SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES,

CHITTOOR,

(AUTONOMOUS)

Approved by AICTE, New Delhi, Affiliated to JNTUA, Ananthapuramu

Lecture Notes

Subject Notes: Cost and Management Accounting

Year/Branch: II / MBA

Regulations: R22

Prepared By: Dr. K. Suresh, Assistant Professor

II MBA – Semester - III					
Course Code	**COST AND MANAGEMENT ACCOUNTING**	**L**	**T**	**P**	**C**
22MBA233A		**3**	**1**	**0**	**4**

Course Educational Objectives (CEO):

- **CEO1**: To provide knowledge on Cost and management Accounting, Apportionment of Overheads and Calculation of Machine Hour Rate.
- **CEO2**: To develop skills for the application of costing for specific industries
- **CEO3**: To give an elaborate view on marginal costing and its importance in managerial decisions.
- **CEO4**: To understand the application of break-even analysis to solve various business problems.
- **CEO5**: To make the students understand about the various budgets and Evaluation of various variances using variance analysis.

UNIT - I	**Introduction to Cost and Management Accounting**	Lecture Hrs: 8
Management Accounting vs. Cost Accounting vs. Financial Accounting - Role of Accounting Information in Planning and Control - Cost Concepts and Managerial Use of Classification of Costs - Direct and Indirect Expenses - Allocation and Apportionment of Overheads - Calculation of Machine Hour Rate.		
UNIT - II	**Costing for Specific Industries**	Lecture Hrs: 12
UNIT Costing - Job Costing - Cost Sheet – Tender and Process Costing and their Variants - Treatment of Normal Losses and Abnormal Losses – Inter - Process Profits - Costing for By-products and Equivalent Production.		
UNIT - III	**Marginal Costing**	Lecture Hrs:12
Introduction, Application of Marginal Costing in Terms of Cost Control - Profit Planning - Closing Down a Plant - Dropping a Product Line - Fixation of Selling Price - Make or Buy Decisions - Key or Limiting Factor - Selection of Suitable Product Mix -Desired Level of Profits - Closing Down or Suspending Activities.		
UNIT - IV	**Break-Even Analysis (BEA)**	Lecture Hrs:12
Concept of Cost-Volume-Profit Relationship -Mechanics of BEA - Determination of Break Even Point (BEP) - Break-Even - Graph -Assumptions of BEP – Importance - Margin of Safety - Angle of Incidence - Application of BEP for Various Business Problems.		
UNIT - V	**Budgetary Control and Analysis of Variance**	Lecture Hrs:12
Budget - Budgetary Control - Steps in Budgetary Control - Flexible Budget - Different types of Budget: Sales Budget, Cash Budget, Production Budget, Master Budget, Zero Based Budgeting, Analysis of Variance - Standard Cost - Standard Costing - Material Variance - Labor Variance -Sales Variance.		

Course Outcomes:

On successful completion of the course the student will be able to,		**POs related to COs**
CO1	**Understand** the concept of Cost and Management Accounting, Apportionment of Overheads and calculation of	PO1,PO8

	Machine Hour Rate	
CO2	**Acquire** the knowledge on application of costing methods for specific industries.	PO1, PO2, PO5,PO8
CO3	**Demonstrate the importance** of marginal costing in managerial decisions in manufacturing enterprises	PO1, PO2, PO5, PO8
CO4	**Acquire** the knowledge on application of break-even point to solve the various business problems	PO1, PO2, PO5, PO8
CO5	**Develop** the various budgets and **Evaluate** the material, labour and sales variances using variance analysis.	PO1, PO2, PO5,PO8

Text Books:

1. Cost and Management Accounting, M. N. Arora , Himalaya Publishing House, 2016.
2. Cost and Management Accounting, 13/e, Dr.S.N.Maheswari, Sultan Chand & Sons, New Delhi, 2010.
3. Cost and Management Accounting, S.P. Jain and K.L. Narang, Kalyani Publishers, New Delhi, 2006.

Reference Books:

1. Management Accounting: Theory and Problems, 4/e, M.Y. Khan, P.K. Jain, Tata McGraw-Hill, New Delhi, 2007.
2. Managerial Accounting, James Jiambalvo, John Wiley & Sons, Inc. New Delhi, 2007.
3. Management Accounting, Atkinson, Banker, Kaplan and Young, PHI Learning Private Limited, New Delhi, 2006.
4. Cost Accounting Principles and Practices, Manash Gupta, Pearson Education, New Delhi, 2006.
5. Cost Management A Strategic Emphasis, 3/e, Blocher, Chen, Cookins, Lin, Tata McGraw-Hill, New Delhi, 2006.

Online Learning Resources:

https://archive.nptel.ac.in/courses/110/107/110107127/
https://nptel.ac.in/courses/110101132
https://www.digimat.in/nptel/courses/video/110101132/L01.html
http://www.digimat.in/nptel/courses/video/110101003/L26.html

Bloom's Taxonomy Levels Used in This Document

Level	Bloom's Category	Typical Verbs
L1	Remember	Define, State, List, Name
L2	Understand	Explain, Distinguish, Describe
L3	Apply	Compute, Prepare, Calculate, Demonstrate
L4	Analyze	Discuss, Compare, Examine
L5	Evaluate	Critically evaluate, Justify, Assess
L6	Create	Design, Formulate, Develop

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UNIT I — Introduction to Cost and Management Accounting

> *"What gets measured gets managed."*
> *— Peter Drucker*

Unit Overview

This opening unit lays the conceptual foundation for the entire course. It positions Cost and Management Accounting alongside Financial Accounting, explains how costs are classified for different managerial purposes, and builds up to the practical problem of charging overhead costs — which cannot be traced to a single unit of output — fairly onto products through allocation, apportionment and the Machine Hour Rate.

Objectives of the Unit
1. Distinguish between Financial Accounting, Cost Accounting and Management Accounting.
2. Explain the role of accounting information in managerial planning and control.
3. Classify costs on the basis of nature, function, behaviour, controllability and relevance.
4. Differentiate direct and indirect expenses and explain their treatment.
5. Apply the principles of allocation and apportionment of overheads to departments.
6. Compute the Machine Hour Rate (MHR) for absorption of overheads to production.

Key Concepts

- Cost, Cost Centre and Cost Unit — the basic vocabulary of costing.
- Financial Accounting vs Cost Accounting vs Management Accounting.
- Classification of cost by nature, function, behaviour, controllability and relevance.
- Direct and Indirect Expenses (Overheads).
- Allocation and Apportionment of overheads to cost centres.
- Absorption of overheads and the Machine Hour Rate (MHR).

Learning Outcomes

On successful completion of this unit, students will be able to:

- Differentiate clearly between Financial, Cost and Management Accounting and explain why the distinction matters to a manager.
- Classify a given cost under multiple classification bases and justify the classification.
- Distinguish direct from indirect expenses and identify their accounting treatment.
- Apportion common overhead costs across departments using an appropriate basis, including the reciprocal-service method.
- Compute the Ordinary and Comprehensive Machine Hour Rate for a given machine.
- Evaluate the strengths and limitations of MHR as a basis of overhead absorption.

Importance of Studying This Unit

Every costing and pricing decision studied later in this course rests on the vocabulary and overhead-absorption techniques introduced here. A manager who cannot correctly allocate and apportion overheads will under- or over-cost a product, leading to flawed pricing, product-mix and outsourcing decisions. This unit is therefore the building block on which Units II to V are constructed.

Unit I: Flow of Overhead Costs to Products

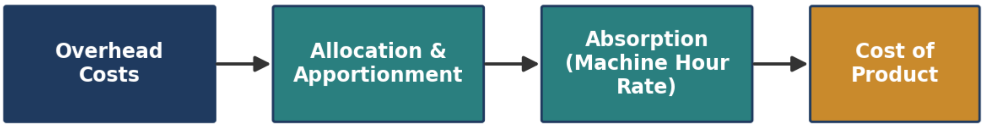

Figure: Key concept map for Unit I

1.1 Introduction

Every organisation, whether manufacturing a product or rendering a service, must know what it costs to produce that product or service before it can price it correctly, control its expenses, and plan for the future. Cost and Management Accounting is the branch of accounting that supplies this information. While Financial Accounting looks backwards and reports to outsiders, Cost and Management Accounting looks both backwards and forwards and reports to insiders — the managers who run the business day to day. This unit lays the conceptual foundation for the entire course: it explains how the three branches of accounting relate to one another, how costs are classified for different managerial purposes, and how overhead costs — the costs that cannot be traced directly to a single unit of product — are allocated, apportioned and absorbed into the cost of products through techniques such as the Machine Hour Rate

1.2 Key Terminologies

Term	Meaning
Cost	The amount of expenditure (actual or notional) incurred on, or attributable to, a given thing or activity.
Cost Accounting	The process of accounting for cost, from the point at which expenditure is incurred to the establishment of its ultimate

Term	Meaning
	relationship with cost centres and cost units.
Management Accounting	The application of accounting techniques to provide information designed to assist management in decision making, planning and control.
Cost Centre	A location, person, or item of equipment for which cost is ascertained and used for the purpose of cost control.
Cost Unit	A unit of product, service or time in relation to which cost may be ascertained or expressed.
Allocation	The process of charging the whole amount of a cost item directly to a cost centre or cost unit.
Apportionment	The process of distributing a common cost item over several cost centres on an equitable basis.
Absorption	The process of charging overheads to individual units of output through a suitable overhead rate.
Machine Hour Rate	The cost of running a machine for one hour, used to absorb overhead cost into jobs or products passing through that machine.

1.3 Financial Accounting, Cost Accounting and Management Accounting

These three branches of accounting are related but distinct. Financial Accounting is concerned with recording, classifying and summarising business transactions in monetary terms to prepare the Profit and Loss Account and the Balance Sheet for a defined accounting period, primarily for external stakeholders such as shareholders, creditors, tax authorities and regulators. Cost Accounting concentrates on ascertaining, recording and controlling the cost of a product, process, job, contract or service, and is used mainly by internal management for cost control and decision making, although some cost data also feed into statutory financial statements. Management Accounting is the broadest of the three; it uses both financial and cost data, along with non-financial and statistical information, to help managers plan, organise, direct and control operations, and it is entirely voluntary and forward looking, with no prescribed format.

Comparative Table

Basis	Financial Accounting	Cost Accounting	Management Accounting
Objective	Ascertains profit/loss of the whole business for a period	Ascertains cost and profitability of each product, job or process	Assists management in planning, decision making and control
Users	External — shareholders, creditors, government	Internal — cost department, production managers	Internal — top and middle management
Time Orientation	Historical (past transactions)	Historical as well as predetermined (standard costs)	Mostly futuristic — budgets, forecasts
Legal Requirement	Statutorily required (Companies Act, Income Tax Act)	Required for certain industries (Cost Audit)	Not legally required; purely for internal use
Format	Prescribed formats (Schedule III etc.)	No prescribed format, but conventional statements used	No fixed format — tailored to managerial need
Precision	Deals with actual, exact figures	Uses both actual and estimated figures	Approximations and estimates freely used for speed
Reporting Period	Usually annual	As required — daily, weekly, monthly	As required — even real-time dashboards
Scope	Monetary transactions only	Monetary and quantitative cost data	Monetary, cost, and qualitative/non-financial data

Why This Distinction Matters

A manager who confuses these three functions risks making poor decisions. For instance, financial accounting profit for the year tells the owner whether the business as a whole was profitable, but it does not tell the plant manager whether Product A is more profitable per unit than Product B, whether Machine 3 is running efficiently, or whether next month's cash position will support a planned expansion. Cost accounting answers the product-level question; management accounting answers the planning and decision question. In practice, the three systems are integrated in an Enterprise Resource Planning (ERP) environment, but conceptually the manager must know which lens to apply to which problem.

1.4 Role of Accounting Information in Planning and Control

Planning is the process of deciding in advance what is to be done, how it is to be done, and by whom. Control is the process of ensuring that actual performance conforms to the plan, and of taking corrective action where it does not. Accounting information is the principal language through which both processes are carried out in a business organisation.

In Planning

- Cost data helps set realistic selling prices and sales targets.
- Budgets translate strategic plans into quantified financial targets for each department.
- Break-even and marginal costing techniques help evaluate alternative courses of action before they are undertaken.
- Capital budgeting techniques use projected costs and revenues to appraise investment proposals.

In Control

- Standard costing and variance analysis compare actual performance against a predetermined benchmark.
- Responsibility accounting assigns costs to the manager who can control them, enabling performance evaluation.
- Cost reports highlight areas of inefficiency (e.g., excess material usage, idle machine time) for corrective action.
- Management by Exception allows managers to focus attention only on significant deviations rather than every transaction.

The planning–control cycle is therefore continuous: plans are set using accounting data, actual results are recorded using the same accounting system, variances are analysed, and the feedback is used to revise the next period's plan. This feedback loop is often depicted as a closed loop, shown conceptually below.

Figure 1.1: The Planning–Control Cycle

Set Objectives → Prepare Budgets/Standards → Execute Operations → Record Actual Costs → Compare Actual vs Standard/Budget (Variance Analysis) → Report to Management → Corrective Action / Revise Plan → (cycle repeats). This loop illustrates that accounting information is not a one-time report but an ongoing feedback mechanism that keeps operations aligned with organisational goals.

1.5 Cost Concepts and Managerial Use of Classification of Costs

Costs can be classified in several ways depending on the managerial purpose to be served. No single classification is 'correct'; the choice depends on the decision the manager is trying to make.

(a) By Nature / Element

- Material Cost — cost of materials used in production (direct and indirect).
- Labour Cost — cost of remuneration paid to employees (direct and indirect).
- Expenses — all costs other than material and labour (direct and indirect, e.g., power, rent, depreciation).

(b) By Function

- Production/Manufacturing Cost — costs incurred in the factory to convert raw material into finished goods.

- Administration Cost — cost of formulating policy, directing the organisation and controlling operations.
- Selling Cost — cost of creating and stimulating demand and securing orders.
- Distribution Cost — cost of the sequence of operations from making the packed product available for despatch to making the goods available to the customer.

(c) By Behaviour (Variability)

- Fixed Cost — remains constant in total, irrespective of the level of output, within a relevant range (e.g., rent, salaries of permanent staff).
- Variable Cost — varies in direct proportion to the volume of output (e.g., direct material, direct labour, power for machines).
- Semi-Variable (Mixed) Cost — has both a fixed and a variable component (e.g., telephone charges, electricity bill with a minimum charge plus usage charge).

This classification is the foundation of marginal costing and break-even analysis, both of which are covered in later units of this course. Managers use it to predict how total cost will behave at different levels of activity, which is essential for flexible budgeting and short-term decision making.

(d) By Controllability

- Controllable Cost — can be influenced by the action of a specified member of the organisation (e.g., a supervisor controlling overtime).
- Uncontrollable Cost — cannot be influenced by the action of a given person in a given time span (e.g., a plant manager cannot control head-office allocated rent).

(e) By Relevance to Decision Making

- Relevant Cost — a future cost that differs between alternatives and is therefore relevant to a specific decision.

- Sunk Cost — a cost already incurred that cannot be changed by any future decision (irrelevant for decision making).
- Opportunity Cost — the value of the benefit sacrificed in favour of an alternative course of action.
- Imputed (Notional) Cost — a hypothetical cost not involving actual cash outflow, e.g., interest on owner's own capital.
- Differential Cost — the change in total cost resulting from a change in the level or nature of activity.
- Marginal Cost — the additional cost of producing one more unit of output.

(f) By Time

- Historical Cost — cost ascertained after it has been incurred.
- Predetermined Cost — cost computed in advance of production, on the basis of specification of all factors affecting cost (standard cost, estimated cost).

Managerial Use — Why Classification Matters

A cost accountant does not classify costs for the sake of academic tidiness; each classification directly serves a managerial purpose. Functional classification is used to prepare a cost sheet and fix responsibility across departments. Behavioural classification underlies cost-volume-profit analysis, flexible budgeting, and the decision to accept a special order at a price below full cost. Controllability classification underlies performance evaluation and responsibility accounting, ensuring that a manager is judged only on costs within their authority. Relevance classification prevents managers from being misled by sunk costs when evaluating options such as make-or-buy or shut-down decisions — a mistake commonly seen in practice, where a manager continues to run an unprofitable machine merely because 'so much has already been spent on it.'

1.6 Direct and Indirect Expenses

All expenditure can first be split according to traceability to a cost object (usually a unit of product).

Direct Expenses

Direct expenses are expenses, other than direct material and direct labour, that can be identified with and allocated to a particular job, product, process or cost centre in an economically feasible way. Examples include hire charges for special equipment taken for a specific job, royalty paid on production, cost of special patterns or drawings prepared for a particular order, and carriage inward on a specific purchase. Direct material, direct labour and direct expenses together constitute the Prime Cost of a product.

Indirect Expenses (Overheads)

Indirect expenses, commonly called overheads, are costs that cannot be conveniently and economically traced to a specific cost unit, and are therefore incurred for the benefit of a number of cost centres or cost units collectively. Overheads are further classified by function into Factory (Works) Overheads, Office and Administration Overheads, and Selling and Distribution Overheads. Typical examples are factory rent, depreciation of plant, supervisory salaries, general lighting, and indirect material such as lubricants and consumable stores.

Basis	Direct Expense	Indirect Expense (Overhead)
Traceability	Directly identifiable with a single cost unit	Common to several cost units/centres
Example	Royalty on production, hire of special tool for a job	Factory rent, general supervision, insurance of building
Treatment	Charged in full to the job/product (Prime Cost)	Apportioned and absorbed using a suitable basis/rate
Cost Sheet Position	Included in Prime Cost	Added after Prime Cost as Works/Office/S&D overhead

1.7 Allocation and Apportionment of Overheads

Because overheads, by definition, cannot be traced to a single cost unit, they must be distributed to cost centres and, ultimately, to cost units through a two-stage process: allocation and apportionment, followed by absorption.

Cost Allocation

Allocation is possible only when the overhead item can be identified, without ambiguity, wholly with one particular cost centre. For example, the salary of a supervisor who works exclusively in the machining department is allocated wholly to the machining department; the depreciation on a specific machine located in the assembly department is allocated to that department.

Cost Apportionment

Apportionment becomes necessary when an overhead item is common to more than one cost centre and cannot be allocated in full to any one of them; it must be split among the benefiting cost centres on some equitable basis that reflects the extent to which each centre has caused or benefited from the cost.

Overhead Item	Basis of Apportionment
Rent and rates, building insurance	Floor area occupied by each department
Lighting and heating	Floor area or number of light points
Depreciation and insurance of plant	Value of plant and machinery in each department
Power and fuel	Horse power of machines, or machine hours
Supervision, canteen expenses	Number of employees in each department
Employees' insurance/welfare (ESI, PF)	Direct wages of each department
Repairs and maintenance of plant	Value of plant and machinery / capital values
Material handling	Weight, volume, or value of materials handled

Primary and Secondary Distribution

The distribution of overheads to all departments, both production and service departments, on the basis discussed above is called Primary Distribution. Since service departments (e.g., stores, maintenance, power house, canteen) exist only to serve the production departments, their costs must be further redistributed — this is called Secondary Distribution — to the production departments, using bases appropriate to each service department (e.g., maintenance department cost apportioned on the basis of machine hours worked for each production department; canteen cost apportioned on the basis of number of employees).

Methods of Secondary Distribution When Service Departments Serve Each Other

- Direct Distribution Method — service department costs are apportioned only to production departments, ignoring inter-service-department services.
- Step (Sequential) Distribution Method — service departments are ranked and their costs distributed one at a time to all other departments that have not yet been closed, starting with the department serving the largest number of other departments.
- Reciprocal Service Method (Simultaneous Equations / Repeated Distribution) — used when service departments render service to each other; the true cost of each is determined by setting up simultaneous equations or by repeated distribution until the figures are negligible.

Illustration 1.1 — Primary and Secondary Overhead Distribution

A factory has two production departments, P1 and P2, and one service department, S. The overheads for a month are: Rent ₹18,000, Depreciation on Machinery ₹12,000, Supervision ₹15,000, and Power ₹10,000. The following information is available: Floor area — P1: 3,000 sq.ft., P2: 2,000 sq.ft., S: 1,000 sq.ft.; Value of machinery — P1: ₹60,000, P2: ₹40,000, S: ₹20,000; Number of employees — P1: 30, P2: 20, S: 10; Horse power of machines — P1: 40, P2: 30, S: 10. The service department's cost is apportioned to P1 and P2 in the ratio of 3:2 (based on service rendered).

Solution — Primary Distribution:

Overhead	Basis	P1 (₹)	P2 (₹)	S (₹)
Rent 18,000	Floor area (3:2:1)	9,000	6,000	3,000
Depreciation 12,000	Value of machinery (3:2:1)	6,000	4,000	2,000
Supervision 15,000	No. of employees (3:2:1)	7,500	5,000	2,500
Power 10,000	H.P. of machines (4:3:1)	5,000	3,750	1,250
Total (Primary)	—	27,500	18,750	8,750

Secondary Distribution — Service department S's cost of ₹8,750 is apportioned to P1 and P2 in the ratio 3:2, i.e., P1 gets ₹5,250 and P2 gets ₹3,500. Final overhead of P1 = 27,500 + 5,250 = ₹32,750. Final overhead of P2 = 18,750 + 3,500 = ₹22,250. Total overhead of ₹55,000 is thus fully absorbed by the two production departments, confirming that the primary and secondary distributions together account for the entire overhead pool.

1.8 Calculation of Machine Hour Rate (MHR)

Once overhead has been allocated and apportioned to a production department (or, more precisely, to a machine or a group of similar machines), it must be absorbed into the cost of the jobs or products that pass through that machine. Where production is largely machine-driven, the Machine Hour Rate is the most scientific basis of absorption because it links overhead recovery directly to the time a job occupies the machine, rather than to labour cost or units produced, which may bear little relationship to actual machine usage.

Machine Hour Rate = Total Overheads Attributable to the Machine ÷ Effective (Normal) Machine Hours

The overheads attributable to a machine are classified into (i) Standing (fixed) charges — costs that do not vary with machine usage, such as rent, lighting, and supervision applicable to the machine's location, and (ii) Machine (running) expenses — costs that vary with the running of the machine, such as power, repairs, and depreciation. Standing charges are usually expressed per annum and converted to an hourly rate by dividing by the normal working hours; running expenses that are already on a per-hour basis are added directly.

Steps in Computing MHR

1. Determine standing (fixed) overheads per annum attributable to the machine and divide by effective machine hours to get standing charges per hour.
2. Compute machine (variable) expenses per hour, such as power, depreciation, and repairs, directly on an hourly basis.
3. Add standing charges per hour and machine expenses per hour to arrive at the ordinary (simple) Machine Hour Rate.
4. Where a comprehensive rate is required, add the direct wages of the operator per hour to the ordinary MHR to arrive at the Comprehensive Machine Hour Rate.

Illustration 1.2 — Machine Hour Rate

From the following data relating to a machine, compute the ordinary Machine Hour Rate: Cost of machine ₹1,08,000; estimated scrap value ₹8,000; effective life 10 years; effective working hours per annum 2,000; repairs and maintenance ₹8,000 per annum; power consumption 10 units per hour at ₹2 per unit; rent and rates of the shop (allocated to this machine) ₹6,000 per annum; supervision (allocated) ₹10,000 per annum; lighting (allocated) ₹4,000 per annum.

Solution:

Particulars	Per Annum (₹)	Per Hour (₹)
Standing Charges:		
Rent and rates	6,000	3.00
Supervision	10,000	5.00
Lighting	4,000	2.00
Total Standing Charges	20,000	10.00
Machine Expenses:		
Depreciation [(1,08,000 − 8,000) ÷ 10 ÷ 2,000]	10,000	5.00
Repairs and maintenance	8,000	4.00
Power (10 units × ₹2)	—	20.00
Ordinary Machine Hour Rate	—	39.00

Thus, the ordinary Machine Hour Rate is ₹39 per hour. If the machine operator's wage of, say, ₹15 per hour is to be included, the Comprehensive Machine Hour Rate would be ₹39 + ₹15 = ₹54 per hour. This rate is then multiplied by the number of hours a particular job occupies the machine to determine the overhead (or total) cost to be charged to that job.

