,000
EPS	13	13

(iii) $$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t) - P(1+Dt)}{N_4}$$

Or $$\frac{X(1-0.35)}{30,000} = \frac{(X - Rs\,1,00,000)(1-0.35) - Rs\,1,30,000\,(1+0.1)}{10,000}$$

Or $$\frac{0.65X}{30,000} = \frac{0.65X - Rs\,65,000 - Rs\,1,43,000}{10,000}$$

Or X = Rs 4,80,000

Confirmation table

	Equity financing	*Equity + Preference + Debentures financing*
EBIT	Rs 4,80,000	Rs 4,80,000
Less interest	—	1,00,000
Earnings after interest	4,80,000	3,80,000
Less taxes	1,68,000	1,33,000
Earning after taxes	3,12,000	2,47,000
Less dividends including dividend tax on preference shares	—	1,43,000
Earnings available for equity holders	3,12,000	1,04,000
Number of equity shares	30,000	10,000
EPS	10.4	10.4

(iv) $$\frac{(X-I)(1-t)}{N_2} = \frac{(X-I)(1-t) - P}{N_4}$$

Or $$\frac{(X - 1,00,000)(1-0.35)}{20,000} = \frac{(X - 80,000)(1-0.35) - 1,30,000}{12,000}$$

X = Rs 5,50,000

(*Contd.*)

(*Contd.*)

Confirmation table

	Equity financing	*Equity + Debt + Preference financing*
EBIT	Rs 5,50,000	Rs 5,50,000
Less interest	1,00,000	80,000
Earnings before taxes	4,50,000	4,70,000
Less taxes	1,57,500	1,64,500
Earning after taxes	2,92,500	3,05,500
Less dividends on preference shares	—	1,30,000
Earnings for equity holders	2,92,500	1,75,500
Number of equity shares	20,000	12,000
EPS	14.625	14.625

Graphic Approach The indifference point can also be determined graphically. Figures 8.1 and 8.2 portray the graphic representation of financial plans (i) and (ii) of Example 8.7. The horizontal X-axis represents EBIT while EPS is represented on the Y-axis.

In order to graph the financial plan, two sets of EBIT-EPS coordinates are required. The EPS values associated with EBIT values of Rs 2,00,000 and Rs 6,00,000 are calculated and plotted on the graph paper under each financial plan in case of Figure 8.1. It may noted that 100 per cent equity financing plan starts from origin (O) because EPS would be zero if EBIT is zero. However, EBIT required to have the value of the EPS as zero is Rs 1,50,000, that is, the interest charges payable on 10% debentures of Rs 15,00,000. Therefore, the starting point of 50 per cent equity financing plan is away from the point of the origin (i.e. it starts from Rs 1.5 lakh). The point at which the two lines intersect is the *indifference point (IP)*. When we draw a perpendicular to the X-axis from the point of intersection, we have EBIT required for the IP. A line drawn from the point of intersection and joined with the Y-axis determines the EPS at the indifference point of EBIT.

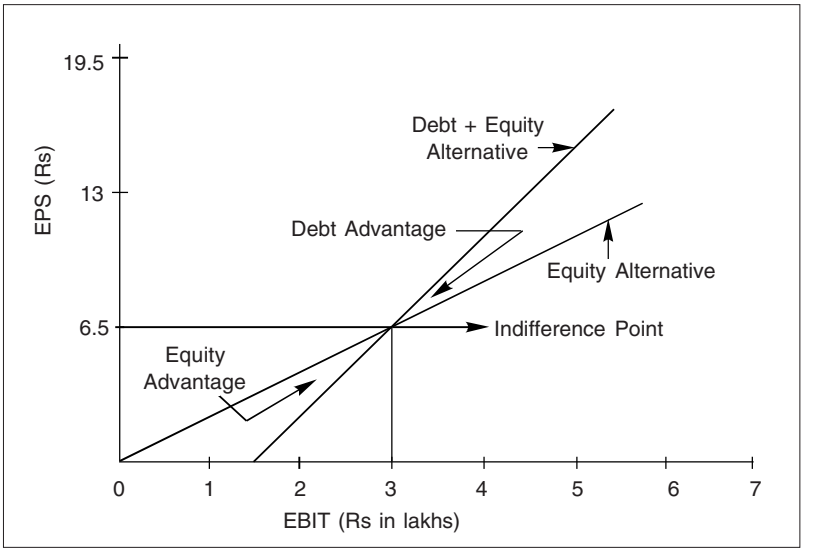

Figure 8.1 *EBIT-EPS Analysis*

An important point to be remembered in relation to the drawing of 33 per cent preference share financial plan (Fig. 8.2), is that EPS would not be zero if the firm's EBIT is Rs 1,30,000, because dividend payable on preference share is not tax-deductible. The firm must earn so much more than Rs 1,30,000 that it is left with Rs 1,30,000 after paying taxes. This amount can be calculated dividing by $(1 - t)$. The required amount is Rs 2,00,000 (Rs 1,30,000) ÷ (1 – 0.35). Thus, the starting point of preference share financial plan would be Rs 2 lakh.

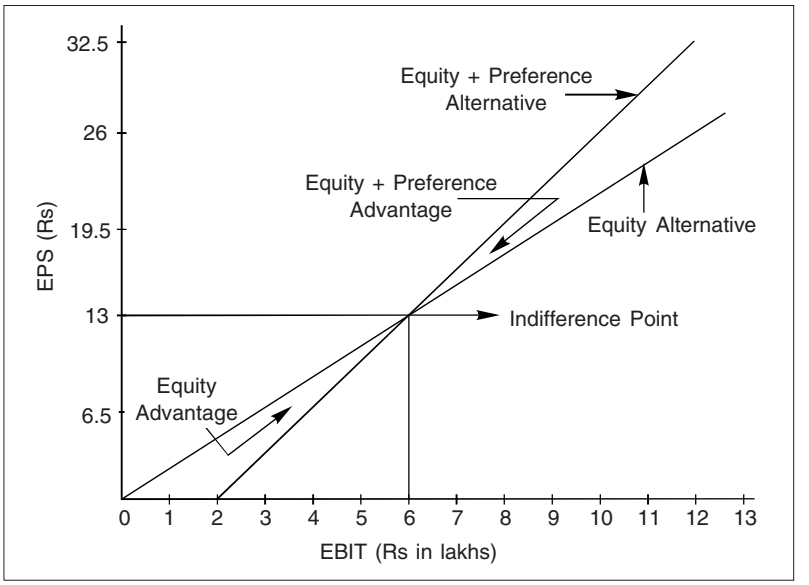

Figure 8.2 *EBIT-EPS Analysis*

The indifference points of Figs. 8.1 and 8.2 correspond to what we have determined through the algebraic approach. But the utility of the EBIT-EPS chart lies in its being more informative regarding the EBIT-EPS relationship. It gives a bird's eye view of EPS at various levels of EBIT. The EPS value at the estimated level of EBIT can be promptly ascertained. Moreover, it more easily explains why an equity financing plan is better than other plans requiring debenture and/or preference shares for the EBIT level below the IP. For instance, Fig. 8.2 indicates that for all EBIT levels below Rs 6 lakh, the EPS under equity alternative is greater than 33 per cent preference share financing plan and for all EBIT levels above Rs 6 lakh, the EPS is greater under 33 per cent financing plan than 100 per cent equity financing. The IP can be compared with the most likely level of EBIT. If the likely level of EBIT is more than the IP, the use of fixed cost financing plan may be recommended, otherwise equity plan would be more suitable. To sum up, *the greater the likely level of EBIT than the indifference point, the stronger is the case for using levered financial plans to maximise the EPS. Conversely, the lower the likely level of EBIT in relation to the indifference point, the more useful the unlevered financial plan would be* from the view point of EPS. In other words, financial leverage will be favourable and shareholders will get higher EPS if the return on total investment is more than the fixed cost (interest and preference dividend). If the return is less than the fixed financial charge, the EPS will decline with the use of debt and the leverage will be unfavourable. The financial leverage will have no effect on EPS in case the return on investment is exactly equal to the fixed financial costs.

The indifference point may be computed in another way using market value as the basis. Since the operational objective of financial management is the maximisation of share prices, the market price of

shares of a firm with two different financial plans should be identical. Thus, on the basis of level of EBIT which ensures identical market price for alternative financial plans, the indifference point can be symbolically computed by Equation 8.10.

$$P/E_1\left[\frac{X(1-t)}{N_1}\right] = P/E_2\left[\frac{(x-I)(1-t)-D_P}{N_2}\right] \tag{8.10}$$

where PE_1 = P/E ratio of unlevered plan and P/E_2 = P/E ratio of levered plan.

EXAMPLE 8.8

Determine the indifference point at which market price of equity shares of a corporate firm will be the same from the following data:

1. Funds required, Rs 50,000.
2. Existing number of equity shares outstanding, 5,000 @ Rs 10 per share.
3. Existing 10% debt, Rs 20,000
4. Funds required can be raised either by (a) issue of 2,000 equity shares, netting Rs 25 per share or (b) new 15 per cent debt.
5. The P/E ratio will be 7 times in equity alternative and 6 times in debt alternative.
6. Corporate tax rate, 35 per cent.

SOLUTION

$$P/E_1\left[\frac{(x-I_1)(1-t)}{N_1}\right] = P/E_2\left[\frac{(x-I_1-I_2)(1-t)}{N_2}\right]$$

or $$7\left[\frac{(x-\text{Rs } 2,000)\,0.65}{7,000}\right] = 6\left[\frac{(x-\text{Rs } 9,500)\,0.65}{5,000}\right]$$

or $$\frac{0.65\,x-\text{Rs } 1,300}{7,000} = \frac{0.65\,x-\text{Rs } 6,175}{5,000}$$

or $$5(4.55x-\text{Rs } 9,100) = 7(3.9x \times \text{Rs } 37,050)$$

or $$4.55x = \text{Rs } 2,13,850, \text{ i.e. } x = \text{Rs } 47,000$$

Confirmation table

Particulars	*15% Debt issue*	*Equity issue*
EBIT	Rs 47,000	Rs 47,000
Less interest	9,500	2,000
Earning before taxes	37,500	45,000
Less taxes	13,125	15,750
Earning after taxes	24,375	29,250
Number of equity shares	5,000	7,000
Earnings per share	4.875	4.18
P/E ratio (times)	6	7
Market price of the share	29.25	29.25

Measures of Financial Leverages

Financial leverage measures the degree of the use of debt and other fixed-cost sources of fund to finance the assets the firm has acquired. As shown above, the use of debt has a magnifying effect on the earnings per share. It can be said that the higher the proportion of debt in the capital structure, the higher is the financial leverage and *vice-versa.* Broadly speaking, financial leverage can be measured in two ways: (i) stock terms, and (ii) flow terms.

Stock Terms It can be measured either by (a) a simple ratio of debt to equity, or (b) by the ratio of long-term debt plus preference share to total capitalisation. Each of these measures indicates the relative proportion of the funds to the total funds of the firm on which it is to pay fixed financial charges.

Flow Terms The financial leverage can be measured either by (a) the ratio of EBIT to interest payments or (b) the ratio of cash flows to interest payment, popularly called the *debt service capacity/ coverage*. These coverage ratios are useful to the suppliers of the funds as they assess the degree of risk associated with lending to the firm.

In general, the higher the 'stock' ratios and the lower the 'flow' ratios, the greater is the risk and *vice versa.*

COMBINED LEVERAGE: TOTAL RISK

The operating leverage has its effects on operating risk and is measured by the percentage change in EBIT due to percentage change in sales. The financial leverage has its effects on financial risk and is measured by the percentage change in EPS due to percentage change in EBIT. Since both these leverages are closely concerned with ascertaining the ability to cover fixed charges (fixed-operating costs in the case of operating leverage and fixed-financial costs in the case of financial leverage), if they are combined, the result is total leverage and the risk associated with combined leverage is known as *total risk*. Symbolically,

$$DCL = DOL \times DFL \tag{8.11}$$

where DCL = Degree of combined leverage
DOL = Degree of operating leverage
DFL = Degree of financial leverage

Substituting the values of DOL and DFL, we have:

$$DCL = \frac{\%\text{ change in EBIT}}{\%\text{ change in sales}} \times \frac{\%\text{ change in EPS}}{\%\text{ change in EBIT}}$$

$$= \frac{\%\text{ change in EPS}}{\%\text{ change in sales}}$$

or
$$DCL = \frac{\text{Contribution}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{EBIT} - \text{I}} = \frac{\text{Contribution}}{\text{EBIT} - \text{I}} \tag{8.12}$$

Thus, the DCL measures the percentage change in EPS due to percentage change in sales. If the degree of operating leverage of a firm is 6 and its financial leverage is 2.5, the combined leverage of this firm would be 15(6 x 2.5). That is, 1 per cent change in sales would bring about 15 per cent change in EPS in the

direction of the change in sales. The combined leverage can work in either direction. It will be favourable if sales increase and unfavourable when sales decrease because changes in sales will result in more than proportionate returns in the form of EPS.

The usefulness of DCL lies in the fact that it indicates the effect that sales changes will have on EPS. Its potential is also great in the area of choosing financial plans for new investments. If, for example, a firm begins to invest heavily in more risky assets than usual, the operating leverage will obviously increase. If it does not change its financing policy, that is, the capital structure remains constant, there would be no change in its financial leverage. As a result, the combined leverages would increase causing an increase in its total risk. The firm, in order to keep its risk constant, may like to lower its financial leverage. This could be done if the new investments are financed with more equity than the firm has used in the past. This would lower the financial leverage and compensate for the increased operating leverage caused by investment in more risky investments. If the operating leverage has decreased due to low fixed costs, the firm can afford to have a more levered financial plan to keep the total risk constant at the same time having the same prospects of magnifying effects on EPS due to change in sales.

SUMMARY

- Leverage refers to the use of an asset or source of funds which involves fixed costs or fixed returns. As a result, the earnings available to the shareholders/owners are affected as also their risk. There are three types of leverage, namely, operating, financial and combined.
- Leverage associated with asset acquisition or investment activities is referred to as the operating leverage. It refers to the firm's ability to use fixed operating costs to magnify the effect of changes in sales on its operating profits (EBIT) and results in more than a proportionate change (±) in EBIT with change in the sales revenue.
- Degree of operating leverage (DOL) is computed in two ways: (i) Percentage change in EBIT/ Percentage change in sales and (ii) (Sales – Variable costs)/EBIT.
- The operating leverage is favourable when increase in sales volume has a positive magnifying effect on EBIT. It is unfavourable when a decrease in sales volume has a negative magnifying effect on EBIT. Therefore, high DOL is good when sales revenues are rising and bad when they are falling.
- The DOL is a measure of the business/operating risk of the firm. Operating risk is the risk of the firm not being able to cover its fixed operating costs. The larger is the magnitude of such costs, the larger is the volume of sales required to recover them. Thus, the DOL depends on fixed operating costs.
- Financial leverage is related to the financing activities of a firm. It results from the presence of fixed financial charges (such as interest on debt and dividend on preference shares). Since such financial expenses do not vary with the operating profits, financial leverage is concerned with the effect of changes in EBIT on the earnings available to equity-holders. It is defined as the ability of a firm to use fixed financial charges to magnify the effect of changes in EBIT on the earnings per share (EPS).
- The degree of financial leverage (DFL) can be computed in the following ways:
  (i) DFL = Percentage change in EPS/Percentage change in EBIT.
  (ii) DFL = EBIT/(EBIT – I), when debt is used.
  (iii) DFL = EBIT/[EBIT – $I - D_p/(1 - t)$], when debt as well as preference capital is used.
  (iv) DFL = EBIT/[EBIT – $I - (D_p + D_t)/(1 - t)$], when dividends paid on preference share capital are subject to dividend tax.
- Financial leverage involves the use of funds obtained at a fixed cost in the hope of increasing the return to the equity-holders. When a firm earns more on the assets purchased with the funds than the

fixed cost of their use, the financial leverage is favourable. Unfavourable leverage occurs when the firm does not earn as much as the funds cost.

- High fixed financial costs increase the financial leverage and, thus, financial risk. The financial risk refers to the risk of the firm not being able to cover its fixed financial costs. In case of default, the firm can be technically forced into liquidation. The larger is the amount of fixed financial costs, the larger is EBIT required to recover them. Thus, the DFL depends on fixed financial costs.
- To devise an appropriate capital structure, the amount of EBIT under various financing plans should be related to EPS. The EBIT-EPS analysis is a widely-used method of examining the effect of financial leverage/use of debt. A financial alternative that ensures the largest EPS is preferred, given the level of EBIT.
- Financial break-even point (BEP) represents a point at which before-tax earnings are equal to the firm's fixed financial obligations. Symbolically, it is computed as follows: $[I + D_p + D_t)/(1 - t)]$. In other words, at financial BEP, EPS is zero.
- The EBIT level at which the EPS is the same for two alternative financial plans is known as the indifference point/level. Beyond the indifference level of EBIT, the benefits of financial leverage begin to operate with respect to EPS.
- The indifference point (IP) can be determined by using the following equations:

(a) For a new company

(i) $$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)}{N_2}$$ (Equity versus Debentures)

(ii) $$\frac{X(1-t)}{N_1} = \frac{X(1-t) - D_p\,(1+D_t)}{N_3}$$ (Equity versus Preference shares)

(iii) $$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t) - D_p\,(1+D_t)}{N_4}$$ (Equity versus Preference shares and Debentures)

(b) For an existing company (having existing debt)

$$\frac{(X-I_1)(1-t)}{N_1} = \frac{(X-I_1-I_2)(1-t) - D_p(1+D_t)}{N_4}$$ (Equity versus Preference shares and Debentures)

- The indifference point can also be determined graphically. In order to graph the financial plan, two sets of EBIT-EPS coordinates are required for each financial plan. The point at which the two lines intersect is the IP.
- The greater is the likely level of EBIT than the IP, the stronger is the case for using levered plan (debt) to maximise the EPS. Conversely, the lower is the likely level of EBIT in relation to IP, the unlevered (equity) plan would be more useful from the perspective of EPS.
- The IP can be computed using market value (instead of EPS) as the basis. Under this method, the IP is that level of EBIT at which market price of the share (MPS) is the same for two alternative financial plans. Symbolically,

$$P/E_1\left[\frac{X(1-t)}{N_1}\right] = P/E_2\left[\frac{(X-I)(1-t) - D_p\,(1+D_t)}{N_4}\right]$$

(Equity versus preference shares and debentures)

- Combined leverage (DCL) is the product of operating and financial leverage. It indicates the effect that changes in sales will have on EPS. Symbolically, it can be computed by the following methods:
  (i) DCL = DOL × DFL
  (ii) DCL = Percentage change in EPS/Percentage change in sales
  (iii) DCL = (Sales – Variable costs)/(EBIT – *I*)
- Combined leverage is a measure of the total risk of the firm. To keep the risk within manageable limits, a firm which has high degree of operating leverage should have low financial leverage and *vice-versa*.

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1. Joy, PM, *Introduction to Financial Management*, Irwin Homewood Ill., p. 226.
2. Gitman, LJ, *Principles of Managerial Finance,* Harper & Row, New York, 1997, p. 84.

SOLVED PROBLEMS

P.8.1 Calculate the operating leverage for each of the four firms, A, B, C and D from the following price and cost data. What conclusions can you draw with respect to levels of fixed cost and the degree of operating leverage result? Explain. Assume number of units sold is 5,000.

	Firms			
	A	*B*	*C*	*D*
Sale price per unit	Rs 20	Rs 32	Rs 50	Rs 70
Variable cost per unit	6	16	20	50
Fixed operating cost	80,000	40,000	2,00,000	Nil

SOLUTION

	Firms			
	A	*B*	*C*	*D*
Sales (units)	5,000	5,000	5,000	5,000
Sales revenue (Units × price) (Rs)	1,00,000	1,60,000	2,50,000	3,50,000
Less variable cost (Units × VC per unit) (Rs)	30,000	80,000	1,00,000	2,50,000
Less fixed operating costs (Rs)	80,000	40,000	2,00,000	Nil
EBIT	(10,000)	40,000	(50,000)	1,00,000

$$\text{DOL} = \frac{\text{Current sales (S)} - \text{Variable costs (VC)}}{\text{Current EBIT}}$$

$$\text{DOL}_{(A)} = \frac{\text{Rs}\,1,00,000 - \text{Rs}\,30,000}{\text{Rs}\,10,000} = 7$$

$$DOL_{(B)} = \frac{Rs\,1{,}60{,}000 - Rs\,80{,}000}{Rs\,40{,}000} = 2$$

$$DOL_{(C)} = \frac{Rs\,2{,}50{,}000 - Rs\,1{,}00{,}000}{Rs\,50{,}000} = 3$$

$$DOL_{(D)} = \frac{Rs\,3{,}50{,}000 - Rs\,2{,}50{,}000}{Rs\,1{,}00{,}000} = 1$$

The operating leverage exists only when there are fixed costs. In the case of firm D, there is no magnified effect on the EBIT due to change in sales. A 20 per cent increase in sales has resulted in a 20 per cent increase in EBIT. In the case of other firms, operating leverage exists. It is maximum in firm A, followed by firm C and minimum in firm B. The interpretation of DOL of 7 is that 1 per cent change in sales results in 7 per cent change in EBIT level in the direction of the change of sales level of firm A.

P.8.2 A firm's sales, variable costs and fixed cost amount to Rs 75,00,000, Rs 42,00,000 and Rs 6,00,000 respectively. It has borrowed Rs 45,00,000 at 9 per cent and its equity capital totals Rs 55,00,000.

(a) What is the firm's ROI?
(b) Does it have favourable financial leverage?
(c) If the firm belongs to an industry whose asset turnover is 3, does it have a high or low asset leverage?
(d) What are the operating, financial and combined leverages of the firm?
(e) If the sales drop to Rs 50,00,000, what will the new EBIT be?
(f) At what level will the EBT of the firm equal to zero?

SOLUTION

(a) ROI = EBIT/Investment
EBIT = Sales – VC – FC = Rs 75 lakh – Rs 45 lakh – Rs 6 lakh = Rs 27 lakh.
ROI = Rs 27 lakh/Rs 100 lakh = 27 per cent.

(b) Yes, the firm has favourable financial leverage as its ROI is higher than the interest on debt.

(c) Asset turnover = Sales/Total assets or Total investments. = Rs 75 lakh/Rs 100 lakh = 0.75 It is lower than the industry average.

(d) Operating leveage $= \frac{\text{Sales} - \text{Variable costs}}{\text{EBIT}} = \frac{Rs\,75\,lakh - Rs\,42\,lakh}{Rs\,27\,lakh} = 1.22$

Financial leverage $= \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}} = \frac{Rs\,27\,lakh}{(Rs\,27\,lakh - Rs\,4.05\,lakh)} = 1.18$

Combined leverage $= \frac{\text{Sales} - \text{VC}}{\text{EBIT} - \text{Interest}} = \frac{Rs\,33\,lakhs}{Rs\,22{,}95{,}000} = 1.44$

Alternatively $= \text{OL} \times \text{FL} = 1.22 \times 1.18 = 1.44$

(e) EBIT at sales level of Rs 50 lakh

Sales revenue	Rs 50,00,000
Less variable costs (50 lakh × 0.56)	28,00,000
Less fixed costs	6,00,000
EBIT	16,00,000

(f) Zero EBT implies break-even sales (BESR) = FC/CV ratio, CV ratio = Rs 33 lakhs/Rs 75 lakhs = 44 per cent
BESR = (Rs 6 lakh + Rs 4.05 lakh)/0.44 = Rs 22,84,091.

Confirmation table

Sales revenue	Rs 22,84,091
Less VC (0.56)	12,79,091
Less FC (operating)	6,00,000
Less Interest (additional fixed cost)	4,05,000
EBT	ZERO

P.8.3 The selected financial data for A, B and C companies for the current year ended March 31 are as follows:

	A	*B*	*C*
Variable expenses as a percentage of sales	66.67	75	50
Interest expenses (Rs)	200	300	1,000
Degree of operating leverage	5	6	2
Degree of financial leverage	3	4	2
Income-tax rate	0.35	0.35	0.35

(a) Prepare income statements for A, B, and C companies.
(b) Comment on the financial position and structure of these companies.

SOLUTION

(a) Income statement of companies A, B and C for the current year, ended 31st March

	A	*B*	*C*
Sales	Rs 4,500	Rs 9,600	Rs 24,000
Less variable costs	3,000	7,200	12,000
Less fixed costs (Sales – VC – EBIT)	1,200	2,000	10,000
EBIT	300	400	2,000
Less interest	200	300	1,000
Earnings after interest	100	100	1,000
Less taxes	35	35	350
EAT (Net income)	65	65	650

Working Notes

(a) The preparation of the income statement requires data for (i) sales revenue, (ii) variable costs and (iii) fixed costs.

$$\text{DFL} = 3,\ \text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - \text{I}}$$

Company A:

$$3 = \frac{\text{EBIT}}{\text{EBIT} - \text{Rs } 200}$$

$$\text{EBIT} = \text{Rs } 300$$

$$\text{DOL} = \frac{\text{Sales} - \text{Variable costs (V)}}{\text{EBIT}}$$

$$5 = \frac{\text{S} - 0.667\text{S}}{\text{Rs } 300} \text{ where } S = \text{sales} = \text{Rs } 4{,}500$$

$$\text{VC} = 0.667 \times \text{Rs } 4{,}500 = \text{Rs } 3{,}000$$

Company B:

$$4 = \frac{\text{EBIT}}{\text{EBIT} - \text{Rs}\,300}$$

$$\text{EBIT} = \text{Rs}\,400$$

$$6 = \frac{\text{S} - 0.75\,\text{S}}{\text{Rs}\,400} = \text{Rs}\,9{,}600$$

$$\text{VC} = 0.75 \times \text{Rs}\,9{,}600 = \text{Rs}\,7{,}200$$

Company C:

$$2 = \frac{\text{EBIT}}{\text{EBIT} - \text{Rs}\,1{,}000}$$

$$\text{EBIT} = \text{Rs}\,2{,}000$$

$$6 = \frac{\text{S} - 0.50\,\text{S}}{\text{Rs}\,2{,}000} = \text{Rs}\,24{,}000$$

$$\text{VC} = 0.50 - \text{Rs}\,24{,}000 = \text{Rs}\,12{,}000$$

(b) The financial position of company C can be regarded better than other companies: (i) It has the least financial risk as it is has minimum degree of financial leverage. It is true that there will be a more magnified impact on EPS of A and B due to change in EBIT, but, their EBIT level due to low sales is very low. (ii) From the point of view of DCL, company C is better placed. The degree of combined leverage is maximum in company B (24); for company A (15) and for company C it is 4. The total risk (business plus financial) of company C is the lowest. (iii) The ability of the company C to meet interest liability is better. The EBIT/interest ratios for the three companies are:

C, 2.0 (Rs 2,000 ÷ Rs 1,000)
B, 1.5 (Rs 300 ÷ Rs 200)
A, 1.33 (Rs 400 ÷ Rs 300)

P.8.4 Calculate (a) the operating leverage, (b) financial leverage and (c) combined leverage from the following data under situations I and II and financial plans, A and B.
Installed capacity, 4,000 units
Actual production and sales, 75 per cent of the capacity
Selling price, Rs 30 per unit
Variable cost, Rs 15 per unit

Fixed cost:
Under situation I, Rs 15,000
Under situation II, 20,000

Capital structure:

	Financial plan	
	A	*B*
Equity	Rs 10,000	Rs 15,000
Debt (0.20 interest)	10,000	5,000
	20,000	20,000

SOLUTION

(a) Determination of operating leverage

	Situations	
	I	*II*
Sales	Rs 90,000	Rs 90,000
Less variable costs	45,000	45,000
Contribution	45,000	45,000
Less fixed costs	15,000	20,000
EBIT	30,000	25,000
Operating leverage $\left(\frac{\text{Contribution}}{\text{EBIT}}\right)$	1.5	1.8

(b) Determination of financial leverage

	Situation I Financial plans		*Situation II Financial plans*	
	A	*B*	*A*	*B*
EBIT	Rs 30,000	Rs 30,000	Rs 25,000	Rs 25,000
Less interest on debt	2,000	1,000	2,000	1,000
EBT	28,000	29,000	23,000	24,000
Financial leverage (EBIT/EBT)	1.07	1.03	1.09	1.04

(c) Determination of combined leverage

	Financial plans	
	A	*B*
Situation I	1.5 × 1.07 = 1.61	1.5 × 1.03 = 1.54
Situation II	1.8 × 1.09 = 1.96	1.8 × 1.04 = 1.87

P.8.5 Calculate operating leverage and financial leverage under situations A, B and C and financial plans 1, 2 and 3 respectively from the following information relating to the operation and capital structure of X, Y, Z Ltd. Also find out the combinations of operating and financial leverage which give the highest value and the least value.

Installed capacity (units)	1,200
Actual production and sales (units)	800
Selling price per unit (Rs)	15
Variable cost per unit (Rs)	10
Fixed costs (Rs): *Situation A*	1,000
Situation B	2,000
Situation C	3,000

Capital Structure:

	Financial plan		
	1	*2*	*3*
Equity	Rs 5,000	Rs 7,500	Rs 2,500
Debt	5,000	2,500	7,500
Cost of debt (for all plans)		12 per cent	

SOLUTION

Determination of operating leverage

	Situations		
	A	*B*	*C*
Sales level (units)	*800*	*800*	*800*
Sales revenue	Rs 12,000	Rs 12,000	Rs 12,000
Less variable costs	8,000	8,000	8,000
Less fixed cost	1,000	2,000	3,000
Operating profits (EBIT)	3,000	2,000	1,000
$DOL = \frac{S - VC}{EBIT}$	1.33	2	4

Determination of financial leverage

	Financial plan		
	1	*2*	*3*
Situation A:			
EBIT	Rs 3,000	Rs 3,000	Rs 3,000
Less interest	600	300	900
Earnings after interest	2,400	2,700	2,100
Financial leverage (EBIT/EBIT - I)	1.25	1.11	1.43
Situation B:			
EBIT	2,000	2,000	2,000
Less interest	600	300	900
Earnings after interest	1,400	1,700	1,100
Financial leverage	1.43	1.18	1.82
Situation C:			
EBIT	1,000	1,000	1,000
Less interest	600	300	900
Earnings after interest	400	700	100
Financial leverage	2.5	1.43	10

Determination of the highest and the lowest value of combined leverage (combined leverage = DOL x DFL)

Situations	*Financial plan*		
	1	*2*	*3*
A	1.66	1.48	1.90
B	2.86	2.36	3.64
C	10.00	5.72	40.00

The above calculations suggest that the highest value is in situation C financed by plan 3 and the lowest value is in situation A financed by plan 2.

P.8.6 The capital structure of the Progressive Corporation Ltd consists of an ordinary share capital of Rs 10,00,000 (shares of Rs 100 par value) and Rs 10,00,000 of 10% debentures. The unit sales increased by 20 per cent from 1,00,000 units to 1,20,000 units, the selling price is Rs 10 per unit, variable costs amount to Rs 6 per unit and fixed expenses amount to Rs 2,00,000. The income tax rate is assumed to be 35 per cent.

(a) You are required to calculate the following:
  (i) The percentage increase in earnings per share.
  (ii) The degree of financial leverage at 1,00,000 units and 1,20,000 units.
  (iii) The degree of operating leverage at 1,00,000 units and 1,20,000 units.

(b) Comment on the behaviour of operating and financial leverage in relation to increase of production from 1,00,000 to 1,20,000 units.

SOLUTION

(a) Determination of earnings per share (EPS)

Sales level (units)	1,00,000	1,20,000
Sales revenue	Rs 10,00,000	Rs 12,00,000
Less variable costs	6,00,000	7,20,000
Less fixed costs	2,00,000	2,00,000
EBIT	2,00,000	2,80,000
Less interest	1,00,000	1,00,000
Earnings after interest	1,00,000	1,80,000
Less taxes	35,000	63,000
EAT	65,000	1,17,000
Number of equity shares	10,000	10,000
EPS (EAT + N)	6.5	11.7

(i) The percentage increase per share is $= \frac{\Delta EPS}{EPS} \times 100 \quad = \frac{Rs\ 5.2}{Rs\ 6.5} \times 100 = 80$ per cent

(ii) DFL (at 1,00,000 units) $= \frac{Rs\ 2,00,000}{Rs\ 1,00,000} = 2.0$

(at 1,20,000 units) $= \frac{Rs\ 2,80,000}{Rs\ 1,80,000} = 1.56$

(iii) DOL (at 1,00,000 units) $= \frac{Rs\ 4,00,000}{Rs\ 2,00,000} = 2.0$

(at 1,20,000 units) $= \frac{Rs\ 4,80,000}{Rs\ 2,80,000} = 1.71$

(b) As a result of increase in production and sales from 1,00,000 units to 1,20,000 units, EPS has gone up by 80 per cent. Moreover, there has been a decrease in both types of leverages–operating as well as financial–reflecting a decline in the total risk of the company.

P.8.7 Exel Limited is considering three financing plans. The key information is as follows:

(a) Total funds to be raised, Rs 2,00,000.

(b) Financing plans

Plans	*Equity*	*Debt*	*Preference*
A	100 per cent	—	—
	50	50 per cent	—
C	50	—	50 per cent

(c) Cost of debt 8 per cent; cost of preference shares 8 per cent
(d) Tax rate, 35 per cent
(e) Equity shares of the face value of Rs 10 each will be issued at a premium of Rs 10 per share.
(f) Expected EBIT, Rs 80,000.

Determine for each plan:

(i) earnings per share (EPS) and financial break-even point.
(ii) indicate if any of the plans dominate, and compute the EBIT range among the plans for indifference.

SOLUTION

(i) Determination of EPS under Plans A, B and C

EBIT	Rs 80,000	Rs 80,000	Rs 80,000
Less interest	—	8,000	—
EBT	80,000	72,000	80,000
Less taxes (0.35)	28,000	25,200	28,000
EAT	52,000	46,800	52,000
Less dividend on prefernec shares	—	—	8,000
Earnings for requity-holders	52,000	46,800	44,000
÷ number of shares	10,000	5,000	5,000
EPS	5.2	9.36	8.8

Financial BEP for plans, A, B and C

Plan A = Zero
Plan B = Rs 8,000 (Rs 1,00,000 × 0.08)
Plan C $= \frac{D_P}{(1-t)} = \frac{\text{Rs } 8{,}000}{0.65}$ = Rs 12,308

(ii) Indifference point among financial plans

(a) A and B:

$$\frac{X(1-t)}{N_1} \quad \frac{(X-I)(1-t)}{N_2}; \frac{0.65\,X}{10{,}000} = \frac{(X - \text{Rs } 8{,}000)\,0.65}{5{,}000}$$

X = Rs 10,400/0.65 = Rs 16,000.

(b) B and C:

$$\frac{(X-I)(1-t)}{N_1} = \frac{X(1-t) - D_P}{N_2}; \frac{0.65\,(X - \text{Rs } 8{,}000)}{5{,}000} = \frac{0.65\,X - \text{Rs } 8{,}000}{5{,}000}$$

or $0.65X$ – Rs 5,200 = $0.65X$ – Rs 8,000
or $0.65X - 0.65X$ = Rs 5,200 – Rs 8,000

Thus, indifference point between plans B and C is indeterminate.

(c) A and C:

$$\frac{X(1-t)}{N_1} = \frac{X(1-t) - D_P}{N_2}; \frac{0.65\,X}{10{,}000} = \frac{0.65\,X - \text{Rs } 8{,}000}{5{,}000}$$

or $0.65X = 13X$ – Rs 16,000 or X = Rs 16,000/0.65 i.e. Rs 24,615

Domination of plan: Plan B dominates plan C as the financial BEP of plan B is lower.

P.8.8 Skyline Software Ltd has appointed you as its finance manager. The comapny wants to implement a project for which Rs 30 lakh is required to be raised from the market as a means of financing the projet. The following financing plans and options are at hand: (Number in thousands)

	Plan A	*Plan B*	*Plan C*
Option 1:			
Equity shares	30	30	30
Option 2:			
Equity shares	15	20	10
12% Preference shares	Nil	10	10
10% Non-convertible debentures	15	Nil	10

Assuming corporate tax to be 35 per cent and the face value of all the shares and debentures to be Rs 100 each, calculate the indifference points and earnings per share (EPS) for each of the financing plans. Which plan should be accepted by the company?

SOLUTION

Determination of indifference point under Plans A, B, C

Plan A:

$$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)}{N_2}; \frac{X(1-0.35)}{30,000} = \frac{(X - \text{Rs } 1.5 \text{ lakh})\,0.65}{15,000}$$

OR $X - 0.35X = 2(0.65X - \text{Rs } 97,500);$

$X - 0.35X = 1.3X - \text{Rs } 1,95,000$

OR $0.65X = \text{Rs } 1,95,000$ or $X = \text{Rs } 1,95,000/0.65 = \text{Rs } 3,00,000$

Plan B:

$$\frac{X(1-0.35)}{30,000} = \frac{X(1-0.35) - \text{Rs } 1,20,000}{20,000}$$

OR $$\frac{0.65X}{30,000} = \frac{0.65X - \text{Rs } 1,20,000}{20,000};$$

$2(0.65X) = 3(0.65X - \text{Rs } 1,20,000)$

$1.3X = 1.95X - \text{Rs } 3,60,000$

OR $X = \text{Rs } 3,60,000/0.65 = \text{Rs } 5,53,846$

Plan C:

$$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t) - D_P}{N_2}; \frac{0.65X}{30,000} = \frac{(X - \text{Rs } 1 \text{ lakh})\,0.65 - \text{Rs } 1.2 \text{ lakh}}{10,000}$$

OR $$\frac{0.65X}{30,000} = \frac{0.65X - \text{Rs } 65,000 - \text{Rs } 1,20,000;}{10,000}$$

OR $$\frac{0.65X}{30,000} = \frac{0.65X - \text{Rs } 1,85,000}{10,000}$$

$X = \text{Rs } 5,55,000/1.3 = \text{Rs } 4,26,923$

Determination of EPS under plans A, B and C for options 1 and 2

	Plan A		*Plan B*		*Plan C*	
	1	*2*	*1*	*2*	*1*	*2*
EBIT (Rs)	3,00,000	3,00,000	5,53,846	5,53,846	4,26,923	4,26,923
Less interest	—	1,50,000	—	—	—	1,00,000
EBT	3,00,000	1,50,000	5,53,846	5,53,846	4,26,923	3,26,923
Less taxes	1,05,000	52,500	1,93,846	1,93,846	1,49,423	1,14,423
EAT	1,95,000	97,500	3,60,000	3,60,000	2,77,500	2,12,500
Less dividend on preference shares	—	—	—	1,20,000	—	1,20,000
Earnings available for equity-holders	1,95,000	97,500	3,60,000	2,40,000	2,77,500	92,500
Number of equity shares (N)	÷ 30,000	÷ 15,000	÷ 30,000	÷ 20,000	÷ 30,000	÷ 10,000
EPS	6.5	6.5	12	12	9.25	9.25

P.8.9 *X* Ltd, a widely held company, is considering a major expansion of its production facilities and the following alternatives are available:

	Alternatives (Rs lakh)		
	A	*B*	*C*
Share capital	50	20	10
14% Debentures	—	20	15
Loan from a financial institution @ 18 per cent	—	10	25

The expected rate of return before interest and tax is 25 per cent. The rate of dividend of the comapny is not less than 20 per cent. The company at present has no debt. The corporate tax rate is 35 per cent. Which of the alternative would you choose, assuming maximising ROR on equity capital as the objective of the firm?

SOLUTION

Rate of return on equity capital under proposed financial alternatives

	Financing alternatives (Rs lakh)		
	A	*B*	*C*
EBIT (Rs 50 lakh × 0.25)	12.5	12.5	12.5
Less interest on debentures	—	2.8	2.1
Less interest on loan	—	1.8	4.5
EBT	12.5	7.9	5.9
Less taxes (0.35)	4.375	2.765	2.065
EAT	8.125	5.135	3.835
ROR on equity capital (%)	16.25	25.675	38.35

Alternative C is the best.

P.8.10 The ABC Ltd has the following balance sheet and income statement information:

Balance sheet as on March 31

Liabilities		*Assets*	
Equity capital (Rs 10 per share)	Rs 8,00,000	Net fixed assets	Rs 10,00,000
10% Debt	6,00,000	Current assets	9,00,000
Retained earnings	3,50,000		
Current liabilities	1,50,000		
	19,00,000		19,00,000

Income statement for the year ending March

Sales	Rs 3,40,000
Operating expenses (including Rs 60,000 depreciation)	1,20,000
EBIT	2,20,000
Less interest	60,000
Earning before tax	1,60,000
Less taxes	56,000
Net earnings (EAT)	1,04,000

(a) Determine the degree of operating, financial and combined leverages at the current sales level, if all operating expenses, other than depreciation, are variable costs.

(b) If total assets remain at the same level, but sales (i) increase by 20 per cent and (ii) decrease by 20 per cent, what will be the earnings per share in the new situation?

SOLUTION

(a) $$\text{DOL} = \frac{\text{Rs } 3{,}40{,}000 - \text{Rs } 60{,}000}{\text{Rs } 2{,}20{,}000} = 1.27$$

$$\text{DFL} = \frac{\text{Rs } 2{,}20{,}000}{\text{Rs } 1{,}60{,}000} = 1.37$$

$$\text{DCL} = \text{DOL} \times \text{DFL} = 1.27 \times 1.37 = 1.75$$

(b) *Earning per share at the new sales level*

Sales level	Rs 4,08,000	Rs 2,72,000
Less variable expenses	72,000	48,000
Less fixed cost	60,000	60,000
Earnings before interest and taxes	2,76,000	1,64,000
Less interest	60,000	60,000
Earnings before taxes	2,16,000	1,04,000
Less taxes	75,600	36,400
Earnings after taxes (EAT)	1,40,400	67,600
Number of equity shares (N)	80,000	80,000
EPS	1.75	0.84

Working Notes

(i) Variable costs = Rs 60,000 (total cost – depreciation).

(ii) Variable costs = (a) at sales level, Rs 4,08,000 = Rs 72,000, (b) at the sales level, Rs 2,72,000 = 48,000

P.8.11 The Well Established Company's most recent balance sheet is as follows:

Liabilities	*Amount*	*Assets*	*Amount*
Equity capital (Rs 10 per share)	Rs 60,000	Net fixed assets	Rs 1,50,000
10% Long-term debt	80,000	Current assets	50,000
Retained earnings	20,000		
Current liabilities	40,000		
	2,00,000		2,00,000

The company's total assets turnover ratio is 3, its fixed operating costs are Rs 1,00,000 and the variable operating costs ratio is 40 per cent. The income tax rate is 35 per cent.

(a) Calculate all the three types of leverages.

(b) Determine the likely level of EBIT if EPS is (i) Re 1, (ii) Rs 3, and (iii) Zero.

SOLUTION

Income statement

Sales	Rs 6,00,000
Less variable costs	2,40,000
Less fixed costs	1,00,000
EBIT	2,60,000
Less interest	8,000
Earnings before interest	2,52,000
Less taxes	88,200
Earnings after taxes	1,63,800

(a) $\text{DOL} = \dfrac{\text{Rs } 6,00,000 - 2,40,000}{\text{Rs } 2,60,000} = 1.38$

$\text{DFL} = \dfrac{\text{Rs } 2,60,000}{\text{Rs } 2,52,000} = 1.03$

$\text{DCL} = 1.38 \times 1.03 = 1.42$

(b) (i) $\text{EPS} = \dfrac{(\text{EBIT} - \text{I})(1 - \text{t})}{\text{N}}$

$\text{Re } 1 = \dfrac{(\text{EBIT} - \text{Rs } 8,000)(1 - 0.35)}{6,000}$

$\text{Rs } 6,000 = 0.65\ \text{EBIT} - \text{Rs } 5,200$

$\text{EBIT} = \text{Rs } 17,231$

(ii) $\text{Rs } 3 = \dfrac{(\text{EBIT} - \text{Rs } 8,000) \times 0.65}{6,000}$

$\text{EBIT} = \text{Rs } 35,692$

(iii) $0(\text{Zero}) = \dfrac{(\text{EBIT} - \text{Rs } 8,000) \times 0.65}{6,000}$

$\text{EBIT} = \text{Rs } 8,000$

Confirmation table

EBIT	Rs 8,000	Rs 17,231	Rs 35,692
Less interest	8,000	8,000	8,000
Earnings after interest	Nil	9,231	27,692
Less taxes	Nil	3,231	9,692
Net income (NI)	Nil	6,000	18,000
Number of shares (N)	6,000	6,000	6,000
EPS (NI + N)	Zero	1	3

Working Notes

$$\text{Total assets turnover ratio} = 3 = \frac{\text{Sales}}{\text{Rs } 2{,}00{,}000}$$

Sales = Rs 6,00,000

P.8.12 A plastic manufacturing company is planning to expand its assets by 50 per cent. All financing for this expansion will come from external sources. The expansion will generate additional sales of Rs 3 lakh with a return of 25 per cent on sales before interest and taxes. The finance department of the company has submitted the following plans for the consideration of the Board.

Plan 1: Issue of 10% debentures.

Plan 2: Issue of 10% debentures for half the required amount and balance in equity shares to be issued at 25 per cent premium.

Plan 3: Issue equity shares at 25 per cent premium.

Balance sheet of the company as on March 31

Liabilities	*Amount*	*Assets*	*Amount*
Equity capital (Rs 10 per share)	Rs 4,00,000	Total assets	Rs 12,00,000
8% Debentures	3,00,000		
Retained earnings	2,00,000		
Current liabilities	3,00,000		
	12,00,000		12,00,000

Income statement for the year ending March 31

Sales	Rs 19,00,000
Operating costs	16,00,000
EBIT	3,00,000
Interest	24,000
Earning after interests	2,76,000
Taxes	96,600
EAT	1,79,400
EPS	4.48

(a) Determine the number of equity shares that will be issued if financial plan 3 is adopted.

(b) Determine indifference point between (i) plans 1 and 2, (ii) plans 1 and 3, and (iii) plans 2 and 3.

(c) Assume that the price earnings ratio is expected to remain unchanged at 8 if plan 3 is adopted, but is likely to drop to 6 if either plan 1 or 2 is used to finance the expansion. Determine the expected market price of the shares in each of the situations.

SOLUTION

(a) Number of shares issued = $48{,}000 = \dfrac{\text{Rs } 6{,}00{,}000}{\text{Rs } 12.5}$

(b) (i) $\dfrac{(X - I_1 - I_2)(1 - t)}{N_1} = \dfrac{(X - I_1 - I_2)(1 - t)}{N_2}$

or $\dfrac{(X - \text{Rs } 24{,}000 - \text{Rs } 60{,}000) \times 0.65}{40{,}000} = \dfrac{(X - \text{Rs } 24{,}000 - \text{Rs } 30{,}000)(0.65)}{64{,}000}$

$X = \text{Rs } 1{,}34{,}000$

(ii) $\dfrac{(X - I_1 - I_2)(1 - t)}{N_1} = \dfrac{(X - I_1)(1 - t)}{N_2}$

$\dfrac{(X - \text{Rs } 84{,}000) \times (0.65)}{40{,}000} = \dfrac{(X - \text{Rs } 24{,}000) \times 0.65}{88{,}000}$

$X = \text{Rs } 1{,}34{,}000$

(iii) $\dfrac{(X - I_1 - I_2)}{N_1} = \dfrac{(X - I_2)(1 - t)}{N_2}$

$\dfrac{(X - \text{Rs } 54{,}000) \times 0.65}{40{,}000} = \dfrac{(X - \text{Rs } 24{,}000) \times 0.65}{88{,}000}$

$X = \text{Rs } 1{,}34{,}000$

Verification table

	Plans		
	1	*2*	*3*
EBS	Rs 1,34,000	Rs 1,34,000	Rs 1,34,000
Less interest	84,000	54,000	24,000
Earnings before taxes	50,000	80,000	1,10,000
Less taxes	17,500	28,000	38,500
EAT	32,500	52,000	71,500
Number of equity shares (N)	40,000	64,000	88,000
EPS	0.812	0.812	0.812

(c) Determination of market price per share under various alternative financial plans:

	Plans		
	1	*2*	*3*
EBIT	Rs 3,75,000	Rs 3,75,000	Rs 3,75,000
Less interest	84,000	54,000	24,000
Earnings before taxes	2,91,000	3,21,000	3,51,000
Less taxes	1,01,850	1,12,350	1,22,850
EAT	1,89,150	2,08,650	2,28,150
N	40,000	64,000	88,000
EPS	4.73	3.26	2.59
P/E ratio	6	6	8
Market price	28.38	19.56	20.72

P.8.13 Consider the following information for Strong Ltd:

EBIT	1,120 Rs in lakh
EBT	320
Fixed cost	700

Calculate the percentage of change in EPS, if sales increase by 5 per cent.

SOLUTUION

Degree of combined leverage (DCL) = (Degree of operating leverage x Degree of financial leverage)

$$= \frac{\text{Percentage change in EBIT}}{\text{Percentage change in sales}} \times \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}}$$

$$\text{DCL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in sales}}$$

Alternatively, DCL can be determined as

$$\text{DCL} = \left(\frac{\text{Sales} - \text{Variable costs}^*}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{EBT}} \right)$$

* Sales- VC i.e., Contribution = EBIT + Fixed costs = Rs 1,120 lakh + Rs 700 lakh = Rs 1,820 lakh

DCL = (Contribution / EBT) i.e. (Rs 1,820 lakh/ Rs 320 lakh) = 5.6875

5.6875 = Percentage change in EPS/ Precentage increase in sales

Percentage change in EPS = Percentage increase in sales × 5.6875 = 5% x 5.6875 = 28.4375 per cent

5 per cent increase in sales will cause 28.4375 per cent increase in EPS

REVIEW QUESTIONS

RQ.8.1 What is meant by the term 'leverage'? What are its types? With what type of risk is each leverage generally associated? Why is increasing leverage also indicative of increasing risk? State the situation when there is neither a financial risk nor business risk.

RQ.8.2 A financial analyst is interested in ascertaining business risk of two similar firms. If all operating data for the two firms were the same, save the following differences, which firm would have greater amount of business risk in each instance?

(a) Firm X has a higher sales level than Firm Y.
(b) Firm X has a higher EBIT level.
(c) Firm Y has a lower variable cost ratio.

RQ.8.3 What is combined leverage? What does it measure? What would be the changes in the degree of combined leverage, assuming other things being equal, in each of the following situations?

(a) The fixed costs increase.
(b) The EBIT level increases.
(c) The sale price decreases.
(d) The variable cost decreases.

RQ.8.4 Why must the finance manager keep in mind the degree of financial leverage in evaluating various financing plans? When does financial leverage become favourable?

RQ.8.5 What is the 'indifference point' and why is it so called? What is its usefulness?

RQ.8.6 What is an indifference point in the EBIT-EPS analysis? How would you compute it?

RQ.8.7 Explain the significance of operating and financial leverage analysis for a financial executive in corporate profit and financial structure planning.

RQ.8.8 From the following selected operating data, determine the degree of operating leverage. Which company has the greater amount of business risk? Why?

	A Ltd	*B Ltd*
Sales	Rs 25,00,000	Rs 30,00,000
Fixed costs	7,50,000	15,00,000

Variable expenses as a percentage of sales are 50 per cent for firm *A* and 25 per cent for firm B.

SOLUTION

Determination of operating leverage (DOL)

Particulars	*A Ltd*	*B Ltd*
Sales revenue	Rs 25,00,000	Rs 30,00,000
Less: variable costs	12,50,000	7,50,000
fixed costs	7,50,000	15,00,000
EBIT (operating profit)	5,00,000	7,50,000
DOL = (Sales – VC)/EBIT	2.5	3

B Ltd has greater business risk as its DOL is higher.

RQ.8.9

(i) Find out operating leverage from the following data:

Sales: Rs 50,000
Variable costs: 60 per cent
Fixed costs: Rs 12,000.

(ii) Compute the financial leverage from the following data:

Net worth = Rs 25,00,000
Debt/equity = 3:1
Interest rate = 12 per cent
Operating profit = Rs 20,00,000

SOLUTION

(i) *Determination of operating leverage*

Sales	Rs 50,000
Less variable costs (0.60)	30,000
Contribution	20,000
Less fixed costs	12,000
EBIT	8,000
DOL (Rs 20,000/8,000)	2.5

(ii) DFL = Rs 20,00,000/(Rs 20,00,000 – Rs 9,00,000)* = 1.82

*Interest on debt (Rs 25,00,000, networth × three times, D/E ratio = Rs 75,00,000) × 0.12 = Rs 9,00,000.

RQ.8.10 Royal Industries Ltd, a well-established firm in plastics, is considering the purchase of one of the two manufacturing companies. The financial manager of the company has developed the following information about the two companies. Both companies have total assets of Rs 15,00,000.

Operating statement

	X Ltd	*Y Ltd*
Sales revenue	Rs 30,00,000	Rs 30,00,000
Less: cost of goods sold	22,50,000	22,50,000
selling expenses	2,40,000	2,40,000
administrative expenses	90,000	1,50,000
depreciation	1,20,000	90,000
EBIT	3,00,000	2,70,000
Cost break-ups		
Variable costs:		
Cost of goods sold	9,00,000	18,00,000
Selling expenses	1,50,000	1,50,000
Total	10,50,000	19,50,000

(i) Prepare operating statements for both the companies, assuming that sales increase by 20 per cent. The total fixed costs are likely to remain unchanged and the variable costs are a linear function of sales.
(ii) Calculate the degree of operating leverage.
(iii) If Royal Industries Ltd wishes to buy a company which has a lower degree of business risk, which company would be purchased by it?

SOLUTION

(i) *Operating statement of X Ltd. and Y Ltd.*

Particulars	*X Ltd*	*Y Ltd*
Sales revenue	Rs 36,00,000	Rs 36,00,000
Less: cost of goods sold	24,30,000	26,10,000
selling expenses	2,70,000	2,70,000
administrative expenses	90,000	1,50,000
depreciation	1,20,000	90,000
EBIT	6,90,000	4,80,000
Cost of goods sold break-up		
Variable costs	10,80,000 [1]	21,60,000 [2]
Fixed costs	13,50,000	4,50,000
	24,30,000	26,10,000

[1]30 per cent of sales
[2]60 per cent of sales

(ii) DOL(X) = (D EBIT ÷ EBIT)/(D Sales ÷ Sales) = (Rs 3,90,000 ÷ Rs 3,00,000)/(Rs 6,00,000 ÷ Rs 30,00,000) = 6.5.
DOL(Y) = (Rs 2,10,000 ÷ Rs 2,70,000)/(Rs 6,00,000 ÷ Rs 30,00,000) = 3.88.

Alternatively,

DOL(X) = (Sales – VC)/(Current EBIT) = (Rs 30,00,000 – Rs 10,50,000)/3,00,000 = 6.5.
DOL(Y) = Rs 30,00,000 – Rs 19,50,000)/2,70,000 = 3.88.

(iii) Royal Industries Ltd should purchase Y Ltd.

RQ.8.11 XYZ Ltd has an average selling price of Rs 10 per unit. Its variable unit costs are Rs 7, and fixed costs amount to Rs 1,70,000. It finances all its assets by equity funds. It pays 35 per cent tax on its income.

ABC Ltd is identical to XYZ Ltd, except in the pattern of financing. The latter finances its assets 50 per cent by equity and 50 per cent by debt, the interest on which amounts to Rs 20,000.

Determine the degree of operating, financial and combined leverage at Rs 7,00,000 sales for both the firms, and interpret the results.

SOLUTION

Determination of various types of leverage

Particulars	*XYZ Ltd*	*ABC Ltd*
Sales revenue	Rs 7,00,000	Rs 7,00,000
Less: variable cost (0.70)	4,90,000	4,90,000
fixed costs	1,70,000	1,70,000
EBIT (operating profit)	40,000	40,000
Less interest	Nil	20,000
EBT	40,000	20,000
Less taxes (0.35)	14,000	7,000
EAT	26,000	13,000
DOL = (Sales–VC)/EBIT	5.25	5.25
DFL = EBIT/(EBIT – I)	1	2
DCL = (Sale – VC)/(EBIT – I) (or DOL x DFL)	5.25	10.5

The DCL of the ABC Ltd is higher due to higher financial leverage. Its total risk is, therefore, higher althouh its DOL (operating risk) is equal to that of the XYZ Ltd.

RQ.8.12 The operating income of Hypothetical Ltd amounts to Rs 1,86,000. It pays 35 per cent tax on its income. Its capital structure consists of the following:

14% Debentures	Rs 5,00,000
15% Preference shares	1,00,000
Equity shares (Rs 100 each)	4,00,000

(i) Determine the firm's EPS.
(ii) Determine the percentage change in EPS associated with 30 per cent change (both increase and decrease) in EBIT.
(iii) Determine the degree of financial leverage at the current level of EBIT.
(iv) What additional data do you need to compute operating as well as combined leverage?

SOLUTION

(i) *Determination of EPS*

Particulars	*Amount*
EBIT	Rs 1,86,000
Less interest (0.14 × Rs 5,00,000)	70,000
EBT	1,16,000
Less taxes (0.35)	40,600
EAT	75,400
Less dividend on preference shares	15,000
Earnings available for equity holders	60,400
EPS (Rs 60,400 ÷ 4,000)	15.1

(ii) *Change in EPS*

Particulars	*Change in EBIT*	
	(+30%)	*(–30%)*
EBIT	Rs 2,41,800	Rs 1,30,200
Less interest	70,000	70,000

(*Contd.*)

(*Contd.*)

EBT	1,71,800	60,200
Less taxes (0.35)	60,130	21,070
EAT	1,11,670	39,130
Less dividends payable on preference shares	15,000	15,000
Earnings available for euity holders	96,670	24,130
EPS	24.17	6.03
Change in EPS (Δ EPS ÷ EPS)	(+60.05%)	(–60.05%)

(iii) DFL = EBIT/EBIT – I – [D_p/(1 – t)] = Rs 1,86,000/ (Rs 1,86,000 – Rs 70,000 – [Rs 15,000 ÷ (0.65)] = 2 (times).
(iv) The additional data required to compute the operating and combined leverage relate to sales and variable cost.

RQ.8.13 The operating and cost data of ABC Ltd are:

Sales	Rs 20,00,000
Variable costs	14,00,000
Fixed costs	4,00,000 (including 15 per cent interest on Rs 10,00,000)

Calculate its operating, financial and combined leverage.

SOLUTION

(i) *Income statement*

Sales revenue (SR)	Rs 20,00,000
Less variable cost (VC)	14,00,000
Less operating fixed costs (Rs 4,00,000 – 1,50,000)	2,50,000
EBIT	3,50,000
Less interest	1,50,000
Net earnings before taxes	2,00,000
DOL = (SR – VC)/EBIT	1.71
DFL = EBIT/(EBIT – I)	1.75
DCL = (DOL × DFL)	2.99

RQ.8.14 The Hypothetical Ltd's current EBIT is Rs 25 lakh. Its present borrowings are:

14% Term loans	Rs 40 lakh
Working capital borrowings from banks at (0.16)	33
15% Public deposits	15

The sales of the company are growing, and to support them the company proposes to obtain an additional bank loan of Rs 25 lakh. The increase in EBIT is expected to be 20 per cent. Calculate the change in interest coverage ratio after the additional borrowing and comment.

SOLUTION

Interest on present borrowings

Particulars	*Amount*	*Rate*	*Total interest*
Term loan	Rs 40,00,000	0.14	Rs 5,60,000
Bank loan	33,00,000	0.16	5,28,000
Public deposit	15,00,000	0.15	2,25,000
			13,13,000

Interest coverage ratio = EBIT/Interest = Rs 25,00,000/ Rs 13,13,000 = 1.90.

Revised EBIT = Rs 25,00,000 + 0.20 × (Rs 25,00,000) = Rs 30,00,000.

Revised interest = Rs 13,13,000 + 0.16 × (Rs 25,00,000) = Rs 17,13,000.

Interest coverage ratio (revised) = Rs 30,00,000/ Rs 17,13,000 = 1.75.

As a result of additional borrowing, the interest coverage ratio would decrease marginally from 1.90 to 1.75. Nevertheless, the expected profit would be adequate to meet the interest liability.

RQ.8.15 The operating profit (EBIT) of ABC Ltd is Rs 1,60,000. Its capital structure consists of the following:

10% Debentures	Rs 5,00,000
12% Preference shares	1,00,000
Equity shares of Rs 100 each	4,00,000

The company is in the 35 per cent tax bracket. The withholding tax on preference dividend is 10 per cent.

(i) Determine the firm's EPS.
(ii) Determine the percentage change in EPS associated with 30 per cent increase in EBIT.
(iii) Determine the degree of financial leverage.
(iv) Assuming DOL, 2, determine the DCL.

SOLUTION

(i) *Determination of EPS*

EBIT	Rs 1,60,000
Less interest (0.10 × Rs 5,00,000)	50,000
EBT	1,10,000
Less taxes (0.35 × Rs 1,10,000)	38,500
EAT	71,500
Less dividends on preference shares (Rs 12,000 + Rs 1,200, 10% withholding tax)	13,200
Earnings for equity holders	58,300
EPS (Rs 58,300 ÷ 4,000)	14.58

(ii) *Change in EPS (30 per cent increase in EBIT)*

EBIT	Rs 2,08,000
Less interest	50,000
EBT	1,58,500
Less taxes	55,475
EAT	1,03,025
Less dividends on preference shares including withholding tax	13,200
Earnings for equity holders	89,825
EPS	22.46
Percentage change in EPS (Δ EPS ÷ EPS) + 54.1	

(iii) DFL = EBIT/EBIT – I – [D_p + $Wt/(1 - t)$] = Rs 1,60,000/ Rs 1,60,000 – Rs 50,000 – Rs 20,308 = 1.78.
(iv) DCL = 1.78 × 2 = 3.56.

RQ.8.16 From the following financial data of companies, X Ltd and Y Ltd, prepare their income statements.

	X Ltd	*Y Ltd*
Variable cost as percentage of sales	50	60
Interest expense	Rs 20,000	6,000
DOL	3-1	5-1
DFL	2-1	3-1
Income tax rate	0.35	0.35

SOLUTION

Income statement of companies, *X* Ltd and *Y* Ltd

Particulars	*X Ltd*	*Y Ltd*
Sales revenue	Rs 2,40,000	Rs 1,12,500
Less: variable cost	1,20,000	67,500
fixed costs (sales – VC – EBIT)	80,000	36,000
EBIT	40,000	9,000
Less interest	20,000	6,000
EBT	20,000	3,000
Less taxes	7,000	1,050
EAT	13,000	1,950

Working Notes

X Ltd	*Y Ltd*
EBIT/(EBIT – Rs 20,000) = 2	EBIT/(EBIT – Rs 6,000) = 6
EBIT = 2(EBIT – Rs 20,000)	EBIT = 3(EBIT – Rs 6,000)
= Rs 40,000	= Rs 9,000
3 = (Sales – 0.5 sales)/Rs 40,000	5 = (Sales – 0.6 sales)/Rs 9,000
Rs 1,20,000 = 0.5 sales	Rs 45,000 = 0.4 sales
Sales = Rs 2,40,000	Sales = Rs 1,12,500
VC (0.5 sales)= Rs 1,20,000	VC (0.6 sales)= Rs 67,500

RQ.8.17 From the following, prepare income statement of A Ltd, B Ltd and C Ltd. Briefly comment on each company's performance:

Company	*A*	*B*	*C*
Financial leverage	3:1	4:1	2:1
Interest (Rs)	200	300	1,000
Operating leverage	4:1	5:1	3:1
Variable cost as a percentage of sales	66.33	75	50
Tax rate	35	35	35

SOLUTION

Income statements of companies A Ltd, B Ltd and C Ltd

Particulars	*A*	*B*	*C*
Sales revenue	Rs 3,600	Rs 8,000	Rs 12,000
Less variables costs	2,400	6,000	6,000
Less fixed costs (balancing figure)	900	1,600	4,000
EBIT	300	400	2,000
Less interest	200	300	1,000
EBT	100	100	1,000
Less taxes	35	35	350
EAT	65	65	650

Working Notes

A Ltd:

EBIT/(EBIT – Rs 200) = 3 or EBIT = 3 EBIT – Rs 600 or EBIT = Rs 300

(Sales – 2/3 sales)/Rs 300 = 4 or 1/3 sales = Rs 1,200 or sales = Rs 3,600

Variable costs = Rs 3,600 × 2/3 = Rs 2,400.

B Ltd:

EBIT/(EBIT – Rs 300) = 4 or EBIT = 4 EBIT – Rs 1,200 or EBIT = Rs 400

(Sales – 0.75 sales)/Rs 400 = 5 or 0.25 sales = Rs 2,000 or sales = Rs 8,000

Variable costs = Rs 8,000 × 0.75 = Rs 6,000.

C Ltd:

EBIT/(EBIT – Rs 1,000) = 2 or EBIT = 2 EBIT – Rs 2,000 or EBIT = Rs 2,000

(Sales – 0.5 sales)/2,000 = 3 or 0.5 sales = Rs 6,000 or sales = Rs 12,000.

Comment: The performance of C Ltd is the best. It has the lowest business risk, financial risk and total risk as reflected in the lowest degree of operating, financial and combined leverages. In addition, its interest coverage ratio is the maximum (2) as compared to 1.5 of A Ltd and 1.33 of B Ltd.

RQ.8.18 Calculate operating, financial and combined leverages under situations when fixed costs are (a) Rs 5,000 (b) Rs 10,000 and financial plans 1 and 2, respectively, from the following information pertaining to the operation and capital structure of XYZ Ltd.

Total assets		Rs 30,000
Total assets turnover based on sales		2
Variable costs as percentage of sales		60
Capital structure:	*Financial plans*	
	1	2
Equity	Rs 30,000	Rs 10,000
10% Debentures	10,000	30,000

SOLUTION

Determination of operating leverage

Particulars	*Situations*	
	(a)	*(b)*
Sales revenue	Rs 60,000	Rs 60,000
Less: variable costs	36,000	36,000
fixed costs	5,000	10,000
EBIT	19,000	14,000
DOL	1.26	1.71

Working Notes

Sales = Rs 60,000 (Rs 30,000 × 2)

VC = 0.60 × Rs 60,000 = Rs 36,000

DOL(a) = (Rs 60,000 – Rs 36,000)/19,000 = 1.26

DOL(b) = (Rs 60,000 – Rs 36,000)/14,000 = 1.71

Determination of financial and combined leverages

Particulars	*Plan 1*		*Plan 2*	
	(a)	*(b)*	*(a)*	*(b)*
EBIT	Rs 19,000	Rs14,000	Rs 19,000	Rs14,000
Less interest	1,000	1,000	3,000	3,000
EBT	18,000	13,000	16,000	11,000
DFL	1.06	1.08	1.19	1.27
DOL	1.26	1.71	1.26	1.71
DCL (DOL × DFL)	1.34	1.84	1.50	2.18

RQ.8.19 The following figures relate to two companies: (Rupees in lakh)

	P Ltd	*Q Ltd*
Sales	500	1,000
Variable cost	200	300
Contribution	300	700
Fixed cost	150	400
EBIT	150	300
Interest	50	100
Profit before tax	100	200

You are required to: (i) calculate the operating, financial and combined leverages for the two companies; and (ii) comment on their relative risk positions.

SOLUTION

(a) *Determination of operating, financial and combined leverage (Rupees in lakh)*

	P Ltd	*Q Ltd*
Sales	500	1,000
Less variable cost	200	300
Contribution	300	700
Fixed cost	150	400
EBIT	150	300
Less interest	50	100
EBT	100	200
DOL (contribution/EBIT)	2	2.33
DFL (EBIT/EBIT – I)	1.5:1	1.5
DCL (DOL × DFL)	3	3.5

Q Ltd has higher operating as well as total risk.

RQ.8.20 A firm has sales of Rs 20,00,000, variable costs of Rs 14,00,000, fixed costs of Rs 4,00,000, and a debt of Rs 10,00,000 at 10 per cent.

Calculate its operating, financial and combined leverages.

SOLUTION

DOL = (Sales – VC)/EBIT = (Rs 20,00,000 – Rs 14,00,000)/3,00,000 = 2

DFL = EBIT/(EBIT – I) = Rs 3,00,000/2,00,000 = 1.5

EBIT = Sales – VC – Fixed costs (other than interest of Rs 1,00,000) = Rs 20,00,000 – Rs 14,00,000 – Rs 3,00,000
= Rs 3,00,000.

DCL = DOL × DFL = 2 × 1.5 = 3

RQ.8.21 The Hypothetical Ltd is currently earning EBIT of Rs 12 lakh. Its present borrowings are:

11% Term loans (Rs lakh)	Rs 40
Working capital — borrowing from bank at 16%	33
12% Public deposit	15

The sales of the company are growing, and to support this the company proposes to obtain an additional bank borrowing of Rs 25 lakh. The increase in EBIT is expected to be 20 per cent. Calculate the change in interest coverage ratio after the additional borrowing and comment.

SOLUTION

Interest on present borrowings

	Amount	*Rate*	*Total interest*
Term loan	Rs 40,00,000	0.11	Rs 4,40,000
Bank loan	33,00,000	0.16	5,28,000
Public deposit	15,00,000	0.12	1,80,000
			11,48,000

Interest coverage ratio = EBIT/Interest = Rs 12,00,000/ Rs 11,48,000 = 1.05

Revised EBIT = Rs 12,00,000 + [0.20 × (Rs 12,00,000)] = Rs 14,40,000

Revised interest = Rs 11,48,000 + (0.16 × Rs 25,00,000) = Rs 15,48,000

Interest coverage ratio (revised) = Rs 14,40,000/ Rs 15,48,000 = 0.93

The interest coverage ratio is alarmingly low (0.93). This signifies that the firm's expected profit would not be adequate to meet the interest liability. Clearly, the proposal of additional borrowings to support growing sales is not a sound plan.

RQ.8.22 Calculate the DOL, DFL and DCL for the following firms and interpret the results, given the following data.

	P Ltd	*Q Ltd*	*R Ltd*
Output (units)	3,00,000	75,000	5,00,000
Fixed operating costs	Rs 3,50,000	Rs 7,00,000	Rs 75,000
Unit variable costs	1	7.50	0.10
Interest expenses	25,000	40,000	Nil
Unit selling price	3	25	0.50

SOLUTION

Determination of EBIT

	P Ltd	*Q Ltd*	*R Ltd*
Sales revenue	Rs 9,00,000	Rs 18,75,000	Rs 2,50,000
Less: fixed operating costs	3,50,000	7,00,000	75,000
variable costs	3,00,000	5,62,500	50,000
	2,50,000	6,12,500	1,25,000

Computation of operating, financial and combined leverages

DOL(P) = Rs 6,00,000/Rs 2,50,000	2.40
DOL(Q) = Rs 13,12,500/Rs 6,12,500	2.14
DOL(R) = Rs 2,00,000/Rs 1,25,000	1.60
DFL(P) = Rs 2,50,000/Rs (2,50,000 – Rs 25,000)	1.11
DFL(Q) = Rs 6,12,500/Rs (6,12,500 – Rs 40,000)	1.07
DFL(R) = Rs 1,25,000/Rs (1,25,000 – 0)	1
DCL(P) = 2.40 × 1.11	2.66
DCL(Q) = 2.14 × 1.07	2.29
DCL(R) = 1.60 × 1.00	1.60

Interpretation of results: The DOL and DFL measures business risk and financial risk, respectively. The product of the two leverages is a measure of the total risk complexion of a firm. On this basis, out of the three, P Ltd appears to be the most risky as its individual as well as combined leverage are the highest and R Ltd is the least risky as its operating, financial, and combined leverages are the lowest. However, P Ltd and Q Ltd may not be risky at all for two reasons: (a) the values of operating, financial and combined leverages are low, and (b) the firms have adequate interest coverage (EBIT/interest) ratio; it is 10 times in the case of P Ltd, and more than 15 times in the case of firm Q Ltd.

RQ.8.23 Calculate operating leverage and financial leverage under situations A, B and C and financial plans I, II and III respectively from the following information relating to the operations and capital structure of XYZ Ltd for producing additional 800 units.

