

Intermediate Course

Study Material

(Modules 1 to 2)

Paper : 4

Cost and Management Accounting

**(Relevant for May, 2025 and
onward Examinations)**

Module – 2



BOARD OF STUDIES
THE INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA

This Study Material has been prepared by the faculty of the Board of Studies. The objective of the Study Material is to provide teaching material to the students to enable them to obtain knowledge in the subject. In case students need any clarification or have any suggestion for further improvement of the material contained herein, they may write to the Joint Director, Board of Studies.

All care has been taken to provide interpretations and discussions in a manner useful for the students. However, the Study Material has not been specifically discussed by the Council of the Institute or any of its committees and the views expressed herein may not be taken to necessarily represent the views of the Council or any of its Committees.

Permission of the Institute is essential for reproduction of any portion of this material.

© THE INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior permission, in writing, from the publisher.

Basic draft of this publication was prepared by CA. (Dr.) Rashmi Goel

Edition	:	July, 2024
Committee/Department	:	Board of Studies
E-mail	:	bosnoida@icai.in
Website	:	www.icai.org
Price	:	₹ /- (For All Modules)
ISBN No.	:	978-81-19472-65-9
Published by	:	The Publication & CDS Directorate on behalf of The Institute of Chartered Accountants of India, ICAI Bhawan, Post Box No. 7100, Indraprastha Marg, New Delhi 110 002 (India)
Printed by	:	

CONTENTS

MODULE – 1

Chapter 1 – Introduction to Cost and Management Accounting

Chapter 2 – Material Cost

Chapter 3 – Employee Cost and Direct Expenses

Chapter 4 – Overheads: Absorption Costing Method

Chapter 5 – Activity Based Costing

Chapter 6 – Cost Sheet

Chapter 7 – Cost Accounting System

MODULE – 2

Chapter 8 – Unit & Batch Costing

Chapter 9 – Job Costing and Contract Costing

Chapter 10 – Process & Operation Costing

Chapter 11 – Joint Products & By Products

Chapter 12 – Service Costing

Chapter 13 – Standard Costing

Chapter 14 – Marginal Costing

Chapter 15 – Budget and Budgetary Control

DETAILED CONTENTS: MODULE-2

CHAPTER 8 – UNIT & BATCH COSTING 8.1-8.30

Learning Outcomes	8.1
Chapter Overview	8.1
1. Introduction.....	8.2
1.1 For industry doing job work	8.2
1.2 For continuous or process type of industries.....	8.2
2. Unit Costing	8.3
3. Cost Collection Procedure in Unit Costing.....	8.3
3.1 Treatment of spoiled and defective work	8.4
4. Batch Costing.....	8.8
5. Costing Procedure in Batch Costing	8.8
6. Economic Batch Quantity (EBQ)	8.11
7. Difference between Job and Batch Costing.....	8.15
Summary	8.15
Test Your Knowledge.....	8.16
Multiple Choice Questions (MCQs).....	8.16
Theoretical Questions	8.18
Practical Problems	8.18
Case Scenarios	8.20
Answers to the MCQs.....	8.22
Answers to the Theoretical Questions	8.22
Answers to the Practical Problems	8.23
Answers to the Case Scenarios	8.27

CHAPTER 9 – JOB COSTING 9.1-9.23

Learning Outcomes	9.1
Chapter Overview	9.1
1. Job Costing.....	9.2
1.1 Meaning of Job Costing	9.2
1.2 Principles of Job Costing	9.2
1.3 Process of Job Costing.....	9.2
1.4 Suitability of Job Costing	9.3
2. Job Cost Card/ Sheet.....	9.3
3. Collection of costs for a Job.....	9.4
3.1 Collection of Materials Cost.....	9.4
3.2 Collection of Labour Cost	9.5
3.3 Collection of Overheads.....	9.6
3.4 Treatment of spoiled and defective work	9.6
4. Accounting of Costs for a Job.....	9.8
4.1 Entries in Control Accounts.....	9.8
4.2 Advantages and Disadvantages of Job Costing.....	9.13
4.3 Difference between Job Costing and Process Costing	9.13
Summary	9.14
Test Your Knowledge.....	9.14
Multiple Choice Questions (MCQs)	9.14
Theoretical Questions	9.16
Practical Problems	9.16
Answers to the MCQs	9.20
Answers to the Theoretical Questions	9.20
Answers to the Practical Problems	9.20

CHAPTER 10 – PROCESS & OPERATION COSTING 10.1-10.50

Learning Outcomes	10.1
Chapter Overview	10.2
1. Meaning of Process Costing	10.2
1.1 Basic Features	10.2
2. Costing Procedure in Process Costing	10.3
3. Treatment of Normal , Abnormal Loss and Abnormal Gain	10.5
3.1 Normal and Abnormal loss	10.5
3.2 Abnormal Process Gain/ Yield.....	10.9
4. Valuation of Work in-Process.....	10.15
4.1 Equivalent Units.....	10.16
5. Steps in Process Costing	10.18
6. Process Costing Methods	10.19
7. Inter-Process Profits.....	10.23
8. Operation Costing	10.26
Summary	10.27
Test Your Knowledge.....	10.28
Multiple Choice Questions (MCQs).....	10.28
Theoretical Questions	10.31
Practical Problems	10.32
Case Scenarios.....	10.37
Answers to the MCQs	10.39
Answers to the Theoretical Questions	10.39
Answers to the Practical Problems	10.39
Answers to the Case Scenarios	10.49

CHAPTER 11 – JOINT PRODUCTS AND BY PRODUCTS 11.1-11.39

Learning Outcomes	11.1
Chapter Overview	11.1
1. Meaning of Joint Products and By Products	11.2
2. Apportionment of Joint Costs.....	11.4
3. Methods of Apportionment of Joint Cost to Joint Products.....	11.4
4. Methods of Apportionment of Joint Costs to By Products.....	11.15
5. Treatment of By Products Cost in Cost Accounting	11.17
Summary	11.18
Test Your Knowledge.....	11.20
Multiple Choice Questions (MCQs).....	11.20
Theoretical Questions	11.23
Practical Problems	11.23
Case Scenarios.....	11.27
Answers to the MCQs	11.29
Answers to the Theoretical Questions	11.30
Answers to the Practical Problems	11.30
Answers to the Case Scenarios	11.37

CHAPTER 12 – SERVICE COSTING..... 12.1-12.73

Learning Outcomes	12.1
Chapter Overview	12.1
1. Introduction.....	12.2
1.1 Application of Service Costing.....	12.2
1.2 Service Costing vs. Product Costing	12.3
2. Service Cost Unit and KPI.....	12.3

2.1	Methods for ascertaining Service Cost Unit	12.7
3.	Statement of Costs for Service Sectors.....	12.10
4.	Applications of Costing Methods in Service Costing	12.11
5.	Costing of Transport Services.....	12.11
6.	Costing of Hotels and Lodges.....	12.22
7.	Costing of Hospitals.....	12.28
7.1	Unit of Cost	12.28
7.2	Cost Segregation.....	12.29
8.	Costing of IT & ITES	12.30
8.1	Concept of Project.....	12.32
8.2	Effort Involved	12.32
8.3	Parameters in Computation of Total Cost.....	12.34
9.	Costing of Toll Roads.....	12.36
9.1	Cost Involved	12.37
9.1.1	Capital Costs	12.37
9.1.2	Operating and Maintenance Costs.....	12.37
9.2	Build-Operate-Transfer (BOT) Approach.....	12.38
9.3	Toll Rate.....	12.38
10.	Costing of Educational Institutions	12.41
10.1	Income of the Educational Institutions.....	12.41
10.2	Expenditure of the Educational Institutions.....	12.41
11.	Costing in Insurance Companies.....	12.47
11.1	Income of Insurance Companies.....	12.48
11.2	Expenditure of Insurance Companies.....	12.48
11.3	Method of Costing in an Insurance Company.....	12.48
12.	Costing in Financial Institutions.....	12.51

12.1	Cost Measurement in Financial Institutions.....	12.51
12.2	Activity Based Costing in Financial Institutions	12.52
13.	Other Services-Costing for Power Houses	12.53
	Summary	12.57
	Test Your Knowledge.....	12.57
	Multiple Choice Questions (MCQs).....	12.57
	Theoretical Questions	12.59
	Practical Problems	12.59
	Case Scenarios.....	12.63
	Answers to the MCQs	12.65
	Answers to the Theoretical Questions	12.65
	Answers to the Practical Problems	12.66
	Answers to the Case Scenarios	12.71

CHAPTER 13 – STANDARD COSTING 13.1-13.87

	Learning Outcomes	13.1
	Chapter Overview	13.1
1.	Introduction.....	13.2
1.1	What is a Standard or Standard Cost?	13.2
1.2	Why Standard Costing is Needed?	13.2
2.	Types of Standards	13.3
3.	The Process of Standard Costing	13.5
4.	Setting-up of Standard Cost.....	13.5
4.1	Physical Standards.....	13.6
4.1.1	Problems faced while setting physical standards.....	13.8
4.2	Price or Rate Standards	13.9
5.	Types of Variances.....	13.11

6.	Classification of Variances	13.12
7.	Computation of Variances	13.13
7.1	Material Cost Variance	13.14
7.2	Labour Cost Variance.....	13.24
7.3	Variable Overhead Cost Variance	13.36
7.4	Fixed Overhead Cost Variance	13.38
8.	Advantages and Criticism of Standard Costing.....	13.49
8.1	Advantages of Standard Costing	13.49
8.2	Criticism of Standard Costing.....	13.51
	Summary	13.52
	Test Your Knowledge.....	13.54
	Multiple Choice Questions (MCQs).....	13.54
	Theoretical Questions	13.57
	Practical Problems	13.57
	Case Scenarios.....	13.65
	Answers to the MCQs	13.67
	Answers to the Theoretical Questions	13.67
	Answers to the Practical Problems	13.67
	Answers to the Case Scenarios	13.85

CHAPTER 14 – MARGINAL COSTING 14.1-14.80

	Learning Outcomes	14.1
	Chapter Overview	14.2
1.	Introduction.....	14.2
2.	Characteristics of Marginal Costing	14.5
3.	Facts about Marginal Costing	14.6
4.	Determination of Cost and Profit under Marginal Costing.....	14.7

5.	Absorption Costing	14.9
6.	Advantages and Limitations of Marginal Costing	14.9
7.	Cost-Volume-Profit (CVP) Analysis.....	14.11
7.1	Marginal Cost Equation	14.13
7.2	Profit Volume Ratio or P/V ratio.....	14.13
7.3	Break-Even Analysis	14.14
8.	Methods of Break-Even Analysis.....	14.14
8.1	Break-even Point.....	14.14
8.2	Cash Break-even Point.....	14.15
8.3	Multi-Product Break-even Analysis.....	14.16
8.4	Break-even Chart.....	14.20
8.5	Contribution Breakeven Chart.....	14.20
8.6	Profit-Volume Chart.....	14.21
9.	Limitations of Break-Even Analysis.....	14.25
10.	Margin of Safety	14.26
11.	Variations of Basic Marginal Cost Equation and Other Formulae	14.28
12.	Angle of Incidence.....	14.31
13.	Application of CVP Analysis in Decision Making	14.32
13.1	Framework for Decision Making	14.32
13.2	Principles for Identification of Cost and Benefits for Measurement.....	14.33
13.3	Principles of Estimation of Costs and Benefits.....	14.35
13.4	Short-term Decision Making using concepts of CVP Analysis.....	14.36
14.	Distinction between Marginal and Absorption Costing	14.43
14.1	Main Points of distinction between Marginal and Absorption Costing	14.43

14.2 Difference in Profit under Marginal and Absorption Costing	14.44
Summary	14.49
Test Your Knowledge.....	14.50
Multiple Choice Questions(MCQs)	14.50
Theoretical Questions	14.52
Practical Problems	14.52
Case Senarios	14.59
Answers to the MCQs.....	14.61
Answers to the Theoretical Questions	14.61
Answers to the Practical Problems	14.61
Answers to the Case Senarios	14.79

CHAPTER 15-BUDGETS AND BUDGETARY CONTROL 15.1-15.98

Learning Outcomes	15.1
Chapter Overview	15.2
1. Introduction	15.2
2. Essentials Characteristics of Budget	15.3
3. Essentials Steps for Preparing Budget	15.4
4. Objectives of Budgeting.....	15.5
5. Budgetary Control.....	15.7
5.1 Budgetary Control Involves	15.7
5.2 Objectives of Budgetary Control System	15.7
5.3 Steps for establishing Budgetary Conrol	15.8
5.4 Feedback and Feedforward Control	15.9
5.5 Budget Committee and Budget Officer.....	15.10
5.6 Advantages of Budgetary Control System.....	15.12
5.7 Limitations of Budgetary Control System	15.13

5.8	Components of Budgetary Control System	15.14
6.	Budgets and Motivation.....	15.14
7.	Preparation of Budgets.....	15.16
8	Different Types of Budgets.....	15.19
8.1	Classification on the basis of Capacity or Flexibility.....	15.19
8.2	Classification on the basis of Function	15.29
8.3	Master Budget.....	15.55
8.4	Classification on the basis of Time Period.....	15.58
9	Zero Based Budgeting (ZBB)	15.59
9.1	Stages in Zero-based Budgeting.....	15.60
9.2	Advantages of Zero-based budgeting	15.60
9.3	Difference between Traditional and Zero- based Budgeting.....	15.61
9.4	Limitations of Zero- based Budgeting.....	15.62
10	Performance Budgeting (PB).....	15.62
10.1	Traditional Budgeting vs. Performance Budgeting	15.63
10.2	Steps in Performance Budgeting.....	15.63
11	Budget Ratio.....	15.67
	Summary	15.70
	Test Your Knowledge.....	15.71
	Multiple Choice Questions (MCQs).....	15.71
	Theoretical Questions.....	15.74
	Practical Problems	15.74
	Case Scenarios.....	15.81
	Answers to the MCQs	15.83
	Answers to the Theoretical Questions	15.84
	Answers to the Practical Problems.....	15.84
	Answers to the Case Scenarios.....	15.96

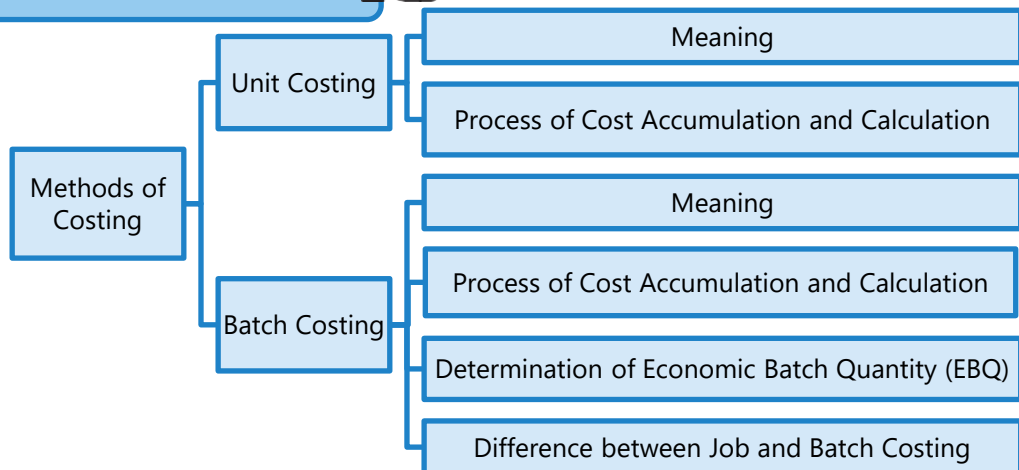
UNIT & BATCH COSTING



LEARNING OUTCOMES

- ◆ Describe Unit Costing method.
- ◆ Prepare and calculate the cost under Unit Costing.
- ◆ Describe Batch Costing methods.
- ◆ Explain the accounting entries for cost elements under the method.
- ◆ Determine the cost for a batch
- ◆ Differentiate between Job Costing and Batch Costing.

CHAPTER OVERVIEW



 1. INTRODUCTION

So far, we have discussed in earlier chapters, the element wise cost collection, calculation and its accounting under integral and non- integral accounting systems. Now we will discuss how the cost accounting information can be presented and used according to the needs of the management. To fulfil the need of the users of the cost accounting information, different methods of costing are followed. Costing methods enable the users to have customized information of any cost object according to the need and suitability. Different methods of costing have been developed according to the needs and nature of industries. For the sake of simplicity, industries can be grouped into two basic types i.e. Industries doing job work and industries engaged in mass production of a single product or identical products.

1.1 For industry doing job work

An entity which is engaged in the execution of special orders, each order being distinguishable from each other, such a concern is thought of involved in performing job works. Jobs are worked strictly in accordance with the customer's specifications and requirements, thus, each job order is unique. Examples of job order types of production are: ship building, construction of road and bridges, manufacturing of heavy electrical machineries and tools, wood and furniture works etc. Here, each job or unit of production is treated as a separate identity for the purpose of costing. The methods of costing for ascertaining cost of each job are known as a job costing, contract costing and batch costing.

1.2 For continuous or process type of industries

The continuous or process type of industries are characterised by the continuous production of uniform products according to the standard specifications. In such a case the successive lots are generally indistinguishable as to size and form and, even if there is some variation in specifications, it is of a minor character. Examples of continuous type of industries are chemical and pharmaceutical products, paper/food products, canning, paints and varnish oil, rubber, textile etc. Here the methods of costing used for the purpose of ascertaining costs are: process costing; single output costing; operating costing etc.

In this chapter two methods of costing are being discussed and distinguished from each type. Other methods will also be discussed in subsequent chapters.

2. UNIT COSTING

Unit costing is that method of costing where the output produced is identical and each unit of output requires identical cost. Unit costing is synonymously known as single or output costing, but these are sub-division of unit costing method. This method of costing is followed by industries which produce single output or few variants of a single output. Under this method costs, are collected and analysed element wise and then total cost per unit is ascertained by dividing the total cost with the number of units produced. If we have to state it in the form of a formula, then

$$\text{Cost per unit} = \frac{\text{Total Cost of Production}}{\text{No. of units produced}}$$

This method of costing, therefore finds its application in industries like paper, cement, steel works, mining, breweries etc. These types of industries produce identical products and therefore have identical costs.

3. COST COLLECTION PROCEDURE IN UNIT COSTING

The cost for production of output is collected element wise and posted in the cost accounting system for cost ascertainment. The element-wise collection is done as below:

Collection of Materials Cost

Cost of materials issued for production are collected from Material Requisition notes and accumulated for a certain period or volume of activity. The cost of material so accumulated is posted in cost accounting system. Through the cost accounting system, cost sheet for the period or activity is prepared to know cost for the period element-wise and functions-wise.

Collection of Employees (Labour) Cost

All **direct employee (labour) cost is collected from job time cards or sheets** and accumulated for a certain period or volume of activity. The time booked or recorded in the job time and idle time cards is valued at appropriate rates and entered in the cost accounting system. Other items of indirect employee (labour) costs are collected from the payrolls books for the purpose of posting against standing order or expenses code numbers in the overhead expenses ledger.

Collection of Overheads

Overheads are collected under suitable standing orders numbers, and selling and distribution overheads against cost accounts numbers. Total overhead expenses so collected are apportioned to service and production departments on some suitable basis. The expenses of service departments are finally transferred to production departments. The total overhead of production departments is then applied to products on some realistic basis, *e.g.* machine hour; labour hour; percentage of direct wages; percentage of direct materials; etc.

3.1 Treatment of spoiled and defective work

Circumstances	Treatment
(1) Loss due to normal reasons	When a normal rate of defectives has already been established and actual number of defectives is within the normal limit, the cost of rectification or loss will be charged to the entire output . If, on the other hand, the number of defective units substantially exceeds the normal limits, the cost of rectification or loss beyond normal limits are written off in Costing Profit and Loss Account.
(2) Loss due to abnormal reasons	In this case cost of rectification and loss is treated as abnormal cost and the cost of rectification or loss is written off as loss in Costing Profit and Loss Account .

ILLUSTRATION 1

The following data relate to the manufacture of a standard product during the 4-week ended 28th February:

<i>Raw Materials Consumed</i>	<i>₹ 4,00,000</i>
<i>Direct Wages</i>	<i>₹ 2,40,000</i>
<i>Machine Hours Worked</i>	<i>3,200 hours</i>
<i>Machine Hour Rate</i>	<i>₹ 40</i>
<i>Office Overheads</i>	<i>10% of works cost</i>
<i>Selling Overheads</i>	<i>₹ 20 per unit</i>
<i>Units produced and sold</i>	<i>10,000 at ₹ 120 each</i>

You are required to **FIND OUT** the cost per unit and profit for the 4-week ended 28th February.

SOLUTION**Statement of Cost per Unit****No. of units produced: 10,000 units**

Particulars	Cost per unit (₹)	Amount (₹)
Raw Materials Consumed	40.00	4,00,000
Direct Wages	24.00	2,40,000
Prime cost	64.00	6,40,000
Add: Manufacturing Overheads (3,200 hours × ₹ 40)	12.80	1,28,000
Works cost	76.80	7,68,000
Add: Office Overheads (10% of Works Cost)	7.68	76,800
Cost of goods sold	84.48	8,44,800
Add: Selling Overheads (10,000 units × ₹ 20)	20.00	2,00,000
Cost of sales / Total cost	104.48	10,44,800
Add: Profit (Bal Figure)	15.52	1,55,200
Sales	120.00	12,00,000

ILLUSTRATION 2

Atharva Pharmacare Limited produced a uniform type of product and has a manufacturing capacity of 3,000 units per week of 48 hours. From the records of the company, the following data are available relating to output and cost of 3 consecutive weeks

Week Number	Units Manufactured	Direct Material (₹)	Direct Wages (₹)	Factory Overheads (₹)
1	1,200	9,000	3,600	31,000
2	1,600	12,000	4,800	33,000
3	1,800	13,500	5,400	34,000

Assuming that the company charges a profit of 20% on selling price, FIND OUT the selling price per unit when the weekly output is 2,000 units

SOLUTION**Statement of Cost and Selling price for 2,000 units of output**

Particulars	Cost per unit (₹)	Total Cost (₹)
Direct Materials	7.50	15,000
Direct Labour	3.00	6,000
Prime cost	10.50	21,000
Add: Factory Overheads (Refer working note-2)	17.50	35,000
Total cost	28.00	56,000
Add: Profit (20% of Sales is equivalent to 25% of Cost)	7.00	14,000
Sales	35.00	70,000

Working Notes:

- (1) Direct Material and Direct Labour cost is varying directly in proportion to units produced and shall remain same per unit of output. Thus, direct material cost is equal to ₹ 9000 ÷ 1200 units = ₹ 7.50 per unit and labour cost is equal to ₹ 3600 ÷ 1200 units = ₹ 3 per unit.

(2) Calculation of Factory Overheads- An observation of cost related to different output levels for factory overheads shall reveal 2 things

- a. Total cost increases from ₹31,000 to ₹34,000 along with increase in output from 1,200 units to 1,800 units but cost per unit is not constant. Thus it is not a variable cost. Cost per unit is reducing along with increase in output from ₹ 25.83 ($\text{₹ } 31,000 \div 1,200 \text{ units}$) to ₹ 18.89 ($\text{₹ } 34,000 \div 1,800 \text{ units}$)
- b. Since the cost is varying with the output, it is also not a fixed cost.

Hence, we can see that the cost is a semi- variable cost and has to be calculated for 2,000 units by analysing its fixed and variable components

Week Number	Units Manufactured	Factory Overheads
1	1,200	31,000
2	1,600	33,000
Difference	400	2,000

Therefore, Variable Cost per unit = Change in Factory Overheads $\div$ Change in output

$$= \text{₹ } 2,000 \div 400 = \text{₹ } 5$$

Now total factory overheads for week 2 = ₹33,000

Out of this, Variable Overheads = 1,600 units $\times$ ₹5 = ₹ 8,000

Thus, fixed component = ₹ 33,000 – ₹ 8,000 = ₹ 25,000

Therefore, Variable Cost for 2,000 units = 2,000 units $\times$ ₹5 = ₹ 10,000

Fixed Cost will not change and hence will be = ₹25,000

Therefore, Total Factory Cost = Variable Overheads + Fixed Overheads

Overheads for 2,000 units = ₹10,000 + ₹25,000 = ₹ 35,000

4. BATCH COSTING

Batch Costing is a type of specific order costing where articles are manufactured in predetermined lots, known as batch. Under this costing method, the cost object for cost determination is a batch for production rather output as seen in unit costing method.