Advantages of Machine Hour Rate

- Gives a scientific and equitable basis of overhead absorption in machine-intensive industries.
- Recognises the time factor, so idle machine time is not wrongly charged to production.
- Facilitates comparison of the cost-effectiveness of different machines.
- Useful for quoting realistic prices for jobs that use expensive machinery for varying durations.

Limitations of Machine Hour Rate

- Not suitable where production is predominantly manual (labour-intensive) rather than machine-intensive.

- Requires detailed record-keeping of machine hours for each job, which increases clerical work.
- Estimation of effective machine hours and apportioned standing charges involves subjective judgement.
- Ignores other bases (e.g., labour cost) that might sometimes be more relevant for certain overhead items.

1.9 Real-World Application

Precision engineering and machine-tool companies such as those in the auto-ancillary and aerospace-component sectors rely heavily on machine hour rates to quote job costs, because a CNC machine or a five-axis milling centre represents a very large fixed investment whose cost must be recovered accurately per job. A single hour on a high-precision CNC machine may carry an MHR many times that of a conventional lathe, and pricing a job without recognising this difference can silently erode margins on high-precision work while overpricing simple jobs. Textile mills similarly use machine hour rates separately for spinning, weaving and processing machinery, since each type of machine has a very different cost structure.

Case Study: Overhead Apportionment at a Multi-Product Auto Component Plant

A mid-sized auto-component manufacturer produced three components — brackets, brake pads, and clutch plates — across two production departments (Machining and Assembly) supported by a Maintenance department. For years the company apportioned all factory overheads on the single basis of direct labour hours, regardless of each department's actual power consumption, machine value, or floor area. A newly appointed cost accountant found that the Machining department, which used costly CNC equipment and consumed the bulk of the factory's power, was under-absorbing overhead, while the labour-intensive Assembly department was over-absorbing.

The cost accountant undertook a proper primary distribution of overheads using appropriate bases — floor area for rent, machine value for depreciation, and horse-power for power cost — followed by secondary distribution of Maintenance department cost on the basis of machine hours served to each production department. The revised distribution showed that the true overhead cost of brackets (which passed mostly through Machining) was nearly 18 percent higher than previously reported, while the cost of clutch plates (largely an Assembly operation) was overstated. Armed with correct department-wise overhead rates and machine hour rates for the CNC machines, management repriced the bracket contract and renegotiated better margins, while also identifying that certain older, low-utilisation machines in Assembly could be phased out without affecting overall capacity.

This case illustrates that a poor choice of overhead apportionment basis can systematically distort product costs and lead to wrong pricing and investment decisions, whereas a properly designed two-stage allocation-apportionment-absorption system, culminating in machine hour rates for machine-intensive departments, restores accuracy to product costing and supports sound managerial decisions.

1.10 Objectives and Scope of Cost Accounting

Cost Accounting was originally developed to answer one narrow question — what does a unit of product cost? — but it has since grown into a comprehensive system serving several distinct managerial objectives simultaneously. Understanding these objectives helps explain why a cost accounting system is designed the way it is, and why it must go well beyond simply recording expenditure.

- Ascertainment of Cost — determining the cost of a product, job, process, or service through appropriate costing methods and techniques.
- Cost Control — ensuring that actual cost does not exceed the cost that should have been incurred, through budgets, standards and continuous monitoring.
- Cost Reduction — a planned, positive approach to permanently lowering the cost of a product or service without impairing its suitability for the intended use, as distinct from cost control, which merely keeps cost within a set limit.
- Guiding Managerial Decisions — supplying relevant cost data for pricing, make-or-buy, product-mix, shut-down, and capital investment decisions.
- Determination of Selling Price — providing the cost base on which a reasonable margin of profit can be added to fix selling price, particularly in cost-plus contracts.

- Ascertaining Profitability — measuring the profit or loss of each product, department, or process, which aggregate financial accounting cannot reveal.
- Assisting in Preparation of Budgets — supplying the historical and standard cost data on which realistic budgets are built.

Cost Control vs Cost Reduction

Basis	Cost Control	Cost Reduction
Nature	Preventive — keeps cost within a predetermined standard/budget	Corrective and dynamic — seeks a permanent, real reduction in cost
Approach	Achieves the target cost already set	Challenges the target itself, seeking a lower one
Assumption	Assumes the existing standard is already the best attainable	Assumes there is always scope to do better than the current standard
Time Horizon	Continuous, but confined to the current budget period	Continuous, without a defined terminal point
Emphasis	On present level of performance	On improving performance and quality simultaneously

1.11 Essentials of a Good Cost Accounting System

Installing a cost accounting system is itself a significant managerial exercise, and a system that is poorly designed for the specific business can create more paperwork than insight. Several essentials distinguish a well-designed system from an ineffective one.

- Suitability to the nature and size of the business — the system must fit the specific production process (job, batch, process) rather than force a generic template on it.
- Simplicity — the system should be easily understood by the people who operate it and by the managers who use its output; excessive complexity defeats its own purpose.
- Accuracy and reliability of the data collected, particularly at the source (stores records, time sheets, and job cards).
- Promptness — cost information loses much of its value if it arrives too late to influence a decision; hence the emphasis, in modern systems, on near real-time cost dashboards.

- Economy — the cost of running the costing system itself must be reasonable in relation to the benefits derived from it.
- Comparability — the system should permit comparison of costs across periods, departments, and with external benchmarks, which requires consistency in classification and treatment over time.
- Cooperation and support of operating departments, since much of the primary data (material issues, time bookings) originates outside the cost department itself.

1.12 Elements of Cost — A Closer Look

Section 1.5(a) introduced material, labour and expenses as the three elements of cost by nature. It is worth examining each a little more closely, since the direct/indirect split within each element determines how it flows into the cost sheet.

Material Cost

Direct material is that which can be conveniently identified with and allocated to a specific unit of output, and which becomes a part of the finished product — for example, timber in furniture-making, or steel sheet in an automobile body. Indirect material, though necessary for production, does not form part of the finished product itself, or is too insignificant in value to justify tracing to individual units — for example, lubricating oil, cleaning materials, or small consumable tools.

Labour Cost

Direct labour (or productive labour) is the cost of remuneration for labour that is directly engaged in converting raw material into finished output and can be identified with a specific unit, job, or process — for example, a machine operator's wages on a specific job. Indirect labour is remuneration for employees who do not work directly on the product but who support production or the organisation generally, such as supervisors, maintenance staff, storekeepers and security personnel.

Expenses

As explained in Section 1.6, direct expenses are traceable to a specific job or product (e.g., royalty, hire of special equipment), while indirect expenses (overheads) are common to several cost centres or units and must be apportioned. It is useful to remember that indirect material and indirect labour, together with indirect expenses, collectively constitute overheads — the category that Sections 1.7 and 1.8 of this unit deal with at length.

1.13 Additional Illustration — Step (Sequential) Distribution Method

The direct distribution method illustrated earlier (Illustration 1.1) ignores services rendered by one service department to another. Where a service department also serves other service departments, the Step Distribution Method is more accurate: service department costs are distributed one at a time, in a sequence usually starting with the department that serves the largest number of other departments (or has the highest cost), and once a department's cost has been distributed, it is not reopened even if it later receives an apportioned share from another service department.

Illustration 1.3: A factory has two production departments, P1 and P2, and two service departments, S1 (Stores) and S2 (Maintenance). Overheads after primary distribution are: P1 ₹40,000; P2 ₹35,000; S1 ₹15,000; S2 ₹10,000. S1's cost is to be apportioned to P1, P2 and S2 in the ratio 4:3:1(no service back to S1 from S2); S2's cost (after receiving its share from S1) is apportioned to P1 and P2 in the ratio 3:2.

Solution: Step 1 — Distribute S1 (₹15,000) in the ratio 4:3:1 (total 8 parts): P1 gets 15,000 × 4/8 = ₹7,500; P2 gets 15,000 × 3/8 = ₹5,625; S2 gets 15,000 × 1/8 = ₹1,875. S2's revised total = 10,000 + 1,875 = ₹11,875. Step 2 — Distribute this ₹11,875 to P1 and P2 in the ratio 3:2: P1 gets 11,875 × 3/5 = ₹7,125; P2 gets 11,875 × 2/5 = ₹4,750. Final overhead of P1 = 40,000 + 7,500 + 7,125 = ₹54,625. Final overhead of P2 = 35,000 + 5,625 + 4,750 = ₹45,375. Total = 54,625 + 45,375 = ₹1,00,000, which agrees with the total overhead of all four departments (40,000+35,000+15,000+10,000), confirming the distribution is complete and accurate.

1.14 Additional Illustration — Comprehensive Machine Hour Rate with Multiple Machines

Illustration 1.4: A department has two identical machines, M1 and M2, each working 200 hours a month. Combined monthly overheads apportioned to the department are: Rent ₹4,000; Supervision ₹6,000; Insurance ₹2,000 (all standing charges, shared equally by the two machines). Each machine separately incurs: Power ₹1,600 per month (8 units/hour at ₹1 per unit for 200 hours); Repairs ₹1,000 per month; Depreciation ₹2,400 per month. The operator of each machine is paid ₹12,000 per month. Compute the Comprehensive Machine Hour Rate for one machine.

Solution: Standing charges per machine = (4,000+6,000+2,000)/2 = ₹6,000 per month, i.e., 6,000/200 = ₹30 per hour. Machine expenses per hour: Power = 1,600/200 = ₹8; Repairs = 1,000/200 = ₹5; Depreciation = 2,400/200 = ₹12. Total machine expenses = ₹25 per hour. Ordinary MHR = 30 + 25 = ₹55 per hour. Operator's wage per hour = 12,000/200 = ₹60. Comprehensive MHR = 55 + 60 = ₹115 per hour. This example shows how standing charges, which are common to a department, must first be equitably split among the individual machines within it before an individual machine's MHR can be computed.

1.15 Industry Applications Beyond Manufacturing

While cost concepts are most vividly illustrated with manufacturing examples, the classification, allocation and apportionment principles of this unit apply equally to service organisations. A hospital apportions the cost of its power plant, housekeeping and administration departments to revenue-generating departments such as radiology, surgery and the outpatient department, using bases such as floor area, number of beds, or patient-days, in essentially the same way a factory apportions overheads to production departments. A bank apportions central data-processing and compliance costs to individual branches using bases such as number of transactions or number of accounts serviced. An educational institution apportions library, administration and campus-maintenance costs to individual academic departments using bases such as number of students or number of faculty. The underlying logic — identify what can be directly allocated, apportion what is common on an equitable basis, and absorb the total into the final cost object — is universal across manufacturing and service contexts alike.

1.15A Additional Illustration — Combined Allocation, Apportionment and Machine Hour Rate

Illustration 1.5: A small engineering workshop has two production departments, Turning and Milling, and one service department, Stores. Annual overheads before distribution are: Factory Rent ₹60,000; Insurance of Plant ₹18,000; General Supervision ₹90,000; Power ₹36,000. The following information is available: Floor area — Turning 2,400 sq.ft., Milling 1,800 sq.ft., Stores 800 sq.ft.; Value of plant — Turning ₹3,00,000, Milling ₹2,40,000, Stores ₹60,000; Number of employees — Turning 18, Milling 14, Stores 8; H.P. of machines — Turning 25, Milling 20, Stores 5. Stores department cost is apportioned to Turning and Milling in the ratio 5:3. The Turning department has a single principal machine, working 2,400 effective hours per annum, with additional running costs of ₹1,20,000 (depreciation and repairs) per annum and power of 6 units per hour at ₹2 per unit specific to that machine (already excluded from the general power overhead above). Compute the departmental overhead for Turning after secondary distribution, and the Machine Hour Rate for the principal Turning machine, assuming the departmental (apportioned) overhead is a standing charge fully attributable to this one machine.

Solution — Primary Distribution (ratios rounded to whole rupees):

Overhead (₹)	Basis (Turning:Milling:Stores)	Turning (₹)	Milling (₹)	Stores (₹)
Rent 60,000	Floor area 2,400:1,800:800 (24:18:8)	28,800	21,600	9,600
Insurance 18,000	Plant value 300:240:60 (30:24:6)	9,000	7,200	1,800
Supervision 90,000	Employees 18:14:8 (18:14:8)	40,500	31,500	18,000
Power 36,000	H.P. 25:20:5 (25:20:5)	18,000	14,400	3,600
Total (Primary)	—	96,300	74,700	33,000

Secondary Distribution — Stores' cost of ₹33,000 is apportioned to Turning and Milling in the ratio 5:3 (8 parts): Turning gets 33,000 × 5/8 = ₹20,625; Milling gets 33,000 × 3/8 = ₹12,375. Final departmental overhead — Turning = 96,300 + 20,625 = ₹1,16,925; Milling = 74,700 + 12,375 = ₹87,075. (Total ₹2,04,000 agrees with total overheads of 60,000+18,000+90,000+36,000 = ₹2,04,000.)

Machine Hour Rate for the principal Turning machine: Standing charges per hour = 1,16,925 ÷ 2,400 = ₹48.72 (approx). Running expenses per hour: Depreciation and repairs = 1,20,000 ÷ 2,400 = ₹50.00; Power = 6 × 2 = ₹12.00. Ordinary Machine Hour Rate = 48.72 + 50.00 + 12.00 = ₹110.72 per hour (approx). This illustration ties together, in a single worked example, the full sequence covered in this unit: primary distribution, secondary distribution, and the build-up of a Machine Hour Rate from the resulting departmental standing charge.

Case Study: Departmental Overhead Rates versus a Single Blanket Rate at a Machine Tool Company

A machine-tool manufacturer had for years applied one single 'blanket' overhead rate across its entire factory, computed as total factory overhead divided by total direct labour hours, and used uniformly to cost every job regardless of which department or machine actually performed the work. Management routinely praised the Grinding department for its consistently 'low-cost' jobs and quietly worried about the seemingly 'expensive' Milling department, without realising this comparison was distorted by the blanket rate.

An internal audit, prompted by a lost tender to a competitor on a large milling contract, led the company to compute separate departmental overhead rates using proper allocation and apportionment as covered in this unit. The audit revealed that Milling, which housed the company's most expensive CNC equipment, had a departmental overhead rate nearly three times that of the labour-intensive Grinding department — meaning the old blanket rate had been significantly overcharging Grinding jobs (making them look artificially expensive) while significantly undercharging Milling jobs (making them look artificially cheap and encouraging under-pricing of milling-heavy tenders).

Switching to departmental rates, and eventually to machine hour rates for the CNC-intensive machines within Milling, allowed the company to price future tenders far more accurately, winning back competitive milling contracts it had previously lost due to unknowingly overpriced quotations, while also correcting years of understated internal performance criticism of the Grinding department's staff, who had, in fact, been performing efficiently all along.

1.17A Additional Illustration — Reciprocal Service Method

Illustration 1.6: Two service departments, X and Y, render service to each other as well as to two production departments, A and B. Overheads after primary distribution are: A ₹50,000; B ₹40,000; X ₹18,000; Y ₹12,000. X renders 20% of its service to Y, 50% to A and 30% to B. Y renders 10% of its service to X, 60% to A and 30% to B. Using the simultaneous equation method, find the final overhead of A and B.

Solution: Let the true (total) cost of X be 'x' and of Y be 'y', after accounting for the reciprocal service each renders to the other.

x = 18,000 + 0.10y

$y = 12{,}000 + 0.20x$

Substituting the second equation into the first: $x = 18{,}000 + 0.10(12{,}000 + 0.20x) = 18{,}000 + 1{,}200 + 0.02x$, so $x - 0.02x = 19{,}200$, giving $0.98x = 19{,}200$, so $x = 19{,}200 \div 0.98 \approx$ ₹19,592. Then $y = 12{,}000 + 0.20 \times 19{,}592 \approx 12{,}000 + 3{,}918 =$ ₹15,918.

Now distribute these true costs to A and B (and cross-charge each other, which nets off): A's share from X = 19,592 × 50% = ₹9,796; A's share from Y = 15,918 × 60% = ₹9,551; B's share from X = 19,592 × 30% = ₹5,878; B's share from Y = 15,918 × 30% = ₹4,775.

Final overhead of A = 50,000 + 9,796 + 9,551 = ₹69,347. Final overhead of B = 40,000 + 5,878 + 4,775 = ₹50,653. (Minor rounding differences of a rupee or two may arise depending on the number of decimal places carried through the calculation; students should carry at least two decimal places throughout to minimise this.) Total = 69,347 + 50,653 = ₹1,20,000, which agrees with the total overhead of all four departments before distribution (50,000+40,000+18,000+12,000 = ₹1,20,000), confirming the reciprocal service method has fully and correctly redistributed the service department costs, unlike the direct and step methods, which only approximate the true reciprocal cost when services flow in both directions between service departments.

1.16 Emerging Trends and Recent Advancements

The practice of cost accounting has evolved considerably from its origins in simple factory bookkeeping. Enterprise Resource Planning (ERP) systems such as SAP and Oracle now integrate cost accounting with production, procurement and sales modules, so that material issues, labour time bookings and overhead allocation happen automatically as transactions occur, replacing the manual ledgers and cost sheets on which classical cost accounting was originally built. Activity-Based Costing (ABC), developed in the 1980s, refines the crude single-basis overhead apportionment described in Section 1.7 by tracing overhead to the specific activities (e.g., machine set-ups, quality inspections, order processing) that actually drive the cost, and then to products in proportion to their consumption of those activities, giving a far more accurate product cost in complex, multi-product environments than traditional volume-based apportionment. Environmental (Green) Cost Accounting is increasingly used to identify, measure and report the environmental costs of operations — such as waste disposal, emissions compliance, and energy consumption — that traditional cost accounting often buries within general factory overhead, so that management can evaluate genuinely sustainable, and not merely regulation-compliant, production choices. Finally, real-time dashboards and predictive analytics, built on the same underlying cost data this unit has introduced, are increasingly replacing the traditional monthly cost report, allowing managers to see cost trends and machine-hour utilisation as they happen rather than weeks after the event.

1.17 Industry Insight — Overhead Absorption in the Age of Automation

As factories automate, direct labour cost as a proportion of total cost has fallen dramatically in many industries, while overhead — largely driven by expensive automated machinery, robotics, and computer-controlled equipment — has risen to become the dominant element of cost. This shift has made the traditional practice of absorbing overhead 'as a percentage of direct labour cost' increasingly unreliable, since a small amount of labour on a highly automated line now sits alongside a very large amount of machine-driven overhead, and a labour-based percentage badly distorts the true cost of automated versus manual jobs. This is precisely why the Machine Hour Rate, discussed at length in Section 1.9, and Activity-Based Costing, mentioned above, have grown in importance relative to older labour-based overhead absorption methods as manufacturing has modernised.

Question Bank

(a) Short Answer Questions (2 Marks)

S.No	Question	Marks	Bloom Level
1	Define Cost Accounting.	2	L1
2	What is Management Accounting?	2	L1
3	State any two differences between Cost Accounting and Financial Accounting.	2	L2
4	What is meant by a Cost Centre?	2	L1
5	Define Cost Unit with an example.	2	L1
6	Distinguish between Allocation and Apportionment.	2	L2
7	What is a semi-variable cost? Give one example.	2	L2
8	What is meant by Opportunity Cost?	2	L1
9	Define Machine Hour Rate.	2	L1
10	What are Standing Charges in the context of MHR?	2	L1
11	Give two examples of controllable costs.	2	L2
12	What is meant by Sunk Cost?	2	L1

(b) Essay Type Questions (10 Marks)

S.No	Question	Marks	Bloom Level
1	Explain in detail the differences between Financial Accounting, Cost Accounting and Management Accounting.	10	L2
2	Discuss the role of accounting information in managerial planning and control with a suitable diagram of the planning-control cycle.	10	L4
3	Explain the various bases of classification of costs and their managerial significance.	10	L2
4	Distinguish between direct and indirect expenses. Explain, with examples, the treatment of overheads in a cost sheet.	10	L4
5	What is meant by allocation and apportionment of overheads? Explain the commonly used bases of apportionment for different overhead items.	10	L3
6	Explain the steps involved in the computation of Machine Hour Rate. Distinguish between Ordinary and Comprehensive Machine Hour Rate.	10	L3
7	Critically evaluate the advantages and limitations of using Machine Hour Rate as a basis of overhead absorption.	10	L5
8	Explain the direct distribution method, step distribution method and reciprocal service method of redistributing service department costs, with suitable examples.	10	L4

Problems

S.No	Problem	Marks	Bloom Level
1	Problem 1.1: From the following annual data relating to Machine	10	L3

	'X', compute the Machine Hour Rate: Cost of machine ₹2,50,000; scrap value ₹10,000; estimated life 12 years; effective working hours 2,400 per annum; power cost ₹3 per unit, consumption 8 units per hour; repairs ₹12,000 p.a.; rent apportioned ₹15,000 p.a.; supervision apportioned ₹18,000 p.a.		
2	Problem 1.2: A factory has three production departments A, B, C and one service department D. Overheads for the month were: Factory rent ₹24,000, Depreciation of plant ₹18,000, General supervision ₹20,000, Power ₹12,000. Floor area: A 4,000, B 3,000, C 2,000, D 1,000 sq.ft.; Value of plant: A ₹90,000, B ₹60,000, C ₹40,000, D ₹10,000; No. of employees: A 40, B 30, C 20, D 10; H.P. of machines: A 30, B 25, C 20, D 5. Apportion the overheads to all departments and then redistribute department D's cost to A, B and C in the ratio 3:2:1 using the direct distribution method.	10	L3
3	Problem 1.3: Compute the Comprehensive Machine Hour Rate given: Ordinary Machine Hour Rate ₹45 per hour, and the machine operator is paid ₹18,000 per month for 200 effective working hours.	10	L3

Case Study: Real-Time Case Study: Job Pricing Decision at a Precision Tooling Unit

A precision tooling workshop received an enquiry to manufacture 500 custom die components. The job required 4 hours on a CNC machining centre and 2 hours of manual fitting per unit. The company had never separately computed a machine hour rate; overheads had always been absorbed as a flat 150% of direct labour cost. Using this old method, the quoted price appeared attractive to the customer but management suspected the job was actually loss-making given the CNC centre's high depreciation and power cost.

The company's cost accountant computed a proper Machine Hour Rate for the CNC centre — factoring in depreciation on the ₹80 lakh machine, power consumption, and apportioned floor and supervision cost — and arrived at a rate of ₹950 per machine hour, substantially higher than what the old flat-percentage method implied. Recomputing the job cost using the correct MHR revealed that the original quotation would have resulted in a loss of nearly ₹6 lakh across the 500-unit order.

Management revised its pricing policy for all future CNC-intensive jobs to use department-specific machine hour rates rather than a blanket percentage-of-labour overhead rate, protecting margins on high-precision work while remaining competitive on simpler manual jobs. The case demonstrates the practical, bottom-line consequences of choosing an appropriate overhead absorption base.

Unit Highlights

- Cost Accounting looks at both the past and the future and reports to internal managers, unlike Financial Accounting.
- Costs can be classified in at least six different ways, each suited to a different managerial purpose.
- Allocation charges a cost item wholly to one cost centre; apportionment divides a common cost fairly across several centres.

- The reciprocal service method is the most accurate way to redistribute costs between service departments that serve each other.
- The Machine Hour Rate converts machine-running overheads into a per-hour rate for absorbing cost into jobs.

Unit Summary

This unit established the foundation for the entire course. Financial Accounting, Cost Accounting and Management Accounting were distinguished by their objective, users, time orientation and legal status, and accounting information was shown to be the language through which both organisational planning and control are carried out, tied together in a continuous feedback loop. Costs were classified by nature, function, behaviour, controllability, relevance and time, each classification serving a distinct managerial purpose, from preparing a cost sheet to making a sound short-run decision that is not contaminated by irrelevant sunk costs. Direct expenses were distinguished from indirect expenses (overheads), and the two-stage process of allocating and apportioning overheads to production and service departments — through primary distribution followed by secondary distribution via the direct, step, or reciprocal service method — was explained and illustrated. Finally, the Machine Hour Rate was developed as the most scientific basis for absorbing overhead into machine-intensive production, distinguishing standing charges from machine (running) expenses, and distinguishing the ordinary rate from the comprehensive rate that also includes the operator's wage. Together, these concepts equip a manager to understand not just what a product costs today, but why it costs what it does, and how that cost is built up from the factory floor to the final cost sheet.