Also, find out the combination of operating and financial leverages which gives the highest value and the least value. How are these calculations useful to the finance manager of the company?

Selling price per unit: Rs 30

Variable cost per unit: Rs 20

Fixed operating costs:

Situation A	Rs 2,000
B	4,000
C	6,000

Capital structure:

	Financial plan		
	I	*II*	*III*
Equity	Rs 10,000	Rs 15,000	Rs 5,000
Debt (0.12)	10,000	5,000	15,000

SOLUTION

Determination of DOL in situations A, B and C.

Particulars	*Situations*		
	A	*B*	*C*
Sales revenue (800 × Rs 30)	Rs 24,000	Rs 24,000	Rs 24,000
Less variable costs (800 × Rs 20)	16,000	16,000	16,000
Contribution	8,000	8,000	8,000
Less fixed costs	2,000	4,000	6,000
EBIT	6,000	4,000	2,000
DOL (contribution/EBIT)	1.33	2	4

Determination of DFL in various situations and under alternative financial plans

Particulars	*Alternative financial plans*		
	I	*II*	*III*
Situation A:			
EBIT	Rs 6,000	Rs 6,000	Rs 6,000
Less interest	1,200	600	1,800
EBT	4,800	5,400	4,200
DFL (EBIT/(EBIT – I)	1.25	1.11	1.43
Situation B:			
EBIT	4,000	4,000	4,000
Less interest	1,200	600	1,800
EBT	2,800	3,400	2,200
DFL	1.43	1.18	1.82
Situation C:			
EBIT	2,000	2,000	2,000
Less interest	1,200	600	1,800
EBT	800	1,400	200
DFL	2.5	1.43	10

Determination of combined leverage in situations A, B and C and under financial plans, I, II and III.

Particulars	*Situation A*			*Situation B*			*Situation C*		
	I	*II*	*III*	*I*	*II*	*III*	*I*	*II*	*III*
DOL	1.33	1.33	1.33	2	2	2	4	4	4
DFL	1.25	1.11	1.43	1.43	1.18	1.82	2.5	1.43	10
DCL	1.66	1.48	1.90	2.86	2.36	3.64	10	5.72	40

(i) Situation A (with fixed costs = Rs 2,000) under financial plan II (equity = Rs 15,000) gives the lowest DCL (1.48).
(ii) Situation C (with fixed costs = Rs 6,000) under financial plan III (debt = Rs 15,000) gives the highest DCL (40).

EXAMINATION QUESTIONS

EQ.8.1 Differentiate between business risk and financial risk. (*CA (PE-II)—May, 2007*)

EQ.8.2 The data relating to two companies are as given below:

	Company A	*Company B*
Equity capital	Rs 6,00,000	Rs 3,50,000
12% debentures	4,00,000	6,50,000
Output (units) per annum	60,000	15,000
Selling price/unit	30	250
Fixed costs per annum	7,00,000	14,00,000
Variable cost per unit	10	75

You are required to calculate the operating leverage, financial leverage and combined leverage of two companies (*CA—November, 2002*)

SOLUTION

Computation of operating leverage, financial leverage and combined leverage of companies A and B

Particulars	*Company A*	*Company B*
Output produced per annum	60,000 units	15,000 units
Selling price (SP) per unit	Rs 30	Rs 250
Variable cost (VC) per unit	Rs 10	Rs 75
Sales revenue (Units × SP per unit)	Rs 18,00,000	Rs 37,50,000
Less variable costs (Units × VC per unit)	6,00,000	11,25,000
Contribution (Sales revenue – Variable costs)	12,00,000	26,25,000
Less fixed costs (Operating)	7,00,000	14,00,000
Earnings before interest and taxes (EBIT)	5,00,000	12,25,000
Less interest on debentures @ 12%	48,000	78,000
Earnings before taxes (EBT)	4,52,000	11,47,000
Operating leverage (Contribution/EBIT)	2.4	2.14
Financial leverage (EBIT/EBT)	1.11	1.07
Combined leverage (Contribution/EBT) or	2.65	2.29
Alternatively (Operating leverage × Financial leverage)	2.66	2.29

EQ.8.3 Calculate the level of earnings before interest and tax (EBIT) at which the EPS indifference point between the following financing alternatives will occur.

(i) Equity share capital of Rs 6,00,000 and 12 per cent debentures of Rs 4,00,000.

or

(ii) Equity share capital of Rs 4,00,000, 14 per cent preference share capital of Rs 2,00,000 and 12 per cent debentures of Rs 4,00,000.

Assume the corporate tax rate is 35 per cent and par value of equity shares is Rs 10 in each case.

(*CA—May, 2003*)

SOLUTION

Determination of indifference level of EBIT (X)

$[(X - I)(1 - t)]/ N_1 = [(X - I)(1 - t) - D_p]/ N_2$

$[(X - Rs\ 48{,}000)\ 0.65]/60{,}000 = [(X - Rs\ 48{,}000)\ 0.65 - Rs\ 28{,}000]/40{,}000$

Or $(0.65X - Rs\ 31{,}200)/60{,}000 = (0.65X - Rs\ 31{,}200 - Rs\ 28{,}000)/40{,}000$

Or $2(0.65X - Rs\ 31{,}200) = 3\ (0.65X - Rs\ 59{,}200)$

Or $1.3X - Rs\ 62{,}400 = 1.95X - Rs\ 1{,}77{,}600$

Or $0.65X = Rs\ 1{,}15{,}200;\ X = Rs\ 1{,}15{,}200/0.65 = Rs\ 1{,}77{,}231$

EQ.8.4 The following summarises the percentage changes in operating income, percentage changes in revenues, and betas for four pharmaceutical firms.

Firm	*Change in revenue*	*Change in operating income*	*Beta*
PQR Ltd.	27%	25%	1.00
RST Ltd.	25%	32%	1.15
TUV Ltd.	23%	36%	1.30
WXY Ltd.	21%	40%	1.40

Required:

(i) Calculate the degree of operating leverage for each of these firms. Comment also. (ii) Use the operating leverage to explain why these firms have different beta. (*CA—November, 2004*)

SOLUTION

(i) Computation of degree of operating leverage of firms

DOL = (% change in EBIT/% Change in revenue)
PQR Ltd. = 25%/27% = 0.9259 DOL
RST Ltd. = 32%/25% = 1.28
TUV Ltd. = 36%/23% = 1.5652
WXY Ltd. = 40%/21% = 1.9048

(ii) Relationship between DOL and beta

Firm	*DOL*	*Beta*
PQR Ltd.	0.9259	1.00
RST Ltd.	1.28	1.15
TUV Ltd.	1.5652	1.30
WXY Ltd.	1.9048	1.40

Operating leverage is the measure of operating/business risk. Higher is the DOL, higher is the risk assumed by the firm. Therefore, high DOL leads to high beta. The firm PQR Ltd with the lowest DOL (0.9259) has the lowest beta (1.00) and the firm WXY Ltd has the highest beta valu e of 1.40 (as this firm has the maximum DOL at 1.9048).

EQ 8.5 A Company needs Rs 31,25,000 for the construction of new plant. The following three plans are feasible:

I. The Company may issue 3,12,500 eauity shares at Rs 10 per share.
II. The Company may issue 1,56,250 ordinary equity shares at Rs 10 per share and 15,625 debentures of Rs 100 denomination bearing a 8% rate of interest.
III. The Company may issue 1,56,250 equity shares at Rs 10 per share and 15,625 preference shares at Rs 100 per share bearing a 8% rate of dividend.

(i) If the Company's earnings before interest and taxes are Rs 1,25,000, Rs 2,50,000, Rs. 3,75,000 and Rs 6,25,000, what are the earnings per share under each of three financial plans? Assume a corporate income-tax rate of 40%.
(ii) Which alternative would you recommend and why?
(iii) Determine the EBIT-EPS indifference points by formulae between Financing Plan I and Plan II and Plan I and Plan III. (*CA—November, 2005*)

SOLUTION

(i) Statement showing determination of EPs at varying EBIT amounts under different financed plans.

Particulars	*EBIT*											
	Rs 1,25,000			*Rs 2,50,000*			*Rs 3,75,000*			*Rs 6,25,000*		
	I	*II*	*III*	*I*	*II*	*III*	*I*	*II*	*III*	*I*	*II*	*III*
EBIT	1,25,000	1,25,000	1,25,000	2,50,000	2,50,000	2,50,000	3,75,000	3,75,000	3,75,000	6,25,000	6,25,000	6,25,000
Less interest	—	1,25,000	—	—	1,25,000	—	—	1,25,000	—	—	1,25,000	—
EBT	1,25,000	—	1,25,000	2,50,000	1,25,000	2,50,000	3,75,000	2,50,000	3,75,000	6,25,000	5,00,000	6,25,000
Less taxes (0.4)	50,000		50,000	1,00,000	50,000	1,00,000	1,50,000	1,00,000	1,50,000	2,50,000	2,00,000	2,50,000
EAT	75,000	—	75,000	1,50,000	75,000	1,50,000	2,25,000	1,50,000	2,25,000	3,75,000	3,00,000	3,75,000
Less dividend on preference shares	—	—	1,25,000	—	—	1,25,000	—	—	1,25,000	—	—	1,25,000
Earnings for equity shares	75,000	—	(50,000)	1,50,000	75,000	25,000	2,25,000	1,50,000	1,00,000	3,75,000	3,00,000	2,50,000

(*Contd*)

(*Contd*)

Dividend by number of equity shares	3,12,500	1,56,250	1,56,250	3,12,500	1,56,250	1,56,250	3,12,500	1,56,250	1,56,250	3,12,500	1,56,250	1,56,250
EPS	0.24	0	(0.32)	0.48	0.48	0.16	0.72	0.96	0.64	1.20	1.92	1.6

(ii) The choice of financial alternative depends on the level of EBIT which the company would be able to earn. In case, there is a very high probability of earning EBIT of more than Rs 2,50,000, financial plan II (based on debt-equity mix of 1 : 1) is desirable as it leads to higher EPS. Plan I (equity plan) should be preferred in the case of likely EBIT of less than Rs 2,50,000. Plan III is unsuitable under all situations.

(iii) (a) Indifference point (Financial plans I and II)

$$\frac{X(1-t)}{N_1} = \frac{(X-I)(1-t)}{N_2}$$

$$\frac{X(1-0.4)}{3,12,500} = \frac{(X - \text{Rs}\,1,25,000)\,0.6}{1,56,250}$$

$$\frac{0.6X}{3,12,500} = \frac{0.6X - \text{Rs}\,75,000}{1,56,250}$$

$0.6X = 2(0.6X - \text{Rs}\ 75,000)$ or $1.2X - 1,50,000$

$0.6X = \text{Rs}\ 1,50,000$ or $X = \text{Rs}\ 1,50,000/0.6 = \text{Rs}\ 2,50,000$

(b) Financial plans I and III

$$\frac{X(1-t)}{N_1} = \frac{X(1-t) - D_p}{N_2}$$

$$\frac{0.6X}{3,12,500} = \frac{0.6X - \text{Rs}\,1,25,000}{1,56,250}$$

$0.6X = 2(0.6X - \text{Rs}\ 1,25,000)$ or $1.2X - 2,50,000$

$0.6X = \text{Rs}\ 2,50,000$ or $X = \text{Rs}\ 2,50,000/0.6 = \text{Rs}\ 4,16,667$

EQ. 8.6 A company had the following Balance Sheet as on March 31, current year:

Liabilities and Equity	*Rs (in crore)*	*Assets*	*Rs (in crore)*
Equity share capital (one crore shares of Rs 10 each)	10	Fixed assets (Net)	25
Reserves and surplus	2	Current assets	15
15% Debentures	20		
Current liabilities	8		
	40		40

The additional information given is as under:

Fixed costs per annum (excluding interest)	Rs 8 crore
Variable operating costs ratio	65%
Total Assets turnover ratio	2.5
Income-tax rate	40%

Calculate the following and comment: (i) Earnings per share (ii) Operating Leverage (iii) Financial Leverage (iv) Combined Leverage. (*CA—November, 2006*)

SOLUTION

Determination of earnings per share (EPS) and various leverages (Amount in Rs crores)

Particulars	*Amount*
Sales revenue (2.5 total assets turnover ratio × Rs 40 crore total assets)	Rs 100
Less variable costs (Rs 100 crore × 0.65)	65
Total contribution	35
Less operating fixed costs	8
Earnings before interest and taxes (EBIT)	27
Less interest (Rs 20 crore debentures × 0.15)	3
Earnings before taxes	24
Less taxes (Rs 24 × 0.4)	9.6
Earning after taxes	14.4
	Rs 14.4
(i) EPS Rs 14.4 crore/1 crore equity share	14.4
(ii) Operating leverage (Contribution/EBIT) = Rs 35/Rs 27	1.296
(iii) Financial leverage [EBIT/(EBIT-I) = Rs 27/24	1.125
(iv) Combined leverage 1.296 × 1.125	1.458

Comment: Leverages are measures of risk. Since values of all leverages are less than 1.5 (the range being 1.125 – 1.458), the firm has lower operating risk, financial risk and total risk.

EQ. 8.7 The following details of RST limited for the current year ended 31 March are given below:

Operating leverage	1.4
Combined leverage	2.8
Fixed cost (excluding interest)	Rs 2.04 lakh
Sales	Rs 30.00 lakh
12% Debentures of Rs 100 each	21.25 lakh
Equity share capital of Rs 10 each	Rs 17.00 lakh
Income tax rate	30 per cent

Required: (i) Calculate financial leverage. (ii) Calculate P/V ratio and Earning per Share (EPS). (iii) If the company belongs to an industry, whose assets turnover (based on sales) is 1.5, does it have a high or low assets leverage? (iv) At what level of sales the Earning before Tax (EBT) of the company will be equal to zero? (*CA (PCE)—May, 2006*)

SOLUTION

(i) *Determination of financial leverage*
Combined leverage = (Operating leverage × Financial leverage)
2.8 = 1.4 × Financial leverage
Financial leverage = 2.8/1.4 = 2.

(ii) (a) *Determination of P/V ratio*
Operating leverage = (SR – VC = Contribution, C)/C – FC, operating
1.4 = C/(C – 2,04,000)
1.4C – Rs 2,85,600 = C
C = Rs 2,85,600/0.4 = Rs 7,14,000
P/V ratio (also known as C/V ratio) = Rs 7,14,000/Rs 30,00,000 = 23.8%

(b) *Determination of EPS*

Sales revenue	Rs 30,00,000
Less variable costs (Rs 30,00,000 – Rs 7,14,000)	22,86,000

Less operating fixed costs	2,04,000
Less interest (Rs 21,25,000 × 0.12)	2,55,000
Earning before taxes (EBT)	2,55,000
Less taxes (Rs 2,55,000 × 0.3)	76,500
Earnings after taxes	1,78,500
Dividend by number of equity shares	1,70,000
EPS	Rs 1.05

(iii) Assets turnover ratio = Total sales/Total assets = Rs 30,00,000/Rs 38,25,000 (Equity capital + Debentures) = 0.78

The company has lower assets leverage as 0.78 is lower than industry average of 1.5. In fact, the company's assets leverage is likely to be lower than 0.78 as total liabilities (and so the total assets) are likely to be higher by the amount of current liabilities and reserves.

(iv) *Determination of sales at which EBT is zero.*

Total fixed costs + Total variable costs = Total sales (x) Rs 4,59,000 + 0.762x = x

x = Rs 4,59,000/0.238 = Rs 19,28,571.

9 Capital Structure, Cost of Capital and Valuation

Introduction

The discussions in the preceding chapter have shown that financial leverage has a magnifying effect on EPS, such that, for a given level of change in EBIT, there will be a more than proportionate change in the same direction in the EPS. But financial leverage also increases the financial risk, defined as the risk of possible insolvency arising out of inadequacy of available cash as well as the variability in the earnings available to the ordinary shareholders. Given the objective of the firm to maximise the value of the equity shares, the firm should select a financing-mix/capital structure/financial leverage which will help in achieving the objective of financial management. As a corollary, the capital structure should be examined from the viewpoint of its impact on the *value* of the firm. It can be legitimately expected that if the capital structure decision affects the total value of the firm, a firm should select such a financing-mix as will maximise the shareholders' wealth. Such a capital structure is referred to as the optimum capital structure. The optimum capital structure may be defined as the *capital structure or combination of debt and equity that leads to the maximum value of the firm*.

The importance of an appropriate capital structure is, thus, obvious. There is a viewpoint that strongly supports the close relationship between leverage and value of a firm. There is an equally strong body of opinion which believes that financing-mix or the combination of debt and equity has no impact on the shareholders' wealth and the decision on financial structure is irrelevant. In other words, there is nothing such as *optimum capital structure*.

In theory, capital structure can affect the value of a company by affecting either its expected earnings or the cost of capital, or both. While it is true that financing-mix cannot affect the total operating earnings of a firm, as they are determined by the investment decisions, it can affect the share of earnings belonging to the ordinary shareholders. The capital structure decision can influence the value of the firm through the earnings available to the shareholders. But the leverage can largely influence the value of the firm through the cost of capital. In exploring the relationship between leverage and value of a firm in this chapter we are concerned with the relationship between leverage and cost of capital from the standpoint of valuation. While section one deals with the assumptions, definition and symbols relating to capital structure theories, the next four sections of the chapter

explain the major capital structure theories, namely: (i) Net Income Approach, (ii) Net Operating Income Approach, (iii) Modigliani-Miller (MM) Approach, and (iv) Traditional Approach. The last section summarises the main points.

CAPITAL STRUCTURE THEORIES

Assumptions

1. There are only two sources of funds used by a firm: perpetual riskless debt and ordinary shares.
2. There are no corporate taxes. This assumption is removed later.
3. The dividend-payout ratio is 100. That is, the total earnings are paid out as dividend to the shareholders and there are no retained earnings.
4. The total assets are given and do not change. The investment decisions are, in other words, assumed to be constant.
5. The total financing remains constant. The firm can change its degree of leverage (capital structure) either by selling shares and use the proceeds to retire debentures or by raising more debt and reduce the equity capital.
6. The operating profits (EBIT) are not expected to grow.
7. All investors are assumed to have the same subjective probability distribution of the future expected EBIT for a given firm.
8. Business risk is constant over time and is assumed to be independent of its capital structure and financial risk.
9. Perpetual life of the firm.

Definitions and Symbols

In addition to the above assumptions, we shall make use of some symbols in our analysis of capital structure theories:

S = total market value of equity
B = total market value of debt
I = total interest payments
V = total market value of the firm ($V = S + B$)
NI = net income available to equity holders.

We shall also make use of some basic definitions:

(1) Cost of debt $(k_i) = \dfrac{I}{B}$ (9.1)

Value of debt $(B) = \dfrac{I}{k_i}$ (9.2)

(2) Cost of equity capital $(k_e) = \dfrac{D_1}{P_0} + g$ (9.3)

where D_1 = net dividend; P_0 = current market price of shares and g is the expected growth rate. According to assumption (3), the percentage of retained earnings is zero. Since $g = br$, where r is the rate of return on equity shares and b is the retention rate, $g = 0$, the growth rate is zero. This is consistent with assumption (6). In operational terms $D_1 = E_1$, $g = 0$. Therefore,

$$k_e = \frac{E_1}{P_0} + g = \frac{E_1}{P_0} + 0 = \frac{E_1}{P_0} \tag{9.4}$$

where E_1 = earnings per share. Equation 9.4 is on a per share basis. Multiplying both the numerator and the denominator by the number of shares outstanding (N) and assuming there are no income taxes, we have

$$K_e = \frac{E_1 (\times) N}{P_0 (\times) N} = \frac{\text{EBIT} - I \text{ or } NI}{S}$$

or
$$= \frac{\text{Net income available to equity holders}}{\text{Total market value of equity shares}} \tag{9.5}$$

Thus, k_e may be defined on either per share or total basis.

From Eqs. 9.4 and 9.5 follow the equations of determining the value of equity shares on per share basis and total basis.

(i) *Per share basis*, $P_0 = \dfrac{E_1}{k_e}$ (9.6)

(ii) *Total basis*, $S = P_0 N = \dfrac{EBIT - I}{k_e}$ (9.7)

(iii) *Overall cost of capital or weighted average cost of capital:*

$K_0 = W_1 k_i + W_2 k_e$ (where W_1 and W_2 are relative weights)

$$= (\text{B/V})\, k_i + (S/V) k_e = \left[\frac{B}{B+S}\right] k_i + \left[\frac{S}{B+S}\right] k_e \tag{9.8}$$

or
$$k_0 = \frac{I + NI}{V} = \frac{EBIT}{V} \tag{9.9}$$

From Eq. 11.9 follows the equation of total value of the firm. Thus,

$$V = \frac{EBIT}{k_0} \tag{9.10}$$

Alternatively:
$$V = \frac{I}{k_i} + \frac{EBIT - I}{k_e} \tag{9.11}$$

Another useful way of measuring the cost of equity capital is described below:

We know k_0 is the weighted average of the cost of equity and the cost of debt. Symbolically,

$$k_0 = \left[\frac{B}{B+S}\right] k_i + \left[\frac{S}{B+S}\right] k_e \tag{9.8}$$

$$= k_i \left(\frac{B}{V}\right) + k_e \left(\frac{S}{V}\right) \tag{9.8.1}$$

$$k_e = \frac{k_0 - k_i (B/V)}{S/V} \tag{9.8.2}$$

We know that $V = B + S$. Therefore, equity ratio, S/V can be expressed as:

$$\frac{S}{V} = \frac{S}{B+S} = 1 - \frac{B}{B+S} \tag{9.8.3}$$

Substituting the value of Eq. 9.8.3 in Eq. 9.8.2, we have

$$k_e = k_0 - k_i \left[\frac{B}{B+S}\right] \Big/ 1 - \frac{B}{B+S}$$

$$= \frac{k_0 (B+S) - k_i B}{B+S} \Big/ \frac{B+S-B}{B+S} \tag{9.8.4}$$

Or

$$= \frac{k_0 B + k_0 S - k_i B}{B+S} \Big/ \frac{S}{B+S} \tag{9.8.5}$$

Simplifying Eq. 9.8.5, we have

$$k_e = \frac{k_0 B + k_0 S - k_i B}{S} \tag{9.8.6}$$

$$k_e = k_0 + (k_0 - k_i)\, B/S \tag{9.12}$$

While exploring the relationship between capital structure and value of the firm, our concern is with the cost of equity capital (k_e), cost of debt (k_i) and overall cost of capital (k_0) when the capital structure/leverage changes, as measured by the change in the relationship between total value of debt and debt to total of ordinary shares (B/S).

NET INCOME APPROACH

According to the Net Income (NI) Approach, suggested by the Durand[1], the capital structure decision is relevant to the valuation of the firm. In other words, a change in the financial leverage will lead to a corresponding change in the overall cost of capital as well as the total value of the firm. If, therefore, the degree of financial leverage as measured by the ratio of debt to equity is increased, the weighted average cost of capital will decline, while the value of the firm as well as the market price of ordinary shares will increase. Conversely, a decrease in the leverage will cause an increase in the overall cost of capital and a decline both in the value of the firm as well as the market price of equity shares.

The NI Approach to valuation is based on three assumptions: first, there are no taxes; second, that the cost of debt is less than the equity-capitalisation rate or the cost of equity; third, that the use of debt does not change the risk perception of investors. That the financial risk perception of the investors does not change with the introduction of debt or change in leverage implies that due to change in leverage, there is no change in either the cost of debt or the cost of equity. The implication of the three assumptions underlying the NI Approach is that as the degree of leverage increases, the proportion of a cheaper source of funds, that is, debt in the capital structure increases. As a result, the weighted average cost of capital tends to decline,

leading to an increase in the total value of the firm. Thus, with the cost of debt and cost of equity being constant, the increased use of debt (increase in leverage), will magnify the shareholder's earnings and, thereby, the market value of the ordinary shares.

The financial leverage is, according to the NI Approach, an important variable to the capital structure of a firm. With a judicious mixture of debt and equity, a firm can evolve an optimum capital structure which will be the one at which value of the firm is the highest and the overall cost of capital is the lowest. At that structure, the market price per share would be maximum.

If the firm uses no debt or if the financial leverage is zero, the overall cost of capital will be equal to the equity-capitalisation rate. The weighted average cost of capital will decline and will approach the cost of debt as the degree of leverage reaches one.

The NI Approach is illustrated in Example 9.1.

EXAMPLE 9.1

A company's expected annual net operating income (EBIT) is Rs 50,000. The company has Rs 2,00,000, 10% debentures. The equity capitalisation rate (k_e) of the company is 12.5 per cent.

SOLUTION

With no taxes, the value of the firm, according to the Net Income Approach is depicted in Table 9.1.

Table 9.1 *Value of the Firm (Net Income Approach)*

Net operating income (EBIT)	Rs 50,000
Less interest on debentures (*I*)	20,000
Earnings available to equity holders (*NI*)	30,000
Equity capitalisation rate (k_e)	0.125
Market value of equity (S) = NI/k_e	2,40,000
Market value of debt (B)	2,00,000
Total value of the firm ($S + B$) = V	4,40,000
Overall cost of capital = k_0 = EBIT/V	11.36 per cent
Alternatively: $k_0 = k_i\,(B/V) + k_e(S/V)$ where *ki* and k_e are cost of debt and cost of equity respectively, $= 0.10\left(\frac{\text{Rs } 2,00,000}{\text{Rs } 4,40,000}\right) + 0.125\left(\frac{\text{Rs } 2,40,000}{\text{Rs } 4,40,000}\right)$	11.36 per cent

Increase in Value

In order to examine the effect of a change in financing-mix on the firm's overall (weighted average) cost of capital and its total value, let us suppose that the firm has decided to raise the amount of debenture by Rs 1,00,000 and use the proceeds to retire the equity shares. The k_i and k_e would remain unaffected as per the assumptions of the NI Approach. In the new situation, the value of the firm is shown in Table 9.2.

Table 9.2 *Value of the Firm (Net Income Approach)*

Net operating income (EBIT)	Rs 50,000
Less interest on debentures (*I*)	30,000
Earnings available to equity holders (*NI*)	20,000
Equity capitalisation rate (k_e)	0.125

(*Contd.*)

(*Contd.*)

Market value of equity (S) = NI/k_e	1,60,000
Market value of debt (B)	3,00,000
Total value of the firm ($S + B$) = V	4,60,000

$$k_0 = \left[\frac{\text{Rs } 50{,}000}{\text{Rs } 4{,}60{,}000}\right] \quad \text{Or} \quad 0.10\left[\frac{\text{Rs } 3{,}00{,}000}{\text{Rs } 4{,}60{,}000}\right] + 0.125\left[\frac{\text{Rs } 1{,}60{,}000}{\text{Rs } 4{,}60{,}000}\right] \qquad 10.9 \text{ per cent}$$

Thus, the use of additional debt has caused the total value of the firm to increase and the overall cost of capital to decrease.

Decrease in Value

If we decrease the amount of debentures in the original Example 9.1, the total value of the firm, according to the NI Approach, will decrease and the overall cost of capital will increase. Let us suppose that the amount of debt has been reduced by Rs 1,00,000 to Rs 1,00,000 and a fresh issue of equity shares is made to retire the debentures. Assuming other facts as given in Example 9.1, the value of the firm and the weighted average cost of capital are shown in Table 9.3.

Table 9.3 *Value of the Firm (Net Income Approach)*

Net operating income (EBIT)	Rs 50,000
Less interest on debentures (I)	10,000
Earnings available to equity holders (NI)	40,000
Equity capitalisation rate (k_e)	0.125
Market value of equity (S) = NI/k_e	3,20,000
Market value of debt (B)	1,00,000
Total value of the firm ($S + B$) = V	4,20,000

$$k_0 = \frac{\text{Rs } 50{,}000}{\text{Rs } 4{,}20{,}000} \quad \text{Or} \quad 0.10\left[\frac{\text{Rs } 1{,}00{,}000}{\text{Rs } 4{,}20{,}000}\right] + 0.125\left[\frac{\text{Rs } 3{,}20{,}000}{\text{Rs } 4{,}20{,}000}\right] \qquad 11.9 \text{ per cent}$$

Thus, we find that the decrease in leverage has increased the overall cost of capital and has reduced the value of firm.

Market Price

Thus, according to the NI Approach, the firm can increase/decrease its total value (V) and lower/increase its overall cost of capital (k_0) as it increases/decreases the degree of leverage. As a result, the market price per share is affected. To illustrate, assume in Example 9.1 that the firm with Rs 2,00,000 debt has 2,400 equity shares outstanding. The market price per share works out to Rs 100 (Rs 2,40,000 ÷ 2,400). The firm issues Rs 1,00,000 additional debt and uses the proceeds of the debt to repurchase/retire Rs 1,00,000 worth of equity shares or 1,000 shares. It, then, has 1,400 shares outstanding. We have observed in Example 9.1 that the total market value of the equity after the change in the capital structure is Rs 1,60,000 (Table 9.2). Therefore, the market price per share is Rs 114.28 (Rs 1,60,000 ÷ 1,400), as compared to the original price of Rs 100 per share. Likewise, when the firm employs less amount of debt, the market value per share declines. To continue with Example 9.1, the firm raises Rs 1,00,000 additional equity capital by

issuing 1,000 equity shares of Rs 100 each and uses the proceeds to retire the debenture amounting to Rs 1,00,000. It would then have 3,400 shares (2,400 old + 1,000 new) outstanding. With this capital structure, we have seen in Example 9.1 that the total market value of equity shares is Rs 3,20,000 (Table 9.3). Therefore, the market price per share has declined to Rs 94.12 (Rs 3,20,000 ÷ 3,400) from Rs 100 before a change in the leverage.

We can graph the relationship between the various factors (k_e, k_i, k_0) with the degree of leverage (Fig. 9.1).

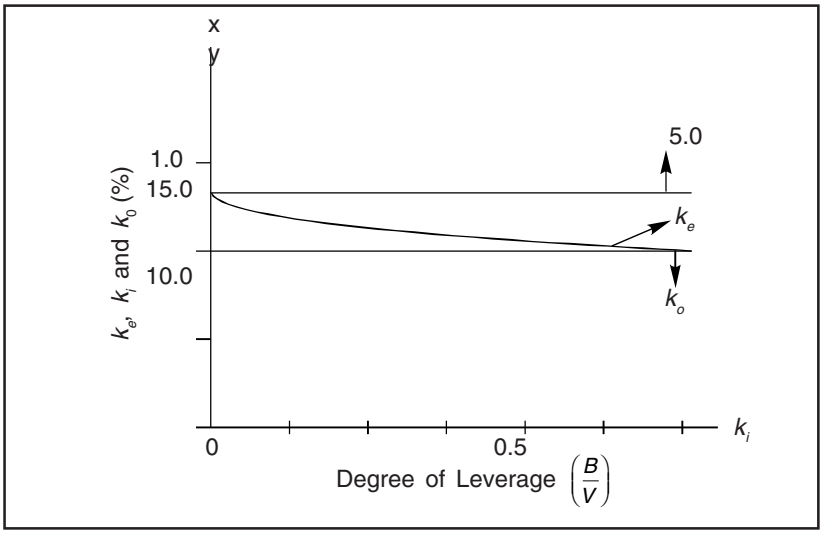

Figure 9.1 *Leverage and Cost of Capital (NI Approach)*

The degree of leverage (B/V) is plotted along the X-axis, while the percentage rates of k_i, k_e and k_0 are on the Y-axis. This graph is based on Example 9.1. Due to the assumptions that k_e and k_i remain unchanged as the degree of leverage changes, we find that both the curves are parallel to the X-axis. But as the degree of leverage increases, k_0 decreases and approaches the cost of debt when leverage is 1.0, that is, ($k_0 = k_i$). It will obviously be so owing to the fact that there is no equity capital in the capital structure. At this point, the firm's overall cost of capital would be minimum. The significant conclusion, therefore, of the NI Approach is that the firm can employ almost 100 per cent debt to maximise its value.

NET OPERATING INCOME (NOI) APPROACH

Another theory of capital structure, suggested by Durand[2], is the Net Operating Income (NOI) Approach. This Approach is diametrically opposite to the NI Approach. The essence of this Approach is that the capital structure decision of a firm is irrelevant. Any change in leverage will not lead to any change in the total value of the firm and the market price of shares as well as the overall cost of capital is independent of the degree of leverage.

The NOI Approach is based on the following propositions.

Overall Cost of Capital/Capitalisation Rate (k_0) is Constant

The NOI Approach to valuation argues that the overall capitalisation rate of the firm remains constant, for all degrees of leverage. The value of the firm, given the level of EBIT, is determined by Eq. 9.13.

$$V = \frac{\text{EBIT}}{k_0} \tag{9.13}$$

In other words, the market evaluates the firm as a whole. The split of the capitalisation between debt and equity is, therefore, not significant.

Residual Value of Equity

The value of equity is a residual value which is determined by deducting the total value of debt (B) from the total value of the firm (V). Symbolcially, Total market value of equity capital (S) = $V - B$.

Changes in Cost of Equity Capital

The equity-capitalisation rate/cost of equity capital (k_e) increases with the degree of leverage. The increase in the proportion of debt in the capital structure relative to equity shares would lead to an increase in the financial risk to the ordinary shareholders. To compensate for the increased risk, the shareholders would expect a higher rate of return on their investments. The increase in the equity-capitalisation rate (or the lowering of the price-earnings ratio, that is, P/E ratio) would match the increase in the debt-equity ratio. The

k_e would be $= k_0 + (k_0 - k_i)\left[\frac{B}{S}\right]$

Cost of Debt

The cost of debt (k_i) has two parts: (a) *Explicit cost* which is represented by the rate of interest. Irrespective of the degree of leverage, the firm is assumed to be able to borrow at a given rate of interest. *This implies that the increasing proportion of debt in the financial structure does not affect the financial risk of the lenders* and they do not penalise the firm by charging higher interest; (b) *Implicit or 'hidden' cost*. As shown in the assumption relating to the changes in k_e, increase in the degree of leverage or the proportion of debt to equity causes an increase in the cost of equity capital. This increase in k_e, being attributable to the increase in debt, is the implicit part of k_i.

Thus, the advantage associated with the use of debt, supposed to be a 'cheaper' source of funds in terms of the explicit cost, is exactly neutralised by the implicit cost represented by the increase in k_e. As a result, *the real cost of debt and the real cost of equity*, according to the NOI Approach, are the same and equal k_0.

Optimum Capital Structure

The total value of the firm is unaffected by its capital structure. No matter what the degree of leverage is, the total value of the firm will remain constant. The market price of shares will also not change with the change in the debt-equity ratio. There is nothing such as an *optimum capital structure*. Any capital structure is optimum, according to the NOI Approach.

The effect of NOI Approach on value of the firm, k_e, and the market price per share is illustrated in Example 9.2.

EXAMPLE 9.2

Assume the figures given in Example 9.1: operating income Rs 50,000; cost of debt, 10 per cent; and outstanding debt, Rs 2,00,000. If the overall capitalisation rate (overall cost of capital) is 12.5 per cent, what would be the total value of the firm and the equity-capitalisation rate?

SOLUTION

The computation is depicted in Table 9.4.

Table 9.4 *Total Value of the Firm (Net Operating Income Approach)*

Net operating income (EBIT)	Rs 50,000
Overall capitalisation rate (k_0)	0.125
Total market value of the firm (V) = EBIT/k_0	4,00,000
Total value of debt (B)	2,00,000
Total market value of equity (S) = ($V - B$)	2,00,000
Equity-capitalisation rate, $k_e = \frac{\text{EBIT} - \text{I}}{V - B} = \frac{\text{Earnings available to equityholders}}{\text{Total market value of equity shares}}$	
$= \frac{\text{Rs } 50,000 - \text{Rs } 20,000}{\text{Rs } 2,00,000}$	0.15
Alternatively, $k_e = k_0 + (k_0 - k_i)B/S$: $0.125 + (0.125 - 0.10)\left[\frac{\text{Rs } 2,00,000}{\text{Rs } 2,00,000}\right] = 0.15$	0.15
The weighted average cost of capital to verify the validity of the NOI Approach:	
$k_0 = k_i(B/V) + k_e(S/V) = 0.10\left[\frac{\text{Rs } 2,00,000}{\text{Rs } 4,00,000}\right] + 0.15\left[\frac{\text{Rs } 2,00,000}{\text{Rs } 4,00,000}\right]$	0.125

Thus, we find that the overall cost of capital is 12.5 per cent as per the requirement of the NOI Approach.

In order to examine the effect of leverage, let us assume that the firm increases the amount of debt from Rs 2,00,000 to Rs 3,00,000 and uses the proceeds of the debt to repurchase equity shares. The value of the firm would remain unchanged at Rs 4,00,000, but the equity-capitalisation rate would go up to 20 per cent as shown in Table 9.5.

Table 9.5 *Value of the Firm (NOI Approach)*

Net operating income (EBIT)	Rs 50,000
Overall capitalisation rate (k_0)	0.125
Total market value of the firm (V) = EBIT/k_0	4,00,000
Total value of debt (B)	3,00,000
Total market value of equity (S) = ($V - B$)	1,00,000
$k_e = \frac{\text{Rs } 50,000 - \text{Rs } 30,000}{\text{Rs } 1,00,000}$	0.20
Alternatively: $k_e = 0.125 + (0.125 - 0.10)\left[\frac{\text{Rs } 3,00,000}{\text{Rs } 1,00,000}\right]$	0.20
$k_0 = 0.10\left[\frac{\text{Rs } 3,00,000}{\text{Rs } 4,00,000}\right] + 0.20\left[\frac{\text{Rs } 1,00,000}{\text{Rs } 4,00,000}\right]$	0.125

Let us further suppose that the firm retires debt by Rs 1,00,000 by issuing fresh equity shares of the same amount. The value of the firm would remain unchanged at Rs 4,00,000 and the equity-capitalisation rate would come down to 13.33 per cent as manifested in the calculations in Table 9.6.

Table 9.6 *Total Value of the Firm (NOI Approach)*

Net operating income (EBIT)	Rs 50,000
Overall capitalisation rate (k_0)	0.125
Total market value of the firm (V) = EBIT/k_0	4,00,000
Total value of debt (B)	1,00,000
Total market value of equity (S) = ($V - B$)	3,00,000
$k_e = \frac{\text{Rs } 50,000 - \text{Rs } 10,000}{\text{Rs } 3,00,000}$	0.133
Alternatively: $k_e = 0.125 + (0.125 - 0.10)\left[\frac{\text{Rs } 1,00,000}{\text{Rs } 3,00,000}\right]$	0.133
$k_0 = 0.10\left[\frac{\text{Rs } 1,00,000}{\text{Rs } 4,00,000}\right] + 0.133\left[\frac{\text{Rs } 3,00,000}{\text{Rs } 4,00,000}\right]$	0.125

The significant feature is that the equity-capitalisation rate, k_e, increases with the increase in the degree of leverage. It has gone up from 15 per cent to 20 per cent with the increase in leverage from 0.50 to 0.75. The equity capitalisation rate decreases with the decrease in the degree of leverage. It has come down from 15 per cent to 13.33 per cent with the decrease in leverage from 0.50 to 0.25.

Market Price of Shares

In Example 9.2, let us suppose the firm with Rs 2 lakh debt has 2,000 equity shares (of Rs 100 each) outstanding. The firm has issued additional debt of Rs 1,00,000 to repurchase its shares amounting to Rs 1,00,000; it has to repurchase 1,000 shares of Rs 100 each from the market. It, then, has 1,000 equity shares outstanding, having total market value of Rs 1,00,000. The market price per share, therefore, is Rs 100 (Rs 1,00,000 ÷ 1,000) as before.

In the second situation the firm issues, 1,000 equity shares of Rs 100 each to retire debt aggregating Rs 1,00,000. It will have 3,000 equity shares outstanding, having total market value of Rs 3,00,000, thus, giving a market price of Rs 100 per share.

Thus, we note that there is no change in the market price per share due to change in leverage.

We have portrayed the relationship between the leverage and the various costs, viz. k_i, k_e and k_0 in Fig. 9.2.

The graph is based on Example 9.2. Due to the assumption that k_0 and k_i remain unchanged as the degree of leverage changes, we find that both the curves are parallel to the X-axis. But as the degree of leverage increases, the k_e increases continuously.

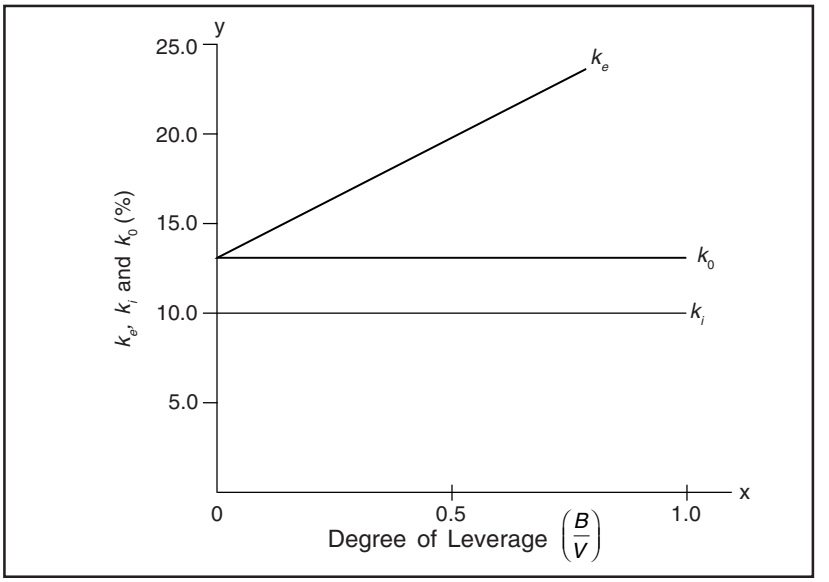

Figure 9.2 *Leverage and Cost of Capital (NOI Approach)*

MODIGLIANI-MILLER (MM) APPROACH

The Modigliani-Miller Thesis[3] relating to the relationship between the capital structure, cost of capital and valuation is akin to the NOI Approach. The NOI Approach, as explained above, is definitional or conceptual and lacks behavioural significance.[4] The NOI Approach, in other words, does not provide operational justification for the irrelevance of the capital structure. The MM proposition supports the NOI Approach relating to the independence of the cost of capital of the degree of leverage at any level of debt-equity ratio. The significance of their hypothesis lies in the fact that it provides behavioural justification for constant overall cost of capital and, therefore, total value of the firm. In other words, the MM Approach maintains that the weighted average (overall) cost of capital does not change, as shown in Fig. 9.3, with a change in

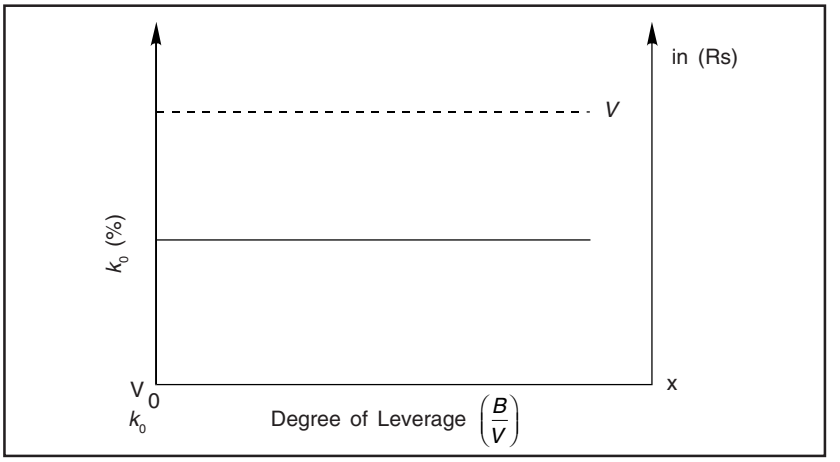

Figure 9.3 *Leverage and Cost of Capital (MM Approach)*

the proportion of debt to equity in the capital structure (or degree of leverage). They offer operational justification for this and are not content with merely stating the proposition.

Basic Propositions

There are three basic propositions of the MM Approach:

I The overall cost of capital (k_0) and the value of the firm (V) are independent of its capital structure. The k_0 and V are constant for all degrees of leverage. The total value is given by capitalising the expected stream of operating earnings at a discount rate appropriate for its risk class.

II The second proposition of the MM Approach is that the k_e is equal to the capitalisation rate of a pure equity stream plus a premium for financial risk equal to the difference between the pure equity-capitalisation rate (k_e) and k_i times the ratio of debt to equity. In other words, k_e increases in a manner to offset exactly the use of a less expensive source of funds represented by debt.

III The cut-off rate for investment purposes is completely independent of the way in which an investment is financed.

We are interested mainly in exploring the relationship between leverage and valuation. Our focus, therefore, is on proposition(1).

Assumptions

The proposition that the weighted average cost of capital is constant irrespective of the type of capital structure is based on the following assumptions:

(a) *Perfect capital markets*: The implication of a perfect capital market is that (i) securities are infinitely divisible; (ii) investors are free to buy/sell securities; (iii) investors can borrow without restrictions on the same terms and conditions as firms can; (iv) there are no transaction costs; (v) information is perfect, that is, each investor has the same information which is readily available to him without cost; and (vi) investors are rational and behave accordingly.

(b) Given the assumption of perfect information and rationality, all investors have the same expectation of firm's net operating income (EBIT) with which to evaluate the value of a firm.

(c) Business risk is equal among all firms within similar operating environment. That means, all firms can be divided into 'equivalent risk class' or 'homogeneous risk class'. The term equivalent/homogeneous risk class means that the expected earnings have identical risk characteristics. Firms within an industry are assumed to have the same risk characteristics. The categorisation of firms into equivalent risk class is on the basis of the industry group to which the firm belongs.

(d) The dividend payout ratio is 100 per cent.

(e) There are no taxes. This assumption is removed later.

Proposition I The basic premise of the MM Approach (proposition I) is that, given the above assumptions, the total value of a firm must be constant irrespective of the degree of leverage (debt-equity ratio). Similarly, the cost of capital as well as the market price of shares must be the same regardless of the financing-mix.

The operational justification for the MM hypothesis is the *arbitrage process*. The term 'arbitrage' refers to an act of buying an asset/security in one market (at lower prices) and selling it in another (at higher price). As a result, equilibrium is restored in the market price of a security in different markets. The essence of the arbitrage process is the purchase of securities/assets whose prices are lower (undervalued securities) and, sale of securities whose prices are higher, in related markets which are temporarily out of equilibrium. The

arbitrage process is essentially a balancing operation. It implies that a security cannot sell at different prices. The MM Approach illustrates the arbitrage process with reference to valuation in terms of two firms which are exactly similar in all respects except leverage so that one of them has debt in its capital structure while the other does not. Such homogeneous firms are, according to Modigliani and Miller, perfect substitutes. The total value of the homogeneous firms which differ only in respect of leverage cannot be different because of the operation of arbitrage. The investors of the firm whose value is higher will sell their shares and instead buy the shares of the firm whose value is lower. Investors will be able to earn the same return at lower outlay with the same perceived risk or lower risk. They would, therefore, be better off. The behaviour of the investors will have the effect of (i) increasing the share prices (value) of the firm whose shares are being purchased; and (ii) lowering the share prices (value) of the firm whose shares are being sold. This will continue till the market prices of the two identical firms become identical. Thus, the switching operation (arbitrage) drives the total value of two homogeneous firms in all respects, except the debt-equity ratio, together. The arbitrage process, as already indicated, ensures to the investor the same return at lower outlay as he was getting by investing in the firm whose total value was higher and yet, his risk is not increased. This is so because the investors would borrow in the proportion of the degree of leverage present in the firm. The use of debt by the investor for arbitrage is called as 'home-made' or 'personal' leverage. The essence of the arbitrage argument of Modigliani and Miller is that the investors (arbitragers) are able to substitute personal leverage or home-made leverage for corporate leverage, that is, the use of debt by the firm itself.

The operation of the arbitrage process is illustrated in Example 9.3.

EXAMPLE 9.3

Assume there are two firms, L and U, which are identical in all respects except that firm L has 10 per cent, Rs 5,00,000 debentures. The earnings before interest and taxes (EBIT) of both the firms are equal, that is, Rs 1,00,000. The equity-capitalisation rate (k_e) of firm L is higher (16 per cent) than that of firm U (12.5 per cent).

SOLUTION

The total market values of firms L and U are computed in Table 9.7.

Table 9.7 *Total Value of Firms L and U*

Particulars	Firms	
	L	*U*
EBIT	Rs 1,00,000	Rs 1,00,000
Less interest	50,000	—
Earnings available to equity holders	50,000	1,00,000
Equity-capitalisation rate (k_e)	0.16	0.125
Total market value of equity (S)	3,12,500	8,00,000
Total market value of debt (B)	5,00,000	—
Total market value (V)	8,12,500	8,00,000
Implied overall capitalisation rate/cost of capital (k_0) = EBIT/V	0.123	0.125
Debt-equity ratio = B/S	1.6	—

Thus, the total market value of the firm which employs debt in the capital structure (L) is more than that of the unlevered firm (U). According to the MM hypothesis, this situation cannot continue as the arbitrage process, based on the substitutability of personal leverage for corporate leverage, will operate and the values of the two firms will be brought to an identical level.

Arbitrage Process The *modus operandi* of the arbitrage process is as follows:

Suppose an investor, Mr X, holds 10 per cent of the outstanding shares of the levered firm (L). His holdings amount to Rs 31,250 (i.e. 0.10 × Rs 3,12,500) and his share in the earnings that belong to the equity shareholders would be Rs 5,000 (0.10 × Rs 50,000).

He will sell his holdings in firm L and invest in the unlevered firm (U). Since firm U has no debt in its capital structure, the financial risk to Mr X would be less than in firm L. To reach the level of financial risk of firm L, he will borrow additional funds equal to his proportionate share in the levered firm's debt on his personal account. That is, he will substitute personal leverage (or home-made leverage) for corporate leverage. In other words, instead of the firm using debt, Mr X will borrow money. The effect, in essence, of this is that he is able to introduce leverage in the capital structure of the the unlevered firm by borrowing on his personal account. Mr X in our example will borrow Rs 50,000 at 10 per cent rate of interest. His proportionate holding (10 per cent) in the unlevered firm will amount to Rs 80,000 on which he will receive a dividend income of Rs 10,000. Out of the income of Rs 10,000 from the unlevered firm (U), Mr X will pay Rs 5,000 as interest on his personal borrowings. He will be left with Rs 5,000 that is, the same amount as he was getting from the levered firm (L). But his investment outlay in firm U is less (Rs 30,000) as compared with that in firm L (Rs 31,250). At the same time, his risk is identical in both the situations. The effect of the arbitrage process is summarised in Table 9.8.

Table 9.8 *Effect of Arbitrage*

(A) *Mr X's position in firm L (levered) with 10 per cent equity holding*		
(i) Investment outlay		Rs 31,250
(ii) Dividend Income		5,000
(B) *Mr X's position in firm U (unlevered) with 10 per cent equity holding*		
(i) Total funds available (own funds, Rs 31,250 + borrowed funds, Rs 50,000)		81,250
(ii) Investment outlay (own funds, Rs 30,000 + borrowed funds, Rs 50,000)		80,000
(iii) Dividend Income:		
Total Income (0.10 × Rs 1,00,000)	Rs 10,000	
Less interest payable on borrowed funds	5,000	5,000
(C) *Mr X's position in firm U if he invests the total funds available*		
(i) Investment costs		81,250.00
(ii) Total income		10,156.25
(iii) Dividend income (net) (Rs 10,156.25 – Rs 5,000)		5,156.25

It is, thus, clear that Mr X will be better off by selling his securities in the levered firm and buying the shares of the unlevered firm. With identical risk characteristics of the two firms, he gets the same income with lower investment outlay in the unlevered firm. He will obviously prefer switching from the levered to the unlevered firm. Other investors will also, given the assumption of rational investors, enter into the arbitrage process. The consequent increasing demand for the securities of the unlevered firm will lead to an increase in the market price of its shares. At the same time, the price of the shares of the levered firm will decline. This will continue till it is possible to reduce the investment outlays and get the same return. Beyond this point, switching from firm L to firm U or arbitrage will not be identical. This is the point of equilibrium. At this point, the total value of the two firms would be identical. The cost of capital of the two firms would also be the same. Thus, it is unimportant what the capital structure of firm L is. The weighted cost of capital (k_0) after the investors exercise their home-made leverage is constant because investors exactly offset the firm's leverage with their own.[5]

Arbitrage Process: Reverse Direction According to the MM hypothesis, since debt financing has no advantage, it has no disadvantage either. In other words, just as the total value of a levered firm cannot be

more than that of an unlevered firm, the value of an unlevered firm cannot be greater than the value of a levered firm. This is because the arbitrage process will set in and depress the value of the unlevered firm and increase the market price and, thereby, the total value of the levered firm. The arbitrage would, thus, operate in the opposite direction. Here, the investors will dispose of their holdings in the unlevered firm and obtain the same return by acquiring proportionate share in the equity capital and the debt of the levered firm at a lower outlay without any increase in the risk. This is illustrated in Example 9.4.

EXAMPLE 9.4

Assume that in Example 9.3, the equity-capitalisation rate (k_e) is 20 per cent in the case of the levered firm (L), instead of the assumed 16 per cent. The total values of the two firms are given in Table 9.9.

Table 9.9 *Total Value of Firms L and U*

Particulars	*L*	*U*
EBIT	Rs 1,00,000	Rs 1,00,000
Less interest	50,000	—
Income to equity holders	50,000	1,00,000
Equity-capitalisation rate (k_e)	0.20	0.125
Market value of equity	2,50,000	8,00,000
Market value of debt	5,00,000	—
Total value (V)	7,50,000	8,00,000
(k_0)	0.133	0.125
B/S	2	0

Since both firms are similar, except for financing-mix, a situation in which their total values are different, cannot continue, as arbitrage will drive the two values together.

Suppose, Mr Y has 10 per cent shareholdings of firm U. He earns Rs 10,000 (0.10 × Rs 1,00,000). He will sell his securities in firm U and invest in the undervalued levered firm, L. He can purchase 10 per cent of firm L's debt at a cost of Rs 50,000 which will provide Rs 5,000 interest and 10 per cent of L's equity at a cost of Rs 25,000 with an expected dividend of Rs 5,000 (0.10 × Rs 50,000). The purchase of a 10 per cent claim against the levered firm's income costs Mr Y only Rs 75,000, yielding the same expected income of Rs 10,000 from the equity shares of the unlevered firm. He would prefer the levered firm's securities as the outlay is lower. Table 9.10 portrays the reverse arbitrage process.

Table 9.10 *Effect of Reverse Arbitrage Process*

(A)	*Mr Y's current position in firm U*		
	Investment outlay		Rs 80,000
	Dividend income		10,00
(B)	*Mr Y sells his holdings in firm U and purchases 10 p cent of the levered firm's equity and debentures*		
		Investment	Income
	Debt	Rs 50,000	Rs 5,000
	Equity	25,000	5,000
	Total	75,000	10,000

(*Contd.*)

(Contd.)

Y would prefer alternative B to A, as he is able to earn the same income with a smaller outlay.

(C) *He invests the entire sum of Rs 80,000 in firm L*

	Investment	Income
Debt	Rs 53,333.00	Rs 5,333.30
Equity	26,667.00	5,333.40
Total	80,000,00	10,666.70

He augments his income by Rs 666.70.

The above illustrations establish that the arbitrage process will make the values of both the firms identical. Thus, Modigliani and Miller show that the value of a levered firm can neither be greater nor smaller than that of an unlevered firm; the two must be equal. There is neither an advantage nor a disadvantage in using debt in the firm's capital structure. The principle involved is simply that investors are able to reconstitute their former position by off-setting changes in corporate leverage with personal leverage. As a result the investment opportunities available to them are not altered by changes in the capital structure of the firm.[6]

Limitations

Does the MM hypothesis provide a valid framework to explain the relationship between capital structure, cost of capital and total value of a firm? The most crucial element in the MM Approach is the *arbitrage process* which forms the behavioural foundation of, and provides operational justification to, the MM hypothesis. The arbitrage process, in turn, is based on the crucial assumption of perfect substitutability of personal/home-made leverage with corporate leverage. The validity of the MM hypothesis depends on whether the arbitrage process is effective in the sense that personal leverage is a perfect substitute for corporate leverage. The arbitrage process is, however, not realistic and the exercise based upon it is purely theoretical and has no practical relevance.

Risk Perception In the first place, the risk perceptions of personal and corporate leverage are different. If home-made and corporate leverages are perfect substitutes, as the MM Approach assumes, the risk to which an investor is exposed, must be identical irrespective of whether the firm has borrowed (corporate leverage) or the investor himself borrows proportionate to his share in the firm's debt. If not, they cannot be perfect substitutes and consequently the arbitrage process will not be effective. The risk exposure to the investor is greater with personal leverage than with corporate leverage. The liability of an investor is limited in corporate enterprises in the sense that he is liable to the extent of his proportionate shareholdings in case the company is forced to go into liquidation. The risk to which he is exposed, therefore, is limited to his relative holding. The liability of an individual borrower is, on the other hand, unlimited as even his personal property is liable to be used for payment to the creditors. The risk to the investor with personal borrowing is higher. In Example 11.3, for instance, Mr X's liability (risk), when the firm has borrowed (levered firm), is Rs 31,250, that is, his 10 per cent share in firm L. If he were to borrow equal to his proportionate share in the firm's debt (Rs 50,000), his total liability will be Rs 80,000. Thus, investments in a levered firm (corporate leverage) and in an unlevered firm (personal leverage) are not on an equal footing from the viewpoint of risks to the investors. Since investors can reasonably be expected to prefer an arrangement which, while giving the same return, ensures lower risk, the personal and corporate leverages cannot be perfect substitutes.

Convenience Apart from higher *risk exposure*, the investors would find the personal leverage *inconvenient*. This is so because with corporate leverage the formalities and procedures involved in borrowing

are to be observed by the firms while these will be the responsibility of the investor-borrower in case of personal leverage. That corporate borrowing is more convenient to the investor means, in other words, that investors would prefer them rather than to do the job themselves. The perfect substitutability of the two types of leverage is, thus, open to question.

Cost Another constraint on the perfect substitutability of personal and corporate leverage and, hence, the effectiveness of the arbitrage process is the relatively *high cost of borrowing* with personal leverage. If the two types of leverage are to be perfect substitutes, the cost of borrowing ought to be identical for both: borrowing by the firm and borrowing by the investor-borrower. If the borrowing costs vary so that they are higher/lower depending on whether the borrowing is done by a firm or an individual, the borrowing arrangement with lower cost will be preferred by the investors. That lending costs are not uniform for all categories of borrowers is, as an economic proposition, well recognised. As a general rule, large borrowers with high credit-standing can borrow at a lower rate of interest compared to borrowers who are small and do not enjoy high credit-standing. For this reason, it is reasonable to assume that a firm can obtain a loan at a cost lower than what the individual investor would have to pay. As a result of higher interest charges, the advantage of personal leverage would largely disappear and the MM assumption of personal and corporate leverages being perfect substitutes would be of doubtful validity. In fact, borrowing by a firm has definite superiority over a personal loan from the viewpoint of the cost of borrowing. Investors can be expected to definitely prefer corporate borrowing as they would not be in the same position by borrowing on personal account.

Institutional Restrictions Yet another problem with the MM hypothesis is that *institutional restrictions* stand in the way of a smooth operation of the arbitrage process. Several institutional investors such as Life Insurance Corporation of India, Unit Trust of India, commercial banks and so on are not allowed to engage in personal leverage. Thus, switching the option from the unlevered to the levered firm may not apply to all investors and, to that extent, personal leverage is an imperfect substitute for corporate leverage.

Double Leverage A related dimension is that in certain situations, the arbitrage process (substituting corporate leverage by personal leverage) may not actually work. For instance, when an investor has already borrowed funds while investing in shares of an unlevered firm. If the value of the firm is more than that of the levered firm, the arbitrage process would require selling the securities of the overvalued (unlevered) firm and purchasing the securities of the levered firm. Thus, an investor would have *double leverage* both in personal portfolio as well as in the firm's portfolio. The MM assumption would not hold true in such a situation.

Transaction Costs Transaction costs would affect the arbitrage process. The effect of transaction/ flotation cost is that the investor would receive net proceeds from the sale of securities which will be lower than his investment holding in the levered/unlevered firm, to the extent of the brokerage fee and other costs. He would, therefore, have to invest a larger amount in the shares of the unlevered/ levered firm, than his present investment, to earn the same return.

Personal leverage and corporate leverage are, therefore, not perfect substitutes. This implies that the arbitrage process will be hampered and will not be effective. To put it differently, the basic postulate of the MM Approach is not valid. Therefore, a firm may increase its total value and lower its weighted cost of capital with an appropriate degree of leverage. Thus, the capital structure of the firm is not irrelevant to its valuation and the overall cost of capital. In brief, imperfections in the capital market retard perfect

functioning of the arbitrage. As a consequence, the MM Approach does not appear to provide a valid framework for the theoretical relationship between capital structure, cost of capital and valuation of a firm.

Taxes Finally, if corporate taxes are taken into account, the MM Approach will fail to explain the relationship between financing decision and value of the firm. Modigliani and Miller themselves, as shown below, are aware of it and have, in fact, recognised it.

Corporate Taxes

As already mentioned, MM agree[7] that the value of the firm will increase and cost of capital will decline with leverage, if corporate taxes are introduced in the exercise. Since interest on debt is tax-deductible, the effective cost of borrowing is less than the contractual rate of interest. Debt, thus, provides a benefit to the firm because of the *tax-deductibility* of interest payments. Therefore, a levered firm would have greater market value than an unlevered firm. Specifically, MM state that the value of the levered firm would exceed that of the unlevered firm by an amount equal to the levered firm's debt multiplied by the tax rate. Symbolically,

$$V_l = V_u + Bt \tag{9.14}$$

where V_l = value of levered firm
V_u = value of unlevered firm
B = amount of debt
t = tax rate

Since the value of the levered firm is more than that of the unlevered firm, it is implied that the overall cost of capital of the former would be lower than that of the latter.

Equation 9.14 also implies that the market value of a levered firm (V_i) is equal to the market value of an unlevered firm (V_u) in the same risk class plus the discounted present value of the tax saving resulting from tax-deductibility of interest payments.[8]

EXAMPLE 9.5

The earnings before interest and taxes are Rs 10 lakh for companies L and U. They are alike in all respects except that Firm L uses 15 per cent debt of Rs 20 lakh; Firm U does not use debt. Given the tax rate of 35 per cent, the stakeholders of the two firms will receive different amounts as shown in Table 9.11.

Table 9.11 *Effect of Leverage on Shareholders*

	Company L	*Company U*
EBIT	Rs 10,00,000	Rs 10,00,000
Less interest	3,00,000	—
Earnings before taxes	7,00,000	10,00,000
Less taxes	2,45,000	3,50,000
Income available for equity-holders	4,55,000	6,50,000
Income available for debt-holders and equity-holders	7,55,000	6,50,000

The total income to both debt holders and equity holders of levered Company L is higher. The reason is that while debt holders receive interest without tax-deduction at the corporate level, equity holders of

Company L have their incomes after tax-deduction. As a result, total income to both types of investors increases by the interest payment times the rate, that is, Rs 3,00,000 × 0.35 = Rs 1,05,000.

Assuming further that the debt employed by Company L is permanent, the advantage to the firm is equivalent to the present value of the tax shield, that is, Rs 7 lakh (Rs 1,05,000/0.15). Alternatively, it can be determined with reference to Equation 9.15.

$$\frac{Brt}{r} = Bt \tag{9.15}$$

where t = Corporate tax

r = Rate of interest on debt

B = Amount of debt = 0.35 × Rs 20 lakh = Rs 7 lakh.

It may be noted that value of levered firm (as shown by equation 9.14) reckons this tax shield due to debt.

The implication of MM analysis in this case is that the value of the firm is maximised when its capital structure contains only debt. In other words, a firm can lower its cost of capital continnually with increased leverage. However, the extensive use of debt financing would expose business to high probabilities of default; it would find it difficult to meet the promised payments of interest and principal. Moreover, the firm is likely to incur costs and suffer penalties if it fails to make payments of interest and principal when they become due. Legal expenses, disruption of operations, and loss of potentially profitable investment opportunities may result. As the amount of debt in the capital structure increases, so does the probability of incurring these costs. Consequently, there are disadvantages of debt; and excessive use of debt may cause a rise in the cost of capital owing to the increased financial risk and may reduce the value of the firm.[9] Again, we find that MM's proposition is unjustified when leverage is extreme, that is, when the firm uses 100 per cent debt and no equity. Clearly, the optimal capital structure is not one which has the maximum amount of debt, but, one which has the desired amount of debt, determined at a point and/or range where the overall cost of capital is minimum. Modigliani and Miller also recognise that extreme leverage increases financial risk as also the cost of capital. They suggest that firms should adopt '*target debt ratio*' so as not to violate limits of leverage imposed by the creditors. This suggestion indirectly admits that there is a safe limit for the use of debt and firms should not use debt beyond that limit/point. It implies that the cost of capital rises beyond a certain level on the use of debt. There is, therefore, an optimal capital structure.

TRADITIONAL APPROACH

The preceding discussions clearly show that the Net Income Approach (NI) as well as Net Operating Income Approach (NOI) represent two extremes as regards the theoretical relationship between financing decisions as determined by the capital structure, the weighted average cost of capital and total value of the firm. While the NI Approach takes the position that the use of debt in the capital structure will *always* affect the overall cost of capital and the total valuation, the NOI Approach argues that capital structure is totally irrelevant. The MM Approach supports the NOI Approach. But the assumptions of MM hypothesis are of doubtful validity. The Traditional Approach is midway between the NI and NOI Approaches. It partakes of some features of both these Approaches. It is also known as the *intermediate* Approach. It resembles the NI Approach in arguing that cost of capital and total value of the firm are not independent of the capital structure. But it does not subscribe to the view (of NI Approach) that value of a firm will necessarily increase for all degrees of leverage. In one respect it shares a feature with the NOI Approach that beyond a certain degree of leverage, the overall cost increases leading to a decrease in the total value of the firm. But it differs from the NOI Approach in that it does not argue that the weighted average cost of capital is constant for all degrees of leverage.

The crux of the traditional view relating to leverage and valuation is that through *judicious* use of debt-equity proportions, a firm can increase its total value and thereby reduce its overall cost of capital. The rationale behind this view is that debt is a relatively cheaper source of funds as compared to ordinary shares. With a change in the leverage, that is, using more debt in place of equity, a relatively cheaper source of funds replaces a source of funds which involves a relatively higher cost. This obviously causes a decline in the overall cost of capital. If the debt-equity ratio is raised further, the firm would become financially more risky to the investors who would penalise the firm by demanding a higher equity-capitalisation rate (k_e). But the increase in k_e may not be so high as to neutralise the benefit of using cheaper debt. In other words, the advantages arising out of the use of debt is so large that, even after allowing for higher k_e, the benefit of the use of the cheaper source of funds is still available. If, however, the amount of debt is increased further, two things are likely to happen: (i) owing to increased financial risk, k_e will record a substantial rise; (ii) the firm would become very risky to the creditors who also would like to be compensated by a higher return such that k_i will rise. The use of debt beyond a certain point will, therefore, have the effect of raising the weighted average cost of capital and conversely the total value of the firm. Thus, up to a point/degree of leverage, the use of debt will favourably affect the value of a firm; beyond that point, use of debt will adversely affect it. At that level of debt-equity ratio, the capital structure is an optimal capital structure. *At the optimum capital structure, the marginal real cost of debt, defined to include both implicit and explicit, will be equal to the real cost of equity. For a debt-equity ratio before that level, the marginal real cost of debt would be less than that of equity capital, while beyond that level of leverage, the marginal real cost of debt would exceed that of equity.*

There are, of course, variations to the Traditional Approach. According to one of these, the equity-capitalisation rate (k_e) rises only after a certain level of leverage and not before, so that the use of debt does not necessarily increase the k_e. This happens only after a certain degree of leverage. The implication is *that a firm can reduce its cost of capital significantly with the initial use of leverage*.

Another variant of the Traditional Approach suggests that there is no one single capital structure, but, there is a range of capital structures in which the cost of capital (k_0) is the minimum and the value of the firm is the maximum. In this range, changes in leverage have very little effect on the value of the firm.

The *modus operandi* of the Traditional Approach is illustrated in Example 9.6.

EXAMPLE 9.6

Let us suppose that a firm has 20 per cent debt and 80 per cent equity in its capital structure. The cost of debt and the cost of equity are assumed to be 10 per cent and 15 per cent respectively. What is the overall cost of capital, according to the traditional Approach?

SOLUTION

$$\text{The overall cost of capital } (k_0) = k_i \text{ i.e. } 0.10\left[\frac{20}{100}\right] + k_e \text{ i.e. } 0.15\left[\frac{80}{100}\right] = 14 \text{ per cent}$$

Further, suppose, the firm wants to increase the percentage of debt to 50. Due to the increased financial risk, the k_i and k_e will presumably rise. Assuming, they are 11 per cent (k_i) and 16 per cent (k_e), the cost of capital (k_0) would be: $= 0.11\left[\frac{50}{100}\right] + 0.16\left[\frac{50}{100}\right] = 13.5$ per cent

It can, thus, be seen that with a rise in the debt-equity ratio, k_e and k_i increase, but, k_0 has declined presumably because these increases have not fully offset the advantages of the cheapness of debt.

Assume further, the level of debt is raised to 70 per cent of the capital structure of the firm. There would consequently be a sharp rise in risk to the investors as well as creditors. The k_e would be, say, 20 per cent and the k_i 14 per cent. The $k_0 = 0.14\left[\frac{70}{100}\right] + 0.20\left[\frac{30}{100}\right] = 15.8$ per cent

The overall cost of capital has actually risen when the firm tries to employ more of what appeared, at the previous debt-equity ratio, to be the least costly source of funds, that is, debt. Therefore, the firm should take into account the consequences of raising the percentage of debt to 70 per cent on the cost of both equity and debt.

The above illustration eloquently demonstrates that the increasing use of debt does not always lower k_0. In fact, excessive use of debt greatly increases financial risk and completely offsets the advantage of using the lower-cost debt. Therefore, the firm should consider the two off-setting effects of increasing the proportion of debt in the capital structure: the rise in k_i and k_e and the decrease or increase in k_0 and total value (V), generated by using a greater proportion of debt. The traditional Approach is illustrated in Example 9.7.

EXAMPLE 9.7

Assume a firm has EBIT of Rs 40,000. The firm has 10 per cent debentures of Rs 1,00,000 and its current equity capitalisation rate is 16 per cent. The current value of the firm (V) and its overall cost of capital would be, as shown in Table 9.12.

Table 9.12 *Total Value and Cost of Capital (Traditional Approach)*

Net operating income (EBIT)	Rs 40,000
Less interest (I)	10,000
Earnings available to equityholders (NI)	30,000
Equity capitalisation rate (k_e)	0.16
Total Market value of equity (S) = NI/k_e	1,87,500
Total Market value of debt (B)	1,00,000
Total value of the firm (V) = $S + B$	2,87,500
Overall cost of capital, k_0 = EBIT/V	0.139
Debt-equity ratio (B/S) = (Rs 1,00,000 ÷ Rs 1,87,500)	0.53

The firm is considering increasing its leverage by issuing additional Rs 50,000 debentures and using the proceeds to retire that amount of equity. If, however, as the firm increases the proportion of debt, k_i would rise to 11 per cent and k_e to 17 per cent, the total value of the firm would increase and k_0 would decline as shown in Table 9.13.

Table 9.13 *Total Value and Cost of Capital (Traditional Approach)*

Net operating income (EBIT)	Rs 40,000
Less interest (I)	16,500
Earnings available to equityholders (NI)	23,500
Equity capitalisation rate (k_e)	0.17
Total Market value of equity (S) = NI/k_e	1,38,235
Total Market value of debt (B)	1,50,000
Total value of the firm (V) = $S + B$	2,88,235
Overall cost of capital, k_0 = EBIT/V	0.138
Debt-equity ratio (B/S)	1.08

Let us further suppose that the firm issues additional Rs 1,00,000 debentures instead of Rs 50,000 (that is, having Rs 2,00,000 debentures) and uses the proceeds to retire that amount of equity. Due to increased financial risk, k_i would rise to 12.5 per cent and k_e to 20 per cent, the total value of the firm would decrease and k_0 would rise as is clear from Table 9.14.