A batch consists of certain number of units which are processed simultaneously to be for manufacturing operation. Under this method of manufacturing, the inputs are accumulated in the assembly line till it reaches minimum batch size. Soon after a batch size is reached, all inputs in a batch is processed for further operations. Reasons for batch manufacturing may be either technical or economical or both. For example, in pen manufacturing industry, it would be too costly to manufacture one pen of a particular design at a time to meet the demand of one customer. On the other hand, the production, of say 10,000 pens, of the same design will reduce the cost to a sizeable extent.

To initiate production process, an entity has to incur expenditures on engaging workers for production and supervision, setting-up of machine to run for production etc. These are the minimum level of expenditures which have to be incurred each time a batch is run irrespective of number of units produced.

5. Costing Procedure in Batch Costing

To facilitate convenient cost determination, one number is allotted for each batch. Material cost for the batch is arrived at on the basis of material requisitions for the batch and labour cost is arrived at by multiplying the time spent on the batch by direct workers as ascertained from time cards or job tickets. Overheads are absorbed on some suitable basis like machine hours, direct labour hours etc.

ILLUSTRATION 3

Arnav Confectioners (AC) owns a bakery which is used to make bakery items like pastries, cakes and muffins. AC use to bake at most 50 units of any item at a time. A customer has given an order for 600 muffins. To process a batch of 50 muffins, the following cost would be incurred:

Direct materials- ₹ 500

Direct wages- ₹ 50

Oven set- up cost ₹ 150

AC absorbs production overheads at a rate of 20% of direct wages cost. 10% is added to the total production cost of each batch to allow for selling, distribution and administration overheads.

AC requires a profit margin of 25% of sales value.

DETERMINE the selling price for 600 muffins.

SOLUTION

Statement of cost per batch and per order

No. of batch = 600 units ÷ 50 units = 12 batches

Particulars	Cost per batch (₹)	Total Cost (₹)
Direct Material Cost	500.00	6,000
Direct Wages	50.00	600
Oven set-up cost	150.00	1,800
Add: Production Overheads (20% of Direct wages)	10.00	120
Total Production cost	710.00	8,520
Add: S&D and Administration overheads (10% of Total production cost)	71.00	852
Total Cost	781.00	9,372
Add: Profit (1/3 rd of total cost)	260.33	3,124
Selling price	1,041.33	12,496
Selling Price per unit = $1041.33 \div 50 = ₹ 20.83$		

ILLUSTRATION 4

A jobbing factory has undertaken to supply 200 pieces of a component per month for the ensuing six months. Every month a batch order is opened against which materials and labour hours are booked at actual. Overheads are levied at a rate equal to per labour hour. The selling price contracted for is ₹ 8 per piece. From the following data CALCULATE the cost and profit per piece of each batch order and overall position of the order for 1,200 pieces.

Month	Batch Output	Material cost	Direct wages	Direct labour
		(₹)	(₹)	hours
January	210	650	120	240
February	200	640	140	280
March	220	680	150	280
April	180	630	140	270
May	200	700	150	300
June	220	720	160	320

The other details are:

Month	Overheads	Direct labour
	(₹)	hours
January	12,000	4,800
February	10,560	4,400
March	12,000	5,000
April	10,580	4,600
May	13,000	5,000
June	12,000	4,800

SOLUTION

Particulars	Jan.	Feb.	March	April	May	June	Total
Batch output (in units)	210	200	220	180	200	220	1,230
Sale value (₹)	1,680	1,600	1,760	1,440	1,600	1,760	9,840
Material cost (₹)	650	640	680	630	700	720	4,020
Direct wages (₹)	120	140	150	140	150	160	860
Overheads* (₹)	600	672	672	621	780	800	4,145
Total cost (₹)	1,370	1,452	1,502	1,391	1,630	1,680	9,025
Profit per batch (₹)	310	148	258	49	(30)	80	815
Total cost per unit (₹)	6.52	7.26	6.83	7.73	8.15	7.64	7.34
Profit per unit (₹)	1.48	0.74	1.17	0.27	(0.15)	0.36	0.66

Overall position of the order for 1,200 units

Sales value of 1,200 units @ ₹ 8 per unit	₹ 9,600
Total cost of 1,200 units @ ₹ 7.34 per unit	<u>₹ 8,808</u>
Profit	<u>₹ 792</u>

$$* \frac{\text{Overheads}}{\text{Direct labour hour for the month}} \times \text{Direct labour hours for batch}$$

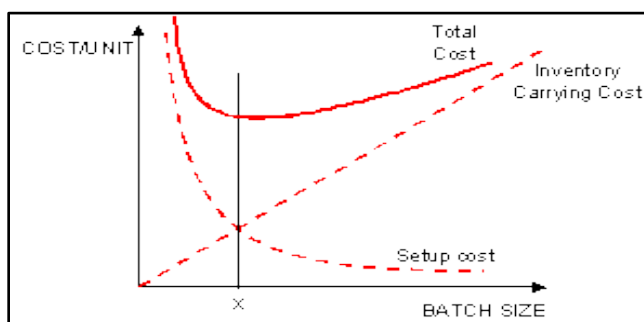
6. ECONOMIC BATCH QUANTITY (EBQ)

As the product is produced in batches or lots, the lot size chosen will be critical in achieving least cost of operation. Primarily, the total production cost under batch production comprises of two main costs, namely,

1. Machine Set Up Costs and
2. Inventory holding costs.

If the size is higher, the set up cost may decline due to lesser number of set ups required; but units in inventory will go up leading to higher holding costs. If the lot size is lower, lower inventory holding costs are accomplished but only with higher set up costs. **Economic batch quantity is the size of a batch where total cost of set-up and holding costs are at minimum.**

This relationship is explained with the help of following diagram



As can be seen in the above diagram, costs are shown on the Y axis and Batch size or batch quantity is shown on the X axis. With the higher batch size, holding cost shows a tendency to increase whereas set-up costs show a declining trend. The point where both the cost lines intersect each other represents the lowest cost combination.

The economic batch size or Economic Batch Quantity may be determined by calculating the total cost for a series of possible batch sizes and checking which batch size gives the minimum cost. Alternatively, a formula can be derived which is similar to determination of Economic Order Quantity (EOQ). The objective here being to determine the production lot (Batch size) that optimizes on both set up and inventory holding costs formula. The mathematical formula usually used for its determination is as follows:

$$EBQ = \sqrt{\frac{2DS}{C}}$$

Where, D = Annual demand for the product

S = Setting up cost per batch

C = Carrying cost per unit of production

ILLUSTRATION 5

Monthly demand for a product	500 units
Setting-up cost per batch	₹ 60
Cost of manufacturing per unit	₹ 20
Rate of interest	10% p.a.

DETERMINE economic batch quantity.

SOLUTION

$$EBQ = \sqrt{\frac{2DS}{C}} = \sqrt{\frac{2 \times 500 \times 12 \times 60}{0.1 \times 20}} = 600 \text{ units.}$$

ILLUSTRATION 6

M/s. KBC Bearings Ltd. is committed to supply 48,000 bearings per annum to M/s. KMR Fans on a steady daily basis. It is estimated that it costs ₹1 as inventory holding cost per bearing per month and that the set up cost per run of bearing manufacture is ₹3,200

- (i) DETERMINE the optimum run size of bearing manufacture.
- (ii) STATE what would be the interval between two consecutive optimum runs.
- (iii) FIND OUT the minimum inventory holding cost.

SOLUTION

- (i) Optimum batch size or Economic Batch Quantity (EBQ):

$$\text{EBQ} = \sqrt{\frac{2DS}{C}} = \sqrt{\frac{2 \times 48,000 \times 3,200}{12}} = 5,060 \text{ units.}$$

- (ii) Number of Optimum runs = $48,000 \div 5,060 = 9.49$ or 10 run

Interval between 2 runs (in days) = $365 \text{ days} \div 10 = 36.5 \text{ days}$

- (iii) Minimum Inventory Cost = Average Inventory $\times$ Inventory Carrying Cost per unit per annum

Average Inventory = $5,060 \text{ units} \div 2 = 2,530 \text{ units}$

Carrying Cost per unit per annum = $\text{₹}1 \times 12 \text{ months} = \text{₹}12$

Minimum Inventory Holding Costs = $2,530 \text{ units} \times \text{₹}12 = \text{₹}30,360$

ILLUSTRATION 7

A Company has an annual demand from a single customer for 50,000 litres of a paint product. The total demand can be made up of a range of colour to be produced in a continuous production run after which a set-up of the machinery will be required to accommodate the colour change. The total output of each colour will be stored and then delivered to the customer as single load immediately before production of the next colour commences.

The Set up costs are ₹ 100 per set up. The Service is supplied by an outside company as required.

The Holding costs are incurred on rented storage space which costs ₹ 50 per sq. meter per annum. Each square meter can hold 250 Litres suitably stacked.

You are required to:

- (i) *CALCULATE the total cost per year where batches may range from 4,000 to 10,000 litres in multiples of 1,000 litres and hence choose the production batch size which will minimize the cost.*
- (ii) *Use the economic batch size formula to CALCULATE the batch size which will minimise total cost.*

SOLUTION

(i)

Production Batch Size (Lt.)	Set-up costs per annum (₹)	Holding Costs per annum (₹)	Total Costs per annum (₹)
4,000	1,250	400	1,650
5,000	1,000	500	1,500
6,000	833	600	1,433
7,000	714	700	1,414
8,000	625	800	1,425
9,000	556	900	1,456
10,000	500	1000	1,500

As the total cost is minimum at 7,000 ltr. i.e. ₹ 1,414, thus economic production lot would be 7,000 Litres

(ii) Economic Batch Quantity (EBQ):

$$EBQ = \sqrt{\frac{2DS}{C}}$$

Where, D = Annual demand for the product = 50,000 Litres

S = Setting up cost per batch = ₹100 per set-up

C = Carrying cost per unit of production

= ₹ 50 / 250 litres = 0.20 per litre per annum

$$= \sqrt{\frac{2 \times 50,000 \times 100}{0.2 \times 1}} = 7,071 \text{ Litres}$$

Working Note:

1. For Production batch size of 7,000 litres

Number of set ups per year = 50,000 ÷ 7,000 = 7.14 or 8 set-ups

Hence, annual set up cost per year = 8 × ₹100 = ₹800

Average Quantity = 7,000 ÷ 2 = 3,500 litres

Holding Costs = 3,500 ltr. ÷ 250 × 50 = ₹ 700

2. It can be seen that EBQ determined with mathematical formula (7,071 litres) slightly varies from the one determined by trial and error method (7,000 Litres)



7. DIFFERENCE BETWEEN JOB AND BATCH COSTING

Sr. No	Job Costing	Batch Costing
1	Method of costing used for non- standard and non-repetitive products produced as per customer specifications and against specific orders.	Homogeneous products produced in a continuous production flow in lots.
2	Cost determined for each Job	Cost determined in aggregate for the entire Batch and then arrived at on per unit basis.
3	Jobs are different from each other and independent of each other. Each Job is unique.	Products produced in a batch are homogeneous and lack of individuality

SUMMARY

- ♦ **Unit Costing:** Unit costing is that method of costing where the output produced by an entity is identical and each unit of output require identical cost.
- ♦ **Job Costing:** Job costing is the method of costing required to be done for unique products manufacturing done against specific orders.
- ♦ **Batch Costing:** Batch Costing is a type of specific order costing where articles are manufactured in predetermined lots, known as batch. Under this costing method, the cost object for cost determination is a batch for production rather output as seen in unit costing.
- ♦ **Economic Batch Quantity (EBQ):** Economic batch quantity is the size of a batch where total cost of set-up and holding costs are at minimum.

$$EBQ = \sqrt{\frac{2DS}{C}}$$

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQ)

1. *Different businesses in order to determine cost of their product or service offering follow:*
 - (a) *Different methods of Costing*
 - (b) *Uniform Costing*
 - (c) *Different techniques of costing*
 - (d) *None of the above*
2. *In order to determine cost of the product or service, following are used:*
 - (a) *Techniques of costing like Marginal, Standard etc.*
 - (b) *Methods of Costing*
 - (c) *Comparatives*
 - (d) *All of the above*
3. *Unit Costing is applicable where:*
 - (a) *Product produced are unique and no 2 products are same*
 - (b) *Dissimilar articles are produced as per customer specification*
 - (c) *homogeneous articles are produced on large scale*
 - (d) *Products made require different raw materials*
4. *In case product produced or jobs undertaken are of diverse nature, the system of costing to be used should be:*
 - (a) *Process costing*
 - (b) *Operating costing*
 - (c) *Job costing*
 - (d) *None of the above*

5. *Job Costing is:*
- (a) *Applicable to all industries regardless of the products or services provided*
 - (b) *Technique of costing*
 - (c) *Suitable where similar products are produced on mass scale*
 - (d) *Method of costing used for non- standard and non- repetitive products.*
6. *The production planning department prepares a list of materials and stores required for the completion of a specific job order, this list is known as:*
- (a) *Bin card*
 - (b) *Bill of material*
 - (c) *Material requisition slip*
 - (d) *None of the above*
7. *Batch costing is a type of:*
- (a) *Process costing*
 - (b) *Job Costing*
 - (c) *Differential costing*
 - (d) *Direct costing*
8. *Batch costing is similar to that under job costing except with the difference that a:*
- (a) *Job becomes a cost unit.*
 - (b) *Batch becomes the cost unit instead of a job*
 - (c) *Process becomes a cost unit*
 - (d) *None of the above*
9. *The main points of distinction between job and contract costing includes:*
- (a) *Length of time to complete.*
 - (b) *Big jobs*

- (c) Activities to be done outside the factory area
 - (d) All of the above
10. Economic batch quantity is that size of the batch of production where:
- (a) Average cost is minimum
 - (b) Set-up cost of machine is minimum
 - (c) Carrying cost is minimum
 - (d) Both (b) and (c)

Theoretical Questions

1. DESCRIBE Unit Costing and Batch Costing giving example of industries where these are used.
2. DISTINGUISH between Job Costing & Batch Costing.
3. In Batch Costing, STATE how is Economic Batch Quantity determined.
4. Z Ltd. produces product ZZ in batches, management of the Z Ltd. wants to know the number of batches of product ZZ to be produced where the cost incurred on batch setup and carrying cost of production is at optimum level. How will they DETERMINE the optimum batch number?

Practical Problems

1. Wonder Ltd. has a capacity of 120,000 units per annum as its optimum capacity. The production costs are as under:

Direct Material – ₹ 90 per unit

Direct Labour- ₹ 60 per unit

Overheads:

Fixed: ₹ 30,00,000 per annum

Variable: ₹ 100 per unit

Semi Variable: ₹ 20,00,000 per annum up to 50% capacity and an extra amount of ₹ 4,00,000 for every 25% increase in capacity or part thereof

The production is made to order and not for stocks.

If the production programme of the factory is as indicated below and the management desires a profit of ₹20,00,000 for the year DETERMINE the average selling price at which each unit should be quoted.

First 3 months: 50% capacity

Remaining 9 months: 80% capacity

Ignore Administration, Selling and Distribution overheads.

2. Rio Limited undertakes to supply 1000 units of a component per month for the months of January, February and March. Every month a batch order is opened against which materials and labour cost are booked at actual. Overheads are levied at a rate per labour hour. The selling price is contracted at ₹ 15 per unit.

From the following data, CALCULATE the profit per unit of each batch order and the overall position of the order for the 3,000 units.

Month	Batch Output (Numbers)	Material Cost (₹)	Labour Cost (₹)
January	1,250	6,250	2,500
February	1,500	9,000	3,000
March	1,000	5,000	2,000

Labour is paid at the rate of ₹ 2 per hour. The other details are:

Month	Overheads (₹)	Total Labour Hours
January	12,000	4,000
February	9,000	4,500
March	15,000	5,000

3. X Ltd. is committed to supply 24,000 bearings per annum to Y Ltd. on steady basis. It is estimated that it costs 10 paise as inventory holding cost per bearing per month and that the set-up cost per run of bearing manufacture is ₹ 324.
 - (a) COMPUTE what would be the optimum run size for bearing manufacture?
 - (b) Assuming that the company has a policy of manufacturing 6,000 bearings per run, CALCULATE how much extra costs the company would be incurring as compared to the optimum run suggested in (a) above?
 - (c) CALCULATE the holding cost at optimum inventory level?

4. A customer has been ordering 90,000 special design metal columns at the rate of 18,000 columns per order during the past years. The production cost per unit comprises ₹ 2,120 for material, ₹ 60 for labour and ₹ 20 for fixed overheads. It costs ₹ 1,500 to set up for one run of 18,000 column and inventory carrying cost is 5%.
- (i) FIND the most economic production run.
 - (ii) CALCULATE the extra cost that company incur due to processing of 18,000 columns in a batch.
5. XYZ Ltd. has obtained an order to supply 48000 bearings per year from a concern. On a steady basis, it is estimated that it costs ₹ 0.20 as inventory holding cost per bearing per month and the set-up cost per run of bearing manufacture is ₹ 384.

You are required to:

- (i) compute the optimum run size and number of runs for bearing manufacture.
- (ii) compute the interval between two consecutive runs.
- (iii) find out the extra costs to be incurred, if company adopts a policy to manufacture 8000 bearings per run as compared to optimum run Size.
- (iv) give your opinion regarding run size of bearing manufacture.

Assume 365 days in a year.

Case Scenarios

1. Arnav Ltd. operates in beverages industry where it manufactures soft-drink in three sizes of Large (3 litres), Medium (1.5 litres) and Small (600 ml) bottles. The products are processed in batches. The 5,000 litres capacity processing plant consumes electricity of 90 Kilowatts per hour and a batch takes 1 hour 45 minutes to complete. Only symmetric size of products can be processed at a time. The machine set-up takes 15 minutes to get ready for next batch processing. During the set-up power consumption is only 20%.
- (i) The current price of Large, Medium and Small are ₹150, ₹90 and ₹50 respectively.

- (ii) To produce a litre of beverage, 14 litres of raw material-W and 25 ml of Material-C are required which costs ₹0.50 and ₹1,000 per litre respectively.
- (iii) 20 direct workers are required. The workers are paid ₹880 for 8 hours shift of work.
- (iv) The average packing cost per bottle is ₹3
- (v) Power cost is ₹7 per Kilowatt -hour (Kwh)
- (vi) Other variable cost is ₹30,000 per batch.
- (vii) Fixed cost (Administration and marketing) is ₹4,90,00,000.
- (viii) The holding cost is ₹1 per bottle per annum.

The marketing team has surveyed the following demand (bottle) of the product:

Large	Medium	Small
3,00,000	7,50,000	20,00,000

The following information has been sought from you for the purpose of performance review meeting:

- (i) Number of large size bottles that can be processed in a batch?
 - (a) 5,000 bottles
 - (b) 1,666 bottles
 - (c) 3,333 bottles
 - (d) 8,333 bottles
- (ii) Total number of batches to be run to process medium size bottles
 - (a) 180
 - (b) 225
 - (c) 240
 - (d) 645
- (iii) Material -W required for small size bottles
 - (a) 1,26,00,000 ltrs
 - (b) 1,68,00,000 ltrs
 - (c) 1,57,50,000 ltrs

- (d) 1,51,50,000 ltrs
- (iv) Calculate total profit/ loss per batch.
- (a) ₹ 3,46,28,460
- (b) ₹ 2,56,28,360
- (c) ₹ 2,82,17,370
- (d) ₹ 1,88,56,360
- (v) Compute Economic Batch Quantity (EBQ) for small size bottles.
- (a) 1,34,234 ltrs
- (b) 2,12,243 ltrs
- (c) 1,57,882 ltrs
- (d) 3,46,592 ltrs

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(a)	2.	(b)	3.	(c)	4.	(c)	5.	(d)	6.	(b)
7.	(b)	8.	(b)	9.	(d)	10.	(d)				

Answers to the Theoretical Questions

1. Please refer paragraph 2 & 4
2. Please refer paragraph 7
3. Please refer paragraph 6
4. Please refer paragraph 6

Answers to the Practical Problems

1. Statement of Cost and Total Sales

Amount (₹)

Particulars	First 3 months	Next 9 months	Total
Capacity Utilisation (No of units)	120,000x3/12x50% = 15,000	120,000x9/12x80% = 72,000	87,000
Direct Material	13,50,000	64,80,000	78,30,000
Direct Labour	9,00,000	43,20,000	52,20,000
Add: Overheads:			
- Fixed (1:3)	7,50,000	22,50,000	30,00,000
- Variable	15,00,000	72,00,000	87,00,000
Semi Variable	5,00,000 (For first 3 months at the rate of ₹ 20,00,000)	21,00,000 (at the rate of ₹ 28,00,000 for 9 months)	26,00,000
Total cost	50,00,000	2,23,50,000	2,73,50,000
Add: Profit			20,00,000
Sales			2,93,50,000

Average Selling Price = ₹2,93,50,000 ÷ 87,000 units = ₹ 337.356

2. Statement of Cost and Profit per unit of each batch

	January	February	March	Total
a) Batch Output (Nos.)	1,250	1,500	1,000	3,750
b) Sales Value (@ ₹ 15 per unit)	(₹) 18,750	(₹) 22,500	(₹) 15,000	(₹) 56,250
Cost				
Material	6,250	9,000	5,000	20,250
Wages	2,500	3,000	2,000	7,500
Overheads	3,750	3,000	3,000	9,750
c) Total	12,500	15,000	10,000	37,500
d) Profit per batch (b) – (c)	6,250	7,500	5,000	18,750

e) Cost per unit (c) ÷ (a)	10	10	10	
f) Profit per unit (d) ÷ (a)	5	5	5	

Overall Position of the Order for 3,000 Units

Sales value (3,000 units × ₹ 15)	₹45,000
Less: Total cost (3,000 units × ₹ 10)	<u>30,000</u>
Profit	<u>15,000</u>

Calculation of overhead per hour:

	January	February	March
i. Labour hours:			
= $\frac{\text{Labour cost}}{\text{Labour rates per hour}}$	$\frac{₹2,500}{2} = 1,250$	$\frac{₹3,000}{2} = 1,500$	$\frac{₹2,000}{2} = 1,000$
ii. Overhead per hour:			
= $\frac{\text{Total Overheads}}{\text{Total labour hour}}$	$\frac{₹12,000}{4,000} = ₹ 3$	$\frac{₹9,000}{4,500} = ₹ 2$	$\frac{₹15,000}{5,000} = ₹ 3$
iii. Overhead for batch (i) × (ii)	₹ 3,750	₹ 3,000	₹ 3,000

3. (a) Optimum production run size (Q) = $\sqrt{\frac{2DS}{C}}$

where,

D = No. of units to be produced within one year.

S = Set-up cost per production run

C = Carrying cost per unit per annum.

$$= \sqrt{\frac{2DS}{C}} = \sqrt{\frac{2 \times 24,000 \times ₹324}{0.10 \times 12}} = 3,600 \text{ bearings.}$$

(b) Total Cost (of maintaining the inventories) when production run size (Q) are 3,600 and 6,000 bearings respectively

Total cost = Total set-up cost + Total carrying cost.

	When run size is 3,600 bearings	When run size is 6,000 bearings
Total set up cost	$= \frac{24,000}{3,600} \times ₹ 324 = ₹ 2,160$ Or, $\begin{aligned} \text{No. of setups} &= 6.67 \text{ (7 setups)} \\ &= 7 \times 324 = ₹ 2,268 \end{aligned}$	$= \frac{24,000}{6,000} \times ₹ 324 = ₹ 1,296$
Total Carrying cost	$\frac{1}{2} \times 3,600 \times 0.10P \times 12$ $= ₹ 2,160$	$\frac{1}{2} \times 6,000 \times 0.10P \times 12$ $= ₹ 3,600$
Total Cost	₹ 4,320/ ₹ 4,428	₹ 4,896

₹ 576/ ₹ 468 is the excess cost borne by the firm due to run size not being economic batch quantity.