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UNIT II — Costing for Specific Industries

> *"It is not necessary to know everything in order to understand something."*
> *— Jean Piaget*

Unit Overview

Different industries manufacture in fundamentally different ways, so this unit matches the costing method to the mode of production. It moves from Unit (Output) Costing and Job Costing — suited to distinct jobs or a single homogeneous product — through Batch and Contract Costing, to Process Costing and its complications: normal and abnormal loss, inter-process profit, joint products/by-products, and equivalent production.

Objectives of the Unit
1. Explain unit costing and prepare a cost sheet.
2. Describe job costing and its application to jobbing industries.
3. Prepare quotations/tenders based on cost sheet data.
4. Explain process costing and account for normal and abnormal losses/gains.
5. Account for inter-process profits in process costing.
6. Distinguish joint products from by-products and account for by-product costs.
7. Compute equivalent production and value work-in-progress under process costing.

Key Concepts

- Cost Sheet — Prime Cost, Works Cost, Cost of Production, Total Cost.
- Job Costing, Batch Costing and Contract Costing.
- Tender / Quotation costing based on historical cost ratios.
- Process Costing, Normal Loss, Abnormal Loss and Abnormal Gain.
- Inter-process profit and the provision for unrealised profit.
- Joint Products, By-Products and methods of joint-cost apportionment.
- Equivalent Production (no opening WIP, and FIFO/weighted-average with opening WIP).

Learning Outcomes

On successful completion of this unit, students will be able to:

- Prepare a cost sheet and compute Prime Cost, Works Cost, Cost of Production and Total Cost.
- Prepare a job cost sheet and a quotation/tender based on cost data.
- Prepare process accounts recognising normal loss, abnormal loss and abnormal gain.
- Account for inter-process profit and the unrealised profit provision on closing stock.
- Apportion joint cost between joint products using at least two accepted methods and account for by-product value.
- Compute equivalent production and value closing work-in-progress under FIFO.

Importance of Studying This Unit

Choosing the wrong costing method distorts the cost of every unit produced. This unit equips future managers to recognise which costing method fits a given production process — job shop, batch, continuous process, or long-duration contract — a judgement routinely required in manufacturing, engineering and process industries.

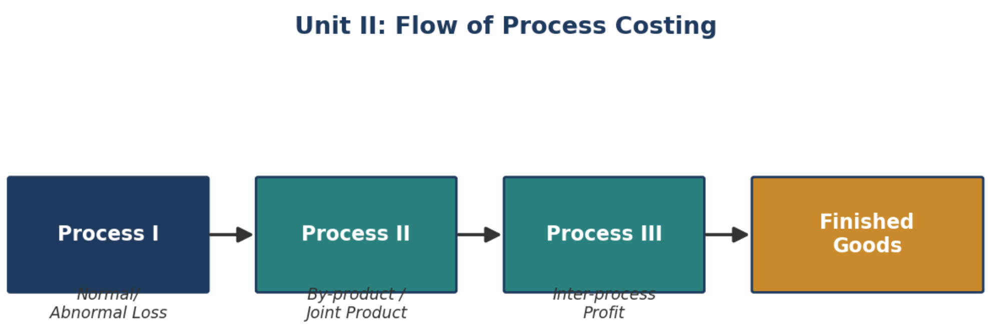

Figure: Key concept map for Unit II

2.1 Introduction

Different industries manufacture in fundamentally different ways, and a single costing method cannot serve them all equally well. A shipbuilder executes one large, unique contract at a time; a printer produces a distinct batch of visiting cards for each customer; a cement plant, on the other hand, produces a continuous, homogeneous output through a sequence of processes. Costing methods are therefore tailored to the nature of production. This unit covers Unit (Output) Costing and Job Costing, which suit specific, identifiable jobs or homogeneous single products, and Process Costing, which suits continuous, multi-stage production, together with its complications — normal and abnormal loss, inter-process profit, joint products and by-products, and equivalent production.

2.2 Key Terminologies

Term	Meaning
Cost Sheet	A statement that shows the various components of total cost of a product for a given period, arranged under Prime Cost, Works Cost, Cost of Production and Total Cost.
Job Costing	A method of costing applied where work is undertaken according to customers' specific requirements, each job being a distinct cost unit.
Tender/Quotation	A price offer made to a prospective customer, based on estimated cost plus a margin of profit.

Term	Meaning
Process Costing	A method of costing applied to industries where production is continuous and the product passes through two or more distinct processes.
Normal Loss	The loss that is inherent in a manufacturing process and cannot be avoided under normal operating conditions.
Abnormal Loss	Loss in excess of the normal, pre-determined loss, arising from carelessness, accident or other abnormal causes.
Abnormal Gain	The gain arising when actual loss is less than the normal loss anticipated.
Equivalent Production	The notional whole units representing the incomplete units of work-in-progress in terms of completed units.
Joint Products	Two or more products of significant sale value produced simultaneously from the same process and raw material.
By-Product	A secondary product of relatively minor value that emerges incidentally during the manufacture of the main product.

2.3 Unit (Output) Costing and the Cost Sheet

Unit costing (also called output costing or single costing) is used in industries producing a single product, or a few grades of one product, on a continuous basis, such as brick-making, mining, cement or dairy. The total cost is ascertained for the period and divided by the number of units produced to obtain cost per unit. The cost sheet is the principal statement used to present this cost, and it is built up in stages.

Format of a Cost Sheet

Particulars	Amount (₹)
Opening Stock of Raw Material	xxx
Add: Purchases of Raw Material (net of returns)	xxx
Less: Closing Stock of Raw Material	(xxx)
Direct Material Consumed	xxx
Add: Direct Wages (Labour)	xxx
Add: Direct Expenses	xxx
PRIME COST	xxx

Particulars	Amount (₹)
Add: Factory/Works Overheads	xxx
Add: Opening Work-in-Progress; Less: Closing Work-in-Progress	xxx / (xxx)
WORKS / FACTORY COST	xxx
Add: Office and Administration Overheads	xxx
COST OF PRODUCTION	xxx
Add: Opening Stock of Finished Goods; Less: Closing Stock of Finished Goods	xxx / (xxx)
COST OF GOODS SOLD	xxx
Add: Selling and Distribution Overheads	xxx
COST OF SALES (TOTAL COST)	xxx
Add: Profit	xxx
SALES	xxx

Illustration 2.1 — Preparation of a Cost Sheet

From the following particulars for the month, prepare a cost sheet and find the cost per unit and profit, given that 1,000 units were produced and sold: Opening stock of raw material ₹20,000; purchases ₹1,60,000; closing stock of raw material ₹15,000; direct wages ₹90,000; direct expenses ₹10,000; factory overheads ₹63,000; office overheads 10% of works cost; selling overheads ₹8 per unit; profit is 20% on sales.

Solution: Material consumed = 20,000 + 1,60,000 − 15,000 = ₹1,65,000. Prime cost = 1,65,000 + 90,000 + 10,000 = ₹2,65,000. Works cost = 2,65,000 + 63,000 (factory overhead) = ₹3,28,000. Office overhead = 10% of 3,28,000 = ₹32,800. Cost of production = 3,28,000 + 32,800 = ₹3,60,800. Selling overhead = 1,000 × 8 = ₹8,000. Total cost = 3,60,800 + 8,000 = ₹3,68,800. Cost per unit = 3,68,800 ÷ 1,000 = ₹368.80. Since profit is 20% on sales, cost of sales is 80% of sales, so Sales = 3,68,800 ÷ 0.80 = ₹4,61,000; Profit = 4,61,000 − 3,68,800 = ₹92,200; Selling price per unit = ₹461.

2.4 Job Costing

Job costing is used where production is carried out against specific orders rather than for stock, so that each job is a distinguishable unit of cost. It is common in printing presses, foundries, ship-repair yards, furniture-making, and general engineering workshops undertaking made-to-order work. A separate Job Cost Sheet (or Job Card) is opened for every job, on which material requisitions, time sheets (labour) and overhead absorbed are recorded as the job progresses, so that the total cost — and hence the profitability — of each individual job can be determined the moment it is completed.

Procedure in Job Costing

5. Customer's enquiry is received and a job number is allotted.
6. A production order is issued authorising the start of work.
7. Materials issued against the job are recorded on Material Requisition Notes and charged to the Job Cost Sheet at actual or standard price.
8. Labour time booked on the job (from time sheets/job cards) is charged at the appropriate wage rate.
9. Overheads are absorbed into the job using a predetermined overhead absorption rate (e.g., percentage of direct wages, or machine hour rate).
10. On completion, total cost is compared with the quoted price (if any) to determine profit or loss on the job.

Illustration 2.2 — Job Cost Sheet

Job No. 007 required direct material of ₹12,500 and direct labour of 80 hours at ₹60 per hour. Factory overhead is absorbed at 150% of direct labour cost, and office overhead at 10% of works cost. The job was quoted and invoiced at ₹32,000. Prepare the Job Cost Sheet and determine profit or loss.

Solution: Direct material ₹12,500; Direct labour = 80 × 60 = ₹4,800; Prime cost = ₹17,300; Factory overhead = 150% of 4,800 = ₹7,200; Works cost = 17,300 + 7,200 = ₹24,500; Office overhead = 10% of 24,500 = ₹2,450; Total cost of the job = ₹26,950. Invoice price = ₹32,000. Profit on Job No. 007 = 32,000 − 26,950 = ₹5,050.

2.5 Costing for Tenders / Quotations

A tender is a price quotation submitted in response to an enquiry, usually for a large or repeat order, and must be based on a careful estimate of cost plus a reasonable margin of profit. The estimate is normally built up by expressing each element of cost (material, labour, and different categories of overhead) as a percentage of a known base (e.g., overheads as a percentage of direct wages or prime cost) derived from the costs of the previous, comparable period, and then applying those percentages to the estimated material and labour cost of the new job or the anticipated output for which the tender is invited.

Illustration 2.3 — Tender Costing

The following data relate to the year just ended, during which 10,000 units were produced: Direct material ₹4,00,000; direct labour ₹2,00,000; factory overhead ₹1,00,000; office overhead ₹60,000; selling overhead ₹40,000. A tender is to be submitted for the supply of 2,000 units next year, when material prices are expected to rise by 10% and labour rates by 5%; other costs and cost ratios are expected to remain unchanged. The company wants a profit of 20% on the tender price. Prepare a statement showing the tender price.

Solution: Per unit costs this year — Material ₹40, Labour ₹20, Factory overhead ₹10, Office overhead ₹6, Selling overhead ₹4. For 2,000 units next year: Material = 2,000 × 40 × 1.10 = ₹88,000; Labour = 2,000 × 20 × 1.05 = ₹42,000; Factory overhead (50% of labour, as per this year's ratio 1,00,000/2,00,000) = 21,000; Office overhead (15% of works cost, i.e., 60,000/4,00,000 works-cost ratio — computed similarly) ≈ ₹22,650; Selling overhead (10% of works cost, per prior ratio) ≈ ₹15,100. Total estimated cost ≈ ₹1,88,750. Since profit is 20% on tender price (i.e., cost is 80% of price), Tender Price = 1,88,750 ÷ 0.80 ≈ ₹2,35,938, i.e., about ₹118 per unit. (Students should carry all workings to two decimals in examinations.)

2.6 Process Costing

Process costing applies where a product passes through two or more distinct, sequential processes before it becomes a finished product, and the output of one process becomes the raw material (input) of the next. It is typical of chemicals, sugar, textiles, paper, oil refining, and food processing industries. Since individual units lose their separate identity while passing through a continuous process, cost cannot be traced to individual units as in job costing; instead, the total cost incurred in a process during a period is averaged over the total output of that process to find cost per unit.

Features of Process Costing

- Production is continuous, and output of one process is the input of the next.
- Products are homogeneous, and cost is averaged rather than traced to specific units.
- Losses (normal and abnormal) often occur inherently at various process stages.
- By-products or joint products may emerge from a common process.
- A separate Process Account is maintained for each process, and the output (with cost) of one process is transferred to the next.

Format of a Process Account

Dr.	Units	Amount (₹)	Cr.	Units	Amount (₹)
To Materials	xx	xxx	By Normal Loss (Scrap value)	xx	xxx
To Labour		xxx	By Abnormal Loss (at process cost per unit)	xx	xxx
To Direct Expenses		xxx	By Process II A/c (Transfer)	xx	xxx
To Production Overhead		xxx			
To Abnormal Gain (if any, at process cost per unit)	xx	xxx			
Total	xx	xxx	Total	xx	xxx

2.7 Normal Loss, Abnormal Loss and Abnormal Gain

Normal Loss is the loss that is expected and unavoidable under efficient operating conditions — e.g., evaporation, shrinkage, or scrap arising from the nature of the material or process — and is usually expressed as a fixed percentage of input, determined from past experience or technical estimates. The scrap value, if any, of normal loss units is credited to the Process Account and deducted from the process cost before finding cost per unit of good output, so that the entire process cost is spread over the good units expected, i.e.:

Normal Cost per unit = (Total Process Cost − Scrap Value of Normal Loss) ÷ (Input Units − Normal Loss Units)

Abnormal Loss occurs when actual loss exceeds normal loss, due to causes such as a machine breakdown, use of substandard material, or careless handling; because it is avoidable and not a normal cost of production, it must not be allowed to inflate the cost of good production. Abnormal loss units are valued at the same rate as normal (good) output — i.e., at the normal cost per unit computed above — and are credited to the Process Account and transferred to a separate Abnormal Loss Account, which is later closed to the Costing Profit and Loss Account (after crediting any scrap realised from the abnormal loss units).

Abnormal Gain arises in the opposite situation, when actual loss is less than the normal loss anticipated, so that actual output exceeds the output expected after providing for normal loss. Abnormal gain units are also valued at the normal cost per unit and are debited to the Process Account (increasing its credit-side balance to tally) and credited to an Abnormal Gain Account, which is transferred to the Costing Profit and Loss Account as an addition to profit, after adjusting for the scrap value that would have been realised had those units instead been treated as normal loss.

Illustration 2.4 — Normal Loss and Abnormal Loss

Input to Process I is 1,000 units at a cost of ₹50,000; additional costs incurred in the process: labour ₹15,000, overhead ₹10,000. Normal loss is 10% of input, and scrap realises ₹5 per unit. Actual output is 850 units. Prepare Process I Account.

Solution: Normal loss = 10% of 1,000 = 100 units (scrap value = 100 × 5 = ₹500). Total process cost = 50,000 + 15,000 + 10,000 = ₹75,000. Normal cost per good unit = (75,000 − 500) ÷ (1,000 − 100) = 74,500 ÷ 900 = ₹82.78 (approx). Expected output after normal loss = 900 units, but actual output is only 850 units, so Abnormal Loss = 900 − 850 = 50 units, valued at ₹82.78 each = ₹4,139 (approx).

Dr. Process I A/c	Units	₹	Cr.	Units	₹
To Cost incurred (Material+Labour+OH)	1,000	75,000	By Normal Loss (scrap)	100	500
			By Abnormal Loss (@82.78)	50	4,139
			By Output transferred (@82.78)	850	70,361
Total	1,000	75,000	Total	1,000	75,000

2.8 Inter-Process Profits

In some organisations, the output of each process is transferred to the next not at cost, but at a transfer price that includes an element of profit, as though each process were an independent, profit-making entity. This is done to evaluate the efficiency of each process in comparison with the market price of similar goods at that stage. The consequence is that stocks of work-in-progress and finished goods carry an unrealised profit element, which must be eliminated for external financial reporting through a Provision for Unrealised Profit on Stock, calculated as:

Unrealised Profit on Closing Stock = Closing Stock Value × [Profit Element ÷ Transfer (Invoice) Price]

This ensures that inventory in the Balance Sheet is not overstated by profit that has not actually been realised through a sale to an outside party. A separate 'Stock Reserve' or 'Provision for Unrealised Profit' account is created and adjusted each period as the level of closing stock changes.

2.9 Joint Products and By-Products

Joint Products are two or more products of comparable importance and significant sale value that are produced simultaneously from the same process and the same input, up to a point called the Split-off (or Separation) Point, beyond which each may require further separate processing (e.g., petrol, diesel and kerosene from crude oil refining). A By-Product, in contrast, is a secondary or incidental product of relatively minor sale value that emerges during the processing of the main product (e.g., molasses in sugar manufacture, or bran in flour milling).

Methods of Accounting for By-Products

- Other Income Method — sale value of the by-product is credited directly to the Costing Profit and Loss Account, without adjusting the process cost of the main product.
- Credit to Process (Sale Value) Method — sale value (or net realisable value) of the by-product is credited to the Process Account of the main product, reducing the cost of the main product.
- Reverse Cost / Net Realisable Value Method — estimated further cost of processing and selling the by-product is deducted from its sale value, and only the net realisable value is credited to the main process.
- Standard Cost Method — by-product is credited to the process at a pre-determined standard rate, and variances are analysed separately.

Methods of Apportioning Joint Cost among Joint Products

- Physical Units (Quantity) Method — joint cost apportioned in proportion to the physical quantity (weight/volume) of each joint product at the split-off point.
- Sales Value at Split-off Method — joint cost apportioned in the ratio of the sale value of each product at the point of separation.
- Net Realisable Value Method — used when products need further processing after split-off; joint cost apportioned in the ratio of sale value at the end less further processing cost.
- Average Unit Cost Method — total joint cost divided by total units of all joint products to give a uniform cost per unit, ignoring differences in individual sale value.

2.10 Equivalent Production

Since production is continuous, at the end of an accounting period some units will remain incomplete (Work-in-Progress). It would be inequitable to spread the entire process cost equally over both fully completed units and partly completed units, since the latter have not received the full amount of material, labour and overhead. Equivalent Production converts the incomplete units into an equivalent number of fully completed units, based on the percentage of work actually performed on them, so that cost can be fairly apportioned between finished output and closing work-in-progress.

Equivalent Units = Actual Units of WIP × Percentage of Completion

Because material, labour and overhead are often added at different rates during the process (e.g., all material may be introduced at the start, while labour and overhead accrue evenly), equivalent production is usually computed separately for each cost element.

Illustration 2.5 — Equivalent Production (FIFO basis, no opening WIP)

In a process, 1,000 units were introduced during the month. 800 units were completed and transferred to the next process. 200 units remained in process, complete as to materials (100%) but only 50% complete as to labour and overhead. Costs incurred during the month: Materials ₹40,000; Labour ₹27,000; Overhead ₹18,000. Compute equivalent production and the cost per equivalent unit, and value the closing WIP.

Element	Completed Units	Equivalent Units of Closing WIP (200 units)	Total Equivalent Units	Cost (₹)	Cost per Equivalent Unit (₹)
Material (100% complete in WIP)	800	200 × 100% = 200	1,000	40,000	40.00
Labour (50% complete in WIP)	800	200 × 50% = 100	900	27,000	30.00
Overhead (50%	800	200 × 50% = 100	900	18,000	20.00

Element	Completed Units	Equivalent Units of Closing WIP (200 units)	Total Equivalent Units	Cost (₹)	Cost per Equivalent Unit (₹)
complete in WIP)					

Cost of 800 completed units = 800 × (40 + 30 + 20) = 800 × ₹90 = ₹72,000. Value of closing WIP = (200 × 40) + (100 × 30) + (100 × 20) = 8,000 + 3,000 + 2,000 = ₹13,000. Total cost accounted for = 72,000 + 13,000 = ₹85,000, which tallies with total cost incurred (40,000 + 27,000 + 18,000 = ₹85,000), confirming the correctness of the computation.

2.11 Advantages and Limitations of Process Costing

Advantages

- Simple to operate since costs are collected process-wise rather than unit-wise.
- Facilitates cost comparison between processes and between successive periods.
- Enables identification of inefficiency through abnormal loss/gain analysis at each process.
- Suitable for standard costing since output is homogeneous.

Limitations

- Cost per unit is often an average figure and may not represent the exact cost of a specific unit.
- Valuation of work-in-progress through equivalent production involves estimation and subjectivity.
- Apportionment of joint costs among joint products is inherently arbitrary to some degree.
- Errors in one process are carried forward and compounded in subsequent processes.

Case Study: Process Costing and By-Product Valuation in a Sugar Mill

A cooperative sugar mill processes sugarcane through crushing, clarification, evaporation, and crystallisation processes to produce sugar, generating molasses and bagasse as by-products at various stages. For years the mill had charged the entire cost of the crushing and clarification processes to sugar alone, treating molasses revenue as 'miscellaneous income' credited straight to the profit and loss account rather than to the relevant process account.

A newly hired cost accountant pointed out that this practice understated the recorded cost of molasses-related processes and overstated the apparent cost of sugar, distorting the mill's understanding of which season's operations were truly efficient. By switching to the net realisable value method — crediting the estimated net realisable value of molasses to the relevant Process Account — the mill obtained a more accurate cost per quintal of sugar, which turned out to be about 6% lower than previously reported once molasses revenue was properly netted off.

This revised, more accurate sugar cost enabled the mill's management to negotiate better bulk-supply contracts with confidence, since they now knew their true break-even price, and also to evaluate whether investing in better molasses-processing facilities (to convert it into ethanol) would be a worthwhile diversification, since the by-product's true contribution was now visible in the accounts rather than buried as generic other income.

2.12 Batch Costing

Batch costing is a variant of job costing used where identical units are manufactured in batches, and it is uneconomical to treat each individual unit as a separate job — for example, in pharmaceutical manufacture, biscuit and garment manufacture, and spare-parts production. Each batch is treated as a cost unit, and cost is accumulated for the batch as a whole, then divided by the number of units in the batch to arrive at cost per unit. A key managerial decision peculiar to batch costing is determining the Economic Batch Quantity (EBQ) — the batch size that minimises the combined cost of set-up (which falls as batch size rises, since set-up cost per unit is spread over more units) and carrying cost of inventory (which rises as batch size rises, since larger batches mean more stock is held for longer).

Economic Batch Quantity (EBQ) = √[(2 × Annual Demand × Set-up Cost per Batch) ÷ Carrying Cost per Unit per Annum]

This formula mirrors the Economic Order Quantity (EOQ) formula used in materials management, with 'set-up cost' replacing 'ordering cost' — a natural analogy, since both balance a fixed cost incurred per batch/order against a variable holding cost per unit.

2.13 Contract Costing

Contract costing is another variant of job costing, applied to large jobs of long duration undertaken at the customer's site — typical of construction, shipbuilding, and civil engineering contracts. Because a single contract may span more than one accounting year, contract costing has to solve a problem that ordinary job costing does not face: how much profit, if any, should be recognised on an incomplete contract at the end of an accounting period? The generally accepted (conservative) approach is to recognise only a prudent portion of the notional profit on incomplete contracts, based on the percentage of completion, withholding the rest as a reserve against unforeseen future costs or losses, and to recognise the entire loss immediately, in full, as soon as a loss is anticipated on the contract as a whole (in line with the prudence concept).

- Where a contract is less than one-quarter complete, no profit is usually taken to the Profit and Loss Account.
- Where a contract is one-quarter or more, but less than one-half complete, a conventional (though not universal) formula is: Profit transferred to P&L = Notional Profit × 1/3 × (Cash Received ÷ Work Certified).
- Where a contract is one-half or more, but not yet complete, a common formula is: Profit transferred to P&L = Notional Profit × 2/3 × (Cash Received ÷ Work Certified).
- On a contract that is nearly complete, estimated total profit on the whole contract is often apportioned in the ratio of work certified to total contract price, or of cost incurred to date to total estimated cost.

Retention Money — a portion of the value of work certified withheld by the contractee as security against defective work, released after a defect-liability period — is a distinctive feature of contract accounts, and reduces the cash actually received relative to the value of work certified, which is precisely why the formulae above use the ratio of cash received to work certified rather than assuming the two are equal.

2.14 Equivalent Production with Opening Work-in-Progress

Illustration 2.5 dealt with equivalent production where there was no opening WIP. In practice, a process usually carries forward some incomplete units from the previous period as opening WIP, and two methods are used to handle this: the FIFO Method, which assumes opening WIP is completed first before new units are started, so that separately identifiable equivalent units are computed for (i) completing the opening WIP, (ii) units introduced and completed within the period, and (iii) closing WIP; and the Average Cost Method (Weighted Average Method), which does not distinguish opening WIP from units introduced during the period, but pools the cost of opening WIP with the cost incurred during the current period, and spreads this combined cost over total equivalent production (treating opening WIP units as though they were 100% units of the current period for costing purposes).