Table 9.14 *Total Value and Cost of Capital (Traditional Approach)*

Net operating income (EBIT)	Rs 40,000
Less interest (I)	25,000
Earnings available to equityholders (NI)	15,000
Equity capitalisation rate (k_e)	0.20
Total Market value of equity (S) = NI/k_e	75,000
Total Market value of debt	2,00,000
Total value of the firm (V) = $S + B$	2,75,000
Overall cost of capital, k_0 = EBIT/V	0.145
Debt-equity ratio (B/S) (Rs 2,00,000 ÷ Rs 75,000)	2.67

In Example 9.7, it is clear that the optimal debt-equity ratio must be less than 2.67 since at this ratio, the value of the firm is Rs 2,75,000, while at a debt-equity ratio of 1.08 it is Rs 2,88,235.

The traditional Approach suggests that:

> Other things being equal, the market value of a company's securities will rise as the amount of leverage (L) in its financial structure is increased from zero to some point determined by the capital market's evaluation of the level of business uncertainty involved. Beyond this point and up to a second point, changes in leverage have very little effect, that is, within this range of leverage the total market value of the company is unchanged as leverage changes. Beyond this range of 'acceptable' leverage, the total market value of securities will decline with further increase in L.[10]

The effect of increase in leverage from zero, on cost of capital and valuation of the firm, can be thought to involve three distinct phase.[11]

Increased Valuation and Decreased Overall Cost of Capital

During the first phase, increasing leverage increases the total valuation of the firm and lowers the overall cost of capital. As the proportion of debt in the capital structure increases, the cost of equity (k_e) begins to rise as a reflection of the increased financial risk. But it does not rise fast enough to off set the advantage of using the cheaper source of debt capital. Likewise, for most of the range of this phase, the cost of debt (k_i) either remains constant or rises to a very small extent because the proportion of debt by the lender is considered to be within safe limits. Therefore, they are prepared to lend to the firm at almost the same rate of interest. Since debt is typically a cheaper source of capital than equity, the combined effect is that the overall cost of capital begins to fall with the increasing use of debt. Example 9.7 has shown that an increase in leverage (B/S) from 0.53 to 1.08 has had the effect of increasing the total market value from Rs 2,87,500 to Rs 2,88,235 and decreasing the overall capitalisation rate from 13.9 to 13.8 per cent.

Constant Valuation and Constant Overall Cost of Capital

After a certain degree of leverage is reached, further moderate increases in leverage have little or no effect on total market value. During the middle range,the changes brought in equity-capitalisation rate and debt-capitalisation rate balance each other. As a result, the values of (V) and (k_0) remain almost constant.

Decreased Valuation and Increased Overall Cost of Capital

Beyond a certain critical point, further increases in debt proportions are not considered desirable. They increase financial risks so much that both k_e and k_i start rising rapidly causing (k_0) to rise and (V) to fall. In

Example 9.7, the effect of an increase in *B*/*S* ratio from 1.08 to 2.67 is to increase (k_0) from 13.8 to 14.5 per cent and to decrease (*V*) from Rs 2,88,235 to Rs 2,75,000.

A numerical illustration, given in Table 9.15[12] and its graphic presentation in Fig.9.4[13] further help to clarify the relationship between leverage and cost of capital. They present hypothetical changes similar to those envisaged by the traditional approach and examine the effect of leverage on the individual variables. We have assumed, in addition to other assumptions already stated at the beginning of the chapter, that given capital market conditions, the company can repurchase its own shares.[14] The face value of a share is Rs 10 and that of debentures Rs 100 each. The symbols used in Table 9.14 have the same meaning as explained at the beginning of the chapter.

Table 9.15 *Leverage, Capitalisation Rates and Valuation*[a]

B	k_i *(%)*	*EBIT*	I	*NI (EBIT-I)*	k_e *(%)*	*Number of shares*	*Amount of shares (book value)*	S *(NI ÷ k_e)*	*Market value per share*	V *(B + S)*	k_0 *%*	L_1 *(B/S)*	L_2 *(B/V)*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
0	4.0	Rs 100	Rs Nil	Rs 100	10.0	100	Rs 1,000	Rs 1,000	Rs 10.00	Rs 1,000	10.2	0	0
100	4.0	100	4.0	96	10.0	90	900	960	10.67	1,060	9.4	0.10	0.09
200	4.0	100	8.0	92	10.3	80	800	893	10.16	1,093	9.1	0.22	0.18
300	4.2	100	12.6	87.4	10.8	70	700	810	11.57	1,111	9.0	0.33	0.27
400	4.5	100	18.0	82	11.5	60	600	711	11.85	1,111	9.0	0.56	0.36
500	5.0	100	25.0	75	12.3	50	500	611	12.22	1,111	9.0	0.82	0.45
600	5.5	100	33.0	67	13.1	40	400	512	12.80	1,111	9.0	1.17	0.54
700	7.0	100	49.0	51	14.0	30	300	364	12.13	1,064	9.4	1.92	0.65
800	8.5	100	68.0	32	15.0	20	200	213	10.65	1,013	9.9	3.76	0.79

[a] Solomon, E., *Theory of Financial Management*, Columbia University Press, New York, 1969, p. 95. Reprinted with permission from Columbia University Press, New York, USA.

Tables 9.15 as well as Fig. 9.4 reveal that with an increase in leverage (B/V) from zero to 0.27, the market value of the firm increases (from Rs 1,000 to Rs 1,111) and the overall cost of capital declines from 10 to 9 per cent (Phase I). With further increases in leverage from 0.27 up to 0.54, there is no change either in (*V*) or in (k_0); both the values remain constant, that is, Rs 1,111 and 9 per cent respectively (Phase 2). During Phase 3, with an increase in the ratio beyond 0.54 up to 0.79, there is a decrease in market value of the firm (from Rs 1,111 to Rs 1,013) and an increase in (k_0) (from 9 to 9.4 per cent), suggesting that the optimal leverage lies within the range of 0.27 to 0.54 debt-equity ratio.

In practice, it may not be possible to determine the minimum overall cost of capital. Therefore, a diagrammatic presentation is useful as it depicts a range over which the cost of capital is minimised. The (k_0) curve developed in Fig. 9.4 is a fairly shallow saucer with a horizontal section over the middle ranges of leverage (0.27 to 0.54). *The firm should not go to the left or to the right of the saucer* part of the curve.

The traditional view on leverage is commonly referred to as one of *'U' shaped cost of capital curve* (as shown in Fig. 9.5). In such a situation, the degree of leverage is optimum at a point at which the rising marginal cost of borrowing is equal to the average overall cost of capital. For this purpose, marginal cost of a unit of debt capital consists of two parts: (i) the increase in total interest payable on debt; (ii) the amount of extra net earnings required to restore the value of equity component to what it would have been under the pre-existing capitalisation rate before the debt is increased.

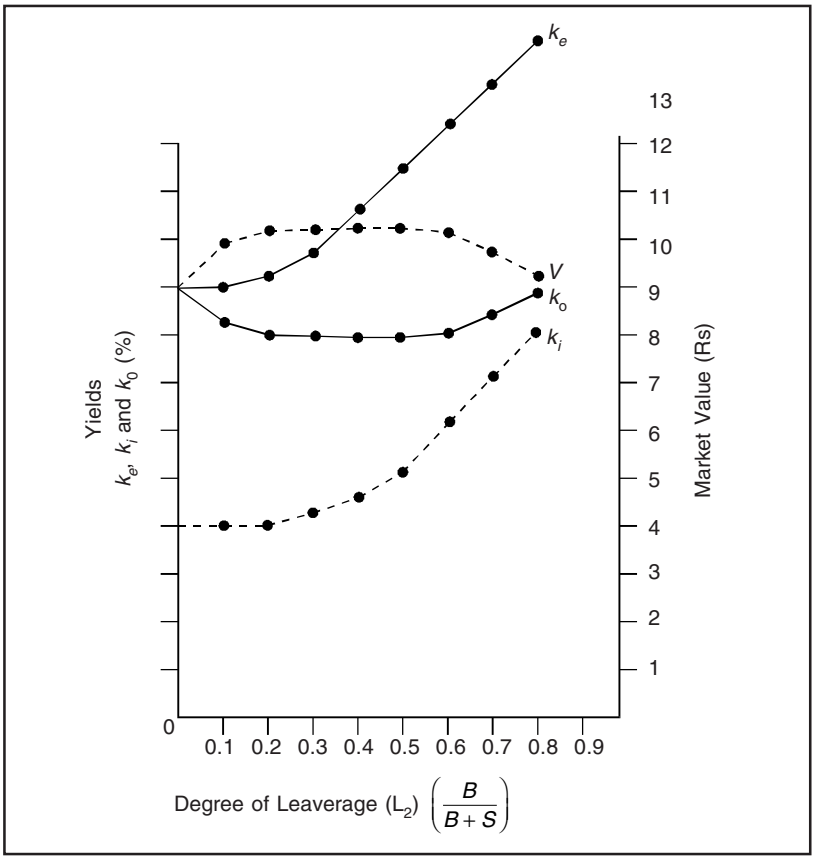

Figure 9.4 *Leverage and Cost of Capital (Traditional Approach)*

Thus, in Table 9.15, the marginal cost of borrowing the seventh to Rs 100 units of funds is Rs 19 or 19 per cent. It is determined as follows:

(i)	Increase in total interest payable (I) Rs 49 (when B is Rs 700) – Rs 33 (when B is 600)	Rs 16
Plus (ii)	Increase in net income required for shareholders (When the value of a share is Rs 12.13, the required earnings are Rs 51. Therefore, to maintain the value of share at Rs 12.80, the earnings are Rs 54 i.e. $\left[\frac{\text{Rs } 12.80}{\text{Rs } 12.13}\right] \times \text{Rs } 51$; thus, the increased earnings required is Rs 3).	3

Since the marginal cost of debt is 19 per cent, while the over all cost of capital is 9 per cent, the use of more debt at this stage is imprudent. In other words, *a mix of debt of Rs 600 with equity capital of Rs 400 provides the optimum combination of debt and equity and optimum capital structure*.

Thus, according to the traditional approach, the cost of capital of a firm as also its valuation is dependent upon the capital structure of the firm and there is an optimum capital structure in which the firm's k_0 is minimum and its (V) the maximum.

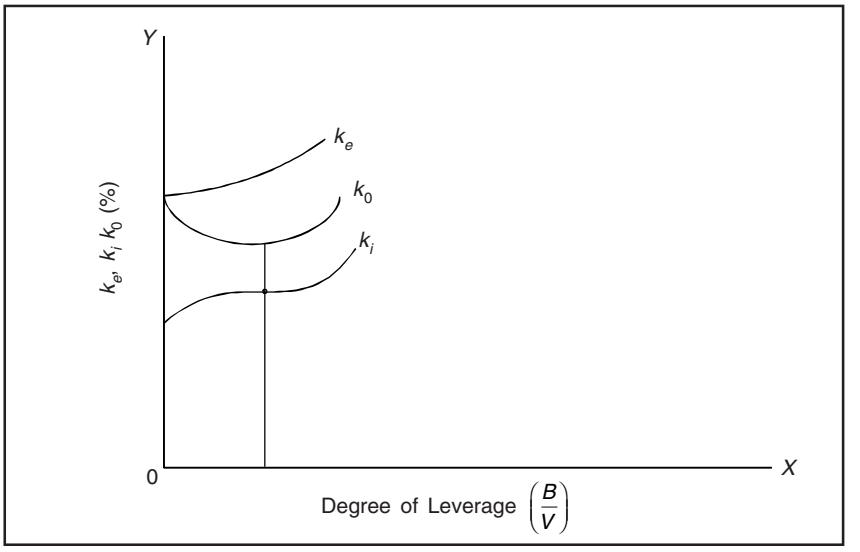

Figure 9.5 *Leverage and Cost of Capital (Traditional Approach)*

SUMMARY

- Capital structure refers to the mix or proportion of different sources of finance (debt and equity) to total capitalisation. A firm should select such a financing-mix which maximises its value/the shareholders' wealth (or minimises its overall cost of capital). Such a capital structure is referred to as the optimum capital structure.
- Capital structure theories explain the theoretical relationship between capital structure, overall cost of capital (k_0) and valuation (V). The four important theories are: (i) Net income (NI) approach, (ii) Net operating income (NOI) approach, (iii) Modigliani and Miller (MM) approach and (iv) Traditional approach.
- According to the NI approach, capital structure is relevant as it affects the k_0 and V of the firm. The core of this approach is that as the ratio of less expensive source of funds (i.e., debt) increases in the capital structure, the k_0 decreases and V of the firm increaseas. With a judicious mixture of debt and equity, a firm can evolve an optimum capital structure at which the k_0 would be the lowest, the V of the firm the highest and the market price per share the maximum.
- The NOI approach is diametrically opposite to the NI approach. The essence of this approach is that capital structure decision of a corporate does not affect its cost of capital and valuation, and, hence, irrelevant.

  The main argument of NOI is that an increase in the proportion of debt in the capital structure would lead to an increase in the financial risk of the equityholders. To compensate for the increased risk, they would require a higher rate of return (k_e) on their investment. As a result, the advantage of the lower cost of debt would exactly be neturalised by the increase in the cost of equity.

  The cost of debt has two components: (i) explicit, represented by rate of interest, and (ii) implicit, represented by the increase in the cost of equity capital. Therefore, the real cost of debt and equity would be the same and there is nothing like an optimum capital structure.

- Modigliani and Miller (MM) concur with NOI and provide a behavioural justification for the irrelevance of capital structure. They maintain that the cost of capital and the value of the firm do not change with a change in leverage.
- They contend that the total value of homogeneous firms that differ only in respect of leverage cannot be different because of the operations of arbitrage. The arbitrage refers to the switching over operations, that is, the investors switch over from the over-valued firm (levered firm) to the under-valued firms (unlevered). The essence of arbitrage is that the investors (arbitragers) are able to substitute personal or home-made leverage for corporate leverage. The switching operation drives the total value of the two homogeneous firms equal.
- The basic premises of the MM approach, in practice, are of doubtful validity. As a result, the arbitrage process is impeded. To the extent, the arbitrage process is imperfect, it implies that the capital structure matters.
- The MM contend that with corporate taxes, debt has a definite advantage as interest paid on debt is tax-deductible and leverage will lower the overall cost of capital. The value of the levered firm (V_1) would exceed the value of the unlevered firm (V_u) by an amount equal to levered firm's debt multiplied by tax rate.
- The traditional approach is mid-way between the two extreme (the NI and NOI) approaches. The crux of this approach is that through a judicious combination of debt and equity, a firm can increase its value (V) and reduce its cost of capital (k_0) upto a point. However, beyond that point, the use of additional debt will increase the financial risk of the investors as well as of the lenders and as a result will cause a rise in the k_0. At such a point, the capital structure is optimum. In other words, at the optimum capital structure the marginal real cost of debt (both implicit and explicit) will be equal to the real cost of equity.

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11. *Ibid.,* p. 94.
12. Based on Solomon, E *op. cit.*, p. 95.
13. *Ibid.*, p. 96.
14. Under the Indian Company Law, a company cannot re purchase its own shares except under exceptional circumstances.

SOLVED PROBLEMS

P.9.1 Company X and Company Y are in the same risk class, and are identical in every respect except that company X uses debt, while company Y does not. The levered firm has Rs 9,00,000 debentures, carrying 10 per cent rate of interest. Both the firms earn 20 per cent operating profit on their total assets of Rs 15 lakhs. Assume perfect capital markets, rational investors and so on; a tax rate of 35 per cent and capitalisation rate of 15 per cent for an all-equity company.

(a) Compute the value of firms X and Y using the Net Income (NI) Approach.
(b) Compute the value of each firm using the Net Operating Income (NOI) Approach.
(c) Using the NOI Approach, calculate the overall cost of capital (k_0) for firms X and Y.
(d) Which of these two firms has an optimal capital structure according to the NOI Approach? Why?

SOLUTION

(a) *Valuation under NI Approach*

	Firm X	*Firm Y*
EBITRs 3,00,000	Rs 3,00,000	
Less interest	90,000	—
Taxable income	2,10,000	3,00,000
Less taxes	73,500	1,05,000
Earnings for equity holders	1,36,500	1,95,000
Equity capitalisation rate (k_e)	0.15	0.15
Market value of equity (S)	9,10,000	13,00,000
Market value of debt (B)	9,00,000	—
Total value of firm (V)	18,10,000	13,00,000

(b) *Valuation under NOI Approach*

$$V_Y = \frac{\text{Rs } 3,00,000\,(1 - 0.35)}{0.15} = \text{Rs } 13,00,000$$

V_X = Rs 13,00,000 + Rs 9,00,000 (0.35) = Rs 16,15,000

(c) $$KO_x = k_d(.065)\left[\frac{\text{Rs } 9,00,000}{\text{Rs } 16,15,000}\right] + k_e(0.191)\left[\frac{\text{Rs } 7,15,000}{\text{Rs } 16,15,000}\right] = 12.1 \text{ per cent}$$

Similarly, K_{o_y} = 15 per cent

Working Notes

EBITRs	3,00,000
Less interest	90,000
Taxable income	2,10,000
Less taxes	73,500
NI	1,36,500
V as determined in (ii)	16,15,000
B	9,00,000
S ($V - B$)	7,15,000
$k_e = \frac{\text{Rs } 1,36,500}{\text{Rs } 7,15,000}$	191 per cent
k_d = 0.10 (1–0.35)	6.5 per cent

(d) Neither firm has an optimum capital structure according to the NOI Approach. Under the MM assumptions, the optimum capital structure requires 100 per cent debt.

P.9.2 Companies U and L are identical in every respect, except that U is unlevered while L is levered. Company L has Rs 20 lakh of 8 per cent debentures outstanding. Assume (1) that all the MM assumptions are met, (2) that the tax rate is 35 per cent, (3) that EBIT is Rs 6 lakh and that equity-capitalisation rate for company U is 10 per cent.

(a) What would be the value for each firm according to the MM's Approach?

(b) Suppose V_u = Rs 25,00,000 and V_l = Rs 35,00,000. According to MM do they represent equilibrium values? If not, explain the process by which equilibrium will be restored.

SOLUTION

(a) $V_u = \dfrac{\text{EBIT}\,(1-t)}{k_e} = \dfrac{\text{Rs } 6,00,000\,(1-0.35)}{0.10} = \text{Rs } 39,00,000$

$V_l = V_u + Bt$ = Rs 39,00,000 + Rs 20,00,000 (0.35) = Rs 46,00,000

(b) Firm U is undervalued and firm L is overvalued. Investors will be better off by investing in the undervalued firm as they will require lower investment cost to earn the same income as they earn in the overvalued firm. Therefore, they will sell their holdings of the overvalued firm (L) and buy shares of the undervalued firm (U). As a result, the price of shares of company L will come down while that of company U will rise. This process will continue until equilibrium in the values is restored.

P.9.3 In considering the most desirable capital structure of a company, the following estimates of the cost of debt and equity capital (after tax) have been made at various levels of debt-equity mix:

Debt as percentage of total capital employed	*Cost of debt (per cent)*	*Cost of equity (per cent)*
0	5.0	12.0
10	5.0	12.0
20	5.0	12.5
30	5.5	13.0
40	6.0	14.0
50	6.5	16.0
60	7.0	20.0

You are required to determine the optimal debt-equity mix for the company by calculating the composite cost of capital.

SOLUTION

Solution table

k_d *(%)*	k_e *(%)*	W_1 *(B/V)*	W_2 S/V *= (1 − B/V)*	$k_d(W_1) + K_e(W_2) = k_0$*(%)*
5.0	12.0	0.0	1.0	12.00
5.0	12.0	0.1	0.9	11.30
5.0	12.5	0.2	0.8	11.00
5.5	13.0	0.3	0.7	10.75
6.0	14.0	0.4	0.6	10.80
6.5	16.0	0.5	0.5	11.25
7.0	20.0	0.6	0.4	12.20

Optimal debt-equity mix for the company is at a point where the composite cost of capital is minimum. When debt is 30 per cent of the total capital employed, the k_0 is minimum. Therefore, 30 per cent debt and 70 per cent equity mix would be an optimal debt-equity mix for the company.

P.9.4 A company wishes to determine the optimal capital structure. From the following selected information supplied to you, determine the optimal capital structure of the company.

Situation	*Debt*	*Equity*	*After tax cost of debt (%)*	k_e *(%)*
1	Rs 4,00,000	Rs 1,00,000	9	10
2	2,50,000	2,50,000	6	11
3	1,00,000	4,00,000	5	14

SOLUTION

Situation	k_d *(%)*	k_e *(%)*	W_1 *(B/V)*	W_2 *(S/V)*	$k_d(W_1) + k_e(W_2) = k_0$ *(%)*
1	9	10	0.8	0.2	9.2
2	6	11	0.5	0.5	8.5
3	5	14	0.2	0.8	12.2

The optimal capital structure for the company is in situation 2, when it uses 50 per cent debt and 50 per cent equity, as its cost of capital at this level of debt is minimum.

P.9.5 Compute the equilibrium values and capitalisation rates of equity (K) of the companies A and B on the basis of the following data. Assume that (i) there is no income tax, and (ii) the equilibrium value of average cost of capital (P) is 8.5 per cent.

	Initial disequilibrium	
	Company A	*Company B*
Total market value	Rs 250	Rs 300
Debt (L)	0	150
Equity (S)	250	150
Expected net operating income (X)	25	25
Interest ($K.L$)	0	9
Net income (X – K.L)	25	16
Cost of equity (k_e)	0.10	0.107
Leverage (L/V)	0	0.5
Average cost of capital (P)	0.10	0.833

SOLUTION

(i) The equilibrium values $(V_e) = \dfrac{X}{P} = \dfrac{\text{Rs } 25}{\text{Rs } 0.085} = \text{Rs } 294.12$

(ii) *Equity-capitalisation rates for companies A and B:*

	Company A	*Company B*
Expected net operating income (X)	Rs 25	Rs 25
Less interest ($K.L$)	—	9
NI available for equity ($X - K.L$)	25	16
Equilibrium cost of capital (P)	0.085	0.085
Total value of company (X/P)	294.12	294.12
Market value of debt (L)	—	150.00
Market value of equity (S)	294.12	144.12
Cost of equity, $\dfrac{(X - K.L)}{S}$	0.085	0.111

Alternatively, k_e for the levered company B can be determined as follows:

$$k_e = k_0 + (k_0 - k_i)\,\frac{B}{S},\ k_i = 0.06 \text{ (Rs 9 interest on Rs 150 debt)}$$

$$= 0.085 + (0.085 - 0.06) \times \left[\frac{\text{Rs } 150}{\text{Rs } 144.12}\right] = 0.1111$$

For the unlevered company (A) $K_e = k_0$, as there is no k_i.

P.9.6 The values of two firms X and Y in accordance with the traditional theory are given below:

	X	*Y*
Expected operating income ($\bar{X}$)	Rs 50,000	Rs 50,000
Total cost of debt ($k_d.D = R$)	0	10,000
Net income ($\bar{X} - R$)	50,000	40,000
Cost of equity (k_e)	0.10	0.1111
Market value of shares (S)	5,00,000	3,60,000
Market value of debt (D)	0	2,00,000
Total value of firm ($V = S + D$)	5,00,000	5,60,000
Average cost of capital (k_0)	0.10	0.09
Debt equity ratio	0	0.556

Compute the values of firms X and Y as per the MM thesis. Assume that (i) corporate income taxes do not exist, and (ii) the equilibrium values of k_0 is 12.5 per cent.

SOLUTION

Particulars	*Company X*	*Company Y*
Expected operating income ($\bar{X}$)	Rs 50,000	Rs 50,000
Total cost of debt (kd.D = R)	0	10,000
Net income for equity, $\bar{X} - R$	50,000	40,000
Equilibrium cost of capital (k_0)	0.125	0.125
Total value of company = $\bar{X}/k_0$	4,00,000	4,00,000
Market value of debt (D)	—	2,00,000
Market value of equity ($V - D$)	4,00,000	2,00,000
Cost of equity (k_e) $= \dfrac{\bar{X} - R}{S}$	0.125	0.20

P.9.7 Given (i) the EBIT of Rs 2,00,000, (ii) the corporate tax rate of 35 per cent, and (iii) the following data, determine the amount of debt that should be used by the firm in its capital structure to maximise the value of the firm.

Debt	k_i *(before tax) (%)*	k_e*(%)*
Nil	Nil	12.0
Rs 1,00,000	10.0	12.0
2,00,000	10.5	12.6
3,00,000	11.0	13.0
4,00,000	12.0	13.6
5,00,000	14.0	15.6
6,00,000	17.0	20.0

SOLUTION

EBIT	I	*NI*	*Taxes (t)*	*EAT (NI – t)*	K_d *(%)*	K_e *(%)*	B	S	V
Rs 2,00,000	—	Rs 2,00,000	Rs 70,000	Rs 1,30,000	—	12.0	—	Rs 10,83,333	Rs 10,83,333
2,00,000	Rs 10,000	1,90,000	66,500	1,23,500	6.5	12.0	Rs 1,00,000	10,29,167	11,29,167
2,00,000	21,000	1,79,000	62,650	1,16,350	6.8	12.6	2,00,000	9,23,413	11,23,413
2,00,000	33,000	1,67,000	58,450	1,08,550	7.1	13.0	3,00,000	8,35,000	11,35,000
2,00,000	48,000	1,52,000	53,200	98,800	7.8	13.6	4,00,000	7,26,471	11,26,471
2,00,000	70,000	1,30,000	45,500	84,500	9.1	15.6	5,00,000	5,41,667	10,41,667
2,00,000	1,02,000	98,000	34,300	63,700	11.0	20.0	6,00,000	3,18,500	9,18,500

The firm should use Rs 3,00,000 debt to maximise the value of the firm.

P.9.8 A company's current operating income is Rs 4 lakh. The firm has Rs 10 lakh of 10 per cent debt outstanding. Its cost of equity capital is estimated to be 15 per cent.

(a) Determine the current value of the firm, using traditional valuation approach.

(b) Calculate the overall capitalisation rate as well as both types of leverage ratio:(a) B/S (b) B/V.

(c) The firm is considering increasing its leverage by raising an additional Rs 5,00,000 debt and using the proceeds to retire that amount of equity. As a result of increased financial risk, k_i is likely to go up to 12 per cent and k_e to 18 per cent. Would you recommend the plan?

SOLUTION

(a) and (b)

EBIT	Rs 4,00,000
Less interest	1,00,000
Earnings for equityholders (NI)	3,00,000
Equity-capitalisation rate (k_e)	0.15
Market value of equity (S)	20,00,000
Market value of debt (B)	10,00,000
Total market value of firm ($S + B$)	30,00,000
Overall capitalisation rate = EBIT/V	0.1333
(a) Debt/equity ratio (B/S)	0.5
(b) Debt/value ratio (B/V)	0.33

Alternatively, $k_0 = k_i(\text{B/V}) + k_e(\text{S/V}) = 0.10\left[\frac{\text{Rs } 10,00,000}{\text{Rs } 30,00,000}\right] + 0.15\left[\frac{\text{Rs } 20,00,000}{\text{Rs } 30,00,000}\right] = 0.1333$

(c)

EBIT	Rs 4,00,000
Less interest	1,80,000
Earnings for equityholders (NI)	2,20,000
Equity-capitalisation rate (k_e)	0.18
Market value of equity (S)	12,22,222
Market value of debt (B)	15,00,000
Total market value of firm ($S + B$) = V	27,22,222

No, we shall not recommend the plan, as the increased proportion of debt would lower the value of the firm from Rs 30,00,000 to Rs 27,22,222.

P.9.9 The two companies, U and L, belong to an equivalent risk class. These two firms are identical in every respect except that U company is unlevered while Company L has 10 per cent debentures of Rs 30 lakh. The other relevant information regarding their valuation and capitalisation rates are as follows:

	Firm U	*Firm L*
Net operating income (EBIT)	Rs 7,50,000	Rs 7,50,000
Interest on debt (I)	—	3,00,000
Earnings to equityholders (NI)	7,50,000	4,50,000
Equity-capitalisation rate (ke)	0.15	0.20
Market value of equity (S)	50,00,000	22,50,000
Market value of debt (B)	—	30,00,000
Total value of firm (S + B) = V	50,00,000	52,50,000
Implied overall capitalisation rate (k_0)	0.15	0.143
Debt-equity ratio (B/S)	0	1.33

(a) An investor owns 10 per cent equity shares of company L. Show the arbitrage process and the amount by which he could reduce his outlay through the use of leverage.

(b) According to Modigliani and Miller, when will this arbitrage process come to an end?

SOLUTION

(a) Arbitrage process

(i)	Investor's current position (in firm L)	
	Dividend income	Rs 45,000
	Investment cost	2,25,000
(ii)	He sells his holdings of firm L for Rs 2,25,000 and creates a personal leverage by borrowing Rs 3,00,000 (0.10 × Rs 30,00,000 debt of firm L). The total amount with him is Rs 5,25,000. Income required to break even would be:	
	Dividend income (L firm)	45,000
	Interest on personal borrowing (0.10 × Rs 3,00,000)	30,000
		75,000
(iii)	He purchases 10 per cent equity holdings of the firm U for Rs 5,00,000.	
	Dividend income (U firm) (0.10 × Rs 7,50,000)	75,000
	Amount of investment	5,00,000

He will reduce his outlay by Rs 25,000 through the use of leverage.

(b) According to Modigliani and Miller, this arbitrage process will come to an end when the values of both the firms are identical.

P.9.10 The two companies X and Y belong to the same risk class. They have everything in common except that firm Y has 10% debentures of Rs 5 lakh. The valuation of the two firms is assumed to be as follows:

Particulars	*X*	*Y*
Net operating income (EBIT)	Rs 7,50,000	Rs 7,50,000
Interest on debt (*I*)	Nil	50,000
Earnings to equityholders (NI)	7,50,000	7,00,000
Equity-capitalisation rate (k_e)	0.125	0.14
Market value of equity (*S*)	60,00,000	50,00,000
Market value of debt (*B*)	—	5,00,000
Total market value of the firm (*V*)	60,00,000	55,00,000
Implied overall capitalisation rate (k_0)	0.125	0.1363
Debt-equity ratio (*B*/*S*)	0	0.1

An investor owns 10 per cent of the equity shares of the overvalued firm. Determine his investment cost of earnings the same income so that he is at a break-even point? Will he gain by investing in the undervalued firm?

SOLUTION

(A)	Investor's position in over valued firm X	
	Investment cost (0.10 × Rs 60,00,000)	Rs 6,00,000
	Dividend income (0.10 × Rs 7,50,000)	75,000
(B)	He sells his holdings in firm X and purchases 10 per cent equity shares and 10 per cent of debentures of under valued firm Y to earn Rs 75,000.	

	Investment	Income
Shares	Rs 5,00,000	Rs 70,000
Debentures	50,000	5,000
	5,50,000	75,000

The investment of Rs 5,50,000 earns the same amount of income which he was earning on an investment of Rs 6,00,000 in the overvalued firm. Clearly, he will gain by investing in the under valued firm Y.

P.9.11 The following is the data regarding two companies 'X' and 'Y'belonging to the same risk class:

	Company X	*Company Y*
Number of ordinary shares	Rs 90,000	Rs 1,50,000
Market price per share	1.20	1.00
6% Debentures	60,000	—
Profit before interest	18,000	18,000

All profits after debentures interest are distributed as dividends.

Explain how under Modigliani and Miller Approach an investor holding 10 per cent of shares in Company X will be better off in switching his holdings to Company Y.

SOLUTION

(a)	Investor's current position in Firm X with 10 per cent equity holdings:	
	(i) Investments (9,000 shares × Rs 1.20)	Rs 10,800
	(ii) Dividend income 0.10 × (Rs 18,000 – Rs 3,600)	1,440
(b)	Investor sells his holdings of Firm X for Rs 10,800 and creates a personal leverage by borrowing Rs 6,000 (0.10 × Rs 60,000). Thus, the total amount available with him is Rs 16,800.	
(c)	He purchases 10 per cent equity holdings of Company Y for Rs 15,000 (15,000 shares × Re 1); his dividend income is Rs 1,800 (Rs 18,000 × 0.10).	
(d)	Gross income	1,800
	Less interest on personal borrowings (0.06 × Rs 6,000)	360
	Net income	1,440
	He breaks-even by investing in Firm Y. But in the process he reduces his investment outlay by Rs 1,800. Therefore, he is better off by investing in Firm Y. Alternatively, by investing Rs 16,800, he could augment his income to Rs 1,656:	
	Dividend income from Firm Y $\text{Rs}\,18{,}000\left(\frac{\text{Rs}\,16{,}800}{\text{Rs}\,1{,}50{,}000}\right)$	Rs 2,016
	Less interest on personal borrowings	360
	Net income	1,656

REVIEW QUESTIONS

RQ.9.1 What is meant by the concept 'financial risk'? What is the relationship between leverage and the cost of capital? Explain.

RQ.9.2 Give a critical appraisal of the (a) traditional Approach and (b) the Modigliani-Miller Approach to the theory of capital structure.

RQ.9.3 Explain briefly the view of traditional writers on the relationship between capital structure and the value of a firm.

RQ.9.4 'The total value of a firm remains unchanged regardless of variations in its financing mix'. Discuss this statement and point out the role of arbitraging and homemade leverage.

RQ.9.5 Is the MM thesis realistic with respect to capital structure and the value of a firm? If not, what are its main weaknesses?

RQ.9.6 Write notes on:

(a) Home made leverage
(b) Arbitrage process
(c) NI and NOI Approaches
(d) Reverse leverage
(e) MM's thesis with corporate taxes.

RQ.9.7 How would you determine the following?

(a) The cost of equity in the NOI Approach.
(b) The value of equity, given the equity capitalisation rate, EBIT and interest.
(c) The overall capitalisation rate, given the EBIT, value of equity and value of debentures.
(d) The value of levered firm under MM's thesis with taxes.
(e) The overall capitalisation rate, given k_e, k_d, S and B.

RQ.9.8 How will a firm go about determining its 'optimal capital structure'?

RQ.9.9 Alfa Ltd with net operating earnings of Rs 3,00,000 is attempting to evaluate a number of possible capital structures, given below. Which of the capital structure will you recommend, and why?

Capital structure	*Debt in capital structure*	*Cost of debt (K_i) (per cent)*	*Cost of equity (K_e) (per cent)*
1	Rs 3,00,000	10	12
2	4,00,000	10	12.5
3	5,00,000	11	13.5
4	6,00,000	12	15
5	7,00,000	14	18

SOLUTION

Determination of capital structure

	Capital structure plans having debts of various amounts				
Particulars	*1*	*2*	*3*	*4*	*5*
EBIT	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000	Rs 3,00,000
Less interest ($K_i \times B$)	30,000	40,000	55,000	72,000	98,000
Net Income (NI) for equityholders	2,70,000	2,60,000	2,45,000	2,28,000	2,02,000
K_e (equity capitalisation rate)	0.12	0.125	0.135	0.150	0.180

(*Contd.*)

(*Contd.*)

S (market value of equity)	22,50,000	20,80,000	18,14,815	15,20,000	11,22,222
B (market value of debt)	3,00,000	4,00,000	5,00,000	6,00,000	7,00,000
Total market value ($S + B$) = V	25,50,000	24,80,000	23,14,815	21,20,000	18,22,222
Overall cost of capital (K_o) = $EBIT/V$ (per cent)	11.76	12.10	12.96	14.15	16.47

Capital structure having debts of Rs 3,00,000 is recommended as the overall cost of capital at this level is the lowest.

RQ.9.10 The Hypothetical Ltd's current earnings before interest and taxes are Rs 4,00,000. It currently has outstanding debts of Rs 15 lakh at an average cost (K_i) of 10 per cent. Its cost of equity capital is estimated to be 16 per cent.

(i) Determine the current value of the firm,using the traditional approach.

(ii) Determine the firm's overall capitalisation rate and both types of leverage ratios: (a) B/S and (b) B/V.

(iii) The firm is considering reducing its leverage by selling Rs 5 lakh of equity shares in order to redeem Rs 5 lakh debt. The cost of debt is expected to be unaffected. However, the cost of equity capital is to be reduced to 14 per cent. Would you recommend the proposed action?

SOLUTION

(i) *Value of the firm (traditional approach)*

EBIT	Rs 4,00,000
Less interest	1,50,000
NI for equityholders	2,50,000
K_e (equity capitalization rate)	0.16
S (market value of shares)	15,62,500
B (market value of debt)	15,00,000
Total market value ($S + B$)	30,62,500

(ii) K_o = Rs 4,00,000/30,62,500 = 0.131
Leverage ratios: (a) B/S = Rs 15,00,000/15,62,500 = 0.96
(b) B/V = Rs 15,00,000/30,62,500 = 0.49

(iii) *Value of the firm*

EBIT	Rs 4,00,000
Less interest	1,00,000
NI for equityholders	3,00,000
K_e (equity capitalisation rate)	0.14
Market value of shares (*S*)	21,42,857
Market value of debt (*B*)	10,00,000
Total value ($S + B$) = V	31,42,857
K_o = $EBIT/V$	0.1273

The proposal should be accepted as it would increase the value of the firm and reduce the overall cost of capital.

RQ.9.11 Companies U and L are identical in every respect except that the former does not use debt in its capital structure, while the latter employs Rs 6 lakh of 15 per cent debt. Assuming that, (a) all the MM assumptions are met, (b) the corporate tax rate is 35 per cent, (c) the EBIT is Rs 2,00,000, and (d) the equity capitalisation of the unlevered company is 20 per cent, what will be the value of the firms, U and L? Also, determine the weighted average cost of capital for both the firms.

SOLUTION

Value of unlevered firm, V_u = EBIT $(1 - t)/K_e$ = Rs 2,00,000 (1 – 0.35)/0.20 = Rs 6,50,000
Value of levered firm, $V_l = V_u + B_t$ = Rs 6,50,000 + [Rs 6,00,000 (0.35)] = Rs 8,60,000
K_0 of levered firm = 0.20 ($K_e = K_o$)
K_0 of levered firm

EBIT	Rs 2,00,000	
Less interest	90,000	
Net income after interest	1,10,000	
Less taxes	38,500	
NI for equityholders	71,500	
Total market value (V)	8,60,000	
Market value of debt (B)	6,00,000	
Market value of equity (V – B)	2,60,000	
K_e = (NI ÷ S) = Rs 71,500/Rs 2,60,000		0.275
$K_o = K_i$(B/V) + K_e(B/V) = 0.0975 (Rs 6,00,000/Rs 8,60,000) + 0.275 (Rs 2,60,000/Rs 8,60,000)		0.1511

RQ.9.12 (a) The earnings before interest and taxes are Rs 20 lakh for companies L and U. They are alike in all respects except that firm L uses 15 per cent debt aggregating Rs 40 lakh. Given a tax rate of 35 per cent, determine the income to be received by the stakeholders of the two firms. What is the implication of such an outcome on the valuation of the firm, based on MM assumptions?
(b) Determine the values of both the firms, assuming 13 per cent equity capitalisation rate for firm U.

SOLUTION

(a) Income to be received by stakeholders of firms L and U

	Company L	*Company U*
EBIT	Rs 20,00,000	Rs 20,00,000
Less interest	6,00,000	—
Earnings before taxes	14,00,000	20,00,000
Less taxes (0.35)	4,90,000	7,00,000
Income available to equityholders	9,10,000	13,00,000
Income available to debt-holders	6,00,000	—
Income available to stakeholders	15,10,000	13,00,000

Thus, excess income available to L is Rs 2,10,000 which is equivalent to the tax shield on interest (Rs 6 lakhs × 0.35).
PV of tax shield is Rs 2,10,000/0.15 = Rs 14 lakh.
Alternatively, it is equal to $Brt/r = Bt$ = Rs 40 lakh × 0.35. Valuation of *L* will be higher by Rs 14 lakh.

(b) V_u = Rs 13,00,000/0.13 = Rs 100 lakh
$V_l = V_u + Bt$ = Rs 100 lakh + (Rs 40 lakh × 0.35) = Rs 114 lakh.

RQ.9.13 From the following selected data, determine the value of the firms, P and Q belonging to the homogeneous risk class under (a) NI approach, and (b) the NOI approach.

	Firm P		*Firm Q*
EBIT	Rs 2,25,000		Rs 2,25,000
Interest (0.15)	75,000		
Equity capitalisation rate (K_e)		0.20	
Tax rate		0.35	

Which of the two firms has an optimal capital structure?

SOLUTION

(a) *Valuation of the firms (NI approach)*

Particulars	*Firm P*	*Firm Q*
EBIT	Rs 2,25,000	Rs 2,25,000
Less interest	75,000	—
Net income	1,50,000	2,25,000
Less taxes	52,500	78,750
NI for equityholders	97,500	1,46,250
K_e	0.20	0.20
S	4,87,500	7,31,250
B	5,00,000	—
$(B + S)$	9,87,500	7,31,250
K_o	0.1481*	0.20**

*0.0975 [(Rs 5,00,000)/9,87,500] + 0.20[(Rs 4,87,500)/9,87,500] = 0.1481
** 0.20 = K_e

(b) *Valuation of the firms (NOI approach)*

V_Q = EBIT$(1 - t)/K_e$ = [Rs 2,25,000 × (0.65)]/0.20 = Rs 7,31,250
$V_P = V_Q + B_t$ = Rs 7,31,250 + [Rs 5,00,000 × 0.35] = Rs 9,06,250
$S_P = (V_P - B_P)$ = Rs 9,06,250 − Rs 5,00,000 = Rs 4,06,250
K_e = Rs 97,500/4,06,250 = 0.24
$K_o(P) = K_d(B/V) + K_e(S/V)$ = [0.0975 × (Rs 5,00,000/Rs 9,06,250)] + [0.24 × (Rs 4,06,250/Rs 9,06,250)] = 0.1614]
$K_o(Q)$ = 0.20

Conclusion: Firm P has optimal capital structure, under both the NI and NOI approaches.

RQ.9.14 Compute the equilibrium values (V) and equity capitalisation rate of the two companies, X and Y on the basis of the data given below. Assume that (i) there is no income tax, and (ii) the overall rate of capitalisation for such companies in the market is 12.5 per cent.

	X	*Y*
Expected net operating income (NOI)	Rs 1,50,000	Rs 1,50,000
Interest ($K_i \times B$)	20,000	—
NI for equityholders	1,30,000	1,50,000
Equity capitalisation rate	0.13	0.12

(*Contd.*)

(Contd.)

Market value of equity	10,00,000	12,50,000
Market value of debt	4,00,000	—
Total value of firm	14,00,000	12,50,000
Weighted average cost of capital, K_o	0.1071	0.12

SOLUTION

Equilibrium value, V = EBIT/K_o = Rs 1,50,000/0.125 = Rs 12,00,000 (both for X and Y)

Determination of K_e

	X	*Y*
EBIT	Rs 1,50,000	Rs 1,50,000
Less interest	20,000	—
Earnings for equityholders	1,30,000	1,50,000
Overall capitalisation rate	0.125	0.125
Total value of firm	12,00,000	12,00,000
Less market value of debt	4,00,000	—
Market value of equity	8,00,000	12,00,000
K_e	0.1625	0.125

RQ.9.15 The following are the equilibrium values of two firms belonging to the homogeneous risk class according to the NOI approach.

	X	*Y*
Expected NOI (net operating income)	Rs 25,000	Rs 25,000
Less cost of debt (I) = ($K_i \times B$)	5,000	—
Net income for equityholders (EBIT – I)	20,000	25,000
Equilibrium cost of capital (K_o)	0.125	0.125
Total value (V), EBIT/K_o	2,00,000	2,00,000
Market value of debt (B)	1,00,000	—
Market value of equity ($V – B$)	1,00,000	2,00,000
Cost of equity (K_e)	0.20	0.125

Determine the values of the firms, X and Y under the traditional approach, assuming the K_e for company Y as 11 per cent and for X as 14 per cent.

SOLUTION

Valuation of the firms (traditional approach)

	X	*Y*
Expected NOI	Rs 25,000	Rs 25,000
Less cost of debt	5,000	—
NI	20,000	25,000
K_e	0.14	0.11
Market value of equity	1,42,857	2,27,273
Market value of debt	1,00,000	—
Total value	2,42,857	2,27,273

RQ.9.16 Two companies, X and Y belong to equivalent risk group. The two companies are identical in every respect except that company Y is levered, while X is unlevered. The outstanding amount of debt of the levered company is Rs 6,00,000 in 10 per cent debentures. The other information for the two companies is as follows:

	X	*Y*
NOI (net operating income)	Rs 1,50,000	Rs 1,50,000
Interest on debt	—	– 60,000
Earnings to equityholders	1,50,000	90,000
Equity capitalisation rate	0.15	0.20
Market value of equity	10,00,000	4,50,000
Market value of debt	—	6,00,000
Total value of firm	10,00,000	10,50,000
Overall capitalisation rate	0.15	0.143
Debt/equity ratio	0	1.33

An investor owns 5 per cent equity shares of company Y. Show the process and the amount by which he could reduce his outlay through use of the arbitrage process. Are there any limits to the 'process'?

SOLUTION

Abritrage process

(a) Investor's current position (in firm Y)	
Dividend income (0.05 × Rs 90,000)	Rs 4,500
Investment cost (0.05 × Rs 4,50,000)	22,500
(b) He sells his holdings in firm Y for Rs 22,500 and creates a personal leverage by borrowing Rs 30,000 (0.05 × Rs 6,00,000). The total amount with him is Rs 52,500. Income required for break even is:	
Dividend income (Y firm)	4,500
Add interest on personal borrowings (0.10 × Rs 30,000)	3,000
	7,500
(c) He purchases five per cent equity shares of the firm X for Rs 50,000 as the total value of the firm is Rs 10,00,000.	
Dividend of the firm X (0.15 × Rs 50,000)	7,500
Amount of investment	50,000

The investor, thus, can reduce his outlay by Rs 2,500 through the use of leverage.

Yes, there are limits to the arbitrage process; this process will come to an end when the values of both firm become identical.

RQ.9.17 Two companies, A and B, belong to the same risk class. The two firms are identical in every respect except that firm A has 10 per cent debentures. The valuation of the two firms as per the traditional theory is as follows:

	A	*B*
NOI (net operating income)	Rs 22,50,000	Rs 22,50,000
Interest on debt	1,50,000	—
Earnings to equityholders	21,00,000	22,50,000
Equity capitalisation rate	0.14	0.125
Market value of equity	1,50,00,000	1,80,00,000
Market value of debt	15,00,000	—
Total market value of firm	1,65,00,000	1,80,00,000
Implied overall capitalisation rate	0.1364	0.125
Debt/equity ratio	0.1	0

Show the arbitrage process by which an investor who holds shares worth Rs 22,500 in company B will be benefited by investing in company A.

SOLUTION

Arbitrage process

(i) Investor's current position (in firm *B*)

Dividend income (Rs 22,50,000 × 0.125)	Rs 2,812.50
Investment cost	22,500

(ii) He sells his current holdings in firm *B* for Rs 22,500 and acquires 12.5 per cent of equity and debt of company *A.* As a result of this investment, his income and investment outlay would be as follows:

	Investment outlay	*Income*
Equity	Rs 18,750	Rs 2,625
Debt	1,875	187.50
	20,625	2,812.50

(iii) Thus, the investor can reduce his outlay by Rs 1,875 through the arbitrage process.

EXAMINATION QUESTIONS

EQ. 9.1 State three assumptions of Modigliani and Miller approach to cost of capital. (*CA—November, 2002*)

EQ. 9.2 Discuss the relationship between the financial leverage and firm's required rate of return to equity shareholders as per Modigliani and Miller proposition II. (*CA—May, 2003*)

EQ. 9.3 Discuss briefly the propositions made in Modigliani and Miller approach on cost of capital. (*CA (PE-II)—May, 2007*)

EQ. 9.4 Explain in brief the assumptions of Modigliani-Miller theory. (*CA (PE-II—May, 2007*)

10 Designing Capital Structure

Introduction

The preceding chapter, focusing on the theoretical relationship between capital structure, cost of capital and valuation, has shown that although the empirical evidence is not conclusive, theoretically a judicious combination of debt and equity does affect the cost of capital as also the total value of the firm. There is, in other words, an optimum capital structure. The capital structure is said to be optimum when the marginal real cost (explicit as well as implicit) of each available source of financing is identical. With an optimum debt and equity mix, the cost of capital is minimum and the market price per share (or total value of the firm) is maximum. The use of debt in capital structure or financial leverage has both benefits as well as costs. While the principal attraction of debt is the tax benefit, its cost is *financial distress* and reduced commercial profitability. The term *financial distress*[1] includes a broad spectrum of problems ranging from relatively minor liquidity shortages to bankruptcy. The problem of financial distress will magnify with an increase in financial leverage. Beyond a certain point, the expected cost of financial distress will outweigh the tax benefit. A firm is, thus, concerned with a trade-off between risk and return emanating from the use of debt. A proper balance between the two is, therefore, called for.

Given the objective of maximisation of shareholders' wealth, the need for an optimal capital structure cannot, therefore, be overemphasized. In operational terms, every firm should try to design such a capital structure. But the determination of an optimum capital structure is a formidable task. It should be clearly understood that identifying the *precise percentage* of debt that will maximise price per share is almost impossible. It is possible, however, to determine the *approximate proportion* of debt to use in the financial plan in conformity with the objective of maximising share prices.

In theory, one can speak of an *optimum* capital structure, but, in practice, it is very difficult to design one. There are significant variations among industries as also among individual companies within the same industry in respect of capital structure. This is so because there are a host of factors, both quantitative and qualitative, including subjective judgement of financial managers which determine the capital structure of a firm. These factors are highly complex and cannot fit entirely into a theoretical framework. From the operational standpoint, therefore, what should be attempted is an *appropriate* capital structure, given the facts of a particular case.

The present chapter which focuses on determining the *appropriate* mix of debt to be used along with equity in the capital structure discusses the important factors which have a bearing on designing

capital structure of a firm. The terms *designing capital structure, capital structure decision, factors determining capital structure and capital structure planning* are used interchangeably here.

It may be noted, at the outset, that there are certain common, and often, conflicting considerations involved in determining the methods of financing assets because the position of each company is different. Accordingly, the weight given to various factors also varies widely, according to conditions in the economy, the industry and the company itself. Above all, the freedom of management to adjust the mix of debt and equity in accordance with these criteria is limited by the availability of the various types of debt to have an appropriate capital structure, but the debt may not be available to the company because the suppliers of the funds may think that it will involve too much financial risk for them. Consequently, the plans that management ultimately makes in the light of these considerations often involve a compromise between the desires and conditions imposed by the suppliers of funds. Moreover, none of the factors by itself is completely satisfactory. But, collectively, they provide sufficient information for taking rational decisions. The key factors governing the capital structure decisions are (i) profitability aspect, (ii) liquidity aspect, (iii) control, (iv) leverage ratios in industry, (v) nature of industry, (vi) consultation with investment banks/lenders, (vii) commercial strategy, (viii) timing, (ix) company characteristics and (x) tax planning.

PROFITABILITY ASPECT

Earnings Before Interest and Tax (EBIT) – Earnings per Share (EPS) Analysis

Keeping in view the primary objective of financial management of maximising the market value of the firm, the EBIT-EPS analysis should be considered logically as the first step in the direction of designing a firm's capital structure. As discussed in detail in Chapter 8, the EBIT-EPS analysis shows the impact of various financing alternatives on EPS at various levels of EBIT. This analysis is useful for two reasons: (i) the EPS is a measure of a firm's performance—given the P/E ratio, the larger the EPS, the larger would be the value of a firm's shares; and (ii) given the importance of EPS and the function of the EBIT-EPS analysis to show the value of EPS under various financial alternatives at different levels of EBIT, the EBIT-EPS analysis information can be extremely useful to the finance manager in arriving at an appropriate financing decision. The EBIT-EPS analysis is illustrated in Chapter 8. From Fig. 8.5, [based on Example 8.8 (i)], we see that the EPS is Rs 6.5 per share at the point of intersection of two financial alternatives: (i) 100 per cent equity financing, and (ii) 50 per cent equity financing and 50 per cent debt financing. At that point, EPS is equal under both the plans. At the point of intersection, the EBIT level is Rs 3 lakh. Beyond the point of intersection, the EPS is higher under alternative (ii) which uses 50 per cent debt than alternative (i). Below the point of intersection, the EPS is higher under alternative (i) which exclusively uses equity rather than the half debt-mixed alternative (ii). Which financial plan should be adopted, is to be determined with reference to the likely level of EBIT. If the company's likely level of EBIT is Rs 4.5 lakh, the debt-mixed alternative should be preferred as the EPS is Rs 13 under this alternative while it is Rs 9.75 under the equity alternative. Thus, the finance manager can compare the point of intersection with the most likely level of EBIT and can decide the financing mix. The manager should determine the probability of 'critical' levels of EBIT. If the probability of EBIT going below Rs 3 lakh is negligible or very low, the debt-mix alternative should be recommended by the finance manager. On the other hand, if the probability of EBIT falling below the indifference point is high, the equity-alternative should be preferred. In general, the higher the level of EBIT and the lower the probability of downward fluctuation, the greater is the amount of debt that can be employed. While taking a decision in this respect, it should be remembered that P/E ratio is less for a levered

financial plan due to increased financial risk. Therefore, increase in EPS should be greater so that its advantage is not completely offset or more than offset by using debt in the capital structure. Moreover, if the debt alternative entails a provision for creating a sinking fund, the finance manager should keep in mind that earnings available for payment of dividends and reinvestment to further expand facilities would be reduced by the amount of the sinking fund payment. The indifference point would then be computed using Eq. 10.1.

$$\frac{\text{UEPS – Debt Plan}}{\dfrac{(\text{EBIT} - \text{I})\,(1 - \text{t}) - \text{SF}}{\text{N}_1}} = \frac{\text{UEPS – Equity Plan}}{\dfrac{(\text{EBIT})\,(1 - \text{t})}{\text{N}_2}} \tag{10.1}$$

where UEPS = uncommitted earnings per share

SF = sinking fund payment per annum

I = interest payments

Let us suppose in our example 8.8, the sinking fund payment is Rs 1,40,000 for 8 years. The indifference point would have to be escalated to Rs 5,00,000. The earlier decision of going for debt at the most likely level of EBIT of Rs 4.5 lakh will be reversed. Likewise, in calculating the indifference level of EBIT, he should take cognizance of fixed interest or sinking fund liability on the other debts already outstanding. If preference shares are outstanding, its dividend (and sinking fund, if any, in the case of redeemable preference shares) requirements should also be provided for.

Coverage Ratio

Apart from the EBIT-EPS analysis, the ability of a firm to use debt, from the profitability point of view, can also be judged in terms of a coverage ratio, namely,

$$\frac{\text{EBIT}}{\text{I}} \tag{10.2}$$

Or

$$\frac{\text{EBIT}}{\text{I} + \left[\dfrac{\text{SF}}{1 - \text{t}}\right]} \tag{10.3}$$

The ratio measures the size of the interest payments relative to the EBIT. The reciprocal of this ratio (I/EBIT) measures the proportion of EBIT devoted to interest payments. The higher the coverage ratio, the greater is the certainty that the firm would be in a position to meet its obligations of interest payment.

The coverage ratio can be calculated, like the EPS, for various levels of EBIT. This would provide a better picture of the firm's most likely EBIT to meet out specific commitments. It will throw light on the adequacy of EBIT to meet the firm's annual burden of payments connected with interest on loan, preference dividend, contribution to sinking fund (if any) and other repayments of principal.

LIQUIDITY ASPECT

Cash Flow Analysis

EBIT-EPS analysis and coverage ratios are very useful in making explicit the impact of leverage on EPS and on the firm's ability to meet its commitments at various levels of EBIT. But the EBIT/interest ratio is

less than a perfect measure to analyse the firm's ability to service fixed charges because the firm's ability to do so depends on the total payments required, that is, interest and principal, in relation to the cash flow available to meet them. Therefore, the analysis of the cash flow ability of the firm to service fixed charges is an important exercise to be carried out in capital structure planning in addition to profitability analysis. The exercise is of overwhelming significance in the context of the risk of bankruptcy. If the firm borrows more than its debt capacity and, therfore, fails to meet its obligations in future, the lenders may seize the assets of the company to satisfy their claims. Thus, the basic existence of the company would be endangered.

It may be possible that the company's EBIT is adequate to cover its specific commitments, arising out of debt obligations; but, the firm may not have sufficient cash to pay as its income is blocked within the firm in the form of higher inventory, receivables and/or sometimes purchases of fixed assets, particularly, when the company is a growing one. In the absence of cash flow analysis, a company, which is otherwise profitably sound, would, in case of default, run into great difficulties. Thus, cash flow analysis is an essential ingredient of any sound capital structure decision.

Cash flow analysis yields a number of distinct advantages in the crucial task of setting debt policy: (i) it focuses on the *solvency* of the firm during adverse circumstances in contrast to EBIT-EPS analysis which is concerned with the effects of leverage under normal circumstances; (ii) it takes into consideration the balance sheet changes and other cash flows that do not appear in the profit and loss account; (iii) it gives an insight into the *inventory of financial resources* available in the event of recession; and (iv) finally, it views the problem in a dynamic context over time whereas EBIT/EPS and coverage analysis normally consider only a single year. From all these points, it can be concluded that the cash flow analysis evaluates the risk of financial distress and should be recognised as a good supporting supplement to the EBIT/EPS analysis in framing the firm's capital structure.

In assessing the liquidity position of a firm in terms of its cash flow analysis, various measures can be employed. One such measure[2] is the *ratio of fixed charges to net cash inflows*. This ratio measures the coverage of fixed financial charges (interest plus repayment of principal, if any) to net cash inflows. In other words, it indicates the number of times the fixed financial requirements are covered by the net cash inflows. The greater the coverage ratio, the greater is the amount of debt (and other sources of funds carrying a fixed rate of interest/dividend) that a firm can use.

Another measure[3] to analyse the cash flow ability of a firm to service fixed charges in determining an appropriate capital structure is to prepare a cash budget to determine whether the expected cash flows are sufficient to cover the fixed obligations.[4] The purpose of preparing the cash budget is to find out possible deviations in actual cash flows from those that are expected. Therefore, cash budgets should be prepared for a range of possible cash inflows with a probability attached to each of them. This information can be used to evaluate the ability of the firm to meet its fixed obligations. Since the probability of various cash flow patterns is known, the firm can work out the amount of fixed charges as well as the debt that the firm can employ and still remain within an *insolvency limit tolerable to the management*.[5]

Suppose, the firm is of the view that 5 per cent is the maximum probability of not having cash to meet charges that can be tolerated (i.e. it will not cause insolvency). Further, suppose that the actual probability of being out of cash on the basis of the cash budget prepared under adverse circumstances is also 5 per cent. In such a situation, according to Van Horne, debt can be employed up to a point where the cash balance is just sufficient to cover the fixed charges. That is to say, debt can be increased up to the point at which the additional cash drain would cause the probability of cash insolvency to equal the risk tolerance specified by management. It is, of course, not necessary that the debt would be increased to that point. This method of analysis suggested by Van Horne provides a means for assessing the effect of increase in debt on the risk of cash insolvency. On the basis of the information available from this analysis, the firm would determine the most appropriate level of debt.

A similar type of analysis has been suggested by Gordon Donaldson.[6] It is argued that a firm will normally be able to meet its fixed obligations in terms of interest as well as repayment of principal. It is only during adverse circumstances that firms will not be able to maintain their ability to meet contractual obligations and would be exposed to the *risk of bankruptcy* or the extreme form of *risk of financial distress*. Donaldson terms these as *recession* conditions. To examine the impact of alternative debt policies on the risk of bankruptcy, therefore, what is required is a careful analysis of how a firm's cash flows would be affected by recession conditions. We illustrate below the effect of alternative debt policies on the risk of bankruptcy so as to determine debt capacity or optimum amount of debt appropriate to a particular firm.[7]

Cashflow Analysis in Recession The alternative debt policies in recession are illustrated in Example 10.1.

EXAMPLE 10.1

A firm, Hypothetical Ltd, is planning its financial structure. At present the debt-equity ratio is 1:4, that is, debt is 20 per cent of the total. The firm has to choose an appropriate amount of debt. The question at issue is whether the Hypothetical Ltd should (i) continue with the present level of debt, (ii) use more debt or (iii) use less debt.

The Hypothetical Ltd manufactures a wide variety of industrial products. It sales are moderately affected by the business cycle. Its sales and cash flow data for four years are given in Table 10.1.[8]

Table 10.1 *Actual Sales and Cash Flows*

(Rs Lakh)

Particulars	*Year 1*	*Year 2*	*Year 3*	*Year 4*
Sales	116.6	121.1	112.0	126.5
Profits after taxes	5.8	7.7	6.7	6.5
Sources of funds:				
Operations	21.1	23.1	22.4	22.4
Working capital	3.0	(0.6)	3.1	(1.2)
Total	24.2	22.5	25.5	21.2
Uses of funds:				
Plant and equipment	(6.8)	(8.2)	(13.2)	(14.5)
Taxes	(3.8)	(3.7)	(3.4)	(3.2)
Lease payments	(1.9)	(2.0)	(2.1)	(2.1)
Interest	(2.0)	(1.8)	(1.7)	(1.6)
Repayment of debt	(1.4)	(1.4)	(1.4)	(1.4)
Dividend	(2.8)	(2.8)	(2.8)	(3.0)
Miscellaneous	(0.1)	(0.2)	(0.7)	(0.3)
Total	(18.8)	(20.1)	(25.3)	(26.1)
Changes in cash balance	*5.4*	*2.4*	*0.2*	*(4.9)*

The firm expects that in the subsequent years there will be recession. On the basis of past experience, the assumed pattern of sales during the recession is as given in Table 10.2.

Table 10.2 *Assumed Patterns of Sales during Recession (Percentages)*

Year prior to recession	*Year of recession*			
0	*1*	*2*	*3*	*4*
100	90	80	80	100

The implication of this pattern of sales is that the decline in sales during the recession period ranges between 10 and 20 per cent. Also, assume that the prices would decline by 3 per cent but would recover in the fourth year to the level of the year prior to the recession.

Prepare cash forecasts under recession conditions to determine the debt capacity of the Hypothetical Ltd.

SOLUTION

To prepare forecasts of cash flows under recession conditions, cash flows are divided into three categories: (i) operating; (ii) non-operating; and (iii) financial flows.

Operating Cash Flows cover sales revenues and cash operating expenses. Using the above information/ assumptions regarding sales volume and price, the operating cash flows of the Hypothetical Ltd over the recession period are computed in Table 10.3.

Table 10.3 *Operating Cash Flows under Recession Conditions for Hypothetical Ltd*

(Rs Lakh)

Particulars	*Year prior to recession*	*Recession years*			
	0	*1*	*2*	*3*	*4*
1. Sales at stable prices	126.5	113.9	101.2	101.2	126.5
2. As % of sales for year 4 (year prior to recession)	100	90	80	80	100
3. Sales at 3% price decline	126.5	110.5	98.2	98.2	126.5
4. Cash operating expenses	101.6	90.7	84.4	82.6	101.6
5. Net operating cash flows (3-4)	24.9	19.8	13.8	15.6	24.9

Non-operating Cash Flows include capital outlays and changes in working capital. The non-operating financial flows of the Hypothetical Ltd are given in Table 10.4.

Table 10.4 *Non-operating Cash Flows under Recession Conditions for Hypothetical Ltd*

(Rs Lakh)

Particulars	*Year prior to recession*	*Recession years*			
	0	*1*	*2*	*3*	*4*
1. Plant and equipment	(10.0)	(10.0)	(5.0)	(3.0)	(7.0)
2. Expenditure for working capital:					
Cash	(0.2)	0.3	—	—	(0.4)
Marketable securities	—	0.4	—	—	—
Accounts receivable	(1.2)	(1.6)	2.4	(1.1)	(3.6)
Inventory	(1.7)	2.6	0.4	(1.2)	(3.4)
Accounts payable	1.6	(2.1)	(2.0)	0.8	1.0
Total	(1.5)	(0.4)	0.8	(1.5)	(6.4)
3. Net operating cash outflow (1 + 2)	(11.5)	(10.4)	(4.2)	(4.5)	(13.4)

Financial Flows cover lease payments, interest on debt, repayment of principal, taxes and dividends. The financial flows of the Hypothetical Ltd under the present capital structure are shown in Table 10.5.

Table 10.5 *Projected Financial Flows under the Existing Capital Structure*

(Rs Lakh)

	Year prior to recession	*Recession years*			
	0	*1*	*2*	*3*	*4*
1. Lease payments	(2.1)	(2.1)	(2.1)	(2.1)	(2.1)
2. Interest on debt*	(1.5)	(1.4)	(1.3)	(1.2)	(1.0)
3. Repayment of debt	(1.4)	(1.4)	(1.4)	(1.4)	(1.4)
4. Dividend[a]	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
5. Taxes	(3.2)	(2.6)	(2.1)	(2.6)	(3.2)
Total	(11.2)	(10.5)	(9.9)	(10.3)	(10.7)

*Principal due at the beginning of year. 0 = Rs 18.6 lakh. Rate of interest 8 per cent. Interest shown for year 0 is that due in year, 0. Sinking fund payments are Rs 1.4 lakh per year.

[a]Dividend is Rs 2 per share on 1.5 lakh outstanding shares.

Alternative Debt Policies We now show cash flows for three debt policies: (i) for the current capital structure with 20 per cent debt; (ii) for Alternative A with 35 per cent debt; and (iii) for 50 per cent debt which may be referred to as Alternative B. While total financial flows for proposed alternative debt policies are presented in Table 10.6, Table 10.7 contains the relevant cash flows for the three alternative debt policies for the Hypothetical Ltd.

Table 10.6 *Projected Total Financial Flows Under Proposed Debt Policies*

	Year prior to recession	*Recession year*			
	(0)	*(1)*	*(2)*	*(3)*	*(4)*
35% Debt	(12.3)	(11.5)	(10.8)	(11.1)	(11.5)
50% Debt	(13.3)	(12.4)	(11.6)	(11.8)	(12.1)

Table 10.7 *Alternative Debt Policies for Hypothetical Ltd[aa].*

(Rs Lakh)

Particulars	*Year prior to recession*	*Recession years*			
	0	*1*	*2*	*3*	*4*
Current Capital Structure:					
1. Non-financial flows, net (Tables 12.3 & 12.4)	13.4	9.4	9.6	11.1	11.5
2. Financial flows (Table 12.5)	(11.2)	(10.5)	(9.9)	(10.3)	(10.7)
3. Change in cash balance (1-2)	2.2	(1.1)	(0.3)	0.8	0.8
4. Cumulative change	2.2	1.1	0.8	1.6	2.4
5. Change in cash with dividend eliminated in year 1[a] (Item 3 + Rs 3 lakh)	2.2	1.9	2.7	3.8	3.8
6. Cumulative change	2.2	4.1	6.8	10.6	14.4

(*Contd.*)

(*Contd.*)

Alternative A: 35% debt:					
7. Financial flows	(12.3)	(11.5)	(10.8)	(11.1)	(11.5)
8. Change in cash balance (1-7)	1.1	(2.1)	(1.2)	—	—
9. Cumulative change	1.1	(1.0)	(2.2)	(2.2)	(2.2)
10. Change in cash with dividend eliminated in year[b] (Item 8 + Rs 2.4 lakh)	1.1	0.3	1.2	2.4	2.4
11. Cumulative change	1.1	1.4	2.6	5.0	7.4
Alternative B: 50% debt:					
12. Financial flows	(13.3)	(12.4)	(11.6)	(11.8)	(12.1)
13. Change in cash balance (1 - 12)	0.1	(3.0)	(2.0)	(0.7)	(0.6)
14. Cumulative change	0.1	(2.9)	(4.9)	(5.6)	(6.2)
15. Change in cash with dividend eliminated in year 1[c] (Item 13 + Rs 1.9 lakh)	0.1	(1.1)	(0.1)	1.2	1.3
16. Cumulative change	0.1	(1.0)	(1.1)	0.1	1.4

[aa]Solomon, E and J J Pringle, op.cit. p. 486. Reprinted by permission from Goodyear Publishing Company, Santa Monica, USA.

[a]Dividend of Rs 3.0 lakh per year. Item 5 assumes that dividend is eliminated completely in year 1 and no dividend at all is paid in years 1-4.

[b]Dividend of Rs 2.4 lakh per year with less equity and more debt in capital structure. Same assumptions regarding elimination in year 1.

[c]Dividend of Rs 1.9 lakh per year, with same assumptions regarding elimination.

Interpretation of Cash Flow Analysis in Recession It can be seen from Table 10.7 that interest on incremental debt is 8 per cent a year, that is, the same in all alternatives. However, dividends, repayment of principal and tax payments change as a result of change in the amount of debt under various alternatives.

The conclusions that emerge from the cash flow analysis in Table 10.7 are:

1. Under the current financing plan, with 20 per cent debt, there is a cash deficit in years 1 and 2, assuming there is no cut in divided (Item 3). These deficits are financed by the surplus in the year prior to the onset of recession (0 year). On a cumulative basis (Item 4), the firm could survive the recession without cutting the divided to the shareholders.
2. Under Alternative A, with 35 per cent debt, the cash deficit is somewhat larger in years 1 and 2 (Item 8). The surplus (Rs 1.1 lakh) in year 0 is not sufficient to finance the subsequent deficits. To eliminate cash deficit, dividends are to be cut. It implies that the firm can survive the recession only if it cuts the dividends to the shareholders.
3. Finally, when the debt is increased to 50 per cent (Alternative B), there is cash deficit in all the years of recession (Item 13). Even after eliminating dividends, there is cash deficit in years 1 and 2, even on a cumulative basis (Items 15 and 16). Thus, Alternative B cannot be sustained during a recession even after no dividends are paid.

Given the above facts, it may be concluded that the Hypothetical Ltd can use 30-35 per cent debt and avoid financial bankruptcy during recession.

The approach illustrated above to analyse cash flows to determine debt capacity can be refined by introducing probabilities. Probability distributions would be required for revenues and other uncertain cash flows. Probability distributions then could be estimated for the changes in cash balance shown in Table 10.7. A complete analysis would yield a probability distribution for each cash balance figure in each year. Such a procedure is very difficult and complex. We have, therefore, excluded this aspect.[9] Thus, cash flow

analysis under recession conditions provides information on the effects of alternative financing plans on the risk of insolvency. This information is extremely useful in taking capital structure decisions.

CONTROL

Another consideration in planning the types of funds to use is the attitude of the management towards control. Lenders have no direct voice in the management of a company. They may, of course, place certain restrictions in the loan agreement on the management's activities. So long as there is no default in the payment of interest or the repayment of the principal, there is little that they can do legally against the company. For all practical purposes, they have very little say in the policy-decisions of the company or in the selection of the board of directors. Likewise, preference shareholders do not have the right to vote for the appointment of the board of directors. However, if the financial affairs of the company have deteriorated to such an extent that dividends on preference shares have not been paid for a certain number of years (2-year period in India), they are given the right to attend the meetings and participate in the voting. In most of the cases, they, like the creditors, do not have any say in the selection of the management. The power to choose the management in most cases rests with the equity holders. Accordingly, if the main object of the management is to maintain control, they will like to have a greater weightage for debt and preference shares in additional capital requirements, since by obtaining funds through them the management sacrifices little or no control. However, it should be remembered that if the company borrows more than what it can service or repay, the creditors may seize the assets of the company to satisfy their claims. In that situation, the management would lose all control. It might be better to sacrifice a measure of control by some additional equity financing rather than run the risk of losing all control to creditors by employing too much debt.[10] The same holds true for preference shares. In such a situation, equity would be a better source of financing. However, if the firm has the ability, as determined by profitability and solvency considerations discussed above, and the management wants to maintain control in its own hands, the issue of senior securities will be recommended as the issue of additional equity shares would involve the risk of losing control. This will be all the more true if the company is *closely held*. The management of widely-held companies runs little risk of losing continuation of control. The shares of such companies are widely distributed. Most of the shareholders are interested simply in the return and have neither the time nor the inclination to participate in management. If they are not satisfied, they will switch over to other companies.