- (c) Inventory holding cost at EBQ $= \frac{1}{2} Q \times C$
 (when Q = 3,600 bearings) $= \frac{1}{2} \times 3,600 \text{ bearings} \times 0.10P \times 12$
 $= ₹ 2,160$

4. (i) Total Cost of production $= ₹ 2,120 + 60 + 20 = ₹ 2,200$

Calculation of Economic Batch Quantity (EBQ):

$$EBQ = \sqrt{\frac{2 \times 90,000 \times ₹ 1,500}{5\% \text{ of } 2,200}} = \sqrt{\frac{27,00,00,000}{₹ 110}} = 1,567 \text{ columns.}$$

- (ii) Calculation of Extra Cost due to processing of 18,000 columns in a batch

	When run size is 1,567 columns	When run size is 18,000 columns
Total set up cost	$\begin{aligned} \text{No. of setups} &= 90,000/1567 = 57.43 \text{ (58 setups)} \\ &= \frac{90,000}{1,567} \times ₹ 1,500 \\ &= ₹ 87,000 \end{aligned}$	$\begin{aligned} &= \frac{90,000}{18,000} \times ₹ 1,500 \\ &= ₹ 7,500 \end{aligned}$

Total Carrying cost	$\frac{1}{2} \times 1,567 \times ₹ 110$ = ₹ 86,185	$\frac{1}{2} \times 18,000 \times ₹ 110$ = ₹ 9,90,000
Total Cost	₹ 1,73,185	₹ 9,97,500

Thus, extra cost = ₹ 9,97,500 – ₹ 1,73,185 = ₹ 8,24,315

5. (i) Optimum batch size or Economic Batch Quantity (EBQ):

$$EBQ = \sqrt{\frac{2DS}{C}} = \sqrt{\frac{2 \times 48,000 \times 384}{2.4}} = 3919.18 \text{ or } 3,920 \text{ units}$$

Number of Optimum runs = $48,000 \div 3,920 = 12.245$ or 13 run

- (ii) Interval between 2 runs (in days) = $365 \text{ days} \div 13 = 28 \text{ days}$

Or $365 \div 12.24 = 29.82 \text{ days}$

- (iii) Statement showing Total Cost at Production Run size of 3,600 and 8,000 bearings

A.	Annual requirement	48,000	48,000
B.	Run Size	3,920	8,000
C.	No. of runs (A/B)	12.245	6
D.	Set up cost per run	₹ 384	₹ 384
E.	Total set up cost (CxD)	₹. 4,702	₹ 2,304
F.	Average inventory (B/2)	1,960	4,000
G.	Carrying cost per unit p.a.	2.40	2.40
H.	Total Carrying cost (FxG)	4,704	9,600
I.	Total cost (E+H)	9,406	11,904

Extra cost incurred, if run size is of 8,000 = ₹ 11,904 – 9,406 = ₹. 2,498

- (iv) To save cost the company should run at optimum batch size ie 3,920 Units. It saves ₹ 2,498. Run size should match with the Economic production run of bearing manufacture. When managers of a manufacturing operation make decisions about the number of units to produce for each production run, they must consider the costs related to setting up the production process and the costs of holding inventory

Answers to the Case Scenarios

1.

i.	(b)	ii.	(b)	iii.	(b)	iv.	(c)	v.	(d)

- (i) (b) **Working note 1: Maximum number of bottles that can be processed in a batch:**

$$\frac{5,000 \text{ ltrs}}{\text{Bottle volume}}$$

Large		Medium		Small	
Qty (ltr)	Max bottles	Qty (ltr)	Max bottles	Qty (ml)	Max bottles
3	1,666	1.5	3,333	600	8,333

*For simplicity of calculation small fractions has been ignored.

- (ii) (b) **Working note 2: Number of batches to be run:**

		Large	Medium	Small	Total
A	Demand	3,00,000	7,50,000	20,00,000	
B	Bottles per batch (Refer WN-1)	1,666	3,333	8,333	
C	No. of batches [A÷B]	180	225	240	645

*For simplicity of calculation small fractions has been ignored.

- (iii) (b) **Working note 3:**

Quantity of Material-W and Material C required to meet demand:

	Particulars	Large	Medium	Small	Total
A	Demand (bottle)	3,00,000	7,50,000	20,00,000	
B	Qty per bottle (Litre)	3	1.5	0.6	
C	Output (Litre) [A×B]	9,00,000	11,25,000	12,00,000	32,25,000
D	Material-W per litre of output (Litre)	14	14	14	

E	Material-W required (Litre) $[C \times D]$	1,26,00,000	1,57,50,000	1,68,00,000	4,51,50,000
F	Material-C required per litre of output (ml)	25	25	25	
G	Material-C required (Litre) $[(C \times F) \div 1000]$	22,500	28,125	30,000	80,625

(iv) (c) **Workings:**

4. No. of Man-shift required:

		Large	Medium	Small	Total
A	No. of batches	180	225	240	645
B	Hours required per batch (Hours)	2	2	2	
C	Total hours required (Hours) $[A \times B]$	360	450	480	1,290
D	No. of shifts required $[C \div 8]$	45	57	60	162
E	Total manshift [D × 20 workers]	900	1,140	1,200	3,240

5. Power consumption in Kwh

		Large	Medium	Small	Total
For processing					
A	No. of batches	180	225	240	645
B	Hours required per batch (Hours)	1.75	1.75	1.75	1.75
C	Total hours required (Hours) $[A \times B]$	315	393.75	420	1,128.75
D	Power consumption per hour	90	90	90	90
E	Power consumption in Kwh $[C \times D]$	28,350	35,437.5	37,800	1,01,587.5

F	Per batch consumption (Kwh) $[E \div A]$	157.5	157.5	157.5	157.5
For set-up					
G	Hours required per batch (Hours)	0.25	0.25	0.25	0.25
H	Total hours required (Hours) $[A \times G]$	45	56.25	60	161.25
I	Power consumption per hour $[20\% \times 90]$	18	18	18	18
J	Power consumption in Kwh $[H \times I]$	810	1,012.5	1,080	2,902.5
K	Per batch consumption (Kwh) $[J \div A]$	4.5	4.5	4.5	4.5

Calculation of Profit/ loss per batch:

	Particulars	Large	Medium	Small	Total
A	Demand (bottle)	3,00,000	7,50,000	20,00,000	30,50,000
B	Price per bottle (₹)	150	90	50	
C	Sales value (₹) $[A \times B]$	4,50,00,000	6,75,00,000	10,00,00,000	21,25,00,000
	Direct Material cost:				
E	Material-W (₹) [Qty in WN-3 $\times$ ₹0.50]	63,00,000	78,75,000	84,00,000	2,25,75,000
F	Material-C (₹) [Qty in WN-3 $\times$ ₹1,000]	2,25,00,000	2,81,25,000	3,00,00,000	8,06,25,000
G	$[E + F]$	2,88,00,000	3,60,00,000	3,84,00,000	10,32,00,000
H	Direct Wages (₹) [Man-shift in WN-4 $\times$ ₹880]	7,92,000	10,03,200	10,56,000	28,51,200
I	Packing cost (₹) $[A \times ₹3]$	9,00,000	22,50,000	60,00,000	91,50,000
	Power cost (₹)				
J	For processing (₹) [WN-5 $\times$ ₹7]	1,98,450	2,48,062.5	2,64,600	7,11,112.5

K	For set-up time (₹) [WN-5 × ₹7]	5,670	7,087.5	7,560	20,317.5
L	[J+K]	2,04,120	2,55,150	2,72,160	7,31,430
M	Other variable cost (₹) [No. of batch in WN-2 × ₹30,000]	54,00,000	67,50,000	72,00,000	1,93,50,000
N	Total Variable cost per batch [G+H+I+L+M]	3,60,96,120	4,62,58,350	5,29,28,160	13,52,82,630
O	Profit/ loss before fixed cost [C-N]	89,03,880	2,12,41,650	4,70,71,840	7,72,17,370
P	Fixed Cost				4,90,00,000
Q	Total Profit [O-P]				2,82,17,370

(v) (d) **Computation of Economic Batch Quantity (EBQ):**

$$EBQ = \sqrt{\frac{2 \times D \times S}{C}}$$

D = Annual Demand for the Product = Refer A below

S = Set-up cost per batch = Refer D below

C = Carrying cost per unit per annum = Refer E below

	Particulars	Large	Medium	Small
A	Annual Demand (bottle)	3,00,000	7,50,000	20,00,000
Set-up Cost:				
B	Power cost for set-up time (₹) [Consumption per batch in WN-5 × ₹7]	31.50	31.50	31.50
C	Other variable cost (₹)	30,000	30,000	30,000
D	Total Set-up cost [B+C]	30,031.50	30,031.50	30,031.50
E	Holding cost:	1.00	1.00	1.00
F	EBQ (Bottle)	1,34,234	2,12,243	3,46,592

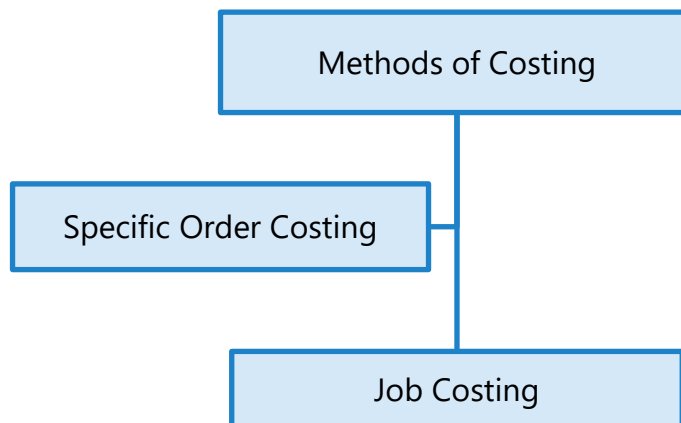
JOB COSTING



LEARNING OUTCOMES

- ◆ Describe Job Costing methods.
- ◆ Explain the accounting entries for cost elements under both the methods.
- ◆ Determining cost for a job.

CHAPTER OVERVIEW





1. JOB COSTING

1.1 Meaning of Job Costing

CIMA London defines Job Costing as **“the category of basic costing methods which is applicable where the work consists of separate contracts, jobs or batches, each of which is authorised by specific order or contract.”** According to this method, costs are collected and accumulated according to jobs, contracts, products or work orders. Each job or unit of production is treated as a separate entity for the purpose of costing. Job Costing is carried out for the purpose of ascertaining cost of each job and takes into account the cost of materials, employees and overhead etc. The job costing method is also applicable to industries in which production is carried out in batches. **Batch production basically is of the same character as the job order production, the difference being mainly one in the size of different orders.**

1.2 Principles of Job Costing

The job costing method may be regarded as the principal method of costing since the basic object and purpose of all costing is to:

- Analysis and ascertainment of cost of each unit of production
- Control and regulate cost
- Determine the profitability

The basic principles enunciated for the job costing method are valid essentially for all types of industry. For example, printing; furniture; hardware; ship-building; heavy machinery; interior decoration, repairs and other similar work.

1.3 Process of Job Costing

- Prepare a separate cost sheet for each job
- Disclose cost of materials issued for the job
- Employee costs incurred (on the basis of bill of material and time cards respectively)
- When job is completed, overhead charges are added for ascertaining total expenditure

1.4 Suitability of Job Costing

- When jobs are executed for different customers according to their specifications.
- when no two orders are alike and each order/job needs special treatment.
- Where the work-in-progress differs from period to period on the basis of the number of jobs in hand.

2. JOB COST CARD/ SHEET

Each job order is asymmetrical to other due to specific and customised requirements. To ascertain cost of a particular job, it is necessary to record all the expenditure related with a job separately. For this purpose, Job Cost card is used. Job cost card is a cost sheet, where the quantity of materials issued, hours spent by different class of employees, amount of other expenses and share of overheads are recorded. This is helpful in knowing the total cost, profitability etc. of a job. The following is an illustrative format of Job Cost card/ sheet.

Format of Job Cost Sheet:

JOB COST SHEET					
Description: _____			Job No.: _____		
Blue Print No.: _____			Quantity: _____		
Material No.: _____			Date of delivery: _____		
Reference No.: _____			Date commenced: _____		
			Date finished: _____		
Date	Reference	Details	Material	Labour	Overhead
		Total			

Summary of costs	Estimated (₹)	Actual (₹)	
Direct material cost			For the job _____
Direct wages			Units produced _____
Production overhead			Cost/unit _____
PRODUCTION COST			Remarks _____
Administration and Selling & Distribution Overheads			Prepared by: _____
			Checked by: _____
TOTAL COST			
PROFIT/LOSS			
SELLING PRICE			

3. COLLECTION OF COSTS FOR A JOB

3.1 Collection of Materials Cost

An essential requirement of job cost accounting is that **direct materials and their cost must be traced to and identified with specific job or work order**. This segregation of materials cost by jobs or work order is brought by the use of separate stores requisitions for each job or work order. Where a bill of material is prepared, it provides the basis for the preparation of these stores requisitions. But when the entire quantity of materials specified in the bill of materials is drawn in one lot or in installments, the bill itself could be made to serve as a substitute for the stores requisition.

After the materials have been issued and the stores requisitions have been priced, it is usual to enter the value of the stores requisition in a material abstract or analysis book. It serves to analyse and collect the cost of all direct materials according to job or work orders and departmental standing orders or expense code numbers. From the abstract book, **the summary of materials cost of each job is posted to individual job cost sheets or cards in the Work-in-Progress ledger**. The postings are usually made weekly or monthly. Similarly, at periodic intervals, from the material abstract books, summary cost of indirect material is posted to

different standing orders or expense code numbers in the Overhead Expenses ledger. If any special material has been purchased for a particular job, it is generally the practice to charge such special material direct to the job concerned without passing it through the Stores Ledger, as soon as it is purchased.

If any surplus material is left over in the case of any job, unless it can be immediately and economically used on some other job, the same is returned to the stores with a proper supporting document/stores Debit Note or Shop Credit, and the relevant job account is credited with the value of excess material returned to the stores. **If the surplus material is utilised on some other job, instead of being returned to the stores first, a material transfer note is prepared.** The transfer note would show the number of the transfer to job as well as transferee job (or jobs) so that, on that basis, the cost thereof can be adjusted in the Work-in-Progress Ledger.

3.2 Collection of Labour Cost

All direct labour cost must be analysed according to individual jobs or work orders. Similarly, different types of indirect labour cost also must be collected and accumulated under appropriate standing order or expenses code number. The analysis of labour according to jobs or work orders is, usually, made by means of job time cards or sheets. **All direct labour is booked against specific jobs in the job time cards or sheets.** All the idle time also is booked against appropriate standing order expense code number either in the job time card for each job or on a separate idle time card for each worker (where the job time card is issued job-wise). The time booked or recorded in the job time and idle time cards is valued at appropriate rates and entered in the labour abstract or analysis book. All direct employee cost is accumulated under relevant job or work order numbers, and **the total or the periodical total of each job or work order is then posted to the appropriate job cost card or sheet in Work-in-Progress ledger.** The postings are usually made at the end of each week or month.

The abstraction of idle time costs under suitable standing order or expenses code numbers is likewise done and the amounts are posted to the relevant departmental standing order or expense code number in the Overhead Expenses Ledger at periodical intervals. As regards other items of indirect labour cost these are collected from the payrolls books for the purpose of posting against standing order or expenses code numbers in the Overhead Expenses ledger.

3.3 Collection of Overheads

Manufacturing overheads are collected under suitable standing order numbers and selling and distribution overheads against cost accounts numbers. Total overhead expenses so collected are apportioned to service and production departments on some suitable basis. The expenses of service departments are finally transferred to production departments. The total overhead of production departments is then applied to products on some realistic basis, *e.g.* machine hour; labour hour; percentage of direct wages; percentage of direct materials; etc. It should be remembered that the use of different methods will lead to a different amount being computed for the works overhead charged to a job hence to different total cost. The problem of accurately absorbing, in each individual job or work order, the overhead cost of different cost centres or departments involved in the manufacture is difficult under the job costing method. It is because the cost or the expenses thereof cannot be traced to or identified with any particular job or work order. In such circumstances, the best that can be done is to apply a suitable overhead rate to each individual article manufactured or to each production order. This is essentially an *arbitrary* method.

3.4 Treatment of spoiled and defective work

Spoiled work is the quantity of production that has been totally rejected and cannot be rectified.

Defective work refers to production that is not as perfect as the saleable product but is capable of being rectified and brought to the required degree of perfection provided some additional expenditure is incurred. Normally, all the manufacturing operations are not fully successful; they result in turning out a certain amount of defective work. Nonetheless, over a period of time it is possible to work out a normal rate of defectives for each manufacturing process which would represent the number of defective articles which a process shall produce in spite of due care. Defects arise in the following circumstances:

Circumstances	Treatment
(1) Where a percentage of defective work is allowed in a particular batch as it cannot be avoided.	When a normal rate of defectives has already been established, if the actual number of defectives is within the normal limit or is near thereto the cost of rectification will be charged to the whole job and spread over the entire output of the batch. If, on the other hand, the number of defective units substantially exceeds the normal, the cost of rectification of the number which exceeds the normal will be written off as a loss in the Costing Profit and Loss Account.
(2) Where defect is due to bad workmanship.	In this case cost of rectification will be abnormal cost, <i>i.e.</i> , not a legitimate element of the cost. Therefore, the cost of rectification shall be written off as a loss , unless by an arrangement, it is to be recovered as a penalty from the workman concerned. It is possible, however that the management did provide for a certain proportion of defectives on account of bad workmanship as an unavoidable feature of production. If that be the case, the cost of rectifying to the extent provided for by the management will be treated as a normal cost and charged to the batch.
(3) Where defect is due to the Inspection Department wrongly accepting incoming material of poor quality.	In this case the cost of rectification will be charged to the department and will not be considered as cost of manufacture of the batch. Being an abnormal cost, it will be written off to the Costing Profit and Loss Account.



4. ACCOUNTING OF COSTS FOR A JOB

4.1 Entries in Control Accounts

1. For purchase of materials-

Stores Ledger Control A/c	Dr.
To Cost Ledger Control A/c*	
2. For the value of direct materials issued to jobs-

Work-in-Process Control A/c	Dr.
To Stores Ledger Control A/c	
3. For return of direct materials from jobs-

Stores Ledger Control A/c	Dr.
To Work-in-Process Control A/c	
4. For return of materials to suppliers –

Cost Ledger Control A/c	Dr.
To Stores Ledger Control A/c	
5. For indirect materials-

Factory Overhead Control A/c	Dr.
To Stores Ledger Control A/c	
6. For wages paid-

Wages Control A/c	Dr.
To Cost Ledger Control A/c	
7. For direct wages incurred on jobs-

Work-in-Process Control A/c	Dr.
To Wages Control A/c	
8. For indirect wages –

Factory Overhead Control A/c	Dr.
To Wages Control A/c	

9. For any indirect expense paid-

Factory Overhead Control A/c	Dr.
To Cost Ledger Control A/c	
10. For charging overhead to jobs-

Work-in-Process Control A/c	Dr.
To Factory Overhead Control A/c	
11. For the total cost of jobs completed-

Cost of Sales A/c	Dr.
To Work-in-Progress Control A/c	
12. The balance of Cost of Sales A/c is transferred to Costing Profit and Loss a/c; For such transfer –

Costing Profit and Loss A/c	Dr.
To Cost of Sales A/c	
13. For the sales value of jobs completed -

Cost Ledger Control A/c	Dr.
To Costing Profit and Loss A/c**	

*General ledger adjustment account is another name of Cost Ledger Control Account.

**The balance of Costing Profit and Loss Account shall now represent profit or loss. The balance of Cost Ledger Control Account shall be carried forwarded. With the balance on all the accounts trial balance can be drawn.

ILLUSTRATION 1

The manufacturing cost of a work order is ₹ 1,00,000; 8% of the production against that order spoiled and the rejection is estimated to have a realisable value of ₹ 2,000 only. The normal rate of spoilage is 2%. RECORD this in the costing journal.

SOLUTION

Actual loss due to spoilage = 8% of ₹ 1,00,000 = ₹8,000 and Normal loss = 2% of ₹ 1,00,000 = ₹2,000, therefore abnormal loss = ₹6,000.

The rejection has a realisable value of ₹ 2,000, which is to be apportioned between normal loss and abnormal loss in the ratio of 2 : 6.

The accounting entries necessary for recording the above facts would be:

		(₹)	(₹)
Material Control Account	Dr.	2,000	
Overhead Control Account	Dr.	1,500	
Costing Profit and Loss Control Account	Dr.	4,500	
To Work-in-Progress Control Account			8,000

In the case of defectives being inherent in the manufacturing process, the rectification cost may be charged to the specific jobs in which they have arisen. In case defectives cannot be identified with jobs, the cost of rectification may be treated as factory overheads. Abnormal defectives should be written off to the Costing Profit and Loss Account.

ILLUSTRATION 2

A shop floor supervisor of a small factory presented the following cost for Job No. 303, to determine the selling price.

	Per unit (₹)
<i>Materials</i>	70
<i>Direct wages 18 hours @ ₹ 2.50</i> <i>(Deptt. X 8 hours; Deptt. Y 6 hours; Deptt. Z 4 hours)</i>	45
<i>Chargeable expenses</i>	5
	120
<i>Add : 33-1/3 % for expenses cost</i>	40
	160

Analysis of the Profit/Loss Account
(for the current financial year)

	(₹)		(₹)
Materials used	1,50,000	Sales less returns	2,50,000
Direct wages:			
Deptt. X	10,000		
Deptt. Y	12,000		
Deptt. Z	<u>8,000</u>		
	30,000		
Special stores items	4,000		
Overheads:			
Deptt. X	5,000		
Deptt. Y	9,000		
Deptt. Z	<u>2,000</u>		
	<u>16,000</u>		
Works cost	2,00,000		
Gross profit c/d	<u>50,000</u>		
	<u>2,50,000</u>		<u>2,50,000</u>
Selling expenses	20,000	Gross profit b/d	50,000
Net profit	<u>30,000</u>		
	<u>50,000</u>		<u>50,000</u>

It is also noted that average hourly rates for the three Departments X, Y and Z are similar.

You are required to:

- (i) PREPARE a job cost sheet.
- (ii) CALCULATE the entire revised cost using current financial year actual figures as basis.
- (iii) Add 20% to total cost to DETERMINE selling price.

SOLUTION**Job Cost Sheet**

Customer Details _____

Job No. _____

Date of commencement _____

Date of completion _____

Particulars	Amount (₹)
Direct materials	70
Direct wages:	
Deptt. X ₹ 2.50 × 8 hrs. = ₹ 20.00	
Deptt. Y ₹ 2.50 × 6 hrs. = ₹ 15.00	
Deptt. Z ₹ 2.50 × 4 hrs. = ₹ 10.00	45
Chargeable expenses	<u>5</u>
Prime cost	120
Overheads:	
Deptt. X = $\frac{₹5,000}{₹10,000} \times 100 = 50\% \text{ of ₹ 20} = ₹ 10.00$	
Deptt. Y = $\frac{₹9,000}{₹12,000} \times 100 = 75\% \text{ of ₹ 15} = ₹ 11.25$	
Deptt. Z = $\frac{₹2,000}{₹8,000} \times 100 = 25\% \text{ of ₹ 10} = ₹ 2.50$	<u>23.75</u>
Works cost	<u>143.75</u>
Selling expenses = $\frac{₹20,000}{₹2,00,000} \times 100 = 10\% \text{ of work cost}$	<u>14.38</u>
Total cost	158.13
Profit (20% of total cost)	<u>31.63</u>
Selling price	<u>189.76</u>

4.2 Advantages and Disadvantages of Job Costing

Some of the advantages and disadvantages of Job costing are summarised as below:

Advantages	Disadvantages
1. The details of Cost of material, labour and overhead for all job is available to control.	1. Job Costing is costly and laborious method.
2. Profitability of each job can be derived.	2. As lot of clerical process is involved the chances of error is more.
3. It facilitates production planning.	3. This method is not suitable in inflationary condition.
4. Budgetary control and Standard Costing can be applied in job costing.	4. Previous records of costs will be meaningless if there is any change in market condition.
5. Spoilage and detective can be identified and responsibilities can be fixed accordingly.	

4.3 Difference between Job Costing and Process Costing

The main points which distinguish job costing and process costing are as below:

Job Costing	Process Costing
(i) A Job is carried out or a product is produced by specific orders.	The process of producing the product has a continuous flow and the product produced is homogeneous.
(ii) Costs are determined for each job.	Costs are compiled on time basis i.e., for production of a given accounting period for each process or department.
(iii) Each job is separate and independent of other jobs.	Products lose their individual identity as they are manufactured in a continuous flow.

(iv) Each job or order has a number and costs are collected against the same job number.	The unit cost of process is an average cost for the period.
(v) Costs are computed when a job is completed. The cost of a job may be determined by adding all costs against the job.	Costs are calculated at the end of the cost period. The unit cost of a process may be computed by dividing the total cost for the period by the output of the process during that period.
(vi) As production is not continuous and each job may be different, so more managerial attention is required for effective control.	Process of production is usually standardized and is therefore, quite stable. Hence control here is comparatively easier.