Illustration 2.6 — Equivalent Production Using the FIFO Method

Opening WIP: 200 units, 100% complete as to material and 60% complete as to labour and overhead, valued at ₹18,000 (brought forward). During the month, 1,800 units were introduced; costs incurred during the month were Material ₹90,000, Labour ₹54,000, Overhead ₹36,000. 1,700 units were completed and transferred out; Closing WIP was 300 units, 100% complete as to material and 40% complete as to labour and overhead. Compute equivalent production under FIFO and the cost per equivalent unit for the current period's costs.

Solution: Units to be accounted for = Opening WIP 200 + Introduced 1,800 = 2,000 units. Units accounted for = Completed and transferred 1,700 + Closing WIP 300 = 2,000 units (tallies).

Element	To complete Opening WIP (200 units)	Units Introduced & Completed (1,700 − 200 = 1,500)	Closing WIP (300 units)	Total Equivalent Units (current period)	Current Cost (₹)	Cost per Eq. Unit (₹)
Material (already 100% in opening WIP; nil further work needed)	200 × 0% = 0	1,500 × 100% = 1,500	300 × 100% = 300	1,800	90,000	50.00
Labour (opening WIP needs remaining 40%)	200 × 40% = 80	1,500 × 100% = 1,500	300 × 40% = 120	1,700	54,000	31.76
Overhead (opening WIP needs remaining 40%)	200 × 40% = 80	1,500 × 100% = 1,500	300 × 40% = 120	1,700	36,000	21.18

Cost to complete opening WIP = (80×31.76)+(80×21.18) = 2,541+1,694 ≈ ₹4,235 (material already complete, no further material cost). Total cost of opening WIP now transferred = 18,000 (brought forward) + 4,235 ≈ ₹22,235 for 200 units. Cost of units introduced and completed = 1,500 × (50.00+31.76+21.18) = 1,500 × 102.94 ≈ ₹1,54,410. Value of Closing WIP = (300×50.00)+(120×31.76)+(120×21.18) = 15,000+3,811+2,542 ≈ ₹21,353. This FIFO approach keeps the cost of the previous period (embedded in opening WIP) separate from the cost of the current period, giving a cleaner period-on-period comparison of processing efficiency than the weighted average method, which blends the two periods' costs together.

2.15 Advantages and Limitations of Job Costing

Advantages

- Provides accurate cost, and hence profitability, of each individual job, aiding pricing of future similar jobs.
- Facilitates comparison of estimated and actual cost of a job, helping identify inefficiency.
- Useful basis for quoting competitive prices for new enquiries, using past job data.

Limitations

- Involves considerable clerical work in maintaining detailed job cost sheets, material requisitions and time sheets.
- Overhead absorption still relies on estimated rates, so job cost is not entirely free of approximation.
- Costly to operate in businesses with a very large number of small, low-value jobs.

2.15A Additional Illustration — Joint Cost Apportionment (Sales Value at Split-off Method)

Illustration 2.7: A dairy processes raw milk in a single common process to yield three joint products at the split-off point: Cream, Toned Milk, and Skimmed Milk Powder base. The joint cost of the common process for the month is ₹6,00,000. Output and sale value at split-off are: Cream 2,000 litres at ₹150 per litre; Toned Milk 10,000 litres at ₹40 per litre; Skimmed Milk Powder base 1,000 kg at ₹100 per kg. Apportion the joint cost among the three products using the Sales Value at Split-off Method.

Solution: Sales value at split-off — Cream = 2,000 × 150 = ₹3,00,000; Toned Milk = 10,000 × 40 = ₹4,00,000; Skimmed Milk Powder base = 1,000 × 100 = ₹1,00,000. Total sales value = 3,00,000 + 4,00,000 + 1,00,000 = ₹8,00,000.

Product	Sales Value at Split-off (₹)	Proportion	Joint Cost Apportioned (₹)	Cost per Unit
Cream (2,000 litres)	3,00,000	3/8 = 37.5%	2,25,000	₹112.50/litre
Toned Milk (10,000 litres)	4,00,000	4/8 = 50.0%	3,00,000	₹30.00/litre
Skimmed Milk Powder base (1,000 kg)	1,00,000	1/8 = 12.5%	75,000	₹75.00/kg
Total	8,00,000	100%	6,00,000	—

Since the joint cost is apportioned in exact proportion to sales value at split-off, every product carries the same gross margin percentage on the joint process cost by construction, which is precisely the property that makes this method popular for regulatory and pricing purposes, even though it provides no insight into which individual product actually 'costs more' to produce in a physical sense — a limitation students should note when comparing this method with the Physical Units Method illustrated in Section 2.9.

Case Study: Joint Cost Apportionment Dispute in an Edible Oil Refinery

An edible oil refinery processed crude oilseed through a single crushing and refining process, yielding refined oil (the main, high-value product) and de-oiled cake (a joint product used as cattle feed, with meaningful but much lower value). For years the company had apportioned joint processing cost using the physical-units (weight) method, since oil and cake are both measured in tonnes, which seemed administratively convenient.

A commodity price surge in cattle feed suddenly made de-oiled cake almost as valuable, per tonne, as refined oil for a few months, yet the physical-units method continued to apportion the bulk of joint cost to cake simply because it was heavier in weight, even though it was now earning comparable revenue per tonne to the oil. This distorted product-level profitability reporting, making refined oil appear to be an unusually high-margin product during this period and cake appear to be unusually low-margin, purely due to the apportionment method rather than genuine underlying economics.

The company's cost accountant switched to the Sales Value at Split-off Method for the duration of the price anomaly, which better reflected each product's actual, current earning capacity and gave management a truer picture of margin per product during the volatile period, restoring confidence in the segment-profitability figures used for internal performance review and short-term pricing decisions on both products.

2.16A Additional Illustration — Contract Costing with Profit Recognition

Illustration 2.8: A contractor undertook a contract for ₹20,00,000. At the end of the year, the following information is available: Cost incurred to date ₹9,00,000; Work certified by the architect ₹12,00,000; Cash received from the contractee (80% of work certified) ₹9,60,000; Work uncertified (cost, not yet certified) ₹40,000; Estimated further cost to complete the contract ₹6,00,000. Determine the notional profit to date and the amount of profit to be prudently transferred to the Profit and Loss Account.

Solution: Notional Profit to date = Value of Work Certified + Cost of Work Uncertified − Cost Incurred to Date = 12,00,000 + 40,000 − 9,00,000 = ₹3,40,000.

Percentage of completion (work certified ÷ contract price) = 12,00,000 ÷ 20,00,000 = 60%, which is more than one-half but less than complete, so the conventional formula for this stage applies: Profit to be transferred = Notional Profit × 2/3 × (Cash Received ÷ Work Certified) = 3,40,000 × 2/3 × (9,60,000 ÷ 12,00,000) = 3,40,000 × 2/3 × 0.80 = 3,40,000 × 0.5333 ≈ ₹1,81,333.

The balance of the notional profit, ₹3,40,000 − ₹1,81,333 = ₹1,58,667, is retained in the Contract Account as a reserve against the remaining ₹6,00,000 of estimated future cost and any unforeseen contingencies before the contract is finally completed and certified in full, consistent with the prudence principle discussed in Section 2.13: only a conservative portion of profit on an incomplete, long-duration contract is recognised in the current period's accounts, with the remainder deferred until the contract is substantially or fully complete.

2.16 Emerging Trends and Recent Advancements

Process industries increasingly use Manufacturing Execution Systems (MES) integrated with cost accounting modules to track material and yield at each process stage in real time, replacing the periodic (often monthly) process accounts described in this unit with continuous, transaction-level process costing that flags abnormal loss the moment it occurs rather than at month-end. In job and batch industries, cloud-based job-costing software now automatically pulls material cost from digital purchase orders and labour cost from biometric time-clock data, dramatically reducing the clerical burden historically associated with job costing (Section 2.15) while improving accuracy. Sustainability reporting has also begun to influence process costing: many process industries (e.g., cement, steel, and chemicals) are now required to separately track and report the carbon cost of each process stage alongside its traditional cost per unit, effectively adding a new 'element of cost' — environmental cost — to the classical process cost sheet. In the joint-products and by-products space, industries such as petroleum refining increasingly use sophisticated linear-programming-based joint cost allocation models, rather than the simpler physical-unit or sales-value methods described in Section 2.9, to optimise product slate decisions across dozens of joint and by-products simultaneously.

2.17 Industry Insight — Lean Manufacturing and Process Costing

The adoption of Lean Manufacturing principles, which emphasise minimising work-in-progress and pursuing continuous, small-batch flow rather than large-batch production, has direct implications for the equivalent production computations covered in Section 2.10. In a well-implemented lean environment, work-in-progress inventory is deliberately kept very small, which simplifies equivalent production calculations (since there is little WIP to convert into equivalent units) but places much greater pressure on accurate, near-real-time process cost tracking, since there is far less buffer stock to absorb costing errors before they affect customer-facing output. This is one reason many lean manufacturers have moved towards simplified 'backflush costing' — where cost is not tracked meticulously stage by stage but is calculated in reverse from completed output — as a pragmatic simplification of classical process costing suited to a low-inventory environment.

Question Bank

(a) Short Answer Questions (2 Marks)

S.No	Question	Marks	Bloom Level
1	What is a Cost Sheet?	2	L1
2	Define Job Costing.	2	L1
3	What is a Tender?	2	L1
4	Define Process Costing.	2	L1
5	What is Normal Loss?	2	L1
6	Distinguish between Abnormal Loss and Abnormal Gain.	2	L2
7	What are Inter-Process Profits?	2	L1
8	Distinguish between Joint Products and By-Products.	2	L2
9	What is Equivalent Production?	2	L1
10	Name any two methods of apportioning joint costs.	2	L1
11	What is Prime Cost?	2	L1
12	Give an example of an industry using process costing.	2	L1
13	What is Batch Costing?	2	L1
14	Define Economic Batch Quantity.	2	L1
15	What is Contract Costing?	2	L1
16	What is Retention Money in a contract?	2	L1

(b) Essay Type Questions (10 Marks)

S.No	Question	Marks	Bloom Level
1	Explain the format of a cost sheet with a specimen, and discuss its usefulness to management.	10	L2
2	Describe the procedure followed in Job Costing, and explain how the profitability of a specific job is determined.	10	L2
3	Explain the principles of tender/quotation costing with a suitable illustration.	10	L3
4	Distinguish between Job Costing and Process Costing on various parameters.	10	L4
5	Explain the accounting treatment of Normal Loss, Abnormal Loss and Abnormal Gain in Process Costing.	10	L3

6	What are Inter-process Profits? Explain the need for a 'Provision for Unrealised Profit' and how it is computed.	10	L3
7	Explain the various methods of accounting for by-products and apportioning joint costs among joint products.	10	L4
8	What is meant by Equivalent Production? Explain its computation with an illustration and discuss why it is necessary.	10	L3
9	Explain Batch Costing and the concept of Economic Batch Quantity, with the relevant formula.	10	L3
10	Explain Contract Costing and the principles followed for recognising profit on incomplete contracts.	10	L4
11	Distinguish between the FIFO method and the Weighted Average method of computing equivalent production.	10	L4

Problems

S.No	Problem	Marks	Bloom Level
1	Problem 2.1: Prepare a cost sheet from: Raw material consumed ₹2,50,000; Direct wages ₹1,20,000; Direct expenses ₹20,000; Factory overhead 60% of direct wages; Office overhead 10% of works cost; Selling overhead ₹15 per unit; 5,000 units produced and sold; profit 25% on cost. Find total cost, profit and selling price per unit.	10	L3
2	Problem 2.2: Input to a process is 2,000 units costing ₹1,00,000; further costs — labour ₹30,000, overheads ₹20,000. Normal loss is 5% of input with scrap value ₹4 per unit. Actual output is 1,850 units. Prepare the Process Account showing normal loss, abnormal loss/gain as applicable.	10	L4
3	Problem 2.3: 1,500 units are introduced into a process during the month. Materials cost ₹75,000, labour ₹36,000, overhead ₹24,000. At the end of the month, 1,200 units are completed and transferred; 300 units remain in process, 100% complete for material and 40% complete for labour and overhead. Compute equivalent production, cost per equivalent unit, and value the closing work-in-progress.	10	L4

Case Study: Real-Time Case Study: Job Costing Turnaround at a Printing Press

A commercial printing press regularly under-quoted large corporate print jobs because its overhead absorption rate — a flat 100% of direct labour cost — had not been revised in five years, even though the press had since invested heavily in an automated digital printing line with much higher depreciation and maintenance cost than the manual finishing department it was meant to complement.

After introducing a proper job costing system with department-wise overhead rates (a high rate for the digital press department reflecting its equipment cost, and a lower rate for manual finishing), the press discovered that several of its 'flagship' large corporate jobs — which used the digital line intensively — had actually been priced below their true cost for years, while small manual jobs had been overpriced and were losing the press competitive bids to rivals.

Revising its quotation policy using accurate job cost sheets, the press raised prices selectively on digital-intensive jobs and became more competitive on manual jobs, improving overall profitability within two quarters without losing its major corporate clients, who valued the consistent quality more than the modest price increase.

Unit Highlights

- The costing method must match the nature of production: job, batch, contract or process.
- Normal loss is absorbed into the cost of good production; abnormal loss and gain are costed separately so they do not distort efficiency.
- Inter-process profit requires a provision for unrealised profit on closing process stock.
- Joint cost is apportioned among joint products using methods such as physical units or sales value at split-off.
- Equivalent production converts partly-completed units into an equivalent number of fully completed units for costing purposes.

Unit Summary

This unit surveyed the costing methods best suited to different modes of production. Unit (output) costing and the cost sheet were shown to suit continuous, single-product manufacture, building total cost up through Prime Cost, Works Cost, Cost of Production and Total Cost. Job costing, its variant batch costing, and the closely related discipline of contract costing were shown to suit made-to-order and large, long-duration work respectively, each requiring its own job/batch/contract cost sheet and its own conventions — such as the Economic Batch Quantity in batch costing, and the profit-recognition formulae for incomplete contracts. Tender/quotation costing was shown to apply historical cost ratios, adjusted for anticipated price and rate changes, to price a new enquiry. The bulk of the unit then examined process costing, the method suited to continuous, multi-stage production: normal loss, abnormal loss and abnormal gain were shown to require careful, separate valuation so that only avoidable losses distort reported efficiency; inter-process profits were

shown to require a provision for unrealised profit on inventory; joint products and by-products were distinguished, along with the several accepted methods of apportioning joint cost and accounting for by-product value; and equivalent production, under both the no-opening-WIP case and the more realistic FIFO and weighted-average treatments of opening WIP, was shown to be the mechanism by which cost is fairly divided between finished output and work still in progress.

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UNIT III — Marginal Costing

> *"The essence of decision making lies in knowing what to give up."*
> *— Anonymous (Economics maxim on opportunity cost)*

Unit Overview

This unit reframes costing as a decision-support technique rather than a method of cost ascertainment. By separating cost into fixed and variable components, Marginal Costing isolates Contribution as the single most useful number for short-run managerial decisions, and the unit applies it to a wide range of real decisions: pricing, make-or-buy, product mix, and shutting down a plant.

Objectives of the Unit
1. Explain the concept and assumptions of marginal costing and distinguish it from absorption costing.
2. Compute contribution and P/V ratio and apply them to managerial decisions.
3. Use marginal costing for cost control and profit planning.
4. Apply marginal costing to decisions such as plant shut-down, dropping a product line, and pricing.
5. Apply marginal costing to make-or-buy decisions and key/limiting factor problems.
6. Determine the optimum product mix and the sales level needed for a desired profit.

Key Concepts

- Marginal Cost and Contribution (Sales − Variable Cost).
- P/V Ratio (Contribution Margin Ratio).
- Break-even Point and Margin of Safety.
- Key (Limiting) Factor and optimum product mix.
- Marginal costing vs Absorption costing.
- Cost Indifference Point and differential cost analysis.

Learning Outcomes

On successful completion of this unit, students will be able to:

- Distinguish marginal costing from absorption costing and state the assumptions underlying marginal costing.
- Compute Contribution and the P/V Ratio, and use them for profit planning.
- Apply marginal costing to plant shut-down, product-line and pricing decisions.
- Solve make-or-buy problems and determine the optimum product mix under a limiting factor.
- Determine the sales volume needed to earn a desired level of profit.
- Compute and interpret the cost indifference point between two cost structures.

Importance of Studying This Unit

Short-run decisions — accepting a special order, dropping a product, choosing between two machines — are made every week in real organisations, and absorption costing's 'full cost' figure can mislead a manager into a wrong decision. This unit gives students a contribution-based decision framework that is directly usable in a managerial role, and it underpins the break-even analysis in Unit IV.

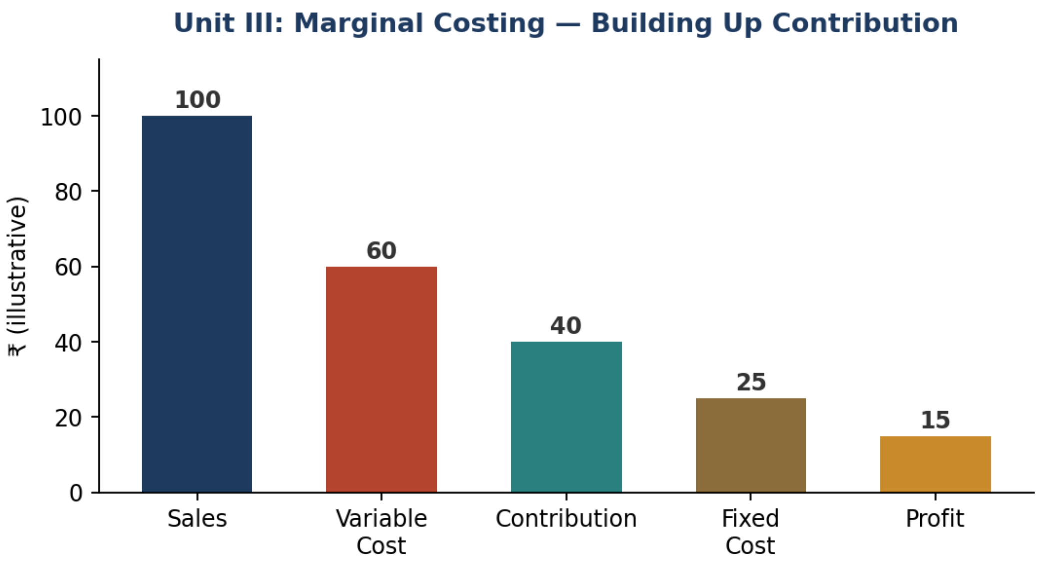

Figure: Key concept map for Unit III

3.1 Introduction

Marginal Costing is not a distinct method of ascertaining cost like job or process costing; it is a technique of costing and decision making that focuses on the behaviour of costs — specifically, on separating costs into fixed and variable components — so that management can see how profit changes with volume, and can make short-run decisions with clarity. Because fixed costs remain the same in total regardless of the volume of activity within a relevant range, marginal costing argues that only variable (marginal) cost is truly relevant to a unit of output, and that fixed cost is a cost of having the capacity to produce, to be recovered from the total contribution earned during the period rather than loaded onto individual units.

3.2 Key Terminologies

Term	Meaning
Marginal Cost	The cost of producing one additional unit of output; broadly, the total variable cost per unit.
Contribution	Sales revenue minus variable cost; the amount available to cover fixed cost and then to provide profit.
P/V Ratio (Contribution	Contribution expressed as a percentage (or ratio) of sales; measures

Term	Meaning
Margin Ratio)	the profitability of sales.
Break-even Point	The level of sales at which total contribution exactly equals total fixed cost, i.e., profit is zero.
Margin of Safety	The excess of actual (or budgeted) sales over the break-even sales.
Key (Limiting) Factor	A factor, such as material, labour, machine hours, or market demand, that restricts the level of activity that can be achieved at a given time.
Angle of Incidence	The angle at which the sales line cuts the total cost line on a break-even chart, indicating the rate of profit growth beyond BEP.

3.3 Marginal Costing vs Absorption Costing

Absorption Costing charges both fixed and variable manufacturing overhead to the product, so that closing inventory carries a share of fixed overhead forward to the next period. Marginal Costing, on the other hand, charges only variable cost to the product and treats the whole of fixed cost as a period cost, written off in full against the contribution earned during the period in which it is incurred. This difference in treatment of fixed overhead is the fundamental distinction between the two techniques, and it causes reported profit to differ between the two methods whenever opening and closing stock levels are not equal.

Basis	Absorption Costing	Marginal Costing
Treatment of Fixed Overhead	Charged to product; included in inventory valuation	Treated as a period cost; excluded from inventory valuation
Profit When Stock Increases	Higher (some fixed cost deferred in closing stock)	Lower (full fixed cost charged in the current period)
Usefulness	Useful for external reporting and long-run pricing	Useful for short-run decisions, CVP analysis, cost control
Classification of Cost	By function (production, admin, selling)	By behaviour (fixed and variable)
Cost Presentation	Cost of sales includes both fixed and variable production cost	Statement shows Sales − Variable Cost = Contribution − Fixed Cost = Profit

Assumptions of Marginal Costing

- All elements of cost — production, administration, and selling and distribution — can be classified into fixed and variable components.
- Variable cost per unit remains constant at all levels of activity; only total variable cost changes with volume.
- Fixed cost remains constant in total over the relevant range of activity and time period under consideration.
- Selling price per unit remains unchanged at all levels of output considered.
- There is only one product, or, if there are several, the product mix remains constant.

3.4 Contribution, P/V Ratio and the Marginal Cost Equation

Contribution = Sales − Variable Cost = Fixed Cost ± Profit/Loss

P/V Ratio = (Contribution ÷ Sales) × 100 = (Change in Profit ÷ Change in Sales) × 100

The P/V ratio is a key index of profitability: it shows the percentage of every additional rupee of sales that flows through to contribution (and, once fixed cost is covered, to profit). A higher P/V ratio means a product earns more contribution per rupee of sales, and therefore profit grows faster once the break-even point is crossed. The P/V ratio remains unchanged so long as the selling price and variable cost per unit do not change, even if volume of sales changes — which is why it is such a robust tool for profit planning.

Illustration 3.1 — Contribution and P/V Ratio

A company sells a product at ₹100 per unit; variable cost is ₹60 per unit; fixed cost for the period is ₹2,00,000; budgeted sales are 8,000 units. Calculate contribution per unit, P/V ratio, total contribution, and profit.

Solution: Contribution per unit = 100 − 60 = ₹40. P/V Ratio = 40/100 × 100 = 40%. Total contribution = 8,000 × 40 = ₹3,20,000. Profit = Total contribution − Fixed cost = 3,20,000 − 2,00,000 = ₹1,20,000.

3.5 Application of Marginal Costing to Managerial Decisions

(a) Cost Control

Because marginal costing separates fixed and variable cost, management attention is not diluted by arbitrary apportionment of fixed overhead across products; controllable variable costs can be monitored and compared directly against standards, while fixed costs — which are largely a function of capacity decisions rather than day-to-day operations — are controlled separately through budgetary discipline. This sharper focus improves the effectiveness of cost control compared with absorption costing, where a change in volume alone (through over/under-absorption of fixed overhead) can distort apparent efficiency.

(b) Profit Planning

Because Contribution = Fixed Cost + Desired Profit at the target level, management can work backwards from a desired profit figure to the sales volume or sales value required, using the marginal cost equation. This makes marginal costing indispensable in preparing realistic sales targets and budgets.

Sales Required for Desired Profit = (Fixed Cost + Desired Profit) ÷ P/V Ratio

Illustration 3.2: Using the data of Illustration 3.1, if the company wants a profit of ₹1,60,000, what sales value is required? Solution: Sales required = (2,00,000 + 1,60,000) ÷ 0.40 = 3,60,000 ÷ 0.40 = ₹9,00,000.