LEVERAGE RATIOS FOR OTHER FIRMS IN THE INDUSTRY

Yet another approach to the capital structure decisions is to make a comparison with the debt-equity ratios of companies belonging to the same industry, having a similar business risk. The rationale of the use of industry standards is that debt-equity ratios appropriate for other firms in a similar line of business should be appropriate for the company as well. Industry standards provide a useful benchmark. If the firm is out of line, it is conspicuous in the market place. This does not necessarily imply that the firm's capital structure planning is inappropriate. It may well be possible that other firms may not be using appropriate debt-equity ratios. They may be more conservative or more aggressive risk-takers than desired. However, comparison is helpful as it acts as a red signal to the management that there may be something wrong with the debt-equity mix of the company. In other words, what it suggests is that if a firm is out of line, it should know the reasons why and be satisfied that there are good reasons for it.[11]

NATURE OF INDUSTRY

The nature of industry is one of the most important elements in determining the degree of financial leverage a firm can carry safely without any risk of bankruptcy. If an industry's sales are subject to wide fluctuations, over a business cycle, the firm should have a low degree of financial leverage. Such firms will already have a high operating leverage. In case both are high, the total risk of the firm as determined by the combined leverage (the product of operating leverage and financial leverage) would become unduly high.[12] The firms with high debt ratios belonging to industries such as refrigeration, televisions, machine tools and capital equipment manufacturing, run the risk of not being able to meet the required payments in lean years which would cause financial distress. Clearly, such firms should have a more conservative capital structure and rely less on debt. On the other hand, industries dealing with non-durable consumer goods (food) or with inexpensive items (paper clips, match boxes) or with items in habitual use (cigarettes) or all those products which have an inelastic demand are not likely to be subject to wide fluctuations in sales. Such industries can afford to have higher debt proportions in capital structure as in lean years they do not run the risk of being unable to meet their commitments.

Judging industry by its competitive nature, it may be inferred that those industries which have keen competition among themselves should have a relatively greater proportion of equity than debt. For example, in the garment industry much of the competition is based on style. The styles being unpredictable and transitory the profits also fluctuate accordingly. Therefore, such firms should emphasise equity over debt because of the excessive risk of not being able to meet payments on borrowed funds. At the other extreme, there are public utility undertakings involved in the production of electricity, gas, water, transportation services or telephone services, which are relatively free from intra-industry competition. Their sales are more stable and predictable. Therefore, such companies can afford to use more debt.

The stage of the life cycle of the industry has also a crucial bearing in assigning relative weightage to various sources of raising finance. If the industry is in its infancy, the probability of the rate of mortality would be high. Therefore, more emphasis needs to be placed on equity capital. The firm would do well to avoid seeking funds from senior securities which require fixed payments. At such a stage, risk outweighs the attractions of financial leverage. When the industry has reached maturity and is passing through the period of rapid growth, the firm should pay special attention to manoeuverability to assure that as it grows it obtains funds when needed and under acceptable terms. If the outlook is for a long-term decline in business, the firm should build such a plan which allows for easy contraction in the sources of the funds used.[13] For this purpose, the firm can have 'call' provision in the case of senior securities.

CONSULTATION WITH INVESTMENT BANKERS AND LENDERS

Another useful approach in deciding the proportion of various securities in a firm's structure is to seek the opinion of investment analysts, institutional investors, investment bankers and lenders. These analysts, having been in business for a considerable period of time, acquire expertise and have access to information regarding securities of a large number of companies and know how the market evaluates them. They are, therefore, in a better position to assess a particular financial plan.

Similarly, the opinions of prospective lenders and investors are likely to be very useful to the firm; it is they who will ultimately provide funds to the firm. Therefore, the type of securities which they will prefer to buy is very significant information for the financial manager and helps him in taking a decision regarding the form of securities to be issued. It is imperative that if a financial decision is to contribute to the valuation of the firm, the finance manager must think in a way similar to that of the investors.

MAINTAINING MANOEUVERABILITY FOR COMMERCIAL STRATEGY

Manoeuverability refers to a firm's ability to adjust its sources of funds in either direction–increase or decrease–in response to changes in the need for funds. That is, the finance manager must keep himself in a situation where he can change positions. Therefore, while designing the capital structure, he should not lose sight of the future impact on the present financial plan. For instance, the firm may adopt an aggressive debt policy as it looks good at one point but if in future the firm is in need of additional funds, it may be forced to issue equity shares on unfavourable terms as the firm has a too heavy debt and is, therefore, unable to obtain funds in this form. Due to increased financial risk, the cost of equity would be higher. Clearly, the opportunity cost of an unwise debt-policy could turn out to be very high. Therefore, in order to preserve operating flexibility, a firm is well advised to have unused debt capacity for future needs, that is, it should operate below the maximum safe debt level. The preservation of unused debt capacity can be an important consideration for the company whose funds requirements are sudden and unpredictable. It gives the company financial manoeuverability by virtue of leaving the options open.[14]

There should be room for flexibility not only in obtaining funds but also in refunding them. To provide the desired flexibility, the firm might incorporate a call provision as one of the covenants of the agreement with the suppliers of funds. The call provision implies that the firm with an adequate notice can repay their principal sum.

Flexibility, however, can be obtained only at a cost. When a finance manager achieves flexibility, it means that the party at the other end of the transaction is foregoing something and for doing this would like to be compensated. *Callable* preference shares and options for advance payment of long-term debt are devices for maintaining flexibility. But, they will require higher yield to be paid than *non-callable* preference shares and long-term debts for a definite number of years. Therefore, the finance manager faces the task of risk/return trade-off. He is to assure himself that he is *not buying flexibility at a higher cost than is warranted by gains achieved through flexibility*

TIMING OF ISSUE

Closely related to flexibility in deciding the types of funds to be used, is the question of timing. Frequently very substantial savings may be obtained by proper timing of security issues. Thus, the timing of the public offerings is also an important consideration in capital structure decisions of a firm. Public offering should be made at a time when the state of the economy as well as the capital market is ideal to provide the funds. The monetary and fiscal policies that are pursued by the government are also important in this regard. *The government follows a cheap money policy to boost the economy during a recession and a dear money policy during inflationary periods.* The type of policy pursued by the government reflects itself in prices as well as yields on senior securities and equity. High debentures yields are associated with relative scarcity of debt money and low P/E ratios on shares are an indication of the relative scarcity of equity funds. Frequently, therefore, the company has to decide whether to finance initially with an equity issue and later with a debt issue, or *vice-versa.* Consequently, it is forced to evaluate the alternative methods of financing in the light of general market conditions and expectations for the company itself. If the management feels that borrowed funds will become costly or scarce, the firm may like to use the benefit of financial leverage immediately. An expected decline in interest rates may encourage the firms to postpone borrowings, and remain in a flexible position which helps to take advantage of lower interest rates in the future.

At times, funds will be needed and must be obtained if they are relatively costly. This aspect of our discussion is related to the internal rate of return (IRR). If the project materialises just when demand for the product involved is strong, the early return to flow of funds is higher; the IRR is higher and perhaps a somewhat higher cost of capital can be profitably tolerated. The differential increase in the rate of return, at this time, is more than the differential in the cost of money. It is foolhardy for a finance manager to chase the lowest cost of money only to find that he has procured the funds at bargain rates when the time for their usefulness has passed.[15]

However, it should be borne in mind, that timing is not the only consideration. The timing analysis may suggest, for instance, use of debt. But the company cannot go in for debt if its existing capital structure is already top-heavy with debt. Agreements with the existing lenders of the funds may impose certain other restrictions. Thus, timing in obtaining funds is exercised within limits imposed by the timing of needs for funds, the extent of flexibility, and existing explicit agreements, sometimes an implicit understanding, with lenders and owners.

CHARACTERISTICS OF THE COMPANY

The characteristics of a company in terms of size and credit standing, among others, also play a vital role in determining the share of senior securities and equity in its capital structure.

The management's freedom of choice is extremely limited in the case of small and very large companies. Companies that are very small must rely, to a considerable degree, upon the owner's funds for their financing; they find it very difficult to obtain long-term debts. In the minds of investors, generally, small firms are considered to be more risky than large firms. Therefore, such firms do not have ready access to different types of funds from various sources. They are generally in a weak bargaining position in obtaining funds. Since their sources of raising funds are limited, they can assign larger weights to the factor of flexibility. In contrast, very large companies are compelled to make use of different sources of raising funds as no single source can cater to their total requirements of funds.

Firms enjoying a high credit standing among investors/ lenders in the capital market are in a better position to get funds from the sources of their choice. If the credit standing is poor, the firm's choice of obtaining funds is rather limited.

TAX PLANNING

Finally, tax planning is likely to have a significant bearing on capital structure decisions. Under the Income Tax Act, 1961, while interest on borrowed funds is allowed as a deduction under Section 36(1)(iii), dividend on shares is not deductible from the operating profits of a company. With effect from June 1, 1997, distributed profits are subject to an extra 10 per cent tax under Sections 115,O/P/Q. Secondly, cost of raising finance through borrowings is deductible in the year of incurrence. If, however, it is incurred during pre-commencement of business period, it has to be capitalised. The cost of issue of shares is allowed as a deduction in 10 years under Section 35 D. As a result, corporate taxation is an important determinant of the choice between different sources of financing. For a widely-held company with expansion involving Rs 100 lakh, the implication on taxes on the rate of return on equity capital with reference to the alternative capital structures are depicted in Table 10.8: (1) Alternative I, Rs 100 lakh equity capital; (2) Alternative II, equity capital, Rs 40 lakh + debentures, Rs 40 lakh + institutional loans, Rs 20 lakh, and (3) Alternative III, equity capital, Rs 20 lakh + debentures, Rs 30 lakh + loans from financial institutions, Rs 50 lakh. The before-tax expected rate of return = 25 per cent. The rate of dividend is 20 per cent.

Table 10.8 *Effect of Taxes on Capital Structure Decision (Rs thousand)*

Particulars	Alternative I	Alternative II	Alternative III
Return (Rs 100 lakh × 0.25)	Rs 2,500	Rs 2,500	Rs 2,500
Less interest on debentures (0.14)	—	560	420
Less interest on loan (0.18)	—	360	900
Taxable profit	2,500	1,580	1,180
Tax (0.35)	875	553	413
Return on equity capital	1,625	1,027	767
Rate of return on equity capital (before dividend tax)	16.25	25.68	38.35

The alternative III is obviously the best.

The effect of corporate taxation on capital structure decision is further illustrated in Example 10.2.

EXAMPLE 10.2

The paid-up capital of a company is Rs 100 lakh. It has been declaring 20 per cent dividend for the last 5 years.

It has under consideration an expansion programme involving an investment of Rs 100 lakh and its board of directors desires to raise the dividend to 25 per cent. The expansion programme can be financed by four alternatives: A, 100 per cent equity; B, 18 per cent institutional loan (debt) and equity 50:50. C, equity and debt, 70:30; and D, 100 per cent debt. Income tax and dividend tax are 35 per cent and 10 per cent respectively.

Assuming rate of return of X, analyse the various financing alternatives from the point of view of taxes.

SOLUTION

The computation are shown in Table 10.9.

Table 10.9 *Effect of Taxes on Financing Alternatives (Rs lakh)*

Particulars	*A*	*B*	*C*	*D*
1. Return on Rs 100 lakh	100X	100X	100X	100X
2. Less interest (0.18)	—	9	5.4	18
3. Balance	100X	100X – 9	100X – 5.4	100X – 18
4. Less tax (0.35)	35X	35X – 3.16	35X – 1.9	35X – 6.30
5. Balance	65X	65X – 5.86	65X – 3.52	65X – 11.70
6. *Add* distributable profit before expansion (0.20 × Rs 100 lakh)	20	20	20	20
7. Total profits available for distribution (a)	20 + 65X	14.14 + 65X	16.48 + 65X	8.30 + 65X
8. Expected rate of dividend (%)	25	25	25	25
9. Expected dividend (0.25 × [Rs 100 lakh + new capital]	50	37.50	42.50	25
10. Dividend tax (0.10)	5	3.76	4.26	2.5
11. Total of dividend and dividend tax (b) [9 + 10]	55	41.26	46.76	27.5
12. Rate of return (value of X) to pay dividend and dividend tax [value of X if (a) = (b)] (%)	54[@]	42	47	30

[@] 20 + 65 X = 55 or X = 35/65 = 54 per cent; other vlues are also determind like this.

Thus, the company will be able to raise dividend on shares to 25 per cent only if the return on the new project under the four alternatives are 54(A), 42(B), 47(C) and 30(D).

SUMMARY

- A host of factors, both quantitative and qualitative, including subjective judgment of financial managers, have a bearing on the determination of an optional capital structure of a firm. They are not only highly complex but also conflicting in nature and, therefore, cannot fit entirely into a theoretical framework. Moreover, the weights assigned to various factors also vary widely, according to conditions in the economy, the industry and the company itself. Therefore, a corporate should attempt to evolve an appropriate capital structure, given the facts of a particular case.
- The key factors relevant to designing an appropriate capital structure are: (i) profitability, (ii) liquidity, (iii) control, (iv) leverage ratios in industry, (v) nature of industry, (vi) consultation with investment banks/lenders, (vii) commercial strategy, (viii) timing, (ix) company characteristics and (x) tax planning.
- Given the objective of financial management to maximise the shareholders wealth, a corporate should carry out profitability analysis in terms of determining the amount of EBIT (indifference point) at which its MPS is identical under two proposed financial plans. In general, the higher the level of EBIT than the indifference point and the lower the probability of its downward fluctuation, the greater is the amount of debt that can be employed by a corporate.

  Coverage ratio can also be used to judge the adequacy of EBIT to meet the firm's obligations to pay financial charges, interest on loan, preference dividend and repayment of principal. A higher ratio implies that the firm can go for larger proportion of debt in its capital structure.
- Liquidity position of a firm is analysed by cash flow analysis. One measure relates the ratio of fixed financial charges to net cash inflows. A firm can afford higher debt if the ratio is high.

  Another measure to determine the adequacy of cash flows to meet the fixed obligations in cash budget. A cash budget should be prepared for a range of possible cash inflows with a probability attached to each of them. Since the probability of various cash flow pattern is known, the firm can determine the level of debt it can employ and still remain within an insolvency limit tolerable to the management. The impact of alternative debt policies should also be examined under adverse circumstances/recession conditions.
- To retain control over management, a firm would prefer use of debt to equity.
- The debt-equity ratio of a firm should be similar to those of other companies in the industry.
- In case sales are subject to wide fluctuations, a firm should employ less debt. Firms subject to keen competition should prefer a greater proportion of equity. The corporates in industry groups which are at their infancy should rely more on equity capital.
- Investment analysts/bankers/institutional investors understand the capital market better as well as requirements of investors/lenders. Their opinion is also useful in designing capital structure.
- An appropriate capital structure should provide room for flexibility not only in obtaining funds but also in refunding them.
- Public issue of share as well as debt capital should be made at a time when the state of the economy as well as the capital market is ideal to provide the funds. For instance, it will be useful to postpone borrowings if decline in interest rates is expected in the future.
- The characteristics of company, *inter-alia,* in terms of size and credit standing are decisive in determining its capital structure. While large firms enjoying a high credit standing among investors

are in a better position to obtain funds from the sources of their choice, the relatively small firms, new firms and firms having poor credit standing have limited option in this regard.

➔ The choice of an appropriate debt policy involves a trade-off between tax benefits and the cost of financial distress. Moreover, the management should consider the implicit cost of the tax subsidy in using debt.

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9. For such analysis, refer to Donaldson, *op. cit.*, pp. 67-79. Also Van Horne, *op. cit.*, pp. 234-36.
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11. Solomon, E and J J Pringle, *op. cit.*, p. 478.
12. For a discussion of 'operating and financial leverage' refer to Chapter 10.
13. Johnson, R W, *op. cit.*, p. 233.
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SOLVED PROBLEMS

P.10.1 The Hardware Company Ltd has to make a choice between debt issue and equity issue for its expansion programme. Its current position is as follows:

5% Debt	Rs 20,000
Equity capital (Rs 10 per share)	50,000
Surpluses	30,000
Total capitalisation	1,00,000
Sales	3,00,000
Total costs	2,69,000
Income before interest and taxes	31,000
Interest	1,000
Earnings before taxes	30,000
Income tax	10,500
Income after taxes	19,500

The expansion programme is estimated to cost Rs 50,000. If this is financed through debt, the rate of interest on new debt will be 7 per cent and the price-earnings ratio will be 6. If the expansion programme is financed through equity, new shares can be sold netting Rs 25 per share; and the price-earnings ratio will be 7. The expansion will generate additional sales of Rs 1,50,000 with a return of 10 per cent on sales before interest and taxes.

If the company is to follow a policy of maximising the market value of its shares, which form of financing should it choose?

SOLUTION

Determination of market value of a share under different financing alternatives

Particulars	*Financial plan*	
	7% debt issue	*Equity issue*
EBIT	Rs 46,000	Rs 46,000
Less interest	4,500	1,000
Earnings after interest	41,500	45,000
Less taxes	14,525	15,750
EAT	26,975	29,250
EPS (EAT/Number of shares)	5.395	4.18
Price earning ratio	6	7
Market value of share	32.37	29.25

The company should choose debt form of financing to maximise the market value of its shares.

Working Notes

(i) Present EBIT Rs 31,000
Plus expected EBIT (0.10 × Rs 1,50,000) 15,000
Total EBIT 46,000

(ii) Number of equity shares: With debt financing, the number of ordinary shares = 5,000 (Rs 50,000 ÷ Rs 10). In case of equity financing = additional 2,000 (Rs 50,000 ÷ Rs 25) new equity shares.

P.10.2 AB Limited provides you with the following information:

Profit	Rs 3,00,000
Less interest on debentures (0.12)	60,000
Earnings before taxes	2,40,000
Less taxes (0.35)	84,000
Earnings after taxes	1,56,000
Number of equity shares (Rs 10 each)	40,000
Earnings per share	3.9
Ruling market price	39
P/E ratio (Price/EPS)	10 times

The company has undistributed reserves, Rs 6,00,000. It needs Rs 2,00,000 for expansion which will earn the same rate as funds already employed.

You are informed that a debt-equity ratio (debt/debt-equity) higher than 35 per cent will push the P/E ratio down to 8 and raise the interest rate on additional amount borrowed to 14 per cent.

You are required to ascertain the probable price of the shares:

(a) If the additional funds are raised as debt; and

(b) If the amount is raised by rising equity shares (at current market price).

SOLUTION

Probable price of share of AB Ltd under different alternatives

	14% Debt	*Equity shares*
EBIT at 20%* on capital employed@	Rs 3,40,000	Rs 3,40,000
Less debenture interest	60,000	60,000
Less interest on borrowings	28,000	—
Earnings before taxes	2,52,000	2,80,000
Less taxes	88,200	98,000
Earnings after taxes	1,63,800	1,82,000
Number of equity shares	40,000	45,128
EPS	4.095	4.033
X P/E ratio	8 times	10 times
MPS	32.76	40.33

@ Rs 17,00,000 [Rs 4,00,000 equity + Rs 6,00,000 reserves + Rs 5,00,000 (Rs 60,000/0.12 debentures) + Rs 2,00,000 proposed to be raised).

* Rs 3,00,000/Rs 15,00,000 = 0.20

P.10.3 The Evergreen Company has the choice of raising an additional sum of Rs 50 lakh either by the sale of 10 per cent debentures or by issue of additional equity shares of Rs 50 per share. The current capital structure of the company consists of 10 lakh ordinary shares.

At what level of earnings before interest and tax (EBIT) after the new capital is required, would earnings per share (EPS) be the same whether new funds are raised by issuing ordinary shares or by issuing debentures? Also, determine the level of EBIT at which uncommitted earnings per share (UEPS) would be the same if sinking fund obligations amount to Rs 5 lakhs per year. Assume a 35 per cent tax rate. Discuss the relevance of the calculation.

SOLUTION

(i) Determination of indifference point:

Debt alternative	=	*Equity alternative*
$\frac{(X - I)(1 - t)}{N_1}$	=	$\frac{(X)(1 - t)}{N_2}$
$\frac{(X - \text{Rs } 5,00,000)(1 - 0.35)}{10,00,000}$	=	$\frac{x(1 - 0.35)}{11,00,000}$
X = Rs 55,00,000		

Verification table

	10% Debt alternative	*Equity alternative*
EBIT	Rs 55,00,000	Rs 55,00,000
Less interest	5,00,000	Nil
Earnings after interest	50,00,000	55,00,000
Less taxes	17,50,000	19,25,000
EAT	32,50,000	35,75,000
N	10,00,000	11,00,000
EPS	3.25	3.25

(ii) Determination of indifference level with sinking funds(s)

Debt alternative	=	*Equity alternative*
$\frac{(X - I)(1 - t) - S}{N_1}$	=	$\frac{(X)(1 - t)}{N_2}$
$\frac{(X - \text{Rs } 5,00,000) \times (0.65) - (\text{Rs } 5,00,000)}{10,00,000}$	=	$\frac{0.65X}{11,00,000}$
X = Rs 1,39,61,538		

Verification table

	10% Debt	*Equity*
EBIT	Rs 1,39,61,538	Rs 1,39,61,538
Less interest	5,00,000	Nil
EBT	1,34,61,538	1,39,61,538
Less taxes	47,11,538	48,86,538
Earnings after taxes	87,50,000	90,75,000
Less sinking fund payment	5,00,000	Nil
Earning for equityholders	82,50,000	90,75,000
N	10,00,000	11,00,000
EPS	8.25	8.25

The relevance of indifference level of EBIT is that it enables the management to take better financial decisions. It is a point beyond which the leverage (use of debt) becomes favourable in that the use of debt could be employed to enhance the EPS. Therefore, if the estimated EBIT is more than the indifference level, debt alternative to raise finance should be used, otherwise the equity alternative would be preferred.

The uncommitted EPS approach is useful to the conservative decision makers, who look to debt not only in terms of interest payment but also in terms of its repayment. Therefore, they want to get an idea of earnings which, could meet both the payments. However, this approach is of short-term significance only as after the redemption of debentures, the sinking fund balance is transferred to general reserves and thus forms a part of the equity holders' funds.

REVIEW QUESTIONS

RQ.10.1 Discuss the influence of the following two factors on the choice of a specific mode of financing a company: (a) general financial position of a company; and (b) general market conditions.

RQ.10.2 Define capital structure. What is an appropriate capital structure? What is a flexible capital structure?

RQ.10.3 Write a note on the important determination of the capital structure of a firm.

RQ.10.4 '.....an analysis of the magnitude and stability of cash flows relative to fixed charges is extremely important in determining an appropriate capital structure.' Comment.

RQ.10.5 How can the effect of profitability on designing an appropriate capital structure be analysed? Illustrate your answer with the help of EBIT-EPS analysis.

RQ.10.6 X Ltd is considering three different plans to finance its total project cost of Rs 100 lakh: A, B and C.

	Plan A	*Plan B*	*Plan C*
Equity capital (Rs 100 per share)	50	34	25
10% Debentures	50	66	75
	100	100	100

Sales for the first 3 years of operations are estimated at Rs 100 lakh, Rs 125 lakh and Rs 150 lakh respectively and a 10 per cent profit before interest and taxes is forecast. The tax is to be taken at 35 per cent.

Compute EPS in each of the 3 alternative financing plans.

SOLUTION

Determination of EPS for years 1–3 under alternative financing plans (amount in lakh of rupees)

Particulars	*Year 1*			*Year 2*			*Year 3*		
	A	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
Sales	*100*	*100*	*100*	*125*	*125*	*125*	*150*	*150*	*150*
EBIT (0.10 × sales)	10	10	10	12.5	12.5	12.5	15	15	15
Less interest	5.0	6.6	7.5	5.0	6.6	7.5	5.0	6.6	7.5
EBT 5	3.4	2.5	7.5	5.9	5.0	10.0	8.4	7.5	
Less taxes (0.35)	1.75	1.19	0.875	2.625	2.065	1.75	3.5	2.94	2.625
EAT 3.25	2.21	1.625	4.875	3.835	3.25	6.5	5.46	4.875	
Number of shares	50,000	34,000	25,000	50,000	34,000	25,000	50,000	34,000	25,000
EPS (Rs)	6.5	6.5	6.5	9.75	11.28	13	13	16.06	19.5

RQ.10.7 A promoter is considering methods to finance establishment of a company. Initially, Rs 2,00,000 will be needed. The promoter is considering two proposals for the purpose: (a) issue of 15% Debentures of Rs 1,00,000, and issue of 1,000 equity shares of Rs 100 each; and (b) issue of 2,000 equity shares of Rs 100 each. The tax rate is 35 per cent.

(i) (a) Compute the indifference point of the above proposed financial plans.
(b) Show that the indifference point computed in (a) above is correct.
(c) Compute EPS under the two proposed financial plans if EBIT is Rs 40,000. How do you explain the difference in your results?

(ii) Assume that levered financial plan is used. Initially, the company is expected to operate at a level of 1,00,000 units (selling price is Rs 2 per unit; variable cost, Re 1 per unit, and fixed operating costs, Rs 50,000). Your calculations will show increase in EBIT, compared to assumed level of EBIT in (i) (c) of Rs 40,000. What is the percentage increase in EPS due to increase in EBIT? Use these figures to compute the degree of financial leverage.

(iii) Assuming everything to be the same as given in situation (ii), except that sales rises by 20 per cent from 1,00,000 units to 1,20,000 units, compute; (a) The percentage increase in EPS; (b) The degree of operating leverage (take 1,00,000 units as the base level); and (c) The combined leverage.

SOLUTION

(i) (a) $[(X - I)(1 - t)]/N_1 = X(1 - t)/N_2 = [(X - \text{Rs } 15{,}000)\ 0.65]\ /1{,}000 = (X - 0.65X)/2{,}000 = (0.65X - \text{Rs } 9{,}750)\ /\ 1{,}000 = 0.65X\ /\ 2{,}000 = 2(0.65X - \text{Rs } 9{,}750) = 0.65X.$

$1.3X - \text{Rs } 19{,}500 = 0.65X$ or $0.65X = \text{Rs } 19{,}500$ or $X = \text{Rs } 30{,}000$. Indifference point would be at the level of Rs 30,000 EBIT (X).

(b) *Verification table*

Particulars	*Plan 1* (Equity + Debt)	*Plan 2* (Equity)
EBIT	Rs 30,000	Rs 30,000
Less interest	15,000	—
EBT	15,000	30,000
Less taxes	5,250	10,500
EAT	9,750	19,500
EPS (EAT ÷ N)	9.75	9.75

(c) *EPS: When EBIT is* Rs *40,000*

Particulars	*Plan 1*	*Plan 2*
EBIT	Rs 40,000	Rs 40,000
Less interest	15,000	—
EBT	25,000	40,000
Less taxes	8,750	14,000
EAT	16,250	26,000
EPS	16.25	13

Leverage starts becoming favourable after the EBIT of Rs 30,000. Therefore, the financial plan, having debt-equity mix, yields higher EPS compared to pure equity plan.

(ii) *Determination of EPS*

Sales revenue	Rs 2,00,000
Less variable costs	1,00,000
Less fixed costs	50,000
EBIT	50,000
Less interest	15,000
EBT	35,000
Less taxes	12,250
EAT	22,750
EPS	22.75

DFL = % Change in EPS/% Change in EBIT = 0.4/0.25 = 1.6

(iii) *Determination of EPS*

Sales revenue	Rs 2,40,000
Less variable costs	1,20,000
Less fixed costs	50,000
EBIT	70,000
Less interest	15,000
EBT	55,000
Less taxes	19,250
EAT	35,750
EPS	35.75

(a) Percentage increase in EPS is 57.14 per cent (Rs 13.75/Rs 22.75).
(b) DOL = [EBIT ÷ EBIT]/[Sales ÷ Sales] = [Rs 20,000 ÷ Rs 50,000]/[Rs 40,000 ÷ Rs 2,00,000] = 0.4/0.2 = 2.
(c) DFL = % Change in EPS/% Change in EBIT = 0.5714/0.40 = 1.43
(d) DCL = DOL × DFL = 2 × 1.43 = 2.86.

RQ.10.8 Key information pertaining to the proposed new financing plans of Hypothetical Ltd is given below:

Sources of funds	*Financing plans*	
	1	*2*
Equity	15,000 shares of Rs 100 each	30,000 shares of Rs 100 each
Preference shares	12%, 25,000 shares of Rs 100 each	—
Debentures	Rs 5,00,000 at a coupon rate of 0.10	15,00,000, coupon rate of 0.11

Assuming 35 per cent tax rate,
(i) Determine the two EBIT - EPS coordinates for each financial plan.
(ii) Determine the (a) indifference point, and (b) financial break-even point for each financing plan.
(iii) Which plan has more financial risk and why?
(iv) Indicate over what EBIT range, if any, one plan is better than the other.
(v) If the firm is fairly certain that its EBIT will be Rs 12,50,000, which plan would you recommend, and why?

SOLUTION

(i) *Two EBIT-EPS coordinates for each financial plan*

		Financing plans	
		1	*2*
Interest on debentures		Rs 50,000	Rs 1,65,000
Dividend on preference shares before taxes (Rs 3,00,000/(1– 0.35)		4,61,538	—
	(a)	5,11,538	1,65,000
Expected EBIT		12,50,000	12,50,000
Less interest on debentures		50,000	1,65,000
EBT		12,00,000	10,85,000
Less taxes		4,20,000	3,79,750
EAT		7,80,000	7,05,250
Less preference shares dividend		3,00,000	—
Earnings for equity holders		4,80,000	7,05,250
Number of shares		15,000	30,000
EPS	(b)	32	23.51

Coordinate	*EBIT Financial plan*		*EPS Financial plan*	
	1	*2*	*1*	*2*
Lower (one)	Rs 5,11,538	Rs 1,65,000	Zero	Zero
Higher (two)	12,50,000	12,50,000	Rs 32	Rs 23.51

(ii) (a) *Indifference point*: $[(X - I)(1 - t) - D_p]/N_1 = [(X - I(1 - t)]/N_2 = [(X$ – Rs 50,000) × 0.65 – Rs 3,00,000]/15,000 = [(X – Rs 1,65,000) × 0.65]/30,000 or [0.65X – Rs 32,500 – Rs 3,00,000]/15,000 = [0.65X – Rs 1,07,250]/30,000.

Multiplying both sides of the equation by 30,000, we have,
2(0.65X – Rs 3,32,500) = 0.65X – Rs 1,07,250
X – Rs 6,65,000 = 0.65X – Rs 1,07,250
0.65X = Rs 5,57,750, or X = Rs 8,58,077.
(b) *Financial break even points*: $I + D_p/(1 - t)$, Plan 1 = Rs 50,000 + (Rs 3,00,000)/0.65 = Rs 5,11,538, Plan 2 = Rs 1,65,000.

(iii) *Financial risk is measured by the DFL. Plan 1 has more financial risk as its DFL is likely to be higher.*
(iv) *Plan 2 is better for EBIT level of less than Rs 8,58,077; Plan 1 is better for EBIT ranges beyond that level.*
(v) *Plan 1, as EPS will be higher [(determined in (i) above)].*

RQ.10.9 Hypothetical Ltd is in need of Rs 1,00,000 to finance its increased net working capital requirements. The finance manager of the company believes that its various financial costs and share price will be unaffected by the selection of a particular plan, since a small sum is involved. Debentures will cost 10 per cent, preference shares 11 per cent, and equity shares can be sold for Rs 25 per share. The tax rate is 35 per cent.

Sources of funds	*Financial plans (per cent)*		
	1	*2*	*3*
Equity shares	100	30	50
Preference shares	0	10	20
Debentures	0	60	30

(i) Determine the financial break even point.
(ii) Which plan has grater risk? Assume EBIT level of Rs 50,000.

SOLUTION

(i) *Financial break-even point* = $I + D_p/(1 - t)$
Financial plan 1 = zero
2 = Rs 6,000 + (Rs 1,100/0.65) = Rs 7,692
3 = Rs 3,000 + (Rs 2,200/0.65) = 6,385

(ii) $DFL = EBIT/[EBIT - I - D_p/(1 - t)]$
Financial plan 1 = Rs 50,000/Rs 50,000 = 1
2 = Rs 50,000/(Rs 50,000 – Rs 7,692) = 1.18
3 = Rs 50,000/(Rs 50,000 – Rs 6,385) = 1.15

Financial plan 2 has higher financial risk.

RQ.10.10 Aditya Mills Ltd has submitted to you the following four ways of financing its expansion programme. The tax rate is 35 per cent. Key information relating to the four plans is as follows:

Sources of funds	*Financial plans*			
	1	*2*	*3*	*4*
Equity shares	Rs 58,500	Rs 37,500	Rs 83,500	Rs 25,000
Preference shares of Rs 100 each	Nil	11,250 @ 10%	7,500 at 9%	Nil
Debentures	15,00,000 @ 10%	10,00,000 @ 11%	Nil	25,00,000 @ 12%

(i) Determine the financial break-even point for each plan.
(ii) Determine the degree of financial leverage associated with each plan. (Assume EBIT of Rs 10 lakh).
(iii) Which plan is the least risky?

SOLUTION

(i) *Financial break even point* = $I + D_p/(1 - t)$

Plan 1 = Rs 1,50,000

2 = Rs 1,10,000 + (Rs 1,12,500/0.65) = Rs 2,83,077

3 = Rs 67,500/0.65 = Rs 1,03,846

4 = Rs 3,00,000

(ii) *Degree of financial leverage* = EBIT/[EBIT – I – $(D_p/1 - t)$]

Plan 1 : Rs 10,00,000/(Rs 10,00,000 – Rs 1,50,000) = 1.18

2 : Rs 10,00,000/[(Rs 10,00,000 – Rs 1,10,000 – (Rs 1,12,500/0.65) = 1.39

3 : Rs 10,00,000/[Rs 10,00,000 – (Rs 67,000/0.65)] = 1.12

4 : Rs 10,00,000/(Rs 10,00,000 – Rs 3,00,000) = 1.43

RQ.10.11 A growing company is confronted with a choice between 15% Debt issue and equity issue to finance its new investments. Its pre-expansion income statement is as follows:

Sale (production capacity of Rs 60,00,000 at current sales price)	Rs 45,00,000
Fixed cost	5,00,000
Variable cost (2/3 of sales)	30,00,000
EBIT	10,00,000
Interest at (0.125)	1,00,000
EBT	9,00,000
Income tax (0.35)	3,15,000
Net income	5,85,000
EPS	11.7

The expansion programme is estimated to cost Rs 5,00,000. If this is financed through debt, the rate of interest will be 15 per cent and the P/E ratio will be 10. If expansion programme is financed through equity, new shares can be sold at Rs 100 per share, and the P/E ratio will be 12. Expansion will generate additional sales of Rs 12,75,000. No additional fixed costs would be needed to meet the expansion operation. If the company is to follow a policy of maximising the market value (MV) of its shares, which form of financing should be employed by the company?

SOLUTION

Market value of shares under different financing alternatives

Particulars	*15% Debt*	*Equity shares*
Sales revenue	Rs 57,75,000	Rs 57,75,000
Less fixed costs	5,00,000	5,00,000
Less Variable costs (2/3 of sales)	38,50,000	38,50,000
EBIT	14,25,000	14,25,000
Less interest	1,75,000	1,00,000
EBT	12,50,000	13,25,000
Less taxes	4,37,500	4,63,750
EAT	8,12,500	8,61,250
Number of equity shares (N)	50,000	55,000
EPS (EAT ÷ N)	16.25	15.66
P/E ratio (times)	10	12
Market price (EPS × P/E ratio)	162.50	187.92

Recommendation: Equity financing should be adopted by the company, as it maximises the MPS.

EXAMINATION QUESTIONS

EQ. 10.1 Discuss the major considerations in capital structure planning. (*CA—May, 2006*)

EQ. 10.2 A company earns a profit of Rs 3,00,000 per annum after meeting its interest liability of Rs 1,20,000 on 12 per cent debentures. The tax rate is 50 per cent. The number of equity shares of Rs 10 each are 80,000 and the retained earnings amount to Rs 12,00,000. The company proposes to take up an expansion scheme for which a sum of Rs 4,00,000 is required. It is anticipated that after expansion, the company will be able to achieve the same return on investment as at present. The funds required for expansion can be raised either through debt at the rate of 12 per cent or by issuing equity shares at par.

Required:

(i) Compute the earnings per share (EPS), if:
- The additional funds were raised as debt
- The additional funds were raised by issue of equity shares

(ii) Advise the company as to which source of finance is preferable. (*CA—November, 2002*)

SOLUTION

Determination of EPS under proposed financial plans

Particulars	*12% Debt*	*Equity shares*
EBIT after expansion (see working notes 1 – 4)	Rs 4,76,000	Rs 4,76,000
Less interest	1,68,000	1,20,000
EBT	3,08,000	3,56,000
Less taxes (0.50)	1,54,000	1,78,000
EAT	1,54,000	1,78,000
Number of equity shares	80,000	1,20,000
EPS	1.925	1.483

Advise: Debt plan is preferable as EPS is higher under this plan.

Working Notes

1. *Total capital employed*

Equity capital (80,000 shares × Rs 10)	Rs 8,00,000
Retained earnings	12,00,000
Debentures (Rs 1,20,000/0.12)	10,00,000
	30,00,000

2. *Earnings before interest and taxes (EBIT)*

Earnings after interest/Earnings before taxes	Rs 3,00,000
Add interest	1,20,000
EBIT	4,20,000

3. *Existing ROR on investment/capital employed*

ROR = EBIT/Total capital employed

= Rs 4,20,000/Rs 30,00,000 = 14 per cent

4. *Expected EBIT after expansion*

Existing EBIT	Rs 4,20,000
Add additional EBIT (0.14 × Rs 4,00,000)	56,000
	4,76,000

Part Five

Our discussion in Part III of this Volume related to the management of the fixed assets which yield returns over a period of time. In practice, a firm has also to employ short-term assets and short-run resources of financing. The management of such assets, described as working capital management or current assets management, is one of the most important aspects of the overall financial management. Technically, working capital management is an integral part of the overall financial management. To that extent, it is similar to the long-term decision-making process because both entail an analysis of the effect of risk and profitability.

The problems involved in the management of working capital differ from those in the management of in fixed assets. In the first place, fixed assets are acquired to be retained in the business over a period of time and yield returns over the life of the assets. Probably, the most notable feature of such assets, from the view point of financial analysis, is the time dimension. The operational implication is that discounting and compounding techniques to adjust the value of benefits accruing from such assets over time play a fairly significant role in financial management. In contrast, the stock-in-trade of working capital management, by definition, is short-term assets which loses its identity fairly quickly, usually within an operating cycle not exceeding a year. In the management of working capital, therefore, the time factor is not at all crucial as a decision variable.

Yet another notable feature of short-term assets is the question of profitability versus liquidity and the related aspect of risk. If the size of such assets is large, the liquidity position would improve, but profitability would be adversely affected as funds will remain idle. conversely, if the holdings of such assets are relatively small, the overall profitability will no doubt increase, but it will have an adverse effect on the liquidity position and make the firm more risk–prone. Working capital management should, therefore, aim at striking a balance such that there is an optimum amount of short-term assets. The purpose of this Part is to provide an insight into the problems of managing working capital. There are two issues involved; first, the overview of working capital management in terms of the basic concepts, basic relationships between different kinds of short-term assets and liabilities, their financing and so on. It has been covered in Chapter 11. Secondly, the components of working capital, the individual assets, are covered in the subsequent chapters of this Part. The chapters 12 through 14 respectively analyse the management of cash, receivables and inventory.

11 Working Capital Management—An Overview

Introduction

This chapter presents an overview of working capital management. Section 1 explains the nature of working capital and the determination of financing mix. Section 2 is concerned with the planning of working capital requirements. The main sources of working capital financing are covered in Section 3. The main points are summarised in the last Section.

NATURE OF WORKING CAPITAL

This Section explains the nature of working capital in terms of the basic concepts, strategies and policies of working capital management. It also illustrates the determination of financing mix.

Working capital management is concerned with the problems that arise in attempting to manage the current assets, the current liabilities and the interrelationship that exists between them. The term *current assets* refer to those assets which in the ordinary course of business can be, or will be, converted into cash within one year without undergoing a diminution in value and without disrupting the operations of the firm. The major current assets are cash, marketable securities, accounts receivable and inventory. Current liabilities are those liabilities which are intended, at their inception, to be paid in the ordinary course of business, within a year, out of the current assets or earnings of the concern. The basic current liabilities are accounts payable, bills payable, bank overdraft, and outstanding expenses. *The goal of working capital management is to manage the firm's current assets and liabilities in such a way that a satisfactory level of working capital is maintained.* This is so because if the firm cannot maintain a satisfactory level of working capital, it is likely to become insolvent and may even be forced into bankruptcy. The current assets should be large enough to cover its current liabilities in order to ensure a reasonable margin of safety. Each of the current assets must be managed efficiently in order to maintain the liquidity of the firm while not keeping too high a level of any one of them. Each of the short-term sources of financing must be continuously managed to ensure that they are obtained and used in the best possible way. *The interaction between current assets and current liabilities is, therefore, the main theme of the theory of working management.*

Concepts and Definitions of Working Capital

There are two concepts of working capital: gross and net.

The term *gross working capital*, also referred to as working capital, means the total current assets.

The term *net working capital* can be defined in two ways: (i) the most common definition of net working capital (NWC) is the difference between current assets and current liabilities; and (ii) alternate definition of NWC is that portion of current assets which is financed with long-term funds.[1]

The task of the financial manager in managing working capital efficiently is to ensure sufficient liquidity in the operations of the enterprise. The liquidity of a business firm is measured by its ability to satisfy short-term obligations as they become due. The three basic measures of a firm's overall liquidity are (i) the current ratio, (ii) the acid-test ratio, and (iii) the net working capital. The suitability of the first two measures has already been discussed in detail in Chapter 4. In brief, they are very useful in interfirm comparisons of liquidity. Net working capital (NWC), as a measure of liquidity, is not very useful for comparing the performance of different firms, but it is quite useful for internal control. The NWC helps in comparing the liquidity of the same firm over time. *For purpose of working capital management, therefore, NWC can be said to measure the liquidity of the firm. In other words, the goal of working capital management is to manage the current assets and liabilities in such a way that an acceptable level of NWC is maintained.*

The Common Definition of NWC and its Implications *NWC is commonly defined as the difference between current assets and current liabilities*. Efficient working capital management requires that firms should operate with some amount of NWC, the exact amount varying from firm to firm and depending, among other things, on the nature of industry. The theoretical justification for the use of NWC to measure liquidity is based on the premise that the greater the margin by which the current assets cover the short-term obligations, the more is the ability to pay obligations when they become due for payment. The NWC is necessary because the cash outflows and inflows do not coincide. In other words, it is the *non-synchronous* nature of cash flows that makes NWC necessary. In general, the cash outflows resulting from payment of current liabilities are relatively predictable. The cash inflows are, however, difficult to predict. The more predictable the cash inflows are, the less NWC will be required. A firm, say an electricity generation company, with almost certain and predictable cash inflows can operate with little or no NWC. But where cash inflows are uncertain, it will be necessary to maintain current assets at a level adequate to cover current liabilities, that is, there must be NWC.

Alternative Definition of NWC *NWC can alternatively be defined as that part of the current assets which are financed with long-term funds*. Since current liabilities represent sources of short-term funds, as long as current assets exceed the current liabilities, the excess must be financed with long-term funds.

Determining Financing Mix

One of the most important decisions, involved in the management of working capital is how current assets will be financed. There are, broadly speaking, two sources from which funds can be raised for current asset financing; (i) short-term sources (current liabilities), and (ii) long-term sources, such as share capital, long-term borrowings, internally generated resources like retained earnings and so on. What proportion of current assets should be financed by current liabilities and how much by long-term resources? *Decisions on such questions will determine the financing mix.*

There are three basic approaches to determine an appropriate financing mix: (a) Hedging approach, also called the Matching approach; (b) Conservative approach,and (c) Trade-off between these two.

Hedging Approach The term 'hedging' is often used in the sense of a risk-reducing investment strategy involving transactions of a simultaneous but opposing nature so that the effect of one is likely to counterbalance the effect of the other. With reference to an appropriate financing-mix, the term hedging can be said to refer to the process of matching maturities of debt with the maturities of financial needs.[2] This approach to the financing decision to determine an appropriate financing mix is, therefore, also called as Matching approach.

According to this approach, the maturity of the source of funds should match the nature of the assets to be financed. For the purpose of analysis, the current assets can be broadly classified into two classes:

1. those which are required in a certain amount for a given level of operation and, hence, do not vary over time.
2. those which fluctuate over time.

The hedging approach suggests that long-term funds should be used to finance the fixed portion of current assets requirements as spelt out in (1) above, in a manner similar to the financing of fixed assets. The purely temporary requirements, that is, the seasonal variations over and above the permanent financing needs should be appropriately financed with short-term funds (current liabilities). This approach, therefore, divides the requirements of total funds into permanent and seasonal components, each being financed by a different source. This has been illustrated in Table 11.1.

Table 11.1 *Estimated Total Funds Requirements of Hypothetical Ltd*

Month	*Total funds required*	*Permanent requirements*	*Seasonal requirements*
(1)	*(2)*	*(3)*	*(4)*
January	Rs 8,500	Rs 6,900	Rs 1,600
February	8,000	6,900	1,100
March	7,500	6,900	600
April	7,000	6,900	100
May	6,900	6,900	0
June	7,150	6,900	250
July	8,000	6,900	1,100
August	8,350	6,900	1,450
September	8,500	6,900	1,600
October	9,000	6,900	2,100
November	8,000	6,900	1,100
December	7,500	6,900	600
			11,600

According to the hedging approach, the permanent portion of funds required (Col.3) should be financed with long-term funds and the seasonal portion (Col.4) with short-term funds. With this approach, the short-term financing requirements (current assets) would be just equal to the short-term financing available (current liabilities). There would, therefore, be no NWC.

Conservative Approach This approach suggests that the estimated requirement of total funds should be met from long-term sources; the use of short-term funds should be restricted to only emergency situations or when there is an unexpected outflow of funds. In the case of the Hypothetical Ltd in

Table 11.1, the total requirements, including the entire Rs 9,000 needed in October, will be financed by long-run sources. The short-term funds will be used only to meet contingencies. The amounts given in column 4 of Table 11.1 represent the extent to which short-term financial needs are being financed by long-term funds, that is, the NWC. The NWC reaches the highest level (Rs 2,100) in October (Rs 9,000 – Rs 6,900). Any long-term financing in excess of Rs 6,900 in permanent financing the needs of the company represents NWC.

Comparison of Hedging Approach with Conservative Approach A comparison of the two approaches can be made on the basis of (i) cost considerations, and (ii) risk considerations.

Cost Considerations The cost of these financing plans has a bearing on the profitability of the enterprise. We assume that the cost of short-term funds and long-term funds, as in the preceding Section dealing with profitability-risk trade-off, is 3 per cent and 8 per cent respectively.

Hedging Plan The cost of financing under the hedging plan can be estimated as follows:

(i) Cost of short-term funds: The cost of short-term funds = average annual short-term loan x interest rate.
Average annual short-term loan = total of monthly seasonal requirements (Col.4) divided by the number of months.
Average annual short-term loan = Rs 11,600 ÷ 12 = Rs 966.67.
Short-term cost = Rs 966.67 × 0.03 = Rs 29.

(ii) Cost of long-term funds = (Average annual long-term fund requirement) × (annual interest rate)
= Rs 6,900 × 0.08 = Rs 552.

(iii) Total cost under hedging plan = total of (i) + (ii) = Rs 29 + Rs 552 = Rs 581

Conservative Plan The cost of financing under the conservative plan is equal to the cost of the long-term funds, that is, annual average loan, multiplied by the long-term rate of interest = Rs 9,000 × 0.08 = Rs 720.

Thus, the cost of financing under the conservative approach (Rs 720) is higher than the cost using the hedging approach (Rs 581). The conservative plan for financing is more expensive because the available funds are not fully utilised during certain periods; moreover, interest has to be paid for funds which are not actually needed (i.e. the period when there is NWC).

Risk Considerations The two approaches can also be contrasted on the basis of the risk involved.

Hedging Approach The hedging approach is more risky in comparison to the conservative approach. There are two reasons for this. First, there is, as already observed, no NWC with the hedging approach because no long-term funds are used to finance short-term seasonal needs, that is, current assets are just equal to current liabilities. On the other hand, the conservative approach has a fairly high level of NWC. Secondly, the hedging plan is risky because it involves almost full utilisation of the capacity to use short-term funds and in emergency situations it may be difficult to satisfy the short-term needs.

Conservative Approach With the conservative approach, in contrast, the company does not use any of its short-term borrowings. Therefore, the firm has sufficient short-term borrowing capacity to cover unexpected financial needs and avoid technical insolvency.

To summarise, the hedging approach is a high profit (low cost)-high risk (no NWC) approach to determine an appropriate financing-mix. In contrast, the conservative approach is low profit (high cost)-low risk (high NWC). The contrast between these approaches is indicative of the need for trade-off between profitability and risk.

A Trade-off between the Hedging and Conservative Approaches It has been shown that the hedging approach is associated with high profits as well as high risk, while the conservative approach provides low profits and low risk. Obviously, neither approach by itself would serve the purpose of efficient working capital management. A trade-off between these two extremes would give an acceptable financing strategy. The third approach–trade-off between the two approaches–strikes a balance and provides a financing plan that lies between these two extremes.

The exact trade-off between risk and profitability will differ from case to case depending on risk perception of the decision makers. One possible trade-off could be assumed to be equal to the average of the minimum and maximum monthly requirements of funds during a given period of time. This level of requirement of funds may be financed through long-run sources and for any additional financing need, short-term funds may be used. The breakdown of the requirement of funds of the Hypothetical Ltd between long-term and short-term sources under the trade-off plans is shown in Table 11.2.

Table 11.2 *Trade-off between Hedging and Conservative Approaches*

Month	*Total funds required*	*Permanent requirements*	*Seasonal requirements*
(1)	*(2)*	*(3)*	*(4)*
January	Rs 8,500	Rs 7,950	Rs 550
February	8,000	7,950	50
March	7,500	7,950	0
April	7,000	7,950	0
May	6,900	7,950	0
June	7,150	7,950	0
July	8,000	7,950	50
August	8,350	7,950	400
September	8,500	7,950	550
October	9,000	7,950	1,050
November	8,000	7,950	50
December	7,500	7,950	0
			2,700

The figures in Table 11.2 reveal that the maximum fund required is Rs 9,000 (October) and the minimum is Rs 6,900 (May). The average $\left(\frac{\text{Rs } 9{,}000 + \text{Rs } 6900}{2}\right)$ = Rs 7,950. In other words, the company should use Rs 7,950 each month (Col.3) in the form of long-term funds and raise additional funds, if needed, through short-term resources (current liabilities). It is clear from the table that no short-term funds are required during 5 months, namely, March, April, May, June and December, because long-term funds available exceed the total requirements for funds. In the remaining 7 months, the company will have to use short-term funds totalling Rs 2,700 (Col. 4).

Cost of the Financing Plan under the Trade-off Approach

(i) Cost of short-term funds: = (Average annual short-term funds required) × (Rate of short-term interest) = Rs $\frac{2{,}700}{12}$ = Rs 225 × 0.03 = Rs 6.75

(ii) Cost of long-term funds = (Average long-term funds required) × (Rate of interest on long-term funds) = Rs 7,950 × 0.08 = Rs 636

(iii) Total cost of the trade-off plan = Rs 6.75 + Rs 636 = Rs 642.75

Risk Consideration The NWC under this plan would be Rs 1,050 (Rs 7,950 – Rs 6,900).

Comparison of the Trade-off Plan with the Hedging and Conservative Approaches For a comparison of the three approaches to determine an appropriate financing-mix, the summary of the results of these approaches on profitability and risk is given in Table 11.3.

Table 11.3 *Comparision of Trade-off Plan*

Financing Plan	*Maximum NWC**	*Degree of risk*	*Total cost of financing*	*Level of profits*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
Hedging	0	Highest	Rs 581.00	Highest
Trade-off	Rs 1,050	Intermediate	642.75	Intermediate
Conservative	2,100	Lowest	720.00	Lowest

*The minimum level would be zero in each case.

Interpretation From the summary of results in Table 11.3, it can be seen clearly that the hedging approach is the most risky while the conservative approach is the least risky. The trade-off plan stands midway; less risky than the hedging approach but more risky than the conservative approach. The measure of risk is the level of NWC. From the point of view of profitability (as reflected in the level of total cost of financing plan) a similar kind of relationship is found to exist, the trade-off plan lying between the other two approaches. The preceding analysis, thus, established the trade-off between profitability and risk. In this connection two generalisations are warranted: (i) the lower the NWC, the higher is the risk present, and (ii) the higher the risk of insolvency, the higher is the expected profits.

PLANNING OF WORKING CAPITAL

This Section is concerned with the planning of working capital requirements. The aspects covered here are the need for working capital, the determinants of working capital and its computation.

Need for Working Capital

The need for working capital (gross) or current assets cannot be overemphasized. Given the objective of financial decision making to maximsie the shareholders' wealth, it is necessary to generate sufficient profits. The extent to which profits can be earned will naturally depend, among other things, upon the magnitude of the sales. A successful sales programme is, in other words, necessary for earning profits by any business enterprise. However, sales do not convert into cash instantly; there is invariably a time-lag between the sale of goods and the receipt of cash. There is, therefore, a need for working capital in the form of current assets to deal with the problem arising out of the lack of immediate realisation of cash against goods sold. Therefore, sufficient working capital is necessary to sustain sales activity. Technically, this is referred to as the *operating or cash cycle*. The operating cycle can be said to be at the heart of the need for working capital. 'The continuing flow from cash to suppliers, to inventory, to accounts receivable and back into cash is what is called the operating cycle'.[3] In other words, the term cash cycle refers to the length of time necessary to complete the following cycle of events:

1. Conversion of cash into inventory;
2. Conversion of inventory into receivables;
3. Conversion of receivables into cash.

The operating cycle, which is a continuous process, is shown in Fig. 11.1.

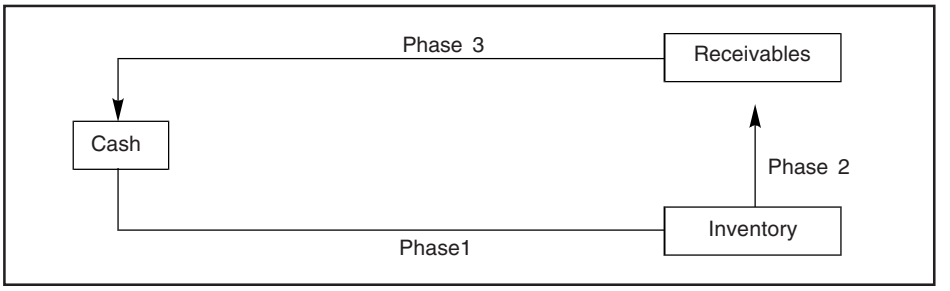

Figure 11.1 *Operating Cycle*

If it were possible to complete the sequences instantaneously, there would be no need for current assets (working capital). But since it is not possible, the firm is forced to have current assets. Since cash inflows and outflows do not match, firms have to necessarily keep cash or invest in short-term liquid securities so that they will be in a position to meet obligations when they become due. Similarly, firms must have adequate inventory to guard against the possibility of not being able to meet demand for their products. Adequate inventory, therefore, provides a cushion against being out of stock. If firms have to be competitive, they must sell goods to their customers on credit which necessitates the holding of accounts receivable. It is in these ways that an adequate level of working capital is absolutely necessary for smooth sales activity which, in turn, enhances the owner's wealth.

The operating cycle consists of three phases. In phase 1, cash gets converted into inventory. This includes purchase of raw materials, conversion of raw materials into work-in-progress, finished goods and finally the transfer of goods to stock at the end of the manufacturing process. In the case of trading organisations, this phase is shorter as there would be no manufacturing activity and cash is directly converted into inventory. The phase is, of course, totally absent in the case of service organisations.

In phase II of the cycle, the inventory is converted into receivables as credit sales are made to customers. Firms which do not sell on credit obviously not have phase II of the operating cycle.

The last phase, phase III, represents the stage when receivables are collected. This phase completes the operating cycle. Thus, the firm has moved from cash to inventory, to receivables and to cash again.

Permanent and Temporary Working Capital The operating cycle, thus, creates the need for current assets (working capital). However, the need does not come to an end after the cycle is completed. It continues to exist. To explain this continuing need of current assets, a distinction should be drawn between *permanent* and *temporary* working capital.

Business activity does not come to an end after the realisation of cash from customers. For a company, the process is continuous and, hence, the need for a regular supply of working capital. However, the magnitude of working capital required is not constant, but fluctuating. To carry on business, a certain minimum level of working capital is necessary on a continuous and uninterrupted basis. For all practical purposes, this requirement has to be met permanently as with other fixed assets. This requirement is referred to as *permanent or fixed working capital*.

Any amount over and above the permanent level of working capital is *temporary, fluctuating or variable working capital*.[4] The position of the required working capital is needed to meet fluctuations in demand consequent upon changes in production and sales as a result of seasonal changes. The basic distinction between permanent and temporary working capital is illustrated in Fig. 11.2.

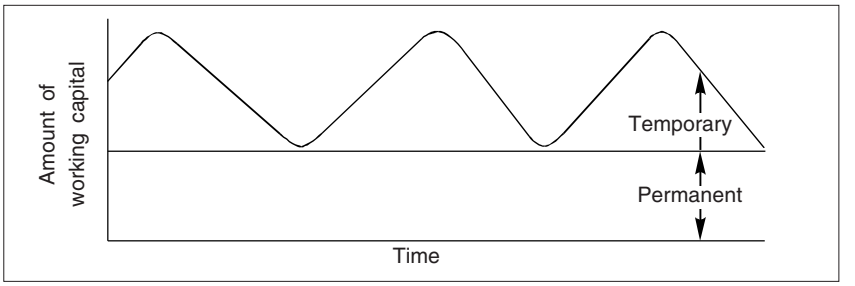

Figure 11.2 *Permanent and Temporary Working Capital*

Figure 12.2 shows that the permanent level is fairly constant, while temporary working capital is fluctuating–increasing and decreasing in accordance with seasonal demands. In the case of an expanding firm, the permanent working capital line may not be horizontal. This is because the demand for permanent current assets might be increasing (or decreasing) to support a rising level of activity. In that case the line would be a rising one as shown in Fig. 11.3.

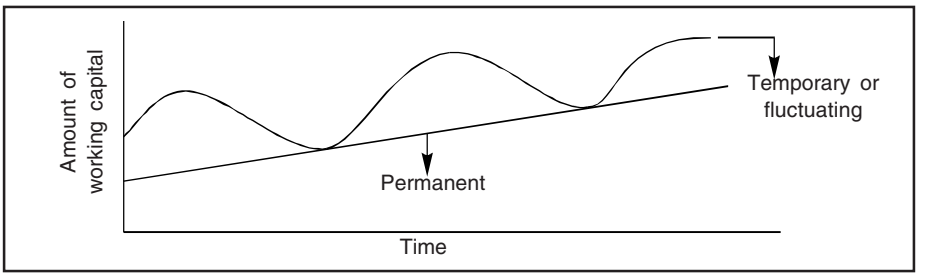

Figure 11.3 *Permanent and Temporary Working Capital*

Both kinds of working capital are necessary to facilitate the sales process through the operating cycle. Temporary working capital is created to meet liquidity requirements that are of a purely transient nature.

Changes in Working Capital The changes in the level of working capital occur for the following three basic reasons: (i) changes in the level of sales and/or operating expenses, (ii) policy changes, and (iii) changes in technology.

Changes in Sales and Operating Expenses The first factor causing a change in the working capital requirement is a change in the sales and operating expenses. The changes in this factor may be due to three reasons: First, there may be a *long-run* trend of change. For instance, the price of a raw material, say oil, may constantly rise, necessitating the holding of a large inventory. The *secular* trends would mainly affect the need for permanent current assets. In the second place, *cyclical* changes in the economy leading to ups and downs in business activity influence the level of working capital, both permanent and temporary. The third source of change is seasonality in sales activity. Seasonality–peaks and troughs–can be said to be the main source of variation in the level of temporary working capital.

The change in sales and operating expenses may be either in the form of an increase or decrease. An increase in the volume of sales is bound to be accompanied by higher levels of cash, inventory and receivables. The decline in sales has exactly the opposite effect–a decline in the need for working capital. A change in the operating expenses–rise or fall–has a similar effect on the levels of working capital.

Policy Changes The second major cause of changes in the level of working capital is because of policy changes initiated by the management. There is a wide choice in the matter of current assets policy. The term current asset policy may be defined as the relationship between current assets and sales volume. A firm following a conservative policy in this respect having a very high level of current assets in relation to sales may deliberately opt for a less conservative policy and *vice versa*. These conscious managerial decisions certainly have an impact on the level of working capital.

Technological Changes Finally, technological changes can cause significant changes in the level of working capital. If a new process emerges as a result of technological developments, which shortens the operating cycle, it reduces the need for working capital and *vice versa.*

Determinants of Working Capital

A firm should plan its operations in such a way that it should have neither too much nor too little working capital. The total working capital requirement is determined by a wide variety of factors. These factors, however, affect different enterprises differently. They also vary from time to time. In general, the following factors are involved in a proper assessment of the quantum of working capital required.

General Nature of Business The working capital requirements of an enterprise are basically related to the conduct of business. Enterprises fall into some broad categories depending on the nature of their business. For instance, public utilities have certain features which have a bearing on their working capital needs. The two relevant features are: (i) the cash nature of business, that is, cash sale, and (ii) sale of services rather than commodities. In view of these features, they do not maintain big inventories and have, therefore, probably the least requirement of working capital. At the other extreme are trading and financial enterprises. The nature of their business is such that they have to maintain a sufficient amount of cash, inventories and book debts. They have necessarily to invest proportionately large amounts in working capital. The manufacturing enterprises fall, in a sense, between these two extremes. The industrial concerns require fairly large amounts of working capital though it varies from industry to industry depending on their asset structure. The proportion of current assets to total assets measures the relative requirements of working capital of various industries. Available data in respect of companies in India confirm the wide variations in the use of working capital by different enterprises. The percentage of current assets to total assets was found to be the lowest in hotels, restaurants and eating houses (10-20 per cent range), while in electricity generation and supply it was in the range of 20-30 per cent. The enterprises in the tobacco, construction and trading groups had, as is to be expected, the highest component of working capital (80-90 per cent range). The other industrial groups fall between these limits though there are very wide inter-industry variations.[5]

Production Cycle Another factor which has a bearing on the quantum of working capital is the production cycle. The term 'production or manufacturing cycle' refers to the time involved in the manufacture of goods. It covers the time-span between the procurement of raw materials and the completion of the manufacturing process leading to the production of finished goods. Funds have to be necessarily tied up during the process of manufacture, necessitating *enhanced* working capital. In other words, there is some time gap before raw materials become finished goods. To sustain such activities the need for working capital is obvious. The longer the time-span (i.e. the production cycle), the larger will be the tied-up funds and, therefore, the larger is the working capital needed and *vice versa*. There are enterprises which, due to the nature of business, have a short operating cycle. A distillery, which has an ageing process, has generally to make a relatively heavy investment in inventory. The other extreme is provided by a bakery. The bakeries

sell their products at short intervals and have a very high inventory turnover. The investment in inventory and, consequently, working capital is not very large.

Further, even within the same group of industries, the operating cycle may be different due to technological considerations. For economy in working capital, that process should be selected which has a shorter manufacturing process. Having selected a particular process of manufacture, steps should be taken to ensure that the cycle is completed in the expected time. This underlines the need for effective organisation and coordination at all levels of the enterprise. Appropriate policies concerning terms of credit for raw materials and other supplies can help in reducing working capital requirements. Often, companies manufacturing heavy machinery and equipment minimise the investment in inventory or working capital by requiring advance payment from customers as work proceeds against orders. Thus, a part of the financial burden relating to the manufacturing cycle time is passed on to others.

Business Cycle The working capital requirements are also determined by the nature of the business cycle. Business fluctuations lead to cyclical and seasonal changes which, in turn, cause a shift in the working capital position, particularly for temporary working capital requirements. The variations in business conditions may be in two directions: (i) *upward phase* when boom conditions prevail, and (ii) *downswing phase* when economic activity is marked by a decline. During the upswing of business activity, the need for working capital is likely to grow to cover the lag between increased sales and receipt of cash as well as to finance purchases of additional material to cater to the expansion of the level of activity. Additional funds may be required to invest in plant and machinery to meet the increased demand. The downswing phase of the business cycle has exactly an opposite effect on the level of working capital requirement. The decline in the economy is associated with a fall in the volume of sales which, in turn, leads to a fall in the level of inventories and book debts. The need for working capital in recessionary conditions is bound to decline. In brief, business fluctuations influence the size of working capital mainly through the effect on inventories. The response of inventory to business cycles is mild or violent according to nature of the business cycle.

Production Policy The quantum of working capital is also determined by production policy. In the case of certain lines of business, the demand for products is seasonal, that is, they are purchased during certain months of the year. What kind of production policy should be followed in such cases? There are two options open to such enterprises: either they confine their production only to periods when goods are purchased or they follow a steady production policy throughout the year and produce goods at a level to meet the peak demand. In the former case, there are serious production problems. During the slack season, the firms have to maintain their working force and physical facilities without adequate production and sale. When the peak period arrives, the firms have to operate at full capacity to meet the demand. This kind of arrangement would not only be expensive but also inconvenient. Thus, serious difficulties will be encountered in trying to match production to the ebb and flow of the seasonal demand pattern. A better alternative is a steady production policy independent of shifts in demand for the finished goods. This means a large accumulation of finished goods (inventories) during the off-season and their abrupt sale during the peak season. The progressive accumulation of stock naturally requires an increasing amount of working capital which remains tied up for some months. Working capital planning has to incorporate this pattern of requirement of funds when production and seasonal sales are steady. This strategy (steady production policy) is, however, not necessarily adopted by everyone. It may be possible, for instance, for some to follow a policy of diversification which enables them to engage the working force and the physical facilities in some other activity. If this is possible, there will be no major working capital problem. Moreover, the nature of some products may be such that accumulation of inventories may create special risk and cost problems. For them, a production policy in tune with the changing demands may be preferable. Therefore,

production policies have to be formulated on the basis of the individual setting of each enterprise and the magnitude and dimension of the working capital problems will accordingly vary.

Credit Policy The credit policy relating to sales and purchases also affects the working capital. The credit policy influences the requirement of working capital in two ways: (i) through credit terms granted by the firm to its customers/buyers of goods; (ii) credit terms available to the firm from its creditors.

The credit terms granted to customers have a bearing on the magnitude of working capital by determining the level of book debts. The credit sales result in higher book debts (receivables). Higher book debts mean more working capital. On the other hand, if liberal credit terms are available from the suppliers of goods (trade creditors), the need for working capital is less. The working capital requirements of a business are, thus, affected by the terms of purchase and sale, and the role given to credit by a company in its dealings with creditors and debtors.

Credit terms fixed by an enterprise are affected by the prevailing trade practices as well as changing economic conditions. If, for example, competition is keen, there would be pressure to grant generous credit terms. Nevertheless, there is wide scope for managerial discretion in working out a suitable credit policy relevant to each customer based on the merits of each case. For instance, liberal credit facilities can be extended on the basis of credit rating. This will avoid the problem of having excess working capital. Similarly, the collection procedure can be so framed that funds, which would otherwise be available for meeting operating needs[6] are not locked up. Thus, adoption of rationalised credit policies would be a significant factor in determining the working capital needs of an enterprise.

Such discretion may, however, not be available to a company which operates in a highly competitive market. To win and retain customers, it may be forced, among other things, to offer generous credit terms to them. The investment in book debts will consequently be of a higher order, necessitating large working capital in another way. To be able to enjoy consumer patronage on a continuous basis, a firm will have to offer a variety of products quite unlike a firm which has a hold on the market and, hence, does not need special efforts to satisfy customer requirements. The consequence of a higher level of inventories would be an additional need for working capital. The degree of competition is, therefore, an important factor influencing working capital requirements.

Growth and Expansion As a company grows, it is logical to expect that a larger amount of working capital is required. It is, of course, difficult to determine precisely the relationship between the growth in the volume of business of a company and the increase in its working capital. The composition of working capital in a growing company also shifts with economic circumstances and corporate practices. Other things being equal, growth industries require more working capital than those that are static. 'The critical fact, however, is that the need for increased working capital funds does not follow the growth in business activities but precedes it.'[7] Advance planning of working capital is, therefore, a continuing necessity for a growing concern. Or else, the company may have substantial earnings but little cash.

Vagaries in the Availability of Raw Material The availability or otherwise of certain raw materials on a continuous basis without interruption would sometimes affect the requirement of working capital. There may be some materials which cannot be procured easily either because of their sources are few or they are irregular. To sustain smooth production, therefore, the firm might be compelled to purchase and stock them far in excess of genuine production needs. This will result in an excessive inventory of such materials. The procurement of some essential raw materials is difficult because of their sporadic supply. This happens very often with raw materials which are in short supply and are controlled to ensure equitable distribution. The buyer has in such cases very limited options as to the quantum and timing of procurement. It may so happen that a bulk consignment may be available but the firm may be short of funds, while when

surplus funds are available the commodities may be in short supply. This element of uncertainty would lead to a relatively high level of working capital. Finally, some raw materials may be available only during certain seasons. They would have to be necessarily obtained, when available, to provide for a period when supplies are lean. This will cause seasonal fluctuations in working capital requirements.

Profit Level The level of profits earned differ from enterprise to enterprise. In general, the nature of the product, hold on the market, quality of management and monopoly power would by and large determine the profit earned by a firm. *A priori*, it can be generalised that a firm dealing in a high quality product, having a good marketing arrangement and enjoying monopoly power in the market, is likely to earn high profits and vice versa. Higher profit margin would improve the prospects of generating more internal funds thereby contributing to the working capital pool. *The net profit is a source of working capital to the extent that it has been earned in cash.* The cash profit can be found by adjusting non-cash items such as depreciation, outstanding expenses and losses written off, in the net profit. But, in practice, the net cash inflows from operations cannot be considered as cash available for use at the end of cash cycle. Even as the company's operations are in progress, cash is used for augmenting stock, book debts and fixed assets.[8] It must, therefore, be seen that cash generation has been used for furthering the interest of the enterprise. It is in this context that elaborate planning and projections of expected activities and the resulting cash inflows on a day-to-day, week-to-week and month-to-month basis assume importance because steps can then be taken to deal with surplus and deficit cash.

The availability of internal funds for working capital requirements is determined not merely by the profit margin but also by the manner of appropriating profits. The availability of such funds would depend upon the profit appropriations for taxation, dividend, reserves and depreciations.

Level of Taxes The first appropriation out of profits is payment or provision for tax. The amount of taxes to be paid is determined by the prevailing tax regulations. The management has no discretion in this respect. Very often, taxes have to be paid in advance on the basis of the profit of the preceding year. Tax liability is, in a sense, short-term liability payable in cash. An adequate provision for tax payments is, therefore, an important aspect of working capital planning. If tax liability increases, it leads to an increase in the requirement of working capital and vice versa. Management has no discretion in regard to the payment of taxes; in some cases non-payment may invite penal action. There is, however, wide scope to reduce the tax liability through proper tax planning. The service of tax experts can be availed of to take advantage of the various concessions and incentives through avoidance as opposed to evasion of taxes. Tax planning can, therefore, be said to be an integral part of working capital planning.

Dividend Policy Another appropriation of profits which has a bearing on working capital is dividend payment. The payment of dividend consumes cash resources and, thereby, affects working capital to that extent. Conversely, if the firm does not pay dividend but retains the profits, working capital increases. In planning working capital requirements, therefore, a basic question to be decided is whether profits will be retained or paid out to shareholders. In theory, a firm should retain profits to preserve cash resources and, at the same time, it must pay dividends to satisfy the expectations of investors. When profits are relatively small, the choice is between retention and payment. The choice must be made after taking into account all the relevant factors.