SUMMARY

- ♦ **Job Costing:** The category of basic costing methods which is applicable where the work consists of separate contracts, jobs or batches, each of which is authorised by specific order or contract.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

- In case product produced or jobs undertaken are of diverse nature, the system of costing to be used should be:*
 - Process costing*
 - Operating costing*
 - Job costing*
 - None of the above*
- The production planning department prepares a list of materials and stores required for the completion of a specific job order, this list is known as:*
 - Bin card*
 - Bill of material*

- (c) *Material requisition slip*
 - (d) *None of the above*
3. *Job costing is similar to that under Batch costing except with the difference that a:*
- (a) *Job becomes a cost unit.*
 - (b) *Batch becomes the cost unit instead of a job*
 - (c) *Process becomes a cost unit*
 - (d) *None of the above.*
4. *In job costing which of the following documents are used to record the issue of direct material to a job':*
- (a) *Goods received note*
 - (b) *Material requisition*
 - (c) *Purchase order*
 - (d) *Purchase requisition*
5. *The most suitable cost system where the products differ in type of materials and work performed is :*
- (a) *Job Costing*
 - (b) *Process Costing*
 - (c) *Operating Costing*
 - (d) *None of these.*
6. *Which of the following statements is true:*
- (a) *Job cost sheet may be used for estimating profit of jobs.*
 - (b) *Job costing cannot be used in conjunction with marginal costing.*
 - (c) *A production order is an order received from a customer for particular jobs.*
 - (d) *None of these.*

7. Which of the following statements is true:
- (a) Job cost sheet may be prepared for facilitating routing and scheduling of the job
 - (b) Job costing can be suitably used for concerns producing uniformly any specific product
 - (c) Job costing cannot be used in companies using standard costing
 - (d) Neither (a) nor (b) nor (c)

Theoretical Questions

1. DESCRIBE Job Costing giving example of industries where it is used.
2. DISTINGUISH between Job Costing & Process Costing.

Practical Problems

1. In a factory following the Job Costing Method, an abstract from the work-in-progress as on 30th September was prepared as under.

Job No.	Materials (₹)	Direct hrs.	Labour (₹)	Factory Overheads applied (₹)
115	1325	400 hrs.	800	640
118	810	250 hrs.	500	400
120	765	300 hrs.	475	380
	2,900		1,775	1,420

Materials used in October were as follows:

Materials Requisition No.	Job No.	Cost (₹)
54	118	300
55	118	425
56	118	515
57	120	665
58	121	910

59	124	720
		3,535

A summary for labour hours deployed during October is as under:

Job No.	Number of Hours	
	Shop A	Shop B
115	25	25
118	90	30
120	75	10
121	65	--
124	25	10
	275	75
Indirect Labour: Waiting of material	20	10
Machine breakdown	10	5
Idle time	5	6
Overtime premium	6	5
	316	101

A shop credit slip was issued in October, that material issued under Requisition No. 54 was returned back to stores as being not suitable. A material transfer note issued in October indicated that material issued under Requisition No. 55 for Job 118 was directed to Job 124.

The hourly rate in shop A per labour hour is ₹ 3 per hour while at shop B, it is ₹ 2 per hour. The factory overhead is applied at the same rate as in September. Job 115, 118 and 120 were completed in October.

You are asked to COMPUTE the factory cost of the completed jobs. It is the practice of the management to put a 10% on the factory cost to cover administration and selling overheads and invoice the job to the customer on a total cost plus 20% basis. DETERMINE the invoice price of these three jobs?

2. *Ares Plumbing and Fitting Ltd. (APFL) deals in plumbing materials and also provides plumbing services to its customers. On 12th August, 2022, APFL received a job order for a students' hostel to supply and fitting of plumbing materials. The work is to be done on the basis of specification provided by the hostel owner. Hostel will be inaugurated on 5th September, 2022 and the work is to be completed by 3rd September, 2022. Following are the details related with the job work:*

Direct Materials

APFL uses a weighted average method for the pricing of materials issues.

Opening stock of materials as on 12th August 2022:

- 15mm GI Pipe, 12 units of (15 feet size) @ ₹ 600 each
- 20mm GI Pipe, 10 units of (15 feet size) @ ₹ 660 each
- Other fitting materials, 60 units @ ₹ 26 each
- Stainless Steel Faucet, 6 units @ ₹ 204 each
- Valve, 8 units @ ₹ 404 each

Purchases:

On 16th August 2022:

- 20mm GI Pipe, 30 units of (15 feet size) @ ₹ 610 each
- 10 units of Valve @ ₹ 402 each

On 18th August 2022:

- Other fitting materials, 150 units @ ₹ 28 each
- Stainless Steel Faucet, 15 units @ ₹ 209 each

On 27th August 2022:

- 15mm GI Pipe, 35 units of (15 feet size) @ ₹ 628 each
- 20mm GI Pipe, 20 units of (15 feet size) @ ₹ 660 each
- Valve, 14 units @ ₹ 424 each

Issues for the hostel job:

On 12th August 2022:

- 20mm GI Pipe, 2 units of (15 feet size)
- Other fitting materials, 18 units

On 17th August 2022:

- 15mm GI Pipe, 8 units of (15 feet size)
- Other fitting materials, 30 units

On 28th August 2022:

- 20mm GI Pipe, 2 units of (15 feet size)
- 15mm GI Pipe, 10 units of (15 feet size)
- Other fitting materials, 34 units
- Valve, 6 units

On 30th August 2022:

- Other fitting materials, 60 units
- Stainless Steel Faucet, 15 units

Direct Labour:

Plumber: 180 hours @ ₹50 per hour (includes 12 hours overtime)

Helper: 192 hours @ ₹35 per hour (includes 24 hours overtime)

Overtimes are paid at 1.5 times of the normal wage rate.

Overheads:

Overheads are applied @ ₹13 per labour hour.

Pricing policy:

It is company's policy to price all orders based on achieving a profit margin of 25% on sales price.

You are required to

- Calculate the total cost of the job.
- Calculate the price to be charged from the customer

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(c)	2.	(b)	3.	(a)	4.	(b)	5.	(a)	6.	(a)
7.	(d)										

Answers to the Theoretical Questions

1. Please refer paragraph 1
2. Please refer paragraph 4

Answers to the Practical Problems

1. **Factory Cost Statement of Completed Job.**

Month	Job No.	Materials	Direct labour	Factory overheads (80% of direct labour cost)	Factory cost
	(₹)	(₹)	(₹)	(₹)	(₹)
September	115	1,325	800	640	2,765
October	115	--	125	100	225
Total		1,325	925	740	2,990
September	118	810	500	400	1,710
October	118	515	330	264	1,109
Total		1,325	830	664	2,819
September	120	765	475	380	1,620
October	120	665	245	196	1,106
Total		1,430	720	576	2,726

Invoice Price of Complete Job

Job No.	115 (₹)	118 (₹)	120 (₹)
Factory cost	2,990.00	2,819.00	2,726.00
Administration and selling overheads @ 10% of factory cost	299.00	281.90	272.60
Total cost	3,289.00	3,100.90	2,998.60
Profit (20% of total cost)	657.80	620.18	599.72
Invoice Price	3,946.80	3,721.08	3,598.32

Assumption: - Indirect labour costs have been included in the factory overhead which has been recovered as 80% of the labour cost.

2. (a) Calculation of Total Cost for the Hostel Job:

Particulars	Amount (₹)	Amount (₹)
Direct Material Cost:		
- 15mm GI Pipe (Working Note- 1)	11,051.28	
- 20mm GI Pipe (Working Note- 2)	2,588.28	
- Other fitting materials (Working Note-3)	3,866.07	
- Stainless steel faucet	3,113.57	
- 15 units $\times \left(\frac{6 \times ₹ 204 + 15 \times ₹ 209}{21 \text{ units}} \right)$		
- Valve	2,472.75	23,091.95
- 6 units $\times \left(\frac{8 \times ₹ 404 + 10 \times ₹ 402 + 14 \times ₹ 424}{32 \text{ units}} \right)$		
Direct Labour:		
- Plumber [(180 hours $\times$ ₹ 50) + (12 hours $\times$ ₹ 25)]	9,300.00	
- Helper [(192 hours $\times$ ₹ 35) + (24 hours $\times$ ₹ 17.5)]	7,140.00	16,440.00

- Overheads [₹ 13 × (180 + 192) hours]		4,836.00
Total Cost		44,367.95

(b) Price to be charged for the job work:

	Amount (₹)
Total Cost incurred on the job	44,367.95
Add: 25% Profit on Job Price $\left(\frac{44,367.95}{75\%} \times 25\% \right)$	14,789.32
	59,157.27

Working Note:**1. Cost of 15mm GI Pipe**

Date		Amount (₹)
17-08-2022	8 units × ₹ 600	4,800.00
28-08-2022	10 units × $\left(\frac{4 \times ₹ 600 + 35 \times ₹ 628}{39 \text{ units}} \right)$	6,251.28
		11,051.28

2. Cost of 20mm GI Pipe

Date		Amount (₹)
12-08-2022	2 units × ₹ 660	1,320.00
28-08-2022	2 units × $\left(\frac{8 \times ₹ 660 + 30 \times ₹ 610 + 20 \times ₹ 660}{58 \text{ units}} \right)$	1,268.28
		2,588.28

3. Cost of Other fitting materials

Date		Amount (₹)
12-08-2022	18 units × ₹ 26	468.00
17-08-2022	30 units × ₹ 26	780.00

28-08-2022	$34 \text{ units} \times \left(\frac{12 \times ₹ 26 + 150 \times ₹ 28}{162 \text{ units}} \right)$	946.96
30-08-2022	$60 \text{ units} \times \left(\frac{12 \times ₹ 26 + 150 \times ₹ 28}{162 \text{ units}} \right)$	1,671.11
		3,866.07

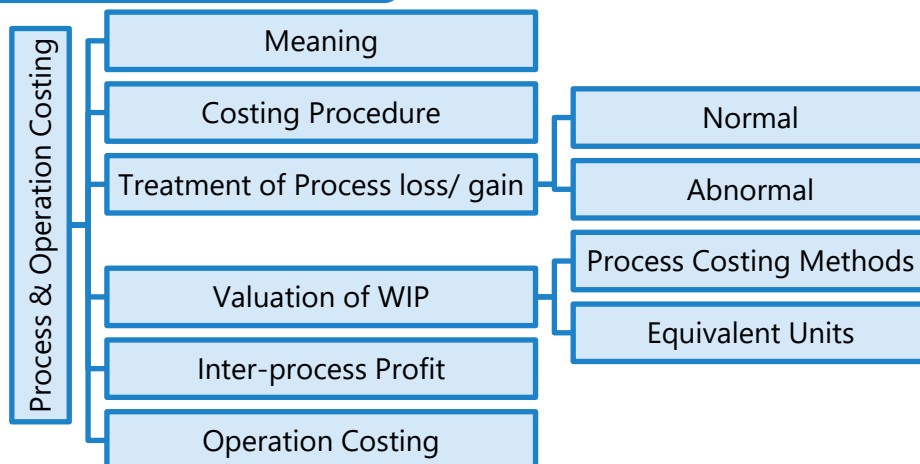
PROCESS & OPERATION COSTING



LEARNING OUTCOMES

- ◆ State the meaning of Process and Operation Costing.
- ◆ Discuss the treatment of process loss and gains in cost accounts.
- ◆ Compute equivalent completed production units.
- ◆ Discuss the various methods of valuation of work in process.
- ◆ State the meaning and treatment of Inter-process profits.

CHAPTER OVERVIEW

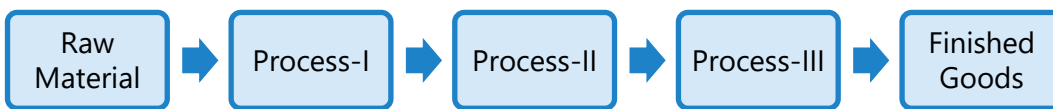




1. MEANING OF PROCESS COSTING

Process Costing is a method of costing used in industries where the material has to pass through two or more processes for being converted into a final product. It is defined as "a method of Cost Accounting whereby costs are charged to processes or operations and averaged over units produced". A separate account for each process is opened and all expenditure pertaining to a process is charged to that process account. Such type of costing method is useful in the manufacturing of products like steel, paper, medicines, soaps, chemicals, rubber, vegetable oil, paints, varnish etc. where the production process is continuous and the output of one process becomes the input of the following process till completion.

This can be understood with the help of the following diagram:



1.1 Basic Features

Industries, where process costing can be applied, have normally one or more of the following features:

1. Each plant or factory is divided into a number of processes, cost centres or departments, and each such division is a stage of production or a process.
2. **Manufacturing activity is carried on continuously by means of one or more process run sequentially, selectively or simultaneously.**
3. **The output of one process becomes the input of another process.**
4. The end product usually is of like units not distinguishable from one another.
5. **It is not possible to trace the identity of any particular lot of output to any lot of input materials.** For example, in the sugar industry, it is impossible to trace any lot of sugar bags to a particular lot of sugarcane fed or *vice versa*.
6. Production of a product may give rise to Joint and/or By-Products.



2. COSTING PROCEDURE IN PROCESS COSTING

The Cost of each process comprises the cost of:

- (i) Materials
- (ii) Employee Cost (Labour)
- (iii) Direct expenses, and
- (iv) Overheads of production.

Materials - Materials and supplies which are required for each process are drawn against Material Requisitions Notes from the stores. **Each process for which the materials are used, are debited with the cost of materials consumed** on the basis of the information received from the Cost Accounting department. The finished product of first process generally become the raw materials of second process; under such a situation the account of second process is debited with the cost of transfer from the first process and also with the cost of any additional material used in process.

Employee Cost (Labour) - Each **process account should be debited with the labour cost** or wages paid to labour for carrying out the processing activities. Sometimes the wages paid are apportioned over the different processes after selecting appropriate basis.

Direct expenses - Each **process account should be debited with direct expenses** like depreciation, repairs, maintenance, insurance etc. associated with it.

Production Overheads- Expenses like rent, power expenses, lighting bills, gas and water bills etc. are known as production overheads. These expenses cannot be allocated to a process. The suitable way out to recover them is to apportion them over different processes by using suitable basis. Usually, these expenses are estimated in advance and **the processes debited with these expenses on a pre-determined basis.**

ILLUSTRATION 1

From the following data, PREPARE process accounts indicating the cost of each process and the total cost. The total units that pass through each process were 240 for the period.

	Process I (₹)	Process II (₹)	Process III (₹)
Materials	1,50,000	50,000	20,000
Labour	80,000	2,00,000	60,000
Other expenses	26,000	72,000	25,000

Indirect expenses amounting to ₹ 85,000 may be apportioned on the basis of wages. There was no opening or closing stock.

SOLUTION

Dr.		Process- I Account				Cr.
Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)	
To Material	625	1,50,000	By Process -II A/c	1,150	2,76,000	
" Labour	334	80,000	(Transfer to Process-II)			
" Other expenses	108	26,000				
" Indirect expenses*	83	20,000				
	1,150	2,76,000		1,150	2,76,000	

Dr.		Process- II Account				Cr.
Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)	
To Process-I A/c	1,150	2,76,000	By Process-III A/c	2,700	6,48,000	
" Material	208	50,000	(Transfer to Process-III)			
" Labour	834	2,00,000				
" Other expenses	300	72,000				
" Indirect expenses*	208	50,000				
	2,700	6,48,000		2,700	6,48,000	

Dr.		Process- III Account				Cr.	
Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)		
To Process-II A/c	2,700	6,48,000	By Finished Stock A/c	3,200	7,68,000		
Material	83	20,000	(Transferred)				
" Labour	250	60,000					
" Other expenses	104	25,000					
" Indirect expenses*	63	15,000					
	3,200	7,68,000		3,200	7,68,000		

* Apportionment of Indirect expenses among Process-I, Process-II and Process-III
 Total Wages to processes (I + II + III) = ₹ 80,000 + ₹ 2,00,000 + ₹ 60,000 = ₹ 3,40,000

Apportionment to:

$$\text{Process- I} = \frac{₹85,000}{₹3,40,000} \times ₹80,000 = ₹ 20,000;$$

$$\text{Process- II} = \frac{₹85,000}{₹3,40,000} \times ₹2,00,000 = ₹50,000 \text{ and}$$

$$\text{Process- III} = \frac{₹85,000}{₹3,40,000} \times ₹60,000 = ₹15,000$$

3. TREATMENT OF NORMAL, ABNORMAL LOSS AND ABNORMAL GAIN

3.1 Normal and Abnormal Loss

Loss of material is inherent during processing operation. The loss of material under different processes arises due to reasons like evaporation or a change in the moisture content etc. Process loss is defined as the loss of material arising during the course of a processing operation and is equal to the difference between the input quantity of the material and its output.

There are two types of material losses viz. (i) Normal loss and (ii) Abnormal loss.

(i) Normal Process Loss: It is also known as normal wastage. It is defined as **the loss of material which is inherent in the nature** of work. Such a loss can be reasonably anticipated from the nature of the material, nature of operation, the experience and technical data. It is unavoidable because of nature of the material or the process. It also includes units withdrawn from the process for test or sampling.

Treatment in Cost Accounts: The cost of **normal process loss in practice is absorbed by good units produced** under the process. The amount realised by the sale of normal process loss units should be credited to the process account.

Example-1 (Normal loss with no realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,750 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has no realisable value.

You are required to PREPARE Process- I account, value of normal loss and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	0
To Wages	-	30,000	By Process II	4,750	97,000
To Overhead	-	27,000		5,000	97,000
	5,000	97,000			

Value of Normal loss = Scrap realisable value less cost to sale

Since, scraps do not realise any value, hence, value of normal loss is zero.

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost}-\text{Realisable value of normal loss}}{\text{Total input units}-\text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000-0}{5,000 \text{ units}-250 \text{ units}} \times 4,750 \text{ units} = 97,000$$

Example-2 (Normal loss with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,750 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹2 per unit.

You are required to PREPARE Process- I account, value of normal loss and units transferred to Process-II.

SOLUTION**Process- I Account**

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000			
To Overhead	-	27,000	By Process II	4,750	96,500
	5,000	97,000		5,000	97,000

Value of Normal loss = Scrap realisable value less cost to sale

$$= 250 \text{ units} \times ₹2 = ₹500$$

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost}-\text{Realisable value of normal loss}}{\text{Total input units}-\text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000-₹500}{5,000 \text{ units}-250 \text{ units}} \times 4,750 \text{ units} = 96,500$$

(ii) **Abnormal Process Loss:** It is also known as abnormal wastage. It is defined as the **loss in excess of the pre-determined loss** (Normal process loss). This type of loss may occur due to the carelessness of workers, a bad plant design or operation, sabotage etc. Such a loss cannot obviously be estimated in advance. But it can be kept under control by taking suitable measures.

Treatment in Cost Accounts: The cost of an abnormal process loss unit is equal to the cost of a good unit. The total cost of abnormal process loss is credited to the process account from which it arises. Cost of abnormal process loss is not treated as a part of the cost of the product. In fact, **the total cost of abnormal process loss is debited to costing profit and loss account.**

Example-3 (Abnormal loss with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,550 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹ 2 per unit.

You are required to PREPARE Process- I account, value of normal loss, abnormal loss and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000	By Abnormal Loss	200	4,063
To Overhead	-	27,000	By Process II	4,550	92,437
	5,000	97,000		5,000	97,000

Value of Normal loss = Scrap realisable value less cost to sale
 = 250 units × ₹2 = ₹500

Value of Abnormal loss:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Abnormal loss units}$$

$$= \frac{₹ 97,000 - ₹ 500}{5,000 \text{ units} - 250 \text{ units}} \times 200 \text{ units} = ₹ 4,063$$

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹ 97,000 - ₹ 500}{5,000 \text{ units} - 250 \text{ units}} \times 4,550 \text{ units} = ₹ 92,437$$

3.2 Abnormal Process Gain/ Yield

Sometimes, loss under a process is less than the anticipated normal figure. In other words, **the actual production exceeds the expected figures**. Under such a situation the difference between actual and expected loss or actual and expected production is known as abnormal gain or yield. So, abnormal gain may be defined as an unexpected gain in production under the normal conditions. This arises due to over- estimation of process loss, improvements in work efficiency of workers, use of better technology in production etc.

Treatment in Cost Accounts: The process account under which abnormal gain arises is debited with the abnormal gain and credited to abnormal gain account which will be closed by transferring to the Costing Profit and Loss account. The cost of abnormal gain is computed on the basis of normal production.

Example-4 (Abnormal gain/ yield with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,850 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹ 2 per unit.

You are required to PREPARE Process- I account, value of normal loss, abnormal loss/gain and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000	By Process II	4,850	98,532
To Overhead	-	27,000			
To Abnormal Gain A/c	100	2,032			
	5,100	99,032		5,100	99,032

Value of Normal loss = Scrap realisable value less cost to sale

$$= 250 \text{ units} \times ₹2 = ₹500$$

(even though the actual loss is less than the expected loss (Normal loss), value of the normal loss is calculated on the estimated figure)

Value of Abnormal Gain:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Abnormal Gain units}$$

$$= \frac{₹97,000 - ₹500}{5,000 \text{ units} - 250 \text{ units}} \times 100 \text{ units} = ₹2,032$$

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000 - ₹500}{5,000 \text{ units} - 250 \text{ units}} \times 4,850 \text{ units} = ₹98,532$$

(Process A/c is debited with the value of abnormal gain as calculated above but the Costing Profit & Loss Account will only be credited with actual amount of abnormal gain only considering the actual realisable value through Abnormal Gain A/c, as shown below)

Abnormal Gain A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Normal Loss A/c (100 units × ₹2)	100	200	By Process-I A/c	100	2,032
To Costing P&L A/c	-	1,832			
	100	2,032		100	2,032

(The Costing P&L Account is credited only for actual gain amount)

ILLUSTRATION 2

A product passes through three processes. The output of each process is treated as the raw material of the next process to which it is transferred and output of the third process is transferred to finished stock.

	Process-I (₹)	Process-II (₹)	Process-III (₹)
Materials issued	40,000	20,000	10,000
Labour	6,000	4,000	1,000
Manufacturing overhead	10,000	10,000	15,000

10,000 units have been issued to the Process-I and after processing, the output of each process is as under:

Process	Output	Normal Loss
Process-I	9,750 units	2%
Process-II	9,400 units	5%
Process-III	8,000 units	10%

No stock of materials or of work-in-process was left at the end. CALCULATE the cost of the finished articles.

SOLUTION

Dr.			Cr.		
Particulars	Units	Total (₹)	Particulars	Units	Total (₹)
To Material	10,000	40,000	By Normal Loss A/c (2% of 10,000 units)	200	--

" Labour	--	6,000	" Abnormal Loss A/c (₹ 5.7142 × 50 units)	50	286
" Manufacturing OH	--	10,000	" Process-II A/c (₹ 5.7142 × 9,750 units)	9,750	55,714
	10,000	56,000		10,000	56,000

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost}}{\text{Inputs-Normal loss}} = \frac{₹ 56,000}{10,000\text{units}-200\text{units}} = ₹ 5.7142$$

Dr.

Process-II Account

Cr.

Particulars	Units	Total (₹)	Particulars	Units	Total (₹)
To Process-I A/c	9,750	55,714	By Normal Loss A/c (5% of 9,750 units)	488	--
" Material	--	20,000	" Process-III A/c (₹ 9.6862 × 9,400 units)	9,400	91,051
" Labour	--	4,000			
" Manufacturing OH	--	10,000			
" Abnormal Gain A/c (₹ 9.6862 × 138 units)	138	1,337			
	9,888	91,051		9,888	91,051

Cost per unit of completed units and abnormal gain:

$$\frac{\text{Total Cost}}{\text{Inputs-Normal loss}} = \frac{₹ 89,714}{9,750\text{units}-488\text{units}} = ₹ 9.6862$$

Dr.		Process-III Account				Cr.	
Particulars	Units	Total (₹)	Particulars	Units	Total (₹)		
To Process-II A/c	9,400	91,051	By Normal Loss A/c (10% of 9,400 units)	940	--		
" Material	--	10,000	" Abnormal Loss A/c (₹13.8358 × 460 units)	460	6,364		
" Labour	--	1,000	" Finished Stock A/c (₹13.8358 × 8,000 units)	8,000	1,10,687		
" Manufacturing OH	--	15,000					
	9,400	1,17,051		9,400	1,17,051		

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost}}{\text{Inputs} - \text{Normal loss}} = \frac{₹1,17,051}{9,400 \text{ units} - 940 \text{ units}} = ₹13.8358$$

ILLUSTRATION 3

RST Limited processes Product Z through two distinct processes – Process- I and Process- II. On completion, it is transferred to finished stock. From the following information for the current year, PREPARE Process- I, Process- II and Finished Stock A/c:

Particulars	Process- I	Process- II
Raw materials used	7,500 units	--
Raw materials cost per unit	₹ 60	--
Transfer to next process/finished stock	7,050 units	6,525 units
Normal loss (on inputs)	5%	10%
Direct wages	₹ 1,35,750	₹ 1,29,250
Direct Expenses	60% of Direct wages	65% of Direct wages
Manufacturing overheads	20% of Direct wages	15% of Direct wages
Realisable value of scrap per unit	₹ 12.50	₹ 37.50

6,000 units of finished goods were sold at a profit of 15% on cost. Assume that there was no opening or closing stock of work-in-process.