(c) Closing Down a Plant / Suspending Activities

When demand or other conditions cause a plant, department or product to make an operating loss, management must decide whether to continue operations or shut down. Under marginal costing, the decision rule is straightforward: continue operating so long as the plant is earning a positive contribution (i.e., contribution exceeds zero), because that contribution helps to defray fixed cost that would otherwise have to be paid in full even if the plant were shut down (assuming fixed costs cannot be avoided in the short run). Shutting down is beneficial only where contribution is negative, or where the specific (avoidable) fixed costs saved by closure exceed the contribution that would be lost.

Shut-down Point (in terms of sales): Shut down if Contribution < Avoidable (Specific) Fixed Cost that would be saved by closing

(d) Dropping a Product Line

In a multi-product firm, a product that appears to be loss-making under absorption costing (because it absorbs a share of common fixed overhead) may still be earning a positive contribution and should generally not be dropped, unless dropping it releases capacity that can be more profitably used elsewhere, or unless it is dragging down the sale of other, more profitable products. The decision rule again hinges on contribution: a product with positive contribution helps to cover the firm's common fixed costs, and dropping it, without a better alternative use of the freed capacity or resources, will normally reduce total firm profit by the amount of contribution lost, even though the reported 'loss' on that product on paper appears to disappear.

(e) Fixation of Selling Price

In the short run, particularly where there is idle capacity, marginal costing shows that any price above variable cost per unit generates a positive contribution and is worth accepting, provided it does not disturb the regular market price or invite a price war, and provided the order does not require sacrificing more profitable regular business. In the long run, of course, prices must be set so that contribution is sufficient to cover the full fixed cost of the business and to earn a satisfactory profit; marginal costing is thus primarily a short-run pricing tool, useful for special orders, export orders and off-peak pricing, to be applied with caution alongside long-run full-cost pricing.

(f) Make or Buy Decisions

Where a firm can either manufacture a component itself or buy it from an outside supplier, marginal costing directs attention to the relevant costs of the decision. If the firm has idle capacity, and the fixed costs of the manufacturing facility will be incurred anyway whether or not the component is made in-house, the decision rule is to make the component internally so long as its marginal (variable) cost of manufacture is lower than the price at which it can be bought; only if the marginal cost of making exceeds the buying price should it be purchased externally. If capacity is fully utilised and making the component internally requires sacrificing production of another, more profitable item, the opportunity cost of that lost contribution must also be considered.

(g) Key or Limiting Factor and Optimum Product Mix

When a firm produces multiple products but faces a scarce resource — such as limited raw material, limited machine hours, limited labour hours, or limited market demand — that constrains total output, it cannot simply choose the product with the highest contribution per unit. Instead, it must rank products by contribution per unit of the scarce (key/limiting) resource, and allocate the limited resource to products in that order of priority, so as to maximise total contribution (and hence profit) from the available capacity.

Ranking Criterion = Contribution per Unit ÷ Units of Limiting Factor Required per Unit of Product

Illustration 3.3 — Optimum Product Mix with a Limiting Factor

A company manufactures two products, A and B, with the following data: Product A — selling price ₹200, variable cost ₹120, machine hours required 4 per unit; Product B — selling price ₹150, variable cost ₹90, machine hours required 2 per unit. Total machine hours available are 4,000 per month. Maximum demand: A 500 units, B 1,200 units. Determine the profitable product mix.

Solution: Contribution per unit — A: 200 − 120 = ₹80; B: 150 − 90 = ₹60. Contribution per machine hour — A: 80 ÷ 4 = ₹20; B: 60 ÷ 2 = ₹30. Since B earns higher contribution per machine hour, it should be produced first up to its maximum demand: B = 1,200 units, using 1,200 × 2 = 2,400 machine hours, leaving 4,000 − 2,400 = 1,600 machine hours for A. A = 1,600 ÷ 4 = 400 units (within the maximum demand of 500). Total contribution = (400 × 80) + (1,200 × 60) = 32,000 + 72,000 = ₹1,04,000, which is the maximum achievable contribution given the machine-hour constraint.

3.6 Advantages and Limitations of Marginal Costing

Advantages

- Simple to understand and operate; avoids arbitrary apportionment of fixed overhead.
- Provides a sound basis for short-run pricing, product-mix, and make-or-buy decisions.
- Facilitates cost-volume-profit analysis, break-even analysis and profit planning.
- Highlights contribution of each product, aiding decisions on dropping or continuing product lines.
- Fixed costs, being period costs, are controlled directly through budgets rather than being buried in unit cost.

Limitations

- Segregating semi-variable costs into fixed and variable elements is not always precise.
- Ignoring fixed cost in inventory valuation can understate asset values, and may not be acceptable for external reporting/statutory purposes (which generally require absorption costing under applicable accounting standards).
- Assumes cost and revenue behaviour is linear, which may not hold true over wide ranges of output.
- Overemphasis on short-run contribution may lead to underpricing that fails to recover fixed costs in the long run.
- Not suitable, by itself, for long-term pricing and profitability analysis, where full cost must eventually be recovered.

3.7 Desired Level of Profit and Sales Mix Decisions

Beyond single-product profit planning (Section 3.5(b)), a multi-product firm often needs to decide which combination of products, at what volumes, will deliver a desired level of profit given limited resources or market demand. The approach combines the key-factor ranking technique of Section 3.5(g) with the profit-planning equation: after ranking products by contribution per unit of the scarce resource and determining the resource-constrained optimum mix, the resulting total contribution is compared with the fixed cost and desired profit target to check whether the target is achievable within existing capacity, or whether additional capacity, a price revision, or a cost-reduction programme is required to close the gap.

Illustration 3.4 — Desired Profit with a Sales Mix Decision

A company manufactures products X and Y. X has a contribution of ₹30 per unit and requires 3 machine hours; Y has a contribution of ₹40 per unit and requires 5 machine hours. Machine hours available are 15,000 per annum. Fixed cost is ₹1,00,000 per annum, and the company desires a profit of ₹80,000. Determine whether the target is achievable, assuming unlimited demand for both products, and recommend a product mix.

Solution: Contribution per machine hour — X: 30/3 = ₹10; Y: 40/5 = ₹8. X earns a higher contribution per machine hour, so, with unlimited demand, the entire 15,000 machine hours should be devoted to X. Maximum units of X = 15,000/3 = 5,000 units. Total contribution = 5,000 × 30 = ₹1,50,000. Profit = 1,50,000 − 1,00,000 = ₹50,000, which falls short of the desired ₹80,000 by ₹30,000. Recommendation: since capacity is fully committed to the more profitable product already, the desired profit cannot be reached by changing the mix alone; management must consider expanding machine capacity, raising price (if demand permits), or reducing fixed/variable cost, and should quantify precisely how many additional machine hours (30,000/10 = 3,000 hours) would be needed to close the gap through volume of X alone.

3.8 Cost Indifference Point

Where a firm is choosing between two alternative methods of production or two alternative cost structures (e.g., manual versus automated production, or two different suppliers with different fixed and variable cost combinations), the Cost Indifference Point is the level of output at which total cost under both alternatives is exactly equal; below this volume the alternative with lower fixed cost (and usually higher variable cost) is cheaper, and above this volume the alternative with higher fixed cost (and usually lower variable cost) becomes cheaper, since its lower variable cost per unit eventually outweighs its higher fixed cost as volume grows.

Cost Indifference Point (units) = Difference in Fixed Cost ÷ Difference in Variable Cost per Unit

Illustration 3.5: Method A has fixed cost of ₹2,00,000 and variable cost of ₹40 per unit; Method B has fixed cost of ₹3,50,000 and variable cost of ₹25 per unit. Find the cost indifference point and advise which method is cheaper at a volume of 12,000 units. Solution: Cost Indifference Point = (3,50,000 − 2,00,000) ÷ (40 − 25) = 1,50,000 ÷ 15 = 10,000 units. Below 10,000 units, Method A (lower fixed cost) is cheaper; above 10,000 units, Method B (lower variable cost, spreading its higher fixed cost over more units) is cheaper. At 12,000 units, which exceeds the indifference point, Method B is the more economical choice.

3.9 Differential Cost Analysis — A Related Technique

Closely related to marginal costing is Differential Cost Analysis, which examines the change in total cost and total revenue resulting from a specific managerial decision (such as increasing output by a certain quantity, or switching from one production method to another), comparing the differential (incremental) revenue with the differential cost of the change. Where differential revenue exceeds differential cost, the decision is financially favourable. While marginal costing typically deals with the effect of one additional unit, differential cost analysis is used more broadly for evaluating any specific proposed change, including changes that involve a step-change in fixed cost (e.g., adding a new shift, which entails additional supervisory fixed cost as well as additional variable cost) — situations where the assumption of a strictly constant fixed cost, central to simple marginal costing, would understate the analysis.

3.10 Sensitivity of Marginal Costing Decisions to Assumptions

Because marginal costing decisions rest on the assumptions in Section 3.3, a prudent manager tests how sensitive a decision is to those assumptions before committing to it. For instance, in a make-or-buy decision, if the 'idle capacity' assumption turns out to be wrong — because the capacity used for the component could, in fact, have been used for another profitable product — the decision must be reconsidered including the opportunity cost of the displaced production. Similarly, in a special-order pricing decision, if accepting a low-price order signals to regular customers that the firm is willing to discount, the true cost of accepting the order includes not just its own variable cost but the risk of eroding the firm's regular price realisation — a qualitative factor that marginal cost figures alone cannot capture, and which management must weigh alongside the quantitative analysis.

3.10A Additional Illustration — Multi-Product Contribution and Shut-Down Decision

Illustration 3.6: A company manufactures three products, L, M and N, with the following annual data: L — sales ₹4,00,000, variable cost ₹2,80,000; M — sales ₹3,00,000, variable cost ₹2,55,000; N — sales ₹2,00,000, variable cost ₹1,20,000. Total fixed cost is ₹1,50,000, of which ₹20,000 is specifically attributable to product M and would be saved if M were discontinued; the remaining fixed cost is common to all three products. Advise whether product M, which appears to be making a loss under full-cost allocation, should be discontinued.

Solution: Contribution — L = 4,00,000 − 2,80,000 = ₹1,20,000; M = 3,00,000 − 2,55,000 = ₹45,000; N = 2,00,000 − 1,20,000 = ₹80,000. Total contribution of all three products = 1,20,000 + 45,000 + 80,000 = ₹2,45,000. Total profit = 2,45,000 − 1,50,000 = ₹95,000.

If M is discontinued: contribution lost = ₹45,000; fixed cost saved (specific to M only) = ₹20,000. Net effect of discontinuing M = loss of contribution ₹45,000 less saving in fixed cost ₹20,000 = a net reduction in profit of ₹25,000. Since M's contribution (₹45,000) exceeds the specific fixed cost that would be saved by dropping it (₹20,000), M should NOT be discontinued — doing so would reduce overall company profit from ₹95,000 to ₹70,000, even though M may appear to be 'loss-making' once a share of common fixed cost is allocated to it under a full-cost approach. This illustration reinforces Section 3.5(d): the correct comparison is always contribution versus specifically avoidable fixed cost, never contribution versus an arbitrarily allocated share of common fixed cost.

Case Study: Contribution Analysis Saves a 'Loss-Making' Regional Branch

A retail chain's central finance team allocated head-office overhead to each of its regional branches based on floor area, and one particular branch — smaller than average but located in a high-footfall area with strong sales per square foot — was flagged for closure after three consecutive quarters of reported 'losses' once its share of head-office overhead was allocated.

Before approving closure, a regional manager insisted on a contribution-based review. The branch's sales revenue, once its own directly attributable costs (local rent, local staff wages, local utilities) were deducted, in fact generated a healthy positive contribution; the reported loss existed purely because of the allocated head-office overhead, most of which (IT systems, senior management, brand marketing) would continue unchanged whether or not this one branch remained open.

The chain retained the branch and instead revised its overhead allocation policy going forward to separately report branch-level contribution alongside the fully-allocated 'profit' figure, so that store-closure decisions would in future be based on avoidable cost and contribution rather than on an allocation formula that could make a genuinely profitable location appear artificially loss-making.

3.10B Additional Illustration — Selection of Product Mix under Two Limiting Factors

Illustration 3.7: A company manufactures two products, P and Q. P: selling price ₹150, variable cost ₹90, requires 3 labour hours and 2 machine hours per unit. Q: selling price ₹120, variable cost ₹70, requires 2 labour hours and 4 machine hours per unit. Labour hours available are 3,000 and machine hours available are 4,000 per month; there is no restriction on market demand for either product. Determine which resource is the binding (key) constraint, and recommend the optimum product mix.

Solution: Contribution per unit — P: 150 − 90 = ₹60; Q: 120 − 70 = ₹50. Contribution per labour hour — P: 60/3 = ₹20; Q: 50/2 = ₹25. Contribution per machine hour — P: 60/2 = ₹30; Q: 50/4 = ₹12.50. Notice that P ranks lower than Q on labour hours but higher than Q on machine hours — the ranking depends on which resource actually turns out to be the binding constraint, so both must be checked before a final recommendation is made.

Testing full utilisation on Q alone (ranked first by labour hours): if the company devoted all labour hours to Q, it could make 3,000 ÷ 2 = 1,500 units of Q, requiring 1,500 × 4 = 6,000 machine hours — but only 4,000 machine hours are available, so machine hours would run out first, meaning machine hours, not labour hours, is the true binding constraint in this scenario. The ranking must therefore be redone using contribution per machine hour: P (₹30) outranks Q (₹12.50) on this basis. Recommended mix: produce P first, using the full 4,000 machine hours: 4,000 ÷ 2 = 2,000 units of P, requiring 2,000 × 3 = 6,000 labour hours — but only 3,000 labour hours are available, so labour, in turn, becomes binding on P alone, limiting P to 3,000 ÷ 3 = 1,000 units, which uses 1,000 × 2 = 2,000 machine hours, leaving 4,000 − 2,000 = 2,000 machine hours for Q: 2,000 ÷ 4 = 500 units of Q (using 500 × 2 = 1,000 labour hours, which fits within the remaining 3,000 − 3,000 = 0 labour hours only if P's labour use is reconsidered).

This apparent conflict — both resources binding simultaneously — signals that the problem must be solved as a genuine two-constraint linear programming problem rather than by simple ranking alone: the optimum mix lies at the intersection of the two constraint lines (3P + 2Q = 3,000 labour, and 2P + 4Q = 4,000 machine), which algebraically gives P = 500 units and Q = 750 units, using all 3,000 labour hours (500×3 + 750×2 = 1,500+1,500=3,000) and all 4,000 machine hours (500×2 + 750×4 = 1,000+3,000=4,000) exactly, yielding total contribution = (500×60)+(750×50) = 30,000+37,500 = ₹67,500. This illustration deliberately extends the single-constraint reasoning of Illustration 3.3 to show students why genuinely simultaneous, binding multiple constraints require a linear programming (graphical or simplex) approach rather than the simple per-unit-of-scarce-resource ranking method, which is valid only when a single resource is unambiguously binding.

3.11 Emerging Trends and Recent Advancements

Modern enterprise planning systems now embed marginal costing logic directly into 'what-if' simulation dashboards, allowing a sales manager to instantly see the contribution and profit impact of a proposed discount, a change in product mix, or a new customer order, without waiting for a finance team to manually rebuild a spreadsheet — effectively making the marginal costing techniques of this unit available at the point of decision rather than after the fact. In subscription-based and platform businesses (software-as-a-service, ride-hailing, streaming), the marginal cost of serving one additional customer is often extremely low relative to fixed technology and content costs, making contribution margin and CVP-style thinking central to pricing strategy in ways that closely parallel, but also stretch, the classical assumptions of this unit — for instance, 'capacity' in a digital business is far more elastic than in a traditional factory, which changes how shut-down and key-factor decisions are framed. Sustainability-linked marginal costing is also emerging, where firms increasingly track the 'marginal carbon cost' of an additional unit of production alongside its marginal financial cost, so that make-or-buy and product-mix decisions can be evaluated on a dual financial-and-environmental contribution basis rather than financial contribution alone.

3.12 Industry Insight — Airline Seat Pricing as Applied Marginal Costing

The airline industry offers one of the clearest real-world illustrations of marginal costing principles in this unit. Once an aircraft is scheduled to fly a route, the overwhelming majority of the flight's cost — fuel, crew, airport fees, aircraft ownership cost — is fixed and will be incurred regardless of how many seats are actually sold; the marginal cost of carrying one additional passenger in an otherwise empty seat is very low (essentially the cost of a meal and slightly higher fuel burn from added weight). This is precisely why airlines are willing to sell late, unsold seats at steeply discounted prices rather than fly with them empty — any price above the very low marginal cost generates positive contribution towards the flight's substantial fixed cost, exactly as described in Section 3.5(e) on short-run pricing. At the same time, airlines are careful not to let this logic depress prices on their regular, advance-purchase fare classes, illustrating the caution about market disruption discussed in Section 3.10.

Case Study: Marginal Costing and the Special Export Order Decision

A domestic manufacturer of ceiling fans operated at 70% capacity, with fixed costs of ₹40 lakh per year already fully committed regardless of volume. An overseas buyer offered to purchase 20,000 units at a price 15% below the company's normal domestic selling price, on the condition that this would not affect the regular domestic market (a separate export brand). Using absorption costing, which allocated a share of fixed overhead to every unit, the offered export price appeared to be below full cost, and the sales team was ready to reject it as unprofitable.

The company's management accountant recomputed the decision on a marginal costing basis. Since the fixed costs of the factory would be incurred in full whether or not the export order was accepted (there was ample idle capacity to absorb it), the only relevant cost was the variable cost per unit. The export price, though below full absorption cost, was comfortably above variable cost, meaning the order would generate a substantial positive contribution that would flow straight to the bottom line without disturbing existing domestic sales or fixed costs.

Based on this marginal-cost analysis, the company accepted the export order, which added meaningfully to annual profit purely because idle capacity was converted into contribution. The case highlights the danger of using full absorption cost as the sole criterion for accept/reject decisions on incremental business, and the importance of separating relevant (variable, avoidable) costs from irrelevant sunk or unavoidable fixed costs.

Question Bank

(a) Short Answer Questions (2 Marks)

S.No	Question	Marks	Bloom Level
1	Define Marginal Cost.	2	L1
2	What is Contribution?	2	L1
3	Define P/V Ratio.	2	L1
4	State the marginal cost equation.	2	L1
5	What is meant by a Key/Limiting Factor?	2	L1
6	Distinguish between Marginal Costing and Absorption Costing (any two points).	2	L2
7	What is a Make-or-Buy decision?	2	L1
8	State any two assumptions of marginal costing.	2	L2
9	What do you mean by 'dropping a product line'?	2	L1
10	Define Angle of Incidence.	2	L1
11	Give the formula for sales required for a desired profit.	2	L1
12	What is meant by shut-down point?	2	L2
13	What is Cost Indifference Point?	2	L1
14	What is Differential Cost Analysis?	2	L1
15	Give the formula for Cost Indifference Point.	2	L1

(b) Essay Type Questions (10 Marks)

S.No	Question	Marks	Bloom Level
1	Explain the concept of marginal costing and distinguish it from absorption costing with suitable examples.	10	L2
2	What is Contribution and P/V Ratio? Explain their significance in managerial decision making.	10	L2
3	Discuss how marginal costing is used in profit planning, with an illustration.	10	L3
4	Explain the marginal costing approach to a decision on closing down a plant or suspending activities.	10	L4
5	Discuss the make-or-buy decision under marginal costing, distinguishing situations of idle capacity and full capacity.	10	L4
6	Explain, with a suitable example, how the optimum product mix is determined when a firm faces a limiting factor.	10	L3
7	Critically examine the advantages and limitations of marginal costing as a managerial tool.	10	L5
8	Explain the application of marginal costing to short-run pricing decisions, including special/export orders.	10	L3
9	What is a Cost Indifference Point? Explain its computation and managerial use with an illustration.	10	L3

Problems

S.No	Problem	Marks	Bloom Level
1	Problem 3.1: Selling price ₹250 per unit; variable cost ₹150 per unit; fixed cost ₹5,00,000 per annum. Calculate: (a) P/V ratio; (b) Break-even sales in units and value; (c) Sales required to earn a profit of ₹2,50,000; (d) Profit if sales are 8,000 units.	10	L3
2	Problem 3.2: A firm produces two products, X and Y. X: selling price ₹80, variable cost ₹50, labour hours required 2 per unit. Y: selling price ₹60, variable cost ₹40, labour hours required 1 per unit. Maximum labour hours available: 6,000. Maximum demand: X 2,000 units, Y 3,000 units. Determine the optimum product mix and the resulting total contribution.	10	L4
3	Problem 3.3: A company is considering whether to manufacture a component (variable cost ₹45 per unit) in-house, when it can be bought from the market at ₹40 per unit. The company has idle capacity, and fixed costs of the relevant department (₹1,20,000 per annum) will be incurred regardless of the decision. Advise the company, with reasons, on whether to make or buy 10,000 units annually.	10	L4
4	Problem 3.4: Two alternative production methods are available. Method I: fixed cost ₹1,50,000, variable cost ₹35 per unit. Method II: fixed cost ₹2,70,000, variable cost ₹20 per unit. Find the cost indifference point and advise which method should be adopted at an expected volume of 9,000 units.	10	L4

Case Study: Real-Time Case Study: Product-Line Rationalisation at a Consumer Durables Firm

A consumer durables company manufactured three products — mixers, toasters and irons — sharing common factory overhead. Absorption costing reports consistently showed toasters making a loss after allocation of common fixed overhead, and the board was on the verge of discontinuing the toaster line to 'cut losses'.

Before finalising the decision, the finance team recast the figures on a marginal costing basis and found that toasters were, in fact, earning a healthy positive contribution; the apparent loss existed only because of the arbitrary share of common fixed overhead allocated to that line. Discontinuing toasters would not eliminate the underlying fixed costs (mostly shared factory rent and senior management salaries), which would then have to be spread over the remaining two products, making their reported costs — and prices — rise as well.

Armed with this marginal costing analysis, the board decided to retain the toaster line and instead focused on genuine cost reduction in its variable cost components (e.g., renegotiating heating-element supply contracts), improving the toaster's contribution further. The case illustrates the risk of using absorption-costed 'profit' figures, rather than contribution, for product-discontinuation decisions in a firm with significant common fixed costs.

Unit Highlights

- Marginal costing is a technique of decision-making, not a distinct method of cost ascertainment.
- Contribution, not full cost, is the relevant figure for most short-run decisions.
- The P/V ratio measures profitability independent of volume, as long as price and unit variable cost stay constant.
- The key/limiting factor determines the product mix that maximises contribution when capacity is constrained.
- Every marginal-costing conclusion assumes constant price, constant unit variable cost and unchanged capacity — assumptions a manager must test.

Unit Summary

Marginal costing was introduced as a technique, not a costing method, resting on the separation of cost into fixed and variable elements and on the pivotal idea of Contribution — sales less variable cost — as the amount available first to cover fixed cost and then to generate profit. The P/V ratio was shown to be a robust index of profitability, unaffected by volume so long as price and unit variable cost are unchanged, and the marginal cost equation was used to plan the sales volume needed for a desired profit. A wide range of managerial decisions were then examined through the marginal costing lens: closing down a plant or suspending activities, dropping a product line, fixing a short-run selling price, making versus buying a component, and determining the optimum product mix under a key/limiting factor — in every case, the decision rule centred on comparing contribution against the specific, avoidable costs and opportunity costs relevant to that decision, rather than on the potentially misleading 'full cost' figure that absorption costing would produce. The unit closed with the cost indifference point and differential cost analysis, both natural extensions of the same contribution-based reasoning to comparisons between two alternative cost structures or courses of action, along with a caution that every marginal costing conclusion rests on assumptions — constant price, constant unit variable cost, unchanged capacity and mix — that a careful manager must always test before acting on the numbers.

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UNIT IV — Break-Even Analysis (BEA)

> *"In God we trust; all others bring data."*
> *— W. Edwards Deming*

Unit Overview

Break-Even Analysis is the most widely used practical extension of marginal costing. This unit builds the Cost-Volume-Profit (CVP) relationship algebraically and graphically, defines the Break-Even Point, Margin of Safety and Angle of Incidence, and applies the technique to a range of practical business problems that every manager eventually faces.