There are wide variations in industry practices as regards the interrelationship between working capital requirements and dividend payment. In some cases, shortage of working capital has been a powerful reason for reducing or even skipping dividends in cash. There are occasions, on the other hand, when dividend payments are continued in spite of inadequate earnings in a particular year because of sound liquidity. Sometimes, the dilemma is resolved by the payment of bonus shares. This enables the payment of dividend without draining away the cash resources and, thus, without reducing working capital. Dividend policy, is thus, a significant element in determining the level of working capital in an organisation.

Depreciation Policy Depreciation policy also exerts an influence on the quantum of working capital. Depreciation charges do not involve any cash outflows. The effect of depreciation policy on working capital is, therefore, indirect. In the first place, depreciation affects the tax liability and retention of profits. Depreciation is allowable expenditure in calculating net profits. Enhanced rates of depreciation lower the profits and, therefore, the tax liability and, thus, more cash profits. Higher depreciation also means lower disposable profits and, therefore, a smaller dividend payment. Thus, cash is preserved. In the second place, the selection of the method of depreciation has important financial implications. If current capital expenditure falls short of the depreciation provision, the working capital position is strengthened and there may be no need for short-term borrowing. If, on the other hand, the current capital expenditure exceeds the depreciation provision, either outside borrowing will have to be resorted to or a restriction on dividend payment coupled with retention of profits will have to be adopted to prevent the working capital position from being adversely affected. It is in these ways that depreciation policy is relevant to the planning of working capital.

Price Level Changes Changes in the price level also affect the requirements of working capital. Rising prices necessitate the use of more funds for maintaining an existing level of activity. For the same level of current assets, higher cash outlays are required. The effect of rising prices is that a higher amount of working capital is needed. However, in the case of companies which can raise their prices proportionately, there is no serious problem regarding working capital. Moreover, the price rise does not have a uniform effect on all commodities. It is likely that some firms may not be affected at all. In brief, the implications of changing price levels on working capital position vary from company to company depending on the nature of its operations, its standing in the market and other relevant considerations.

Operating Efficiency The operating efficiency of the management is also an important determinant of the level of working capital. The management can contribute to a sound working capital position through operating efficiency. Although the management cannot control the rise in prices, it can ensure the efficient utilisation of resources by eliminating waste, improving coordination, and a fuller utilisation of existing resources, and so on. Efficiency of operations accelerates the pace of cash cycle and improves the working capital turnover. It releases the pressure on working capital by improving profitability and improving the internal generation of funds.

To conclude, the level of working capital is determined by a wide variety of factors which are partly internal to the firm and partly external (environmental) to it. Efficient working capital management requires efficient planning and a constant review of the needs for an appropriate working capital strategy.

Computation of Working Capital

The two components of working capital (WC) are current assets (CA) and current liabilities (CL). They have a bearing on the cash operating cycle. In order to calculate the working capital needs, what is required is the holding period of various types of inventories, the credit collection period and the credit payment period. Working capital also depends on the budgeted level of activity in terms of production/sales. The calculation of WC is based on the assumption that the production/sales is carried on evenly throughout the year and all costs accrue similarly. As the working capital requirements are related to the cost excluding depreciation and not to the sale price, WC is computed with reference to cash cost. The cash cost approach is comprehensive and superior to the operating cycle approach based on holding period of debtors and inventories and payment period of creditors. Some problems have been solved, however, using the operating cycle approach also.

The steps involved in estimating the different items of CA and CL are as follows:

Estimation of Current Assets

Raw Materials Inventory The investment in raw materials inventory is estimated on the basis of Eq. 11.1.

$$\frac{\text{Budgeted production (in units)} \times \text{Cost of raw material(s) per unit} \times \text{Average inventory holding period (months/days)}}{\text{12 months/365 days}} \quad (11.1)$$

Work-in-Process (W/P) Inventory The relevant costs to determine work-in-process inventory are the proportionate share of cost of raw materials and conversion costs (labour and manufacturing overhead costs excluding depreciation).[9] In case, full unit of raw material is required in the beginning, the unit cost of work-in-proess would be higher, that is, cost of full unit + 50 per cent of conversion cost, compared to the raw material requirement throughout the production cycle; W/P is normally equivalent to 50 per cent of total cost of production. Symbolically,

$$\frac{\text{Budgeted production (in units)} \times \text{Estimated work-in-process cost per unit} \times \text{Average time span of work-in-progress inventory (months/days)}}{\text{12 months/365 days}} \quad (11.2)$$

Finished Goods Inventory Working capital required to finance the inished goods inventory is given by factors summed up in Eq. 11.3.

$$\frac{\text{Budgeted production (in units)} \times \text{Cost of goods produced per unit (excluding depreciation)} \times \text{Finished goods holding period (months/days)}}{\text{12 months/365 days}} \quad (11.3)$$

Debtors The WC tied up in debtors should be estimated in relation to total cost price (excluding depreciation) Symbolically,

$$\frac{\text{Budgeted credit sales (in units)} \times \text{Cost of sales per unit excluding depreciation} \times \text{Average debt collection period (months/days)}}{\text{12 months/365 days}} \quad (11.4)$$

Cash and Bank Balances Apart from WC needs for financing inventories and debtors, firms also find it useful to have some minimum cash balances with them. It is difficult to lay down the exact procedure of determining such an amount. This would primarily be based on the motives for holding cash balances[10] of the business firm, attitude of management toward risk, the access to the borrowing sources in times of need and past experience, and so on.

Estimation of Current Liabilities

The working capital needs of business firms are lower to the that extent such needs are met through the current liabilities (other than bank credit[11]) arising in the ordinary course of business. The important current liabilities (CL), in this context are, trade-creditors, wages and overheads:

Trade Creditors

$$\frac{\text{Budgeted yearly production (in units)} \times \text{Raw material cost per unit} \times \text{Credit period allowed by creditors (months/days)}}{\text{12 months/365 days}} \quad (11.5)$$

Note: Proportional adjustment should be made to cash purchases of raw materials.

Direct Wages

$$\frac{\text{Budgeted yearly production (in units)} \times \text{Direct labour cost per unit} \times \text{Average time-lag in payment of wages (months/days)}}{\text{12 months/365 days}} \quad (11.6)$$

The average credit period for the payment of wages approximates to a half-a-month in the case of monthly wage payment: The first days' monthly wages are paid on the 30th day of the month, extending credit for 29 days, the second day's wages are, again, paid on the 30th, extending credit for 28 days, and so on. Average credit period approximates to half-a-month.

Overheads (Other Than Depreciation and Amortisation)

$$\frac{\text{Budgeted yearly production (in units)} \times \text{Overhead cost per unit} \times \text{Average time-lag in payment of overheads (months/days)}}{\text{12 months/365 days}} \quad (11.7)$$

The amount of overheads may be separately calculated for different types of overheads. In the case of selling overheads, the relevant item would be sales volume instead of production volume.

The computation of working capital is summarised in format 11.1.

Format 11.1 *Determination of Working Capital*

		Amount
(I)	*Estimation of Current Asset*:	
	(a) Minimum desired cash and bank balances	
	(b) Inventories	
	Raw material	
	Work-in-process	
	Finished Goods	
	(c) Debtors*	
	Total Current Assets	
(II)	*Estimation of Current Liabilities*:	
	(a) Creditors**	
	(b) Wages	
	(c) Overheads	
	Total Current Liabilities	
(III)	*Net Working Capital (I-II)*	
	Add margin for contingency	
(IV)	Net Working Capital Required	

*If payment is received in advance, the item would be listed in CL.
**If advance payment is to be made to creditors, the item would appear under CA. The same would be the treatment for advance payment of wages and overheads.

WORKING CAPITAL FINANCING

After determining the level of working capital, as illustrated in Section 2 above, a firm has to decide how it is to be financed. The need for financing arises mainly because the investment in working capital/current assets, that is, raw materials, work/stock-in-process, finished goods and receivables typically fluctuates during the year. The present chapter discusses the main sources of finance for working capital. Although long-term funds partly finance current assets and provide the margin money for working capital, such assets/working capital are virtually exclusively supported by short-term sources. The main sources of working capital financing, namely, trade credit, bank credit, factoring and commercial papers are covered in this Section.

Trade Credit

Features Trade credit refers to the credit extended by the supplier of goods and services in the normal course of transaction/ business/sale of the firm. According to trade practices, cash is not paid immediately for purchases but after an agreed period of time. Thus, deferral of payment (trade credit) represents a source of finance for credit purchases.

There is, however, no formal/specific negotiation for trade credit. It is an informal arrangement between the buyer and the seller. There are no legal instruments/ acknowledgements of debt which are granted on an open account basis. Such credit appears in the records of the buyer of goods as sundry creditors/accounts payable.

A variant of accounts payable is bills/notes payable. Unlike the open account nature of accounts payable, bills/notes payable represent documentary evidence of credit purchases and a formal acknowledgement of obligation to pay for credit purchases on a specified (maturity) date failing which legal/penal action for recovery will follow. A notable feature of bills/notes payable is that they can be rediscounted and the seller does not necessarily have to hold it till maturity to receive payment. However, it creates a legally enforceable obligation on the buyer of goods to pay on maturity whereas the accounts payable have more flexible payment obligations. Although most of the trade credit is on open account as accounts payable, the suppliers of goods do not extend credit indiscriminately. Their decision as well as the quantum is based on a consideration of factors such as earnings record over a period of time, liquidity position of the firm and past record of payment.

Advantages Trade credit, as a source of short-term/working capital finance, has certain advantages. It is easily, almost automatically, available. Moreover, it is a flexible and spontaneous source of finance. The availability and magnitude of trade credit is related to the size of operations of the firm in terms of sales/ purchases. For instance, the requirement of credit purchases to support the existing sales is Rs 5 lakh per day. If the purchases are made on a credit of 30 days, the average outstanding accounts payable/trade credit (finance) will amount to Rs 1.5 crore (Rs 5 lakh $\times$ 30 days). The increase in purchases of goods to support higher sales level to Rs 6 lakh will imply a trade credit finance of Rs 1.8 crore (Rs 6 lakh $\times$ 30 days). If the credit purchases of goods decline, the availability of trade credit will correspondingly decline. Trade credit is also *an informal, spontaneous source of finance.* Not requiring negotiation and formal agreement, trade credit is free from the restrictions associated with formal/negotiated source of finance/credit.

Costs Trade credit does not involve any explicit interest charge. However, there is an implicit cost of trade credit. It depends on the credit terms offered by the supplier of goods. If the terms of the credit are, say, 45 days net, the payable amount to the supplier of goods is the same whether paid on the date of purchase or on the 45th day and, therefore, trade credit has no cost, that is, it is cost-free. But if the credit terms are, say, 2/15, net 45, that is, there is discount for prompt payment, the trade credit beyond the discount period has a cost = [(Discount/1 – Discount) × (360 days/Credit period – Discount period)]. The implicit interest rate/cost = [(0.02/1 – 0.02) × (360/45 – 15)] = 24.5 per cent. Alternatively, the credit terms, 2/15, net 45, imply that the firm (buyer) is entitled to 2 per cent discount for payment made within 15 days when the entire payment is to be made within 45 days. Since the net amount is due in 45 days, failure to take the discount means paying an extra 2 per cent for using the money for an additional 30 days. If a firm were to pay 2 per cent for every 30-day period over a year, there would be 12 such periods (360 days ÷ 30 days). This represents an annual interest rate/cost of 24 per cent. If the terms of credit are 2/10, net 30, the cost of credit works out to 36.4 per cent. *The smaller the difference between the payment day and the end of the discount period, the larger is the annual interest/cost of trade credit.*

To sum up, as the cost of trade credit is generally very high beyond the discount period, firms should avail of the discount on prompt payment. If, however, they are unable to avail of discount, the payment of trade credit should be delayed till the last day of the credit (net) period and beyond without impairing their credit-worthiness. But a precondition for obtaining trade credit particularly by a new company is cultivating good relationship with suppliers of goods and obtaining their confidence by honouring commitments.

Bank Credit

Bank credit is the primary institutional source of working capital finance in India. In fact, it represents the most important source for financing of current assets.

Forms of Credit Working capital finance is provided by banks in five ways: (i) cash credits/ overdrafts, (ii) loans, (iii) purchase/ discount bills, (iv) letter of credit and (v) working capital term loans.

Cash Credit/Overdrafts Under cash credit/overdraft form/ arrangement of bank finance, the bank specifies a predetermined borrowing/credit limit. The borrower can draw/borrow up to the stipulated credit/overdraft limit. Within the specified limit, any number of drawls/drawings are possible to the extent of his requirements periodically. Similarly, repayments can be made whenever desired during the period. The interest is determined on the basis of the running balance/amount actually utilised by the borrower and not on the sanctioned limit. However, a minimum (commitment) charge may be payable on the unutilised balance irrespective of the level of borrowing for availing of the facility. This form of bank financing of working capital is highly attractive to the borrowers because, firstly, it is flexible in that although borrowed funds are repayable on demand, banks usually do not recall cash advances/roll them over and, secondly, the borrower has the freedom to draw the amount in advance as and when required while the interest liability is only on the amount actually outstanding. However, cash credit/overdraft is inconvenient to the banks and hampers credit planning. It was the most popular method of bank financing of working capital in India till the early nineties. With the emergence of new banking since the mid-nineties, cash credit cannot at present exceed 20 per cent of the maximum permissible bank finance (MPBF)/credit limit to any borrower.

Loans Under this arrangement, the entire amount of borrowing is credited to the current account of the borrower or released in cash. The borrower has to pay interest on the total amount. The loans are repayable on demand or in periodic instalments. They can also be renewed from time to time. As a form of financing,

loans imply a financial discipline on the part of the borrowers. From a modest beginning in the early nineties, at least 80 per cent of MPBF/credit limit must now be in the form of loans in India.

Bills Purchased/Discounted This arrangement is of relatively recent origin in India. With the introduction of the New Bill Market Scheme in 1970 by the Reserve Bank of India (RBI), bank credit is being made available through discounting of *usance bills* by banks. The RBI envisaged the progressive use of bills as an instrument of credit as against the prevailing practice of using the widely-prevalent cash credit arrangement for financing working capital. The cash credit arrangement gave rise to unhealthy practices. As the availability of bank credit was unrelated to production needs, borrowers enjoyed facilities in excess of their legitimate needs. Moreover, it led to double financing. This was possible because credit was taken from different agencies for financing the same activity. This was done, for example, by buying goods on credit from suppliers and raising cash credit by hypothecating the same goods. The bill financing is intended to link credit with the sale and purchase of goods and, thus, eliminate the scope for misuse or diversion of credit to other purposes.

The amount made available under this arrangement is covered by the cash credit and overdraft limit. Before discounting the bill, the bank satisfies itself about the credit-worthiness of the drawer and the genuineness of the bill. To popularise the scheme, the discount rates are fixed at lower rates than those of cash credit, the difference being about 1-1.5 per cent. The discounting banker asks the drawer of the bill (i.e. seller of goods) to have his bill accepted by the drawee (buyers) bank before discounting it. The latter grants acceptance against the cash credit limit, earlier fixed by it, on the basis of the borrowing value of stocks. Therefore, the buyer who buys goods on credit cannot use the same goods as a source of obtaining additional bank credit.

The *modus operandi* of bill finance as a source of working capital financing is that a bill arises out of a trade sale-purchase transaction on credit. The seller of goods draws the bill on the purchaser of goods, payable on demand or after a usance period not exceeding 90 days. On acceptance of the bill by the purchaser, the seller offers it to the bank for discount/purchase. On discounting the bill, the bank releases the funds to the seller. The bill is presented by the bank to the purchaser/acceptor of the bill on due date for payment. The bills can also be rediscounted with the other banks/RBI. However, this form of financing is not popular in the country.

Term Loans for Working Capital Under this arrangement, banks advance loans for 3-7 years repayable in yearly or half-yearly instalments.

Letter of Credit While the other forms of bank credit are direct forms of financing in which banks provide funds as well as bear risk, letter of credit is an indirect form of working capital financing and banks assume only the risk, the credit being provided by the supplier himself.

The purchaser of goods on credit obtains a letter of credit from a bank. The bank undertakes the responsibility to make payment to the supplier in case the buyer fails to meet his obligations. Thus, the *modus operandi* of letter of credit is that the supplier sells goods on credit/extends credit (finance) to the purchaser, the bank gives a guarantee and bears risk only in case of default by the purchaser.

Mode of Security

Banks provide credit on the basis of the following modes of security:

Hypothecation Under this mode of security, the banks provide credit to borrowers against the security of movable property, usually inventory of goods. The goods hypothecated, however, continue to be in the possession of the owner of these goods (i.e., the borrower). The rights of the lending bank (hypothecatee) depend upon the terms of the contract between the borrower and the lender. Although the bank does not

have physical possession of the goods, it has the legal right to sell the goods to realise the outstanding loan. Hypothecation facility is normally not available to new borrowers.

Pledge Pledge, as a mode of security, is different from hypothecation in that in the former, unlike in the latter, the goods which are offered as security are transferred to the physical possession of the lender. An essential prerequisite of pledge, therefore, is that the goods are in the custody of the bank. The borrower who offers the security is, called a 'pawnor' (pledgor), while the bank is called the 'pawnee' (pledgee). The lodging of the goods by the pledgor to the pledgee is a kind of bailment. Therefore, pledge creates some liabilities for the bank. It must take reasonable care of goods pledged with it. The term '*reasonable care*' means care which a prudent person would take to protect his property. He would be responsible for any loss or damage if he uses the pledged goods for his own purposes. In case of non-payment of the loans, the bank enjoys the right to sell the goods.

Lien The term 'lien' refers to the right of a party to retain goods belonging to another party until a debt due to him is paid. Lien can be of two types: (i) particular lien, and (ii) general lien. Particular lien is a right to retain goods until a claim pertaining to these goods is fully paid. On the other hand, general lien can be applied till all dues of the claimant are paid. Banks usually enjoy general lien.

Mortgage It is the transfer of a legal/equitable interest in specific immovable property for securing the payment of debt. The person who parts with the interest in the property is called 'mortgagor' and the bank in whose favour the transfer takes place is the 'mortgagee'. The instrument of transfer is called the 'mortgage deed'. Mortgage is, thus, conveyance of interest in the mortgaged property. The mortgage interest in the property is terminated as soon as the debt is paid. Mortgages are taken as an additional security for working capital credit by banks.

Charge Where immovable property of one person is, by the act of parties or by the operation of law, made security for the payment of money to another and the transaction does not amount to mortgage, the latter person is said to have a charge on the property and all the provisions of simple mortgage will apply to such a charge. The provision are as follows:

- A charge is not the transfer of interest in the property though it is security for payment. But mortgage is a transfer of interest in the property.
- A charge may be created by the act of parties or by the operation of law. But a mortgage can be created only by the act of parties.
- A charge need not be made in writing but a mortgage deed must be attested.
- Generally, a charge cannot be enforced against the transferee for consideration without notice. In a mortgage, the transferee of the mortgaged property can acquire the remaining interest in the property, if any is left.

Commercial Papers

Features Commercial Paper (CP) is a short-term unsecured negotiable instrument, consisting of usance promissory notes with a fixed maturity. It is issued on a discount on face value basis but it can also be issued in interest-bearing form. A CP when issued by a company directly to the investor is called a direct paper. The companies announce current rates of CPs of various maturities, and investors can select those maturities which closely approximate their holding period. When CPs are issued by security dealers/dealers on behalf of their corporate customers, they are called *dealer paper*. They buy at a price less than the commission and sell at the highest possible level. The maturities of CPs can be tailored within the range to specific investments.

Advantages A CP has several advantages for both the issuers and the investors. It is a simple instrument and hardly involves any documentation. It is additionally flexible in terms of maturities which can be tailored to match the cash flow of the issuer. A well-rated company can diversify its short-term sources of finance from banks to money market at cheaper cost. The investors can get higher returns than what they can get from the banking system. Companies which are able to raise funds through CPs have better financial standing. The CPs are unsecured and there are no limitations on the end-use of funds raised through them. As negotiable/transferable instruments, they are highly liquid. The creation of the CP market can result in a part of intercorporate funds flowing into this market which would come under the control of monetary authorities in India.

Framework of Indian CP Market The CPs, as a privately placed instrument, emerged as a source of short-term financing in the early nineties to enable highly rated corporate borrowers to diversify their sources of short-term borrowings and to provide an additional instrument to investors. The main elements of the present framework of the Indian CP market prescribed by the RBI are given below:

- A corporate can issue CPs if (i) its tangible networth as per the latest audited balance sheet is not less than Rs 4 crore, (ii) it has been sanctioned working capital limit by banks/All-India financial institutions and (iii) its borrowal account is classified as standard assets by the financing bank(s) institution(s). Tangible networth means the paid-up capital plus free reserves (including balances in the share premium account, capital and debenture redemption reserves and other reserve not being created for repayment of any future liability or for depreciation in any assets or for bad debts or reserves created by revaluation of assets) as reduced by the amount of accumulated balances of losses, revenue expenditure as also other intangible assets. Working capital is defined as the aggregate limits including those by way of purchase/discount of bills sanctioned by one/more banks(s)/financial institutions for meeting the working capital requirements.
- It should have a minimum current credit rating of P-2 of CRISIL Ltd. or such equivalent rating by other credit agencies, namely ICRA Ltd., CARE Ltd. and FITCH Ltd.
- The CP can be issued for maturites between a minimum of 7 days and a maximum upto one year from the date of issue. The maturity date cannot go beyond the validity period of its credit rating.
- Its denomination should be Rs 5 lakh or multiplies thereof and the minimum amount invested by a single investor is Rs 5 lakh (face value).
- It can be issued as a "stand alone" product. In view of CP being a stand alone product, banks/FIs would not provide any stand-by facility to its issuers. However, they would have the flexibility to provide credit enhancement by way of stand-by assistance/credit backstop facility and so on based on their commercial judgement and as per terms prescribed by them. These should be within prudential norms as applicable and subject to specific approval of a Board of Directors. The aggregate amount of CP from an issue should be the lower of (i) the limit approved by its Board of Directors or (ii) the quantum indicated by the credit rating agency for the specified rating. Banks and financial institutions have the flexibility to fix working capital limits duly taking into account the resource pattern of the corporates' financing including CPs.
- The total amount of CP should be raised within two weeks from the date on which the issue is open for subscription.
- Renewal of CP would be treated as a fresh issue.
- Investment in CPs may be made by individuals/banks/other corporate bodies/NRI/FIIs.
- A CP can be issued either in the form of promissory note or in a dematerialised from through one of the depositories. With effect from November 2001, CPs can be held only in dematerialised form. It may be issued at a at a discount to the face value but it cannot be underwritten or co-accepted.

Effective Cost/Interest Yield As the CPs are issued at discount and redeemed at it face value, their effective pre-tax cost/interest yield

$$= \left(\frac{\text{Face value} - \text{Net amount realised}}{\text{Net amount realised}}\right) \times \left(\frac{360}{\text{Maturity period}}\right)$$

where net amount realised = Face value – discount – issuing and paying agent (IPA) charges, that is, stamp duty, rating charges, dealing bank fee and fee for stand by facility.

Assuming face value of a CP, Rs 5,00,000, maturity period, 90 days, net amount realised Rs 4,80,000, discount and other charges associated with the issue of CP, 1.5 per cent, the pre-tax effective cost of CP

$$= \frac{\text{Rs } 5{,}00{,}000 - (\text{Rs } 4{,}80{,}000 - \text{Rs } 7{,}500)}{(\text{Rs } 4{,}80{,}000 - \text{Rs } 7{,}500)} \times \left(\frac{360}{90}\right) = 23.3 \text{ per cent.}$$

Factoring

Factoring provides resources to finance receivables as well as facilitates the collection of receivables. Although such services constitute a critical segment of the financial services scenario in the developed countries, they appeared in the Indian financial scene only in the early nineties as a result of RBI initiatives. There are two bank-sponsored organisations which provide such services: (i) SBI Factors and Commercial Services Ltd, and (ii) Canbank Factors Ltd. The first private sector factoring company, Foremost Factors Ltd, started operations since the beginning of 1997.

Definition and Mechanism **Definition** Factoring can broadly be defined as an agreement in which receivables arising out of sale of goods/services are sold by a firm (client) to the 'factor' (a financial intermediary) as a result of which the title of the goods/services represented by the said receivables passes on to the factor. Henceforth, the factor becomes responsible for all credit control, sales accounting and debt collection from the buyer(s). In a full service factoring concept (without recourse facility), if any of the debtors fails to pay the dues as a result of his financial inability/insolvency/bankruptcy, the factor has to absorb the losses.

Mechanism Credit sales generate the factoring business in the ordinary course of business dealings. Realisation of credit sales is the main function of factoring services. Once a sale transaction is completed, the factor steps in to realise the sales. Thus, the factor works between the seller and the buyer and sometimes with the seller's banks together.

Functions of a Factor Depending on the type/form of factoring, the main functions of a factor, in general terms, can be classified into five categories:

- Financing facility/trade debts;
- Maintenance/administration of sales ledger;
- Collection facility/of accounts receivable;
- Assumption of credit risk/credit control and credit restriction; and
- Provision of advisory services.

Financing Trade Debts The unique feature of factoring is that a factor purchases the book debts of his client at a price and the debts are assigned in favour of the factor who is usually willing to grant advances to the extent of, say, 80 per cent of the assigned debts. Where the debts are factored with recourse, the finance provided would become refundable by the client in case of non-payment of the buyer. However, where the debts are factored without recourse, the factor's obligation to the seller becomes absolute on the due date of the invoice whether or not the buyer makes the payment.

Administration of Sales Ledger The factor maintains the clients' sales ledgers. On transacting a sales deal, an invoice is sent by the client to the customer and a copy of the same is sent to the factor. The ledger is generally maintained under the *open-item method* in which each receipt is matched against the specific invoice. The customer's account clearly reflects the various open invoices outstanding on any given date. The factor also gives periodic (fortnightly/weekly depending on the volume of transactions) reports to the client on the current status of his receivables, receipts of payments from the customers and other useful information. In addition, the factor also maintains a customer-wise record of payments spread over a period of time so that any change in the payment pattern can be easily identified.

Provision of Collection Facility The factor undertakes to collect the receivables on behalf of the client relieving him of the problems involved in collection, and enables him to concentrate on other important functional areas of the business. This also enables the client to reduce the cost of collection by way of savings in manpower, time and efforts. The use of trained manpower with sophisticated infrastructural back-up enables a factor to systematically follow up and make timely demands on the debtors to make payments. Also, the debtors are more responsible to the demands from a factor being a credit institution.

Collection of receivables can be considered as the most important function of a factor. He is generally not required to consult the client with regard to the collection procedure. But he may consult the client if legal action has to be initiated in case of non-payment and so on.

Credit Control and Credit Restriction Assumption of credit risk is one of the important functions of a factor. This service is provided where debts are factored without recourse. The factor in consultation with the client fixes credit limits for approved customers. Within these limits, the factor undertakes to purchase all trade debts of the customer without recourse. In other words, the factor assumes the risk of default in payment by the customer. Arising from this function of the factor, there are two important incidental benefits accruing to the client: firstly, factoring relieves the client of the collection work; secondly, with access to extensive information available on the financial standing and credit rating of individual customers and their track record of payments, the factor is able to advise the client on the credit worthiness of potential customers leading to better credit control.

Operationally, the line of credit/credit limit up to which the client can sell to the customer depends on his financial position, his past payment record and the value of the goods sold by the client to the customer. One approach followed by the factors is to define the monthly sales turnover for each customer which will be automatically covered by the approved credit limit. If, for instance, the approved limit for a customer is Rs 5 lakh and the average collection period is 60 days, sales up to Rs 2.5 lakh $[(5 \times 30)/60]$ per month will be automatically covered. Alternatively, some factors provide periodic reports to the clients on customer-credit utilisation before any major sale is made. The credit-worthiness of customers is assessed by the factors on the basis of information from a number of sources such as credit rating reports, if available; bank reports and trade references; analysis of financial statements on the basis of current ratio, quick ratio, net profit margin and return on investment (ROI); prior collection experience; and customer visits.

Advisory Services These services are a *spin-off* of the close relationship between a factor and a client. By virtue of their specialised knowledge and experience in finance and credit dealings and access to extensive credit information, factors can provide a variety of incidental advisory services to their clients:

- Customer's perception of the client's products, changes in the marketing strategies, emerging trends and so on;
- Audit of the procedures followed for invoicing, delivery and dealing with sales returns;
- Introduction to the credit department of a bank/subsidiaries of banks engaged in leasing, hire-purchase and merchant banking.

Cost of Services The factors provide various services at a charge. The charge for collection and sales ledger administration is in the form of a commission expressed as a value of debt purchased. It is collected up-front/in advance. The commission for short-term financing as advance part-payment is in the form of interest charge for the period between the date of advance payment and the date of collection/guaranteed payment date. It is also known as *discount charge*.

Advantages and Evaluation

Advantages Factoring has several positive features from the point of view of the firm (client of the factor). Some of these advantages are briefly discussed as follows:

Impact on the Balance Sheet The impact of factoring on the balance sheet of the client and its implications are illustrated in Tables 11.4 and 11.5.

Table 11.4 *Balance Sheet: Pre-Factoring Scenario* (Rs lakh)

Current liabilities			*Current assets*	
Bank borrowings:			Inventory	100
Cash credit against inventory	70		Receivables	80
Cash credit against receivables	40	110	Other current assets	20
Other current liabilities (OCL)		40		
Net working capital (NWC)		50		
Total current liabilities + NWC		200	Total current assets	200

Current ratio = 1.33:1

The requirement of NWC is Rs 50 lakh (current assets minus current liabilities). As the borrower carries other current liabilities to the extent of Rs 40 lakh, he is eligible for a maximum permissible bank finance (MPBF)/ working capital limit of Rs 110 lakh. This is bifurcated into cash credit limits of Rs 70 lakh against inventory and Rs 40 lakh against receivables, taking into account the stipulated margins for inventory and receivables and also the proportion of individual levels of inventory of Rs 100 lakh and receivables of Rs 80 lakh.

On the basis of the above configuration, the borrower is eligible for working capital limits aggregating Rs 110 lakh under the second method of lending.

Assume the borrower decides to factor his debts. The factoring transaction is as follows: Receivables aggregating Rs 80 lakh are purchased by a factor who makes prepayment of 80 per cent, that is, Rs 64 lakh. He retains Rs 16 lakh (factor reserve) which will be repaid on payment by the customer. The impact on the balance sheet is shown in Table 11.5.

Table 11.5 *Balance Sheet: Post-Factoring Scenario* (Rs lakh)

Current liabilities			*Current assets*	
Bank borrowings:			Inventory	100
Cash credit against inventory	70		Receivables	16
Cash credit against receivables	—	70	Other current assets	20
Other current liabilities (OCL)		16		
Net working capital (NWC)		50		
Total current liabilities + NWC		136	Total current assets	136

Current ratio = 1.58:1

The impact of factoring on the balance sheet as revealed by Tables 11.4 and 11.5 is three fold:

Off-balance Sheet Financing As the client's debts are purchased by the factor, the finance provided by him is off the balance sheet and appears in the balance sheet only as a contingent liability in the case of recourse factoring. In case of non-recourse factoring, it does not appear anywhere in the financial statements of the borrower. The prepayment of Rs 64 lakh made by the factor goes off the balance sheet getting converted into cash, leaving the balance of Rs 16 lakh in the balance sheet as due from the factor.

Reduction of Current Liabilities From the factoring proceeds of Rs 64 lakh, the bank borrowings are liquidated to the extent of Rs 40 lakh. The balance of Rs 24 lakh can be used by the client for paying off other current liabilities comprising of trade creditors for goods and services, creditors for expenses, loan instalments payable, statutory liabilities and provisions. The client may meet any of these obligations with the balance of Rs 24 lakh. The net effect is to reduce current liabilities by Rs 64 lakh.

Improvement in Current Ratio As the factoring transaction is off the balance sheet, it removes from the asset side the receivables factored to the extent of the prepayment made and on the liabilities side, the current liabilities are also reduced. The result is a desirable improvement in the current ratio, from 1.33:1 to 1.58:1.

In brief, the effect of factoring is to improve the financial discipline of the firm.

Higher Credit Standing There are several reasons why factoring should improve a client's standing. With cash flow accelerated by factoring, the client is able to meet his liabilities promptly as and when they arise. The factor's acceptance of the client's receivables itself speaks highly of the quality of the receivables. In the case of non-recourse factoring, the factor's assumption of credit risk relieves the client, to a significant extent, from the problem of bad debts. This enables him to minimise his bad debts reserve.

Improved Efficiency In order to accelerate cash flow, it is essential to ensure the flow of critical information for decision making and follow-up and eliminate delays and wastage of man-hours. This requires sophisticated infrastructure for high level specialisation in credit control and sales ledger administration. Small and medium-sized units are likely to face a resourse constraint in this area. Factoring is designed to place such units on the same level of efficiency in the areas of credit control and sales ledger administration as that of the more sophisticated large companies.

More Time for Planning and Production In any business concern, it is inevitable that a certain proportion of management time has to be diverted to credit control. Large companies can afford to have special departments for the purpose. However, smaller units cannot afford it. The factor undertakes the responsibility for credit control, sales ledger administration and debt collection problems. Thus, the client can concentrate on functional areas of the business line planning, purchase, production, marketing and finance.

Reduction of Cost and Expenses Since the client need not have a special administrative set-up to look after credit control, he can have the benefit of reduced overheads by way of savings on manpower, time and efforts. With the steady and reliable cash flow facilitated by factoring, the clients have many opportunities to cut costs and expenses like taking supplier's prompt payment and quantity discounts, ordering for materials at the right time and at the right place, avoidance of disruption in the production schedule, and so on.

Additional Source The supplier gets an additional source of funding the receivables which eliminates the uncertainty associated with the collection cycle. More importantly, funds from a factor is an additional source of finance for the client outside the purview of bank credit.

Evaluation Framework The distinct advantages of factoring notwithstanding, it does involve costs. The evaluation framework should be on a consideration of the relative costs and benefits associated with the two alternatives to receivables management. They are: (i) in-house management by the firm itself, (ii) factoring service, either recourse or non-recourse. The relevant costs and benefits associated with these are listed below.

Cost Associated with In-house Management (i) cash discount, (ii) cost of funds invested in receivables, (iii) bad debts, (iv) lost contribution on foregone sales and (v) avoidable costs of sales ledger administration and credit monitoring.

Costs Associated with Recourse and Non-recourse Factoring (i) factoring commission, (ii), discount charge and (iii) cost of long-term funds invested in receivables.

Benefits Associated with Recourse Factoring They are in terms of the costs associated with the in-house management alternative with the exception of item (iii), namely, bad debt loss.

Benefit Associated with Non-Recourse Factoring The above plus the bad debt losses relevant to in-house management of receivables.

The evaluation framework of factoring is elaborated in Example 11.1.

EXAMPLE 11.1

The Reliance Industries Ltd (RIL) is presently managing its accounts receivable internally by the sales and credit department. Its credit terms for sales are 2/10 net, 30. The past experience of RIL has been that on an average 30 per cent of the customers avail of the discount, while the balance of the receivables is collected on an average 60 days after the invoice date. Further, 2 per cent of the sales turnover results in bad debts.

The firm is financing its investments in receivables through a mix of bank finance and long-term finance (own funds) in the ratio of 2:1. The effective rate of interest on bank finance is 12 per cent and the cost of own funds is 15 per cent.

The projected sales for the next year is Rs 500 lakh. The credit and collection department spends on an average one-fourth of its time on collection of receivables.

A proposal to avail of factoring service from Fairgrowth Factors Ltd (FFL) as an alternative to in-house management of receivables collection and credit monitoring is under the consideration of the Board of Directors of the RIL. If the proposal, details of which are given as follows, is accepted, it is expected that the projected sales for the next year can increase by Rs 50 lakh as a result of the diversion of the time of the executives of the sales, credit and collection department to sales promotion. For the type of product the RIL is producing, the gross margin on sales in the past has been 20 per cent. Moreover, there would be a saving in administrative overheads amounting to Rs 2.5 lakh due to discontinuance of sales ledger administration and credit monitoring.

According to the factoring proposal, the FFL offers a guaranteed payment of 30 days. The other details are listed as follows:

The FFL would advance 80 per cent and 85 per cent in case of recourse and non-recourse factoring deals respectively, the balance would be retained as factor reserve. The discount charge in advance (up-front) would be 13 per cent of recourse type and 14 per cent for non-recourse type of service. The FFL would also charge a commission @ 2 per cent (recourse) and 4 per cent (non-recourse). The commission is payable up-front.

Before taking a decision on the proposal, the Board seeks your advice as a financial consultant, on the course of action. What advice would you give? Why?

SOLUTION

Relevant Costs: In-House Management Alternative

Relevant costs	*Amount (Rs lakh)*
1. Cash discount	3.0 (Rs 500 × 0.02 × 0.30)
2. Cost of founds in receivables	8.125 (Working note 1)
3. Bad debt losses	10.0 (Rs.500 × 0.02)
4. Lost contribution on foregone sales	9.0 [Rs 50 × (0.20 – 0.02, Bad bebts)]
5. Avoidable administrative overheads	2.50
Total	32.625

Working Note (1):

Cost of funds invested in receivables:

Average collection period = (10 days × 0.3) + (6 days × 0.70) = 45 days

Cost of bank finance = Rs 500 lakh × 2/3 × 45/360 × 0.12 = 5.0 lakh (a)

Cost of own funds = Rs 500 lakh × 1/3 × 45/360 × 0.15 = 3.125 lakh (b)

Total [(a) + (b)] = Rs 8.125 lakh

Relevant Costs: Recourse Factoring Alternative

Relevant Costs	*Amount (Rs lakh)*
6. Factoring commission	11.0 (Rs 550 × 0.02)
7. Discount charge	4.671 (Working note 2)
8. Cost of long-term funds invested in receivables	1.485[(Rs 550 – Rs 431.2) × 0.15 × 30/360)]
Total	17.156

Working Note (2):

Eligible amount of advance = 0.80 × (Rs 550 – Rs 11) = Rs 431.2 lakh

Discount charge = Rs 431.2 × 0.13 × 30/360 = Rs 4.671 lakh

Relevant Costs: Non-recourse Factoring Alternative

Relevant costs	*Amount (Rs lakh)*
9. Factoring commission	22.0 (Rs 550 × 0.04)
10. Discount charge	5.236 (Working note 3)
11. Cost of long-term funds invested in receivables	1.265[(Rs 550 – Rs 448.8) × 0.15 × 30/360)]
Total	28.501

Working Note (3):

Eligible amount of advance = 0.85 × (Rs 550 – Rs 22) = Rs 448.8 lakh

Discount charge = Rs 448.8 × 0.14 × 30/360 = Rs 5.236 lakh

Decision Analysis: Recourse Factoring (Rs lakh)

Benefits (Rs 32.625 – Rs 10.00 Bad debts yet to be met by RIL)	22.625
Costs	17.156
Net benefits	5.469

Decision Analysis: Non-Recourse Factoring (Rs lakh)

Benefits (Rs 32. 625 + Rs 1.00 Bad debts loss to be borne by factor)	33.625
Costs	28.501
Net benefits	5.124

Alternatively, incremental analysis approach can be used for the decision.

(i) Incremental analysis to decide whether the company should go for recourse factoring or not.

Particulars	*Amount (Rs lakh)*	
Incremental benefits		
1. Incremental contribution on additional sales (Rs 50 × 0.18)	Rs 9.00	
2. Savings in cost of investment in receivables (Rs 8.125 – 1.485	6.64	
3. Savings in avoidable administrative overheads	2.50	
4. Savings in cash discount	3.00	21.14
Incremental costs		
5. Factoring commission	11.00	
6. Discount charge	4.671	15.671
Net benefits		5.469

(ii) Incremental analysis to decide whether the company should go for non-recourse factoring or not

Particulars	*Amount (Rs lakh)*	
Incremental benefits		
1. Incremental profits in additional sales (Rs 50 × 0.20)	10.00	
2. Savings in cost of investment in receivables (Rs 8.125 – 6.86 1.265)		
3. Savings in avoidable administrative overheads	2.50	
4. Savings in cash discount	3.00	
5. Savings in exiting bad debts (Rs 50 lakh × .02)	10.00	32.36
Incremental costs		
6. Factoring commission	22.00	
7. Discount charge	5.236	27.236
Net benefits		5.124

As a financial consultant, my advice to the Board of RIL would be to choose recourse factoring due to higher net benefits.

SUMMARY

- Working capital management is concerned with the problems that arise in managing the current assets (CA), current liabilities (CL) and the interrelationships between them. Its opera-tional goal is to manage the CA and CL in such a way that a satisfactory/acceptable level of net working capital (NWC) is maintained.
- There are two concepts of working capital (WC): gross and net. The gross WC means the total CA. The NWC is the difference between the CA and CL.
- The NWC is necessary due to non-synchronous nature of expected cash inflows and required cash outflows. The more predictable the cash inflows are, the less NWC will be required and *vice-versa.* The NWC represents the liquidity position of a firm.
- The NWC has a bearing on liquidity, profitability and risk of becoming technically insolvent. In general, the greater is the NWC, the higher is the liquidity, the lower is the risk and the profitability, and *vice-versa.* The trade-off between profitability and risk is an important element in the evaluation of the level of NWC of a firm.
- In evaluating the profitability-risk trade-off related to the level of NWC, two ratios are used: (i) ratio of current assets to total assets (CA/TA) and (ii) the ratio of current liabilities to total assets (CL/TA).
- The CA/TA ratio indicates the percentage of CA in the total assets of a firm. Since CA for a business firm are likely to be less profitable than fixed assets, the increase in CA/TA ratio would decrease

profitability, increase liquidity (assuming no change in CL) and reduce the risk of technical insolvency. A decrease in the ratio will result in an increase in profitability as well as risk.

- The CL/TA ratio indicates the percentage of total assets financed by current liabilities. An increase in the ratio will yield higher profitability (due to decrease in costs) and higher risk (due to decrease in NWC, assuming no change in CA). The decrease in the ratio will lead to a decrease in profitability as well as risk.
- The combined effects of changes in CA and CL on profitability-risk trade-off can be evaluated by considering them simultaneously also.
- Determination of financing mix is another important constituent of WC management. The financing mix refers to the proportion of CA to be financed by short-term sources (CL) and long-term sources (such as share capital and long-term borrowings). It is concerned with determination of relative share of these two broad sources in financing CA.
- There are three approaches to determine an appropriate financing mix: (i) hedging/matching approach, (ii) conservative approach and (iii) trade-off between these two.
- According to hedging approach, long-term funds should be used to finance the permanent/core part of the CA and the purely temporary and seasonal requirements (over and above the permanent needs) should be met out of short-term funds. As a result, the short-term financing (CL) would be just equal to current assets (i.e. NWC – 0). This approach is a high profit-high risk financing mix.
- According to the conservative approach, the estimated total requirements of the CA should be financed from long-term sources. The short-term sources of finance should be used only in emergency situations. The firm has NWC equal to the excess of long-term financing over the permanent requirement. This approach is a low-profit, low-risk combination.
- Neither the hedging approach nor the conservative approach is suitable for determining an appropriate financing mix. A trade-off between these two extreme approaches would give an acceptable financing strategy.
- The need for working capital (WC) arises from the cash/operating cycle of a firm. It refers to the length of time required to complete the following sequence of events: conversion of cash into inventory, inventory into receivables and receivables into cash. The operating cycle creates the need for working capital and its length in terms of time-span required to complete the cycle is the major determinant of the firm's working capital needs.
- Working capital can be (i) permanent and (ii) temporary. While the permanent component reflects the need for a certain irreducible level of current assets on a continuous and uninterrupted basis, the temporary portion is needed to meet seasonal and other temporary requirements. While permanent working capital requirements should be financed from long-term sources, short-term funds should be used to finance temporary working capital needs of a firm.
- Working capital requirements are determined by a variety of factors. These factors, however, affect different enterprises differently. In general, the factors relevant for proper assessment of the quantum of working capital required are: general nature of business, production cycle, business cycle, production policy, credit policy, growth and expansion, availability of raw materials, profit-level, level of taxes, dividend policy, depreciation policy, price level changes and operating efficiency.
- Manufacturing and trading enterprises require fairly large amounts of working capital to maintain a sufficient amount of cash, inventories and book debts to support their production (purchases) and sales activity. Service enterprises (like public utilities) and hotels, restaurants and eating houses need to carry less WC.
- The longer is the production cycle, the larger is the WC needed or *vice-versa.*
- While during boom conditions, reflecting upswing in business activity, the need for WC is likely to grow to cater to the increased level of activity, the need for working capital in the downswing phase/recessionary conditions tend to be low due to fall in the volume of sales and production.

- While the liberal credit policy offered to customers would necessitate more working capital, tight credit terms would reduce its requirement. The liberal credit terms available from creditors/suppliers of materials would be an offsetting factor.
- Growth industries and firms require more working capital.
- To meet vagaries in the unavailability, a firm should have excess inventory of raw materials to sustain smooth production. Such a firm would tend to have high level of WC.
- Cash profit, *per-se*, should not be viewed as a source of financing WC. The actual availability of such funds would depend upon the firm's requirement for payment of dividend, payment of loan instalment, creation of sinking fund, purchase of fixed assets, and so on. In case these requirements are substantial, cash profit is not likely to be available to meet the needs of a firm. Alternatively, only adjusted cash profits after provisioning for these requirements should be reckoned for WC financing.
- The payment of dividend consumes cash resources and, therefore, decreases WC of a firm. Conversely, the non-payment of dividend increases WC.
- Higher depreciation (enhanced rates of depreciations) has a positive impact on WC for two reasons: (i) lower tax liability and, hence, more cash profits and (ii) lower disposable profits and, therefore, a smaller dividend payment. They imply more cash with a corporate.
- Rising prices in input costs (without corresponding increase or less than a proportionate increase in selling prices of products) necessitates more WC to sustain an existing level of activity.
- Efficiency of operations accelerates the pace of cash cycle and improves the WC turnover resulting in reduced requirement of WC.
- A firm should have adequate WC to support its budgeted level of activity in terms of production/sales. It should have neither more nor less WC than required. While the excessive WC adversely affects its profits, the inadequate WC interrupts its smooth operations. Therefore, its correct computation is an important constituent of efficient WC management.
- There are two components of WC, namely, CA and CL. Each component is to be separately estimated to determine the correct amount of WC. The relevant factors are the holding periods of the various types of inventories, debtors collection period, creditors payment period, budgeted yearly production/sales, cost of goods produced, cost of sales, average time-lag in payment of wages and other overheads, minimum cash balances and so on.
- Working capital requirements are to be computed with reference to cash costs (excluding depreciation) and not the sale price as depreciation is a non-cash cost and, hence, does not need WC. The investment required to finance debtors are at cost price. The 'cash cost approach' is appropriate to determine WC requirement of a firm.
- Typically, working capital requirements/current assets are financed by a combination of long-term and short-term sources. The important traditional short-term sources of current assets financing are trade credit and bank credit. Two newly emerging sources of working capital finance are factoring and commercial papers.
- Trade credit represents credit extended by suppliers of goods and services in the normal course of transactions of the firm. As cash is not paid immediately for purchase but after an agreed period of time, the deferral of payment (trade credit) represents a source of finance for credit purchases (current assets). It does not involve any explicit interest charge/cost. The implicit cost of trade credit depends on the terms offered by the supplier of goods. When the terms include cash discount for prompt payment, the cost of trade credit is generally very high beyond the discount period.
- Bank credit is the single most important institutional source of working capital finance. It is provided mainly in three forms (i) cash credit/overdraft, (ii) loans, and (iii) purchase/discount of bills. Of these, loans contribute the most important component. The security for working capital advances by banks is in the form of hypothetication or pledge.

- Commercial papers which are unsecured promissory notes issued by firms which enjoy high credit rating are emerging as an innovative short-term source of current assets financing.
- Factoring involves sale of accounts receivables to a factor who charges a commission, bears the credit risk associated with the accounts receivable purchased by it and provides funds in advance of collection and, thus, finances receivables.

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2. *Ibid.*, p. 157.
3. Joy, O M, *Introduction to Financial Management*, Richard D Irwin, Homewood, Ill. 1977, p. 406.
4. *Ibid.*, p. 407.
5. Ramamoorthy, V E, *Working Capital Management*, Institute of Financial Management and Research Madras, 1976, p. 54.
6. These aspects are covered in detail in Chapter 19.
7. Ramamoorthy, V E, *op. cit.*, p. 58.
8. *Ibid.*, p. 60.
9. Administrative overheads are normally ignored for valuation of work-in-process. Depreciation is excluded as it does not involve any cash expenditure.
10. Please refer to Chapter 12.
11. Bank credit is excluded as it is a source of finance of W C.

SOLVED PROBLEMS

P.11.1 X & Y Ltd is desirous to purchase a business and has consulted you, and one point on which you are asked to advise them, is the average amount of working capital which will be required in the first year's working.

You are given the following estimates and are instructed to add 10 per cent to your computed figure to allow for contingencies.

Particulars	*Amount for the year*
(i) Average amount backed up for stocks:	
Stocks of finished product	Rs 5,000
Stocks of stores and materials	8,000
(ii) Average credit given:	
Inland sales, 6 weeks' credit	3,12,000
Export sales, 1.5 weeks' credit	78,000
(iii) Average time lag in payment of wages and other outgoings:	
Wages, 1.5 weeks	2,60,000
Stocks and materials, 1.5 months	48,000
Rent and royalties, 6 months	10,000
Clerical staff, 0.5 month	62,400
Manager, 0.5 month	4,800
Miscellaneous expenses, 1.5 months	48,000
(iv) Payment in advance:	
Sundry expenses (paid quarterly in advance)	8,000
Undrawn profits on an average throughout the year	11,000

Set up your calculations for the average amount of working capital required.

SOLUTION

Statement to determine net working capital for X & Y Ltd

(a) *Current assets*:	
(i) Stock of finished product	Rs 5,000
(ii) Stock of stores and materials	8,000
(iii) Debtors:	
Inland sales (Rs 3,12,000 × 6/52)	36,000
Export sales, (Rs 78,000 × 3/104)	2,250
(iv) Advance payment of sundry expenses (Rs 8,000 × 1/4)	2,000
Total investment in current assets	53,250
(b) *Current liabilities*:	
(i) Wages (Rs 2,60,000 × 3/104)	7,500
(ii) Stocks/materials, (Rs 48,000 × 3/24)	6,000
(iii) Rent, royalties, (Rs 10,000 × 6/12)	5,000
(iv) Clerical staff (Rs 62,400 × 1/24)	2,600
(v) Manager (Rs 4,800 × 1/24)	200
(vi) Miscellaneous expenses (Rs 48,000 × 3/24)	6,000
Total estimate of current liabilities	27,300
(c) Net working capital:	
(i) Current assets – Current liabilities (A – B)	25,950
(ii) *Add* 10 per cent contingency allowance	2,595
Average amount of working capital required	28,545

Assumptions:

(i) A time period of 52 weeks/12 months has been assumed in year.

(ii) Undrawn profit has been ignored in the working capital computation for the following reasons:

(a) For the purpose of determining working capital provided by net profit, it is necessary to adjust the net profit for income tax and dividends/drawings, and so on.

(b) Profit need not always be a source of financing working capital. It may be used for other purposes like purchase of fixed assets, repayment of long-term loans, and so on. Since the firm does not seem to have such uses, Rs 11,000 may be treated as source of working capital. But the WC will not change.

(iii) Actual working capital requirement would be more than what is estimated here as the cash component of current assets is not known.

P.11.2 A proforma cost sheet of a company provides the following particulars:

	Amount per unit
Elements of cost:	
Raw materials	Rs 80
Direct labour	30
Overhead	60
Total cost	170
Profit	30
Selling price	200

The following further particulars are available:

Raw materials in stock, on average, one month; Materials in process (completion stage, 50 per cent), on average, half a month; Finished goods in stock, on average, one month.

Credit allowed by suppliers is one month; Credit allowed to debtors is two months; Average time-lag in payment of wages is 1.5 weeks and one month in overhead expenses; one-fourth of the output is sold against cash; cash in hand and at bank is desired to be mantained at Rs 3,65,000.

You are required to prepare a statement showing the working capital needed to finance a level of activity of 1,04,000 units of production. You may assume that production is carried on evenly throughout the year, and wages and overheads accrue similarly. For calculation purposes, 4 weeks may be taken as equivalent to a month.

SOLUTION

Statement showing determination of net working capital

(A) *Current assets*:	
(i) Stock of materials for 1 month: (1,04,000 × Rs 80 × 4/52)	Rs 6,40,000
(ii) Work-in-progress for 0.5 month:	
(a) Material (1,04,000 × Rs 80 × 2/52) × 0.50	1,60,000
(b) Labour (1,04,000 × Rs 30 × 2/52) × 0.50	60,000
(c) Overheads (1,04,000 × Rs 60 × 2/52) × 0.50	1,20,000
(iii) Finished goods for 1 month: (1,04,000 × Rs 170 × 4/52)	13,60,000
(iv) Debtors for 2 months (78,000 × Rs 170 × 8/52)	20,40,000
(v) Cash in hand and at bank	3,65,000
Total investments in current assets	47,45,000
(B) *Current liabilities*:	
(i) Creditors, 1 month's purchase of raw materials, (i.e. 1,04,000 × Rs80 × 4/52)	6,40,000
(ii)Average time-lag in payment of expenses	
(a) Overheads (1,04,000 × Rs 60 × 4/52)	4,80,000
(b) Labour (1,04,000 × Rs 30 × 3/104)	90,000
Total estimate of current liabilities	12,10,000
(C) Net working capital = Current assets – Current liabilities (A – B)	35,35,000

Working Notes and Assumptions

(i) 26,000 units have been sold for cash. Therefore, credit sales pertain to 78,000 units only.
(ii) Year has 52 weeks.
(iii) All overheads are assumed to be variable. Presence of depreciation element in overheads will lower the working capital requirement.

P.11.3 While preparing a project report on behalf of a client you have collected the following facts. Estimate the net working capital required for that project. Add 10 per cent to your computed figure to allow contingencies:

	Amount per unit
Estimated cost per unit of production is:	
Raw material	Rs 80
Direct labour	30
Overheads (exclusive of depreciation, Rs 10 per unit)	60
Total cash cost	170

Additional information:
Selling price, Rs 200 per unit
Level of activity, 1,04,000 units of production per annum
Raw materials in stock, average 4 weeks
Work in progress (assume 50 per cent completion stage in respect of conversion costs and 100 per cent completion in respect of materials), average 2 weeks
Finished goods in stock, average 4 weeks
Credit allowed by suppliers, average 4 weeks
Credit allowed to debtors, average 8 weeks
Lag in payment of wages, average 1.5 weeks
Cash at bank is expected to be, Rs 25,000.

You may assume that production is carried on evenly throughout the year (52 weeks) and wages and overheads accrue similarly. All sales are on credit basis only.

SOLUTION

Net working capital estimate of a project

(A) *Current assets*:	
(i) Raw materials in stock, (1,04,000 × Rs 80 × 4/52)	Rs 6,40,000
(ii) Work-in-progress	
(a) Raw material (1,04,000 × Rs 80 × 2/52)	3,20,000
(b) Direct Labour (1,04,000 × Rs 15 × 2/52)	60,000
(c) Overheads (1,04,000 × Rs 30 × 2/52)	1,20,000
(iii) Finished goods stock: (1,04,000 × Rs 170 × 4/52)	13,60,000
(iv) Debtors: (1,04,000 × Rs 170 × 8/52)	27,20,000
(v) Cash at bank	25,000
Total investment in current assets	52,45,000
(B) *Current liabilities*:	
(i) Creditors, average 4 weeks: (1,04,000 × Rs 80 × 4/52)	6,40,000
(ii) Lag in payment of wages (1,04,000 × Rs 30 × 3/104)	90,000
Total current liabilities	7,30,000
(C) *Net working capital*: Current assets – Current liabilities	45,15,000
Add 10 per cent contingencies	4,51,500
	49,66,500

Working Note

A full unit of raw material is required at the beginning of the manufacturing process and, therefore, total cost of the material, that is, Rs 80 per unit has been taken into consideration, while in the case of expenses, viz. direct labour and overheads, the unit has been finished only to the extent of 50 per cent. Accordingly, Rs 15 and Rs 30 have been charged for direct labour and overheads respectively in valuing work-in-proess.

P.11.4 A newly formed company has applied for a loan to a commercial bank for financing its working capital requirements. You are requested by the bank to prepare an estimate of the requirements of the working capital for the company. Add 10 per cent to your estimated figure to cover unforeseen contingencies. The information about the projected profit and loss account of this company is as under:

Sales		Rs 21,00,000
Cost of goods sold		15,30,000
Gross profit		5,70,000
Administrative expenses	Rs 1,40,000	
Selling expenses	1,30,000	
		2,70,000
Profit before tax		3,00,000
Provision for tax		1,00,000

Note: Cost of goods sold has been derived as follows:

Materials used	8,40,000
Wages and manufacturing expenses	6,25,000
Depreciation	2,35,000
	17,00,000
Less stock of finished goods (10 per cent not yet sold)	1,70,000
	15,30,000

The figures given above relate only to the goods that have been finished and not to work in progress; goods equal to 15 per cent of the year's production (in terms of physical units) are in progress on an average, requiring full materials but only 40 per cent of other expenses. The company believes in keeping two months consumption of material in stock; Desired cash balance, Rs 40,000.

Average time-lag in payment of all expenses is 1 month; suppliers of materials extend 1.5 months credit; sales are 20 per cent cash; rest are at two months credit; 70 per cent of the income tax has to be paid in advance in quarterly instalments.

You can make such other assumptions as you deem necessary for estimating working capital requirements.

SOLUTION

Net working capital estimate of a company

(A) *Current assets*:		
(i) Raw material in stock = (Rs 8,40,000 × 2/12)		Rs 1,40,000
(ii) Work-in-progress:		
(a) Raw material (Rs 8,40,000 × 15/100)		1,26,000
(b) Wages and manufacturing expenses = (Rs 6,25,000 × 0.4 × 15/100)		37,500
(iii) Stock of finished goods: [Rs 1,70,000 – Rs 23,500 (0.10 × Rs 2,35,000, depreciation)]		1,46,500
(iv) Debtors		
(a) Cost of goods sold	Rs 15,30,000	
Less depreciation (Rs 2,35,000 × 0.9)	2,11,500	
	13,18,500	
(b) Administrative expenses	1,40,000	
(c) Selling expenses	1,30,000	
Total	15,88,500	
Credit sales (4/5 of Rs 15,88,500) = Rs 12,70,800 (12,70,800 × 2/12)		2,11,800
(v) Cash required		40,000
Total investment in current assets		7,01,800
(B) *Current liabilities*:		
(i) Average time-lag in payment of expenses:		
(a) Wages and manufacturing expenses	6,25,000	
(b) Administrative expenses	1,40,000	
(c) Selling expenses	1,30,000	
	8,95,000/12	74,583
(ii) Creditors (Rs 8,40,000 × 3/24)		1,05,000
Total current liabilities		1,79,583
(C) *Net working capital*: Current assets – Current liabilities (A – B)		5,22,217
Add 10 per cent contingencies		52,222
		5,74,439

Assumptions and Working Notes

(i) Depreciation is not a cash expense and, therefore, excluded from cost of goods sold for the purpose of determining work-in-progress, finished goods and investment in debtors.

(ii) Since profit is not taken into consideration in our calculation as a source of working capital, income tax has been excluded as it is to be paid out of profits.

P.11.5 From the following projections of XYZ & Ltd for the next year, you are required to determine the working capital required by the company.

Annual sales, Rs 14,40,000
Costof production (including depreciation of Rs 1,20,000), Rs 12,00,000
Raw material purchases, Rs 7,05,000

Monthly expenditure, Rs 30,000
Estimated opening stock of raw materials, Rs 140,000
Estimated closing stock of raw materials, Rs 1,25,000
Inventory norms:
Raw materials, 2 months
Work-in-process, 1/2 month
Finished goods, 1 month

The firm enjoys a credit of half-a-month on its purchases and allows one month credit on its supplies. On sales orders, the company receives an advance of Rs 15,000.

You may assume that production is carried out evenly throughout the year and minimum cash balance desired to be maintained is Rs 35,000.

SOLUTION

Statement showing determination of net working capital

(A) *Current assets*:			
Cash balance			Rs 35,000
Inventories:			
Raw materials:	Opening stock	Rs 1,40,000	
	Add purchases	7,05,000	
	Less closing stock	1,25,000	
	Annual consumption	7,20,000	
	Two months requirement: (Rs 7,20,000 × 2/12)		1,20,000
Work-in-process: (Rs 10,80,000 × 1/24)			45,000
Finished goods: (Rs 10,80,000 × 1/12)			90,000
Debtors: (Rs 10,80,000 × 1/12)			90,000@
Total current assets			3,80,000
(B) *Current liabilities*:			
Trade creditors: (Rs 7,05,000 × 1/24)			29,375
Advance received from debtors			15,000
Total current liabilities			44,375
(C) Net working capital (A – B)			3,35,625

@It is assumed that there is neither opening nor closing stock of finished stock and, therefore, cost of sales is Rs 10,80,000 excluding depreciation.

Monthly expenditure is excluded as the cost of production includes it (Rs 7.2 lakh, raw materials + Rs 3.6 lakh, other expenses @ Rs 30,000 per month).

P.11.6 From the following data, compute the duration of the operating cycle for each of the two years and comment on the increase/decrease:

	Year 1	*Year 2*
Stocks:		
Raw materials	Rs 20,000	Rs 27,000
Work-in-process	14,000	18,000
Finished goods	21,000	24,000
Purchase of raw materials	96,000	1,35,000
Cost of goods sold	1,40,000	1,80,000
Sales	1,60,000	2,00,000
Debtors	32,000	50,000
Creditors	16,000	18,000

Assume 360 days per year for computations purposes.

SOLUTION

	Year 1 (Days)	*Year 2 (Days)*
(i) Raw materials holding period:		
$\frac{360 \text{ days} \times \text{Stock of raw meteriasls}}{\text{Cost of raw material consumed}}$	$\left(\frac{360 \times \text{Rs } 20,000}{\text{Rs } 96,000}\right) = 75$	$\left(\frac{360 \times \text{Rs } 27,000}{\text{Rs } 1,35,000}\right) = 72$
(assumed to be equivalent to purchases)		
(ii) *Less* creditors payment period:		
$\frac{360 \text{ days} \times \text{Creditors}}{\text{Purchases}}$	$\left(\frac{360 \times \text{Rs } 16,000}{\text{Rs } 96,000}\right) = (60)$	$\left(\frac{360 \times \text{Rs } 18,000}{\text{Rs}1,35,000}\right) = (48)$
(iii) Work-in-process holding period:		
$\frac{360 \text{ days} \times \text{Stock of WIP}}{\text{Cost of goods manufactured}}$	$\left(\frac{360 \times \text{Rs } 14,000}{\text{Rs } 1,40,000}\right) = 36$	$\left(\frac{360 \times \text{Rs } 18,000}{\text{Rs } 1,80,000}\right) = 36$
(assumed equal to cost of goods sold)		
(iv) Finished goods holding period:		
$\frac{360 \text{ days} \times \text{Stock of finished goods}}{\text{Cost of goods sold}}$	$\left(\frac{360 \times \text{Rs } 21,000}{\text{Rs } 1,40,000}\right) = 54$	$\left(\frac{360 \times \text{Rs } 24,000}{\text{Rs } 1,80,000}\right) = 48$
(v) Debtors collection period:		
$\frac{360 \text{ days} \times \text{Debtors}}{\text{Credit sales}}$	$\left(\frac{360 \times \text{Rs } 32,000}{\text{Rs } 1,60,000}\right) = 72$	$\left(\frac{360 \times \text{Rs } 50,000}{\text{Rs } 2,00,000}\right) = 90$
(assumed equal to total sales)		
Duration of operating cycle [sum of (i) to (v)]	= 177	= 198

The duration of the operating cycle has increased by 21 days in year 2 compared to year 1. It will necessitate more working capital in year 2. This increase has been primarily caused by an increase in debtors collection period and decrease in creditors payment period (as shown below):

Increase in debtors collection period	18 days
Decrease in creditors payment period	12
Less decrease in raw material holding period	(3)
Less decrease in finished goods holding period	(6)
Net increase in operating cycle	21

P.11.7 From the following information, extracted from the books of a manufacturing company, compute the operating cycle in days:

Period covered: 365 days
Average period of credit allowed by suppliers, 16 days
Other data are as follows:

	(Rs '000)
Average debtors (outstanding)	480
Raw material consumption	4,400
Total production cost	10,000
Total cost of sales	10,500
Sales for the year	16,000

(*Contd.*)

(*Contd.*)

Value of average stock maintained:	
Raw material	320
Work-in-process	350
Finished goods	260

SOLUTION

Particulars (amount in '000)	*Days*
(i) Raw material holding period (365 days × Rs 320/4,400)	27
(ii) *Less* creditors payment period	(16)
(iii) Work-in-process holding period (365 days × Rs 350/Rs 10,000)	13
(iv) Finished goods holding period (365 days × Rs 260/Rs 10,000)	9
(v) Debtors collection period (365 days × Rs 480/Rs 16,000) (sales given are assumed equal to credit sales)	11
Duration of operating cycle	44

P.11.8 You are supplied with the following information in respect of XYZ Ltd for the ensuing year:

Production of the year, 69,000 units
Finished goods in store, 3 months
Raw material in store, 2 months' consumption
Production process, 1 month
Credit allowed by creditors, 2 months
Credit given to debtors, 3 months
Selling price per unit, Rs 50
Raw material, 50 per cent of selling price
Direct wages, 10 per cent of selling price
Manufacturing and administrative overheads, 16 per cent of selling price
Selling over heads, 4 per cent of selling price

There is a regular production and sales cycle and wages overheads accrue evenly. Wages are paid in the next month of accrual. Material is introduced in the beginning of the production cycle. You are required to ascertain its working capital requirement.

SOLUTION

Statement showing working capital requirement

(A) *Current assets*:	
(i) Raw material in store (69,000 × Rs 25 × 2/12)	Rs 2,87,500
(ii) Work-in-process (69,000 × Rs 31.5* × 1/12) (*Material, Rs 25 + 0.50 × (Rs 5, Direct wages + Rs 8, Manufacturing and other administrative overheads)	1,81,125
(iii) Finished goods in store (69,000 × Rs 38 × 3/12)	6,55,500
(iv) Debtors (69,000 × Rs 40 × 3/12)	6,90,000
Total current assets	18,14,125
(B) *Current liabilities:*	
(i) Creditors (69,000 × Rs 25 × 2/12)	2,87,500
(ii) Wages (69,000 × Rs 5 × 1/12)	28,750
Total current liabilities	3,16,250
(C) *Net working capital (A – B)*	14,97,875

Assumptions: (i) Conversion costs (wages, manufacturing and other administrative overheads) are assumed to be equivalent to 50 per cent to determine WIP (ii) sales are credit sales and equivalent to units produced (69,000).

P.11.9 *X* Ltd sells goods at a gross profit of 20 per cent. It includes depreciation as a part of cost of production. The following figures for the 12 month-period ending March 31, current year are given to enable you to ascertain the requirements of working capital of the company on a cash cost basis.

In your working, you are required to assume that:

(i) A safety margin of 15 per cent will be maintained;
(ii) Cash is to be held to the extent of 50 per cent of current liabilities;
(iii) There will be no work-in-progress;
(iv) Tax is to be ignored;
(v) Finished goods are to be valued at manufacturing costs. Stocks of raw materials and finished goods are kept at one month's requirements.

Sales at 2 month's credit, Rs 27,00,000
Materials consumed (suppliers' credit is for 2 months), Rs 6,75,000
Wages (paid on the last day of the month), Rs 5,40,000
Manufacturing expenses outstanding at the end of the year (cash expenses are paid one month in arrear), Rs 60,000
Total administrative expenses (paid as above), Rs 180,000
Sales promotion expenses (paid quarterly in advance), Rs 90,000

SOLUTION

Statement showing determination of working capital

(A) *Current assets*:	
(i) Raw materials (Rs 6,75,000/12)	Rs 56,250
(ii) Finished goods (Rs 19,35,000/12)	1,61,250
(iii) Debtors (Rs 22,05,000 × 2/12)	3,67,500
(iv) Sales promotion expenses (Rs 90,000 × 3/12)	22,500
(v) Cash in hand (Rs 2,10,000 × 0.50)	1,05,000
Total current assets	7,12,500
(B) *Current liabilities*:	
(i) Creditors (Rs 6,75,000 × 2/12)	1,12,500
(ii) Manufacturing expenses	60,000
(iii) Administrative expenses (Rs 1,80,000/12)	15,000
(iv) Wages (Rs 5,40,000 × 1/24)	22,500
Total current liabilities	2,10,000
(C) Net working capital (A – B)	5,02,500
Add safety margin (0.15 × Rs 5,02,500)	75,375
Working capital required on cash cost basis	5,77,875

Working Notes

(i)	*Determination of manufacturing expenses*		
	Sales		Rs 27,00,000
	Less gross profit margin (Rs 27 lakh × 0.20)		5,40,000
	Total manufacturing costs		21,60,000
	Less cost of materials consumed	Rs 6,75,000	
	Less wages	5,40,000	12,15,000
	Manufacturing expenses (balancing figure)		9,45,000
(ii)	Cash manufacturing expenses (Rs 60,000 × 12)		7,20,000
(iii)	Depreciation (Rs 9,45,000 – Rs 7,20,000)		2,25,000

(iv) Cash manufacturing costs (Rs 21,60,000 – Rs 2,25,000)	19,35,000
(v) Cash cost of sales (Rs 19,35,000 + Rs 1,80,000 + Rs 90,000)	22,05,000

P.11.10 Q Ltd sells goods at a uniform rate of gross profit of 20 per cent on sales including depreciation as part of cost of production. Its annual figures are as under:

Sales (At 2 month's credit)	Rs 24,00,000
Materials consumed (suppliers credit 2 months)	6,00,000
Wages paid (monthly at the beginning of the subsequent month)	4,80,000
Manufacturing expenses (cash expenses are paid - one month in arrear)	6,00,000
Administration expenses (cash expenses are paid - one month in arrear)	1,50,000
Sales promotion expenses (paid quarterly in advance)	75,000

The company keeps one month stock each of raw materials and finished goods. A minimum cash balance of Rs 80,000 is always kept. The company wants to adopt a 10 per cent safety margin in the maintenance of working capital.

The company has no work in progress.

Find out the requirements of working capital of the company on cash cost basis.

SOLUTION

Determination of net working capital

Current assets:	
Cash in hand	Rs 80,000
Raw material Rs (6,00,000 × 1/12)	50,000
Finished goods (16,80,000[1] × 1/12)	1,40,000
Debtors (19,05,000[2] × 2/12)	3,17,500
Sales promotion expenses (75,000 × ¼)	18,750
Total current assets	6,06,250
Current liabilities:	
Creditors (6,00,000 × 2/12)	1,00,000
Wages (4,80,000 × 0.5/12)	20,000[3]
Manufacturing expenses (6,00,000 × 1/12)	50,000
Administration expenses (1,50,000 × 1/12)	12,500
Total current liabilities	1,82,500
Net working capital	4,23,750
Add: Safety margin (10 per cent)	42,375
NWC required	4,66,125

Working Notes

(1) Determination of depreciation:	
Sales	Rs 24,00,000
Less: Gross profit margin @ 20 per cent	4,80,000
Total manufacturing cost including depreciation (A)	19,20,000
Material consumed	6,00,000
Wages	4,80,000
Manufacturing expenses	6,00,000
Total cash manufacturing cost (B)	16,80,000
Depreciation (A) – (B)	2,40,000
(2) Determination of cash cost of sales:	
Cash manufacturing cost	16,80,000
Administration expenses	1,50,000
Sales promotion expenses	75,000
	19,05,000

(3) Since wages are paid in the beginning of the subsequent month therefore average time- lag in payment of wages is half a month.

P.11.11 A newly formed company has applied to the commercial bank for the first time for financing its working capital requirements. The following information is available about the projections for the current year.