SOLUTION**Process- I A/c**

Particulars	Units	(₹)	Particulars	Units	(₹)
To Raw material used (₹60 × 7,500 units)	7,500	4,50,000	By Normal loss (5% of 7,500 units) × ₹12.5	375	4,688
To Direct wages	--	1,35,750	By Process- II A/c (₹96.7947 × 7,050 units)	7,050	6,82,403
To Direct expenses	--	81,450	By Abnormal loss (₹96.7947 × 75 units)	75	7,259
To Manufacturing overhead		27,150			
	7,500	6,94,350		7,500	6,94,350

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost—Realisable value from normal loss}}{\text{Inputs units—Normal loss units}}$$

$$= \frac{₹6,94,350 - ₹4,688}{7,500 \text{ units} - 375 \text{ units}} = \frac{₹6,89,662}{7,125 \text{ units}} = ₹ 96.7947$$

Process- II A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process- I A/c	7,050	6,82,403	By Normal loss (10% of 7,050 units) × ₹ 37.5	705	26,438
To Direct wages	--	1,29,250	By Finished Stock A/c (₹ 140.0496 × 6,525 units)	6,525	9,13,824
To Direct expenses	--	84,013			
To Manufacturing overhead	--	19,387			
To Abnormal gain (₹ 140.0496 × 180 units)	180	25,209			
	7,230	9,40,262		7,230	9,40,262

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost} - \text{Realisable value from normal loss}}{\text{Input units} - \text{Normal loss units}} = \frac{\text{₹9,15,053} - \text{₹26,438}}{7,050 \text{ units} - 705 \text{ units}} = \frac{\text{₹8,88,615}}{6,345 \text{ units}} = \text{₹140.0496}$$

Finished Goods Stock A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process II A/c	6,525	9,13,824	By Cost of Sales (₹140.0496 × 6,000 units)	6,000	8,40,298
			By Balance c/d	525	73,526
	6,525	9,13,824		6,525	9,13,824

Income Statement

Particulars	(₹)	Particulars	(₹)
To Cost of sales (₹140.0496 × 6,000 units)	8,40,298	By Abnormal gain {180 units × (₹140.0496 – ₹37.50)}	18,459
To Abnormal loss {75 units × (₹96.7947 – ₹12.50)}	6,322	By Sales (₹8,40,298 × 115%)	9,66,343
To Net Profit	1,38,182		
	9,84,802		9,84,802



4. VALUATION OF WORK-IN-PROCESS

In the case of process type of industries, it is possible to determine the average cost per unit by dividing the total cost incurred during a given period of time by the total number of units produced during the same period. But this is hardly the case in most of the process type industries where manufacturing is a continuous activity. The reason is that the cost incurred in such industries represents the cost of work carried on opening work-in-process, closing work-in-process and completed units. Thus to ascertain the cost of each completed unit, it is necessary

to ascertain the cost of work-in-process in the beginning and at the end of the process.

The valuation of work-in-process presents a good deal of difficulty because it has units under different stages of completion from those in which work has just begun to those which are only a step short of completion. Work-in-process can be valued on actual basis, *i.e.*, materials used on the unfinished units and the actual amount of labour expenses involved. However, the degree of accuracy in such a case cannot be satisfactory. An alternative method is based on converting partly finished units into equivalent finished units.

4.1 Equivalent Units

Equivalent units or equivalent production units, means converting the incomplete production units into their equivalent completed units. Under each process, an estimate is made of the percentage completion of work-in-process with regard to different elements of costs, *viz.*, material, labour and overheads. It is important that the estimate of percentage of completion should be as accurate as possible. The formula for computing equivalent completed units is:

$$\text{Equivalent completed units} = \left(\frac{\text{Actual number of units in the process of manufacture}}{\text{the process of manufacture}} \right) \times \left(\frac{\text{Percentage of Work completed}}{\text{Work completed}} \right)$$

For instance, if 25% of work has been done on the average of units still under process, then 200 such units will be equal to 50 completed units and the cost of work-in-process will be equal to the cost of 50 finished units.

The following table may be used to compute the equivalent units:

Input Details	Units	Output Particulars	Units	Equivalent Units					
				Material		Labour		Overhead	
				%	Units	%	Units	%	Units
			a	b	c = a × b	d	e = a × d	f	g = a × f
Opening W-I-P	xxx	Opening W-I-P*	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Unit Introduced	xxx	Finished output**	xxx	xxx	xxx	xxx	xxx	xxx	xxx
		Normal loss***	xxx	-	-	-	-	-	-
		Abnormal loss/Gain****	xxx	xxx	xxx	xxx	xxx	xxx	xxx
		Closing W-I-P	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Total	xxx	Total	xxx		xxx		xxx		xxx

* Equivalent units for Opening W-I-P is calculated only under FIFO method. Under the Average method, it is not shown separately.

**Under the FIFO method, Finished Output = Units completed and transferred to next process *less* Opening WIP. Under Average method, Finished Output = Units completed and transferred.

***For normal loss, no equivalent unit is calculated.

****Abnormal Gain/ Yield is treated as 100% complete in respect of all cost elements irrespective of percentage of completion.



5. STEPS IN PROCESS COSTING

For each production process, a Production Cost Report is prepared at the end of each accounting period. The objective of preparing the report is to know physical units and equivalent units in process, element wise cost of goods produced and transferred, goods in process (work-in-process), units lost due to abnormal reasons i.e. abnormal loss etc. To prepare the report, the following steps are generally followed:

Step-1: Analysis of physical flow of production units

The first step is to determine and analyse the number of physical units in the form of inputs (introduced fresh or transferred from previous process, beginning work-in-process) and outputs (completed and work-in-process).

Step-2: Calculation of equivalent units for each cost elements

The second step is to calculate equivalent units of production for each cost element i.e. for material, labour and overheads. It is calculated by taking the extent of work done in respect of each element. For example, if there are 1,000 units in work-in-process at the end of the month. All materials are introduced at the beginning of production process. For labour and overheads, 20% more work is required to get it completed. In this example, the equivalent units of work-in-process in respect of material would be 1,000 units ($1,000 \text{ units} \times 100\% \text{ complete}$) and for labour and overheads 800 units ($1,000 \text{ units} \times 80\% \text{ complete}$).

Step-3: Determination of total cost for each cost element

Total cost for each cost element is collected and accumulated for the period. The process of cost collection has already been discussed above.

Step-4: Computation of cost per equivalent unit for each cost element

In this step, the cost per equivalent unit for each cost element is calculated. The total cost as calculated in Step-3 is divided by the equivalent units as determined in Step-2.

Step-5: Assignment of total costs to units completed and ending WIP

In this step, the total cost for units completed, units transferred to next process, ending work in process, abnormal loss etc. are calculated and posted in the process account and production cost report.

 6. PROCESS COSTING METHODS

Mainly two methods for valuation of work-in-process are followed:

- (i) First-in-First Out (FIFO) method.
- (ii) Weighted Average(Average) method

(i) First-in-first-out (FIFO) method

Under this method the units completed and transferred are taken from both opening work-in-process (WIP) and freshly introduced materials/inputs. **The cost to complete the opening WIP and other completed units are calculated separately.** The cost of opening WIP is added to cost incurred on completing the incomplete (WIP) units into complete one. The total cost of units completed and transferred is calculated by adding opening WIP cost to cost on freshly introduced inputs. **In this method the closing stock of work in process is valued at current cost.**

ILLUSTRATION 4

Opening work-in-process 1,000 units (60% complete); Cost ₹ 1,10,000. Units introduced during the period 10,000 units; Cost ₹ 19,30,000. Transferred to next process - 9,000 units.

Closing work-in-process - 800 units (75% complete). Normal loss is estimated at 10% of total input including units in process at the beginning. Scraps realise ₹ 10 per unit. Scraps are 100% complete.

Using FIFO method, COMPUTE equivalent production and cost per equivalent unit. Also evaluate the output.

SOLUTION**Statement of Equivalent Production Units (Under FIFO Method)**

Particulars	Input units	Particulars	Output units	Equivalent Production	
				(%)	Equivalent units
Opening W-I-P	1,000	From opening W-I-P	1,000	40	400
Units introduced	10,000	From fresh inputs	8,000	100	8,000
		Units completed (Transferred to next process)	9,000		
		Normal Loss {10% (1,000 + 10,000 units)}	1,100	--	--
		Closing W-I-P	800	75	600
		Abnormal loss (Balancing figure)	100	100	100
	11,000		11,000		9,100

Computation of cost per equivalent production unit:

Cost of the Process (for the period)	₹19,30,000
Less: Scrap value of normal loss (₹ 10 × 1,100 units)	(₹11,000)
Total process cost	<u>₹ 19,19,000</u>

$$\text{Cost per equivalent unit} = \frac{₹19,19,000}{9,100 \text{ units}} = ₹ 210.88$$

Statement of Evaluation

Particulars	Equivalent Units (EU)	Cost per EU (₹)	Amount (₹)
(i) Opening W-I-P completed during the period	400	210.88	84,352

Add: Cost of W-I-P at beginning	--	--	1,10,000
Complete cost of 1,000 units of opening W-I-P	1,000	194.35	1,94,352
(ii) Completely processed units	8,000	210.88	16,87,040
(iii) Abnormal Loss	100	210.88	21,088
(iv) Closing W-I-P	600	210.88	1,26,528

(The difference in total amount may arise due to rounding off error)

Process Explained:

- (i) Total Units completed and Transferred is 9,000 units. Out of these 9,000 units, 1,000 units has been taken from opening WIP and the rest is from the fresh units introduced.
- (ii) The opening WIP is 60% complete in respect of costs, hence, 40% more work is to be done during the period.
- (iii) Total cost for cost elements for the period (current period only) is accumulated.
- (iv) The realisable value of scrap (i.e. normal loss) is deducted from the total cost as accumulated above.
- (v) Total cost less realisable value is divided by equivalent units to get cost per equivalent unit.
- (vi) The equivalent cost as calculated above is multiplied by the equivalent units of completely processed goods, abnormal loss and closing WIP to get the value.
- (vii) Cost of units completed and transferred is calculated separately for Opening WIP and fresh inputs.

(ii) Weighted Average (Average) Method:

Under this method, **the cost of opening work-in-process and cost of the current period are aggregated and the aggregate cost is divided by output in terms of completed units.** The equivalent production in this case consists of work-load already contained in opening work-in-process and work-load of current period.

The main difference between FIFO method and average method is that units of opening work in process and their cost are taken in full under average method while under FIFO method only the remaining work done now is considered.

ILLUSTRATION 5

Refer to information provided in Illustration 4 above and solve this by Weighted Average Method:

SOLUTION

Statement of Equivalent Units (Under Weighted Average Method)

Particulars	Input units	Particulars	Output units	Equivalent Production	
				(%)	Equivalent units
Opening W-I-P	1,000	Units completed (Transferred to next process)	9,000	100	9,000
Units introduced	10,000	Normal Loss {10% (1,000 + 10,000 units)}	1,100	--	--
		Closing W-I-P	800	75	600
		Abnormal loss (Balancing figure)	100	100	100
	11,000		11,000		9,700

Computation of cost per equivalent production unit :

Cost of Opening W-I-P	₹ 1,10,000
Cost of the Process (for the period)	₹19,30,000
Less: Scrap value of normal loss (₹ 10 × 1,100 units)	(₹11,000)
Total process cost	₹20,29,000

$$\text{Cost per equivalent unit} = \frac{\text{₹20,29,000}}{9,700 \text{ units}} = ₹ 209.18$$

Statement of Evaluation

Particulars	Equivalent Units (EU)	Cost per EU (₹)	Amount (₹)
(i) Units Completed and transferred to next process	9,000	209.18	18,82,620
(ii) Abnormal Loss	100	209.18	20,918
(iii) Closing W-I-P	600	209.18	1,25,508

(The difference in total amount may arise due to rounding off error)

Process Explained:

- (i) Total Units completed and Transferred is 9,000 units. All the 9,000 units has been considered as equally complete in respected of cost.
- (ii) Total cost for cost elements for the period and opening WIP is accumulated.
- (iii) The realisable value of scrap (i.e. normal loss) is deducted from the total cost as accumulated above.
- (iv) Total cost less realisable value is divided by equivalent units to get cost per equivalent unit.
- (v) The equivalent cost as calculated above is multiplied by the equivalent units of completely processed goods, abnormal loss and closing WIP to get the value.

7. INTER-PROCESS PROFITS

To control cost and to measure performance, different processes within an organization are designated as separate profit centres. In this type of organizational structure, the output of one process is transferred to the next process not at cost but at market value or cost plus a percentage of profit. *The difference between cost and the transfer price is known as inter-process profits.*

The advantages and disadvantages of using inter-process profit, in the case of process type industries are as follows:

Advantages:

1. Comparison between the cost of output and its market price at the stage of completion is facilitated.

2. Each process is made to stand by itself as to the profitability.

Disadvantages:

1. The use of inter-process profits involves complication.
2. The system shows profits which are not realised because of stock not sold out.

ILLUSTRATION 6

A Ltd. produces product 'AXE' which passes through two processes before it is completed and transferred to finished stock. The following data relate for the month of October:

	Process- I (₹)	Process- II (₹)	Finished Stock (₹)
Opening stock	7,500	9,000	22,500
Direct materials	15,000	15,750	--
Direct wages	11,200	11,250	--
Factory overheads	10,500	4,500	--
Closing stock	3,700	4,500	11,250
Inter-process profit included in opening stock	--	1,500	8,250

Output of Process- I is transferred to Process- II at 25% profit on the transfer price.

Output of Process- II is transferred to finished stock at 20% profit on the transfer price. Stock in processes is valued at prime cost. Finished stock is valued at the price at which it is received from process II. Sales during the period are ₹ 1,40,000.

PREPARE Process cost accounts and finished goods account showing the profit element at each stage.

SOLUTION

Process- I Account

Particulars	Total (₹)	Cost (₹)	Profit (₹)	Particulars	Total (₹)	Cost (₹)	Profit (₹)
Opening stock	7,500	7,500	--	Process- II A/c*	54,000	40,500	13,500
Direct materials	15,000	15,000	--	Closing Stock	3,700	3,700	--

Direct wages	11,200	11,200	--				
Prime Cost	33,700	33,700					
Overheads	10,500	10,500	--				
Total Cost	44,200	44,200					
Profit**	13,500	--	13,500				
	57,700	44,200	13,500		57,700	44,200	13,500

$$\text{*Transfer price} = \frac{\text{Total cost} - \text{Closing stock}}{75\%} = \frac{44,200 - 3,700}{75\%} = ₹54,000$$

$$\text{**Profit on transfer} = 54,000 \times 25\% = ₹13,500$$

Process- II Account

Particulars	Total (₹)	Cost (₹)	Profit (₹)	Particulars	Total (₹)	Cost (₹)	Profit (₹)
Opening stock	9,000	7,500	1,500	Finished Stock A/c**	1,12,500	75,750	36,750
Transferred from Process- I	54,000	40,500	13,500	Closing stock*	4,500	3,750	750
Direct materials	15,750	15,750	--				
Direct wages	11,250	11,250	--				
Prime cost	90,000	75,000	15,000				
Overheads	4,500	4,500	--				
Total cost	94,500	79,500	15,000				
Profit***	22,500	--	22,500				
	1,17,000	79,500	37,500		1,17,000	79,500	37,500

$$\text{* Cost of Closing Stock} = \frac{₹75,000}{₹90,000} \times ₹4,500 = ₹3,750$$

$$\text{**Transfer price} = \frac{\text{Total cost} - \text{Closing stock}}{80\%} = \frac{94,500 - 4,500}{80\%} = ₹1,12,500$$

$$\text{***Profit on transfer} = 1,12,500 \times 20\% = ₹22,500$$

Finished Stock Account

Particulars	Total (₹)	Cost (₹)	Profit (₹)	Particulars	Total (₹)	Cost (₹)	Profit (₹)
Opening stock	22,500	14,250	8,250	Costing P&L A/c	1,40,000	82,425	57,575
Process- II	1,12,500	75,750	36,750	Closing stock*	11,250	7,575	3,675
Profit	16,250	--	16,250				
	1,51,250	90,000	61,250		1,51,250	90,000	61,250

$$\text{* Cost of Closing Stock} = \frac{\text{Cost of transfer from Process-II}}{\text{Transfer price from Process-II}} \times \text{Value of closing stock}$$

(As per instruction given in the question)

$$= \frac{₹ 75,750}{₹ 1,12,500} \times ₹ 11,250 = ₹ 7,575$$

8. OPERATION COSTING

This product costing system is used when an entity produces more than one variant of final product using different materials but with similar conversion activities. Which means conversion activities are similar for all the product variants but materials differ significantly. Operation Costing method is also known as Hybrid product costing system as materials costs are accumulated by job order or batch wise but conversion costs i.e. labour and overheads costs are accumulated by department, and process costing methods are used to assign these costs to products. Moreover, under operation costing, conversion costs are applied to products using a predetermined application rate. This predetermined rate is based on budgeted conversion costs.

For example, a company is manufacturing two grades of products, Product- Deluxe and Product- Regular. Both the products pass through a similar production process but require different quality and quantities of raw materials. The cost of raw material is accumulated on the basis of job or batches or units of two variants of products. But the costs for the conversion activities need not to be identified with the product variants as both the Products requires similar activities for conversion. Hence, conversion activity costs are accumulated on the basis of departments or processes only. Example of industries are ready made garments, Shoe making, jewelry etc.

SUMMARY

- ◆ **Process Costing:** Used in industries where the material has to pass through two or more processes for being converted into a final product.
- ◆ **Operation Costing:** It is the refinement of process costing. It is concerned with the determination of the cost of each operation rather than the process.
- ◆ **Treatment of Losses in process costing: -**
 - (i) **Normal process loss** - The cost of normal process loss is absorbed by good units produced under the process. The amount realised by the sale of normal process loss units should be credited to the process account.
 - (ii) **Abnormal process loss** - The total cost of abnormal process loss is credited to the process account from which it arises. The total cost of abnormal process loss is debited to costing profit and loss account.
- ◆ **Abnormal gain** - The process account under which abnormal gain arises is debited with the abnormal gain and credited to Abnormal gain account which will be closed by transferring to the Costing Profit and loss account.
- ◆ **Equivalent production units:** This concept is used in the industries where manufacturing is a continuous activity. Converting partly finished units into equivalent finished units.

Equivalent production means converting the incomplete production units into their equivalent completed units.

$$\text{Equivalent completed units} = \{\text{Actual number of units in the process of manufacture}\} \times \{\text{Percentage of work completed}\}$$
- ◆ **Valuation of work-in-process: two main methods:**
 - (1) First-in-First Out (FIFO) method.
 - (2) Average Cost method (or weighted average cost method).
- ◆ **Inter-Process Profits**

The output of one process is transferred to the next process not at cost but at market value or cost plus a percentage of profit. The difference between cost and the transfer price is known as inter-process profits.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *The type of process loss that should not be allowed to affect the cost of good units is:*
 - (a) *Abnormal loss*
 - (b) *Normal loss*
 - (c) *Seasonal loss*
 - (d) *Standard loss*
2. *200 units were introduced in a process in which 20 units is the normal loss. If the actual output is 150 units, then there is:*
 - (a) *No abnormal loss*
 - (b) *No abnormal gain*
 - (c) *Abnormal loss of 30 units*
 - (d) *Abnormal gain of 30 units*
3. *100 units are processed at a total cost of ₹ 160, normal loss is 10%, & scrap units are sold @ ₹0.25 each. If the output is 80 units, then the value of abnormal loss is:*
 - (a) *₹ 2.50*
 - (b) *₹ 16*
 - (c) *₹ 17.50*
 - (d) *₹ 17.75*
4. *When average method is used in process costing, the opening inventory costs are:*
 - (a) *Subtracted from the new costs*
 - (b) *Added to the new costs*
 - (c) *Kept separate from the costs of the new period*
 - (d) *Averaged with other costs to arrive at total cost*

5. *Spoilage that occurs under inefficient operating conditions and is ordinarily controllable is called:*
- (a) *Normal spoilage*
 - (b) *Abnormal spoilage*
 - (c) *Normal defectives*
 - (d) *None of the above*
6. *The cost of normal process loss is -*
- (a) *Absorbed by good units produced and amount realised by the sale of loss units should be debited to the process account.*
 - (b) *Debited to costing profit and loss account.*
 - (c) *Absorbed by good units produced.*
 - (d) *Debited to costing profit and loss account and amount realised by the sale of loss units should be credited to the process account.*
7. *The value of abnormal loss is equal to:*
- (a) *Total cost of materials*
 - (b) *Total process cost less realizable value of normal loss*
 - (c) *Total process cost less cost of scrap*
 - (d) *Total process cost less realizable value of normal loss less value of transferred out goods.*
8. *Inter-process profit is calculated, because:*
- (a) *a process is a cost centres*
 - (b) *each process has to report profit*
 - (c) *the efficiency of the process is measured*
 - (d) *the wages of employees are linked to the process profitability.*
9. *Under Weighted Average (Average) Method:*
- (a) *The cost to complete the opening WIP is ignored.*

- (b) *The cost to complete the opening WIP and other completed units are calculated separately.*
 - (c) *The cost of opening work-in-process and cost of the current period are aggregated and the aggregate cost is divided by output in terms of completed units.*
 - (d) *Closing stock of work in process is valued at current cost.*
10. *A process account is debited by abnormal gain, the value is determined as:*
- (a) *Equal to the value of normal loss*
 - (b) *Cost of good units less realizable value of normal loss*
 - (c) *Cost of good units less realizable value of actual loss*
 - (d) *Equal to the value of good units less closing stock*
11. *Lean Labs develops 55mm film using a four-step process that moves progressively through four departments. The company specializes in overnight service and has the largest drug store chain as its primary customer. Currently, direct labor, direct materials, and overhead are accumulated by departments.*
- The cost accumulation system that best describes the system Lean Labs is using is:*
- (a) *Operation costing.*
 - (b) *Activity-based costing.*
 - (c) *Job-order costing.*
 - (d) *Process costing.*
12. *When compared with normal spoilage, abnormal spoilage:*
- (a) *Arises more frequently from factors that are inherent in the manufacturing process.*
 - (b) *Is given the same accounting treatment as normal spoilage.*
 - (c) *Is generally thought to be more controllable by purchase department than production department.*
 - (d) *Is not typically influenced by the "tightness" of production standards.*

13. Assume 550 units were worked on during a period in which a total of 500 good units were completed. Normal spoilage consisted of 30 units; abnormal spoilage, 20 units. Total production costs were ₹2,200. The company accounts for abnormal spoilage separately on the income statement as loss due to abnormal spoilage. Normal spoilage is not accounted for separately. What is the cost of the good units produced?
- (a) ₹2,080
(b) ₹2,115
(c) ₹2,200
(d) ₹2,332
14. IC Limited uses process costing systems and inspects its goods post manufacturing. An engineer noticed on May 31st the following:

Good units completed	15,000
Normal spoilage (units)	300
Abnormal spoilage (units)	100

Unit costs were: Material ₹ 2.50 and conversion costs (Labour & overheads) ₹6.00. The number of units that company would transfer to its finished goods stock and the related cost of these units are:

- (a) 15,000 units transferred at a cost of ₹ 127,500
(b) 15,000 units transferred at a cost of ₹ 130,050
(c) 15,000 units transferred at a cost of ₹ 135,000
(d) 15,300 units transferred at a cost of ₹ 130,050

Theoretical Questions

1. EXPLAIN briefly the procedure for the valuation of Work-in-Process.
2. EXPLAIN equivalent units.
3. "Operation costing is defined as refinement of Process costing." EXPLAIN it.
4. What is inter-process profit? STATE its advantages and disadvantages.

Practical Problems

1. An English willow company who manufactures cricket bat buys wood as its direct material. The Forming department processes the cricket bats and the cricket bats are then transferred to the Finishing department where stickers are applied. The Forming department began manufacturing 10,000 initial bats during the month of December for the first time and their cost is as follows:

Direct material: ₹ 33,000

Conversion costs: ₹ 17,000

Total ₹ 50,000

A total of 8,000 cricket bats were completed and transferred to the Finishing department, the rest 2,000 were still in the Forming process at the end of the month. All of the forming departments direct material were placed, but, on average, only 25% of the conversion costs was applied to the ending work in progress inventory.

CALCULATE:

- (i) Equivalent units of production for each cost.
 - (ii) The Conversion cost per Equivalent units.
 - (iii) Cost of closing work in process (WIP) and finished products.
2. Hill manufacturing Ltd uses process costing to manufacture Water density sensors for hydro sector. The following information pertains to operations for the month of May.