Objectives of the Unit
1. Explain the concept of Cost-Volume-Profit (CVP) relationship.
2. Determine the Break-Even Point (BEP) using algebraic and graphic methods.
3. Construct and interpret a break-even chart.
4. State and evaluate the assumptions underlying break-even analysis.
5. Compute and interpret Margin of Safety and Angle of Incidence.
6. Apply break-even analysis to a variety of practical business problems.

Key Concepts

- Cost-Volume-Profit (CVP) analysis.
- Break-Even Point (BEP) — algebraic and graphic methods.
- Break-Even Chart and the Angle of Incidence.
- Margin of Safety (MOS).
- Relevant Range and the assumptions of break-even analysis.

Learning Outcomes

On successful completion of this unit, students will be able to:

- Explain the Cost-Volume-Profit relationship and its underlying assumptions.
- Determine the Break-Even Point using both algebraic and graphical methods.
- Construct a break-even chart and correctly interpret its profit and loss zones.
- Compute and interpret the Margin of Safety and the Angle of Incidence.
- Critically evaluate the assumptions and limitations of break-even analysis.
- Apply break-even analysis to practical pricing, capacity and sensitivity questions.

Importance of Studying This Unit

Break-even analysis is one of the most frequently used tools in real managerial practice, from start-up feasibility studies to pricing and capacity decisions in established firms. Mastery of this unit lets a student translate raw cost and revenue data into a single, intuitive picture that non-finance colleagues can immediately understand.

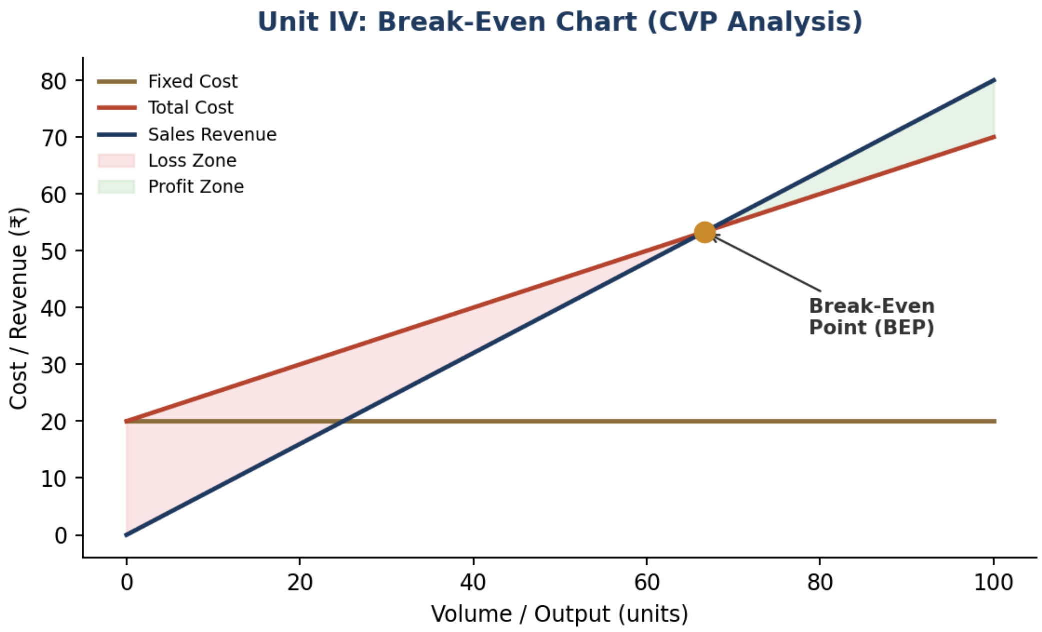

Figure: Key concept map for Unit IV

4.1 Introduction

Break-Even Analysis is the most widely used practical extension of marginal costing. It studies the relationship between cost, volume of output and profit — commonly called Cost-Volume-Profit (CVP) analysis — and answers questions that every manager eventually asks: How many units must we sell before we start making a profit? How much can sales fall before we start making a loss? What happens to profit if we change our price, our cost structure, or our sales mix? The Break-Even Point (BEP) is the fulcrum of this analysis: the level of output or sales at which total revenue exactly equals total cost, so that the firm neither makes a profit nor incurs a loss.

4.2 Key Terminologies

Term	Meaning
Cost-Volume-Profit (CVP) Analysis	The study of the interrelationship between cost, volume of output/sales, and profit.
Break-Even Point (BEP)	The level of output/sales at which total contribution equals total fixed cost, i.e., profit is nil.

Term	Meaning
Break-Even Chart	A graphical presentation of the CVP relationship, showing fixed cost, total cost, and sales lines against volume.
Margin of Safety (MOS)	The excess of actual/budgeted sales over break-even sales; indicates the cushion available before a loss occurs.
Angle of Incidence	The angle formed between the sales line and the total cost line at the break-even point on the chart.
Relevant Range	The range of activity within which the assumed cost behaviour (fixed and variable) is expected to hold true.

4.3 The Cost-Volume-Profit Relationship

CVP analysis rests on the classification of total cost into a fixed component, which does not change with volume within the relevant range, and a variable component, which changes in direct proportion to volume. Total revenue, in turn, is simply selling price per unit multiplied by volume, assuming a constant price. Profit is therefore a function of volume once price and the two cost components are known, and this functional relationship can be expressed algebraically, in a table, or graphically.

Profit = (Selling Price per unit × Volume) − (Variable Cost per unit × Volume) − Fixed Cost

Profit = (Contribution per unit × Volume) − Fixed Cost

4.4 Mechanics and Determination of the Break-Even Point

At the break-even point, by definition, total contribution equals total fixed cost (profit = 0). This gives the two standard formulae for BEP:

BEP (in units) = Fixed Cost ÷ Contribution per Unit

BEP (in sales value) = Fixed Cost ÷ P/V Ratio = Fixed Cost × Selling Price per Unit ÷ Contribution per Unit

Illustration 4.1 — Basic BEP Computation

A firm's fixed cost is ₹3,00,000 per annum. Selling price per unit is ₹50 and variable cost per unit is ₹30. Find the break-even point in units and in sales value.

Solution: Contribution per unit = $50 - 30$ = ₹20. P/V Ratio = $20/50 \times 100 = 40\%$. BEP (units) = $3{,}00{,}000 \div 20 = 15{,}000$ units. BEP (sales value) = $3{,}00{,}000 \div 0.40$ = ₹7,50,000. (Check: 15,000 units × ₹50 = ₹7,50,000 — consistent.)

4.5 The Break-Even Chart

A break-even chart plots volume of output/sales on the horizontal axis and cost/revenue in rupees on the vertical axis. Three lines are drawn: (i) the Fixed Cost line, horizontal and parallel to the x-axis at the level of total fixed cost; (ii) the Total Cost line, starting from the fixed cost line at zero output and rising at a constant slope equal to variable cost per unit as volume increases; and (iii) the Sales (Total Revenue) line, starting from the origin (zero) and rising at a constant slope equal to selling price per unit. The point at which the Sales line intersects the Total Cost line is the Break-Even Point; to its left, the Total Cost line lies above the Sales line, indicating a loss area, and to its right, the Sales line lies above the Total Cost line, indicating a profit area.

Figure 4.1: Conceptual Break-Even Chart

Vertical axis: Cost/Revenue (₹). Horizontal axis: Output/Sales volume (units). The Fixed Cost line runs flat from the origin's height on the y-axis. The Total Cost line starts at the same height as fixed cost (at zero output) and slopes upward. The Sales line starts at the origin (0,0) and slopes upward more steeply than the Total Cost line (since selling price per unit exceeds variable cost per unit). Their crossing point, projected down to the x-axis, gives the Break-Even output; projected further, the vertical gap between the Sales line and the Total

Cost line to the right of BEP represents profit at that volume, while the gap to the left represents loss.

Contribution Break-Even Chart (Alternative Form)

An alternative and often more informative version plots the Variable Cost line first (from the origin), then adds Fixed Cost on top of it to get the Total Cost line; the vertical distance between the Sales line and the Variable Cost line at any volume directly represents Contribution, and the point at which this contribution area exactly equals the fixed cost block is the break-even point. This form makes the build-up of contribution, and its role in covering fixed cost, visually explicit.

4.6 Assumptions of Break-Even Analysis

- All costs can be classified into fixed and variable elements, and semi-variable costs are appropriately segregated.
- Selling price per unit remains constant at all levels of output/sales considered.
- Variable cost per unit remains constant, i.e., variable cost varies strictly in direct proportion to volume.
- Fixed cost remains constant in total over the relevant range and time period analysed.
- There is only a single product, or, where there are several products, the sales mix remains constant.
- Volume of production and volume of sales are the same, i.e., inventory levels do not change (no significant build-up or depletion of stock).
- Productivity per worker and operating efficiency remain unchanged over the range considered.
- There is no change in the general price level (inflation) during the period under study.

4.7 Importance of Break-Even Analysis

- Helps management understand the minimum level of activity needed to avoid a loss.
- Assists in setting realistic sales targets and evaluating the impact of a proposed change in price.
- Facilitates comparison of profitability of alternative products, plants or methods of production.
- Assists in decisions on cost structure, e.g., whether to automate (raising fixed cost, lowering variable cost) or remain labour-intensive.
- Provides an early-warning tool: the Margin of Safety indicates how much cushion the firm has before slipping into loss.
- Useful in short-term decisions such as accepting special orders, discontinuing a product, or changing the sales mix.

4.8 Margin of Safety (MOS)

Margin of Safety measures the extent to which actual (or budgeted) sales exceed the break-even sales, and therefore how much sales can fall before the firm starts to incur a loss. A large margin of safety indicates a financially robust position; a small or negative margin of safety is a warning sign.

Margin of Safety = Actual Sales − Break-Even Sales
MOS Ratio (%) = (Margin of Safety ÷ Actual Sales) × 100
Also: Margin of Safety = Profit ÷ P/V Ratio

This last relationship is particularly useful, because it shows that MOS can be computed directly from profit and the P/V ratio without first calculating BEP explicitly, and it reinforces that improving the P/V ratio (e.g., by cutting variable cost or raising price) increases margin of safety for any given level of profit.

Ways to Improve Margin of Safety

- Increase the selling price, provided demand is not unduly sensitive to price (i.e., demand is relatively inelastic).
- Reduce fixed costs, where feasible, without impairing capacity.
- Reduce variable cost per unit through improved efficiency, better sourcing, or process improvement.
- Increase the volume of sales through demand generation, provided this does not require disproportionate additional fixed cost.
- Shift the sales mix towards products with a higher contribution margin (P/V ratio).

4.9 Angle of Incidence

The Angle of Incidence is the angle at which the Sales line cuts the Total Cost line at the break-even point on the chart. A large angle of incidence indicates that profit accumulates rapidly once the break-even point is crossed — a favourable sign, usually associated with a low variable cost ratio (high P/V ratio) — whereas a small (narrow) angle indicates that profit grows only slowly beyond BEP, usually associated with a high variable cost ratio (low P/V ratio), so that a large volume increase is needed to generate a modest increase in profit. Alongside the margin of safety, the angle of incidence is one of the two chief diagnostic indicators read off a break-even chart.

4.10 Application of Break-Even Analysis to Business Problems

(a) Effect of Change in Selling Price

If selling price is reduced, contribution per unit falls (assuming variable cost is unchanged), so BEP rises — a larger volume is needed just to cover fixed cost — and margin of safety, at any given sales volume, shrinks. Conversely, a price increase (assuming volume does not fall disproportionately) lowers BEP and widens the margin of safety.

(b) Effect of Change in Fixed Cost

An increase in fixed cost (e.g., from acquiring new machinery, or a rent increase) raises BEP without changing the P/V ratio, since contribution per unit is unaffected; a larger volume must now be sold before the firm breaks even. This is the essence of 'operating leverage': businesses with high fixed cost and low variable cost per unit (capital-intensive businesses) have higher break-even points but also gain profit more steeply once that point is crossed (a wide angle of incidence), while low-fixed-cost, high-variable-cost businesses (labour-intensive) have low break-even points but a narrower angle of incidence.

(c) Effect of Change in Variable Cost

A rise in variable cost per unit (e.g., due to an increase in raw material price) reduces contribution per unit and P/V ratio, raising BEP; unless offset by a price increase or cost efficiency elsewhere, both profit at existing volume and margin of safety will fall.

(d) Multi-Product (Composite) Break-Even Point

Where a firm sells more than one product, a composite (weighted-average) P/V ratio is computed using the existing sales mix, and the composite BEP in sales value is then found in the usual way. If the sales mix changes, the composite P/V ratio — and hence the composite BEP — will also change, even if no individual product's own price or cost has changed, since a different mix implies a different weighted average of individual P/V ratios.

Composite P/V Ratio = Total Contribution of All Products ÷ Total Sales of All Products

Illustration 4.2 — Effect of Cost Changes on BEP and MOS

A company has fixed cost of ₹4,00,000, selling price ₹40 per unit, and variable cost ₹24 per unit, with current sales of 30,000 units. (a) Find current BEP, profit and MOS. (b) If fixed cost rises by ₹1,00,000 due to new machinery (which also reduces variable cost to ₹20 per unit), find the new BEP, profit at the same sales volume, and MOS, and comment.

Solution (a): Contribution per unit = 40 − 24 = ₹16; P/V ratio = 16/40 = 40%. BEP (units) = 4,00,000 ÷ 16 = 25,000 units; BEP (sales) = 4,00,000 ÷ 0.40 = ₹10,00,000. Current sales value = 30,000 × 40 = ₹12,00,000. Profit = (30,000 × 16) − 4,00,000 = 4,80,000 − 4,00,000 = ₹80,000. MOS = 12,00,000 − 10,00,000 = ₹2,00,000, or MOS ratio = 2,00,000/12,00,000 = 16.7%.

Solution (b): New fixed cost = ₹5,00,000; new contribution per unit = 40 − 20 = ₹20; new P/V ratio = 20/40 = 50%. New BEP (units) = 5,00,000 ÷ 20 = 25,000 units (unchanged in units, coincidentally); New BEP (sales) = 5,00,000 ÷ 0.50 = ₹10,00,000 (also unchanged here). New profit at 30,000 units = (30,000 × 20) − 5,00,000 = 6,00,000 − 5,00,000 = ₹1,00,000, an improvement of ₹20,000 over the old cost structure at the same volume. Comment: although BEP is unchanged in this example, the automation has increased the P/V ratio (angle of incidence), so profit will now grow faster with each additional unit sold beyond BEP — but the firm is also more vulnerable to a fall in volume, since fixed cost commitment is higher.

4.11 Advantages and Limitations of Break-Even Analysis

Advantages

- Simple, visual, and easily communicated to non-financial managers.
- Provides a quick basis for evaluating pricing, cost structure and volume decisions.
- Highlights the sensitivity of profit to changes in price, cost and volume (useful for what-if analysis).
- Supports profit planning by linking desired profit directly to the required sales volume.

Limitations

- Assumes linear cost and revenue behaviour, which may not hold over wide ranges of output in reality.
- Assumes a constant sales mix in multi-product firms, which is often unrealistic.
- Ignores the time value of money and is essentially a static, short-run tool.
- Segregation of semi-variable costs into fixed and variable elements is subject to estimation error.
- Does not consider external factors such as competitor reaction, government policy, or seasonal demand fluctuations.

4.12 The Profit-Volume (P/V) Graph

An alternative to the conventional break-even chart is the Profit-Volume (P/V) Graph, which plots profit (or loss) directly on the vertical axis against sales volume on the horizontal axis, rather than plotting cost and revenue as two separate lines. A single straight line is drawn, starting at a loss equal to the total fixed cost when sales are zero, and rising at a slope equal to the P/V ratio as sales increase, crossing the horizontal (zero-profit) axis exactly at the break-even point. The P/V graph is often preferred by management because it shows profit directly, at a glance, for any volume, and because it makes comparison of the profitability of two or more products, or two alternative cost structures, particularly easy — the steeper the line, the higher the P/V ratio, and the more rapidly profit grows with volume.

Illustration 4.3 — Constructing a P/V Graph (Numerically)

Using the data of Illustration 4.1 (fixed cost ₹3,00,000; contribution per unit ₹20; selling price ₹50), the P/V line would start at (0 units, −₹3,00,000) and pass through the break-even point (15,000 units, ₹0), then continue upward — for example, at 25,000 units, profit = (25,000 × 20) − 3,00,000 = 5,00,000 − 3,00,000 = ₹2,00,000, so the line also passes through

(25,000 units, ₹2,00,000). Plotting just these two points and joining them with a straight line gives the complete P/V graph for this data, since the relationship between profit and volume is linear under the standard CVP assumptions.

4.13 Cash Break-Even Point

The conventional break-even point assumes that all fixed costs represent cash outflows, but in reality some fixed costs, most notably depreciation, are non-cash charges. The Cash Break-Even Point recognises this distinction and identifies the sales volume at which cash inflow from operations exactly equals cash fixed cost, ignoring non-cash fixed charges such as depreciation. Because non-cash fixed cost is excluded from the numerator, the cash break-even point is always lower than the conventional (accounting) break-even point, and it is a particularly important measure for businesses assessing minimum viable sales for liquidity purposes, as distinct from accounting profitability purposes.

Cash Break-Even Point (units) = Cash Fixed Cost ÷ Contribution per Unit

Illustration 4.4: Using the data of Illustration 4.1, if ₹80,000 of the ₹3,00,000 fixed cost represents depreciation (a non-cash item), find the cash break-even point. Solution: Cash fixed cost = 3,00,000 − 80,000 = ₹2,20,000. Cash BEP = 2,20,000 ÷ 20 = 11,000 units, compared with the conventional (accounting) BEP of 15,000 units computed earlier — a useful reminder that a business can be cash-positive at a volume where it would still show an accounting loss.

4.14 Break-Even Analysis and Operating Leverage

Operating Leverage measures the extent to which a firm's cost structure is weighted towards fixed cost as opposed to variable cost, and is closely linked to the angle of incidence discussed in Section 4.9. It is commonly measured as the Degree of Operating Leverage (DOL):

Degree of Operating Leverage (DOL) = Contribution ÷ Profit (EBIT)

A high DOL indicates that a small percentage change in sales volume produces a much larger percentage change in profit — a double-edged characteristic, since it magnifies profit in a boom but equally magnifies losses in a downturn. Firms with high operating leverage (capital-intensive firms, such as airlines, steel or cement manufacturers) therefore have high break-even points but earn rapidly escalating profit once volume comfortably exceeds BEP, while firms with low operating leverage (labour-intensive service firms) have lower, safer break-even points but slower profit growth thereafter. This concept directly extends the discussion of fixed-cost changes in Section 4.10(b) and is a standard tool for assessing business risk alongside break-even analysis.

4.15 Practical Difficulties in Applying Break-Even Analysis

Beyond the theoretical assumptions listed in Section 4.6, practitioners face several implementation challenges when applying break-even analysis to a real business. Semi-variable costs (e.g., electricity, telephone, maintenance) must be split into fixed and variable elements using techniques such as the High-Low Method or regression analysis, both of which involve estimation error. Multi-product firms must either compute a composite BEP based on a fixed sales-mix assumption, which becomes unreliable if the actual mix shifts significantly during the period, or must compute a separate BEP for each product, ignoring the reality that common fixed costs cannot be neatly attributed to individual products without some arbitrary apportionment. Finally, both cost and price are treated as constant over the entire range considered, whereas in practice, large increases in volume may require additional fixed investment (a 'step fixed cost'), and large decreases in price may be needed to stimulate a large jump in volume — effects that a simple linear break-even chart cannot capture without being redrawn for each relevant range.

4.15A Additional Illustration — Break-Even Analysis with a Target Profit and Sensitivity Check

Illustration 4.5: A start-up manufactures a single product with a selling price of ₹250 per unit and variable cost of ₹150 per unit. Fixed cost for the year is ₹18,00,000. The founders want to know: (a) the break-even point in units and value; (b) the sales volume required to earn a target profit of ₹6,00,000; (c) the new break-even point if a planned marketing campaign raises fixed cost by ₹2,00,000 but is expected to raise the selling price realisation to ₹260 per unit through better brand positioning; and (d) which scenario offers a lower margin of safety requirement at an expected sales volume of 24,000 units.

Solution (a): Contribution per unit = 250 − 150 = ₹100; P/V ratio = 100/250 = 40%. BEP (units) = 18,00,000 ÷ 100 = 18,000 units. BEP (value) = 18,00,000 ÷ 0.40 = ₹45,00,000.

Solution (b): Sales required for target profit = (18,00,000 + 6,00,000) ÷ 100 = 24,00,000 ÷ 100 = 24,000 units, i.e., sales value of 24,000 × 250 = ₹60,00,000.

Solution (c): New fixed cost = 18,00,000 + 2,00,000 = ₹20,00,000; new contribution per unit = 260 − 150 = ₹110; new P/V ratio = 110/260 ≈ 42.3%. New BEP (units) = 20,00,000 ÷ 110 ≈ 18,182 units; New BEP (value) = 20,00,000 ÷ 0.423 ≈ ₹47,28,000 (approx).

Solution (d): At the expected volume of 24,000 units: under the original scenario, MOS = 24,000 − 18,000 = 6,000 units (25% of sales). Under the revised (marketing) scenario, MOS = 24,000 − 18,182 ≈ 5,818 units (≈24.2% of sales). Although the revised scenario raises both price and fixed cost, its margin of safety in percentage terms is only marginally lower than the original scenario at the same expected volume, while its P/V ratio and angle of incidence are higher — meaning that if volume grows beyond 24,000 units, the revised (marketing-led) scenario would generate profit noticeably faster than the original scenario. The founders were advised that the marketing investment is a reasonable risk, provided they are reasonably confident of at least maintaining, and ideally growing, current volume.

Case Study: Break-Even Sensitivity Testing Before a Franchise Rollout

A fast-casual restaurant brand preparing to sell franchise rights needed to give prospective franchisees a realistic break-even estimate for a typical outlet, since an overly optimistic figure could expose the franchisor to later disputes and reputational damage if franchisees failed to break even as promised.

The corporate finance team built a break-even model using conservative, rather than best-case, assumptions for fixed cost (rent, staff, royalty fees) and variable cost (food cost, packaging), and then stress-tested the model by separately flexing rent (which varies significantly by location) and food cost inflation (which had been volatile in recent years) to show a realistic range of break-even sales, rather than a single optimistic number.

This range-based break-even disclosure, rather than a single confident figure, became a standard part of the franchise disclosure document, and franchisee satisfaction improved measurably in subsequent years, since new outlet owners entered with realistic expectations about the sales volume genuinely required to reach profitability at their specific location's rent level, rather than being anchored to an unrealistically low, headline break-even figure quoted for the brand's cheapest possible location.

4.15B Additional Illustration — Break-Even Point When Selling Price Varies by Quantity Discount

Illustration 4.6: A manufacturer sells its product at ₹100 per unit for the first 10,000 units, and at a discounted ₹90 per unit for any additional units sold beyond 10,000, reflecting a bulk-order discount policy. Variable cost is ₹60 per unit throughout. Fixed cost is ₹5,00,000 per annum. Determine the break-even point, and comment on what happens to the P/V ratio once sales exceed 10,000 units.

Solution: Up to 10,000 units, contribution per unit = 100 − 60 = ₹40; P/V ratio = 40/100 = 40%. Break-even point, if it falls within this first price band, = 5,00,000 ÷ 40 = 12,500 units — but this exceeds 10,000 units, so the break-even point does NOT fall within the first price band, and the calculation must continue into the second (discounted) band.

Contribution earned on the first 10,000 units = 10,000 × 40 = ₹4,00,000, leaving Fixed Cost still to be recovered = 5,00,000 − 4,00,000 = ₹1,00,000. Beyond 10,000 units, contribution per unit falls to 90 − 60 = ₹30 (P/V ratio now 30/90 ≈ 33.3%, lower than before, since the discount reduces price while variable cost per unit is unchanged). Additional units needed beyond 10,000 to recover the remaining ₹1,00,000 fixed cost = 1,00,000 ÷ 30 ≈ 3,334 units. Break-even point = 10,000 + 3,334 = 13,334 units (approximately).

This illustration shows that a single-slope break-even chart, as introduced in Section 4.5, is only valid within a single, unchanging price-and-cost band; wherever price or unit variable cost changes at a specific volume threshold — as happens routinely with bulk discounts, overtime premium labour beyond normal capacity, or tiered utility tariffs — the break-even chart must be redrawn with a 'kink' at that threshold, and the break-even point must be located by working through each relevant band in sequence, exactly as done above, rather than by applying a single BEP formula across the entire range.