Estimated level of activity: 1,04,000 completed units of production plus 4,000 units of work-in-progress. Based on the above activity, estimated cost per unit is:

Raw material	Rs 80 per unit
Direct wages	30 per unit
Overheads (exclusive of depreciation)	60 per unit
Total cost	170 per unit
Selling price	200 per unit

Raw materials in stock: average 4 weeks consumption, work-in-progress (assume 50 per cent completion stage in respect of conversion cost) (materials issues at the start of the processing).

Finished goods in stock	8,000 units
Credit allowed by suppliers	Average 4 weeks
Credit allowed to debtors/receivables	Average 8 weeks
Lag in payment of wages	Average 1½ weeks
Cash at bank (for smooth operation) is expected to be	Rs 25,000

Assume that production is carried on evenly throughout the year (52 weeks) and wages and overheads accrue similarly. All sales are on credit basis only.

Find out:

(i) The net working capital required;

(ii) The maximum permissible bank finance under first and second methods of financing as per Tandon committee norms.

SOLUTION

(i) Determination of net working capital

Current assets:	
Raw material (Rs 86,40,000 × 4/52)	Rs 6,64,615[3]
Work-in-progress	5,00,000[2]
Finished goods (8,000 units × Rs 170)	13,60,000
Debtors [(1,04,000-8,000 units) × Rs 170 × 8/52]	25,10,769
Minimum desired bank balance	25,000
	50,60,384
Current liabilities:	
Creditors [(Rs 83,20,000 + 3,20,000 + 6,64,615) × 4/52]	7,15,740
Wages [(31,20,000 + 60,000) × 1.50/52]	91,731
	8,07,471
Net working capital	42,52,913

(i) Maximum permissible bank finance as per Tandon Committee Norms

First Method: 75% of NWC financed by bank: 75% of Rs 46,95,990 = Rs 35,21,993.

Second Method: 75% of Current assets – Current liabilities (75% of 55,03,461) – Rs 8,07,471 = Rs 33,20,125.

Working Notes

(1) Determination of cost of production:

Raw material (1,04,000 units × Rs 80)	Rs 83,20,000
Direct wages (1,04,000 units × Rs 30)	31,20,000
Overheads (excluding depreciation) (1,04,000 units × Rs 60)	62,40,000
	1,76,80,000

(2) Determination of work-in-progress:

Raw material (4,000 units × Rs. 80)	Rs 3,20,000
Direct wages (4,000 units × Rs. 30 × 50%)	60,000
Overheads (4,000 units × Rs. 60 × 50%)	1,20,000
	5,00,000

(3) Determination of raw material:

Raw material included in finished goods (1,04,000 units × Rs 80)	Rs 83,20,000
Raw material included in work-in-process (4,000 units × Rs 80)	3,20,000
	86,40,000

P.11.12 The turnover of R Ltd is Rs 60 lakh of which 80 per cent is on credit. Debtors are allowed one month to clear off the dues. A factor is willing to advance 90 per cent of the bills raised on credit for a fee of 2 per cent a month plus a commission of 4 per cent on the total amount of debts. R. Ltd as a result of this arrangement is likely to save Rs 21,600 annually in management costs and avoid bad debts at 1 per cent on the credit sales.

A bank has come forward to make an advance equal to 90 per cent of the debts at an annual interest rate of 18 per cent. However, its processing fee will be at 2 per cent on the debts. Would you accept factoring or the offer from the bank?

SOLUTION

Cost of factoring:		
Fee (0.02 × 0.90 × Rs 4,00,000)[@]		Rs 7,200
Commission (0.04 × Rs 4,00,000)		16,000
		23,200
Less savings in cost:		
Management costs (Rs 21,600 ÷ 12)	Rs 1,800	
Savings in bad debts (0.01 × Rs 4,00,000)	4,000	5,800
Net cost of factoring		17,400
Cost of bank advance:		
Interest (0.18 × 1/12 × 0.90 × Rs 4,00,000)		5,400
Processing fee (0.02 × Rs 4,00,000)		8,000
Bad debts (0.01 × Rs 4,00,000)		4,000
		17,400

[@](Annual credit sales Rs 48 lakh ÷ 12 months)

Note: It is assumed that R Ltd will continue to incur management costs.

Since the costs of both the alternatives are equal, R Ltd is likely to be indifferent between factoring and bank advance.

P.11.13 The Udar Ltd sells goods on credit. Its current annual credit sales amount to Rs 900 lakh. The variable cost ratio is 80 per cent. The credit terms are 2/10, net 30. On the current level of sales, the bad debts are 0.75 per cent. The past experience has been that 50 per cent of the customers avail of the cash discount, the remaining customers pay on an average 50 days after the date of sale.

The book debts (receivables) of the firm are presently being financed in the ratio of 2:1 by a mix of bank borrowings and owned funds which cost per annum 25 per cent and 28 per cent respectively.

As an alternative to the in-house management of receivables, Udar Ltd is contemplating use of full advance non-recourse factoring deal with the Indbank Factors Ltd. The main elements of such a deal structured by the factor are (i) factor reserve, 15 per cent; (ii) guaranteed payment date, 24 days after the date of purchase; (iii) discount charge, 22 per cent and (iv) commission for other services (payable up-front), 4 per cent of the value of receivables.

The finance manager of Udar Ltd seeks your advice, as a consultant, on the cost-benefit of the factoring arrangement. What advice would you give? You can make your own assumptions, where necessary.

SOLUTION

Decision analysis: In-house management alternative

Relevant costs	*Amount (Rs lakh)*	
Cash discount	9.00	(Rs 900 × 0.02 × 0.5)
Cost of funds in receivables	19.50	(working note 1)
Bad debt losses	6.75	(Rs 900 × 0.0075)
Total	35.25	

Working Note

1. Cost of funds invested in receivables:
   Average collection period = (10 days × 0.5) + (50 days × 0.5) = 30 days
   Average investment in debtors = Rs 900 lakh/12 = Rs 75 lakh
   Cost of bank funds = (Rs 75 lakh × 2/3 × 0.25) = Rs 12.5 lakh
   Cost of owned funds = Rs 75 lakh × 1/3 × 0.28) = Rs 7 lakh
   Total cost = Rs 12.5 lakh + Rs 7 lakh = Rs 19.5 lakh

Decision analysis: Non-recourse factoring alternative

Relevant costs	*Amount (Rs lakh)*	
Factoring commission	36.00	(Rs 900 × 0.04)
Discount charge	10.77	(working note 2)
Cost of owned funds invested in receivables	3.09	(Rs 900 lakh – Rs 734.4 lakh) × 0.28 × 24/360
Total	49.86	

Working Note

2. Eligible amount of advance = 0.85 × (Rs 900 lakh – Rs 36 lakh) = Rs 734.4 lakh
   Discount charge = (Rs 734.4 lakh × 0.22 × 24/360) = Rs 10.77 lakh

Decision analysis: Cost benefit of non-recourse factoring

	Amount (Rs lakh)
Benefits (savings of cost as per in-house management alternative)	35.25
Cost (of non-recourse factoring alternative)	49.86
Net loss	(14.61)

Recommendation: Udar Limited should not go for the factoring alternative.

REVIEW QUESTIONS

RQ.11.1 How are net working capital, liquidity, technical insovlency, and risk related?

RQ.11.2 What is the basic premise of the hedging approach for meeting funds requirements? What are the effects of this approach on the profitability and risk?

RQ.11.3 What is the conservative approach to financing funds requirements? What kind of profitability-risk trade-off is involved?

RQ.11.4 If a firm has constant funds requirement throughout the year, which, if any, of the three financing plans is preferable? Why?

RQ.11.5 'Working capital management deals with decisions regarding the appropriate mix and level of current assets and current liabilities'. Elucidate the statement.

RQ.11.6 Length of operating cycle is the major determinant of working capital needs of a business firm. Explain.

RQ.11.7 Distinguish between the following:
(a) Gross working capital and Net working capital
(b) Permanent and Temporary working capital
(c) Production cycle and Operating cycle.

RQ.11.8 Describe in brief the various factors which are taken into account in determining the working capital needs of a firm.

RQ.11.9 What are the features of trade credit as a short-term source of working capital finance?

RQ.11.10 How can the cost of trade credit be calculated?

RQ.11.11 Discus the main forms of working capital advance by banks. What is the kind of security required by them?

RQ.11.12 Discuss briefly commercial papers as source of working capital finance. How would you compute the cost of commercial papers?

RQ.11.13 What is factoring? Give a brief account of the major functions of a factor.

RQ.11.14 Show, with illustration, the impact of factoring on the balance sheet of the client.

RQ.11.15 Explain and illustrate the framework of evaluation of a factoring deal.

RQ.11.16 Hypothetical Ltd has forecast its total fund requirements for the coming year as follows:

Month	*Amount (Rs in lakh)*	*Month*	*Amount (Rs in lakh)*
January	30	July	200
February	30	August	180
March	40	September	110
April	60	October	70
May	100	November	40
June	150	December	20

The firm's cost of short-term and long-term financing is expected to be 4 per cent and 10 per cent respectively.
(i) Calculate the cost of financing, using the hedging approach.
(ii) Calculate the cost of financing, using the conservative approach.
(iii) Discuss the basic profitability risk trade-off associated with each of these plans.

SOLUTION

Estimated total funds requirements of Hypothetical Ltd for the year (amount in lakh of rupees)

	Hedging approach			*Trade-off approach*	
Month	*Total funds*	*Permanent*	*Seasonal*	*Total*	*Seasonal*
January	30	20	10	110	0
February	30	20	10	110	0
March	40	20	20	110	0
April	60	20	40	110	0
May	100	20	80	110	0
June	150	20	130	110	40
July	200	20	180	110	90
August	180	20	160	110	70
September	110	20	90	110	0
October	70	20	50	110	0
November	40	20	20	110	0
December	20	20	0	110	0
			790		200

(i) *Cost of financing under hedging approach*

Average annual short-term loan = (Rs 790 ÷ 12) = Rs 65.83 lakh	
(a) Cost of short-term funds (Rs 65.83 lakh × 0.04)	Rs 2.63 lakh
(b) Cost of long-term funds (Rs 20 lakh × 0.10)	2.00
Total costs	4.63

(ii) *Cost of financing under conservative approach*

(Annual average loan × Long-term rate of interest) = 200 lakh × 0.10 = Rs 20 lakh

(iii) Requirements of funds under the trade-off plan would be an average of maximum funds requirements and minimum funds requirements, that is, (Rs 200 lakh + Rs 20 lakh)/2 = Rs 110 lakh.	
(1) Cost of long-term funds (Rs 110 lakh × 0.10)	11 lakh
(2) Cost of short-term funds(Rs 200 lakh/12) × 0.04	0.67
Total cost	11.67

RQ.11.17 Strong Cement Company Ltd has an installed capacity of producing 1.25 lakh tonnes of cement per annum; its present capacity utilisation is 80 per cent. The major raw material to manufacture cement is limestone which is obtained from the company's own mechanised mine located near the plant. The company produces cement in 200 kgs bags. From the information given below, determine the net working capital (NWC) requirement of the company for the current year.

Cost structure per bag of cement (estimated)

Gypsum	Rs 25
Limestone	15
Coal	30
Packing material	10
Direct labour	50
Factory overheads (including deprecation of Rs 10)	30
Administrative overheads	20
Selling overheads	25
Total cost	205
Profit margin	45
Selling price	250
Add sale tax (10 per cent of selling price)	25
Invoice price to consumers	275

Additional information:

(i) Desired holding period of raw materials:
Gypsum, 3 months
Limestone, 1 month
Coal, 2.5 months
Packing material, 1.5 months

(ii) The product is in process for a period of 0.5 month (assume full units of materials, namely gypsum limestone and coal are required in the beginning; other conversion costs are to be taken at 50 per cent).

(iii) Finished goods are in stock for a period of 1 month before they are sold.

(iv) Debtors are extended credit for a period of 3 months.

(v) Average time lag in payment of wages is approximately 0.5 month and of overheads, 1 month.

(vi) Average time lag in payment of sales tax is 1.5 months.

(vii) The credit period extended by various suppliers are:
Gypsum, 2 months
Coal, 1 month
Packing material, 0.5 month.

(viii) Minimum desired cash balance is Rs 25 lakh.
You may state your assumptions, if any.

SOLUTION

Statement showing determination of net working capital of Strong Cement Company Ltd

Current assets:		
Minimum desired cash balance		Rs 25,00,000
Raw materials:		
Gypsum (5 lakh bags[1] × Rs 25 × 3/12)		31,25,000
Limestone (5 lakh bags × Rs 15 × 1/12)		6,25,000
Coal (5 lakh bags × Rs 30 × 2.5/12)		31,25,000
Packing material (5 lakh bags × Rs 10 × 1.5/12)		6,25,000
Work-in-process: (5 lakh bags × Rs 115 × 1/24)		23,95,833
– Raw material cost 100 per cent (Rs 25 + Rs 15 + Rs 30)	Rs 70	
– Other conversion costs (Rs 50 + Rs 20 cash factory overheads + Rs 20) × 0.5	45	
	115	
Finished goods (5 lakh bags × Rs 170** × 1/12)		70,83,333
Debtors (5 lakh bags × Rs 220** × 3/12)		2,75,00,000
Total		4,69,79,166
Current liabilities:		
Creditors:		
Gypsum (5 lakh bags × Rs 25 × 2/12)		20,83,333
Limestone (5 lakh bags × Rs 30 × 1/12)		12,50,000
Packing material (5 lakh bags × Rs 10 × 1/24)		2,08,333
Wages (5 lakh bags × Rs 50 × 1/24)		10,41,667
Overheads (5 lakh bags × Rs 65 × 1/12)		27,08,333
Sales tax (5 lakh bags × Rs 25 × 1.5/12)		15,62,500
Total		88,54,166
NWC		3,81,25,000

*1.25 lakh tons × 0.8 = 1 lakh ton /200 kgs = 5,00,000 bags

**(Total cost, Rs 205 – Depreciation, Rs 10 – selling overheads, Rs 25)

***(Cash cost, Rs 195 + sale tax, Rs 25)

RQ.11.18 The Udar Ltd sells goods on credit. Its current annual credit sales (turnover) amount to Rs 810 lakh. The credit terms of Udar Ltd are 2/10, net 30. On the current level of sales, the bad debts are 1 per cent. The past experience has been that 50 per cent of the customers avail of the cash discount; the remaining customers pay on an average 70 days after the date of sale.

The book debts (receivables) of Udar Ltd are at present being financed on a 67:33 basis by a mix of bank borrowings and owned funds which cost per annum 25 per cent and 28 per cent respectively.

As an alternative to the in-house management of receivables, Udar Ltd is contemplating the use of full advance non-recourse factoring deal with the Fairgrowth Factors Ltd. The main elements of such a deal structured by the factor are (i) factor reserve, 15 per cent; (ii) guaranteed payment date, 24 days after the date of purchase; (iii) discount charge, 22 per cent and (iv) commission for other services, 4 per cent of the value of receivables.

The finance manager of Udar Ltd seeks your advice, as a consultant, on the cost-benefit of the factoring arrangement. What advise would you give? You can make your own assumptions, where necessary.

SOLUTION

Decision analysis: in-house management alternative

Relevant costs	*Amount (Rs lakh)*	
Cash discount	8.10	(Rs 810 × 0.02 × 0.5)
Cost of funds in receivables	23.39	(see working note 1)
Bad debt losses	8.10	(Rs 810 × 0.01)
Total	39.59	

Decision analysis; non-recourse factoring alternative

Relevant cost	*Amount (Rs lakh)*	
Factoring commission	32.40	(Rs 810 × 0.04)
Discount charge	9.69	(working note 2)
Cost of owned funds invested in receivables	2.78	(Rs 810 lakh – Rs 660.96 lakh) × 0.28 × 24/360
Total	44.87	

Working Notes

1 *Cost of funds invested in receivables:*

Average collection period = (10 days × 0.5) + (70 days × 0.5) = 40 days

Average investment in debtors = Rs 810 lakh/9 = Rs 90 lakh

Cost of bank funds = (Rs 90 lakh × 0.67 × 0.25) = Rs 15.075 lakh

Cost of owned funds = (Rs 90 lakh × 0.33 × 0.28) = Rs 8.316 lakh

Total cost = Rs 15.075 lakh + Rs 8.316 lakh = Rs 23.39 lakh

2. Eligible amount of advance = 0.85 × (Rs.810 lakh – Rs 32.4 lakh) = Rs 660.96 lakh

Discount charge = (Rs 660.96 lakh × 0.22 × 24/360) = Rs 9.69 lakh

Decision analysis: cost benefit of non-recourse factoring

	Amount (Rs in lakh)
Benefits/savings of cost with in-house management alternative	39.59
Cost (of non-recourse factoring alternative)	44.87
Net loss	(5.28)

Recommendation: Udar Limited should not go for factoring alternative.

RQ.11.19 The following facts relate to the Avon Industries Ltd (AIL):

- Annual credit turnover in the current financial year, Rs 1,200 lakh;
- Average collection period, 75 days;
- Cost of funds, 0.21 per annum;
- Annual credit and collection expenditure, Rs 20 lakh of which three-fourths is avoidable;
- Bad debts, 1 per cent of sales

The Foremost Factors Ltd offers a factoring deal to the AIL. It proposes to charge a commission as percentage of the value of book debts of 2 per cent for recourse factoring and 3.5 per cent for non-recourse factoring. In addition, it would charge 22 per cent per annum as discount/interest for pre-payment (advance against uncollected and not due receivables) to the extent of 80 per cent of the value of the receivables. The guaranteed payment/collection date is 60 days.

Making your own assumption where necessary, what advice would you give to AIL, to continue with the in-house managemnet of receivables or accept the factoring arrangement?

SOLUTION

Decision analysis: in-house management alternative

Relevant costs	*Amount (Rs in lakh)*
Annual credit and collection expenditure	20.00
Bad debts	12.00 (0.01 × 1,200)
Cost of funds in receivables	52.50 (see working note 1)
Total	84.50

Decision analysis; non-recourse factoring alternative

Relevant cost	*Amount (Rs in lakh)*
Factoring commission	42.00 (1,200 × 0.035)
Discount charge	33.97 (see working note 2)
Cost of owned funds invested in receivables	9.58 (1,200 – Rs 926.40) × 0.21x 60/360
Total	85.55

Working Notes

1 *Cost of funds invested in receivables:*

Average investment in debtors = Rs 1,200 lakh/4.8 = Rs 250 lakh

Cost of funds = (Rs 250 lakh × 0.21) = Rs 52.5 lakh

2 Eligible amount of advance = 0.80 × (Rs 1,200s lakh – Rs 42 lakh) = Rs 926.40 lakh

Discount charge = (Rs 926.40 lakh × 0.22 × 60/360) = Rs 33.97 lakh

Decision analysis: cost benefit of non-recourse factoring alternative

	Amount (Rs in lakh)
Benefits (15 + 12 + 52.50)	79.50
Cost (of non-recourse factoring alternative)	85.55
Net loss	(6.05)

Cost of recourse factoring alternative

Relevant cost	*Amount (Rs in lakh)*
Factoring commission	24.00 (1,200 × 0.02)
Discount charge	34.50 (working note 3)
Cost of owned funds invested in receivables	9.07 (1,200 – Rs 940.80) × 0.21 × 60/360
Total	67.57

3 Eligible amount of advance = 0.80 × (Rs 1,200 lakh – Rs 24 lakh) = Rs 940.80 lakh

Discount charge = (Rs 940.80 lakh × 0.22 × 60/360) = Rs 34.50 lakh

Decision analysis: recourse factoring alternative

	Amount (Rs lakh)
Benefits (15 + 52.50)	67.5
Cost of recourse factoring alternative	67.57
Net loss	(0.07)

Recommendation: AIL should continue with the in-house management of receivables.

EXAMINATION QUESTIONS

EQ. 11.1 Explain the importance of trade credit and accruals as source of working capital. What is the cost of these sources? (*CA—May, 2003*)

EQ. 11.2 Write short notes (i) Factoring commercial paper (ii) Recent changes in Maximum Permissible Bank Finance (MPBF). (*CA—November, 2003*)

EQ. 11.3 Discuss the risk-return considerations in financing of current assets. (*CA—November, 2004*)

EQ. 11.4 Discuss the eligibility criteria for issue of commercial paper. (*CA—May -2005*)

EQ. 11.5 The following information has been extracted from the records of a company:

Product cost sheet	*Rs/unit*
Raw materials	45
Direct labour	20
Overheads	40
Total	105
Profit	15
Selling price	120

— Raw materials are in stock on an average of two months.
— The materials are in process on an average for 4 weeks. The degree of completion is 50 per cent.
— Finished goods stock on an average is for one month.
— Time lag in payment of wages and overheads is 1½ weeks.
— Time lag in receipt of proceeds from debtors is 2 months.
— Credit allowed by suppliers is one month.
— 20 per cent of the output is sold against cash.
— The company expects to keep a cash balance of Rs 1,00,000.
— Take 52 weeks per annum.

The company is poised for a manufacturer of 1,44,000 units in the year.

You are required to prepare a statement showing the working capital requirements of the company.

(*CA—May, 2003*)

SOLUTION

Statement showing determination of net working capital

(A) Current assets:	
(i) Raw material stock (1,44,000 × Rs 45 × 2/12)	Rs 10,80,000
(ii) Work-in-process (1,44,000 × Rs 105 × 0.5 × 4/52)	5,81,538
(iii) Finished goods (1,44,000 × Rs 105 × 1/12)	12,60,000
(iv) Debtors (1,44,000 × 0.80 × Rs 105 × 2/12)	20,16,000
(v) Desired cash balance	1,00,000
Total investment in current assets	50,37,538
(B) Current liabilities:	
(i) Creditors (1,44,000 × Rs 45 × 1/12)	5,40,000
(ii) Wages (1,44,000 × Rs 20 × 1.5/52)	83,077
(iii) Overheads (1,44,000 × Rs 40 × 1.5/52)	1,66,154
Total current liabilities	7,89,231
(C) Net working capital (CA – CL)	42,48,307

EQ. 11.6 An engineering company is considering its working capital investment for the year 2003-04. The estimated fixed assets and current liabilities for the next year are Rs 6.63 crore and Rs 5.967 crore respectively. The sales and earnings before interest and taxes (EBIT) depend on investment in its current assets - particularly inventory and receivables. The company is examining the following alternative working capital policies:

Working capital policy	*Investment in current assets (Rs crore)*	*Estimated sales (Rs crore)*	*EBIT (Rs crore)*
Conservative	11.475	31.365	3.1365
Moderate	9.945	29.325	2.9325
Aggressive	6.630	25.500	2.5500

You are required to calculate the following for each policy:

(i) Rate of return on total assets.
(ii) Net working capital position.
(iii) Current assets to fixed assets ratio.
(iv) Discuss the risk-return trade off of each working capital policy. (*CA—May, 2003*)

SOLUTION

Evaluation of working capital policies (Amount in Rs crore)

Particulars	*Working capital policies*		
	Conservative	*Moderate*	*Aggressive*
Fixed assets (FA)	Rs 6.63	Rs 6.63	Rs 6.63
Current assets (CA)	11.475	9.945	6.63
Total assets (TA)	18.105	16.575	13.26
EBIT	3.1365	2.9325	2.55
Current liabilities (CL)	5.967	5.967	5.967
(i) ROR on total assets (EBIT/TA)	17.32%	17.69%	19.23%
(ii) New working capital (CA - CL)	5.508	3.978	0.663
(iii) Current assets to fixed assets ratio (CA/FA)	1.73	1.5	1.0

(iv) Risk-return trade off: Aggressive approach is associated with high profits (19.23% ROR) as well as high risk (NWC is minimum at Rs 0.663 crore). In contrast, conservative approach provides low profits (17.32% ROR) and low risk (NWC is maximum) Return as well as risk lies between these extremes under the moderate approach.

EQ. 11.7 The following annual figures relate to MNP Limited:

Sales (at three months credit)	Rs 90,00,000
Materials consumed (suppliers extend one and half month's credit)	22,50,000
Wages paid (one month in arrear)	18,00,000
Manufacturing expenses outstanding at the end of the year (cash expenses are paid one month in arrear)	2,00,000
Total administrative expenses for the year (cash expenses are paid one month in arrear)	6,00,000
Sales promotion expenses for the year (paid quarterly in advance)	12,00,000

The company sells its products on gross-profit of 25 per cent assuming depreciation as a part of cost of production. It keeps two month's stock of finished goods and one month's stock of raw materials as inventory. It keeps cash balance of Rs 2,50,000.

Assume a 5 per cent safety margin, work out the working capital requirements of the company on cash cost basis. Ignore work-in-progress. (*CA—May, 2004*)

SOLUTION

Statement showing determination of working capital

(A) Current assets:		
(i) Raw material [Rs 22,50,000 × (1/12)]		Rs 1,87,500
(ii) Finished goods [64,50,000 × (2/12)]		10,75,000
(iii) Debtors [82,50,000 × (3/12)]		20,62,500
(iv) Sales promotion expenses [12,00,000 x (3/12)]		3,00,000
(v) Cash in hand		2,50,000
Total current assets		38,75,000
(B) Current liabilities:		
(i) Creditors [Rs 22,50,000 × (1.5/12)]		Rs 2,81,250
(ii) Manufacturing expenses		2,00,000
(iii) Administrative expenses [6,00,000 × (1/12)]		50,000
(iv) Wages [Rs 18,00,000 × (1/12)]		1,50,000
Total current liabilities		6,81,250
(C) Net working capital (A – B)		31,93,750
Add safety margin (0.05 × Rs 31,93,750)		1,59,687
Working capital required on cash cost basis		33,53,437

Working Notes:

(i)	Determination of manufacturing expenses		
	Sales		Rs 90,00,000
	Less gross profit margin (Rs 90,00,000 × 0.25)		22,50,000
	Total manufacturing costs		67,50,000
	Less cost of materials consumed	Rs 22,50,000	
	Less wages	18,00,000	40,50,000
	Manufacturing expenses (balancing figure)		27,00,000
(ii)	Cash manufacturing expenses (Rs 2,00,000 × 12)		24,00,000
(iii)	Depreciation (Rs 27,00,000 – Rs 24,00,000)		3,00,000
(iv)	Cash manufacturing costs (Rs 67,50,000 – Rs 3,00,000)		64,50,000
(v)	Cash cost of sales (Rs 64,50,000 + Rs 6,00,000 + Rs 12,00,000)		82,50,000

EQ.11.8 XYZ Co. Ltd. is a pipe manufacturing company. Its production cycle indicates that materials, are introduced in the beginning of the production cycle; wages and overhead accrue evenly through out the period of the cycle. Wages are paid in the next month following the month of accrual. Work in process includes full units of raw materials used in the beginning of the production process and 50 per cent of wages and overheads are supposed to be conversion costs. Details of production process and the components of working capital are as follows:

Production of pipes	12,00,000 units
Duration of the production cycle	One month
Raw materials inventory held	One month consumption
Finished goods inventory held for	Two months
Credit allowed by creditors	One month
Credit given to debtors	Two months
Cost price of raw materials	Rs 60 per unit
Direct wages	Rs 10 per unit
Overheads	Rs 20 per unit
Selling price of finished pipes	Rs 100 per unit

Required to calculate: (i) The amount of working capital required for the company. (ii) Its maximum permissible bank finance under all the three methods of lending norms as suggested by the Tondon Committee, assuming the value of core current assets: Rs 1,00,00,000. (*CA—May, 2005*)

SOLUTION

(i) Statement showing determination of net working capital

(A) Current assets:		
(i) Raw materials in stock (12,00,000 units × Rs 60 × 1/12)		Rs 60,00,000
(ii) Work-in-progress		
(a) Raw materials (12,00,000 units × Rs 60 × 1/12)	Rs 60,00,000	
(b) Direct wages (12,00,000 units × Rs 5 × 1/12)	5,00,000	
(c) Overheads (12,00,000 units × Rs 10 × 1/12)	10,00,000	75,00,000
(iii) Finished goods stock (12,00,000 units x Rs 90 x 2/12)		1,80,00,000
(iv) Debtors (12,00,000 units × Rs 90 × 2/12)		1,80,00,000
Total investment in current assets		4,95,00,000
(B) Current liabilities:		
(i) Creditors (12,00,000 units × Rs 60 × 1/12)		60,00,000
(ii) Wages (12,00,000 units × Rs 10 × 1/12*)		10,00,000
Total current liabilities		70,00,000
(C) Net working capital (CA – CL)		4,25,00,000

(ii) Maximum permissible bank finance as per Tandon Committee

(a) First method 0.75 (CA – CL = Rs 4,25,00,000) = Rs 3,18,75,000
(b) Second method (0.75 CA – CL) = Rs 3,71,25,000 – Rs 70,00,000 = Rs 3,01,25,000
(c) Third method 0.75 (CA – Core CA) – CL = 0.75 (Rs 4,95,00,000 – Rs 1,00,00,000) – Rs 70,00,000 = Rs 2,26,25,000

* It is assumed that average time-lag in payment of wages is one month.

EQ. 11.9 A proforma cost sheet of a Company provides the following particulars:

	Amount per unit
Raw material cost	Rs 100.00
Direct labour cost	37.50
Overheads cost	75.00
Total cost	212.50
Profit	37.50
Selling price	250.00

The Company keeps raw material in stock, on an average for four weeks; work-in-progress, on an average for one week; and finished goods in stock, on an average for two weeks.

The credit allowed by suppliers is three weeks and company allows four weeks credit to its debtors. The average time-lag in payment of wages is one week and average lag in payment of overhead expenses is two weeks.

The Company sells one-fifth of the output against cash and maintains cash-in-hand and at bank put together at Rs 37,500.

Required: Prepare a statement showing estimate of working capital needed to finance an activity level of 1,30,000 units of production. Assume that production is carried on evenly throughout the year, and wages and overheads accrue similarly. Work-in-progress stock is 80% complete in all respects. (*CA—November, 2006*)

SOLUTION

Statement showing determination of working capital

(I) Estimation of current assets:	
(i) Cash and bank balance	Rs 37,500

(ii)	Inventories:	
	Raw material (1,30,000 × Rs 100 × 4/52)	10,00,000
	Work-in-progress (1,30,000 × Rs 212.50 × 0.8 × 1/52)	4,25,000
	Finished goods (1,30,000 × Rs 212.50 × 2/52)	10,62,500
(iii)	Debtors (1,30,000 × Rs 212.50 × 4/5 × 4/52)	17,00,000
	Total investments in current assets	42,25,000
(II)	Estimation of current liabilities	
	Creditors (1,30,000 × Rs 100 × 3/52)	7,50,000
	Wages (1,30,000 × Rs 37.50 × 1/52)	93,750
	Overheads (1,30,000 × Rs 75 × 2/52)	3,75,000
	Total current liabilities	12,18,750
(III)	Net working capital (I – II)	30,06,250

12 Management of Cash and Marketable Securities

Introduction

Cash management is one of the key areas of working capital management. Apart from the fact that it is the most liquid current asset, cash is the common denominator to which all current assets can be reduced because the other major liquid assets, that is, receivables and inventory get eventually converted into cash. This underlines the significance of cash management.

The present chapter gives a detailed account of the problems involved in managing cash. Section 1 outlines the motives for holding cash followed by the objectives of cash management in Section 2. Section 3 presents a discussion of the factors determining cash needs. The approaches to derive optimal cash balances, namely, cash management models and cash budgets are examined in depth in Section 4. The basic strategies for efficient management of cash are the subject-matter of Section 5. We have explained specific techniques to manage cash subsequently. The remainder of the chapter is devoted to the discussion of marketable securities (Section 5). The chapter concludes with a summary of the major points.

MOTIVES FOR HOLDING CASH

The term cash with reference to cash management is used in two senses. In a narrow sense, it is used broadly to cover currency and generally accepted equivalents of cash, such as cheques, drafts and demand deposits in banks. The broad view of cash also includes near-cash assets, such as marketable securities and time deposits in banks. The main characteristics of these is that they can be readily sold and converted into cash. They serve as a reserve pool of liquidity that provides cash quickly when needed. They also provide a short-term investment outlet for excess cash and are also useful for meeting planned outflow of funds. Here, the term *cash management* is employed in the broader sense. Irrespective of the form in which it is held, a distinguishing feature of cash, as an asset, is that it has no earning power. If cash does not earn any return, why is it held? There are four primary motives for maintaining cash balances: (i) Transaction motive; (ii) Precautionary motive; (iii) Speculative motive; and (iv) Compensating motive.

Transaction Motive

An important reason for maintaining cash balances is the *transaction* motive. This refers to the holding of cash to meet routine cash requirements to finance the transactions which a firm carries on in the ordinary course of business. A firm enters into a variety of transactions to accomplish its objectives which have to be paid for in the form of cash. For example, cash payments have to be made for purchases, wages, operating expenses, financial charges like interest, taxes, dividends, and so on. Similarly, there is a regular inflow of cash to the firm from sales operations, returns on outside investments, and so on. These receipts and payments constitute a continuous two-way flow of cash. But the inflows (receipts), and outflows (disbursements) do not perfectly coincide or synchronise. At times, receipts exceed outflows while, at other times, payments exceed inflows. To ensure that the firm can meet its obligations when payments become due in a situation in which disbursements are in excess of the current receipts, it must have an adequate cash balance. *The requirement of cash balances to meet routine cash needs is known as the transaction motive and such motive refers to the holding of cash to meet anticipated obligations whose timing is not perfectly synchronised with cash receipts.* If the receipts of cash and its disbursements could exactly coincide in the normal course of operations, a firm would not need cash for transaction purposes. Although a major part of transaction balances are held in cash, a part may also be in such marketable securities whose maturity conforms to the timing of the anticipated payments, such as payment of taxes, dividends, and so on.

Precautionary Motive

In addition to the non-synchronisation of anticipated cash inflows and outflows in the ordinary course of business, a firm may have to pay cash for purposes which cannot be predicted or anticipated. The unexpected cash needs at short notice may be the result of:

- Floods, strikes and failure of important customers;
- Bills may be presented for settlement earlier than expected;
- Unexpected slow down in collection of accounts receivable;
- Cancellation of some order for goods as the customer is not satisfied; and
- Sharp increase in cost of raw materials.

The cash balances held in reserve for such random and unforeseen fluctuations in cash flows are called as precautionary balances. In other words, precautionary motive of holding cash implies the need to hold cash to meet unpredictable obligations. Thus, precautionary cash balance serves to provide *a cushion to meet unexpected contingencies*. The more unpredictable are the cash flows, the larger is the need for such balances.

Another factor which has a bearing on the level of such cash balances is the availability of short-term credit. If a firm can borrow at short notice to pay for unforeseen obligations, it will need to maintain a relatively small balance and *vice versa.*

Such cash balances are usually held in the form of marketable securities so that they earn a return.

Speculative Motive

It refers to the desire of a firm to take advantage of opportunities which present themselves at unexpected moments and which are typically outside the normal course of business. While the precautionary motive is defensive in nature in that firms must make provisions to tide over unexpected contingencies, the speculative motive represents a positive and aggressive approach. Firms aim to exploit profitable opportunities and keep cash in reserve to do so. The speculative motive helps to take advantage of:

- An opportunity to purchase raw materials at a reduced price on payment of immediate cash;

- A chance to speculate on interest rate movements by buying securities when interest rates are expected to decline;
- Delay purchases of raw materials on the anticipation of decline in prices; and
- Make purchase at favourable prices.

Compensating Motive

Yet another motive to hold cash balances is to compensate banks for providing certain services and loans. Banks provide a variety of services to business firms, such as clearance of cheque, supply of credit information, transfer of funds, and so on. While for some of these services banks charge a commission or fee, for others they seek indirect compensation. Usually clients are required to maintain a minimum balance of cash at the bank. Since this balance cannot be utilised by the firms for transaction purposes, the banks themselves can use the amount to earn a return. Such balances are *compensating balances.*

Compensating balances are also required by some loan agreements between a bank and its customers. During periods when the supply of credit is restricted and interest rates are rising, banks require a borrower to maintain a minimum balance in his account as a condition precedent to the grant of loan. This is presumably to 'compensate' the bank for a rise in the interest rate during the period when the loan will be pending.

The compensating cash balances can take either of two forms: (i) an absolute minimum, say, Rs 5 lakh, below which the actual bank balance will never fall; (ii) a minimum average balance, say, Rs 5 lakh over the month. The first alternative is more restrictive as the average amount of cash held during the month must be above Rs 5 lakh by the amount of the transaction balance. From the firm's viewpoint, this is obviously dead money. Under the second alternative, the balance could fall to zero one day provided it was Rs 10 lakh some other day with the average working to Rs 5 lakh.

Of the four primary motives of holding cash balances, the two most important are the transactions motive and the compensation motive. Business firms normally do not speculate and need not have speculative balances. The requirement of precautionary balances can be met out of short-term borrowings.

OBJECTIVES OF CASH MANAGEMENT

The basic objectives of cash management are two-fold: (a) to meet the cash disbursement needs (payment schedule); and (b) to minimise funds committed to cash balances. These are conflicting and mutually contradictory and the task of cash management is to reconcile them.

Meeting Payments Schedule

In the normal course of business, firms have to make payments of cash on a continuous and regular basis to suppliers of goods, employees and so on. At the same time, there is a constant inflow of cash through collections from debtors. Cash is, therefore, aptly described as the 'oil to lubricate the ever-turning wheels of business: without it the process grinds to a stop'.[1] A basic objective of cash management is to meet the payment schedule, that is, to have sufficient cash to meet the cash disbursement needs of a firm.

The importance of sufficient cash to meet the payment schedule can hardly be overemphasized. The advantages of adequate cash are: (i) it prevents insolvency or bankruptcy arising out of the inability of a firm to meet its obligations; (ii) the relationship with the bank is not strained; (iii) it helps in fostering good relations with trade creditors and suppliers of raw materials, as prompt payment may help their own cash

management; (iv) a cash discount can be availed of if payment is made within the due date. For example, a firm is entitled to a 2 per cent discount for a payment made within 10 days when the entire payment is to be made within 30 days. Since the net amount is due in 30 days, failure to take the discount means paying an extra 2 per cent for using the money for an additional 20 days. If a firm were to pay 2 per cent for every 20-day period over a year, there would be 18 such periods (360 days ÷ 20 days). This represents an annual interest rate of 36 per cent;[2] (v) it leads to a strong credit rating which enables the firm to purchase goods on favourable terms and to maintain its line of credit with banks and other sources of credit; (vi) to take advantage of favourable business opportunities that may be available periodically; and finally, (vii) the firm can meet unanticipated cash expenditure with a minimum of strain during emergencies, such as strikes, fires or a new marketing campaign by competitors. Keeping large cash balances, however, implies a high cost. The advantage of prompt payment of cash can well be realised by *sufficient* and not *excessive* cash.

Minimising Funds Committed to Cash Balances

The second objective of cash management is to minimise cash balances. In minimising the cash balances, two conflicting aspects have to be reconciled. A high level of cash balances will, as shown above, ensure prompt payment together with all the advantages. But it also implies that large funds will remain idle, as cash is a non-earning asset and the firm will have to forego profits. A low level of cash balances, on the other hand, may mean failure to meet the payment schedule. The aim of cash management, therefore, should be to have an optimal amount of cash balances.

Keeping in view these conflicting aspects of cash management, we propose to discuss the planning/determination of the need for cash balances. There are two aspects involved in cash planning: first, an examination of those factors which have a bearing on the firm's required cash balances; second, a review of the approaches to achieve optimum cash balances.

FACTORS DETERMINING CASH NEEDS

The factors that determine the required cash balances are: (i) synchronisation of cash flows, (ii) short costs, (iii) excess cash balance, (iv) procurement and management, and (v) uncertainty.

Synchronisation of Cash Flows

The need for maintaining cash balances arises from the non-synchronisation of the inflows and outflows of cash: if the receipts and payments of cash perfectly coincide or balance each other, there would be no need for cash balances. The first consideration in determining the cash need is, therefore, the extent of non-synchronisation of cash receipts and disbursements. For this purpose, the inflows and outflows have to be forecast over a period of time, depending upon the planning horizon which is typically a one-year period with each of the 12 months being a subperiod. The technique adopted is a cash budget. The preparation of a cash budget is discussed in the next section of this chapter. A properly prepared budget will pinpoint the months/periods when the firm will have an excess or a shortage of cash.

Short Costs

Another general factor to be considered in determining cash needs is the cost associated with a shortfall in the cash needs. The cash forecast presented in the cash budget would reveal periods of cash shortages. In

addition, there may be some unexpected shortfall. Every shortage of cash–whether expected or unexpected–involves a cost 'depending upon the severity, duration and frequency of the shortfall and how the shortage is covered. Expenses incurred as a result of shortfall are called *short costs*'.[3] Included in the short costs are the following:

(i) ***Transaction costs*** associated with raising cash to tide over the shortage. This is usually the *brokerage* incurred in relation to the sale of some short-term near-cash assets such as marketable securities.
(ii) **Borrowing costs** associated with borrowing to cover the shortage. These include items such as interest on loan, commitment charges and other expenses relating to the loan.
(iii) **Loss of cash-discount,** that is, a substantial loss because of a temporary shortage of cash.
(iv) **Cost associated with deterioration of the credit rating** which is reflected in higher bank charges on loans, stoppage of supplies, demands for cash payment, refusal to sell, loss of image and the attendant decline in sales and profits.
(v) **Penalty rates** by banks to meet a shortfall in compensating balances.

Excess Cash Balance Costs

The cost of having excessively large cash balances is known as the *excess cash balance cost.* If large funds are idle, the implication is that the firm has missed opportunities to invest those funds and has thereby lost interest which it would otherwise have earned. This loss of interest is primarily the excess cost.

Procurement and Management

These are the costs associated with establishing and operating cash management staff and activities. They are generally fixed and are mainly accounted for by salary, storage, handling of securities, and so on.

Uncertainty and Cash Management

Finally, the impact of uncertainty on cash management strategy is also relevant as cash flows cannot be predicted with complete accuracy. The first requirement is a precautionary cushion to cope with irregularities in cash flows, unexpected delays in collections and disbursements, defaults and unexpected cash needs.

The impact of uncertainty on cash management can, however, be mitigated through (i) improved forecasting of tax payments, capital expenditure, dividends, and so on; and (ii) increased ability to borrow through overdraft facility.

DETERMINING CASH NEED

After the examination of the pertinent considerations and cost that determine cash needs, the next aspect relates to the determination of cash needs.

There are two approaches to derive an optimal cash balance, namely, (a) minimising cost cash models and (b) cash budget.

Cash Management Models

While it is true that financial managers need not necessarily follow cash management models exactly but a familiarity with them provides an insight into the normative framework as to how cash management should

be conducted. This section, therefore, attempts to outline the following analytical models for cash management: (i) Baumol Model, (ii) Miller-Orr Model and (iii) Orgler's Model. The Control Theory Model Approach is highly mathematical and outside the scope of this book.[4]

Baumol Model[5] The purpose of this model is to determine the minimum cost amount of cash that a financial manager can obtain by converting securities to cash, considering the cost of conversion and the counter-balancing cost of keeping idle cash balances which otherwise could have been invested in marketable securities. The total cost associated with cash management, according to this model, has two elements: (i) cost of converting marketable securities into cash and (ii) the lost opportunity cost.

The *conversion costs* are incurred each time marketable securities are converted into cash. Symbolically, total conversion cost per period.

$$= \frac{\mathrm{Tb}}{\mathrm{C}} \tag{12.1}$$

Where b = cost per conversion assumed to be independent of the size of the transaction
T = total transaction cash needs for the period
C = value of marketable securities sold at each conversion.

The *opportunity cost* is derived from the lost/forfeited interest rate (i) that could have been earned on the investment of cash balances. The total opportunity cost is the interest rate times the average cash balance kept by the firm. The model assumes a constant and a certain pattern of cash outflows. At the beginning of each period, the firm starts with a cash balance which it gradually spends until at the end of the period it has a zero cash balance and must replenish its each supply to the level of cash balance in the beginning. Symbolically, the average lost opportunity cost.

$$\mathrm{i}\left(\frac{\mathrm{C}}{2}\right) \tag{12.2}$$

Where i = interest rate that could have been earned.
$C/2$ = the average cash balance that is, the beginning cash (C) plus the ending cash balance of the period (zero) divided by 2.

The total cost associated with cash management comprising total conversion cost plus opportunity cost of not investing cash until needed in interest-bearing instruments can be symbolically expressed as:

$$\mathrm{i}\left(\frac{\mathrm{C}}{2}\right)+\left(\frac{\mathrm{Tb}}{\mathrm{C}}\right) \tag{12.3}$$

To minimise the cost, therefore, the model attempts to determine the optimal conversion amount, that is, the cash withdrawal which costs the least. The reason is that a firm should not keep the total beginning cash balance during the entire period as it is not needed at the beginning of the period. For example, if the period were one thirty day month, only one-thirtieth of the opening cash balance each day will be required. This means if only one-thirtieth of the entire amount is withdrawn, the rest could be left invested in interest-earning marketable securities. As a result, on the one-thirtieth of the cash not needed to the last day of the month, twenty-nine day's interest could be earned by the firm and so on. Symbolically, the optimal conversion amount (C),

$$C = \sqrt{\frac{2\mathrm{bt}}{\mathrm{i}}} \tag{12.4}$$

The model in terms of of Eq.12.4 has important implications. First, as the total cash needs for transaction rises because of expansion/diversification, the optimal withdrawal increases less than proportionately. This

is the result of economy of scale in cash management. Each project does not need its own additional cash balances. It only needs enough additions to the general cash balance of the firm to facilitate expanded operations. Secondly, as the opportunity interest rate (i) increases, the optimal cash withdrawal decreases. This is so because as (i) increases it is more costly to forfeit the investment opportunity and financial managers want to keep as much cash invested in securities for as long as possible. They can afford to do this at the higher interest rates because at those higher rates any shortfall costs caused by a lower withdrawal are offset.

In sum, the Baumol Model of cash management is very simplistic. Further, its assumptions of certainty and regularity of withdrawal of cash do not realistically reflect the actual situation in any firm. Also, the model is concerned only with transaction balances and not with precautionary balances. In addition, the assumed fixed nature of the cash withdrawals is also not realistic.

Nevertheless, the model does clearly and concisely demonstrate the economies of scale and the counteracting nature of the conversion and opportunity costs which are undoubtedly major considerations in any financial manager's cash management strategy.

EXAMPLE 12.1

The ABC Ltd requires Rs 30 lakh in cash to meet its transaction needs during the next three-month cash planning period. It holds marketable securities of an equal amount. The annual yield on these marketable securities is 20 per cent. The conversion of these securities into cash entails a fixed cost of Rs 3,000 per transaction. Using Baumol model, compute the amount of marketable securities converted into cash per order. Assuming ABC Ltd can sell its marketable securities in any of the five lot sizes: 1,50,000, 3,00,000, 6,00,000, 7,50,000 and 15,00,000, prepare a table indicating the economic lot size using numerical analysis.

SOLUTION

$$C = \sqrt{\frac{2bT}{i}},$$

where C = optimal conversion amount/amount of marketable securities converted into cash per order; b = cost of conversion into cash per lot/transaction; T = projected cash requirement during the planning period; i = interest rate earned per planning period on investment in marketable securities.

$$= \sqrt{\frac{2 \times \text{Rs } 1{,}500 \times \text{Rs } 30{,}00{,}000}{0.05^{@}}} = \text{Rs } 4{,}24{,}264 \text{ (conversion size = Rs 6,00,000)}$$

[@]Annual yield 20 per cent/4 = 5 per cent.

Table 12.1 *Optimal Cash Conversion Size/Lot*

1. Total annual cash requirement (Rs lakh)	30	30	30	30	30
2. Lot size (Rs lakh)	1.5	3	6	7.5	15
3. Number of lots (1 ÷ 2)	20	10	5	4	2
4. Conversion cost per lot (Rs thousand)	3	3	3	3	3
5. Total conversion cost (3 × 4) (Rs thousand)	60	30	15	12	6
6. Average lot size (Rs lakh)	0.75	1.5	3	3.75	7.5
7. Interest cost (6 × 0.05) (Rs)	3,750	7,500	15,000	18,750	37,500
8. Total cost (5 + 7) (Rs)	63,750	37,500	30,000	30,750	42,500

The optimal cash conversion size is Rs 6 lakh.

Working Note

1. Number of conversion during the planning period $= \dfrac{\text{Total cash requirement (Rs 30 lakh)}}{\text{Cash conversion lot/size}}$
2. Average cash balance = Cash conversion size/2.
3. Interest income foregone = Average cash balance × interest rate for the cash planning period; interest rate = annual yield/4.
4. Cost of cash conversion = Number of conversions × cost per conversion.
5. Total cost of converting and holding cash = Interest income foregone + cost of cash conversion.

Miller-Orr Model[6] The objective of cash management, according to Miller-Orr (MO), is to determine the optimum cash balance level which minimises the cost of cash management. Symbolically,

$$C = \frac{bE(N)}{t} + iE(M) \pm \tag{12.5}$$

Where b = the fixed cost per conversion

$E(M)$ = the expected average daily cash balance

$E(N)$ = the expected number of conversions

t = the number of days in the period

i = the lost opportunity costs

C = total cash management costs

The MO Model is, in fact, an attempt to make the Baumol Model more realistic as regards the pattern of cash flows. As against the assumption of uniform and certain levels of cash balances in the Baumol Model, the MO Model assumes that *cash balances randomly* fluctuate between an upper bound (h) and a lower bound (O). When the cash balances hit the upper bound, the firm has too much cash and should buy enough marketable securities to bring the cash balances back to the optimal bound (z). When the cash balances hit zero, the financial manager must return them to the optimum bound (z) by selling/converting securities into cash. According to the MO Model, as in Baumol model, the optimal cash balance (z) can be expressed symbolically as

$$z = \sqrt[3]{\frac{2br^2}{4i}} \tag{12.6}$$

where r^2 = the variance of the daily changes in cash balances.

Thus, as in Baumol Model, there are economies of scale in cash management and the two basic costs of conversion and lost interest that have to be minimised.

MO Model also specifies the optimum upper boundary (h) as three times the optimal cash balance level such that

$$h = 3z \tag{12.7}$$

Further, the financial manager could consider the use of less liquid, potentially more profitable securities as investments for the cash balances in excess of h.

Orgler's Model[7] According to this model, an optimal cash management strategy can be determined through the use of a multiple linear programming model. The construction of the model comprises three sections: (1) selection of the appropriate planning horizon, (2) selection of the appropriate decision vari-

ables and (3) formulation of the cash management strategy itself. The advantage of linear programming model is that it enables coordination of the optimal cash management strategy with the other operations of the firm such as production and with less restrictions on working capital balances.

The model basically uses one year *planning horizon* with twelve monthly periods because of its simplicity. It has four basic sets of *decisions variables* which influence cash management of a firm and which must be incorporated into the linear programming model of the firm. These are: (i) payment schedule, (ii) short-term financing, (iii) purchase and sale of marketable securities and (iv) cash balance itself.

The formulation of the model requires that the financial managers first specify an objective function and then specify a set of constraints.

Orgler's objective function is to 'minimise the horizon value of the net revenues from the cash budget over the entire planning period'. Using the assumption that all revenues generated are immediately reinvested and that any cost is immediately financed, the objective function represents the value of the net income from the cash budget at the horizon 'by adding the net returns over the planning period'. Thus, the objective function recognises each operation of the firm that generates cash inflows or cash outflows as adding or subtracting profit opportunities for the firm from its cash management operations. In the objective function, decision variables which cause inflows, such as payments on receivables, have positive co-efficient, while decision variables which generate cash outflows, such as interest on short-term borrowings have negative co-efficients. The purchase of marketable securities would, for example, produce revenue and thus have a positive co-efficient while the sale of those securities would incur conversion costs and have a negative co-efficient.

The constraints of the model could be (i) institutional or (ii) policy-constraints. The institutional constraints are those imposed by external factors, that is, bank-required compensating balance. Policy constraints are imposed on cash management by the firm itself. For instance, the financial manager may be prohibited from selling securities before maturity. Either constraint can occur in the model during one monthly period or over several or all the months in the one year planning horizon.

An example of the linear programming model is as follows:
Objective function:

$$\text{Maximise profit} = a_1x_1 + a_2x_2 \tag{12.8}$$

Subject to:

$$b_1x_1 \leq \text{production}$$

$$b_2x_2 \leq \text{constraints} \tag{12.9}$$

$$C_1x_1 + C_2x_2 \leq \text{Cash available constraint} \tag{12.10}$$

$$8_1x_1 + 8_2x_2 > \text{Current assets requirement constraint} \tag{12.11}$$

$$x_i \geq O_i = 1, n \text{ non-negativity constraint} \tag{12.12}$$

A very important feature of the model is that it allows the financial managers to integrate cash management with production and other aspects of the firm.

Cash Budget: Management Tool

A firm is well advised to hold adequate cash balances but should avoid *excessive* balances. The firm has, therefore, to assess its need for cash properly. The cash budget is probably the most important tool in cash management. It is a device to help a firm to plan and control the use of cash. It is a statement showing the estimated cash inflows and cash outflows over the planning horizon. In other words, the net cash position

(surplus or deficiency) of a firm as it moves from one budgeting subperiod to another is highlighted by the cash budget.

The various purposes of cash budgets are: (i) to coordinate the timings of cash needs. It identifies the period(s) when there might either be a shortage of cash or an abnormally large cash requirement; (ii) it pinpoints the period(s) when there is likely to be excess cash; (iii) it enables a firm which has sufficient cash to take advantage of cash discounts on its accounts payable, to pay obligations when due, to formulate dividend policy, to plan financing of capital expansion and to help unify the production schedule during the year so that the firm can smooth out costly seasonal fluctuations;[8] finally, (iv) it helps to arrange needed funds on the most favourable terms and prevents the accumulation of excess funds. With adequate time to study his needs, the finance manager can select the best alternative. In contrast, a firm which does not budget its cash requirements, may suddenly find itself short of funds. With pressing needs and little time to explore alternative avenues of financing, the management would be forced to accept the best terms offered in a difficult situation. 'These terms will not be as favourable, since the lack of planning indicates to the lender, that there is an organisational deficiency. The firm, therefore, represents a higher risk.'[9]

Elements/Preparation of Cash Budget Thus, the principal aim of the cash budget, as a tool to predict cash flows over a given period of time, is to ascertain whether at any point of time there is likely to be an excess or shortage of cash. The preparation of a cash budget involves various steps. These may be described as the elements of the cash budgeting system.

The first element of a cash budget is the selection of the period of time to be covered by the budget. It is referred to as the planning horizon. The planning horizon means the *time span* and the subperiods within that time span over which the cash flows are to be projected. There is no fixed rule. The coverage of a cash budget will differ from firm to firm depending upon its nature and the degree of accuracy with which the estimates can be made. As a general rule, the period selected should be neither too long nor two short. If it is too long, it is likely that the estimates will be inaccurate. If, on the other hand, the time span is too small, many important events which lie just beyond the period cannot be accounted for and the work associated with the preparation of the budget becomes excessive.

The planning horizon of a cash budget should be determined in the light of the circumstances and requirements of a particular case. For instance, if the flows are expected to be stable and dependable, such a firm may prepare a cash budget covering a long period, say, a year and divide it into quarterly intervals. In the case of a firm whose flows are uncertain, a quarterly budget, divided into monthly intervals, may be appropriate. Where flows are affected by seasonal variations, monthly budgets, subdivided on a weekly or even a daily basis, may be necessary. If the flows are subject to extreme fluctuations, even a daily budget may be called for. The idea behind subdividing the budgeting period into smaller intervals is to highlight the movement of cash from one subperiod to another. The subdivision will provide information on the fluctuations in the cash reservoir level during the time span covered by the budget.

The second element of the cash budget is the selection of the factors that have a bearing on cash flows. The items included in the cash budget are only cash items; non-cash items such as depreciation and amortisation are excluded.[10] The factors that generate cash flows are generally divided, for purposes of the construction of cash budget, into two broad categories: (a) operating, and (b) financial. This two-fold classification of cash budget items is based on their *nature*. While the former category includes cash flows generated by the operations of the firms and are known as *operating cash flows*, the latter consists of *financial cash flows*.

Operating Cash Flows The main operating factors/items which generate cash outflows and inflows over the time span of a cash budget are tabulated in Exhibit 12.1.

EXHIBIT 12.1 *Operating Cash Flow Items*

Inflows/Cash Receipts	Outflows/Disbursements
1. Cash sales	1. Accounts payable/Payable payments
2. Collection of accounts receivable	2. Purchase of raw materials
3. Disposal of fixed assets	3. Wages and salary (payroll)
	4. Factory expenses
	5. Administrative and selling expenses
	6. Maintenance expenses
	7. Purchase of fixed assets

Among the operating factors affecting cash flows, are the collection of accounts receivable (inflow) and accounts payable (outflows). The terms of credit and the speed with which the customers pay would determine the lag between the creation of the accounts receivable and their collection. Also, discounts and allowances for early payments, returns from customers and bad debts affect cash inflows. Similarly, in the case of accounts payable relating to credit purchase, cash outflows are affected by the purchase terms.

The calculation of the collection on credit sales and payments on credit purchases, is generally done in the form of a statement known as the worksheet.[11] The results are subsequently incorporated in the cash budget. We illustrate in Example 12.2 how the credit policy of a firm and the purchase terms affect cash flows.

EXAMPLE 12.2

A firm sells goods on credit and allows a cash discount for payments made within 20 days. If the discount is not availed of, the buyer must pay the full amount in 40 days. However, the firm finds that some of its customers delay payments up to 90 days. The experience has been that on 20 per cent of sales, payment is made during the month in which the sale is made, on 70 per cent of the sales payment is made during the second month after sale and on 10 per cent of sales payment is made during the third month.

The raw materials and other supplies required for production amount to 70 per cent of sales and are bought in the month before the firm expects to sell its finished products. Its purchase terms allow the firm to delay payment on its purchases for one month. The credit sales of the firm are: (Rs Lakh)

May	10	August	30	November	20
June	10	September	40	December	10
July	20	October	20	January	10

Prepare a worksheet, showing the anticipated cash inflows on account of collection of receivables and disbursement of payables.

SOLUTION

The expected cash inflows through collection of receivables and the anticipated outflows on account of accounts payable are presented in Table 12.2 in the form of a worksheet.

TABLE 12.2 *Work-Sheet*

(Rs Lakh)

	May	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*
1. Credit sales	10	10	20	30	40	20	20	10	10
2. Collections:									
During month of sale (20%)	2	2	4	6	8	4	4	2	2
During the first month after sale (70%)	—	7	7	14	21	28	14	14	7
During second month after sale (10%)	—	—	1	1	2	3	4	2	2
Total collections	2	9	12	21	31	35	22	18	11
3. Credit purchases (70% of next month's sale)	7	14	21	28	14	14	7	7	7
Payment (one month lag)	—	7	14	21	28	14	14	7	7
Total payments	—	7	14	21	28	14	14	7	7

Financial Cash Flows The major financial factors/items affecting the generation of cash flows are depicted in Exhibit 12.2.

EXHIBIT 12.2 *Financial Cash Flow Items*

Cash Inflows/Receipts	*Cash Outflows/Payments*
1. Loans/Borrowings	1. Income-tax/Tax payments
2. Sales of securities	2. Redemption of loan
3. Interest received	3. Repurchase of shares
4. Dividend received	4. Interest paid
5. Rent received	5. Dividends paid
6. Refund of tax	
7. Issue of new shares and securities	

Preparation of Cash Budget After the time span of the cash budget has been decided and pertinent operating and financial factors have been identified, the final step is the construction of the cash budget. The preparation of a cash budget is illustrated in Examples 12.3 and 12.4.

EXAMPLE 12.3

A firm adopts a six-monthly time span, subdivided into monthly intervals for its cash budget.
(A) The following information is available in respect of its operations: (Rs lakh)

	Months					
	1	*2*	*3*	*4*	*5*	*6*
1. Sales	40	50	60	60	60	60
2. Purchases	1	1.50	2	2	2	1
3. Direct labour	6	7	8	8	8	6
4. Manufacturing overheads	13	13.50	14	14	14	13
5. Administrative expenses	2	2	2	2	2	2
6. Distribution expenses	2	3	4	4	4	2
7. Raw materials (30 days credit)	14	15	16	16	16	15

(B) Assume the following financial flows during the period:

(a) *Inflows*:
1. Interest received in month 1 and month 6, Rs 1 lakh each;
2. Dividend received during months 3 and 6, Rs 2 lakh each;
3. Sales of shares in month 6, Rs 160 lakh.

(b) *Outflows:*
1. Interest paid during month 1, Rs 0.4 lakh;
2. Dividends paid during months 1 and 4, Rs 2 lakh each;
3. Instalment payment on machine in month 6, Rs 20 lakh;
4. Repayment of loan in month 6, Rs80 lakhs.

(c) Assume that 10 per cent of each month's sales are for cash; the balance 90 per cent are on credit. The terms and credit experience of the firm are:
1. No cash discount;
2. 1 per cent of credit sales is returned by the customers;
3. 1 per cent of total accounts receivable is bad debt;
4. 50 per cent of all accounts that are going to pay, do so within 30 days;
5. 100 per cent of all accounts that are going to pay, do so within 60 days.

Using the above information prepare a cash budget.

SOLUTION

The cash budget is constructed in Table 12.3.

TABLE 12.3 *Cash Budget for Six Months*

(Rs Lakh)

	Months					
	1	*2*	*3*	*4*	*5*	*6*
(A) Cash inflows:						
1. Cash sales (10% of total)	4.00	5.00	6.00	6.00	6.00	6.00
2. Receivables collection	—	17.64	39.68	48.50	52.92	52.92
3. Interest received	1.00	—	—	—	—	1.00
4. Dividends received	—	—	2.00	—	—	2.00
5. Sale of shares	—	—	—	—	—	160.00
Total (A) 5.00	22.64	47.68	54.50	58.92	221.92	
(B) Cash outflows:						
1. Purchases	1.00	1.50	2.00	2.00	2.00	1.00
2. Labour	6.00	7.00	8.00	8.00	8.00	6.00
3. Manufacturing overheads	13.00	13.50	14.00	14.00	14.00	13.00
4. Administrative expenses	2.00	2.00	2.00	2.00	2.00	2.00
5. Distribution charges	2.00	3.00	4.00	4.00	4.00	2.00
6. Raw materials (30 days credit)	—	14.00	15.00	16.00	16.00	16.00
7. Interest paid	0.40	—	—	—	—	—
8. Dividend paid	2.00	—	—	2.00	—	—
9. Instalment of machine	—	—	—	—	—	20.00
10. Repayment of loan	—	—	—	—	—	80.00
Total (B) 26.40	41.00	45.00	48.00	46.00	140.00	
(C) Net Receipt or (Payment) (A – B)	(21.40)	(18.36)	2.68	6.50	12.92	81.92

It can be seen from Table 12.3 that the cash budget helps to reconcile the need for cash with the financing arrangement. For instance, in the first two months, the cash receipts fall below the disbursements and the firm obviously needs temporary financing which it will be able to pay in the subsequent months. In month 6, it has, in fact, excess cash for which temporary investment will have to be made until the funds can be employed in business.

EXAMPLE 12.4

The following information is available in respect of a firm:
(A) Balance Sheet as on March 31

Liabilities	*Amount*	*Assets*		*Amount*
Accrued salaries	Rs 500	Cash		Rs 3,000
Other liabilities	2,500	Inventory*		8,000
Capital	65,000	Other assets	Rs 70,000	
		Less depreciation	13,000	57,000
	68,000			68,000

*Consists of Rs 2,000 minimum inventory plus Rs 6,000 of inventory scheduled to be sold next month.

(B) Sales Forecast

April	Rs 10,000	July	Rs 50,000
May	20,000	August	40,000
June	30,000	September	20,000
		October	5,000

(C) Salary Expenses Budget

April	Rs 1,500	July	Rs 4,000
May	2,000	August	3,000
June	2,500	September	2,000

(D) The firm is expected to operate on the following lines:

- Other expenses approximate 12 per cent of sales (paid in the same month).
- Sales will be 80 per cent cash and 20 per cent credit. The all credit sales will be collected in the following month and no bad debts are expected.
- All inventory purchases will be paid for during the month in which they are made.
- A basic inventory of Rs 2,000 (at cost) will be maintained. The firm will follow a policy of purchasing additional inventory each month to cover the following month's sale.
- A minimum cash balance of Rs .3,000 will be maintained.
- New orders for equipment amounting to Rs 20,000 scheduled for May 1 delivery and Rs 10,000 for June 1 delivery have been made. Payment will be made at the time of delivery.
- Accrued salaries and other liabilities will remain unchanged.
- Gross profit margin is 40 per cent of sales.

Prepare a cash budget for 6 months (April to September). Borrowings are made in thousands of rupees. Ignore interest.

SOLUTION

Table 12.4 *Cash Budget (Amount in '000 rupees)*

	April	*May*	*June*	*July*	*Aug.*	*Sept.*
(A) Cash inflows:						
1. Cash sales (0.80)	8	16	24	40	32	16
2. Accounts receivabl collections (0.2)	—	2	4	6	10	8
Total	8	18	28	46	42	24
(B) Cash outflows:						
1. Inventory	12	18	30	24	12	3
2. Salary	1.5	2	2.5	4	3	2
3. Expenses	1.2	2.4	3.6	6	4.8	2.4
4. Equipment	—	20	10	—	—	—
Total	14.7	42.4	46.1	34	19.8	7.4
(C) Net monthly cash gain or loss						
by end of month (A – B)	(6.7)	(24.4)	(18.1)	12	22.2	16.6
Cumulative cash gain or loss by end of month	(6.7)	(31.1)	(49.2)	(37.2)	(15)	1.6
Cumulative borrowing (month-end)	7	32	50	38	15	—

CASH MANAGEMENT: BASIC STRATEGIES

The cash budget, as a cash management tool, would throw light on the net cash position of a firm. After knowing the cash position, the management should work out the basic strategies to be employed to manage its cash. The present section attempts to outline the basic strategies of cash management.

The broad cash management strategies are essentially related to the cash turnover process, that is, the cash cycle together with the cash turnover. The *cash cycle* refers[12] to the process by which cash is used to purchase materials from which are produced goods, which are then sold to customers, who later pay the bills. The firm receives cash from customers and the cycle repeats itself. The *cash turnover* means the number of times cash is used during each year.[13] The cash cycle involves several steps along the way as funds flow from the firm's accounts, as shown in Exhibit 12.3.

EXHIBIT 12.3 *Details of Cash Cycle*

A = Materials ordered; B = Materials received;
C = Payments; D = Cheque clearance; E = Goods sold;
F = Customer mails payments; G = Payment received;
H = Cheques deposited; I = Funds collected

In addressing the issue of cash management strategies, we are concerned with the time periods involved in stages B, C, D, and F, G, H, I. A firm has no control over the time involved between stages A and B. The lag between D and E is determined by the production process and inventory policy. The time period between stages E and F is determined by credit terms and the payments policy of customers.

The cash cycle and cash turnover are illustrated in Example 12.5.

EXAMPLE 12.5

A firm which purchases raw materials on credit is required by the credit terms to make payments within 30 days. On its side, the firm allows its credit buyers to pay within 60 days. Its experience has been that it takes, on an average, 35 days to pay its accounts payable and 70 days to collect its accounts receivable. Moreover, 85 days elapse between the purchase of raw materials and the sale of finished goods, that is to say, the average age of inventory is 85 days. What is the firm's cash cycle? Also, estimate the cash turnover.

SOLUTION

The cash cycle of the firm can be calculated by finding the average number of days that elapse between the cash outflows associated with paying accounts payable and the cash inflows associated with collecting accounts receivable:

(i) Cash cycle = 85 days + 70 days – 35 days = 120 days

(ii) Cash turnover = the assumed number of days in a year (normally 360) divided by the cash cycle

$$= \frac{360}{120} = 3$$

Minimum Operating Cash

The higher the cash turnover, the less is the cash a firm requires. A firm should, therefore, try to maximise the cash turnover. But it must maintain a minimum amount of operating cash balance so that it does not run out of cash. The minimum level of operating cash is determined by dividing the total operating annual outlays by the cash turnover rate. If, for example, the total operating annual outlay of a firm is Rs 240 lakh, its minimum cash requirement is Rs 80 lakh (i.e. Rs 240 lakh ÷ 3). The operational implication of the minimum operating cash requirement is that if the firm has opening cash balance of Rs 80 lakh, it would be able to meet its obligations when they become due. In other words, it would not have to borrow anything. But the minimum operating cash involves a cost in terms of the earnings foregone from investing it temporarily, that is to say, there is an opportunity cost. Assuming 10 per cent return on a riskless investment (or retirement of a debt carrying 10 per cent interest), the cost of the minimum cash balance of Rs 80 lakh works out to Rs 8 lakh.

Cash management strategies are intended to minimise the operating cash balance requirement. The basic strategies that can be employed to do the needful are as follows: [14]

(a) Stretching Accounts Payable,
(b) Efficient Inventory-Production Management,
(c) Speedy Collection of Accounts Receivable, and
(d) Combined Cash Management Strategies.

We spell out the implications of these strategies to the minimum cash balance and the associated cost with the underlying assumption that a firm should adopt such cash management strategies as will lead to the minimising of the operating cash requirement. In other words, efficient cash management implies minimum cash balances consistent with the need to pay bills when they become due.

Stretching Accounts Payable

One basic strategy of efficient cash management is to stretch the accounts payable. In other words, a firm should pay its accounts payable as late as possible without damaging its credit standing. It should, however, take advantage of the cash discount available on prompt payment.

If the firm, in our Example 12.5, can stretch its accounts payable from the current level of 35 days to 45 days, its cash cycle will be 110 days (i.e. reduced by 10 days from the original 120 days). The reduction in the cash cycle by 10 days as a result of the stretching of the accounts payable by 10 days will increase the cash turnover from 3 (initially) to 3.27 (360 ÷ 110). This will lead to a decrease in the minimum cash requirement from Rs 80 lakh to Rs 73.40 lakh (Rs 240 lakh ÷ 3.27). That is, the requirement has been reduced by Rs 6.60 lakh. Assuming a 10 per cent rate of interest, there will be a saving in cost to the firm to the extent of Rs 0.66 lakh.

Efficient Inventory-Production Management

Another strategy is to increase the inventory turnover, avoiding stock-outs, that is, shortage of stock. This can be done in the following ways:

1. *Increasing the raw materials turnover* by using more efficient inventory control techniques.
2. Decreasing the production cycle through better production planning, scheduling and control techniques; it will lead to an increase in the work-in-progress inventory turnover.
3. *Increasing the finished goods turnover* through better forecasting of demand and a better planning of production.

Assume that the firm in Example 12.5 is able to reduce the average age of its inventory from 85 to 70, that is, by 15 days. As a result, the cash cycle will decline by 15 days from 120 days to 105 days. The cash turnover will increase to 3.43 (360 ÷ 105) from the original level of 3. The effect of an increase in the cash turnover will be to reduce the minimum cash requirement from Rs 80 lakh to Rs 70 lakh (Rs 240 lakh ÷ 3.43). The saving in cost on Rs 10 lakh will Re 1 lakh (Rs 10 lakh × 0.10). Thus, efficient inventory and production management causes a decline in the operating cash requirement and, hence, a saving in cash operating cost.

Speeding Collection of Accounts Receivable

Yet another strategy for efficient cash management is to collect accounts receivable as quickly as possible without losing future sales because of high-pressure collection techniques. The average collection period of receivables can be reduced by changes in (i) credit terms, (ii) credit standards, and (iii) collection policies. These are elaborated in the next chapter. In brief, *credit standards* represent the criteria for determining to whom credit should be extended. The collection policies determine the effort put forth to collect accounts receivable promptly.

If the firm in our Example 12.5 manages to reduce the average age of its accounts receivable from the current level of 70 days to 50 days, the cash cycle will be reduced to 100 days from 120 days (decline by 20 days). The cash turnover will increase in consequence to 3.60 (360 ÷ 100) from the original level of 3. The operating cash requirement will fall from Rs 80 lakh to approximately Rs 66.67 lakh (Rs 240 ÷ 3.60). The reduction in cash balance of about Rs 13.33 lakh will lead to a saving in cost amounting to Rs 1.33 lakh (0.10 × Rs 13.33 lakh). Thus, a reduction in the average collection period by 20 days, releases funds equivalent to Rs 13.33 lakh and leads to a saving in cash operating cost of Rs 1.33 lakh.