Particulars	Units
Beginning WIP, May 1	16,000
Started in production during May	1,00,000
Completed production during May	92,000
Ending work in progress, May 31	24,000

The beginning work in progress was 60% complete for materials and 20% complete for conversion costs. The ending inventory was 90% complete for material and 40% complete for conversion costs.

Costs pertaining to the month of May are as follows:

Beginning inventory costs are material ₹27,670, direct labour ₹30,120 and factory overhead ₹12,720.

Cost incurred during May are material used, ₹4,79,000, direct labour ₹1,82,880, factory overheads ₹3,91,160.

CALCULATE:

- (i) Using the FIFO method, the equivalent units of production for material.
 - (ii) Cost per equivalent unit for conversion cost.
3. Following information is available regarding Process-I for the month of February:

<i>Production Record:</i>	
<i>Units in process as on 1st February (All materials used, 25% complete for labour and overhead)</i>	<i>4,000</i>
<i>New units introduced</i>	<i>16,000</i>
<i>Units completed</i>	<i>14,000</i>
<i>Units in process as on 28th February (All materials used, 33-1/3% complete for labour and overhead)</i>	<i>6,000</i>
<i>Cost Records:</i>	
<i>Work-in-process as on 1st February</i>	<i>(₹)</i>
<i>Materials</i>	<i>6,000</i>
<i>Labour</i>	<i>1,000</i>
<i>Overhead</i>	<i>1,000</i>
	<i>8,000</i>
<i>Cost during the month:</i>	
<i>Materials</i>	<i>25,600</i>
<i>Labour</i>	<i>15,000</i>
<i>Overhead</i>	<i>15,000</i>
	<i>55,600</i>

Presuming that average method of inventory is used, PREPARE:

- (i) Statement of equivalent production.
- (ii) Statement showing cost for each element.
- (iii) Statement of apportionment of cost.
- (iv) Process cost account for Process-I.

4. Following details are related to the work done in Process-I by XYZ Company during the month of March:

	(₹)
Opening work-in process (2,000 units)	
Materials	80,000
Labour	15,000
Overheads	45,000
Materials introduced in Process-I (38,000 units)	14,80,000
Direct Labour	3,59,000
Overheads	10,77,000

Units scrapped: 3,000 units

Degree of completion:

Materials	100%
Labour and overheads	80%

Closing work-in process: 2,000 units

Degree of completion:

Materials	100%
Labour and overheads	80%

Units finished and transferred to Process-II: 35,000 units

Normal Loss:

5% of total input including opening work-in-process.

Scrapped units fetch ₹ 20 per piece.

You are required to PREPARE using average method:

- (i) Statement of equivalent production*
- (ii) Statement of cost*
- (iii) Statement of distribution cost, and*
- (iv) Process-I Account, Normal Loss Account and Abnormal Loss Account.*

5. *A company produces a component, which passes through two processes. During the month of April, materials for 40,000 components were put into Process I of which 30,000 were completed and transferred to Process II. Those not transferred to Process II were 100% complete as to materials cost and 50% complete as to labour and overheads cost. The Process I costs incurred were as follows:*

<i>Direct material</i>	<i>₹15,000</i>
<i>Direct wages</i>	<i>₹18,000</i>
<i>Factory overheads</i>	<i>₹12,000</i>

Of those transferred to Process II, 28,000 units were completed and transferred to finished goods stores. There was a normal loss with no salvage value of 200 units in Process II. There were 1,800 units, remained unfinished in the process with 100% complete as to materials and 25% complete as regard to wages and overheads.

No further process material costs occur after introduction at the first process until the end of the second process, when protective packing is applied to the completed components. The process and packing costs incurred at the end of the Process II were:

<i>Packing materials</i>	<i>₹4,000</i>
<i>Direct wages</i>	<i>₹3,500</i>
<i>Factory overheads</i>	<i>₹4,500</i>

Required:

- (i) *PREPARE Statement of Equivalent Production, Cost per unit and Process I A/c.*
 - (ii) *PREPARE Statement of Equivalent Production, Cost per unit and Process II A/c.*
6. 'Healthy Sweets' is engaged in the manufacturing of jaggery. Its process involve sugarcane crushing for juice extraction, then filtration and boiling of juice along with some chemicals and then letting it cool to cut solidified jaggery blocks.

The main process of juice extraction (Process – I) is done in conventional crusher, which is then filtered and boiled (Process – II) in iron pots. The solidified jaggery blocks are then cut, packed and dispatched. For manufacturing 10 kg of jaggery, 100 kg of sugarcane is required, which extracts only 45 litre of juice.

Following information regarding Process – I has been obtained from the manufacturing department of Healthy Sweets for the month of January:

	(₹)
Opening work-in process (4,500 litre)	
Sugarcane	50,000
Labour	15,000
Overheads	45,000
Sugarcane introduced for juice extraction (1,00,000 kg)	5,00,000
Direct Labour	2,00,000
Overheads	6,00,000
Abnormal Loss: 1,000 kg	
Degree of completion:	
Sugarcane	100%
Labour and overheads	80%
Closing work-in process: 9,000 litre	

Degree of completion:	
Sugarcane	100%
Labour and overheads	80%

Extracted juice transferred for filtering and boiling: 39,500 litre

(Consider mass of 1 litre of juice equivalent to 1 kg)

You are required to PREPARE using average method:

- (i) Statement of equivalent production,*
- (ii) Statement of cost,*
- (iii) Statement of distribution cost, and*
- (iv) Process-I Account.*

Case Scenarios

- Arnav Ltd. manufactures chemical solutions used in paint and adhesive products. Chemical solutions are produced in different processes. Some of the processes are hazardous in nature which may results in fire accidents.

At the end of the last month, one fire accident occurred in the factory. The fire destroyed some of the paper files containing records of the process operations for the month.

You being an associate to the Chief Manager (Finance), are assigned to prepare the process accounts for the month during which the fire occurred. From the documents and files of other sources, following information could be retrieved:

Opening work-in-process at the beginning of the month was 500 litres, 80% complete for labour and 60% complete for overheads. Opening work-in-process was valued at ₹2,78,000.

Closing work-in-process at the end of the month was 100 litres, 20% complete for labour and 10% complete for overheads.

Normal loss is 10% of input (fresh) and total losses during the month were 800 litres partly due to the fire damage.

Output transferred to finished goods was 3,400 litres.

Losses have a scrap value of ₹20 per litre.

All raw materials are added at the commencement of the process.

The cost per equivalent unit is ₹660 for the month made up as follows:

Raw Material ₹300 Labour ₹200 Overheads ₹160

The company uses FIFO method to value work-in-process and finished goods.

The following information are required for managerial decisions:

- i. *How much quantity of raw material introduced during the month?*
 - (a) 4,300 Litres
 - (b) 3,500 Litres
 - (c) 4,200 Litres
 - (d) 3,800 Litres
- ii. *The Quantity of normal loss and abnormal loss are:*
 - (a) Normal loss- 380 litres & Abnormal loss- 420 litres
 - (b) Normal loss- 350 litres & Abnormal loss – 450 litres
 - (c) Normal loss- 430 litres & Abnormal loss – 370 litres
 - (d) Normal loss- 420 litres & Abnormal loss – 380 litres.
- iii. *Value of raw material added to the process during the month is:*
 - (a) ₹10,10,000
 - (b) ₹10,33,600
 - (c) ₹10,18,400
 - (d) ₹10,20,000
- iv. *Value of labour and overhead in closing Work-in-process are:*
 - (a) ₹4,000 & ₹1,600 respectively
 - (b) ₹20,000 & ₹16,000 respectively
 - (c) ₹16,000 & ₹9,000 respectively
 - (d) ₹13,200 & ₹6,600 respectively

v. Value of output transferred to finished goods is:

- (a) ₹22,57,200
- (b) ₹20,06,400
- (c) ₹22,44,000
- (d) ₹19,27,200

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(a)	2.	(c)	3.	(c)	4.	(b)	5.	(b)	6.	(c)
7.	(d)	8.	(c)	9.	(c)	10.	(b)	11.	(d)	12.	(d)
13.	(b)	14.	(b)								

Answers to the Theoretical Questions

- Please refer paragraph 4
- Please refer paragraph 4.1
- Please refer paragraph 8
- Please refer paragraph 7

Answers to the Practical Problems

- (i) Calculation of equivalent units of production:

Input Details	Units	Output Particulars	Units	Equivalent Units			
				Material		Conversion cost	
				%	Units	%	Units
Unit Introduced	10,000	Finished output	8,000	100	8,000	100	8,000
		Closing W-I-P	2,000	100	2,000	25	500
Total	10,000	Total	10,000		10,000		8,500

(ii) Calculation of cost per equivalent unit

	Direct Material	Conversion costs
Total cost (₹)	33,000	17,000
Equivalent units	10,000	8,500
Cost per equivalent unit (₹)	3.30	2.00

(iii) The cost of closing work in process (WIP):

COSTS	EQUIVALENT UNITS	RATE (₹)	TOTAL COST (₹)
Direct Material	2,000	3.30	6,600
Conversion Costs	500	2.00	1,000
Total			7,600

The cost of finished products:

COSTS	EQUIVALENT UNITS	RATE (₹)	TOTAL COST (₹)
Direct Material	8,000	3.30	26,400
Conversion Costs	8,000	2.00	16,000
Total			42,400

2. (i) Calculation of equivalent units of production:

Input Details	Units	Output Particulars	Units	Equivalent Units			
				Material		Conversion cost	
				%	Units	%	Units
Beginning WIP	16,000	Completed Output: From beginning WIP	16,000	40	6,400	80	12,800
Unit Introduced	1,00,000	Completed output: From unit introduced	76,000	100	76,000	100	76,000
		Closing W-I-P	24,000	90	21,600	40	9,600
Total	1,16,000	Total	1,16,000		1,04,000		98,400

(ii) Calculation of cost per equivalent unit for conversion costs

Particulars	Amount (₹)
Direct Labour	1,82,880
Factory Overheads	3,91,160
	5,74,040
Equivalent Units	98,400
Cost Per Equivalent Unit (₹)	5.83

3. (i) Statement of equivalent production (Average cost method)

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Material		Labour & O.H.	
				%	Units	%	Units
Opening WIP	4,000	Completed and transferred	14,000	100	14,000	100	14,000
Units introduced	16,000	Closing WIP	6,000	100	6,000	33-1/3	2,000
	20,000		20,000		20,000		16,000

(ii) Statement showing cost for each element

Particulars	Materials (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	6,000	1,000	1,000	8,000
Cost incurred during the month	25,600	15,000	15,000	55,600
Total cost: (A)	31,600	16,000	16,000	63,600
Equivalent units: (B)	20,000	16,000	16,000	
Cost per equivalent unit: (C) = (A ÷ B)	1.58	1	1	3.58

(iii) Statement of apportionment of cost

	Amount (₹)	Amount (₹)
1. Value of units completed and transferred (14,000 units × ₹ 3.58)		50,120
2. Value of Closing W-I-P:		
- Materials (6,000 units × ₹ 1.58)	9,480	
- Labour (2,000 units × ₹ 1)	2,000	
- Overheads (2,000 units × ₹ 1)	2,000	13,480

(iv) Process-I Cost Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W-I-P	4,000	8,000	By Completed units	14,000	50,120
To Materials	16,000	25,600	By Closing W-I-P	6,000	13,480
To Labour	--	15,000			
To Overhead	--	15,000			
	20,000	63,600		20,000	63,600

4. (i) Statement of Equivalent Production

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Material		Labour & O.H.	
				%	Units	%	Units
Opening WIP	2,000	Completed and transferred to Process-II	35,000	100	35,000	100	35,000
Units introduced	38,000	Normal Loss (5% of 40,000)	2,000	--	--	--	--
		Abnormal loss (Balancing)	1,000	100	1,000	80	800

		figure)					
		Closing WIP	2,000	100	2,000	80	1,600
	40,000		40,000		38,000		37,400

(ii) Statement showing cost for each element

Particulars	Materials (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	80,000	15,000	45,000	1,40,000
Cost incurred during the month	14,80,000	3,59,000	10,77,000	29,16,000
Less: Realisable Value of normal scrap (₹ 20 × 2,000 units)	(40,000)	--	--	(40,000)
Total cost: (A)	15,20,000	3,74,000	11,22,000	30,16,000
Equivalent units: (B)	38,000	37,400	37,400	
Cost per equivalent unit: (C) = (A ÷ B)	40.00	10.00	30.00	80.00

(iii) Statement of Distribution of cost

	Amount (₹)	Amount (₹)
1. Value of units completed and transferred (35,000 units × ₹ 80)		28,00,000
2. Value of Abnormal Loss:		
- Materials (1,000 units × ₹ 40)	40,000	
- Labour (800 units × ₹ 10)	8,000	
- Overheads (800 units × ₹ 30)	24,000	72,000
3. Value of Closing W-I-P:		
- Materials (2,000 units × ₹ 40)	80,000	
- Labour (1,600 units × ₹ 10)	16,000	
- Overheads (1,600 units × ₹ 30)	48,000	1,44,000

(iv) **Process-I A/c**

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W.I.P:			By Normal Loss (₹20 × 2,000 units)	2,000	40,000
- Materials	2,000	80,000	By Abnormal loss	1,000	72,000
- Labour	--	15,000	By Process-I A/c	35,000	28,00,000
- Overheads	--	45,000	By Closing WIP	2,000	1,44,000
To Materials introduced	38,000	14,80,000			
To Direct Labour		3,59,000			
To Overheads		10,77,000			
	40,000	30,56,000		40,000	30,56,000

Normal Loss A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process-I A/c	2,000	40,000	By Cost Ledger Control A/c	2,000	40,000
	2,000	40,000		2,000	40,000

Abnormal Loss A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process-I A/c	1,000	72,000	By Cost Ledger Control A/c	1,000	20,000
			By Costing Profit & Loss A/c		52,000
	1,000	72,000		1,000	72,000

5. (i) **Process I – Statement of Equivalent Production**

Particulars	Completed Units	Closing stock of WIP			Equivalent Production units
		Units	% of Completion	Equivalent Units	
	(1)			(2)	(1) + (2)
Material	30,000	10,000	100%	10,000	40,000
Wages	30,000	10,000	50%	5,000	35,000
Overhead	30,000	10,000	50%	5,000	35,000

Process I

Particulars	Process Cost (₹)	Equivalent Production (units)	Process Cost p.u. (2)/(3)	WIP stock Equivalent units	Cost of WIP Stock (₹) (4) x (5)	Transfer to Process II (2)-(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Material	15,000	40,000	0.375	10,000	3,750	11,250
Wages	18,000	35,000	0.514	5,000	2,570	15,430
Overhead	12,000	35,000	0.343	5,000	1,715	10,285
	45,000				8,035	36,965

Process I A/c

	Particulars	Unit	(₹)		Particulars	Units	(₹)
To	Direct material	40,000	15,000	By	Process II A/c	30,000	36,965
To	Direct wages	--	18,000	By	Closing W-I-P	10,000	8,035
To	Factory overhead	--	12,000			--	--
		40,000	45,000			40,000	45,000

(ii) **Process II – Statement of Equivalent Production**

Particulars	Completed Units	Closing stock of WIP			Equivalent Production units
		Units	% of Completion	Equivalent Units	
	(1)			(2)	(1) + (2)
Material	28,000	1,800	100%	1,800	29,800
Wages	28,000	1,800	25%	450	28,450
Overhead	28,000	1,800	25%	450	28,450

Process II

Particulars	Process Cost (₹)	Equivalent Production (units)	Process Cost p.u. (2)/(3)	WIP stock Equivalent units	Cost of WIP Stock (₹) (4) x (5)	Transfer to Finished Stock (2)-(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Material	36,965	29,800	1.240	1,800	2,232	34,733
Wages	3,500	28,450	0.123	450	55	3,445
Overhead	4,500	28,450	0.158	450	71	4,429
	44,965				2,358	42,607
Add: Packing Material Cost						4,000
Cost of Finished Stock						46,607

Process II A/c

	Particulars	Units	(₹)		Particulars	Units	(₹)
To	Process I	30,000	36,965	By	Finished Stock	28,000	46,607
To	Direct wages	--	3,500	By	Normal loss	200	--
To	Factory overhead	--	4,500	By	WIP stock	1,800	2,358
To	Packing charges	--	4,000				
		30,000	48,965			30,000	48,965

6. (i) **Statement of Equivalent Production**

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Sugarcane		Labour & O.H.	
				%	Units	%	Units
Opening WIP	4,500	Completed and transferred to Process - II	39,500	100	39,500	100	39,500
Units introduced	1,00,000	Normal Loss (55%* of 1,00,000)	55,000	--	--	--	--
		Abnormal loss	1,000	100	1,000	80	800
		Closing WIP	9,000	100	9,000	80	7,200
	1,04,500		1,04,500		49,500		47,500

* 100 kg of sugarcane extracts only 45 litre of juice.

Thus, normal loss = $100 - 45 = 55\%$

(ii) **Statement showing cost for each element**

Particulars	Sugarcane (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	50,000	15,000	45,000	1,10,000
Cost incurred during the month	5,00,000	2,00,000	6,00,000	13,00,000
Total cost: (A)	5,50,000	2,15,000	6,45,000	14,10,000
Equivalent units: (B)	49,500	47,500	47,500	
Cost per equivalent unit: (C) = (A ÷ B)	11.111	4.526	13.579	29.216

(iii) Statement of Distribution of cost

		Amount (₹)	Amount (₹)
1.	Value of units completed and transferred (39,500 units × ₹ 29.216)		11,54,032
2.	Value of Abnormal Loss:		
	- Sugarcane (1,000 units × ₹ 11.111)	11,111	
	- Labour (800 units × ₹ 4.526)	3,621	
	- Overheads (800 units × ₹ 13.579)	10,863	25,595
3.	Value of Closing W-I-P:		
	- Sugarcane (9,000 units × ₹ 11.111)	99,999	
	- Labour (7,200 units × ₹ 4.526)	32,587	
	- Overheads (7,200 units × ₹ 13.579)	97,769	2,30,355

(iv) Process-I A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W.I.P:			By Normal Loss	55,000	--
- Sugarcane	4,500	50,000	By Abnormal loss [₹ 25,595 + ₹ 18 (difference due to approximation)]	1,000	25,613
- Labour	--	15,000	By Process-II A/c	39,500	11,54,032
- Overheads	--	45,000	By Closing WIP	9,000	2,30,355
To Sugarcane introduced	100,000	5,00,000			
To Direct Labour		2,00,000			
To Overheads		6,00,000			
	104,500	14,10,000		104,500	14,10,000

ANSWERS TO THE CASE SCENARIOS

1.

i.	(d)	ii.	(a)	iii.	(b)	iv.	(a)	v.	(c)

i. d

Inflow into process	Litres	Outflow from process	Litres
Opening WIP	500	Transferred to finished goods	3,400
Quantity introduced (Balancing figure)	3,800	Total loss	800
		Closing WIP	100
	4,300		4,300

ii. a

Total loss	800 litres
Normal loss (10% of fresh input i.e. 3,800)	380 litres
Abnormal loss	420 litres

iii. b

Calculation of Equivalent production units

Input Details	Units	Output Particulars	Units	Equivalent Production					
				Material		Labour		Overheads	
				%	Units	%	Units	%	Units
Opening WIP	500	From Opening WIP	500	-	-	20	100	40	200
Fresh inputs	3,800	From fresh units	2900	100	2900	100	2900	100	2900
		Normal loss	380	-	-	-	-	-	-
		Closing WIP	100	100	100	20	20	10	10
		Abnormal loss	420	100	420	100	420	100	420
	4,300		4,300		3,420		3,440		3,530

Value of raw materials introduced during the month

	Equivalent units	Cost per EU (₹)	Total cost (₹)
Total value of raw material	3420	300	10,26,000
Add: Scrap value of normal loss	380	20	7,600
Value of raw material introduced			10,33,600

iv. a Value of labour and overhead in closing Work in process

Cost elements	Equivalent units	Cost per EU (₹)	Total cost (₹)
Labour	20	200	4,000
Overheads	10	160	1,600

v. c Value of output transferred to finished goods

Output transferred (Units) × Equivalent cost per unit

3,400 Litres × ₹660 = ₹22,44,000

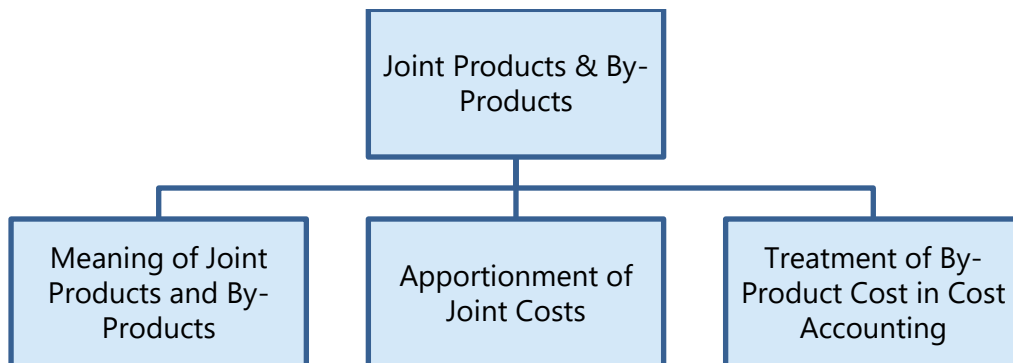
JOINT PRODUCTS AND BY PRODUCTS



LEARNING OUTCOMES

- ◆ Discuss the meaning of Joint products and By products.
- ◆ Differentiate between joint products and by products.
- ◆ Discuss the various methods of apportionment of joint costs to joint products and to by products.
- ◆ State the treatment of by product's cost in cost accounting.

CHAPTER OVERVIEW





1. MEANING OF JOINT PRODUCTS AND BY PRODUCTS

Agricultural product industries, chemical process industries, sugar industries, and extractive industries are some of the industries where two or more products of equal or unequal importance are produced either simultaneously or in the course of processing operation of a main product.

In all such industries, the management is faced with the problems such as, valuation of inventory, pricing of product and income determination, problem of taking decision in matters of further processing of by-products and/or joint products after a certain stage etc. In fact, the various problems relate to

- (i) apportionment of common costs incurred for various products and
- (ii) aspects other than mere apportionment of costs incurred upto the point of separation.

Before taking up the above problems, we first define the various necessary concepts.

(i) Joint Products - Joint products represent **"two or more products separated in the course of the same processing operation** usually requiring further processing, each product being in such proportion that no single product can be designated as a major product".

In other words, two or more products of equal importance, produced, simultaneously from the same process, with each having a significant relative sale value are known as joint products. For example, in the oil industry, gasoline, fuel oil, lubricants, paraffin, coal tar, asphalt and kerosene are all produced from crude petroleum. These are known as joint products.

(ii) By-Products - These are defined as **"products recovered from material discarded in a main process**, or from the production of some major products, where the material value is to be considered at the time of severance from the main product." So in a nutshell By product is a ***product which is recovered incidentally from the material used in the manufacture of main or desired products, such a by-product having either a net realisable value or a usable value which is relatively insignificant in comparison with the saleable value of the main or desired products. By-product may be further processed to***

increase their realisable value Thus by-products emerge as a result of processing operation of another product or they are produced from the scrap or waste of materials of a process. In short a by-product is a secondary or subsidiary product which emanates as a result of manufacture of the main product.

The point at which they are separated from the main product or products is known as split-off point. The expenses of processing are joint till the split –off point.

Split of Point – this is a point in a production process where joint products emerging from the process gets separately identifiable.

Split of Point has its importance in the joint product costing as joint cost incurred up to this point only and needs to be borne jointly by the products emerging from the common process.

Any cost incurred after Split of Point is a product specific cost and to be borne by the product concerned.

Examples of by-products are molasses in the manufacture of sugar, tar, ammonia and benzole obtained on carbonisation of coal and glycerin obtained in the manufacture of soap.

Distinction between Joint-Product and By-Product - The main points of distinction as apparent from the definitions of Joint Products and By-Products are:

- (a) Joint products are of equal importance whereas by-products are of small economic value.
- (b) Joint products are produced simultaneously but the by-products are produced incidentally in addition to the main products.

(iii) Co-Products - Joint products and co-products are used synonymously in common parlance, but strictly speaking a distinction can be made between two. Co-products may be defined as **two or more products which are contemporary but do not emerge necessarily from the same material in the same process**. For instance, wheat and gram produced in two separate farms with separate processing of cultivation are the co-products. Similarly, timber boards made from different trees are co-products.