4.16 Emerging Trends and Recent Advancements

Modern business planning software has largely replaced the hand-drawn break-even chart of Section 4.5 with interactive dashboards that instantly recompute BEP, margin of safety, and profit projections as a manager adjusts price, cost, or volume assumptions with a slider, making sensitivity analysis around the core CVP relationship immediate rather than a manual, iterative exercise. In start-up and venture finance, break-even analysis has become a standard component of business-plan evaluation, with investors specifically scrutinising the assumed sales volume needed to break even against realistic market-penetration estimates, since an unrealistically low implied market share required to reach BEP is often a red flag in a business plan. Break-even thinking has also extended into subscription and SaaS businesses through metrics such as the 'customer break-even point' — the number of months a subscriber must remain active before the cumulative contribution from their subscription fee covers the customer's acquisition cost — a direct, if specialised, descendant of the classical break-even point covered in this unit, now expressed in months and customers rather than units and rupees.

4.17 Industry Insight — Break-Even Analysis in Renewable Energy Projects

Renewable energy projects, such as solar and wind farms, are characterised by very high upfront fixed (capital) cost and very low variable operating cost — since, once built, the 'fuel' (sunlight or wind) is free — making them a textbook illustration of the high-operating-leverage cost structure discussed in Section 4.14. Break-even analysis for such projects is typically expressed not in units sold but in the number of years of operation, or the tariff (price per unit of electricity) required, to recover the fixed capital cost through the cumulative contribution earned from selling power at a very high margin over its near-zero variable cost. This is why renewable energy economics are so sensitive to the guaranteed tariff or power purchase agreement price negotiated at the outset — a small change in tariff has an outsized effect on the break-even period, precisely as break-even theory would predict for a high-fixed-cost, high-P/V-ratio business.

Case Study: Break-Even Analysis Behind a Capacity Expansion Decision

A regional bakery chain was evaluating whether to invest in an automated bread-slicing and packaging line costing ₹60 lakh, which would raise annual fixed cost by ₹12 lakh but reduce variable cost per loaf from ₹9 to ₹6 by cutting labour and wastage. Current volume was 6,00,000 loaves a year at a selling price of ₹15 per loaf, with existing fixed cost of ₹24 lakh.

Using break-even analysis, the finance team compared the two cost structures. Under the existing manual process, contribution per loaf was ₹6 (P/V ratio 40%), giving a BEP of 4,00,000 loaves; at the current volume of 6,00,000 loaves, profit was ₹12 lakh, with a margin of safety of 2,00,000 loaves (33%). Under the proposed automated structure, contribution per loaf would rise to ₹9 (P/V ratio 60%), but fixed cost would rise to ₹36 lakh, pushing BEP up to 4,00,000 loaves as well — but now at a much steeper angle of incidence, meaning profit would grow far faster with any expansion in volume.

At the current volume of 6,00,000 loaves, the automated line would raise profit to ₹18 lakh, a clear improvement, but the analysis also showed that margin of safety, while unchanged in absolute loaves, now represented a business far more sensitive to a downturn — a 34% fall in volume would wipe out all profit, versus needing the same percentage fall under the old structure but from a much lower risk base of committed fixed cost. The board approved the investment, but only after also building a cash reserve equal to three months of the new, higher fixed cost, explicitly informed by the break-even analysis of the increased risk that accompanies increased operating leverage.

Question Bank

(a) Short Answer Questions (2 Marks)

S.No	Question	Marks	Bloom Level
1	Define Break-Even Point.	2	L1
2	What is CVP Analysis?	2	L1
3	Give the formula for BEP in units.	2	L1
4	What is Margin of Safety?	2	L1
5	Define Angle of Incidence.	2	L1
6	State any two assumptions of break-even analysis.	2	L2
7	How is Margin of Safety related to Profit and P/V Ratio?	2	L2
8	What is a Composite P/V Ratio?	2	L1
9	What does a wide angle of incidence indicate?	2	L2
10	Give the formula for BEP in sales value.	2	L1
11	Name any two ways to improve Margin of Safety.	2	L2
12	What is meant by 'Relevant Range' in CVP analysis?	2	L1
13	What is a Cash Break-Even Point?	2	L1
14	Define Degree of Operating Leverage.	2	L1
15	What is a P/V Graph?	2	L1

(b) Essay Type Questions (10 Marks)

S.No	Question	Marks	Bloom Level
1	Explain the concept of Cost-Volume-Profit relationship and its significance to managerial decision making.	10	L2
2	Describe the construction and interpretation of a Break-Even Chart with a neat diagram.	10	L3
3	Discuss critically the assumptions underlying break-even analysis.	10	L4
4	Explain Margin of Safety and Angle of Incidence, and discuss the managerial actions available to improve the margin of safety.	10	L4
5	Explain, with examples, how changes in selling price, fixed cost, and variable cost each affect the break-even point.	10	L4
6	What is a Composite Break-Even Point? Explain its computation in a multi-product firm.	10	L3
7	Discuss the importance and limitations of break-even analysis as a tool for solving business problems.	10	L5
8	Explain how break-even analysis can guide a firm's decision on automating a labour-intensive process.	10	L4
9	Explain the Profit-Volume Graph and the concept of Cash Break-Even Point, distinguishing the latter from the conventional break-even point.	10	L3
10	Explain the concept of Operating Leverage and its relationship with the angle of incidence.	10	L4

Problems

S.No	Problem	Marks	Bloom Level
1	Problem 4.1: Fixed cost ₹6,00,000; selling price ₹120 per unit; variable cost ₹80 per unit. Find (a) BEP in units and value; (b) profit at sales of 20,000 units; (c) sales value required for a profit of ₹3,00,000; (d) margin of safety at sales of 20,000 units.	10	L3
2	Problem 4.2: A company's current sales are ₹15,00,000 with a P/V ratio of 30% and a margin of safety of ₹4,50,000. Calculate (a) BEP in sales value; (b) fixed cost; (c) profit at current sales.	10	L4
3	Problem 4.3: A firm sells two products, P and Q, in the ratio 3:2. P has a selling price of ₹100 and variable cost ₹60; Q has a selling price of ₹80 and variable cost ₹56. Fixed cost is ₹3,50,000. Calculate the composite P/V ratio and the composite break-even sales value.	10	L4
4	Problem 4.4: Fixed cost is ₹5,00,000, of which ₹1,20,000 is depreciation. Selling price is ₹60 per unit and variable cost is ₹36 per unit. Find (a) the conventional break-even point; (b) the cash break-even point; (c) the Degree of Operating Leverage at a sales volume of 30,000 units.	10	L4

Case Study: Real-Time Case Study: Pricing Response Analysed Through BEP

A regional coffee-shop chain faced aggressive discounting from a new entrant and was considering cutting its average ticket price by 10% to defend market share. Before deciding, management used break-even analysis to model the impact: current fixed cost across the chain was ₹1.8 crore per year, average variable cost per cup was ₹35, and average selling price was ₹100, giving a P/V ratio of 65% and a BEP of roughly 2,76,923 cups.

A 10% price cut would reduce the average selling price to ₹90, lowering contribution per cup to ₹55 and the P/V ratio to about 61%, which would raise the break-even volume to roughly 2,95,000 cups — meaning the chain would need to sell about 6.5% more cups merely to break even at the new price, before any profit improvement could be claimed. Sales forecasts suggested the price cut might increase footfall by about 8%, which the BEP model showed would be just barely enough to maintain, but not meaningfully grow, overall profit.

Rather than a blanket price cut, management used the same break-even framework to test a more targeted loyalty-discount scheme confined to weekday off-peak hours, which achieved a similar competitive response with a smaller effect on the average realised price and P/V ratio, protecting overall margin far more effectively than an across-the-board price cut would have. The case shows how BEP-based CVP modelling allows management to quantify competing pricing strategies before committing to one.

Unit Highlights

- The Break-Even Point is the level of sales at which total contribution exactly equals total fixed cost.
- The Margin of Safety shows how far sales can fall before a loss is incurred.
- The Angle of Incidence indicates how quickly profit grows once the break-even point is crossed.
- Break-even analysis assumes constant selling price, constant variable cost per unit and a fixed relevant range of activity.
- Break-even charts make CVP relationships visually intuitive for decision-makers outside the finance function.

Unit Summary

Break-even analysis was developed as the practical, graphical and algebraic extension of marginal costing that every manager reaches for first when asking how cost, volume and profit interact. The Break-Even Point — where total contribution exactly equals total fixed cost — was computed algebraically (fixed cost divided by contribution per unit, or by the P/V ratio) and represented graphically through both the conventional break-even chart and the alternative Profit-Volume graph, each assumption underlying the analysis (constant price, constant unit variable cost, constant fixed cost, single product or constant mix, no significant inventory build-up) being made explicit so that the technique is applied with appropriate caution. Margin of Safety and Angle of Incidence were developed as the two chief diagnostic readings taken from a break-even chart, respectively measuring the cushion available before a loss occurs and the rate at which profit accelerates once BEP is crossed, the latter closely tied to the concept of operating leverage. The unit closed by applying break-even analysis to a range of practical business problems — changes in price, fixed cost, and variable cost; the composite BEP of a multi-product firm; the cash break-even point that strips out non-cash fixed charges such as depreciation; and the particular relevance of high operating leverage to capital-intensive and renewable-energy businesses — equipping students to move fluidly between the algebra, the graph, and the underlying business decision each is meant to inform.

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UNIT V — Budgetary Control and Analysis of Variance

> *"A budget is telling your money where to go instead of wondering where it went."*
> *— John C. Maxwell (adapted for organisational budgeting)*

Unit Overview

This final unit turns from short-run decision techniques to the ongoing managerial discipline of planning and controlling an entire organisation through budgets, and then to standard costing and variance analysis, which diagnoses exactly why actual results departed from what was planned.

Objectives of the Unit
1. Explain the concept, objectives and steps of budgetary control.
2. Distinguish between fixed and flexible budgets and prepare a flexible budget.
3. Prepare various functional budgets: sales, production, cash, and master budget.
4. Explain Zero Based Budgeting and compare it with traditional budgeting.
5. Explain standard costing and compute material, labour and sales variances.
6. Interpret variances for managerial control and corrective action.

Key Concepts

- Budget and Budgetary Control.
- Fixed Budget vs Flexible Budget.
- Functional Budgets and the Master Budget.
- Zero Based Budgeting (ZBB).
- Standard Cost, Standard Costing and Variance.
- Material, Labour, Sales and Overhead variances.

Learning Outcomes

On successful completion of this unit, students will be able to:

- Explain the concept, objectives and steps involved in budgetary control.
- Distinguish a fixed budget from a flexible budget and prepare a flexible budget.
- Prepare functional budgets and consolidate them into a master budget.
- Explain Zero Based Budgeting and compare it with traditional incremental budgeting.
- Compute material, labour, sales and overhead variances and reconcile them to the total variance.
- Interpret variances to recommend targeted managerial corrective action.

Importance of Studying This Unit

Budgeting and variance analysis are the primary tools by which real organisations translate strategy into quantified targets and then hold managers accountable for results. This unit equips students to participate in, and eventually lead, the annual budgeting cycle and the periodic performance review that follows it in almost every medium and large organisation.

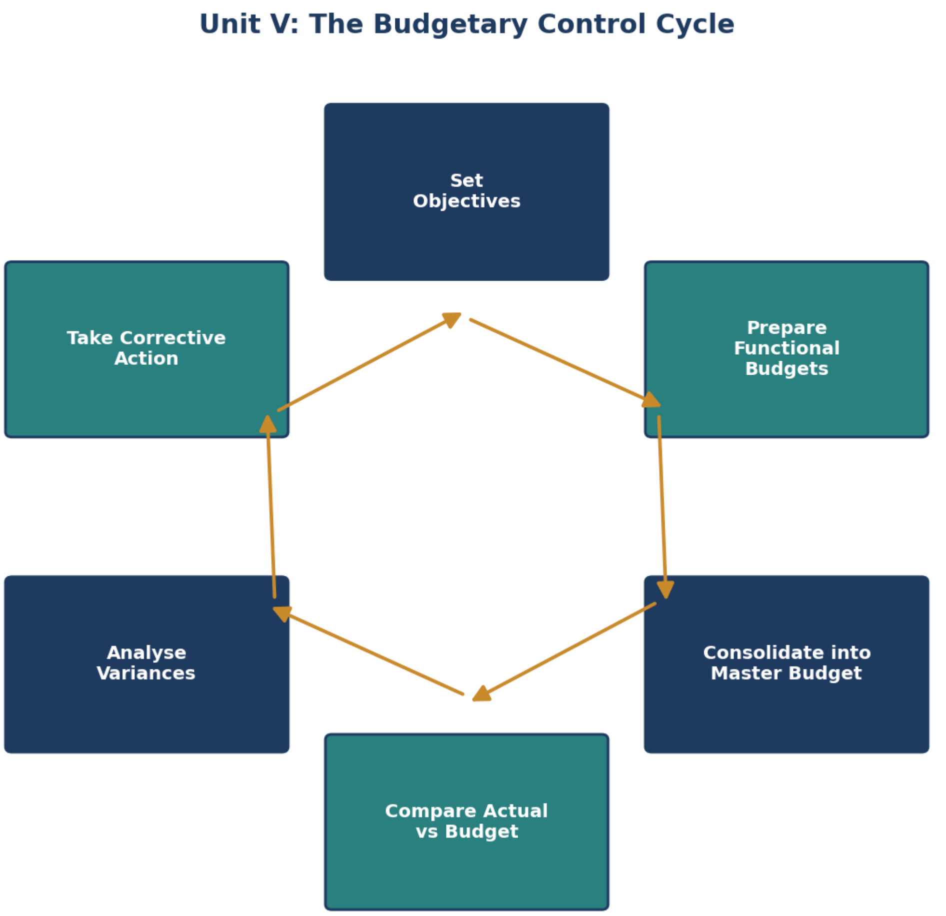

Figure: Key concept map for Unit V

5.1 Introduction

Where marginal costing and break-even analysis help in short-run decisions, and process/job costing help in ascertaining what something did cost, Budgetary Control and Standard Costing look forward: they set out what a cost, revenue, or activity should be, and then measure and analyse the difference between what actually happened and what should have happened. This unit covers the mechanics of budget preparation and the control cycle built around it, and then covers standard costing and variance analysis — the technique of quantifying, in monetary terms, exactly why actual results differed from the plan, so that management can take precisely targeted corrective action rather than a vague general one.

5.2 Key Terminologies

Term	Meaning
Budget	A quantitative statement, for a defined period, of a plan of action expressed in financial and/or physical terms, prepared prior to that period.
Budgetary Control	The establishment of budgets and the continuous comparison of actual results with budgeted results, so as to achieve objectives and provide a basis for revision.
Flexible Budget	A budget designed to change in accordance with the level of activity actually attained.
Master Budget	A summary budget that consolidates all the functional budgets into one overall plan of profit and financial position.
Zero Based Budgeting (ZBB)	A method of budgeting in which every item of expenditure must be justified afresh for each new budget period, starting from a 'zero base' rather than the previous year's figures.
Standard Cost	A predetermined cost, computed in advance of production, on the basis of a specification of all the factors affecting cost.
Standard Costing	A technique that uses standard costs and compares them with actual costs, to measure and analyse variances for control purposes.
Variance	The difference between a standard (or budgeted) figure and the corresponding actual figure.

5.3 Budget and Budgetary Control

A budget converts an organisation's strategic and operating plans into a set of quantified targets — usually financial, but often supported by physical quantities (units, hours) — for a specific future period. Budgetary control is the wider managerial process built around the budget: it does not stop at preparing the budget but continues through the period, comparing actual performance against the budget at regular intervals, analysing the resulting variances, reporting them to the responsible managers, and using the feedback either to correct operations or to revise future plans.

Objectives of Budgetary Control

- To ensure that the organisation's plans are expressed clearly, in quantified, actionable terms.
- To coordinate the activities of different departments towards a common set of objectives.
- To provide a formal basis for controlling income, expenditure and the use of resources.
- To fix responsibility for performance on specific managers (responsibility accounting).
- To provide a basis for performance evaluation, motivation and, where appropriate, incentive reward.
- To anticipate cash requirements and avoid unplanned liquidity crises.

Steps in Budgetary Control

11. Establish a Budget Committee, comprising heads of key functions, to oversee the budgeting process.
12. Determine the Budget Period — the time span for which budgets will be prepared (e.g., one year, further broken into quarters/months).
13. Identify the Principal Budget Factor (Key Factor) — usually sales demand, but sometimes production capacity or material availability — which determines the sequence in which functional budgets are prepared, since the budget for the limiting factor must be prepared first and all others built around it.
14. Prepare the functional (subsidiary) budgets — sales budget, production budget, materials budget, labour budget, overhead budgets, cash budget, and capital expenditure budget — each department head being responsible for their own budget.
15. Coordinate and consolidate the functional budgets into a Master Budget, comprising the budgeted Profit and Loss Account and Budgeted Balance Sheet.
16. Obtain approval of the Master Budget from top management/board.

17. Implement the budget, and continuously monitor actual performance against it, reporting variances to responsible managers.

18. Take corrective action where necessary, and revise the budget if underlying circumstances have materially changed.

5.4 Fixed Budget vs Flexible Budget

A Fixed Budget is prepared for one specific level of activity and is not adjusted, regardless of the level of activity actually attained; it is therefore useful mainly for planning purposes, but becomes a poor tool for control if actual activity differs significantly from the budgeted level, because it then compares actual cost at one volume with budgeted cost at a different volume — an unfair, misleading comparison, particularly for variable and semi-variable costs. A Flexible Budget overcomes this by preparing cost/revenue estimates for a range of activity levels (or by a formula linking cost to activity), so that, once the actual level of activity is known, the budget can be 'flexed' to what costs should have been at that actual level, giving a fair, like-for-like basis of comparison.

Basis	Fixed Budget	Flexible Budget
Activity Level	Prepared for one level only	Prepared for a range of activity levels
Cost Behaviour	Does not distinguish fixed and variable cost separately	Explicitly separates fixed and variable cost
Usefulness for Control	Limited if actual activity differs from budgeted	Provides fair comparison at actual activity level
Revision	Remains unchanged during the period	Can be recast (flexed) to the actual activity achieved

Illustration 5.1 — Flexible Budget

Prepare a flexible budget for production of 6,000, 8,000 and 10,000 units from the following data at the 8,000-unit level: Direct material ₹4,00,000; Direct labour ₹2,40,000; Variable overhead ₹1,60,000; Fixed overhead ₹2,00,000 (fixed, irrespective of volume within this range).

Solution: At 8,000 units, variable cost per unit — Material = 4,00,000/8,000 = ₹50; Labour = 2,40,000/8,000 = ₹30; Variable overhead = 1,60,000/8,000 = ₹20.

Particulars	6,000 units (₹)	8,000 units (₹)	10,000 units (₹)
Direct Material @ ₹50	3,00,000	4,00,000	5,00,000
Direct Labour @ ₹30	1,80,000	2,40,000	3,00,000
Variable Overhead @ ₹20	1,20,000	1,60,000	2,00,000
Fixed Overhead	2,00,000	2,00,000	2,00,000
Total Cost	8,00,000	10,00,000	12,00,000
Cost per Unit	133.33	125.00	120.00

Note how cost per unit falls as volume rises, purely because fixed overhead of ₹2,00,000 is spread over more units — a key insight a fixed budget would obscure.

5.5 Functional Budgets

(a) Sales Budget

The Sales Budget is usually the starting point of the entire budgeting exercise, since sales is typically the principal budget factor. It forecasts the quantity and value of sales expected for each product, region, and period, based on market research, sales-force estimates, past trends, and economic conditions.

(b) Production Budget

The Production Budget converts the sales budget into a production plan, adjusted for planned changes in finished goods inventory:

Budgeted Production = Budgeted Sales + Desired Closing Stock of Finished Goods − Opening Stock of Finished Goods

(c) Cash Budget

The Cash Budget forecasts cash receipts and payments over the budget period (often month by month), to anticipate periods of cash surplus or shortage, allowing management to plan short-term borrowing or investment in advance rather than being caught by surprise. It typically starts with the opening cash balance, adds forecast receipts (from cash sales, collections from debtors, and other income), deducts forecast payments (to suppliers, wages, overheads, capital expenditure, taxes and dividends), and arrives at the closing cash balance for each sub-period.

(d) Master Budget

The Master Budget is the summary document that consolidates every functional budget — sales, production, materials, labour, overheads, cash, and capital expenditure — into a single, coherent plan, typically presented as a Budgeted Profit and Loss Account and a Budgeted Balance Sheet for the period, and it is this master budget that is placed before the board or top management for final approval.

5.6 Zero Based Budgeting (ZBB)

Traditional (incremental) budgeting takes the previous year's budget or actual figures as a base and adjusts it, usually upward, for expected changes in the coming year; this can perpetuate inefficiencies and 'budgetary slack' built up over past years, since past expenditure is rarely questioned. Zero Based Budgeting, in contrast, requires every activity and item of expenditure to be justified afresh, from a zero base, for every new budget period, as though the activity were being proposed for the very first time; only activities that can demonstrate their necessity and cost-effectiveness (usually through 'decision packages' ranked by priority against available funds) receive budget allocation.

Steps in Zero Based Budgeting

19. Identify decision units (activities or cost centres) for which budgets are to be prepared.
20. Develop 'decision packages' for each unit, describing the activity, its purpose, cost, alternative ways of achieving it, and consequences of not funding it.
21. Rank all decision packages in order of priority/benefit across the organisation.
22. Allocate available resources to decision packages in order of rank until funds are exhausted.

Comparison of ZBB with Traditional Budgeting

Basis	Traditional (Incremental) Budgeting	Zero Based Budgeting
Starting Point	Previous year's budget/actuals	Zero base — nothing is assumed necessary
Justification	Only the incremental change is justified	Every activity/cost is justified afresh
Focus	Focus on 'how much more/less' than last year	Focus on 'whether the activity is needed at all'
Effort/Cost of Preparation	Relatively quick and low-effort	Time-consuming and resource-intensive
Effect on Inefficiency	May perpetuate past inefficiency/slack	Tends to expose and eliminate unjustified spending

5.7 Standard Costing and Variance Analysis

Standard Costing sets a predetermined (standard) cost for each element of cost — material, labour and overhead — based on careful technical and cost estimation of what a unit of product should cost under efficient operating conditions. Actual costs incurred are then compared with these standards, and the difference (variance) is analysed into its underlying causes, so that management can pinpoint exactly where and why performance departed from the plan, rather than being told only a single overall figure of profit shortfall.

5.7.1 Material Variances

Material Cost Variance (MCV) = Standard Cost of Actual Output − Actual Cost = (SQ × SP) − (AQ × AP)

Material Cost Variance is analysed into two sub-variances:

Material Price Variance (MPV) = Actual Quantity × (Standard Price − Actual Price) = AQ (SP − AP)

Material Usage (Quantity) Variance (MUV) = Standard Price × (Standard Quantity for Actual Output − Actual Quantity) = SP (SQ − AQ)

Where materials mix is also a factor (multiple materials combined in a standard proportion), Material Usage Variance can be further split into Material Mix Variance and Material Yield (Sub-Usage) Variance, isolating the effect of a different proportion of inputs from the effect of overall material efficiency.

Check: MCV = MPV + MUV, always. This additive relationship allows a manager to verify computations and also to see, at a glance, whether an unfavourable overall variance stems mainly from paying more for material (a purchasing issue) or from using more material than the standard allows (a production efficiency issue).

Illustration 5.2 — Material Variances

Standard: 100 kg of material at ₹10 per kg is required for 100 units of output. Actual: 4,000 units were produced using 4,300 kg of material costing ₹41,000 (i.e., ₹9.53 per kg approximately). Calculate MCV, MPV and MUV.

Solution: Standard Quantity (SQ) for actual output of 4,000 units = (100/100) × 4,000 = 4,000 kg. Standard Price (SP) = ₹10 per kg. Actual Quantity (AQ) = 4,300 kg. Actual Price (AP) = 41,000/4,300 = ₹9.53 per kg (approx).