Combined Cash Management Strategies

We have shown the effect of individual strategies on the efficiency of cash management. Each one of them has a favourable effect on the operating cash requirement. We now illustrate their combined effect, as firms will be well advised to use a combination of these strategies.

Assume the firm in Example 18.5 simultaneously (i) increases the average accounts payable by 10 days; (ii) reduces the average age of inventory by 15 days; (iii) speeds up the collection of accounts receivable by 20 days. Now, the cash cycle will be 75 days (120 days–10 days–15 days–20 days); the cash turnover will increase to 4.8 (360 ÷ 75); the minimum operating cash requirement will go down to Rs 50 lakh, that is, a reduction of Rs 30 lakh; assuming a 10 per cent rate of interest, the saving in cash operating cost will be Rs 3 lakh.

The foregoing discussion clearly shows that the three basic strategies of cash management, related to (1) accounts payable, (2) inventory, and (3) accounts receivable, lead to a reduction in the cash balance. But, they imply certain problems for the management. First, if the accounts payable are postponed too long, the credit standing of the firm may be adversely affected. Secondly, a low level of inventory may lead to a stoppage of production as sufficient raw materials may not be available for uninterrupted production, or the firm may be short of enough stock to meet the demand for its product, that is, 'stock-out'. Finally, restrictive credit standards, credit terms and collection policies may jeopardise sales. These implications should be constantly kept in view while working out cash management strategies.

CASH MANAGEMENT TECHNIQUES/PROCESSES

The basic strategies of cash management have been outlined in the preceding section. It has been shown that the strategic aspects of efficient cash management are: (i) efficient inventory management, (ii) speedy collection of accounts receivable, and (iii) delaying payments on accounts payable. The main elements of an efficient management of inventory are discussed in some detail in Chapter 20. There are some specific techniques and processes for speedy collection of receivables from customers and slowing disbursements. We discuss them in the present section.

Speedy Cash Collections

In managing cash efficiently, the cash inflow process can be accelerated through systematic planning and refined techniques. There are two broad approaches to do this. In the first place, the customers should be encouraged to pay as quickly as possible. Secondly, the payment from customers should be converted into cash without any delay.

Prompt Payment by Customers One way to ensure prompt payment by customers is *prompt billing*. What the customer has to pay and the period of payment should be notified accurately and in advance. The use of mechanical devices for billing along with the enclosure of a self-addressed return envelope will speed up payment by customers. Another, and more important, technique to encourage prompt payment by customers, is the practice of offering cash discounts. The availability of discount implies considerable saving to the customers. To avail of the facility, the customers would be eager to make payment early.

Early Conversion of Payments into Cash Once the customer makes the payment by writing a cheque in favour of the firm, the collection can be expedited by prompt encashment of the cheque. There is a lag between the time a cheque is prepared and mailed by the customer and the time the funds are

included in the cash reservoir of the firm. This is represented by stages F to I in Exhibit 18.3. Within this time interval three steps are involved: (a) *transit* or *mailing* time, that is, the time taken by the post offices to transfer the cheque from the customers to the firm. This delay or lag is referred to as *postal float*; (b) time taken in processing the cheques within the firm before they are deposited in the banks, termed as *lethargy*; and (c) collection time within the bank, that is, the time taken by the bank in collecting the payment from the customer's bank. This is called *bank float*. The early conversion of payment into cash, as a technique to speed up collection of accounts receivable, is done to reduce the time lag between posting of the cheque by the customer and the realisation of money by the firm. The postal float, lethargy and bank float are collectively referred to as *deposit float*. The term deposit float is defined as *the sum of cheques written by customers that are not yet usable by the firm*.[15]

The collection of accounts receivable can be considerably accelerated, by reducing transit, processing and collection time. An important cash management technique is reduction in deposit float. This is possible if a firm adopts a policy of *decentralised collections*. We discuss below some of the important processes that ensure decentralised collection so as to reduce (i) the amount of time that elapses between the mailing of a payment by a customer, and (ii) the point the funds become available to the firm for use. The principal methods of establishing a decentralised collection network are (a) Concentration Banking, and (b) Lock-box System.

Concentration Banking In this system of decentralised collection of accounts receivable, large firms which have a large number of branches at different places, select some of the strategically located branches as collection centres for receiving payment from customers. Instead of all the payments being collected at the head office of the firm, the cheques for a certain geographical area are collected at a specified local collection centre. Under this arrangement, the customers are required to send their payments (cheques) to the collection centre covering the area in which they live and these are deposited in the local account of the concerned collection centre, after meeting local expenses, if any. Funds beyond a predetermined minimum are transferred daily to a *central* or *disbursing* or *concentration* bank or account. A concentration bank is one with which the firm has a major account–usually a disbursement account.[16] Hence, this arrangement is referred to as *concentration banking*.

Concentration banking, as a system of decentralised billing and multiple collection points, is a useful technique to expedite the collection of accounts receivable. It reduces the time needed in the collection process by reducing the *mailing* time. Since the collection centres are near the customers, the time involved in sending the bill to the customer is reduced. Moreover, the time-lag between the despatch of the cheque by the customer and its receipt by the firm is also reduced. Mailing time is saved both in respect of sending the bill to the customers as well as in the receipt of payment. The second reason why deposit float is reduced by concentration banking is that the banks of the firm as well as the customers may be in close proximity. Thus, the arrangement of multiple collection centres with concentration banking results in a saving of time in both mailing and clearance of customer payments and leads to a reduction in the operating cash requirements. Another advantage is that *concentration* permits the firm to 'store' its cash more efficiently.[17] This is so mainly because by pooling funds for disbursement in a single account, the aggregate requirement for cash balance is lower than it would be if balances are maintained at each branch office.

Lock-Box System The concentration banking arrangement is instrumental in reducing the time involved in mailing and collection. But with this system of collection of accounts receivable, *processing* for purpose of internal accounting is involved, that is, some time elapses before a cheque is deposited by the local collection centre in its account. The lock-box system takes care of this kind of problem, apart from effecting economy in mailing and clearance times. Under this arrangement, firms hire a post office lock-box at

important collection centres. The customers are required to remit payments to the post office lock-box. The local banks of the firm, at the respective places, are authorised to open the box and pick up the remittances (cheques) received from the customers. Usually, the authorised banks pick up the cheques several times a day and deposit them in the firm's accounts. After crediting the account of the firm, the banks send a deposit slip alongwith the list of payments and other enclosures, if any, to the firm by way of proof and record of the collection.

Thus, the lock-box system is like concentration banking in that the collection is decentralised and is done at the branch level. But they differ in one very important respect. While the customer sends the cheques, under the concentration banking arrangement, to the collection centres, he sends them to a post office box under the lock-box system. The cheques are directly received by the bank which empties the box and not from the firm or its local branch.

In a way, the lock-box arrangement is an improvement over the concentration banking system. Its superiority arises from the fact that one step in the collection process is eliminated with the use of lock-box: the receipt and deposit of cheques by the firm. In other words, the processing time within the firm before depositing a cheque in the bank is eliminated. Also,some extra saving in mailing timing is provided by the lock-box system as the cheques received in the post office box are not delivered either by the post office or the firm itself to the bank; rather, the bank itself picks them up at the post office.

Thus, the lock-box system, as a method of collection of receivables, has a two-fold advantage: (i) the bank performs the clerical task of handling the remittances prior to deposits, services which the bank may be able to perform at lower cost; (ii) the process of collection through the banking system begins immediately upon the receipt of the cheque/remittance and does not have to wait until the firm completes its processing for internal accounting purposes. In terms of the steps involved in the cash cycle, as shown in Exhibit 18.3, GH and HI would take place simultaneously. As a result, the time-lag between payment by a customer and the availability of funds to the firm for use would be reduced and, thereby, the collection of receivables would be accelerated.

Although the use of concentration banking and lock-box systems accelerate the collection of receivables, they involve a cost. While in the case of the former, the cost is in terms of the maintenance of multiple collection centres, compensation to the bank for services represents the cost associated with the latter. The justification for the use or otherwise of these special cash management techniques would be based on a comparison of the cost with the return generated on the released funds.[18] If the income exceeds the cost, the system is profitable and should be used; otherwise, not. For this reason, these techniques can be pressed into service only by large firms which receive a large number of cheques from a wide geographical area.

EXAMPLE 12.6

A firm uses a continuous billing system that results in an average daily receipt of Rs 40,00,000. It is contemplating the institution of concentration banking, instead of the current system of centralised billing and collection. It is estimated that such a system would reduce the collection period of accounts receivable by 2 days.

Concentration banking would cost Rs 75,000 annually and 8 per cent can be earned by the firm on its investments. It is also found that a lock-box system could reduce its overall collection time by four days and could cost annually Rs 1,20,000.

(a) How much cash would be released with the concentration banking system?
(b) How much money can be saved due to reduction in the collection period by 2 days? Should the firm institute the concentration banking system?
(c) How much cash would be freed by lock-box system?
(d) Between concentration banking and lock-box system, which is better?

SOLUTION

(i) Cash released by the concentration banking system = Rs 40,00,000 × 2 days = Rs 80,00,000
(ii) Saving = 0.08 × Rs 80,00,000 = Rs 6,40,000.
The firm should institute the concentration banking system. It costs only Rs 75,000 while the savings expected are Rs 6,40,000.
(iii) Cash released by the lock-box system = Rs 40,00,000 × 4 days = Rs 1,60,00,000
(iv) Saving in lock-box system: 0.08 × Rs 1,60,00,000 = Rs 12,80,000
(v) Lock-box system is better. Its net savings Rs 11,60,000 (Rs 12,80,000 – Rs 1,20,000) are higher than that of concentration banking.

Slowing Disbursements

Apart from speedy collection of accounts receivable, the operating cash requirement can be reduced by slow disbursements of accounts payable. In fact, slow disbursements represent a source of funds requiring no interest payments. There are several techniques to delay payment of accounts payable, namely, (i) avoidance of early payments; (ii) centralised disbursements; (iii) floats; and (iv) accruals.

Avoidance of Early Payments One way to delay payments is to avoid early payments. According to the terms of credit, a firm is required to make a payment within a stipulated period. It entitles a firm to cash discounts. If, however, payments are delayed beyond the due date, the credit standing may be adversely affected so that the firms would find it difficult to secure trade credit later. But if the firm pays its accounts payable before the due date it has no special advantage. Thus, a firm would be well advised not to make payments early that is, before the due date.

Centralised Disbursements Another method to slow down disbursements is to have centralised disbursements. All the payments should be made by the head office from a centralised disbursement account. Such an arrangement would enable a firm to delay payments and conserve cash for several reasons. Firstly, it involves increase in the *transit* time. The remittance from the head office to the customers in distant places would involve more mailing time than a decentralised payment by the local branch. The second reason for reduction in operating cash requirement is that since the firm has a centralised bank account, a relatively smaller total cash balance will be needed. In the case of a decentralised arrangement, a minimum cash balance will have to be maintained at each branch which will add to a large operating cash balance. Finally, schedules can be tightly controlled and disbursements made exactly on the right day.

Float A very important technique of slow disbursements is *float*. The term float refers to the amount of money tied up in cheques that have been written, but have yet to be collected and encashed. Alternatively, float represents the difference between the bank balance and book balance of cash of a firm. The difference between the balance as shown by the firm's record and the actual bank balance is due to *transit* and processing delays. There is a time-lag between the issue of a cheque by the firm and its presentation to its bank by the customer's bank for payment. The implication is that although the cheque has been issued, cash would be required later when the cheque is presented for encashment. Therefore, a firm can send remittances although it does not have cash in its bank at the time of issuance of the cheque. Meanwhile, funds can be arranged to make payment when the cheque is presented for collection after a few days. Float used in this sense is called as *cheque kiting*.[19] There are two ways of doing it: (a) paying from a distant bank, (b) scientific cheque-cashing analysis.

Paying from a Distant Bank The firm may issue a cheque on banks away from the creditor's bank. This would involve relatively longer transit time for the creditor's bank to get payment and, thus, enable the firm to use its funds longer.

Cheque-encashment Analysis Another way to make use of float is to analyse, on the basis of past experience, the time-lag in the issue of cheques and their encashment. For instance, cheques issued to pay wages and salary may not be encashed immediately; it may be spread over a few days, say, 25 per cent on one day, 50 per cent on the second day and the balance on the third day. It would mean that the firm should keep in the bank not the entire amount of a payroll but only a fraction represented by the actual withdrawal each day. This strategy would enable the firm to save operating cash.

Accruals Finally, a potential tool for stretching accounts payable is *accruals* which are defined as current liabilities that represent a service or goods received by a firm but not yet paid for. For instance, payroll, that is, remuneration to employees who render service in advance and receive payment later. In a way, they extend credit to the firm for a period at the end of which they are paid, say, a week or a month. The longer the period after which payment is made, the greater is the amount of free financing consequently and the smaller is the amount of cash balances required. Thus, less frequent payrolls, that is, weekly as compared to monthly, are an important source of accrual. They can be manipulated to slow down disbursements. Other examples of accrual are rent to lessors and taxes to government. But these can be utilised only to a limited extent as there are legal constraints beyond which such payments cannot be extended.

MARKETABLE SECURITIES

This section presents a brief description of the marketable securities. Attention is focussed on the meaning and characteristics of marketable securities, the general selection criterion and the basic types of such securities.

Meaning and Characteristics

Once the optimum level of cash balance of a firm has been determined, the residual of its liquid assets is invested in marketable securities. Such securities are short-term investment instruments to obtain a return on temporarily idle funds. In other words, they are securities which can be converted into cash in a short period of time, typically a few days. The basic characteristics of marketable securities affect the degree of their marketability/ liquidity. To be liquid, a security must have two basic characteristics: a ready market and safety of principal. Ready marketability minimises the amount of time required to convert a security into cash. A ready market should have both breadth in the sense of a large number of participants scattered over a wide geographical area as well as depth as determined by its ability to absorb the purchase/sale of large amounts of securities.

The second determinant of liquidity is that there should be little or no loss in the value of a marketable security over time. Only those securities that can be easily converted into cash without any reduction in the principal amount qualify for short-term investments. A firm would be better off leaving the balances in cash if the alternative were to risk a significant reduction in principal.

Selection Criterion

A major decision confronting the financial managers involves the determination of the mix of cash and

marketable securities. Some of the quantitative models for determining the optimum amounts of marketable securities to hold in certain circumstances have been outlined in an earlier section. In general, the choice of the mix is based on a trade-off between the opportunity to earn a return on idle funds (cash) during the holding period, and the brokerage costs associated with the purchase and sale of marketable securities. For example, take the case of a firm paying Rs 350 as brokerage costs to purchase and sell Rs 45,000 worth of marketable securities, yielding an annual return of 8 per cent and held for one month. The interest earned on the securities works out at Rs 300 ($1/12 \times .08 \times$ Rs 45,000). Since this amount is less than the cost of the transaction (Rs 350), it is not advisable for the firm to make the investments. This trade-off between interest returns and brokerage costs is a key factor in determining what proportion of liquid assets should be held in the form of marketable securities.

There are three motives for maintaining liquidity (cash as well as marketable securities) and, therefore, for holding marketable securities: transaction motive, safety/ precautionary motive and speculative motive. Each motive is based on the premise that a firm should attempt to earn a return on temporarily idle funds. The type of marketable security purchased will depend on the motive for the purchase. An assessment of certain criteria can provide the financial manager with a useful framework for selecting a proper marketable securities mix. These considerations include evaluation of (i) financial risk, (ii) interest rate risk, (iii) taxability, (iv) liquidity, and (v) yield among different financial assets.

Financial/Default Risk It refers to the uncertainty of expected returns from a security attributable to possible changes in the financial capacity of the *security-issuer* to make future payments to the *security-owner*. If the chance of default on the terms of the investment is high (low), then the financial risk is said to be high (low). As the marketable securities portfolio is designed to provide a return on funds that would be otherwise tied up in idle cash held for transaction or precautionary purposes, the financial manager will not usually be willing to assume such financial/default risk in the hope of greater return within the makeup of the portfolio.

Interest Rate Risk The uncertainty that is associated with the expected returns from a financial instrument attributable to changes in interest rate is known as *interest rate risk*. Of particular concern to the corporate financial manager is the price volatility associated with instruments that have long, as opposed to short, terms to maturity.

If prevailing interest rates rise compared with the date of purchase, the market price of the securities will fall to bring their yield to maturity in line with what financial managers could obtain by buying a new issue of a given instrument, for instance, treasury bills. The longer the maturity of the instrument, the larger will be the fall in prices. To hedge against the price volatility caused by interest rate risk, the market securities portfolio will tend to be composed of instruments that mature over short periods.

Taxability Another factor affecting observed difference in market yields is the differential impact of taxes. Securities, income on which is tax-exempt, sell in the market at lower yields to maturity than other securities of the same maturity. A differential impact on yields arises also because interest income is taxed at the ordinary tax rate while capital gains are taxed at a lower rate. As a result, fixed-interest securities that sell at a discount because of low coupon rate in relation to the prevailing yields are attractive to taxable investors. The reason is that part of the yield to maturity is a capital gain. Owing to the desirability of discount on low-interest fixed-income securities, their yield to maturity tends to be lower than the yield on comparable securities with higher coupon rates. The greater the discount, the greater is the capital gains attraction and the lower is its yield relative to what it would be if the coupon rate were such that the security was sold at par.

Liquidity With reference to marketable securities portfolio, *liquidity* refers to the ability to transform a security into cash. Should an unforeseen event require that a significant amount of cash be immediately

available, a sizeable portion of the portfolio might have to be sold. The financial manager will want the cash *quickly* and will not want to accept a large price reduction in order to convert the securities. Thus, in the formulation of preferences for the inclusion of particular instruments in the portfolio, consideration will be given to (i) the time period needed to sell the security and (ii) the likelihood that the security can be sold at or near its prevailing market price. The latter element, here, means that 'thin' markets, where relatively few transactions take place or where trades are accomplished only with large price changes between transaction, should be avoided.

Yield The final selection criterion is the yields that are available on the different financial assets suitable for inclusion in the marketable/near-cash portfolio. All the four factors listed above, *financial risk, interest rate risk, liquidity* and *taxability*, influence the available yields on financial instruments. Therefore, the yield criterion involves a weighing of the risks and benefits inherent in these factors. If a given risk is assumed, such as lack of liquidity, then a higher yield may be expected on the instrument lacking the liquidity characteristics.

In brief, the finance manager must focus on the risk-return trade-offs associated with the four factors on yield through his analysis. Coming to grips with these trade-offs will enable the finance mananger to determine the proper marketable securities mix for his firm.

Marketable Security Alternatives

In this section, we describe briefly the more prominent marketable/near-cash securities available for investment. Our concern is with money market instruments.

Treasury Bills There are obligations of the government. They are sold on a discount basis. The investor does not receive an actual interest payment. The return is the difference between the purchase price and the face (par) value of the bill.

The treasury bills are issued only in *bearer* form. They are purchased, therefore, without the investors' name upon them. This attribute makes them easily transferable from one investor to another. A very active secondary market exists for these bills. The secondary market for bills not only makes them highly liquid but also allows purchase of bills with very short maturities. As the bills have the full financial backing of the government, they are, for all practical purposes, risk-free. The negligible financial risk and the high degree of liquidity makes their yield lower than those on the other marketable securities. Due to their virtually risk-free nature and because of active secondary market for them, treasury bills are one of the most popular marketable securities even though the yield on them is lower.

Negotiable Certificates of Deposit (CDs) These are marketable receipts for funds that have been deposited in a bank for a fixed period of time. The deposited funds earn a fixed rate of interest. The denomination and maturities are tailored to the investors' need. The CDs are offered by banks on a basis different from treasury bills, that is, they are not sold at a discount. Rather, when the certificates mature, the owner receives the full amount deposited plus the earned interest. A secondary market exists for the CDs. While CDs may be issued in either registered or bearer form, the latter facilitates transactions in the secondary market and, thus, is the most common. The default risk is that of the bank failure, a possibility that is low in most cases.

Commercial Paper It refers to short-term unsecured promissory note sold by large business firms to raise cash. As they are unsecured, the issuing side of the market is dominated by large companies which typically maintain sound credit ratings. Commercial papers (CPs) can be sold either directly or through

dealers. Companies with high credit rating can sell directly to investors. The denominations in which they can be bought vary over a wide range. They can be purchased similarly with varying maturities. These papers are *generally* sold on discount basis in bearer form although at times commercial papers can be issued carrying interest and made payable to the order of the investor. For all practical purposes, there is no active trading in secondary market for commercial paper although direct sellers of CPs often repurchase it on request. This feature distinguishes CPs from all of the previously discussed short-term investment vehicles. When, therefore, a financial manager evaluates these for possible inclusion in marketable securities portfolio, he should plan to hold it to maturity. Owing to its lack of marketability, CPs provide a yield advantage over other near-cash assets of comparable maturity.

Bankers' Acceptances These are drafts (order to pay) drawn on a specific bank by an exporter in order to obtain payment for goods he has shipped to a customer who maintains an account with that specific bank. They can also be used in financing domestic trade. The draft guarantees payment by the accepting bank at a specific point of time. The seller who holds such acceptance may sell it at a discount to get immediate funds. Thus, the acceptance becomes a marketable security. Since acceptances are used to finance the acquisition of goods by one party, the document is not 'issued' in specialised denominations; its size/ denomination is determined by the cost of goods being purchased. They serve a wide range of maturities and are sold on a discount basis, payable to the bearer. A secondary market for the acceptances of large banks does exist. Owing to their greater financial risk and lesser liquidity, acceptances provide investors a yield advantage over treasury bills of like maturity. In fact, the acceptances of major banks are a very safe investment, making the yield advantage over treasury bills worth looking for marketable securities portfolio.

Repurchase Agreements These are legal contracts that involve the actual sale of securities by a borrower to the lender with a commitment on the part of the former to repurchase the securities at the current price plus a stated interest charge. The securities involved are government securities and other money market instruments. The borrower is either a financial institution or a security dealer.

There are two major reasons why a firm with excess cash prefers to buy repurchase agreements rather than a marketable security. First, the original maturities of the instrument being sold can, in effect, be adjusted to suit the particular needs of the investing firm. Therefore, funds available for a very short period, that is, one/two days can be employed to earn a return. Closely related to the first is the second reason, namely, since the contract price of the securities that make up the arrangement is fixed for the duration of the transaction, the firm buying the repurchase agreement is protected against market fluctuations throughout the contract period. This makes it a sound alternative investment for funds that are surplus for only short periods.

Units The units of mutual funds offer a reasonably convenient alternative avenue for investing surplus liquidity as (i) there is a very active secondary market for them, (ii) the income from units is tax-exempt up to a specified amount and, (iii) the units appreciate in a fairly predictable manner.

Intercorporate Deposits *Intercorporate deposits*, that is, short-term deposits with other companies is a fairly attractive form of investment of short-term funds in terms of rate of return which currently ranges between 12 and 15 per cent. However, apart from the fact that one month's time is required to convert them into cash, intercorporate deposits suffer from high degree of risk.

Bills Discounting Surplus funds may be deployed to purchase/discount bills. Bills of exchange are drawn by seller (drawer) on the buyer (drawee) for the value of goods delivered to him. During the

pendency of the bill, if the seller is in need of funds, he may get it discounted. On maturity, the bill should be presented to the drawee for payment. A bill of exchange is a self-liquidating instrument. Bill discounting is superior to intercorporate deposits for investing surplus funds. While parking surplus funds in bills discounting, it should be ensured that the bills are trade bills arising out of genuine commercial transaction and, as far as possible, they should be backed by letter of credit/acceptance by banks to ensure absolute safety of funds.

Call Market It deals with funds borrowed/lent overnight/one-day (call) money and notice money for periods up to 14 days. It enables corporates to utilise their float money gainfully. However, the returns (call rates) are highly volatile. The stipulations pertaining to the maintenance of cash reserve ratio (CRR) by banks is the major determinant of the demand of funds and is responsible for volatility in the call rates. Large borrowings by them to fulfil their CRR requirements pushes up the rates and a sharp decline takes place once these funds are met.

SUMMARY

- Cash management is one of the key areas of working capital management. There are four motives for holding cash: (i) transaction motive, (ii) precautionary motive, (iii) speculative motive, and (iv) compensating motive. The transaction motive refers to the holding of cash to meet anticipated obligations whose time is not perfectly synchronised with cash receipts. The cash balances held in reserve for random and unforeseen fluctuations in cash flows are called precautionary balances. The speculative motive indicates the desire of a firm to take advantage of opportunities which present themselves at unexpected moments and which are typically outside the normal course of business. The compensating motive means keeping the bank balance sufficient to earn a return equal to the cost of free services provided by the banks.
- The basic objectives of cash management are to reconcile two mutually contradictory and conflicting tasks: to meet the payment schedule and to minimise funds committed to cash balances.
- The factors that determine the required cash balances are: (i) synchronisation of cash flows, (ii) the cost associated with a shortfall in the firm's cash needs, (iii) excess cash balance cost, (iv) cost associated with establishing an operating cash management staff and activities, and (v) the impact of uncertainties on cash management strategy.
- Cash budget is probably the most important tool in cash management. It is a device to help a firm to plan and control the use of cash. The cash position of a firm as it moves from one period to another period is highlighted by the cash budget. A cash budget has normally three parts, namely, cash collections, cash payments and cash balances. The major sources of cash receipts and payments are operating and financial. The operating sources are repetitive in nature, while the financial sources are non-recurring.
- The cash management strategies are intended to minimise the operating cash balance requirement. The basic strategies that can be employed are (i) stretching accounts payable without affecting the credit of the firm, (ii) efficient inventory management and (iii) speedy collections of accounts receivable. Some of the specific techniques and processes for speedy collection of receivables from customers are ensuring prompt payment for customers and early payment/conversion into cash. Concentration banking and lock-box system deserve specific mention as principal methods of establishing a decentralised collection network. The techniques to delay payments of accounts payable include avoidance of early payment, centralised disbursements and float.

- Concentration banking, as a system of decentralised billing and multiple collection points, is a useful technique to expedite the collection of accounts receivable by reducing the mailing time. The mailing time is saved both in respect of sending the bill to the customers as well as in the receipt of payment.
- Under the lock-box system, firms hire a post office lock-box at important collection centers where the customers remit payments. The local banks are authorized to open the box and pick up the remittances (cheques) received from the customers. As a result, there is some extra saving in mailing time compared to concentration banking.
- The financial evaluation of concentration banking and lock-box system would be based on the incremental analysis by comparing the cost of operations and benefits in terms of interest earnings on the early release of funds.
- Marketable securities are an outlet for surplus cash as liquid security/assets. To be liquid a security must have two basic characteristics, that is, a ready market and safety of principal.
- The selection criteria for marketable securities include the evaluation of financial risk, interest-rate risk, liquidity, taxability and yield among different financial assets. The prominent marketable securities available for investment are: treasury bills, negotiable certificates of deposits, commercial paper, bankers' acceptance, units of mutual funds, intercorporate deposits, interbank call money, commercial bills under the bill market scheme and short-term deposits.

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SOLVED PROBLEMS

P.12.1 The following information is available in respect of a trading firm:

(i) On an average, debtors are collected after 45 days; inventories have an average holding period of 75 days and creditors payment period on an average is 30 days.

(ii) The firm spends a total of Rs 120 lakh annually at a constant rate.

(iii) It can earn 10 per cent on investments.

From the above information, compute: (a) the cash cycle and cash turnover, (b) minimum amounts of cash to be maintained to meet payments as they become due, (c) savings by reducing the average inventory holding period by 30 days.

SOLUTION

(a) Cash cycle = 45 days + 75 days – 30 days = 90 days (3 months)
Cash turnover = 12 months (360 days)/3 months (90 days) = 4.

(b) Minimum operating cash = Total operating annual outlay/cash turnover, that is, Rs 120 lakh/4 = Rs 30 lakh.

(c) Cash cycle = 45 days + 45 days – 30 days = 60 days (2 months)
Cash turnover = 12 months (360 days)/2 months (60 days) = 6.
Minimum operating cash = Rs 120 lakh/6 = Rs 20 lakh
Reduction in investments = Rs 30 lakh – Rs 20 lakh = Rs 10 lakh
Savings = 0.10 × Rs 10 lakh = Rs 1 lakh.

P.12.2 A firm has been offered a cash management service by a bank for Rs 1,00,000 per year. It is estimated that such a service would not only eliminate 'excess' cash on deposits (Rs 8,00,000) but also reduce its administration and other costs to the tune of Rs 5,000 per month. Assuming the cost of capital of 15 per cent, is it worthwhile for the firm to engage the cash management service?

SOLUTION

Benefits (annual):	
Savings in interest (Rs 8,00,000 × 0.15)	Rs 1,20,000
Reduction in administration and other costs (Rs 5,000 × 12)	60,000
Total	1,80,000
Less cost (annual):	
Bank service charges	1,00,000
Net annual benefits	80,000

It is worthwhile to engage the bank services.

P.12.3 Royal Industries feels a lock-box system can shorten its accounts receivable collection period by 3 days. Credit sales are estimated at Rs 365 lakh per ye r, billed on a continuous basis. The firm's opportunity cost of funds is 15 per cent. The cost of lock box system is Rs 50,000.

(a) Will you advise 'Royal' to go for lock-box system?

(b) Will your answer be different if accounts receivable collection period is reduced by 5 days?

SOLUTION

(a) Cash released by lock-box system (Rs 365 lakh/365 days = Rs 1 lakh × 3 days)	Rs 3,00,000
Savings (Rs 3 lakh × 0.15)	45,000
Less cost of lock-box system	50,000
Net loss	(5,000)

The firm is advised not to go for the lock-box system.

(b)	Cash released: Rs 1 lakh × 5 days	Rs 5,00,000
	Savings (Rs 5 lakh × 0.15)	75,000
	Less cost of lock-box system	50,000
	Net savings	25,000

Yes, the firm should go for the lock box system.

P.12.4 Sagar Industries sells its products through widely dispersed distributors in Northern India. It currently takes on an average 8 days for cash receipt cheques to become available to the firm from the day they are mailed. The firm is contemplating the institution of concentration banking to reduce this period. It is estimated that such a system would reduce the collection period of accounts receivable by 3 days. The daily cheque receipts currently average Rs 10,00,000.

The concentration banking would cost Rs 1,50,000 annually and the cost of funds is 15 per cent.

(a) Advise Sagar whether it should introduce concentration banking system.

(b) Will your answer be different, if it is estimated that a lock-box system can reduce the collection time by 4 days and its annual cost would be Rs 2,00,000?

SOLUTION

(a)	Cash released by concentration banking system	
	Rs 10 lakh × 3 = Rs 30 lakh.	
	Savings (Rs 30 lakh × 0.15)	Rs 4,50,000
	Less costs	1,50,000
	Net savings	3,00,000

The firm should introduce concentration banking system.

(b)	Cash released by lock-box system Rs 10 lakh × 4 = Rs 40 lakh	
	Savings (Rs 40 lakh × 0.15)	6,00,000
	Less costs	2,00,000
	Net savings	4,00,000

The lock box system is better.

P.12.5 The following results are expected by XYZ Ltd by quarters next year, in thousands of rupees.

	Quarter			
	1	*2*	*3*	*4*
Sales	7,500	10,500	18,000	10,500
Cash payments:				
Production costs	7,000	10,000	8,000	8,500
Selling, administrative and other costs	1,000	2,000	2,900	1,600
Purchases of plant and other fixed assets	100	1,100	2,100	2,100

The debtors at the end of a quarter are one-third of sales for the quarter. The opening balance of debtors is Rs 30,00,000. Cash on hand at the beginning of the year is Rs 6,50,000 and the desired minimum balance is Rs 5,00,000. Borrowings are made at the beginning of quarters in which the need will occur in multiplies of Rs 10,000 and are repaid at the end of quarters. Interest charges may be ignored. You are required to prepare:

(a) a cash budget by quarters for the year; and

(b) state the amount of loan outstanding at the end of the year.

SOLUTION

(a) *Cash budget next year (quarter-wise) (thousands of rupees)*

Particulars	*Quarter*				
	1	*2*	*3*	*4*	*Total*
(A) Cash inflows:					
Collection from debtors					
(i) From prior quarter (1/3 of sales)	3,000	2,500	3,500	6,000	15,000
(ii) From current quarter (2/3 of sales)	5,000	7,000	12,000	7,000	31,000
Total	8,000	9,500	15,500	13,000	46,000
(B) Cash outflows:					
Production costs	7,000	10,000	8,000	8,500	33,500
Selling, administrative and other costs	1,000	2,000	2,900	1,600	7,500
Plant and other fixed assets purchased	100	1,100	2,100	2,100	5,400
Total	8,100	13,100	13,000	12,200	46,400
(C) Surplus/(deficiency)	(100)	(3,600)	2,500	800	(400)
Beginning balance	650	550	500	500	650
Ending balance (indicated)	550	(3,050)	3,000	1,300	250
Borrowings required (deficiency + minimum cash required)		3,550			3,550
(Repayments) made (balance – minimum cash required)			(2,500)	(800)	(3,300)
Ending balance (actually now estimated)	550	500	500	500	500

(b) Loan outstanding = Rs 35,50,000 – Rs 33,00,000 = Rs 2,50,000.

P.12.6 The following data pertain to a shop. The owner has made the following sales forecasts for the first 5 months of the coming year:

January	Rs 40,000
February	45,000
March	55,000
April	60,000
May	50,000

Other data are as follows:

(a) Debtors and creditors' balances at the beginning of the year are Rs 30,000 and Rs 14,000, respectively. The balances of other relevant assets and liabilities are:

Cash balance	Rs 7,500
Stock	51,000
Accrued sales commission	3,500

(b) 40 per cent sales are on cash basis. Credit sales are collected in the month following sale.

(c) Cost of sales is 60 per cent of sales.

(d) The only other variable cost is a 5 per cent commission to sales agents. The sales commission is paid in month after it is earned.

(e) Inventory (stock) is kept equal to sales requirements for the next two months' budgeted sales.

(f) Trade creditors are paid in the following month after purchases.

(g) Fixed costs are Rs 5,000 per month, including Rs 2,000 depreciation.

You are required to prepare a cash budget for each of the first three months of coming year.

SOLUTION

Cash budget for 3 months (month-wise)

Particulars	*Month*		
	January	*February*	*March*
(A) Cash inflows:			
Cash sales (40% of total sales)	Rs 16,000	Rs 18,000	Rs 22,000
Collection from debtors (one month after sales)	30,000	24,000	27,000
Total	46,000	42,000	49,000
(B) Cash outflows:			
Paid to trade creditors for purchases (see working note on purchase budget)	14,000	33,000	36,000
Sales commission (5 per cent of prior month's sales)	3,500	2,000	2,250
Fixed costs (Rs 5,000 – Rs 2,000 depreciation)	3,000	3,000	3,000
Total	20,500	38,000	41,250
(C) Surplus/(deficiency) (A) – (B)	25,500	4,000	7,750
Beginning balance	7,500	33,000	37,000
Ending balance (indicated)	33,000	37,000	44,750

Working Notes

Purchase budget

Desired ending inventory (at cost price)	Rs 60,000	Rs 69,000	Rs 66,000
Plus cost of goods sold (current month)	24,000	27,000	33,000
Total requirements	84,000	96,000	99,000
Less beginning inventory	51,000	60,000	69,000
Purchases	33,000	36,000	30,000

P.12.7 From the following information, prepare cash budget of a business firm for the month of April.

(a) The firm makes 20 per cent cash sales. Credit sales are collected 40, 30 and 25 per cent in the month of sales, month after and second month after sales, respectively. The remaining 5 per cent becomes bad debts.

(b) The firm has a policy of buying enough goods each month to maintain its inventory at two and one-half times the following month's budgeted sales.

(c) The firm is entitled to 2 per cent discount on all its purchases if bills are paid within 15 days and the firm avails of all such discounts. Monthly purchases are made in two equal lots on fortnightly basis.

(d) Cost of goods sold, without considering the 2 per cent discount, is 50 per cent of selling prices. The firm records inventory net of discount.

(e) Other data is:

Sales:

January (actual)	Rs 1,00,000
February (actual),	1,20,000
March (actual),	1,50,000
April (budgeted),	1,70,000
May (budgeted),	1,40,000

Inventory on March 31, Rs 2,25,400.

Cash on March 31, Rs 30,000.

Gross purchases in March, Rs 1,00,000.

Selling, general and administrative expenses budgeted for April, Rs 45,000 (includes Rs 10,000 depreciation).

SOLUTION

Cash budget for the month of April

Particulars		*Amount*
(a) *Cash inflows*		
Balance in the beginning April I		Rs 30,000
Collection from sales		
Cash sales (0.20 × Rs 1,70,000)		34,000
Collection from debtors:		
For February sales	Rs (0.25 × Rs 96,000)	24,000
For March sales	(0.30 × 1,20,000)	36,000
For April sales	(0.40 × 1,36,000)	54,400
Total		1,78,400
(b) *Cash outflows*		
Payment for purchases		
March (Rs 1,00,000 × 0.98 × 1/2)		49,000
April (Rs 29,400 × 1/2) (see purchase budget)		14,700
Selling, general and administrative expenses (Rs 45,000 – Rs 10,000)		35,000
Total		98,700
(c) *Budgeted cash balance (end of April (a – b))*		79,700

Working Notes

Purchase budget (April)	*Gross*	*Net*
Desired ending inventory-gross (Rs 1,40,000 × 0.50 × 2.5)	Rs 1,75,000	Rs 1,71,500
Add cost of sales in April-gross (Rs 1,70,000 × 0.50)	85,000	83,300
Total requirements	2,60,000	2,54,800
Less beginning inventory-gross (Rs 2,25,400 × 100/98)	2,30,000	2,25,400
Required purchases	30,000	29,400

P.12.8 Prepare cash budget for April-October from the following information supplied by Shah Agencies Ltd.

Balance sheet as at March 31

Proprietor's capital	Rs 1,00,000	Cash		Rs 20,500
Outstanding liabilities	11,000	Stock in trade		50,500
		Sundry debtors		20,000
		Furniture	25,000	
		Less depreciation	5,000	20,000
	1,11,000			1,11,000

Sales and the expenditure on salaries are expected to be as under:

Months	*Sales*	*Salaries*
April	Rs 30,000	Rs 3,000
May	52,000	3,500
June	50,000	3,500
July	75,000	4,000
August	90,000	4,000
September	35,000	3,000
October	25,000	3,000

The other expenses per month are: Rent, Rs 1,000, Depreciation, Rs 1,000, Miscellaneous expenses, Rs 500, and Commission, 1 per cent of sales.

Of the total sales, 80 per cent is on credit and 20 per cent for cash; 70 per cent of the credit sales are collected in the first month following sale and the balance in the second month. There are no bad debt losses. Gross margin on sales on an average is 30 per cent. Purchases equal to the next month's sales are made every month and they are paid during the month in which they are made. The firm maintains a minimum cash balance of Rs 10,000. Cash deficiencies are made up by the bank loans which are repaid at the earliest opportunity available and cash in excess of Rs 15,000 is invested in securities (interest on bank loans and securities is to be ignored). Outstanding liabilities remain unchanged. Debtors pertain to credit sales of March. State your assumptions, if any.

SOLUTION

Cash budget (April-October)

Particulars	*April*	*May*	*June*	*July*	*August*	*Sep.*	*Oct.*
(a) Cash inflows							
Cash sales	Rs 6,000	Rs 10,400	Rs 10,000	Rs 15,000	Rs 18,000	Rs 7,000	Rs 5,000
Collection from debtors							
First month following sales (70%)	14,000	16,800	29,120	28,000	42,000	50,400	19,600
Second month following sales (30%)	6,000	6,000	7,200	12,480	12,000	18,000	21,600
Total	26,000	33,200	46,320	55,480	72,000	75,400	46,200
(b) *Cash outflows*							
Payment to creditors (*see working notes*)	36,400	35,000	52,500	63,000	24,500	17,500	17,500
Salaries	3,000	3,500	3,500	4,000	4,000	3,000	3,000
Rent	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Miscellaneous expenses	500	500	500	500	500	500	500
Commission (1% of sales)	300	520	500	750	900	350	250
Total	41,200	40,520	58,000	69,250	30,900	22,350	22,250
(c) Surplus/(deficiency) [a – b]	(15,200)	(7,320)	(11,680)	(13,770)	41,100	53,050	23,950
Beginning balance	20,500	10,000	10,000	10,000	10,000	13,700	15,000
Ending balance (deficiency)	5,300	2,680	(1,680)	(3,770)	51,100	66,750	38,950
Borrowing required (minimum cash balance + deficiency – surplus)	4,700	7,320	11,680	13,700	—	—	—
Repayment made	—	—	—	—	37,400	—	—
Investment in securities	—	—	—	—	—	51,750	23,950
Closing balance (actually now estimated)	10,000	10,000	10,000	10,000	13,700	15,000	15,000

Working Notes

Payment to creditors

Particulars	*April*	*May*	*June*	*July*	*August*	*Sept.*	*Oct.*	*Nov.*
Sales (Rs)	30,000	52,000	50,000	75,000	90,000	35,000	25,000	25,000 (assumed)
Cost of goods to be purchased (70% of next month's sales and paid) (Rs)	36,400	35,000	52,500	63,000	24,500	17,500	17,500	—

P.12.9 Prepare cash budget for January-June from the following information:

(i) The estimated sales and expenses are as follows:

Particulars	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*
Sales (Rs)	2,00,000	2,20,000	1,20,000	1,00,000	1,50,000	2,40,000	2,00,000	2,00,000
Wages and salaries (Rs)	30,000	30,000	24,000	24,000	24,000	30,000	27,000	27,000
Miscellaneous expenses (Rs)	27,000	27,000	21,000	30,000	24,000	27,000	27,000	27,000

(ii) 20 per cent of the sales are on cash and balance on credit.

(iii) The firm has a gross margin of 25 per cent on sales.

(iv) 50 per cent of the credit sales are collected in the month following the sales, 30 per cent in the second month and 20 per cent in the third month.

(v) Material for the sale of each month is purchased one month in advance on a credit for two months.

(vi) The time-lag in the payment of wages and salaries is one-third of a month and of miscellaneous expenses, one month.

(vii) Debentures worth Rs 40,000 were sold in January.

(viii) The firm maintains a minimum cash balance of Rs 40,000. Funds can be borrowed @ 12 per cent per annum in the multiples of Rs 1,000, the interest being payable on monthly basis.

(ix) Cash balance at the end of December is Rs 60,000.

SOLUTION

Cash budget (January-June) (Amount in thousands of rupees)

Particulars	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*
(a) *Cash inflows*						
Cash sales (20% of total sales)	24	20	30	48	40	40
Collection from debtors:						
– 50% in the month following	88	48	40	60	96	80
– 30% in the second month	48	52.8	28.8	24	36	57.6
– 20% in the third month	—	32.0	35.2	19.2	16	24
Issue of debentures	40	—	—	—	—	—
Total	200	152.8	134.0	151.2	188	201.6
(b) *Cash outflows*						
Payment to creditors (working notes 1)	165	90	75	112.5	180	150
Wages and salaries						
1/3 of last month	10	8	8	8	10	9
2/3 of current month	16	16	16	20	18	18
Miscellaneous expenses (one month's time-lag)	27	21	30	24	27	27
Total	218	135	129	164.5	235	204
(c) Cash surplus/deficiency) [a – b]	(18)	17.8	5	(13.3)	(47)	(2.4)
Beginning balance	60	42	59.8	64.8	51.5	40.5
Ending balance (indicated)	42	59.8	64.8	51.5	4.5	38.1
Payment of interest	—	—	—	—	—	0.36
Borrowings required	—	—	—	—	36.0	3.0
Ending balance (actual estimated)	42	59.8	64.8	51.5	40.5	40.74

Working Notes

1. Determination of interest: $\text{Rs } 36{,}000 \times \frac{12}{100} \times \frac{1}{12} = \text{Rs } 360$

2. Payment to creditors (amount in thousands of rupees)

Particulars	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*
Sales	200	220	120	100	150	240	200	200
Purchase (75% of sales as 25% is gross margin)	150	165	90	75	112.5	180	150	150
Purchases (one month in advance)	165	90	75	112.5	180	150	150	NA
Payments (two month's time-lag)	—	—	165	90	75	112.5	180	150

P.12.10 Prepare the cash budget for July-December from the following information:

(i) The estimated sales, expenses, etc. are as follows: (Rs Lakh)

	June	*July*	*August*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Sales	35	40	40	50	50	60	65
Purchases	14	16	17	20	20	25	28
Wages and salaries	12	14	14	18	18	20	22
Miscellaneous expenses	5	6	6	6	7	7	7
Interest received	2	—	—	2	—	—	2
Sale of shares	—	—	20	—	—	—	—

(ii) 20 per cent of the sales are on cash and the balance on credit.

(iii) 1 per cent of the credit sales are returned by the customers; 2 per cent debts are uncollectible; 50 per cent of the good accounts receivable are collected in the month of the sales and the rest during next month.

(iv) The time-lag in payment of miscellaneous expenses and purchase is one month. Wages and salaries are paid fortnightly with a time-lag of 15 days.

(v) The company keeps a minimum cash balance of Rs 5 lakhs. Cash in excess of Rs 7 lakh is invested in government securities in multiples of Rs 1 lakh. Shortfalls in the minimum cash balance are made good by borrowings from the banks. Ignore interest received and paid.

SOLUTION

Cash budget for the month of July-December (Amount in lakhs of rupees)

Particulars	*July*	*August*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
(a) Cash inflows						
Cash sales	8.00	8.00	10.00	10.00	12.00	13.00
Collection from debtors (see working notes)	29.10	31.05	34.93	38.81	42.69	48.51
Interest received	—	—	2.00	—	—	2.00
Sale of shares	—	20.00	—	—	—	—
Total	37.10	59.05	46.93	48.81	54.69	63.51
(b) *Cash outflows*						
Payment to suppliers (1 month time-lag)	14.00	16.00	17.00	20.00	20.00	25.00
Miscellaneous expenses (1 month time-lag)	5.00	6.00	6.00	6.00	7.00	7.00
Wages and salaries: (time-lag of 15 days)						
Paid for the previous month (50%)	6.00	7.00	7.00	9.00	9.00	10.00
Paid for the current month (50%)	7.00	7.00	9.00	9.00	10.00	11.00
Total	32.00	36.00	39.00	44.00	46.00	53.00
(c) Surplus/(deficiency) [(a) – (b)]	5.10	23.05	7.93	4.81	8.69	10.51
Beginning balance	5.00	7.10	7.15	7.08	7.89	7.58
Closing balance (indicated)	10.10	30.14	15.08	11.89	16.58	18.09
Investment in Government securities	3.00	23.00	8.00	4.00	9.00	11.00
Closing balance (now actually estimated)	7.10	7.15	7.08	7.89	7.58	7.09

Working Notes

(1) Collection from debtors (amount in lakhs of rupees)

Particulars	*June*	*July*	*August*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Sales	35	40	40	50	50	60	65
Less cash sales (20%)	7	8	8	10	10	12	13
Credit sales	28	32	32	40	40	48	52
less return (1%)	0.28	0.32	0.32	0.40	0.40	0.48	0.52
Net credit sales	27.72	31.68	31.68	39.60	39.60	47.52	51.48
Less bad debts (2%)	0.55	0.63	0.63	0.79	0.79	0.95	1.03
Good accounts receivable	27.17	31.05	31.05	38.81	38.81	46.57	50.45
Collections							
50% in the month of sale	13.59	15.52	15.52	19.40	19.40	23.28	25.22
50% in the next month	—	13.58	15.53	15.53	19.41	19.41	23.29
	13.59	29.10	31.05	34.93	38.81	42.69	48.51

P.12.11 P Co. has to make payment of Rs 2 million on 16th April. It has a surplus money today i.e. 15th January and the company has decided to invest in certificate of deposit (CD's) of a leading nationalized bank at 8.00 per cent per annum What money is required to be invested now? Take year as 365 days.

SOLUTION

Amount required to make payment on 16th April Rs 2 million
Let amount invested in Certificates of Deposit for 91 days on 15th January be Rs x
Rate of interest 8 per cent per annum
Based on these facts, the equation is

$$\text{Rs } x\left(1+\frac{0.08\times 91}{365}\right)=\text{Rs } 20,00,000$$

or 1.0199452 x = Rs 20,00,000

$$x=\frac{\text{Rs } 20,00,000}{1.0199452}=\text{Rs } 19,60,890$$

Therefore, the company is advised to invest Rs 19,60,890 on 15th January in Certificate of Deposit for 91 days in order to receive Rs 2 million on 16th April to make payment.

P.12.12 The annual cash requirement of A Ltd is Rs10 lakh. The company has marketable securities in lot sizes of Rs 50,000, Rs 1,00,00, Rs 2,00,000, Rs 2,50,000 and Rs 5,00,000. Cost of conversion of marketable securities per lot is Rs 1,000. The company can earn 5 per cent yield on its securities.

You are required to prepare a table indicating which lot size will have to be sold by the company.

Also, show that economic lot size can be obtained by the Baumol Model.

SOLUTION

(a) Table showing lot size of marketable securities

1. Total annual cash requirement (Rs)	10,00,000	10,00,000	10,00,000	10,00,000	10,00,000
2. Lot size (Rs)	50,000	1,00,000	2,00,000	2,50,000	5,00,000
3. Number of lots (1 ÷ 2)	20	10	5	4	2
4. Conversion cost per lot (Rs)	1,000	1,000	1,000	1,000	1,000
5. Total conversion cost (3 × 4) (Rs)	20,000	10,000	5,000	4,000	2,000
6. Average lot size (Rs)	25,000	50,000	1,00,000	1,25,000	2,50,000
7. Interest cost (Average lot size × 0.05) (Rs)	1,250	2,500	5,000	6,250	12,500
8. Total cost (5 + 7) (Rs)	21,250	12,500	10,000	10,250	14,500

Economic lot size = Rs 2,00,000 as at this size the total costs are minimum.

(b) Baumol Model $\sqrt{\frac{2bt}{i}}$

where b = Cost per conversion
t = Total cash transaction needs for the period (year)
i = Interest rate that could be earned.

$$= \sqrt{\frac{2 \times \text{Rs}\,1{,}000 \times \text{Rs}\,10{,}00{,}000}{0.05}} = \text{Rs}\ 2{,}00{,}000.$$

REVIEW QUESTIONS

RQ.12.1 What are the principal motives for holding cash?
RQ.12.2 What are the objectives of cash management?
RQ.12.3 Briefly explain the factors that determine the cash needs of a firm. Give examples to illustrate the short, long and procurement costs.
RQ.12.4 Discuss the utility of cash budget as a tool of cash management. What are the steps involved in the construction of a cash budget.
RQ.12.5 What are the basic strategies of efficient cash management? Illustrate with suitable examples the effect of these on the operating cash requirements of a firm.
RQ.12.6 What is the significance of speedy receivables collection? In this context briefly explain concentration banking and lock-box system.
RQ.12.7 What specific strategies can be adopted to slow disbursements of accounts payable?
RQ.12.8 Explain and contrast deposit float and payment float.
RQ.12.9 Distinguish between concentration banking and lock-box system.
RQ.12.10 ABC Ltd produces a single product that sells for Rs 75 per unit. Cost data is:

(a) Variable manufacturing costs are Rs 35 per unit.
(b) Variable selling and administrative expenses are Rs 5 per unit.
(c) Fixed manufacturing costs requiring cash are Rs 2,50,000 per month. Fixed selling and administrative expenses are Rs 2,00,000 per month, all requiring cash. Depreciation is Rs 60,000 per month.
(d) Other relevant data are:
    (1) The firm has a policy of maintaining a 2-months supply of finished products. The opening inventory (January, 1) is 42,000 units.
    (2) The firm does not hold raw materials inventory, and purchases raw materials as needed. The cost of raw materials is included in the variable manufacturing cost of Rs 35.
    (3) The firm has a practice of making all sales on credit, collecting 30 per cent in the month of sale and the balance in the following month. There are no bad debts and overdue accounts. The beginning debtors balance is Rs 7,00,000.
    (4) The firm pays all manufacturing costs in the month of production.
    (5) The firm pays four-fifths of selling and administrative expenses in the month of sale, and the balance one-fifth is paid in the following month. On January 1, the firm owed Rs 30,000 for December expenses.
    (6) The minimum desired cash balance is Rs 80,000, which is also the amount the firm has on January 1. Borrowings are possible and can be made in multiples of Rs 10,000. It must borrow at the beginning of a month and repay at the end if sufficient cash is available. The interest rate is 10 per cent and the firm pays interest when it repays loans, or portions of them.
    (7) The sales budget for the first 6 months (in units) is: January, 20,000; February, 26,000; March, 30,000; April, 32,000; May, 30,000; June, 28,000.

You are required to prepare a cash budget for the first 3 months of the year, month-wise and in total.

SOLUTION

Cash budget — 3 months

Particulars	*January*	*February*	*March*	*Total*
Sales	Rs 1,50,000	Rs 19,50,000	Rs 22,50,000	Rs 57,00,000
(A) *Cash inflows*:				
Beginning balance	80,000	80,000	81,000	80,000
Collection from sales:				
(i) Current month (0.30 × total sales)	4,50,000	5,85,000	6,75,000	17,10,000
(ii) First month following sales (0.70 × sales)	7,00,000	10,50,000	13,65,000	31,15,000
Total cash receipts	12,30,000	17,15,000	21,21,000	49,05,000
(B) *Cash outflows*:				
Production costs (see production budget)	14,40,000	13,70,000	13,00,000	41,10,000
Selling and administrative expenses (fixed)	2,00,000	2,00,000	2,00,000	6,00,000
Selling and administrative expenses (variable):				
(i) Current month (0.80)	80,000	1,04,000	1,20,000	3,04,000
(ii) 1 month after (0.20)	30,000	20,000	26,000	76,000
Total cash payments	17,50,000	16,94,000	16,46,000	50,90,000
(C) *Surplus (deficiency):* indicated	(5,20,000)	21,000	4,75,000	(1,85,000)
Minimum desired balance	80,000	80,000	80,000	80,000
Surplus/(deficiency)	(6,00,000)	(59,000)	3,95,000	(2,65,000)
Borrowings	6,00,000	60,000		6,60,000
Repayments made (principal)			3,80,000	3,80,000
Interest*			9,500	9,500
Ending balance	80,000	81,000	85,500	85,500

*(Rs 38,00,000 × 0.10) × 3/12

Working Notes

Purchase budget

Particulars	*January*	*February*	*March*	*Total*
Desired ending inventory (units)	56,000	62,000	62,000	62,000
Plus cost of goods sold	20,000	26,000	30,000	76,000
Total requirements	76,000	88,000	92,000	1,38,000
Less beginning inventory	42,000	56,000	62,000	42,000
Production inventory	34,000	32,000	30,000	96,000
Production costs at Rs 35 per unit:				
(Variable)	Rs 11,90,000	Rs 11,20,000	Rs 10,50,000	Rs 33,60,000
(Fixed)	2,50,000	2,50,000	2,50,000	7,50,000
Total production cost	14,40,000	13,70,000	13,00,000	41,10,000

RQ.12.11 A firm is contemplating various actions, each of which will have different effects on the average age of inventory, accounts receivables and accounts payable. Which of the following 4 plans is better if the changes indicated below are expected?

Plan	Change in average age		
	Inventory (days)	Accounts receivable (days)	Accounts payable (days)
A	+ 30	– 20	+ 35
B	–10	0	–20
C	0	–30	+ 5
D	–15	+ 10	+ 15

SOLUTION

Change in cash cycle

Plan	Change in average age			Total change + (increase) – (decrease) (days)
	Inventory (days)	Debtors (days)	Creditors (days)	
A	+ 30	–20	+ 35	–25
B	–10	0	–20	+ 10
C	0	–30	+ 5	–35
D	–15	+ 10	+ 15	–20

Plans A and C are better than other plans (B, D) because they reduce the cash cycle by 25 days. Between plans A and C, plan C should be preferred because in plan A, the average age of inventory increases by 30 days, whereas in plan C, there is no increase at all; carrying the inventory also involves costs other than interest.

RQ.12.12 The following information is available about a firm:

(a) On an average, accounts receivable are collected after 80 days; inventories have an average of 100 days and accounts payable are paid approximately 60 days after they arise.

(b) The firm spends a total of Rs 1,81,20,000 annually at a constant rate.

(c) It can earn 8 per cent on investments.

Calculate: (i) the firm's cash cycle and cash turnover assuming a 360-days year; (ii) minimum amount of cash to be maintained to meet payments as they become due; (iii) savings by reducing the average age of inventories to 70 days.

SOLUTION

(i) (a) Cash cycle: 80 days + 100 days – 60 days = 120 days

(b) Cash turnover = 360 ÷ 120 days = 3

(ii) Minimum operating cash = Total operating annual outlay/Cash turnover = Rs 1,81,20,000 ÷ 3 = Rs 60,40,000

(iii) Cash cycle = 120 days – 10 days = 110 days

Cash turnover = 360/110 = 3.273

Minimum operating cash = Rs 1,81,20,000/3.273 = Rs 55,36,713

Reduction in investment = (Rs 60,40,000 – Rs 55,36,713) = Rs 5,03,287

Savings = 0.08 × Rs 5,03,287 = Rs 40,263.

RQ.12.13 Hypothetical Ltd uses a continuous billing system that results in an average daily receipt of Rs 40,00,000. It is contemplating the institution of concentration banking, instead of the current system of centralised billing and collection. It is estimated that such a system would reduce the collection period of accounts receivable by 2 days.

Concentration banking would cost Rs 75,000 annually, and 8 per cent can be earned by the firm on its investments. It is also found that a lock-box system could reduce it overall collection time by 4 days and would cost annually Rs 1,20,000.

(i) How much would cash be released with the concentration banking system?

(ii) How much money can be saved due to reduction in the collection period by 2 days? Should the firm institute the concentration banking system?

(iii) How much would cash be freed by lock-box system?
(iv) How much can be saved with lock-box?
(v) Between concentration banking and lock-box system, which is better?

SOLUTION

(i) Cash released by the concentration banking system = Rs 40,00,000 × 2 days = Rs 80,00,000.
(ii) Savings = 0.08 × Rs 80,00,000 = Rs 6,40,000.
The firm should institute concentration banking system. It costs only Rs 75,000 while the expected savings are Rs 6,40,000.
(iii) Cash released by the lock-box system = Rs 40,00,000 × 4 days = Rs 1,60,00,000.
(iv) Savings in lock-box system: 0.08 × Rs 1,60,00,000 = Rs 12,80,000.
(v) Lock-box system is better. Its net savings, Rs 11,60,000 (Rs 12,80,000 – Rs 1,20,000) are higher *vis-a-vis* of concentration banking.

RQ.12.14 The undermentioned facts about XYZ Ltd are available:
(a) Cash turnover rate is 4.5.
(b) Annual cash outflow is Rs 1,75,000, and
(c) Accounts payable can be stretched by 20 days.

(i) What would be the effect of stretching accounts payable on the minimum operating cash requirements? (ii) Assuming the firm can earn 8 per cent on its investment, what would be the saving on cost?

SOLUTION

(i) Cash cycle = 360 days/4.5 = 80 days (present). Cash cycle, when accounts payables can be stretched by 20 days, would be 60 days. Cash turnover would be 6.
Minimum operating cash requirement:
(a) Current = Rs 1,75,000/4.5 = Rs 38,889
(a) Proposed = Rs 1,75,000/6 = Rs 29,166
(ii) Reduction in investment: (Rs 38,889 – 29,166) = Rs 9,723
Savings in cost = 0.08 × Rs 9,723 = Rs 777.84.

EXAMINATION QUESTIONS

EQ. 12.1 Enumerate the activities which are covered by treasury management. (*CA—November, 2002*)
EQ. 12.2 Write short notes on Willian J Baumal vs. Miller-Orr cash management model. (*CA—May, 2004*)
EQ. 12.3 Write short note on Miller-Orr cash management model. (*CA—May, 2006*)

13 Receivables Management

Introduction

In the preceding chapter, which was devoted to an in-depth examination of one of the most important components of current assets, that is,cash, it was observed that a basic strategy to reduce the operating cash requirement of a firm is to accelerate the collection of receivables so as to reduce the average collection period. The receivables represent an important component of the current assets of a firm. The purpose of the present chapter is to analyse the important dimensions of the efficient management of receivables within the framework of a firm's objectives of value maximisation. Section 1, discusses the objectives of receivables management. This is followed by an in-depth analysis of the three crucial aspects of management of receivables. Section 2 examines the first aspect, that is, Credit Policies, which have two dimensions: (i) credit standard defined as the criteria to determine to whom credit should be extended; and (ii) credit analysis. This section evaluates policies regarding both these aspects. The second major part of receivables management is Credit Terms comprising (i) cash discount, (ii) cash discount period, and (iii) credit period. This is extensively spelt out in Section 3. Section 4 is concerned with the third major component of receivables management, Collection Policies, that is, the types and degree of effort made to collect receivables from customers. The factoring services as a receivables collection/management strategy are illustrated in Section 5. Finally, the last section summarises the main points.

OBJECTIVES

The term receivables is defined as 'debt owed to the firm by customers arising from sale of goods or services in the ordinary course of business'.[1] When a firm makes an ordinary sale of goods or services and does not receive payment, the firm grants trade credit and creates accounts receivable which could be collected in the future. Receivables management is also called *trade credit management*. Thus, accounts receivable represent an extension of credit to customers, allowing them a reasonable period of time in which to pay for the goods received.

The sale of goods on credit is an essential part of the modern competitive economic systems. In fact, credit sales and, therefore, receivables, are treated as a marketing tool to aid the sale of goods. The credit sales are generally made on open account in the sense that there are no formal acknowledgements of debt obligations through a financial instrument. As a marketing tool, they are intended to promote sales and thereby profits. However, extension of credit involves risk and cost. Management should weigh the benefits as well as cost to determine the goal of receivables management. The objective of receivables management is 'to promote sales and profits *until* that point is reached where the return on investment in further funding receivables is less than the cost of funds raised to finance that additional credit (i.e. cost of capital)'.[2] The specific costs and benefits which are relevant to the determination of the objectives of receivables management are examined below.

Costs

The major categories of costs associated with the extension of credit and accounts receivable are: (i) collection cost, (ii) capital cost, (iii) delinquency cost, and (iv) default cost.

Collection Cost Collection costs are administrative costs incurred in collecting the receivables from the customers to whom credit sales have been made. Included in this category of costs are: (a) additional expenses on the creation and maintenance of a credit department with staff, accounting records, stationery, postage and other related items; (b) expenses involved in acquiring credit information either through outside specialist agencies or by the staff of the firm itself. These expenses would not be incurred if the firm does not sell on credit.

Capital Cost The increased level of accounts receivable is an investment in assets. They have to be financed thereby involving a cost. There is a time-lag between the sale of goods to, and payment by, the customers. Meanwhile, the firm has to pay employees and suppliers of raw materials, thereby implying that the firm should arrange for additional funds to meet its own obligations while waiting for payment from its customers. The cost on the use of additional capital to support credit sales, which alternatively could be profitably employed elsewhere, is, therefore, a part of the cost of extending credit or receivables.

Delinquency Cost This cost arises out of the failure of the customers to meet their obligations when payment on credit sales become due after the expiry of the credit period. Such costs are called delinquency costs. The important components of this cost are: (i) blocking-up of funds for an extended period, (ii) cost associated with steps that have to be initiated to collect the overdues, such as, reminders and other collection efforts, legal charges, where necessary, and so on.

Default Cost Finally, the firm may not be able to recover the overdues because of the inability of the customers. Such debts are treated as bad debts and have to be written off as they cannot be realised. Such costs are known as default costs associated with credit sales and accounts receivable.

Benefits

Apart from the costs, another factor that has a bearing on accounts receivable management is the *benefit* emanating from credit sales. *The benefits are the increased sales and anticipated profits because of a more liberal policy.* When firms extend trade credit, that is, invest in receivables, they intend to increase the sales. The impact of a liberal trade credit policy is likely to take two forms. First, it is oriented to sales expansion.

In other words, a firm may grant trade credit either to increase sales to existing customers or attract new customers. This motive for investment in receivables is growth-oriented. Secondly, the firm may extend credit to protect its current sales against emerging competition. Here, the motive is sales-retention. As a result of increased sales, the profits of the firm will increase.

From the above discussion, it is clear that investments in receivables involve both benefits and costs. The extension of trade credit has a major impact on sales, costs and profitability. Other things being equal, a relatively liberal policy and, therefore, higher investments in receivables, will produce larger sales. However, costs will be higher with liberal policies than with more stringent measures. Therefore, accounts receivable management should aim at a trade-off between profit (benefit) and risk (cost). That is to say, *the decision to commit funds to receivables (or the decision to grant credit) will be based on a comparison of the benefits and costs involved, while determining the optimum* level *of receivables. The costs and benefits to be compared are marginal costs and benefits.* The firm should only consider the incremental (additional) benefits and costs that result from a change in the receivables or trade credit policy.[3]

While it is true that general economic conditions and industry practices have a strong impact on the level of receivables, a firm's investments in this type of current assets is also greatly affected by its internal policy. A firm has little or no control over environmental factors, such as economic conditions and industry practices. But it can improve its profitability through a properly conceived trade credit policy or receivables management.

CREDIT POLICIES

In the preceding discussions it has been clearly shown that the firm's objective with respect to receivables management is not merely to collect receivables quickly but attention should also be given to the benefit-cost trade-off involved in the various areas of accounts receivable management. The first decision-area is Credit Policies.

The credit policy of a firm provides the framework to determine (a) whether or not to extend credit to a customer and (b) how much credit to extend. The credit policy decision of firm has two broad dimensions: (i) Credit standards and (ii) Credit analysis. A firm has to establish and use *standards* in making credit decisions, develop appropriate sources of credit information and methods of credit analysis. We illustrate below how these two aspects are relevant to the accounts receivable management of a firm.

Credit Standards

The term credit standards represents the basic criteria for the extension of credit to customers. The quantitative basis of establishing credit standards are factors such as credit ratings, credit references, average payments period and certain financial ratios.[4] Since we are interested in illustrating the trade-off between benefit and cost to the firm as a whole, we do not consider here these individual components of credit standards. To illustrate the effect, we have divided the overall standards into (a) tight or restrictive, and (b) liberal or non-restrictive. That is to say, *our aim is to show what happens to the trade-off when standards are relaxed or, alternatively, tightened.* The trade-off with reference to credit standards covers (i) the collection cost, (ii) the average collection period/investment in accounts receivable, (iii) level of bad debt losses, and (iv) level of sales. These factors should be considered while deciding whether to relax credit standards or not. If standards are relaxed, it means more credit will be extended while if standards are tightened, less credit will be extended. The implications of the four factors are elaborated below.

Collection Costs The implications of relaxed credit standards are (i) more credit, (ii) a large credit department to service accounts receivable and related matters, (iii) increase in collection costs. The effect of tightening of credit standards will be exactly the opposite. These costs are likely to be semi-variable. This is because upto a certain point the existing staff will be able to carry on the increased workload, but beyond that, additional staff would be required. These are assumed to be included in the variable cost per unit and need not be separately identified.

Investments in Receivables or the Average Collection Period The investment in accounts receivable involves a capital cost as funds have to be arranged by the firm to finance them till customers make payments. Moreover, the higher the average accounts receivable, the higher is the capital or carrying cost. A change in the credit standards–relaxation or tightening–leads to a change in the level of accounts receivable either (a) through a change in sales, or (b) through a change in collections.

A relaxation in credit standards, as already stated, implies an increase in sales which, in turn, would lead to higher average accounts receivable. Further, relaxed standards would mean that credit is extended liberally so that it is available to even less *credit-worthy* customers who will take a longer period to pay overdues. The extension of trade credit to slow-paying customers would result in a higher level of accounts receivable.

In contrast, a tightening of credit standards would signify (i) a decrease in sales and lower average accounts receivable, and (ii) an extension of credit limited to more credit-worthy customers who can promptly pay their bills and, thus, a lower average level of accounts receivable.

Thus, a change in sales and change in collection period together with a relaxation in standards would produce a higher carrying costs, while changes in sales and collection period result in lower costs when credit standards are tightened. These basic reactions also occur when changes in credit terms or collection procedures are made. We have discussed these in the subsequent sections of this chapter.

Bad Debt Expenses Another factor which is expected to be affected by changes in the credit standards is bad debt (default) expenses. They can be expected to increase with relaxation in credit standards and decrease if credit standards become more restrictive.

Sales Volume Changing credit standards can also be expected to change the volume of sales. As standards are relaxed, sales are expected to increase; conversely, a tightening is expected to cause a decline in sales.

The basic changes and effects on profits arising from a relaxation of credit standards are summarised in Exhibit 13.1. If the credit standards are tightened, the opposite effects, as shown in the brackets, would follow.

EXHIBIT 13.1 *Effect of Relaxation of Standards*

Item	*Direction of Change (Increase = I Decrease = D)*	*Effect on Profits (Positive + Negative –)*
1. Sales Volume	I(D)	+(–)
2. Average Collection Period	I(D)	–(+)
3. Bad Debt	I(D)	–(+)

The effect of alternative credit standards is illustrated in Example 19.1.

EXAMPLE 13.1

A firm is currently selling a product @ Rs 10 per unit. The most recent annual sales (all credit) were 30,000 units. The variable cost per unit is Rs .6 and the average cost per unit, given a sales volume of 30,000 units, is Rs 8. The total fixed cost is Rs 60,000. The average collection period may be assumed to be 30 days.

The firm is contemplating a relaxation of credit standards that is expected to result in a 15 per cent increase in units sales; the average collection period would increase to 45 days with no change in bad debt expenses. It is also expected that increased sales will result in additional net working capital to the extent of Rs 10,000. The increase in collection expenses may be assumed to be negligible. The required return on investment is 15 per cent.

Should the firm relax the credit standard?

SOLUTION

The decision to put the proposed relaxation in the credit standards into effect should be based on a comparison of (i) additional profits on sales and (ii) cost of the incremental investments in receivables. If the former exceeds the latter, the proposal should be implemented, otherwise not.

Profit on Incremental Sales This can be computed in two ways: (i) long approach, and (ii) short-cut-method.

Long Approach According to this approach, the costs and profits on both the present and the proposed sales level are calculated and the difference in profit at the two levels will be the incremental profit. This is shown in Table 13.1.

Table 13.1 *Long Method to Calculate Marginal Profits*

(A) Proposed Plan:		
1. Sales revenue (34,500 × units Rs 10)		Rs 3,45,000
2. Less costs:		
(a) Variable (34,500 × Rs 6)	Rs 2,07,000	
(b) Fixed	60,000	2,67,000
3. Profits from sales (I)		78,000
(B) Current Plan:		
1. Sales revenue (30,000 × units Rs 10)		3,00,000
2. Less costs:		
(a) Variable (30,000 × Rs 6)	1,80,000	
(b) Fixed	60,000	2,40,000
3. Profits from sales (II)		60,000
(C) Marginal profits with new plan (I-II):		18,000

Short-Cut Method The profits on sales will increase by an amount equal to the product of the additional units sold and additional profit per unit. Since the 30,000 units representing the current level of sales absorb all the fixed costs, any additional units sold will cost only the variable cost per unit. The marginal profit per unit will be equal to the difference between the sales price per unit (Rs 10) and the variable cost per unit (Rs 6). The marginal profit/contribution margin per unit would, therefore, be Rs 4. The total additional (marginal) profits from incremental sales will be Rs 18,000 (Rs 4,500 × Rs 4).