2. APPORTIONMENT OF JOINT COSTS

Joint product costs occur in many industries such as petroleum, oil refinery, textiles, dairy, food processing and many other process industries. The management of business concerns require accurate and reliable cost information related with the joint products to make managerial decisions such as to process further or to sell at split-off stage. To arrive at either decision, it is necessary to know the share of joint costs to be apportioned to the different joint products.

Joint costs are the expenditures incurred upto the point of separation i.e. split-off point. Joint Cost is the resources spent by a manufacturer/producer for producing more than one product from processing a common input. These costs include raw material, labour, power, fuel, depreciation and overhead costs towards the production of the joint products.

The main problem faced in the case of joint products/ by-products is the apportionment of this joint costs to joint products/ or by products. For costs incurred after the split off point there is no problem, as these costs can be directly allocated to individual joint products or by-products.

3. METHODS OF APPORTIONMENT OF JOINT COST TO JOINT PRODUCTS

Proper apportionment of joint cost over the joint products is of considerable importance, as this affects (a) Valuation of closing inventory; (b) Pricing of products; and (c) Profit or loss on the sale of different products. **As the relations between materials, processes and joint products are complex and unobservable, there is no way to determine the cost of the different production factors used in the processes for the production of each of the joint products. Therefore, the costs incurred in the manufacture of each of the joint products cannot be correctly identified.**

It can only be apportioned to the joint products by using some rational methods

The commonly used methods for apportioning total process costs upto the point of separation over the joint products are as follows:

- (i) **Physical Units Method**
- (ii) **Net Realisable Value at split-off point**
- (iii) **Using Technical Estimates**

Some other methods, which managers may also use for making decisions are:

- (i) Market value at the point of separation
- (ii) Market value after further processing
- (iii) Average unit cost method
- (iv) Contribution margin method

(i) Physical Unit Method: This method is based on the assumption that the joint products are capable of being measured in the same units. Accordingly, **joint costs here are apportioned on the basis of some physical base, such as weight, numbers etc.** In other words, the basis used for apportioning joint cost over the joint products is the physical volume the joint products at the point of separation. Any loss arises during the joint production process is also apportioned over the products on the same basis.. ***In situation where physical units are different, the joint products must be converted to a common unit of measurement. In case, the same cannot be converted to a common unit of measurement, this method cannot be applied.*** The main defect of this method is that it gives equal importance and value to all the joint products.

This method of apportioning is mostly followed when sale price of all the products is uniform.

ILLUSTRATION 1

A coke manufacturing company produces the following products by using 5,000 tonnes of coal @ ₹1,100 per tonne into a common process.

Coke	3,500 tonnes
Tar	1,200 tonnes
Sulphate of ammonia	52 tonnes
Benzol	48 tonnes

PREPARE a statement apportioning the joint cost amongst the products on the basis of the physical unit method.

SOLUTION

	Products					
	Coke	Tar	Sulphate of ammonia	Benzole	Wastage	Total
Output (in tonne)	3,500	1,200	52	48	200	5,000
Wastage (in tonne) (Refer Note-1)	146	50	2	2	(200)	
Input (in tonne)	3,646	1,250	54	50	-	5,000
Share of Joint Cost @ ₹1,100 per tonne (in ₹)	40,10,600	13,75,000	59,400	55,000	-	55,00,000

Note-1: Apportionment of wastage of 200 tonnes over the four products on the basis of physical weights (3,500:1,200:52:48) is as follows:

$$\text{Coke:} \quad \frac{200}{4,800} \times 3,500 \text{ tonnes} = 146 \text{ tonnes}$$

$$\text{Tar:} \quad \frac{200}{4,800} \times 1,200 \text{ tonnes} = 50 \text{ tonnes}$$

$$\text{Sulphate of ammonia:} \quad \frac{200}{4,800} \times 52 \text{ tonnes} = 2 \text{ tonnes}$$

$$\text{Benzole:} \quad \frac{200}{4,800} \times 48 \text{ tonnes} = 2 \text{ tonnes}$$

(ii) Net Realisable Value at Split-off Point Method: *To arrive at the sales value at the split-off point, following are deducted from the sales value of joint products at final stage i.e. after processing:*

(i) *directly attributable Selling and distribution expenses like freight, royalty, commission, etc. and*

(ii) *Post split- off processing cost.*

This method has advantage as relative sales value serves as a proxy for relative benefit received by each product from the joint cost. When selling prices for all products exist at split off, the sales value at split off method is the preferred technique. It is a relatively simple technique that depends on a common basis for cost allocation – revenues

The resultant figure so obtained is known as net realisable value of joint products. Joint costs are apportioned in the ratio of net realisable value.

	Product- A Amount (₹)	Product- B Amount (₹)	Product- C Amount (₹)
Sales Value (Units after processing × Selling Price)	xxx	xxx	xxx
Less: Profit Margin	(xxx)	(xxx)	(xxx)
Less: Selling & Distribution costs	(xxx)	(xxx)	(xxx)
Less: Post split-off cost	(xxx)	(xxx)	(xxx)
Net Realisable Value	xxx	xxx	xxx

Example -1: An entity incurs a joint cost of ₹ 64,500 in producing two products A (200 units) and B (200 units) and earns a sales revenue of ₹ 86,000 by selling @ ₹ 170 per unit of product A and product B @ ₹ 260 per unit. Further processing costs for products A and B are ₹ 4,000 and ₹ 32,000 respectively the Joint cost can be apportioned to products A and B as follows:

	Product- A Amount (₹)	Product- B Amount (₹)
Sales Value	34,000 (₹170 × 200 units)	52,000 (₹260 × 200 units)
Less: Post split-off cost (Further processing cost)	(4,000)	(32,000)
Net Realisable Value	30,000	20,000
Apportionment of Joint Cost of ₹64,500 in ratio of 3:2	38,700	25,800

The net realisable value at split-off point method is widely used in the industries. **This method is used when the realisable value of joint products at split-off is not known.**

(iii) Using Technical Estimates: This method uses technical estimates to apportion the joint costs over the joint products. This method is used when the result obtained by the above methods does not match with the resources consumed by joint products or the realisable value of the joint products are not readily available.

Other Methods

The followings are the methods which are used by management for taking managerial decisions:

(i) Market value at the point of separation: This method is used for the apportionment of joint costs to joint products upto the split off point. It is difficult to apply this method if the market value of the products at the point of separation is not available. **It is a useful method when the realisable value of joint products at split-off (point of separation) is known and where further processing costs are incurred disproportionately.**

To determine the apportionment of joint costs over joint products, a factor known as multiplying factor is determined. This multiplying factor on multiplication with the sales values of each joint product gives rise to the proportion of joint cost.

$$\text{Multiply in factor} : \frac{\text{Joint Cost}}{\text{Total Sales Revenue}} \times 100$$

Total Sales Revenue is sum of production quantity multiplied by the market price for each of the joint products.

Example – 2: An entity incurs a joint cost of ₹ 64,500 in producing two products A (200 units) and B (200 units) and earns a sales revenue of ₹ 86,000 by selling @ ₹ 170 per unit of product A and product B @ ₹ 260 per unit.

The multiplying factor in this case is obtained by dividing the total joint cost by total sales revenue and finally multiplying the figure so obtained by 100. The multiplying factor based on the data can be computed as follows:

$$\text{Multiplying Factor: } \frac{\text{₹ } 64,500}{\text{₹ } 86,000} \times 100 = 75\%$$

$$\begin{aligned} \text{Joint cost apportioned over product A} &= \text{Sales revenue of product A} \times 75\% \\ &= \text{₹ } 34,000 \times 75\% = \text{₹ } 25,500 \end{aligned}$$

$$\begin{aligned} \text{Joint cost apportioned over product B} &= \text{Sales revenue of product B} \times 75\% \\ &= \text{₹ } 52,000 \times 75\% = \text{₹ } 39,000 \end{aligned}$$

Alternatively - This joint cost may be apportioned in the ratio of sales values of different joint products.

(ii) Market value after further processing: Here the basis of apportionment of joint cost is the total sales value of finished products and involves the same principle as discussed above.

Example – 3: Suppose that in the example – 2 given above, if sales prices of products A and B after further processing are ₹ 200 and ₹ 300 respectively the joint cost apportioned over Products A and B is as follows:

The pre-separation costs of ₹ 64,500 will be apportioned in the ratio of (2: 3) as follows:

Market sales value after further processing

	(₹)
A : 200 units × ₹ 200	= 40,000
B : 200 units × ₹ 300	= <u>60,000</u>
	<u>1,00,000</u>

Joint cost apportionment:

$$\begin{aligned} \text{A} &= \text{₹ } 64,500 \times \frac{\text{₹ } 40,000}{\text{₹ } 1,00,000} = \text{₹ } 25,800 \\ \text{B} &= \text{₹ } 64,500 \times \frac{\text{₹ } 60,000}{\text{₹ } 1,00,000} = \text{₹ } 38,700 \end{aligned}$$

The use of this method is unfair where further processing costs after the point of separation are disproportionate or when all the joint products are not subjected to further processing. The net realisable value method which is discussed as above overcomes the shortcoming of this method.

(iii) Average Unit Cost Method: Under this method, total process cost (upto the point of separation) is divided by total units of joint products produced. On division average cost per unit of production is obtained.

Average unit cost = Total process cost (upto the point of separation) ÷ Total units of joint product produced.

This is a simple method. The effect of application of this method is that **all joint products will have uniform cost per unit**. If this method is used as the basis for price fixation, then all the products may have more or less the same price. Under this method customers of high quality items are benefitted as they have to pay less price on their purchase.

[Note: Students may note that the physical unit method also follows the same steps of calculation as followed under Average unit cost method, ultimately giving the same outcome.]

ILLUSTRATION 2

FIND OUT the cost of joint products A, B and C using average unit cost method from the following data:

(a) Pre-separation Joint Cost ₹ 60,000

(b) Production data:

Products	Units produced
A	500
B	200
C	<u>300</u>
	<u>1,000</u>

SOLUTION

$$\text{Average cost per unit} = \frac{\text{Total joint costs}}{\text{Units produced}} = \frac{\text{₹ 60,000}}{1,000 \text{ units}} = \text{₹ 60}$$

The joint costs apportioned @ ₹ 60 are as follows:

Products	Units	Cost per unit (₹)	Value (₹)
A	500	60	30,000
B	200	60	12,000
C	300	60	18,000
			60,000

(iv) Contribution Margin Method: According to this method, joint costs are segregated into two parts - variable and fixed. The variable costs are apportioned over the joint products on the basis of units produced (average method) or physical quantities. In case the products are further processed after the point of separation, then all variable cost incurred be added to the variable costs determined earlier. In this way total variable cost is arrived which is deducted from their respective sales values to ascertain their contribution. The fixed costs are then apportioned over the joint products on the basis of the contribution ratios.

Summary of different types of method of apportioning joint costs that can be used under certain circumstances:

Physical Unit Method	When sale price of all the products is uniform.
Net Realisable Value (NRV) at Split-off Point Method	When the realisable value of joint products at split-off is not known.
Technical Estimates	When the result obtained by Net Realisable Value (NRV) at Split-off Point Method does not match with the resources consumed by joint products.
Market value at the point of separation	Where further processing costs are incurred disproportionately.
Market value after further processing	Where further processing costs after the point of separation are proportionate and all the joint products are subject to further processing.
Average Unit Cost Method	When units produced have same unit.

ILLUSTRATION 3

FIND OUT the cost of joint products A and B using contribution margin method from the following data :

Sales

A : 100 kg @ ₹ 60 per kg.

B : 120 kg @ ₹ 30 per kg.

Joint costs

Marginal cost ₹ 4,400

Fixed cost ₹ 3,900

SOLUTION

The marginal cost (variable cost) of ₹ 4,400 is apportioned over the joint products A and B in the ratio of their physical quantity i.e 100 : 120

$$\text{Marginal cost for Product A : ₹ 4,400} \times \frac{100}{220} = ₹ 2,000$$

$$\text{Marginal cost for Product B : ₹ 4,400} \times \frac{120}{220} = ₹ 2,400$$

The fixed cost of ₹ 3,900 is apportioned over the joint products A and B in the ratio of their contribution margin i.e. 40 : 12

(Refer to working note)

$$\text{Product A : ₹ 3,900} \times \frac{40}{52} = ₹ 3,000$$

$$\text{Product B : ₹ 3,900} \times \frac{12}{52} = ₹ 900$$

Working Note:

Computation of contribution margin ratio

Products	Sales revenue	Marginal cost	Contribution
	(₹)	(₹)	(₹)
A	6,000	2,000	4,000
B	3,600	2,400 (Refer to above)	1,200

Contribution ratio is 40 : 12

ILLUSTRATION 4

Inorganic Chemicals purchases salt and processes it into more refined products such as Caustic Soda, Chlorine and PVC. In the month of July, Inorganic Chemicals purchased Salt for ₹ 40,000. Conversion cost of ₹ 60,000 were incurred upto the split off point, at which time two sealable products were produced. Chlorine can be further processed into PVC.

The July production and sales information is as follows:

	Production (in tonne)	Sales Quantity (in tonne)	Selling price per tonne (₹)
Caustic Soda	1,200	1,200	50
Chlorine	800	—	—
PVC	500	500	200

All 800 tonnes of Chlorine were further processed, at an incremental cost of ₹ 20,000 to yield 500 tonnes of PVC. There was no beginning or ending inventories of Caustic Soda, Chlorine or PVC in July.

There is active market for Chlorine. Inorganic Chemicals could have sold all its July production of Chlorine at ₹ 75 per tonne.

Required :

- (1) *SHOW how joint cost of ₹1,00,000 would be apportioned between Caustic Soda and Chlorine under each of following methods:*
 - (a) *sales value at split- off point ;*
 - (b) *physical unit method, and*
 - (c) *estimated net realisable value.*
- (2) *Lifetime Swimming Pool Products offers to purchase 800 tonnes of Chlorine in August at ₹ 75 per tonne. This sale of Chlorine would mean that no PVC would be produced in August. EXPLAIN how the acceptance of this offer for the month of August would affect operating income?*

SOLUTION**1. (a) Sales value at split-off point method**

Products	Sales (in Tonne)	Selling Price per Tonne (₹)	Sales Revenue (₹)	Joint Cost Apportioned (₹)
Caustic Soda	1,200	50	60,000	50,000
Chlorine	800	75	60,000	50,000
			1,20,000	1,00,000

Apportionment of joint cost

$$= \frac{\text{Total joint cost}}{\text{Total sale value}} \times \text{Sale revenue of each product}$$

$$\begin{aligned} \text{Joint cost apportioned to Caustic Soda} &= \frac{\text{₹ } 1,00,000}{\text{₹ } 1,20,000} \times \text{₹ } 60,000 \\ &= \text{₹ } 50,000 \end{aligned}$$

$$\begin{aligned} \text{Joint cost apportioned to Chlorine} &= \frac{\text{₹ } 1,00,000}{\text{₹ } 1,20,000} \times \text{₹ } 60,000 \\ &= \text{₹ } 50,000 \end{aligned}$$

(b) Physical measure method

Products	Sales (in Tonne)	Joint Cost Apportioned (₹)
Caustic Soda	1,200	60,000
Chlorine	800	40,000
		1,00,000

Apportioned joint cost

$$= \frac{\text{Total joint cost}}{\text{Total physical value}} \times \text{Physical units of each product}$$

Joint cost apportioned to Caustic Soda

$$\begin{aligned} &= \frac{\text{₹ } 1,00,000}{2,000 \text{ tonnes}} \times 1,200 \text{ tonnes} \\ &= \text{₹ } 60,000 \end{aligned}$$

$$\begin{aligned}\text{Joint cost apportioned to chlorine} &= \frac{\text{₹ } 1,00,000}{2,000 \text{ tonnes}} \times 800 \text{ tonnes} \\ &= \text{₹ } 40,000\end{aligned}$$

(c) Estimated net realisable value method:

	Caustic Soda Amount (₹)	Chlorine Amount (₹)
Sales Value	60,000 (₹50 × 1,200 tonnes)	1,00,000 (₹200 × 500 tonnes)
Less: Post split-off cost (Further processing cost)	-	(20,000)
Net Realisable Value	60,000	80,000
Apportionment of Joint Cost of ₹1,00,000 in ratio of 3:4	42,857	57,143

2. Incremental revenue from further processing of Chlorine into PVC

$$(500 \text{ tonnes} \times \text{₹ } 200 - 800 \text{ tonnes} \times \text{₹ } 75) \quad \text{₹ } 40,000$$

$$\text{Less : Incremental cost of further processing of Chlorine into PVC} \quad \underline{\text{₹ } 20,000}$$

$$\text{Incremental operating income from further processing} \quad \underline{\text{₹ } 20,000}$$

The operating income of Inorganic Chemicals will be reduced by ₹20,000 in August if it sells 800 tonnes of Chlorine to Lifetime Swimming Pool Products, instead of further processing of Chlorine into PVC for sale.

4. METHODS OF APPORTIONMENT OF JOINT COST TO BY PRODUCTS

The following methods may be adopted for the accounting of by-products and arriving at the cost of production of the main product:

(i) Net Realisable Value method: The realisation on **the disposal of the by-product may be deducted from the total cost of production** so as to arrive at the cost of the main product. For example, the amount realised by the sale of molasses in a sugar factory goes to reduce the cost of sugar produced in the factory.

When the by-product requires some additional processing and expenses are incurred in making it saleable to the best advantage of the concern, the expenses so incurred should be deducted from the total value realised from the sale of the by-product and only the net realisations should be deducted from the total cost of production to arrive at the cost of production of the main product. Separate accounts should be maintained for collecting additional expenses incurred on:

- (a) further processing of the by-product, and
- (b) selling, distribution and administration expenses attributable to the by-product.

(ii) Standard cost in Technical Estimates: By-products may be valued at standard costs. The standard may be determined by averaging costs recorded in the past and making technical estimates of the number of units of original raw material going into the main product and the number forming the by-product or by adopting some other consistent basis.

This method may be adopted where the by-product is not saleable in the condition in which it emerges or comparative prices of similar products are not available.

(iii) Comparative price: Under this method, the value of the by-product is ascertained with reference to the price of a similar or an alternative material.

Suppose in a large automobile plant, a blast furnace not only produces the steel required for the car bodies but also produces gas which is utilised in the factory. This gas can be valued at the price which would have been paid to a gas company if the factory were to buy it from outside sources.

(iv) Re-use basis: In some cases, the by-product may be of such a nature that it can be reprocessed in the same process as part of the input of the process. In that case the value put on the by-product should be same as that of the materials introduced into the process. If, however, the by-product can be put into an earlier process only, the value should be the same as for the materials introduced into the process.



5. TREATMENT OF BY-PRODUCT COST IN COST ACCOUNTING

By-product cost can be dealt in cost accounting in the following ways:

(a) When they are of small total value: When the by-products are of small total value, the amount realised from their sale **may be dealt in any one the following two ways:**

1. The sales value of the by-products may be **credited to the Costing Profit and Loss Account** and no credit be given in the Cost Accounts. The credit to the Costing Profit and Loss Account here is treated either as miscellaneous income or as additional sales revenue.
2. The sale proceeds of the by-product may be **treated as deductions from the total costs**. The sale proceeds in fact should be deducted either from the production cost or from the cost of sales.

(b) When the by-products are of considerable total value: Where by-products are of considerable total value, **they may be regarded as joint products rather than as by-products**. To determine exact cost of by-products the costs incurred upto the point of separation, should be apportioned over by-products and joint products by using a logical basis. In this case, the joint costs may be divided over joint products and by-products by using relative market values; physical output method (at the point of split off) or ultimate selling prices (if sold).

(c) Where they require further processing: In this case, the net realisable value of the by-product at the split-off point may be arrived at by subtracting the further processing cost from the realisable value of by-products.

If total sales value of by-products at split-off point is small, it may be treated as per the provisions discussed above under (a).

In the contrary case, the amount realised from the sale of by-products will be considerable and thus it may be treated as discussed under (b).

SUMMARY

- ◆ **Joint Products.** Two or more products of equal importance, produced, simultaneously from the same process, with each having a significant relative sale value are known as joint products.
- ◆ **Co-Products.** Two or more products which are contemporary but do not emerge necessarily from the same material in the same process.
- ◆ **By-Products.** Products recovered from material discarded in a main process, or from the production of some major products.
- ◆ **Methods of apportioning joint cost over joint products:**

The commonly used methods for apportioning total process costs upto the point of separation over the joint products are as follows:

 - (i) Physical Units Method
 - (ii) Net Realisable Value at split-off point
 - (iii) Using Technical Estimates

Some other methods, which managers may also use for making decisions are:

 - (i) Market value at the point of separation
 - (ii) Market value after further processing
 - (iii) Average unit cost method
 - (iv) Contribution margin method
- ◆ **Methods of apportioning joint cost over by-products:**
 - (i) **Net Realisable Value Method-** The realisation on the disposal of the by-product may be deducted from the total cost of production so as to arrive at the cost of the main product.
 - (ii) **Standard cost in technical estimates-** The standard may be determined by averaging costs recorded in the past and making technical estimates of the number of units of original raw material going into the main product and the number forming the by-product or by adopting some other consistent basis.

This method may be adopted where the by-product is not saleable in the condition in which it emerges or comparative prices of similar products are not available.

- (iii) **Comparative price-** Value of the by-product is ascertained with reference to the price of a similar or an alternative material.
- (iv) **Re-use basis-** The value put on the by-product should be same as that of the materials introduced into the process.

♦ **Treatment of By-Product Cost in Cost-Accounting**

(i) **When they are of small total value:**

1. The sales value of the by-products **may be credited to the Profit and Loss Account** and no credit be given in the Cost Accounts. The credit to the Profit and Loss Account here is treated either as miscellaneous income or as additional sales revenue.
2. The sale proceeds of the by-product **may be treated as deductions from the total costs.** The sale proceeds in fact should be deducted either from the production cost or from the cost of sales.

(ii) **When the by-products are of considerable total value - The joint costs may be divided over joint products and by-products** by using relative market values; physical output method (at the point of split off) or ultimate selling prices (if sold).

(iii) **Where they require further processing** -The net realisable value of the by-product at the split-off point may be arrived at by subtracting the further processing cost from the realisable value of by-products.

If total sales value of by-products at split-off point is small, it may be treated as per the provisions discussed above under (i).

In the contrary case, the amount realised from the sale of by-products will be considerable and thus it may be treated as discussed under (ii).

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *In sugar manufacturing industries molasses is also produced along with sugar. Molasses may be of smaller value as compared with the value of sugar and is known as:*
 - (a) *Common product*
 - (b) *By- product*
 - (c) *Joint product*
 - (d) *None of them*
2. *Method of apportioning joint costs on the basis of output of each joint product at the point of split off is:*
 - (a) *Sales value method*
 - (b) *Physical unit method*
 - (c) *Average cost method*
 - (d) *Marginal cost and contribution method*
3. *In the Net realisable value method, for apportioning joint costs over the joint products, the basis of apportionment would be:*
 - (a) *Selling price per unit of each of the joint products*
 - (b) *Selling price multiplied by units sold of each of the joint products*
 - (c) *Sales value of each joint product less further processing costs of individual products*
 - (d) *Both (b) and (c)*
4. *The main purpose of accounting of joint products and by- products is to:*
 - (a) *Determine the opportunity cost*
 - (b) *Determine the replacement cost*
 - (c) *Determine profit or loss on each product line*
 - (d) *None of the above*

5. *Under net realizable value method of apportioning joint costs to joint products, the selling & distribution cost is:*
 - (a) *Added to joint cost*
 - (b) *Deducted from further processing cost*
 - (c) *Deducted from sales value*
 - (d) *Ignored*
6. *Which of the following is a co-product:*
 - (a) *Diesel and Petrol in an oil refinery*
 - (b) *Edible oils and oil cakes*
 - (c) *Curd and butter in a dairy*
 - (d) *Mustard oil and Sunflower oil in an oil processing company.*
7. *Which of the following is an example of by-product*
 - (a) *Diesel and Petrol in an oil refinery*
 - (b) *Edible oils and oil cakes*
 - (c) *Curd and butter in a dairy*
 - (d) *Mustard seeds and mustard oil.*
8. *Which of following method can be used when the joint products are of unequal quantity and used for captive consumption:*
 - (a) *Technical estimates, using market value of similar goods*
 - (b) *Net Realisable value method*
 - (c) *Physical Units method*
 - (d) *Market value at split-off method.*
9. *Which of the following statement is not correct in relation to Co-products:*
 - (a) *Co-products may also have joint products*
 - (b) *Costing for co-products are done according to process costing method*

- (c) Co-products do not have any by-products
 - (d) Co-products are treated as a separate cost object for costing purpose.
10. When a by-product does not have any realisable value, the cost of by-product is:
- (a) Transferred to Costing Profit & Loss A/c
 - (b) By-product cost is borne by the good units
 - (c) By-product cost is ignored
 - (d) By-product cost is determined taking value of similar goods
11. SG Ltd manufactures two products from a joint milling process. The two products developed are Mine support (MS) and Commercial building (CB). A standard production run incurs joint costs of ₹ 1,00,000 and results in 60,000 units of MS and 90,000 units of CB. Each MS sells for ₹ 200 per unit, and each CB sells for ₹ 450 per unit.
- Assuming no further processing work is done after the split-off point, the amount of joint cost allocated to Commercial building (CB) on a physical quantity allocation basis would be:
- (a) ₹ 60,000.
 - (b) ₹ 180,000.
 - (c) ₹ 225,000.
 - (d) ₹ 120,000.
12. Kay Company manufactures two hair care lotions, Livi and Sili, out of a joint process. The joint (common) costs incurred are ₹ 6,30,000 for a standard production run that generates 1,80,000 gallons of Livi and 1,20,000 gallons of Sili. Livi sells for ₹ 240 per gallon, and Sili sells for ₹ 390 per gallon.
- If additional processing costs beyond the split-off point are ₹ 140 per gallon for Livi and ₹ 90 per gallon for Sili, the amount of joint cost of each production run allocated to Livi on a physical-quantity basis is:
- (a) ₹ 340,000.
 - (b) ₹ 378,000.