$MCV = (SQ \times SP) - (AQ \times AP) = (4{,}000 \times 10) - 41{,}000 = 40{,}000 - 41{,}000 =$ ₹1,000 (Adverse).

$MPV = AQ\,(SP - AP) = 4{,}300 \times (10 - 9.53) = 4{,}300 \times 0.47 \approx$ ₹2,021 (Favourable) [precisely: $AQ \times SP$ − Actual Cost = 43,000 − 41,000 = ₹2,000 Favourable].

$MUV = SP\,(SQ - AQ) = 10 \times (4{,}000 - 4{,}300) = 10 \times (-300) =$ ₹3,000 (Adverse).

Check: MPV + MUV = 2,000 (F) + 3,000 (A) = ₹1,000 (Adverse), which equals MCV — confirmed. Interpretation: although the purchase department bought material more cheaply than standard (a favourable price variance), the production department used considerably more material than the standard allowed, and this adverse usage more than wiped out the price saving, resulting in a net adverse material cost variance overall.

5.7.2 Labour Variances

Labour Cost Variance (LCV) = Standard Cost of Actual Output − Actual Cost = $(SH \times SR) - (AH \times AR)$

Labour Rate Variance (LRV) = Actual Hours × (Standard Rate − Actual Rate) = $AH\,(SR - AR)$

Labour Efficiency (Time) Variance (LEV) = Standard Rate × (Standard Hours for Actual Output − Actual Hours) = $SR\,(SH - AH)$

Where idle time occurs (hours paid for but not worked, due to reasons such as machine breakdown or power failure), Labour Efficiency Variance is often further split into an Idle Time Variance (always adverse, valued at standard rate on idle hours) and a pure Labour Efficiency Variance based on hours actually worked. Check: LCV = LRV + LEV (+ Idle Time Variance, if separately identified).

Illustration 5.3 — Labour Variances

Standard: 10 hours at ₹25 per hour are allowed to produce 1 unit. Actual: 500 units were produced, using 5,300 hours, and total wages paid were ₹1,38,000. Calculate LCV, LRV and LEV.

Solution: Standard Hours (SH) for actual output = 10 × 500 = 5,000 hours. Standard Rate (SR) = ₹25 per hour. Actual Hours (AH) = 5,300 hours. Actual Rate (AR) = 1,38,000/5,300 ≈ ₹26.04 per hour.

LCV = (5,000 × 25) − 1,38,000 = 1,25,000 − 1,38,000 = ₹13,000 (Adverse).

LRV = AH (SR − AR) = (AH × SR) − Actual Cost = (5,300 × 25) − 1,38,000 = 1,32,500 − 1,38,000 = ₹5,500 (Adverse).

LEV = SR (SH − AH) = 25 × (5,000 − 5,300) = 25 × (−300) = ₹7,500 (Adverse).

Check: LRV + LEV = 5,500 (A) + 7,500 (A) = ₹13,000 (Adverse) = LCV — confirmed. Interpretation: both the wage rate paid and the labour time taken exceeded standard, indicating a need to review wage negotiation as well as worker productivity/supervision.

5.7.3 Sales Variances

Sales variances measure the difference between budgeted and actual sales performance, in terms of either value or profit/margin contribution, and help explain whether a shortfall arose from selling at a different price than planned, or from selling a different volume/mix than planned.

Total Sales Value Variance = Actual Sales Value − Budgeted Sales Value

Sales Price Variance = Actual Quantity Sold × (Actual Price − Standard/Budgeted Price)

Sales Volume Variance = Standard/Budgeted Price × (Actual Quantity Sold − Budgeted Quantity)

When profitability (rather than pure sales value) is the focus, Sales Margin Variances are computed on the same principles but using standard profit/contribution per unit rather than price, and Sales Volume Variance can be further analysed into a Sales Mix Variance (effect of selling a different proportion of products than budgeted) and a Sales Quantity Variance (effect of a different total volume than budgeted, at the budgeted mix).

Illustration 5.4 — Sales Value Variance

Budgeted sales: 1,000 units at ₹50 per unit = ₹50,000. Actual sales: 1,100 units at ₹48 per unit = ₹52,800. Calculate the Total Sales Value Variance, Sales Price Variance and Sales Volume Variance.

Solution: Total Sales Value Variance = 52,800 − 50,000 = ₹2,800 (Favourable). Sales Price Variance = Actual Qty × (Actual Price − Standard Price) = 1,100 × (48 − 50) = 1,100 × (−2) = ₹2,200 (Adverse). Sales Volume Variance = Standard Price × (Actual Qty − Budgeted Qty) = 50 × (1,100 − 1,000) = 50 × 100 = ₹5,000 (Favourable). Check: 5,000 (F) − 2,200 (A) = ₹2,800 (Favourable) = Total Sales Value Variance — confirmed. Interpretation: the increase in volume more than compensated for a lower realised selling price, giving a net favourable variance overall.

5.7A Additional Functional Budgets

(e) Materials/Purchase Budget

The Materials Budget translates the production budget into the quantity of raw material required, adjusted for planned changes in raw material inventory, and is used by the purchase department to plan procurement and negotiate supplier contracts in advance.

Budgeted Material Purchases = Material Required for Budgeted Production + Desired Closing Stock of Material − Opening Stock of Material

(f) Labour Budget

The Labour Budget estimates the direct labour hours and cost required to achieve the production budget, department-wise and grade-wise, and is essential input to workforce planning, recruitment, and training schedules.

(g) Overhead Budgets

Separate budgets are usually prepared for Factory (Works) Overhead, Administration Overhead, and Selling and Distribution Overhead, each split into its fixed and variable components so that the budget can, if required, be flexed to the actual level of activity subsequently achieved (see Section 5.4).

(h) Capital Expenditure Budget

The Capital Expenditure Budget plans the acquisition of fixed assets (plant, machinery, buildings) over the budget period, usually extending over a longer horizon than the annual operating budgets, and is closely linked to capital budgeting/investment appraisal techniques covered in financial management.

5.7B Overhead Variances — Standard Costing Extended

Standard costing is not confined to material and labour; overhead cost, too, can be analysed into variances, and this extension is a natural and commonly examined companion to the material and labour variances covered above. The Total Overhead Cost Variance is the difference between overhead absorbed on standard output and actual overhead incurred, and is typically analysed into an Overhead Expenditure (Budget) Variance and an Overhead Volume Variance.

Overhead Cost Variance = Overhead Absorbed (Standard Hours for Actual Output × Standard Overhead Rate) − Actual Overhead Incurred

Overhead Expenditure Variance = Budgeted Overhead for Actual Hours Worked − Actual Overhead Incurred

Overhead Volume Variance = Standard Overhead Rate × (Standard Hours for Actual Output − Budgeted Hours)

The Volume Variance itself can be further analysed into Efficiency Variance (the effect of workers being faster or slower than standard) and Capacity Variance (the effect of the plant working more or fewer hours than budgeted), giving management a complete picture of whether an adverse overhead variance stems from over-spending on overhead items, from under-utilisation of available capacity, or from labour inefficiency in converting available hours into standard output.

Illustration 5.5 — Overhead Cost Variance (Simplified)

Budgeted output is 1,000 units, requiring 2,000 budgeted hours, with budgeted overhead of ₹40,000 (standard overhead rate = ₹20 per hour, or ₹40 per unit). Actual output was 1,100 units, actual hours worked were 2,150, and actual overhead incurred was ₹43,500. Calculate the Overhead Cost Variance and its two sub-variances.

Solution: Standard hours for actual output = 2,000/1,000 × 1,100 = 2,200 hours. Overhead absorbed = 2,200 × 20 = ₹44,000. Overhead Cost Variance = 44,000 − 43,500 = ₹500 (Favourable). Budgeted overhead for actual hours worked (flexed) = 2,150 × 20 = ₹43,000 (assuming a purely variable standard rate for simplicity). Overhead Expenditure Variance = 43,000 − 43,500 = ₹500 (Adverse). Overhead Volume Variance = 20 × (2,200 − 2,000) = 20 × 200 = ₹4,000 (Favourable). Check: Expenditure Variance + Volume Variance = 500(A) + 4,000(F) = ₹3,500 (Favourable) — note that in this simplified variable-overhead illustration this does not equal the Overhead Cost Variance of ₹500(F) exactly, because a full analysis with separate fixed/variable overhead rates and a Capacity Variance is required for precise reconciliation; students should follow the fixed/variable overhead variance formulae prescribed in their reference textbook for examination purposes, since conventions vary slightly across authors.

5.8 Advantages and Limitations of Budgetary Control and Standard Costing

Advantages

- Provides a formal, quantified basis for planning, coordination and control across departments.
- Fixes responsibility clearly and supports performance evaluation of individual managers/cost centres.
- Variance analysis pinpoints precisely where and why actual performance departed from plan, enabling targeted corrective action.
- Facilitates 'management by exception', focusing scarce managerial attention on significant deviations.
- Standard costs simplify inventory valuation and provide a stable benchmark unaffected by short-term price fluctuations.

Limitations

- Budgets and standards are estimates and can quickly become outdated if the business environment changes rapidly.
- Preparation of budgets, and especially Zero Based Budgets, is time-consuming and resource-intensive.
- Rigid adherence to budgets/standards can discourage flexibility, innovation, or necessary deviation from plan.
- Variance analysis explains 'what' happened but does not by itself reveal deeper root causes without further investigation.

- Budgetary slack (managers deliberately understating targets to make them easier to achieve) can undermine the integrity of the process.

5.8A Additional Illustration — Cash Budget

Illustration 5.6: Prepare a Cash Budget for April, May and June from the following data. Opening cash balance on 1 April is ₹50,000. Sales (all realised the month after sale): February ₹1,00,000, March ₹1,20,000, April ₹1,50,000, May ₹1,80,000, June ₹1,60,000. Purchases (paid the month after purchase): March ₹80,000, April ₹90,000, May ₹1,00,000, June ₹95,000. Wages, paid in the same month: April ₹30,000, May ₹32,000, June ₹31,000. Rent of ₹10,000 is paid every month. A machine costing ₹1,20,000 is to be purchased and paid for in May.

Solution: Cash receipts (collections from debtors, one month in arrears) — April: from March's sales = ₹1,20,000; May: from April's sales = ₹1,50,000; June: from May's sales = ₹1,80,000.

Particulars	April (₹)	May (₹)	June (₹)
Opening Balance	50,000	70,000	58,000
Add: Receipts from Debtors	1,20,000	1,50,000	1,80,000
Total Cash Available	1,70,000	2,20,000	2,38,000
Less: Payment to Creditors (purchases, one month arrears)	80,000	90,000	1,00,000
Less: Wages	30,000	32,000	31,000
Less: Rent	10,000	10,000	10,000
Less: Machine Purchase	—	1,20,000	—
Total Payments	1,20,000	2,52,000	1,41,000
Closing Balance	50,000	(32,000)	97,000

The cash budget reveals a projected cash shortfall of ₹32,000 at the end of May, caused by the timing of the machine purchase coinciding with a relatively modest month of collections; the closing balance recovers to a comfortable ₹97,000 by the end of June. Forewarned by this budget, the finance manager can arrange a short-term overdraft facility, or negotiate deferred payment terms for the machine, well in advance of May, rather than being taken by surprise by the cash shortfall — precisely the forward-looking, control-oriented purpose that a cash budget is meant to serve, as introduced in Section 5.5(c).

Case Study: A Cash Budget Averts a Payroll Crisis at a Growing Textile Exporter

A fast-growing textile exporter had historically not prepared a formal cash budget, relying instead on its bank balance as it stood at any given moment to judge its liquidity position, even as export orders — and the associated need to pay for raw material and wages well before export proceeds were realised, often 90 days later under typical letter-of-credit terms — grew rapidly.

A new CFO introduced a rolling three-month cash budget, projecting receipts (export proceeds, factoring in the realistic collection lag) against payments (raw material, wages, statutory dues) month by month. The very first cash budget prepared revealed a projected cash shortfall in the coming month sufficient to threaten timely payroll disbursement, a risk the company's simple bank-balance-watching approach had completely failed to anticipate, since the current balance still looked comfortable at the time the budget was prepared.

Armed with the cash budget's early warning, the CFO arranged a short-term working-capital facility against confirmed export orders well ahead of the shortfall date, avoiding a payroll crisis that could have seriously damaged staff morale and the company's reputation with its bank. The episode led the company to institutionalise rolling cash budgeting as a standing monthly practice, directly illustrating why the cash budget, though the simplest of the functional budgets described in this unit, is often the single most operationally critical one for a growing business.

5.8B Additional Illustration — Material Mix Variance

Illustration 5.7: A standard mix for 100 kg of output requires: Material A 60 kg at ₹15 per kg, Material B 40 kg at ₹10 per kg (standard cost of standard mix = 900 + 400 = ₹1,300 for 100 kg input). Actual output required processing an actual mix of 220 kg, consisting of Material

A 150 kg (actual cost ₹16 per kg) and Material B 70 kg (actual cost ₹9 per kg). Calculate the Material Cost Variance, Material Price Variance, Material Usage Variance, and further split Material Usage Variance into Material Mix Variance and Material Yield (Sub-usage) Variance, assuming standard output from 220 kg of input, in the standard proportion, would be 220 kg (i.e., no normal loss is assumed in this simplified illustration).

Solution: Standard Quantity for actual total input, in standard proportion (60:40 of 220 kg) — A: 220 × 60/100 = 132 kg; B: 220 × 40/100 = 88 kg.

Material	Standard Qty (kg)	Std Price (₹)	Std Cost (₹)	Actual Qty (kg)	Actual Price (₹)	Actual Cost (₹)
A	132	15	1,980	150	16	2,400
B	88	10	880	70	9	630
Total	220	—	2,860	220	—	3,030

Material Cost Variance = Standard Cost − Actual Cost = 2,860 − 3,030 = ₹170 (Adverse).

Material Price Variance = Actual Qty × (Std Price − Actual Price), summed: A = 150 × (15−16) = −150 (i.e., ₹150 Adverse); B = 70 × (10−9) = +70 (i.e., ₹70 Favourable). Total MPV = 150(A) + 70(F) = ₹80 (Adverse).

Material Usage Variance = Std Price × (Std Qty − Actual Qty), summed: A = 15 × (132−150) = 15 × (−18) = −270 (₹270 Adverse); B = 10 × (88−70) = 10 × 18 = +180 (₹180 Favourable). Total MUV = 270(A) + 180(F) = ₹90 (Adverse). Check: MPV + MUV = 80(A) + 90(A) = ₹170 (Adverse) = MCV — confirmed.

Material Mix Variance = Std Price × (Revised Standard Quantity − Actual Quantity), where Revised Standard Quantity keeps the standard proportion but uses the actual TOTAL input of 220 kg (which, in this illustration, is identical to the Standard Quantity computed above, since actual total input exactly equals 220 kg): A = $15\times(132-150) = -270$; B = $10\times(88-70)=+180$; Mix Variance = ₹90 (Adverse), which in this specific case equals the entire Usage Variance because total actual input exactly matched the total assumed for the standard mix, illustrating that Mix Variance isolates the effect of using a different proportion of A and B (more of the costlier Material A, less of the cheaper Material B, than standard), which is the dominant story in this example — the company used a mix skewed towards the more expensive Material A relative to standard, driving the adverse usage variance even though total input quantity matched what was expected.

5.9 Emerging Trends and Recent Advancements

Rolling budgets and rolling forecasts — where a budget is continuously extended by one further period as each period elapses (e.g., always maintaining a twelve-month forward view, updated monthly) — are increasingly replacing the traditional fixed annual budget of Section 5.3 in fast-changing industries, since a budget fixed a year in advance can become obsolete well before the year ends. Beyond Budgeting is an emerging management philosophy that goes further still, arguing that rigid annual budgets and target-linked incentives can encourage dysfunctional, short-term behaviour (such as deliberately understating targets, or delaying beneficial expenditure merely to hit a budget figure), and advocating relative, rolling performance targets benchmarked against competitors or prior periods instead of a single fixed number agreed months in advance. In standard costing, software-driven Statistical Process Control increasingly complements traditional variance analysis, flagging a process as 'out of control' using statistical control limits the moment a cost or quality metric drifts, rather than waiting for the traditional monthly variance report described in Section 5.7. Predictive analytics and machine learning are also being applied to historical variance data to forecast likely future variances before they occur — for instance, predicting a probable adverse material price variance from early signals in commodity markets — shifting variance analysis from a purely retrospective control tool towards a forward-looking early-warning system.

5.10 Industry Insight — Standard Costing in a Volatile Commodity Environment

Manufacturers heavily dependent on volatile commodity inputs — such as copper for electrical goods, or crude-oil-linked plastics for packaging — face a particular challenge in maintaining meaningful material price standards, since global commodity prices can move sharply within a single budget period, generating large material price variances that say more about global markets than about the purchasing department's performance. Many such firms have responded by supplementing standard costing with rolling, frequently revised standards (sometimes revised monthly rather than annually) and by using commodity hedging instruments to lock in input prices in advance, which converts what would otherwise be an uncontrollable price variance into a small, planned hedging cost, restoring the diagnostic value of the remaining variance (which then more accurately reflects genuine purchasing and usage efficiency, largely free of pure market-price noise) — a practical illustration of why the interpretation of a variance, discussed throughout Section 5.7, must always be grounded in an understanding of what is genuinely controllable by the manager being evaluated.

Case Study: Variance Analysis Uncovers a Hidden Efficiency Problem

An auto-parts manufacturer's monthly management reports showed a persistently adverse material cost variance for its flagship gearbox casing, month after month, and the plant manager kept attributing it loosely to 'rising input prices' without further investigation, prompting repeated requests to revise the standard cost upward to make the numbers look better.

A cost accountant insisted on splitting the overall material cost variance into its price and usage components before any standard revision was approved. The analysis revealed that the material price variance was actually favourable — the purchase department had in fact negotiated better rates than standard — while the material usage variance was sharply adverse and growing, indicating that far more raw casting material was being scrapped or wasted on the shop floor than the standard allowed.

Further investigation traced the excess usage to a worn die-casting mould that had not been serviced on schedule, causing increased flash and rejection rates. Once the mould was repaired, the adverse usage variance disappeared within two months, without any need to revise the material price standard, and the plant recovered nearly ₹18 lakh annually in avoided material waste. The case illustrates why decomposing a total variance into its price and quantity/efficiency elements — rather than reacting to the net figure alone — is essential to correctly diagnosing and fixing the underlying operational problem.

Question Bank

(a) Short Answer Questions (2 Marks)

S.No	Question	Marks	Bloom Level
1	Define Budget.	2	L1
2	What is Budgetary Control?	2	L1
3	Distinguish between Fixed Budget and Flexible Budget.	2	L2
4	What is a Master Budget?	2	L1
5	Define Zero Based Budgeting.	2	L1
6	What is a Cash Budget used for?	2	L1
7	Define Standard Cost.	2	L1
8	What is Material Price Variance?	2	L1
9	State the formula for Labour Efficiency Variance.	2	L1
10	What is Sales Volume Variance?	2	L1
11	Name the Principal Budget Factor and give an example.	2	L2
12	What is Idle Time Variance?	2	L1
13	What is a Purchase (Materials) Budget?	2	L1
14	What is a Capital Expenditure Budget?	2	L1
15	Define Overhead Expenditure Variance.	2	L1
16	What is Overhead Volume Variance?	2	L1

(b) Essay Type Questions (10 Marks)

S.No	Question	Marks	Bloom Level
1	Explain the objectives and the steps involved in budgetary control.	10	L2
2	Distinguish between a fixed budget and a flexible budget, and explain why a flexible budget is a better control tool.	10	L4
3	Explain the various functional budgets and how they are consolidated into a Master Budget.	10	L3
4	What is Zero Based Budgeting? Explain its steps and compare it with traditional budgeting.	10	L4

5	Explain standard costing and the process of computing and analysing material cost variances, with an illustration.	10	L3
6	Explain labour rate variance and labour efficiency variance with an illustration, and discuss their managerial significance.	10	L3
7	Explain sales price variance and sales volume variance with an illustration.	10	L3
8	Critically evaluate the advantages and limitations of budgetary control and standard costing as tools of managerial control.	10	L5
9	Explain the various functional budgets — materials, labour, overhead, and capital expenditure budgets — and their interrelationship with the master budget.	10	L4
10	Explain Overhead Cost Variance and its analysis into Expenditure and Volume Variance, with an illustration.	10	L3

Problems

S.No	Problem	Marks	Bloom Level
1	Problem 5.1: Prepare a flexible budget for 70%, 80% and 100% capacity from the following data at 80% capacity (10,000 units): Direct material ₹5,00,000; Direct labour ₹3,00,000; Variable overhead ₹2,00,000; Fixed overhead ₹1,50,000.	10	L3
2	Problem 5.2: Standard material requirement for 1,000 units of output is 500 kg at ₹20 per kg. Actual production was 1,200 units, using 620 kg of material costing ₹13,020. Calculate Material Cost Variance, Material Price Variance and Material Usage Variance.	10	L4
3	Problem 5.3: Standard time for producing 1 unit is 2 hours at ₹40 per hour. Actual production was 800 units, taking 1,700 hours at a total wage cost of ₹70,550. Calculate Labour Cost Variance, Labour Rate Variance and Labour Efficiency Variance.	10	L4
4	Problem 5.4: Budgeted output is 2,000 units requiring 4,000 standard hours, with budgeted overhead of ₹1,00,000. Actual output was 2,200 units, actual hours worked were 4,300, and actual overhead incurred was ₹1,08,000. Calculate the Overhead Cost Variance, Overhead Expenditure Variance and Overhead Volume Variance.	10	L4

Case Study: Real-Time Case Study: Zero Based Budgeting Adopted by a State PSU

A state-owned public transport corporation had, for over a decade, prepared its annual budget by simply increasing the previous year's departmental allocations by a standard inflation percentage, regardless of whether individual routes, workshops, or administrative units were actually justified in their current form. Chronic losses led the state government to mandate a shift to Zero Based Budgeting for the corporation's next budget cycle.

Every depot and department was required to submit 'decision packages' justifying its planned expenditure from a zero base, describing the service level provided, its cost, and the consequence of not funding it. The exercise revealed that several low-ridership routes were being cross-subsidised heavily without any documented policy rationale, while certain high-priority workshop maintenance activities had been chronically under-funded for years under the old incremental approach, contributing to a rising breakdown rate.

Reallocating funds based on the ranked decision packages — reducing frequency on the least-justified routes while increasing the maintenance budget — improved fleet availability within a year and reduced the corporation's operating deficit, even though the total budget size did not increase. The exercise took substantially more staff time than the old incremental method, confirming the well-known trade-off between the rigour of Zero Based Budgeting and the administrative effort it demands.

Unit Highlights

- Budgetary control is a continuous cycle: prepare functional budgets, consolidate into a master budget, compare actual to budget, and act on variances.
- A flexible budget, not a fixed budget, is the fair basis for control when actual activity differs from the original plan.
- Zero Based Budgeting requires every activity to justify its funding afresh each period, unlike incremental budgeting.
- Standard costing decomposes each variance into a price/rate component and a quantity/efficiency/volume component.
- Variance analysis turns a single overall deviation from plan into a precise diagnosis of where, and why, performance departed from expectations.

Unit Summary

This final unit turned from short-run decision techniques to the ongoing managerial discipline of planning and controlling an entire organisation through budgets and standards. Budgetary control was shown to be a continuous cycle — establishing a budget committee, identifying the principal budget factor, preparing functional budgets (sales, production, materials, labour, overhead, cash and capital expenditure), consolidating them into a master budget, and then comparing actual results against budget on an ongoing basis. The flexible budget was distinguished from the fixed budget as the fair basis for control when actual activity differs from the originally budgeted level, and Zero Based Budgeting was presented as a more rigorous, if more resource-intensive, alternative to incremental budgeting, requiring every activity to justify its continued funding afresh each period. The unit then turned to standard costing, where material, labour, sales and overhead variances were each decomposed into a price/rate component and a quantity/efficiency/volume component, with worked illustrations showing how to compute, check (via the additive relationship between sub-variances and the total variance) and interpret each one — turning a single overall deviation from plan into a precise diagnosis of where, and why, actual performance departed from what was expected, which is the ultimate purpose of the entire variance analysis exercise.

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