Cost of Marginal/Incremental Investment in Receivables The second variable relevant to the decision to relax credit standards is the cost of marginal investment in accounts receivable. This cost can be computed by finding the difference between the cost of carrying receivables before and after the proposed relaxation in credit standards. It can be calculated as follows:

(i) *Turnover of accounts receivable*:

$$\text{Proposed plan} = \frac{\text{Number of days in the year}}{\text{Average collection period}} = \frac{360}{45} = 8$$

$$\text{Present plan} = \frac{360}{30} = 12$$

(ii) *Total cost of sales*:

Present plan = Number of units × cost per unit = 30,000 × Rs 8 = Rs 2,40,000

Proposed plan = (30,000 × Rs 8) + (4,500 × Rs 6) = Rs 2,67,000

(iii) *Average investment in accounts receivable*:

Present plan = Rs 2,40,000/12 = Rs 20,000

Proposed plan = Rs 2,67,000/8 = Rs 33,375

(iv) *The cost of marginal investments in accounts receivable*; This is the difference between the average investments in accounts receivable under (i) the proposed plan and (ii) under the present plan. It is calculated as follows:

Average investments with proposed plan	Rs 33,375
Less average investment with present plan	20,000
Marginal investments	13,375

Marginal investments represent the amount of additional funds required to finance incremental accounts receivable if the proposal to relax the credit standards is implemented. The additional cost of Rs 13,375 is the cost of marginal investment in accounts receivable.

$$\text{Given 15 per cent as required return on the investments, the cost} = \frac{\text{Rs } 13,375 \times 15}{100} = \text{Rs } 2,006.25$$

This is an opportunity cost in that the firm would earn this amount from alternative uses if the funds are not tied up in additional accounts receivable.

(v) *Cost of working capital*: Rs 10,000 × 0.15 = Rs 1,500.

In the above illustration, since the additional profits on increased sales as a result of relaxed credit standards (Rs 18,000) is considerably more than the cost of incremental investments in accounts receivable (Rs 2,006.25) and working capital (Rs 1,500), the firm should relax its credit standards. Such an action would lead to an overall increase in the profits of the firm by Rs 14,493.75 (Rs 18,000 – Rs 2,006.25 – Rs 1,500).

The effect of tightening credit standards would be just the opposite and can be illustrated on the above lines.

Credit Analysis

Besides establishing credit standards, a firm should develop procedures for evaluating credit applicants. The second aspect of credit policies of a firm is credit analysis and investigation. Two basic steps are involved in the credit investigation process: (a) obtaining credit information, and (b) analysis of credit information. It is on the basis of credit analysis that the decisions to grant credit to a customer as well as the quantum of credit would be taken.

Obtaining Credit Information The first step in credit analysis is obtaining credit information on which to base the evaluation of a customer. The sources of information, broadly speaking, are (i) internal, and (ii) external.

Internal Usually, firms require their customers to fill various forms and documents giving details about financial operations. They are also required to furnish trade references with whom the firms can have contacts to judge the suitability of the customer for credit. This type of information is obtained from internal sources of credit information. Another internal source of credit information is derived from the records of the firms contemplating an extension of credit. It is likely that a particular customer/applicant may have enjoyed credit facility in the past. In that case, the firm would have information on the behaviour of the applicant(s) in terms of the historical payment pattern. This type of information may not be adequate and may, therefore, have to be supplemented by information from other sources.

External The availability of information from external sources to assess the credit-worthiness of customers depends upon the development of institutional facilities and industry practices. In India, the external sources of credit information are not as developed as in the industrially advanced countries of the world. Depending upon the availability, the following external sources may be employed to collect information.

Financial Statements One external source of credit information is the published financial statements, that is, the balance sheet and the profit and loss account. The financial statements contain very useful information. They throw light on an applicant's financial viability, liquidity, profitability and debt capacity. Although the financial statements do not directly reveal the past payment record of the applicant, they are very helpful in assessing the overall financial position of a firm, which significantly determines its credit standing.

Bank References Another useful source of credit information is the bank of the firm which is contemplating the extension of credit. The *modus operandi* here is that the firm's banker collects the necessary information from the applicant's banks. Alternatively, the applicant may be required to ask his banker to provide the necessary information either directly to the firm or to its bank.

Trade References These refer to the collection of information from firms with whom the applicant has dealings and who on the basis of their experience would vouch for the applicant.

Credit Bureau Reports Finally, specialist *credit bureau* reports from organizations specialising in supplying credit information can also be utilised.

Analysis of Credit Information Once the credit information has been collected from different sources, it should be analysed to determine the credit-worthiness of the applicant. Although there are no established procedures to analyse the information, the firm should devise one to suit its needs. The analysis should cover two aspects: (i) quantitative, and (ii) qualitative.

Quantitative The assessment of the quantitative aspects is based on the factual information available from the financial statements, the past records of the firm, and so on. The first step involved in this type of assessment is to prepare an *Aging Schedule* of the accounts payable of the applicant as well as calculate the average age of the accounts payable. This exercise will give an insight into the past payment pattern of the customer. Another step in analysing the credit information is through a ratio analysis of the liquidity, profitability and debt capacity of the applicant. These ratios should be compared with the industry average. Moreover, trend analysis over a period of time would reveal the financial strength of the customer.

Qualitative The quantitative assessment should be supplemented by a qualitative/subjective interpretation of the applicant's credit-worthiness. The subjective judgement would cover aspects relating to the quality of management. Here, the references from other suppliers, bank references and specialist bureau reports would form the basis for the conclusions to be drawn. In the ultimate analysis, therefore, the decision whether to extend credit to the applicant and what amount to extend will depend upon the subjective interpretation of his credit standing.

CREDIT TERMS

The second decision-area in accounts receivable management is the credit terms. After the credit standards have been established and the credit-worthiness of the customers has been assessed, the management of a firm must determine the terms and conditions on which trade credit will be made available. The stipulations under which goods are sold on credit are referred to as *credit terms*. These relate to the repayment of the amount under the credit sale. Thus, credit terms specify the repayment terms of receivables.

Credit terms have three components: (i) *credit period*, in terms of the duration of time for which trade credit is extended–during this period the overdue amount must be paid by the customer; (b) *cash discount*, if any, which the customer can take advantage of, that is, the overdue amount will be reduced by this amount; and (c) *cash discount period*, which refers to the duration during which the discount can be availed of. These terms are usually written in abbreviations, for instance, '2/10 net 30'. The three numerals are explained below:

- 2 signifies the rate of cash discount (2 per cent), which will be available to the customers if they pay the overdue within the stipulated time;
- 10 represents the time duration (10 days) within which a customer must pay to be entitled to the discount;
- 30 means the maximum period for which credit is available and the amount must be paid in any case before the expiry of 30 days.

In other words, the abbreviation 2/10 net 30 means that the customer is entitled to 2 per cent cash discount (discount rate) if he pays within 10 days (discount period) after the beginning of the credit period (30 days). If, however, he does not want to take advantage of the discount, he may pay within 30 days. If the payment is not made within a maximum period of 30 days, the customer would be deemed to have defaulted.

The credit terms, like the credit standards, affect the profitability as well as the cost of a firm. A firm should determine the credit terms on the basis of cost-benefit trade-off. We illustrate below how the three components of credit terms, namely, rate of discount, period of discount and the credit period, affect the trade-off. It should be noted *that our focus in analysing the credit terms is from the view point of suppliers of trade credit and not the recipients for whom it is a source of financing*.[5]

Cash Discount

The cash discount has implications for the sales volume, average collection period/average investment in receivables, bad debt expenses and profit per unit. In taking a decision regarding the grant of cash discount, the management has to see what happens to these factors if it initiates increase, or decrease in the discount rate. The changes in the discount rate would have both positive and negative effects. The implications of increasing or initiating cash discount are as follows:

1. The sales volume will increase. The grant of discount implies reduced prices. If the demand for the products is elastic, reduction in prices will result in higher sales volume.
2. Since the customers, to take advantage of the discount, would like to pay within the discount period, the average collection period would be reduced. The reduction in the collection period would lead to a reduction in the investment in receivables as also the cost. The decrease in the average collection period would also cause a fall in bad debt expenses. As a result, profits would increase.
3. The discount would have a negative effect on the profits. This is because the decrease in prices would affect the profit margin per unit of sale.

The effects of increase in the cash discount are summarised in Table 13.2. The effect of decrease in cash discount will be exactly opposite.

Table 13.2 *Effects of Increase in Cash Discounts*

Item	*Direction of Change (I = Increase D = Decrease)*	*Effect on Profits (Positive+ or Negative-)*
Sales Volume	I	+
Average Collection Period	D	+
Bad Debt Expenses	D	+
Profit Per Unit	D	–

The cash discount decision is illustrated in Example 13.2.

EXAMPLE 13.2

Assume that the firm in our Example 15.1 is contemplating to allow 2 per cent discount for payment within 10 days after a credit purchase. It is expected that if discounts are offered, sales will increase by 15 per cent and the average collection period will drop to 15 days. Assume bad debt expenses will not be affected; return on investment expected by the firm is 15 per cent; 60 per cent of the total sales will be on discount. Should the firm implement the proposal?

SOLUTION

(i) *Profit on sales*: The profit on sale = sale of additional units multiplied by the difference between the sales price and the variable cost per unit = 4,500 (Rs 10 – Rs 6) = 4,500 × Rs 4 = Rs 18,000

(ii) *Saving on average collection period*: This saving is what would have been earned on the reduced investments in accounts receivable as a result of the cash discount. Average investment in accounts

$$\text{receivable} = \frac{\text{Cost of sales}}{\text{Receivables turnover}}$$

$$\text{(a) Present plan (without discount)} = \frac{(30{,}000 \times \text{Rs } 8)}{12\ (\text{i.e.}\ 360/30)} = \text{Rs } 20{,}000$$

$$\text{(b) Proposed plan (with discount)} = \frac{(30{,}000 \times \text{Rs } 8) + (4{,}500 \times \text{Rs } 6)}{24\ (\text{i.e. } 360/15)} = \frac{\text{Rs } 2{,}67{,}000}{24} = \text{Rs } 11{,}125$$

Thus, if cash discount is allowed, the average investments in receivables will decline by Rs 8,875 (i.e. Rs 20,000 – Rs 11,125). Given a 15 per cent rate of return, the firm could earn Rs 1,331.25 on Rs 8,875. Thus, the saving resulting from a drop in the average collection period is Rs 1,331.25.

(iii) *The total benefits associated with the cash discount*:

Profit on additional sale	Rs 18,000.00
Saving in cost	1,331.25
Total	19,331.25

(iv) *Cash discount*: The cost involved in the cash discount on credit sales, that is, 2 per cent of credit sales = 0.02 × Rs 2,07,000 (i.e. 0.60 × Rs 3,45,000) = Rs 4,140

Thus, against a cost of Rs 4,140, the benefit from initiating cash discount is Rs 19,331.25; that is, there is a net gain of Rs 15,191.25 (Rs 19,331.25 – Rs 4,140). The firm should, therefore, implement the proposal to allow 2 per cent cash discount for payment within 10 days of the credit purchase by the customers.

A similar type of analysis can be made to illustrate the effect of either reduction or elimination of cash discount.

Credit Period

The second component of credit terms is the credit period. The expected effect of an increase in the credit period is summarised in Table 13.3.

Table 13.3 *Effect of Increase in Credit Period*

Item	*Direction of Change (I = Increase D = Decrease)*	*Effect on Profits (Positive or Negative)*
Sales Volume	I	+
Average Collection Period	I	–
Bad Debt Expenses	I	–

A reduction in the credit period is likely to have an opposite effect. The credit period decision is illustrated in Example 13.3.

EXAMPLE 13.3

Suppose, a firm is contemplating an increase in the credit period from 30 to 60 days. The average collection period which is at present 45 days is expected to increase to 75 days. It is also likely that the bad debt expenses will increase from the current level of 1 per cent to 3 per cent of sales. Total credit sales are expected to increase from the level of 30,000 units to 34,500 units. The present average cost per unit is Rs 8, the variable cost and sales per unit is Rs 6 and Rs 10 per unit respectively. Assume the firm expects a rate of return of 15 per cent.

Should the firm extend the credit period?

SOLUTION

(i) *Profit on additional sales*: = (Rs 4 × 4,500) = Rs 18,000

(ii) *Cost of additional investments in receivables*: = Average investments with the proposed credit period less average investments in receivables with the present credit period:

$$\text{Proposed plan} = \frac{\text{Cost of sales}}{\text{Turnover of receivalues}} = \frac{(\text{Rs } 8 \times 30,000) + (\text{Rs } 6 \times 4,500)}{360 \div 75} = \text{Rs } 55,625$$

$$\text{Present plan} = \frac{(\text{Rs } 8 \times 30,000)}{360 \div 45} = \text{Rs } 30,000$$

Additional investment in accounts receivable = Rs 55,625 – Rs 30,000 = Rs 25,625
Cost of additional investment at 15 per cent = 0.15 × Rs 25,625 = Rs 3,843.75.

(iii) *Additional bad debt expenses*: This is the difference between the bad debt expenses with the proposed and present credit periods.
Bad debt with proposed credit period = 0.03 × Rs 3,45,000 = Rs 10,350
Bad debt with present credit period = 0.01 × Rs 3,00,000 = Rs 3,000
Additional bad debt expense = (Rs 10,350 – Rs 3,000) = Rs 7,350

Thus, the incremental cost associated with the extension of the credit period is Rs 11,193.75 (Rs 3,843.75 + Rs 7,350). As against this, the benefits are Rs 18,000. There is, therefore, a net gain of Rs 6,806.25, that is, (Rs 18,000 – Rs 11,193.75). The firm would be well-advised to extend the credit period from 30 to 60 days.

The effect of a decrease in the credit period can be similarly analysed.

COLLECTION POLICIES

The third area involved in the accounts receivable management is collection policies. They refer to the procedures followed to collect accounts receivable when, after the expiry of the credit period, they become due. These policies cover two aspects: (i) degree of effort to collect the overdues, and (ii) type of collection efforts.

Degree of Collection Effort

To illustrate the effect of the collection effort, the credit policies of a firm may be categorised into (i) strict/light, and (ii) lenient. The collection policy would be tight if very rigorous procedures are followed. A tight collection policy has implications which involve benefits as well costs. The management has to consider a trade-off between them. Likewise, a lenient collection effort also affects the cost-benefit trade-off. The effect of tightening the collection is discussed below.

In the first place, the bad debt expenses (default cost) would decline. Moreover, the average collection period will be reduced. As a result of these two effects, the firm will benefit and its profits will increase. But, there would be a negative effects also. A very rigorous collection strategy would involve increased collection costs. Yet another negative effect may be in the form of a decline in the volume of sales. This may be because some customers may not like the pressure and intense efforts initiated by the firm, and may switch to other firms. These effects are tabulated in Table 13.4.

Table 13.4 *Basic Trade-off from Tight Collection Effort*

Item	*Direction of Change (I = Increase D = Decrease)*	*Effect on Profits [Positive (+) or Negative (–)*
Bad Debt Expenses	D	+
Average Collection Period	D	+
Sales Volume	D	–
Collection Expenditure	I	–

The effect of the lenient policy will be just the opposite. We illustrate the basic trade-off in Example 13.4.

EXAMPLE 13.4

A firm is contemplating stricter collection policies. The following details are available:

1. At present, the firm is selling 36,000 units on credit at a price of Rs 32 each; the variable cost per unit is Rs 25 while the average cost per unit is Rs 29; average collection period is 58 days; and collection expenses amount to Rs 10,000; bad debts are 3 per cent.
2. If the collection procedures are tightened, additional collection charges amounting to Rs 20,000 would be required, bad debts will be 1 per cent; the collection period will be 40 days; sales volume is likely to decline by 500 units.

Assuming a 20 per cent rate of return on investments, what would be your recommendation? Should the firm implement the decision?

SOLUTION

(i) *Bad debt expenses*:

Present plan: (0.03 × Rs 11,52,000)	Rs 34,560
Proposed plan: (0.01 × Rs 11,36,000)	11,360
Savings in bad debt expenses	23,200

(ii) *Average collection period/average investment in receivables*:

$$\text{Present plan} = \frac{36,000 \times \text{Rs } 29}{360 \div 58} \qquad 1,68,200 \text{ (a)}$$

$$\text{Proposed plan} = \frac{(36,000 \times \text{Rs } 29) - (500 \times \text{Rs } 25)}{360 \div 40} \qquad 1,14,611 \text{ (b)}$$

Savings in average investments (a – b) 53,589

Assuming a 20 per cent return, the firm will be able to earn Rs 10,718 on this saving.

(iii) *Sales volume*: Since the sales volume will decline by 500 units, there would be a loss of Rs 3,500 (500 × Rs 7).

(iv) *Additional collection charges* = Rs 20,000.

Thus, the total benefits from a tightening of the collection policy will be Rs 33,918 (Rs 23,200 + Rs 10,718) and the total cost will be Rs 23,500 (Rs 3,500 + Rs 20,000). Therefore, there would be a net gain of Rs 10,418 (Rs 33,918 – Rs 23,500). The firm should, therefore, implement the proposed strategy.

EXAMPLE 13.5

Super Sports, dealing in sports goods, has an annual sale of Rs 50 lakh and currently extending 30 days' credit to the dealers. It is felt that sales can pick up considerably if the dealers are willing to carry increased stocks, but the dealers have difficulty in financing their inventory. The firm is, therefore, considering shifts in credit policy. The following information is available:

The average collection period now is 30 days.
Variable costs, 80 per cent of sales.
Fixed costs, Rs 6 lakh per annum
Required (pre-tax) return on investment: 20 per cent

Credit policy	*Average collection period (days)*	*Annual sales (Rs lakh)*
A	45	56
B	60	60
C	75	62
D	90	63

Determine which policy the company should adopt.

SOLUTION

Evaluation of Proposed Credit Policies (*Amount in Rupees lakhs*)

Particulars	*Present*	*Proposed (number of days)*			
	(30)	*A(45)*	*B(60)*	*C(75)*	*D(90)*
(a) Sales revenue	50	56	60	62	63
Less variable costs (80% of sales)	40	44.8	48	49.6	50.4
Total contribution	10	11.2	12	12.4	12.6
Less fixed costs	6	6	6	6	6
Profit	4	5.2	6	6.4	6.6
Increase in profits due to increase in total contribution (20% of sales) compared to present profits	—	1.2	2	2.4	2.6
(b) Investment in debtors:					
Total cost (VC + FC)	46	50.8	54	55.6	56.4
Debtors turnover (DT) (360 days collection period)	12	8	6	4.8	4
Average investment (total cost ÷ DT)	3.83	6.35	9	11.58	14.10
Additional investment compared to present level	—	2.52	5.17	7.75	10.27
Cost of additional investment	—	0.50	1.03	1.55	2.05
(c) Incremental profit (a – b)	—	0.70	0.97	0.85	0.55

Policy B (average collection period 60 days) should be adopted as it yields maximum profit.

EXAMPLE 13.6

XYZ Corporation is considering relaxing its present credit policy and is in the process of evaluating two alternative policies. Currently, the firm has annual credit sales of Rs 50 lakh and accounts receivable turnover ratio of 4 times a year. The current level of loss due to bad debts is Rs 1,50,000. The firm is required to give a return of 25 per cent on the investment in new accounts receivable. The company's variable costs are 70 per cent of the selling price. Given the following information, which is a better option?

	Present policy	*Policy option I*	*Policy option II*
Annual credit sales	Rs 50,00,000	Rs 60,00,000	Rs 67,50,000
Accounts receivable turnover ratio	4	3	2.4
Bad debt losses	1,50,000	3,00,000	4,50,000

SOLUTION

Relative Suitability of Policy Options

	Present policy	*Policy option I*	*Policy option II*
Sales revenue	Rs 50,00,000	Rs 60,00,000	Rs 67,50,000
Less variable cost (70%)	35,00,000	42,00,000	47,25,000
Contribution margin (manufacturing)	15,00,000	18,00,000	20,25,000
Less other relevant costs:			
Bad debt losses	1,50,000	3,00,000	4,50,000
Investment cost (see working notes)	2,18,750	3,50,000	4,92,187.50
Contribution margin (final)	11,31,250	11,50,000	10,82,812.50

The firm is advised to adopt policy option I (extend credit terms to 4 months).

Working notes

Strictly speaking, investment in accounts receivable should be determined with reference to total cost of goods sold on credit. However, fixed costs are not given. It is assumed that there are no fixed costs and investment in debtors/receivables is determined with reference to variable costs only.

$$\text{Present policy: } \frac{\text{Rs } 35,00,000}{4} = \text{Rs } 8,75,000 \times 0.25 = \text{Rs } 2,18,750$$

$$\text{Policy option I: } \frac{\text{Rs } 42,00,000}{3} = \text{Rs } 14,00,000 \times 0.25 = \text{Rs } 3,50,000$$

$$\text{Policy option II: } \frac{\text{Rs } 47,25,000}{2.4} = \text{Rs } 19,68,750 \times 0.25 = \text{Rs } 4,92,187.5$$

Type of Collection Efforts

The second aspect of collection policies relates to the steps that should be taken to collect overdues from the customers. A well-established collection policy should have clear-cut guidelines as to the sequence of collection efforts. After the credit period is over and payment remains due, the firm should initiate measures to collect them. The effort should in the beginning be polite, but, with the passage of time, it should gradually become strict. The steps usually taken are (i) letters, including reminders, to expedite payment; (ii) telephone calls for personal contact; (iii) personal visits; (iv) help of collection agencies; and finally, (v) legal action. The firm should take recourse to very stringent measures, like legal action, only after all other avenues have been fully exhausted. They not only involve a cost but also affect the relationship with the customers. The aim should be to collect as early as possible; genuine difficulties of the customers should be given due consideration.

SUMMARY

- When a firm sells goods and services on credit, it creates accounts receivable/debtors which would be collected in future. Accounts receivable, repesent an extension of credit to customers, allowing them a reasonable period of time, in which to pay for the goods/services purch-ased by them. In fact, credit sales and, therefore, receivables are considered as a marketing tool to promote sales and thereby profits.

- The extension of credit involves risk and cost. The objective of receivables management, therefore, is to have a trade-off between the benefits and costs associated with the extension of credit. The benefits are increased sales and anticipated increased profits/incremental con-tribution. The major costs are collection costs, capital costs, delinquency costs and default costs. The firm should consider only the incremental benefits and costs that result from a change in the receivables or trade credit policy.
- The management of receivables involves crucial decision in three areas: (i) credit policies, (ii) credit terms and (iii) collection policies.
- The credit policy of a firm provides the framework to determine whether or not to extend credit to a customer and how much credit to extend. The two broad dimensions of credit policy decision of a firm are credit standards and credit analysis.
- Credit standards represent the basic criterion for the extension of credit to customers. These can be either tight/restrictive or liberal/non-restrictive. The trade-off with reference to credit standards cover: (i) collection cost, (ii) cost of investment in debtors, (iii) bad debts and (iv) level of sales profit/ contribution. The credit analysis component of credit policies includes obtaining credit information from different sources and its analysis.
- In case, the standards are relaxed, it implies credit for a longer period will be extended. More credit results in increase in sales. The benefits of incremental sales are to be weighed against incremental collection costs, interest costs due to additional investment in debtors, delinquency cost and bad debts.
- When standards are tightened, it implies less period of credit extended to customers. It would result in decrease in sales. The contribution foregone due to decrease in sales is to be com-pared with savings due to the lower collection costs, interest costs and bad debt losses.
- Credit terms specify the repayment terms. The credit terms have three components: (i) credit period, (ii) cash discount and (iii) cash discount period. The credit terms should be determined on the basis of cost-benefit trade-off in these three components.
- Collection policies refer to the procedure followed to collect the receipts when they become due. The collection policies may be classified into (i) strict and (ii) liberal. The effects of tightening the collection policy would be: (i) decline in debts, (ii) decline in collection period resulting lower interest costs, (iii) increase in collection costs and (iv) decline in sales. The effects of a lenient policy would be exactly the opposite.
- The framework of analysis of all the three decision areas in receivables management is to secure a trade-off between the costs and benefits of the measurable effects on the sales vol-ume, capital cost due to change in investment in debtors, collection costs, bad debts and so on. The firm should select an alternative which has potentials of more benefits than the cost.

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3. Cf. Joy, *op. cit.*, p. 458.
4. *Ibid.*, pp. 462-64.
5. For a prenetrating description of the implications of credit terms from the point of recipients (accounts payable) refer to Gitman, LJ, *Principles of Managerial Finance*, Harper and Row, New York, 1993, Chapter 17; also Joy, OM, *op. cit.*, Chapte 19; and Bolten, SE, *Managerial Finance*, Houghton Mifflin Co., Boston, 1991, Chapter 15.

SOLVED PROBLEMS

P.13.1 H Ltd has at present annual sales level of Rs 10,000 units at Rs 300 per unit. The variable cost is Rs 200 per unit and fixed cost amount to Rs 3,00,000 per annum. The present credit period allowed by the company is 1 month. The company is considering a proposal to increase the credit period to 2 months and 3 months and has made the following estimates:

	Existing	*Proposed*	
Credit period (month)	1	2	3
Increase in sales (per cent)	—	15	30
Bad debts (per cent)	1	3	5

There will be increase in fixed cost by Rs 50,000 on account of increase in sales beyond 25 per cent of present level. The company plans a pre-tax return of 20 per cent on investment in receivables.

You are required to calculate the most paying credit policy for the company.

SOLUTION

Decision-making (liberalisation of credit period to 2 months or 3 months)

Particulars	*1 month*	*2 months*	*3 months*
Sales (units)	10,000	11,500	13,000
Sale revenue	Rs 30,00,000	Rs 34,50,000	Rs 39,00,000
Less variable costs	20,00,000	23,00,000	26,00,000
Total contribution	10,00,000	11,50,000	13,00,000
Less other costs:			
Fixed costs	3,00,000	3,00,000	3,50,000
Bad debts	30,000	1,03,500	1,95,000
Investment cost (see working notes)	38,333	86,667	1,47,500
Profit	6,31,667	6,59,833	6,07,500

The firm is advised to adopt policy option of extending credit of 2 months as it yields maximum profit.

Working Notes

	Existing	*2 months*	*3 months*
Investment in debtors (VC + FC)/Debtors turnover	(Rs 23,00,000)/12	(Rs 26,00,000)/6	(Rs 29,50,000)/4
	= Rs 1,91,667	= Rs 4,33,333	= Rs 7,37,500
Cost of investment (Investment in debtors × 0.20)	38,333	86,667	1,47,500

P.13.2 Golden Syntex has annual sales of Rs 24,00,000. The selling price per unit is Rs 10 and the variable cost is 70 per cent of the selling price. The required rate of return on investment is 20 per cent, average cost, Rs 9 per unit; annual collection expenditure, Rs 50,000 and percentage of default, 3 per cent; credit terms, 2 months. Golden Syntex is considering the change in credit policy by following Programme A or Programme B.

	Programme	
	A	*B*
Average collection period (months)	1.5	1
Annual collection expenditure (Rs)	75,000	1,50,000
Percentage of default (Rs)	2	1

Determine which collection programme should Golden Syntex follow?

SOLUTION

Financial evaluation of proposed programmes (A or B) relating to credit policy

Particulars	*Existing*	*Programme A*	*Programme B*
Cost of operation:			
Annual collection expenditure	50,000	75,000	1,50,000
Losses due to default/bad debts (on sales of Rs 24,00,000)	72,000	48,000	24,000
Cost of investment in debtors (see working note 1)	72,000	54,000	36,000
Total	1,94,000	1,77,000	2,10,000

Recommendation: Golden Syntex is advised to adopt Programme A as its entails minimum cost of operation.

Working Note

Cost of investment in debtors

Particulars	Existing	Programme A	Programme B
(a) Investment in debtors [(2,40,000 units × Rs 7) + (2,40,000 × Rs 2)]	(Rs 21.6 lakh) / 6	(Rs 21.6 lakh) / 8	(Rs 21.6 lakh) / 12
	= Rs 3.6 lakh	= Rs 2.7 lakh	= Rs1.8 lakh
(b) Required rate of return	20	20	20
(c) Cost of investment in debtors(a × b)	Rs 72,000	Rs 54,000	Rs 36,000

P.13.3 Sagar company currently makes all sales on credit and offers no cash discount. It is considering a 2 per cent cash discount for payment within 10 days. The firm's current average collection period is 60 days, sales are 2,00,000 units, selling price is Rs 30 per unit, variable cost per unit is Rs 20 and average cost per unit is Rs 25 at the current sales volume.

It is expected that the change in credit terms will result in increase in sales to 2,25,000 units and the average collection period will fall to 45 days. However, due to increased sales, increased working capital required will be Rs 1,00,000 (it does not take into account the effect on debtors). Assuming that 50 per cent of the total sales will be on cash discount and 20 per cent is the required return on investment, should the proposed discount be offered?

SOLUTION

Effect of extending cash discount to customers

Particulars	*Amount*
Increased sales revenue (25,000 × Rs 30)	Rs 7,50,000
Less variable costs (25,000 × Rs 20)	5,00,000
Incremental contribution	2,50,000
Add savings in cost due to decrease in investment in debtors (see working note 1)	29,167
Less cost of additional working capital required (Rs 1,00,000 × 0.20)	(20,000)
Less cost involved in cash discount (0.02 × 2,25,000 units × Rs 30 × 0.5)	(67,500)
Profit	1,91,667

It is advised that the firm should offer cash discount to its customers.

Working Note

1. Savings due to decrease in average collection period:

$$\text{Present investment in debtors (without cash discount)} = \frac{2,00,000 \times \text{Rs } 25}{6\,(360 \text{ days}/60)} = \text{Rs } 8,33,333$$

$$\text{Expected investment in debtors (with cash discount)} = \frac{2,00,000 \times \text{Rs } 25 + 25,000 \times \text{Rs } 20}{8\,(360 \text{ days}/45)} = \text{Rs } 6,87,500$$

Decrease in investment in debtors = Rs 8,33,333 – Rs 6,87,500 = Rs 1,45,833

Savings in cost = Rs 1,45,833 × 0.20 = Rs 29,167

P.13.4 Easy Limited specialises in the manufacture of a computer component. The component is currently sold for Rs 1,000 and its variable cost is Rs 800. For the current year ended December 31, the company sold on an average 400 components per month.

At present, the company grants one month's credit to its customers. It is thinking of extending the same to two months on account of which the following are expected:

Increase in sales, 25 per cent
Increase in stock, Rs 2,00,000
Increase in creditors, Rs 1,00,000

You are required to advise the company on whether or not to extend credit terms if (a) all customers avail of the extended credit period of two months and (b) existing customers do not avail of the credit terms but only the new customers avail of the same. Assume the entire increase in sales is attributable to the new customers.

The company expects a minimum return of 40 per cent on the investments.

SOLUTION

(a) Effect of relaxation of credit period to two months

Particulars	*Amount*
Incremental sales revenue (100 components × 12 × Rs 1,000)	Rs 12,00,000
Less increased variable costs (Rs 12,00,000 × 0.80)	9,60,000
Incremental contribution	2,40,000
Less cost of additional working capital required (see working note 1)	2,32,000
Incremental profit	8,000

Working Note 1

(i)	Present investment in debtors: $\frac{400 \times 12 \times \text{Rs } 800}{12 \text{ (Debtors turnover ratio)}}$	Rs 3,20,000
(ii)	Proposed investment in debtors: $\frac{500 \times 12 \times \text{Rs } 800}{6 \text{ (Debtors turnover ratio)}}$	8,00,000
(iii)	Additional investment in debtors	4,80,000
	Add increase in stock	2,00,000
	Less increase in creditors	1,00,000
(iv)	Additional working capital required	5,80,000
(v)	Minimum return expected on additional working capital (Rs 5,80,000 × 0.40)	2,32,000

(b) Effect of relaxation of credit period to two months

Particulars	*Amount*
Incremental contribution (as per (a) above	Rs 2,40,000
Less cost of additional working capital (see working note 2)	1,04,000
Incremental profit	1,36,000

Working Note 2

(i) Additional investment in debtors (100 × 12 × Rs 800/6)	1,60,000
Add increase in stock	2,00,000
Less increase in creditors	1,00,000
	2,60,000
(ii) Minimum return expected on additional working capital (Rs 2,60,000 × 0.40)	1,04,000

P.13.5 Star Limited, manufacturers of colour TV sets, are considering the liberalisation of existing credit terms to three of their large customers. The credit period and likely quantity of TV sets that will be lifted by the customers are as follows:

Credit period (days)	*Quantity lifted*		
	A	*B*	*C*
0	1,000	1,000	—
30	1,000	1,500	—
60	1,000	2,000	1,000
90	1,000	2,500	1,500

The selling price per TV set is Rs 9,000. The expected contribution is 20 per cent of the selling price. The cost of carrying debtors averages 20 per cent per annum.

You are required:

(a) To determine the credit period to be allowed to each customer (assume 360 days in a year for calculation purposes).

(b) What other problems the company might face in allowing the credit period as determined in (a) above?

SOLUTION

(a) In case of customer A, liberalisation of credit period does not affect sales. No credit should be allowed to him.

Effect of extending credit period to Customer B and C (Amount in lakhs of rupees)

Particulars	*Customer B (days)*				*Customer C (days)*	
	0	*30*	*60*	*90*	*60*	*90*
Sales	90	135	180	225	90	135
Less variable costs (0.80)	72	108	144	180	72	108
Contribution (0.20)	18	27	36	45	18	27
Less cost of investments in debtors (at VC)	—	1.8	4.8	9.0	2.4	5.4
$\left(\frac{\text{Total VC}}{\text{Debtors turnover}}\right) \times 0.20$	—	$\left(\frac{108}{360/30}\right)$	$\left(\frac{144}{360/60}\right)$	$\left(\frac{180}{360/90}\right)$	$\left(\frac{72}{360/60}\right)$	$\left(\frac{108}{360/90}\right)$
Profit	18	25.2	31.2	36	15.6	21.6

Profits are maximum when credit period is 90 days to both customers.

(b) When customer A comes to know of 90 days credit extended to customer B and C, he will either seek similar credit period or press for cash discount.

Customer B will seek either higher credit period or trade discount for buying more than Customer C.

P.13.6 In order to increase sales from the normal level of Rs 2.4 lakh per annum, the marketing manager submits a proposal for liberalising credit policy as under: Normal sales, Rs 2.4 lakh, Normal credit period, 30 days

Proposed increase in credit period beyond normal 30 days	*Increase in normal sales*
15	Rs 12,000
30	18,000
45	21,000
60	24,000

The contribution to volume/profit-volume ratio is 33.33 per cent. The company expects a pre-tax return of 20 per cent on investment. Evaluate the above 4 alternatives and advise the management (assume 360 days a year).

SOLUTION

Effect of extending credit period to customers *(Amount in lakhs of rupees)*

Particulars	*Credit period (days)*				
	30	*45*	*60*	*75*	*90*
Sales	2.4	2.52	2.58	2.61	2.64
Variable costs (2/3)	1.6	1.68	1.72	1.74	1.76
Contribution (1/3)	0.8	0.84	0.86	0.87	0.88
Less cost of investment in debtors at variable costs (as data related to fixed cost is not given)	0.027	0.042	0.057	0.0725	0.088
(Total VC/Debtors turnover) × 0.20	$\left(\frac{1.6}{12}\right)$	$\left(\frac{1.68}{8}\right)$	$\left(\frac{1.72}{6}\right)$	$\left(\frac{1.74}{4.8}\right)$	$\left(\frac{1.76}{4}\right)$
Profit	0.773	0.798	0.803	0.7975	0.792

***Recommendation*:** The company is advised to extend credit for 60 days.

P.13.7 Radiance garments Ltd. manufactures readymade garments and sells them on credit basis through a network of dealers. Its present sale is Rs 60 lakh per annum with 20 days credit period. The company is contemplating an increase in the credit period with a view to increasing sales. Present variable costs are 70 per cent of sales and the total fixed costs Rs 8 lakh per annum. The company expects pre-tax return on investment @ 25 per cent. Some other details are given as under:

Proposed credit policy	*Average collection period (days)*	*Expected annual sales (Rs lakh)*
I	30	65
II	40	70
III	50	74
IV	60	75

Required: Which credit policy should the company adopt? Present your answer in a tabular form. Assume 360-day a year. Calculations should be made upto two digits after decimal.

SOLUTION

Evaluation of proposed credit policies *(amount in Rs lakh)*

Particulars	*Present*	*Proposed (number of days)*			
	(20)	*I (30)*	*II (40)*	*III (50)*	*IV (60)*
(a) Sales revenue	60	65	70	74	75
Less variable costs (VC)	42	45.5	49	51.8	52.5
Total contribution	18	19.5	21	22.2	22.5
Less fixed costs (FC)	8	8	8	8	8
Profit	10	11.5	13	14.2	14.5
Increase in profit due to increase in total contribution compared to present profit	—	1.5	3	4.2	4.5
(b) Investment in debtors/ receivables:					
Total costs (VC + FC)	50	53.5	57	59.8	60.5
Debtors turnover ratio (DT) (360 ÷ Average collection period)	18	12	9	7.2	6
Average investment in debtors (Total cost ÷ DT)	2.78	4.46	6.33	8.3	10.08
Additional investment compared to present level	-	1.68	3.55	5.52	7.30
Cost of additional investment @ 25%	-	0.42	0.89	1.38	1.83
(c) Incremental profit [(a) – (b)]	-	1.08	2.11	2.82	2.67

Recommendation: Policy III (average collection period 60 days) is recommended as it yields maximum profit.

P.13.8 A bank is analysing the receivables of Jackson company in order to identify acceptable collateral for a short-term loan. The company's credit policy is 2/10 net 30. The bank lends 80 per cent on accounts where customers are not currently overdue and where the average payment period does not exceed 10 days past the net period. A schedule of Jackson's receivables has been prepared. How much will the bank lend on a pledge of receivables, if the bank uses a 10 per cent allowance for cash discount and returns?

Account	*Amount*	*Days outstanding*	*Average payment period historically (in days)*
74	Rs 25,000	15	20
91	9,000	45	60
107	11,500	22	24
108	2,300	9	10
114	18,000	50	45
116	29,000	16	10
123	14,000	27	48
	1,08,800		

SOLUTION

Statement showing loan amount on pledge of receivables

Account No.	*Amount*	*Allowance for cash discount and returns (10% × Col.2)*	*Net amount (Col.2 – Col.3)*	*Loan amount @ 80% amount (4)*
1	*2*	*3*	*4*	*5*
74	Rs 25,000	Rs 2,500	Rs 22,500	Rs 18,000
107	11,500	1,150	10,350	8,280
108	2,300	230	2,070	1,656
116	29,000	2,900	26,100	20,880
			Total loan amount	48,816

Working Notes

1. Account numbers 91 and 114 are currently overdue by 15 and 20 days respectively, credit policy being 2/10 net 30 days. Also these accounts have average payment period of more than 40 days i.e., 10 days more than credit period allowed. Loan is not available on these accounts as per short-term loan policy of bank.
2. Account number 123, though not currently overdue but has average payment period of more than 40 days. Hence, this account is not eligible for bank loan.

P.13.9 The credit manager of XYZ Ltd. is reappraising the company's credit policy. The company sells its products on terms of net 30. Cost of goods sold is 85 per cent of sales and fixed costs are further 5 per cent of sales. XYZ classifies its customers on a scale of 1 to 4. During the past five years, the experience was as under:

Classification	*Default as a percentage of sales*	*Average collection period-in days for non-defaulting accounts*
1	0	45
2	2	42
3	10	40
4	20	80

The average rate of interest is 15 per cent. What conclusions do you draw about the company's credit policy? What other factors should be taken into account before changing the present policy? Discuss.

SOLUTION

Statement showing evaluation of credit policy

Classification	*Gross profit @ 15%*	*Fixed costs @ 5%*	*Bad debts*	*Interest cost*[1]	*Total costs (3 + 4 + 5)*	*Net profit (2 − 6)*
1	*2*	*3*	*4*	*5*	*6*	*7*
1	Rs 15	Rs 5	Nil	Rs 1.66	Rs 6.66	Rs 8.34
2	15	5	Rs 2	1.55	8.55	6.45
3	15	5	10	1.48	16.48	(1.48)
4	15	5	20	2.96	27.96	(12.96)

Note: Assuming Rs 100 as the amount of revenue generated from each type of customer.

Working Notes

(1) Computation of interest costs.

Particulars	*1 (45)*	*2 (42)*	*3 (40)*	*4 (80)*
Investment in debtors (Total cost, TC)	90	90	90	90
Debtors turnover (DT) (365 ÷ average collection period)	8.11	8.69	9.125	4.5625
Average investment (TC ÷ DT)	11.096	10.36	9.86	19.73
Interest @ 15 per cent	1.66	1.55	1.48	2.96

The analysis indicates that there seems to be laxity on the part of credit collection department in that the average collection period is higher (40–80 days) than the period allowed (30 days) for all categories of customers. Given the low profit margin of the firm (say 10 per cent as 90 per cent virtually are incremental costs to sales revenue), the firm cannot afford such a policy. In fact, the firm is actually suffering loss on sales made to the two categories of customers (namely, classified as 3 and 4). Losses in these categories are primarily due to substantial amount of bad debts.

To promote sales, firm can afford liberal credit policy as the interest cost constitutes a small percentage of total costs. What required is that the credit collection department of the firm should make more rigorous efforts to judge credit-worthiness of its customers; this, in turn, will reduce bad debts.

REVIEW QUESTIONS

RQ.13.1 What are credit standards? What key variables should be considered in evaluating possible changes in credit standards?

RQ.13.2 What is meant by credit terms? What are the expected effects of (a) a decrease in the cash discount, and (b) a decrease in the credit period?

RQ.13.3 What are collection policies? How can they be evaluated?

RQ.13.4 Explain the objectives of receivables management.

RQ.13.5 XYZ Ltd has credit sales amounting to Rs 32,00,000. The sale price per unit is Rs 40, the variable cost is Rs 25 per unit while the average cost per unit is Rs 32. The average age of accounts receivable of the firm is 72 days.

The firm is considering to tighten the credit standards. It will result in a fall in sales to Rs 28,00,000, and the average age of accounts receivable to 45 days.

Assume 20 per cent rate of return. Is the proposal under consideration feasible?

SOLUTION

Incremental analysis (tightening credit standards or not)

Particulars	*Present plan (80,000* units)	*Proposed plan (70,000* units)	*Differential revenues and costs* (decrease)
Sales revenue	Rs 32,00,000	Rs 28,00,000	Rs (4,00,000)
Less: variable costs @ Rs 25 per unit	20,00,000	17,50,000	(2,50,000)
fixed costs	5,60,000	5,60,000	—
investment cost (working notes)	1,02,400	57,750	(44,650)
Savings (deficiency)	5,37,600	4,32,250	(1,05,350)

Recommendation: The firm should not adopt more strict credit collection policy, as it will decrease profits by Rs 1,05,350.

Working Notes

Investments in accounts receivable:

Present plan: = [(80,000 units × Rs 25 (VC) + TFC (Rs 7 × 80,000)]/5 (360 days ÷ 72 days) = Rs 5,12,000

Proposed plan: [(70,000 units × Rs 25) + Rs 5,60,000]/8 (360 days ÷ 45 days) = Rs 2,88,750

Cost of investment:

Present plan : Rs 5,12,000 × 0.20 = Rs 1,02,400

Proposed plan : 2,88,750 × 0.20 = Rs 57,750

RQ.13.6 Hypothetical Ltd is examining the question of relaxing its credit policy. It sells at present 20,000 units at a price of Rs 100 per unit, the variable cost per unit is Rs 88 and average cost per unit at the current sales volume is Rs 92. All the sales are on credit, the average collection period being 36 days.

A relaxed credit policy is expected to increase sales by 10 per cent and the average age of receivables to 60 days. Assuming 15 per cent return, should the firm relax its credit policy?

SOLUTION

Incremental analysis (relaxation in credit terms or not)

	Present plan (20,000 units)	*Proposed plan (22,000 units)*	*Differential costs and revenues*
Sales revenue	Rs 20,00,000	Rs 22,00,000	Rs 2,00,000
Less: variable cost	17,60,000	19,36,000	1,76,000
fixed costs (20,000 units × 4)	80,000	80,000	
investment cost (working notes)	27,600	50,400	22,800
Income (deficiency)	1,32,400	1,33,600	1,200

Recommendation: The firm should relax its credit policy as it increases profit by Rs 1,200.

Working Notes

Cost of investments in accounts receivable:

Present plan: Rs 18,40,000/10 (360 days ÷ 36 days)	Rs 1,84,000
Cost = (0.15 × Rs 1,84,000)	27,600
Proposed plan = Rs 20,16,000/6 (360 days ÷ 60 days)	3,36,000
Cost = (0.15 × Rs 3,36,000)	50,400

RQ.13.7 Udar Ltd believes that it is possible to increase sales if credit terms are relaxed. The profit plan, based on the old credit terms, envisages projected sales at Rs 10,00,000, a 30 per cent profit volume ratio, fixed costs at Rs 50,000, bad debts of 1 per cent and an accounts receivable turnover of 10 times. The relaxed credit policy is expected to increase sales to Rs 12,00,000. However, bad debts will rise to 2 per cent of sales, and accounts receivable turnover will decrease to 6 times.

Should the company adopt the new (relaxed) credit policy, assuming the company's target rate of return is 20 per cent?

SOLUTION

Incremental analysis (relaxation in credit terms or not)

Particulars	*Present plan*	*Proposed plan*	*Differential revenue and costs*
Sales	Rs 10,00,000	Rs 12,00,000	Rs 2,00,000
Less: variable costs	7,00,000	8,40,000	1,40,000
bad debts	10,000	24,000	14,000
fixed costs	50,000	50,000	—
investment cost (working notes)	15,000	29,666	14,666
Income (deficiency)	2,25,000	2,56,334	31,334

Recommendation: The firm should relax its credit terms, as it will augment income by Rs 31,334.

Working Notes

Cost of investments in accounts receivable:

Present plan : (Rs 7,00,000 + Rs 50,000)/10	Rs 75,000
Cost = (Rs 75,000 × 0.20)	15,000
Proposed plan : (Rs 8,40,000 + Rs 50,000)/6	1,48,333
Cost = (Rs 1,48,333 × 0.20)	29,666

RQ.13.8 The credit manager of ABC Ltd has to decide on a proposal for liberal extension of credit which would result in a slowing process of the average collection period from 1 to 2 months. The company's product is sold for Rs 20 per unit, of which Rs 15 represents the variable costs (including credit department cost). The current actual sales amounted to Rs 24 lakh, represented entirely by credit sales. The average total cost per unit is Rs 18.

The relaxation in credit policy is expected to result in 25 per cent increase in sales, that is, Rs 30 lakh annually. The corporate management aims at a return of 25 per cent on additional investment.

Make relevant calculations to help the credit manager in examining the financial implications of liberalising the credit policy.

SOLUTION

Incremental analysis (extension of credit terms)

Particulars	*Present plan*	*Proposed plan*	*Differential costs and revenues*
Sales	Rs 24,00,000	Rs 30,00,000	Rs 6,00,000
Less: variable costs	18,00,000	22,50,000	4,50,000
fixed costs	3,60,000	3,60,000	—
investment cost (working notes)	45,000	1,08,750	63,750
Income (deficiency)	1,95,000	2,81,250	86,250

Recommendation: The firm is advised to liberalise its credit policy as it augments profit by Rs 82,250.

Working Notes

Cost of investments in accounts receivable:

Present plan : Rs 21,60,000/12 times = Rs 1,80,000, its cost is Rs 1,80,000 × 0.25 = Rs 45,000

Proposed plan : Rs 26,10,000/6 times = Rs 4,35,000, its cost is Rs 4,35,000 × 0.25 = Rs 1,08,750.

RQ.13.9 ABC Ltd is now extending 1 month's credit to its selected customers. It sells its products at Rs 100 each, and has an annual sales volume of 60,000 units. At current level of production, which matches with sales, the product has a total cost of Rs 90 per unit and a variable cost of Rs 80 per unit. The company is considering a plan to grant more liberal terms by extending the duration of credit from 1 month to 2 months and expects the sales to the customer group to go up by 25 per cent. In the background of a normal expectation of a 20 per cent return on investment, will this relaxation in credit standard justify itself?

SOLUTION

(i) Profit on additional sales

Selling price per unit	Rs 100	
Less variable cost per unit	80	
Marginal contribution/unit	20	
Number of additional units to be sold	× 15,000	
		Rs 3,00,000

(ii) *Cost of additional investment in receivables*

(a) Average investments in receivables:

Present plan = (60,000 units × Rs 90)/Debtors turnover, 12(12 ÷ 1) = Rs 4,50,000

Proposed plan: [(60,000 units × Rs 90) + (15,000 units × Rs 80)]/6(12 ÷ 2) = Rs 11,00,000

(b) Additional investments in receivables = Rs 11,00,000 – Rs 4,50,000 = Rs 6,50,000

(c) Cost of additional investments in receivables = 0.20 × Rs 6,50,000 = Rs 1,30,000.

(iii) *Summary*

Profits on additional sales	Rs 3,00,000
Less increased cost of investments	1,30,000
Net increase in profits	1,70,000

Thus, the relaxation of credit standards is justified.

RQ.13.10 Royal Industries Ltd currently makes all sales on credit and offers no cash discount. It is considering a 2 per cent discount for payment within 10 days (terms offered are '2/10 net 30'). The firm's current average collection period is 30 days, sales are 10,000 units, selling price is Rs 100 per unit and variable cost per unit is Rs 50; its existing total fixed costs are Rs 2,00,000 which are likely to remain unchanged with production/sales volume of 12,000 units.

It is expected that the offer of cash discount will result in an increase in sales to 11,000 units and the average collection period will be 20 days as a result. However, due to increased sales, increased working capital required will be for Rs 20,000 (without taking into account the effect of debtors).

Assuming that 50 per cent of the total sales will be on cash discount and 20 per cent is the required return on investment, should the proposed discount be offered?

SOLUTION

Incremental analysis whether cash discount should be offered

Particulars	*Amount*
Incremental sales revenue (1,000 units × Rs 100)	Rs 1,00,000
Less variable costs (1,000 units × Rs 50)	50,000
Incremental contribution	50,000
Add savings in cost due to decrease in investment in debtors (see working note 1)	3,333
Less cost of additional working capital required (Rs 20,000 × 0.20)	(4,000)
Less cash discount (0.02 × 11,000 units × 0.5 × Rs 100)	11,000
Incremental profit	38,333

Recommendation: It is advised that the firm should offer cash discount.

Working Notes

1 *Savings due to decrease in collection period:*

Present investment in debtors (without cash discount) = [(10,000 × Rs 50) + Rs 2,00,000]/12 (360 days/30) = Rs 58,333.

Expected investment in debtors (with cash discount) = [11,000 × Rs 50) + Rs 2,00,000]/18 (360 days/20) = Rs 41.667

Decrease in investment in debtors = Rs 58,333 – Rs 41,667 = Rs 16,666

Savings in interest cost (Rs 16,666 × 0.20) = Rs 3,333.

RQ.13.11 ABC Ltd is considering certain relaxation in its credit policy. The management has evaluated 2 new policies. From the following details, advise which policy should be adopted by ABC Ltd.

(i)	Annual credit sales at present (Rs lakh)	87.5
(ii)	Proposed credit sales (Rs lakh):	
	Alternative I	105
	Alternative II	118
(iii)	Accounts receivable turnover (times):	
	Existing	6
	Alternative I	5.25
	Alternative II	4.2
(iv)	Bad debts (Rs lakh):	
	Existing	2.63
	Alternative I	5.25
	Alternative II	7.88
(v)	Required rate of return on the investment in new accounts receivable	20
(vi)	P/V ratio (per cent)	30

SOLUTION

Evaluation of proposed credit policies

Particulars	*Existing*	*Proposed alternatives*	
		I	*II*
Sales revenue	Rs 87,50,000	Rs 1,05,00,000	Rs 1,18,00,000
Less variable cost (0.70)	61,25,000	73,50,000	82,60,000
Contribution (manufacturing)	26,25,000	31,50,000	35,40,000
Less other relevant costs:			
Bad debt losses	2,63,000	5,25,000	7,88,000
Cost of investment in debtors (see working note)	2,04,167	2,80,000	3,93,333
Contribution (final)	21,57,833	23,45,000	23,58,667

Recommendation: The firm is advised to adopt alternative II as it maximises contribution.

Working Notes

Cost of investment in receivables/debtors:

Present policy : Rs 61,25,000/6 times = Rs 10,20,833; cost (Rs 10,20,833 × 0.2) = Rs 2,04,167

Alternative I : Rs 73,50,000/5.25 times = Rs 14,00,000; cost (Rs 14 lakh × 0.2) = Rs 2,80,000

Alternative II : Rs 82,60,000/4.2 times = Rs 19,66,667; cost (Rs 19,66,667 × 0.2) = Rs 3,93,333

EXAMINATION QUESTIONS

EQ. 13.1 A company has prepared the following projections for a year:

Sales	21,000 units
Selling price per unit	Rs 40
Variable costs per unit	25
Total costs per unit	35
Credit period allowed	One month

The company proposes to increase the credit period allowed to its customers from one month to two months. It is envisaged that the change in the policy as above will increase the sales by 8 per cent. The company desires a return of 25 per cent on its investment.

You are required to examine and advise whether the proposed credit policy should be implemented or not.

(*CA—November, 2002*)

SOLUTION

Incremental analysis (relaxation in credit terms or not)

Incremental sales revenue (1,680 units × Rs 40)		Rs 67,200
Less incremental costs		
Variable costs (1,680 units × Rs 25)	Rs 42,000	
Increased cost of investment in debtors (see working note1)	17,062.50	59,062.50
Net increase in profits		8,137.50

1. Working Notes

Cost of additional investment in debtors

Average investment in debtors	=	(Cost of investment in debtors/ Debtors turnover)
Present plan (TVC 21,000 units × Rs 25 + TFC Rs 2,10,000)/12	=	Rs 61,250
Proposed plan (TVC 22,680 units × Rs 25 + Rs 2,10,000/6	=	Rs 1,29,500
Additional investment in debtors (Rs 1,29,500 – Rs 61,250)	=	Rs 68,250
Cost of additional investment in debtors (Rs 68,250 × 0.25)	=	Rs 17,062.5

EQ. 13.2 A firm has a current sales of Rs 2,56,48,750. The firm has unutilized capacity. In order to boost its sales, it is considering the relaxation in its credit policy. The proposed terms of credit will be 60 days credit against the present policy of 45 days. As a result, the bad debts will increase from 1.5 per cent to 2 per cent of sales. The firm's sales are expected to increase by 10 per cent. The variable operating costs are 72 per cent of the sales. The firm's corporate tax rate is 35 per cent, and it requires an after-tax return of 15 per cent on its investment. Should the firm change its credit period? (*CA—November, 2003*)

SOLUTION

Incremental analysis (relaxation in credit terms or not)

Particulars		*Amount*
Increase in sales revenue (Rs 2,56,48,750 × 10%)		Rs 25,64,875
Less incremental costs:		
Variable operating costs (Rs 25,64,875 × 0.72)		18,46,710
Bad debts expected (Rs 2,82,13,625 × 0.02)	Rs 5,64,273	
Less existing bad debts (Rs 2,56,48,750 × 0.02)	3,84,731	1,79,542
Operating profits before taxes		5,38,623
Less taxes		1,88,518
Operating profits after taxes		3,50,105
Additional investment in debtors		10,77,247*
Expected rate of return (Rs 3,50,105/Rs 10,77,247) = 32.5%		

* **Additional investment in debtors:**

Present plan: (Rs 2,56,48,750 × 0.72 = Rs 1,84,67,100)/Debtors turnover, 8 = Rs 23,08,388

Proposed plan: (Rs 2,82,13,625 × 0.72 = Rs 2,03,13,810/Debtors turnover, 6 = Rs 33,85,635

Additional investment in debtors = Rs 33,85,635 – Rs 23,08,388 = Rs 10,77,247

Assumption: Investment in debtors are computed at cost price.

Recommendation: The firm is advised to relax its credit terms as the expected rate of return on additional investment in debtors is 32.5 per cent *vis-a-vis* required after-tax return of 15 per cent on investments.

EQ. 13.3 A firm is considering offering 30-day credit to its customers. The firm likes to charge them an annualized rate of 24 per cent. The firm wants to structure the credit in terms of a cash discount for immediate payment. How much would the discount rate have to be? (*CA—November, 2004*)

SOLUTION

(i) Determination of interest for 30 days given 365 days in a year:
(Rs 24/365 days) × 30 days = 1.97260274%

(ii) Principal sum of Rs 100 on day zero (at the month beginning) compounds to Rs 101.97260274 on 30th day (at the month-end). In other words, the present value of Re 1 (at the beginning of month) = Rs 100/ Rs 101.97260274 = 0.9806555.

Thus, discount rate = Re 1 – Re 0.9806555 = Re 0.01934444 = 1.934% for 30 days.

EQ. 13.4 A Company has sales of Rs 25,00,000. Average collection period is 50 days; bad debt losses are 5% of sales and collection expenses are Rs 25,000. The cost of funds is 15%. The Company has two alternative Collection Programmes:

	Programme I	*Programme II*
Average Collection Period reduced to	40 days	30 days
Bad debt losses reduced to	4% of sales	3% of sales
Collection Expenses	Rs 50,000	Rs 80,000

Evaluate which Programme is viable. (*CA—May, 2006*)

SOLUTION

Financial evaluation of alternative collection programmes

Particulars	*Collection programmes*		
	Present	*Programme I*	*Programme II*
Sales costs	Rs 25,00,000	Rs 25,00,000	Rs 25,00,000
Bad debts	1,25,000	1,00,000	75,000
Collection expenses	25,000	50,000	80,000
Cost of funds invested in debtors	51,369	41,096	30,822
Total cost	2,01,369	1,91,096	1,85,822
Reduction in cost compared to present programme	—	10,273	15,547

Recommendation: Programme II is more viable as it has least costs.

Working Notes

Cost of funds invested in debtors

Particulars	*Present*	*Programme I*	*Programme II*
Investment in debtors (sales/debtors turnover)	Rs 3,42,466	2,73,973	2,05,479
Cost of funds @ 15%	51,369	41,096	30,822

Note: Due to non-availablity of cost of sales, investment in debtors have been taken at sales price.

EQ. 13.5 JKL Ltd. is considering the revision of its credit policy with a view to increasing its sales and profit. Currently all its sales are on credit and the customers are given one month's time to settle the dues. It has a contribution of 40% on sales and it can raise additional funds at a cost of 20% per annum. The marketing manager of the company has given the following options along with estimates for considerations:

Particulars	*Current position*	*I Option*	*II Option*	*III Option*
Sales (Rs in lakh)	200	210	220	250
Credit period (in months)	1	1½	2	3
Bad debts (% of sales)	2	2½	3	5
Cost of Credit administration (Rs in lakh)	1.20	1.30	1.50	3.00

You are required to advise the company for the best option. (*CA (PE-II) May, 2007*)

SOLUTION

Financial evaluation of proposed credit period options (Rs in lakh)

Particulars	*Credit period extended to debtors*			
	Current	*Option I*	*Option II*	*Option III*
Sales	Rs 200	Rs 210	Rs 220	Rs 250
Less Variable costs (60%)	120	126	132	150
Contribution	80	84	88	100
Less costs:				
Bad debts	4.0	5.25	6.6	12.5
Credit administration	1.2	1.3	1.5	3.0
Cost of funds invested in debtors (Sales/debtors turnover × 0.2)*	3.33	5.25	7.33	12.5
Profit before taxes	71.47	72.20	72.57	72.0
Incremental profit compared to present programme	—	0.73	1.10	0.53

*Rs 200 lakh × 1/12 × 0.2 (current); Rs 210 lakh × 1/8 × 0.2 (Option I);
Rs 220 lakh × 1/6 × 0.2 (Option II); Rs 250 lakh × 1/4 × 0.2 (Option III).

Recommendation: The company should opt for option II as it yields maximum profit.

14 Inventory Management

Introduction

The preceding two chapters have discussed the basic strategies and considerations in managing two individual current assets, namely, cash and receivables. The third major current asset is inventory. The term inventory refers to the stockpile of the products a firm is offering for sale and the components that make up the product.[1] In other words, inventory is composed of assets that will be sold in future in the normal course of business operations. The assets which firms store as inventory in anticipation of need are (i) raw materials, (ii) work-in-process (semi-finished goods) and (iii) finished goods. The raw material inventory contains items that are purchased by the firm from others and are converted into finished goods through the manufacturing (production) process. They are an important input of the final product. The work-in-process inventory consists of items currently being used in the production process. They are normally semi-finished goods that are at various stages of production in a multi-stage production process. Finished goods represents final or completed products which are available for sale. The inventory of such goods consists of items that have been produced but are yet to be sold.

Inventory, as a current asset, differs from other current assets because only financial managers are not involved. Rather, all the functional areas, finance, marketing, production, and purchasing, are involved. *The views concerning the appropriate level of inventory would differ among the different functional areas.*[2] *The job of the financial manager is to reconcile the conflicting viewpoints of the various functional areas regarding the appropriate inventory levels in order to fulfil the overall objective of maximising the owner's wealth.* Thus, inventory management, like the management of other current assets, should be related to the overall objective of the firm. It is in this context that the present chapter is devoted to the main elements of inventory management from the viewpoint of financial managers. The objectives of inventory management are explained in some detail in Section 1. The other relevant aspect relates to inventory management techniques. The basic concepts relevant to the management and control of inventory are: (i) determination of the type of control required, (ii) the basic economic order quantity, (iii) the reorder point, and (iv) safety stocks. As a matter of fact, the inventory management techniques are a part of production management. But a familiarity with them is of great help to the financial managers in planning and budgeting inventory. These have already been covered in Chapter 3 of Volume I (Cost Accounting) of this book. The chapter concludes with the main points.

OBJECTIVES

The basic responsibility of the financial manager is to make sure the firm's cash flows are managed efficiently. Efficient management of inventory should ultimately result in the maximisation of the owner's wealth. It was indicated in Chapter 18 that in order to minimise cash requirements, inventory should be turned over as quickly as possible, avoiding stock-outs that might result in closing down the production line or lead to a loss of sales. It implies that while the management should try to pursue the financial objective of turning inventory as quickly as possible, it should at the same time ensure sufficient inventories to satisfy production and sales demands. In other words, the financial manager has to reconcile these two conflicting requirements. Stated differently, the objective of inventory management consists of two counterbalancing parts: (i) to minimise investments in inventory, and (ii) to meet a demand for the product by efficiently organising the production and sales operations. These two conflicting objectives of inventory management can also be expressed in terms of cost and benefit associated with inventory. That the firm should minimise investment in inventory implies that maintaining inventory involves costs, such that the smaller the inventory, the lower is the cost to the firm. But inventories also provide benefits to the extent that they facilitate the smooth functioning of the firm: the larger the inventory, the better it is from this viewpoint. Obviously, the financial managers should aim at a level of inventory which will reconcile these conflicting elements. That is to say, an optimum level of inventory should be determined on the basis of the trade-off between costs and benefits associated with the levels of inventory.

Costs of Holding Inventory

One operating objective of inventory management is to minimise cost. Excluding the cost of merchandise, the costs associated with inventory fall into two basic categories: (i) Ordering or Acquisition or Set-up costs, and (ii) Carrying costs. These costs are an important element of the optimum level of inventory decisions.

Ordering Costs This category of costs is associated with the acquisition or ordering of inventory. Firms have to place orders with suppliers to replenish inventory of raw materials. The expenses involved are referred to as *ordering costs*. Apart from placing orders outside, the various production departments have to acquire materials from the stores. Any expenditure involved here is also a part of the ordering cost. Included in the ordering costs are costs involved in (i) preparing a purchase order or requisition form and (ii) receiving, inspecting, and recording the goods received to ensure both quantity and quality. The cost of acquiring materials consists of clerical costs and costs of stationery. It is, therefore, called a *set-up cost*. They are generally fixed *per order placed*, irrespective of the amount of the order. The larger the orders placed, or the more frequent the acquisition of inventory made, the higher are such costs. From a different perspective, the larger the inventory, the fewer are the acquisitions and the smaller/lower are the order costs. The acquisition costs are inversely related to the size of inventory: they decline with the level of inventory. Thus, such costs can be minimised by placing fewer orders for a larger amount. But acquisition of a large quantity would increase the cost associated with the maintenance of inventory, that is, carrying costs.

Carrying Costs The second broad category of costs associated with inventory are the carrying costs. They are involved in maintaining or carrying inventory. The cost of holding inventory may be divided into two categories:

1. **Those that arise due to the storing of inventory.** The main components of this category of carrying costs are (i) storage cost, that is, tax, depreciation, insurance, maintenance of the building, utilities and

janitorial services; (ii) insurance of inventory against fire and theft; (iii) deterioration in inventory because of pilferage, fire, technical obsolescence, style obsolescence and price decline; (iv) serving costs, such as, labour for handling inventory, clerical and accounting costs.

2. **The opportunity cost of funds.** This consists of expenses in raising funds (interest on capital) to finance the acquisition of inventory. If funds were not locked up in inventory, they would have earned a return. This is the opportunity cost of funds or the financial cost component of the cost.

The carrying costs and the inventory size are positively related and move in the same direction. If the level of inventory increases, the carrying costs also increase and *vice versa*.

The sum of the order and carrying costs represents the total cost of inventory. This is compared with the benefits arising out of inventory to determine the optimum level of inventory.

Benefits of Holding Inventory

The second element in the optimum inventory decision deals with the benefits associated with holding inventory. The major benefits of holding inventory are the basic functions of inventory. In other words, inventories perform certain basic functions which are of crucial importance in the firm's production and marketing strategies.

The basic function of inventories is to act as a buffer to decouple or uncouple the various activities of a firm so that all do not have to be pursued at exactly the same rate[3]. The key activities are (1) purchasing, (2) production, and (3) selling. The term *uncoupling* means that these interrelated activities of a firm can be carried on independently. Without inventories, purchasing and production would be completely controlled by the sales schedules. If the sales of a firm increases, these two would also increase and *vice versa*. In other words, purchase and production functions would depend upon the level of sales. It is, of course, true that in the long run, the purchasing and production activities are and, in fact, should be tied to the sales activity of a firm. But, if in the short term they are rigidly related, the three key activities cannot be carried out efficiently. Inventories permit short-term relaxation so that each activity may be pursued efficiently. Stated differently, *inventories enable firms in the short run to produce at a rate greater than purchase of raw materials and vice versa, or to sell at a rate greater than production and vice versa.*

Since inventory enables uncoupling of the key activities of a firm, each of them can be operated at the most efficient rate. This has several beneficial effects on the firm's operations. In other words, three types of inventory, raw materials, work-in-process and finished goods, perform certain useful functions. Alternatively, rigid tying (coupling) of purchase and production to sales schedules is undesirable in the short run as it will deprive the firms of certain benefits. The effect of uncoupling (maintaining inventory) are as follows.

Benefits in Purchasing If the purchasing of raw materials and other goods is not tied to production/sales, that is, a firm can purchase independently to ensure the most efficient purchase, several advantages would become available. In the first place, a firm can purchase larger quantities than is warranted by usage in production or the sales level. This will enable it to avail of discounts that are available on bulk purchases. Moreover, it will lower the ordering cost as fewer acquisitions would be made. There will, thus, be a significant saving in the costs. Second, firms can purchase goods before anticipated or announced price increases. This will lead to a decline in the cost of production. Inventory, thus, serves as a hedge against price increases as well as shortages of raw materials. This is a highly desirable inventory strategy.

Benefits in Production Finished goods inventory serves to uncouple production and sale. This enables production at a rate different from that of sales. That is, production can be carried on at a rate

higher or lower than the sales rate. This would be of special advantage to firms with seasonal sales pattern. In their case, the sales rate will be higher than the production rate during a part of the year (peak season) and lower during the off-season. The choice before the firm is either to produce at a level to meet the actual demand, that is, higher production during peak season and lower (or nil) production during off-season, or, produce continuously throughout the year and build up inventory which will be sold during the period of seasonal demand. The former involves discontinuity in the production schedule while the latter ensures level production. The level production is more economical as it allows the firm to reduce the cost of discontinuities in the production process. This is possible because excess production is kept as inventory to meet future demands. Thus, inventory helps a firm to coordinate its production scheduling so as to avoid disruptions and the accompanying expenses.[4] In brief, since inventory permits *least cost* production scheduling, production can be carried on more efficiently.

Benefits in Work-in-Process The inventory of work-in-process performs two functions. In the first place, it is necessary because production processes are not instantaneous. The amount of such inventory depends upon technology and the efficiency of production. The larger the steps involved in the production process, the larger the work-in-process inventory and *vice versa*. By shortening the production time, efficiency of the production process can be improved and the size of this type of inventory reduced. In a multi-stage production process, the work-in-process inventory serves a second purpose also. It uncouples the various stages of production so that all of them do not have to be performed at the same rate. The stages involving higher set-up costs may be most efficiently performed in batches with a work-in-process inventory accumulated during a production run.[5]

Benefits in Sales The maintenance of inventory also helps a firm to enhance its sales efforts. For one thing, if there are no inventories of finished goods, the level of sales will depend upon the level of current production. A firm will not be able to meet demand instantaneously. There will be a lag depending upon the production process. If the firm has inventory, actual sales will not have to depend on lengthy manufacturing processes. Thus, inventory serves to bridge the gap between current production and actual sales. A related aspect is that inventory serves as a competitive marketing tool to meet customer demands. A basic requirement in a firm's competitive position is its ability *vis-a-vis* its competitors to supply goods rapidly. If it is not able to do so, the customers are likely to switch to suppliers who can supply goods at short notice. Inventory, thus, ensures a continued patronage of customers. Moreover, in the case of firms having a seasonal pattern of sales, there should be a substantial finished goods inventory prior to the peak sales season. Failure to do so may mean loss of sales during the peak season.

To summarise the preceding discussion relating to the objective of inventory management, the two main aspects pertain to the minimisation of investment in inventory, on the one hand, and the need to ensure that there is enough inventory to meet demand such that production and sales operations are smooth. They are often in conflict with each other. By holding less inventory, cost can be minimised, but there is a risk that the operations will be disturbed as the emerging demands cannot be met. On the other hand, by holding a large inventory, the chances of disruption of operations are reduced, but, the cost will increase. The appropriate level of inventory should be determined in terms of a trade-off between the benefits and costs associated with maintaining inventory.

SUMMARY

- Inventory refers to the stockpile of the products a firm would sell in future in the normal course of business operations and the components that make up the product. The firm stores three types of inventories, namely, raw materials, work-in-process/semi-finished goods and finished good.

- The management of inventory is different from the management of other current assets in that virtually all the functional areas are involved. The job of the finance manager is to recon-cile the conflicting viewpoints of the various functional areas regarding the appropriate inventory levels.
- The objectives of inventory management consists of two counterbalancing parts: (i) to mini-mise investments in inventory and (ii) to meet the demand for products by efficiently organising the production and sales operations. In operational terms, the goal of inventory management is to have a trade-off between these two conflicting objectives which can be expressed in terms of costs and benefits associated with different levels of inventory.
- The costs of holding inventory are ordering costs and carrying costs. While ordering costs are associated with the acquisition or ordering of inventory, carrying costs arise due to the storing of inventory. The major benefits of holding inventory are in the area of purchasing, production and sales. The total cost of inventory are to be compared with the total benefits arising out of inventory to determine its optimum level.
- There are four decision areas in inventory management: (i) classification problem, (ii) order quantity problem, (iii) order point problem and (iv) safety stock.
- The ABC system is a widely-used classification technique to identify various items of inventory for purposes of inventory control. On the basis of the cost involved, the various items are classified into three categories: (i) A, consisting of items with the large investment, (ii) C, with relatively small investments but fairly large number of items and (iii) B, which stands mid-way between category A and C. Category A needs the most rigorous control, C requires minimum attention and B deserves less attention than A but more than C.
- The order quantity problem relates to the determination of the quantity of inventory which should be ordered. The economic order quantity (EOQ) is that level of inventory order which minimises the total cost associated with inventory management. Symbolically, EOQ = $\sqrt{\frac{2AB}{C}}$.
- The re-order point is that level of inventory when a fresh order should be placed with suppliers to procure additional inventory equal to the EOQ. It is that inventory level which is equal to the consumption during the lead time plus safety stock.
- Safety stocks are the minimum additional inventory which serve as a safety margin to meet an unanticipated increase in usage resulting from an unusually high demand and/or an uncontrollable late receipt of incoming inventory.

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REVIEW QUESTIONS

RQ.14.1 What is inventory? Why do firms maintain inventory?
RQ.14.2 What are the objectives of inventory management?
RQ.14.3 What is the financial manager's role in management of inventory?

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