- (c) ₹ 232,000.
 - (d) ₹ 580,000.
13. *For the purpose of allocating joint costs to joint products, the sales price at point of sale, reduced by cost to complete after split-off, is assumed to be equal to the:*
- (a) *Joint costs*
 - (b) *Sales price less a normal profit margin at point of sale*
 - (c) *Net sales value at split off*
 - (d) *Total costs.*

Theoretical Questions

1. *DISTINGUISH between Joint products and By-products.*
2. *DISCUSS the treatment of byproduct cost in Cost Accounting.*
3. *How apportionment of joint costs upto the point of separation amongst the joint products using net realizable value method is done? DISCUSS.*
4. *DESCRIBE briefly, how joint costs upto the point of separation may be apportioned amongst the joint products under the following methods:*
 - (i) *Average unit cost method*
 - (ii) *Contribution margin method*
 - (iii) *Market value at the point of separation*
 - (iv) *Market value after further processing*
 - (v) *Net realizable value method.*

Practical Problems

1. *Smile company produces two main products and a by-product out of a joint process. The ratio of output quantities to input quantities of direct material used in the joint process remains consistent on yearly basis. Company has employed the physical volume method to allocate joint production costs to the main products. The net realizable value of the by-product is used to reduce the joint production costs before the joint costs are allocated to the*

main products. Details of company's operation are given in the table below. During the month, company incurred joint production costs of ₹ 10,00,000/- The main products are not marketable at the split off point and thus have to be processed further.

Particulars	Product-A	Product-B	By product
Monthly output in kg.	60,000	1,20,000	50,000
Selling price per kg.	₹ 50	₹ 30	₹ 5
Process costs	₹ 2,00,000	₹ 3,00,000	

FIND OUT the amount of joint product cost that Smile company would allocate to the product-B by using the physical volume method to allocate joint production costs?

2. Sun-moon Ltd. produces and sells the following products:

Products	Units	Selling price at split-off point (₹)	Selling price after further processing (₹)
A	2,00,000	17	25
B	30,000	13	17
C	25,000	8	12
D	20,000	10	-
E	75,000	14	20

Raw material costs ₹35,90,000 and other manufacturing expenses cost ₹ 5,47,000 in the manufacturing process which are absorbed on the products on the basis of their 'Net realisable value'. The further processing costs of A, B, C and E are ₹ 12,50,000; ₹ 1,50,000; ₹ 50,000 and ₹ 1,50,000 respectively. Fixed costs are ₹ 4,73,000.

You are required to PREPARE the following in respect of the coming year:

- Statement showing income forecast of the company assuming that none of its products are to be further processed.
- Statement showing income forecast of the company assuming that products A, B, C and E are to be processed further.

Can you suggest any other production plan whereby the company can maximise its profits? If yes, then submit a statement showing income forecast arising out of adoption of that plan.

3. 'Buttery Butter' is engaged in the production of Buttermilk, Butter and Ghee. It purchases processed cream and let it through the process of churning until it separates into buttermilk and butter. For the month of January, 'Buttery Butter' purchased 50 Kilolitre processed cream @ ₹ 100 per 1000 ml. Conversion cost of ₹ 1,00,000 were incurred up-to the split off point, where two saleable products were produced i.e. buttermilk and butter. Butter can be further processed into Ghee.

The January production and sales information is as follows:

Products	Production (in Kilolitre/tonne)	Sales Quantity (in Kilolitre/tonne)	Selling price per Litre/Kg (₹)
Buttermilk	28	28	30
Butter	20	—	—
Ghee	16	16	480

All 20 tonne of butter were further processed at an incremental cost of ₹ 1,20,000 to yield 16 Kilolitre of Ghee. There was no opening or closing inventories of buttermilk, butter or ghee in the month of January.

Required:

- SHOW how joint cost would be apportioned between Buttermilk and Butter under Estimated Net Realisable Value method.
 - 'Healthy Bones' offers to purchase 20 tonne of butter in February at ₹ 360 per kg. In case 'Buttery Butter' accepts this offer, no Ghee would be produced in February. SUGGEST whether 'Buttery Butter' shall accept the offer affecting its operating income or further process butter to make Ghee itself?
4. NN Manufacturing company uses joint production process that produces three products at the split off point. Joint productions costs during September were ₹ 8,40,000. Product information for September was as follows:

Particulars	Product A	Product B	Product C
Units produced	1,500	3,000	4,500
Units sold	2,000	6,000	7,500
Sales prices:			
At the split-off	₹ 100		
After further processing	₹ 150	₹ 175	₹ 50
Costs to process after split-off	₹ 1,50,000	₹ 1,50,000	₹ 1,50,000

Assume that product C is treated as a by-product and the company accounts for the by-product at net realizable value as a reduction of joint cost. Assume also that Product B&C must be processed further before they can be sold. FIND OUT the total cost of Product A in September if joint cost allocation is based on net realizable values?

5. RST Limited produces three joint products X, Y and Z. The products are processed further. Pre-separation costs are apportioned on the basis of weight of output of each joint product. The following data are provided for a particular month:

Cost incurred up to separation point: ₹ 10,000

	Product X	Product Y	Product Z
Output (in Litre)	100	70	80
	₹	₹	₹
Cost incurred after separation point	2,000	1,200	800

Selling Price per Litre:

After further processing	50	80	60
At pre-separation point (estimated)	25	70	45

You are required to:

- PREPARE a statement showing profit or loss made by each product after further processing using the presently adopted method of apportionment of pre-separation cost.
- ADVISE the management whether, on purely financial consideration, the three products are to be processed further or not.

6. OPR Ltd. purchases crude vegetable oil. It does refining of the same. The refining process results in four products at the split-off point - S, P, N and A. Product 'A' is fully processed at the split-off point. Product S, P and N can be individually further refined into SK, PM, and NL respectively. The joint cost of purchasing the crude vegetable oil and processing it were ₹ 40,000 which is apportioned on the basis of Sales Value at split-off point. Other details are as follows:

Product	Further processing costs (₹)	Sales at split-off point (₹)	Sales after further processing (₹)
S	80,000	20,000	1,20,000
P	32,000	12,000	40,000
N	36,000	28,000	48,000
A	-	20,000	-

You are required to IDENTIFY the products which can be further processed for maximizing profits and make suitable suggestions.

Case Scenarios

1. Pokemon Chocolates manufactures and distributes chocolate products. It purchases Cocoa beans and processes them into two intermediate products:

Chocolate powder liquor base

Milk-chocolate liquor base

These two intermediate products become separately identifiable at a single split off point. Every 500 pounds of cocoa beans yields 20 gallons of chocolate – powder liquor base and 30 gallons of milk-chocolate liquor base.

The chocolate powder liquor base is further processed into chocolate powder. Every 20 gallons of chocolate-powder liquor base yields 200 pounds of chocolate powder. The milk-chocolate liquor base is further processed into milk-chocolate. Every 30 gallons of milk-chocolate liquor base yields 340 pounds of milk chocolate.

Production and sales data for October, 2023 are:

Cocoa beans processed 7,500 pounds

Costs of processing Cocoa beans to split off point ₹ 7,12,500
(including purchase of beans)

	Production	Sales	Selling price
Chocolate powder	3,000 pounds	3,000 pounds	₹ 190 per pound
Milk chocolate	5,100 Pounds	5,100 Pounds	₹ 237.50 per pound

The October, 2023 separable costs of processing chocolate-powder liquor into chocolate powder are ₹ 3,02,812.50. The October 2023 separable costs of processing milk-chocolate liquor base into milk-chocolate are ₹ 6,23,437.50.

Pokemon full processes both of its intermediate products into chocolate powder or milk-chocolate. There is an active market for these intermediate products. In October, 2023, Pokemon could have sold the chocolate powder liquor base for ₹ 997.50 a gallon and the milk-chocolate liquor base for ₹ 1,235 a gallon. You are required to show how the joint cost of ₹ 7,12,500 would be allocated between the chocolate powder and milk-chocolate liquor bases :

- (i) how much joint cost is allocated between the chocolate powder and milk-chocolate liquor bases respectively using Sales value at split off point?
 - (a) ₹ 2,22,656.25 and ₹ 4,89,843.75
 - (b) ₹ 2,49,375 and ₹ 4,63,125
 - (c) ₹ 2,21,587.50 and ₹ 4,90,912.50
 - (d) ₹ 2,85,000 and ₹ 4,27,500
- (ii) how much joint cost is allocated between the chocolate powder and milk-chocolate liquor bases respectively using Physical measure (gallons)?
 - (a) ₹ 2,22,656.25 and ₹ 4,89,843.75
 - (b) ₹ 2,49,375 and ₹ 4,63,125
 - (c) ₹ 2,21,587.50 and ₹ 4,90,912.50

- (d) ₹2,85,000 and ₹4,27,500
- (iii) *how much joint cost is allocated between the chocolate powder and milk-chocolate liquor bases respectively using Estimated net realisable value, (NRV)?*
- (a) ₹2,22,656.25 and ₹4,89,843.75
- (b) ₹2,49,375 and ₹4,63,125
- (c) ₹2,21,587.50 and ₹4,90,912.50
- (d) ₹2,85,000 and ₹4,27,500
- (iv) *What is the constant gross-margin percentage NRV?*
- (a) 8%
- (b) 9%
- (c) 12%
- (d) 12.5%
- (v) *how much joint cost is allocated between the chocolate powder and milk-chocolate liquor bases respectively using Constant gross-margin percentage NRV?*
- (a) ₹2,22,656.25 and ₹4,89,843.75
- (b) ₹2,49,375 and ₹4,63,125
- (c) ₹2,21,587.50 and ₹4,90,912.50
- (d) ₹2,85,000 and ₹4,27,500

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(b)	2.	(b)	3.	(d)	4.	(c)	5.	(c)	6.	(d)
7.	(b)	8.	(a)	9.	(c)	10.	(b)	11.	(a)	12.	(b)
13.	(c)										

Answers to the Theoretical Questions

1. Please refer paragraph 1
2. Please refer paragraph 5
3. Please refer paragraph 3
4. Please refer paragraph 3

Answers to the Practical Problems

1. Calculation of Net joint costs to be allocated:

Particulars	Amount (₹)
Joint Costs	10,00,000
Less: Net Realizable value of by-product (50,000×5)	2,50,000
Net joint costs to be allocated	7,50,000

Therefore, amount of joint product cost that Smile company would allocate to the product-B by using the physical volume method to allocate joint production costs:

$$= \frac{\text{Physical quantity of Product-B}}{\text{Total Quantity}} \times \text{Net joint costs to be allocated}$$

$$= \frac{1,20,000 \text{ units}}{1,80,000 \text{ units}} \times ₹7,50,000 = ₹5,00,000$$

2. Working Note:

Apportionment of joint costs on the basis of Net Realisable Value method

Products	Sales Value (₹)	Post separation Cost (₹)	Net Realisable Value (₹)	Apportioned Cost (₹)
A	50,00,000 (2,00,000 units × ₹ 25)	12,50,000	37,50,000	26,25,000
B	5,10,000 (30,000 units × ₹ 17)	1,50,000	3,60,000	2,52,000
C	3,00,000 (25,000 units × ₹ 12)	50,000	2,50,000	1,75,000

D	2,00,000 (20,000 units × ₹ 10)	—	2,00,000	1,40,000
E	15,00,000 (75,000 units × ₹ 20)	1,50,000	13,50,000	9,45,000
			59,10,000	41,37,000

Total joint cost = Raw material costs + Manufacturing expenses

$$= ₹ 35,90,000 + ₹ 5,47,000 = ₹ 41,37,000$$

Apportioned joint cost

$$= \frac{\text{Total joint cost}}{\text{Total net realisable value}} \times \text{Net realisable value of each product}$$

Apportioned joint cost for Product A

$$= \frac{₹ 41,37,000}{₹ 59,10,000} \times ₹ 37,50,000 = ₹ 26,25,000$$

Similarly, the apportioned joint cost for products B, C, D and E are ₹ 2,52,000, ₹ 1,75,000, ₹ 1,40,000 and ₹ 9,45,000 respectively.

(a) Statement showing income forecast of the company assuming that none of its products are further processed

	Products					Total (₹)
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	
Sales revenue	34,00,000 (₹17 × 2,00,000)	3,90,000 (₹13 × 30,000)	2,00,000 (₹8 × 25,000)	2,00,000 (₹10 × 20,000)	10,50,000 (₹14 × 75,000)	52,40,000
Less: Apportioned Costs (Refer Working note)	26,25,000	2,52,000	1,75,000	1,40,000	9,45,000	41,37,000
	7,75,000	1,38,000	25,000	60,000	1,05,000	11,03,000
Less: Fixed Cost						4,73,000
Profit						6,30,000

- (b) Statement showing income forecast of the company: assuming that products A, B, C and E are further processed (Refer to working note)

	Products					Total (₹)
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	
A. Sales revenue	50,00,000	5,10,000	3,00,000	2,00,000	15,00,000	75,10,000
B. Apportioned Costs	26,25,000	2,52,000	1,75,000	1,40,000	9,45,000	41,37,000
C. Further processing cost	12,50,000	1,50,000	50,000	-	1,50,000	16,00,000
D. Total processing cost (B+ C)	38,75,000	4,02,000	2,25,000	1,40,000	10,95,000	57,37,000
E. Excess of sales revenue (A-D)	11,25,000	1,08,000	75,000	60,000	4,05,000	17,73,000
F. Fixed Cost						4,73,000
G. Profit (E - F)						13,00,000

Suggested production plan for maximising profits:

On comparing the figures of excess of revenue over cost of manufacturing in the above statements one observes that the concern is earning more after further processing of A, C and E products but is loosing a sum of ₹ 30,000 in the case of product B (if it is processed further). Hence the best production plan will be to sell A, C and E after further processing and B and D at the point of split off. The profit statement based on this suggested production plan is as below :

Profit statement based on suggested production plan

	Products					Total (₹)
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)	
A. Sales revenue	50,00,000	3,90,000	3,00,000	2,00,000	15,00,000	73,90,000

B. Apportioned Costs	26,25,000	2,52,000	1,75,000	1,40,000	9,45,000	41,37,000
C. Further processing cost	12,50,000	-	50,000	-	1,50,000	14,50,000
D. Total processing cost (B+ C)	38,75,000	2,52,000	2,25,000	1,40,000	10,95,000	55,87,000
E. Excess of sales revenue (A-D)	11,25,000	1,38,000	75,000	60,000	4,05,000	18,03,000
F. Fixed Cost						4,73,000
G. Profit (E - F)						13,30,000

Hence the profit of the company has increased by ₹ 30,000.

3. (i) Estimated Net Realisable Value Method:

	Buttermilk Amount (₹)	Butter Amount (₹)
Sales Value	8,40,000 (₹ 30 × 28 × 1000)	76,80,000 (₹ 480 × 16 × 1000)
Less: Post split-off cost (Further processing cost)	-	(1,20,000)
Net Realisable Value	8,40,000	75,60,000
Apportionment of Joint Cost of ₹ 51,00,000* in ratio of 1:9	5,10,000	45,90,000

* [(₹ 100 × 50 × 1000) + ₹ 1,00,000] = ₹ 51,00,000

(ii) Incremental revenue from further processing of Butter into Ghee

(₹ 480 × 16 × 1000 - ₹ 360 × 20 × 1000) ₹ 4,80,000

Less: Incremental cost of further processing
of Butter into Ghee ₹ 1,20,000

Incremental operating income from further processing ₹ 3,60,000

The operating income of 'Buttery Butter' will be reduced by ₹ 3,60,000 in February if it sells 20 tonne of Butter to 'Healthy Bones',

instead of further processing of Butter into Ghee for sale. Thus, 'Buttery Butter' is advised not to accept the offer and further process butter to make Ghee itself.

4. Product A can be sold at the split-off point, because the question says that "Products B and C must be processed further before they can be sold." Since product A is not included in that, we know that Product A can be sold at the split-off point. Furthermore, the cost to process Product A after the split-off point is ₹ 150,000, whereas the additional revenue to be earned by processing it further is only ₹75,000 (₹50 increase in selling price per unit multiplied by the 1,500 units produced during September). Therefore, Product A will not be processed further, and we use the sales value at split-off for A for allocating the joint costs. The sales value at the split-off for A is ₹ $100 \times 1,500$ units, or ₹1,50,000.

Since Product B must be processed further, we use its net realizable value for the joint cost allocation. The net realizable value of Product B is ₹3,75,000 [(₹175 selling price after further processing $\times$ 3,000 units produced) – ₹1,50,000 in further processing costs].

Product C, the by-product, must also be processed further to be sold. The net realizable value of Product C is ₹ 75,000 [(₹ 50 sales price after further processing $\times$ 4,500 units produced) – ₹ 1,50,000 in further processing costs].

Joint production costs total ₹ 8,40,000. Since the by-product C is accounted for as a reduction to the joint costs, the joint costs to be allocated are ₹ 7,65,000 (₹ 8,40,000 minus the ₹ 75,000 NRV of Product C), to be allocated between Product A (sales value ₹ 1,50,000) and Product B (net realizable value ₹ 3,75,000). So, the total on which the allocation of the joint costs is based is ₹ $1,50,000 + 3,75,000 = ₹ 5,25,000$. Product A represents 28.571% of the total (₹ $1,50,000 \div ₹ 5,25,000$).

Since Product A has no further processing costs, the total cost of Product A is equal to its allocated joint costs, which are 28.571% of the net joint costs of ₹ 7,65,000, or ₹ 2,18,568.

5. (i) **Statement showing profit/loss by each product after further processing products**

	Product X (in ₹)	Product Y (in ₹)	Product Z (in ₹)
Sales value after further processing	5,000	5,600	4,800
Less: Further processing cost	2,000	1,200	800
Less: Joint Cost* (as apportioned)	4,000	2,800	3,200
Profit/(loss)	(1,000)	1,600	800

* Statement showing apportionment of joint cost on the basis of physical units

	Product X (in ₹)	Product Y (in ₹)	Product Z (in ₹)	Total (₹)
Output (in litre)	100	70	80	250
Weight	0.4 (100/250)	0.28 (70/250)	0.32 (80/250)	
Joint cost apportioned	4,000	2,800	3,200	

(ii) **Decision whether to process further or not**

	Product X (in ₹)	Product Y (in ₹)	Product Z (in ₹)
Incremental Revenue	2,500 [(50-25) × 100]	700 [(80-70) × 70]	1,200 [(60-45) × 80]
Less: Further processing cost	2,000	1,200	800
Incremental profit / (loss)	500	(500)	400

	Product X (in ₹)	Product Y (in ₹)	Product Z (in ₹)	Total
Sales	2500	4900	3600	11000
Pre separation costs	4000	2800	3200	10000
Profit/(Loss)	(1500)	2100	400	1000

It is advisable to further process only product X and Z and to sale product Y at the point of separation.

6. Statement of Comparison of Profits before and after further processing

	S (₹)	P (₹)	N (₹)	A (₹)	Total (₹)
A. Sales at split off point	20,000	12,000	28,000	20,000	80,000
B. Apportioned Joint Costs (Refer Working Note)	10,000	6,000	14,000	10,000	40,000
C. Profit at split-off point	10,000	6,000	14,000	10,000	40,000
D. Sales after further processing	1,20,000	40,000	48,000	-	2,08,000
E. Further processing cost	80,000	32,000	36,000	-	1,48,000
F. Apportioned Joint Costs (Refer Working Note)	10,000	6,000	14,000	-	-
G. Profit if further processing (D – E + F)	30,000	2,000	(-) 2,000	-	-
H. Increase/ decrease in profit after further processing (G-C)	20,000	- 4,000	- 16,000	-	-

Suggested Product to be further processed for maximising profits:

On comparing the figures of "Profit if no further processing" and "Profits if further processing", one observes that OPR Ltd. is earning more after further processing of Product S only i.e. ₹ 20,000. Hence, for maximizing profits, only Product S should be further processed and Product P, N and A should be sold at split-off point.

Working Note:

Apportionment of joint costs on the basis of Sales Value at split-off point

$$\text{Apportioned joint cost} = \frac{\text{Total Joint Cost}}{\text{Total Sales value at split - off point}} \times \text{Sales value of each product}$$

Where,

$$\text{Total Joint cost} = ₹ 40,000$$

Total sales at split off point (S, P, N and A) = 20,000 + 12,000 + 28,000 + 20,000 = ₹ 80,000

$$\text{Share of S in joint cost} = \frac{\text{₹ } 40,000}{\text{₹ } 80,000} \times \text{₹ } 20,000 = \text{₹ } 10,000$$

$$\text{Share of P in joint cost} = \frac{\text{₹ } 40,000}{\text{₹ } 80,000} \times \text{₹ } 12,000 = \text{₹ } 6,000$$

$$\text{Share of N in joint cost} = \frac{\text{₹ } 40,000}{\text{₹ } 80,000} \times \text{₹ } 28,000 = \text{₹ } 14,000$$

$$\text{Share of A in joint cost} = \frac{\text{₹ } 40,000}{\text{₹ } 80,000} \times \text{₹ } 20,000 = \text{₹ } 10,000$$

Answers to the Case Scenarios

1.

i.	(b)	ii.	(d)	iii.	(a)	iv.	(a)	v.	(c)

(i) (b) Sales Value at Split-off Point Method

	Chocolate powder liquor base	Milk chocolate liquor base	Total
Sales value of products at split off	₹ 2,99,250*	₹ 5,55,750**	₹ 8,55,000
Weights	0.35	0.65	1.00
Joint cost allocated	₹ 2,49,375 (₹ 7,12,500 × 0.35)	₹ 4,63,125 (₹ 7,12,500 × 0.65)	₹ 7,12,500

*(3,000 lbs ÷ 200 lbs) × 20 gallon × ₹ 997.50 = ₹ 2,99,250

** (5,100 lbs ÷ 340 lbs) × 30 gallon × ₹ 1,235 = ₹ 5,55,750

(ii) (d) Physical Measure Method

	Chocolate powder liquor base	Milk chocolate liquor base	Total
Output	300 gallon*	450 gallon**	750 gallons

Weight	$300/750 = 0.40$	$450/750 = 0.60$	1.00
Joint cost allocated	₹ 2,85,000 (₹ 7,12,500 × 0.40)	₹ 4,27,500 (₹ 7,12,500 × 0.60)	₹ 7,12,500

*(3,000 lbs ÷ 200 lbs) × 20 gallon = 300 gallon

** (5,100 lbs ÷ 340 lbs) × 30 gallon = 450 gallon

(iii) (a) Net Realisable Value (NRV) Method

	Chocolate powder liquor base	Milk chocolate liquor base	Total
Final sales value of production	₹ 5,70,000 (3,000 lbs × ₹190)	₹ 12,11,250 (5,100 lbs × ₹ 237.50)	₹17,81,250
Less: Separable costs	₹ 3,02,812.50	₹ 6,23,437.50	₹ 9,26,250
Net realisable value at split off point	₹ 2,67,187.50	₹ 5,87,812.50	₹ 8,55,000
Weight	0.3125 (2,67,187.50 ÷ 8,55,000)	0.6875 (5,87,812.5 ÷ 8,55,000)	1.00
Joint cost allocated	₹ 2,22,656.25 (₹ 7,12,500 × 0.3125)	₹ 4,89,843.75 (₹ 7,12,500 × 0.6875)	₹ 7,12,500

(iv) (a) Final sales value of total production = ₹17,81,250

Less: Joint and separable cost = ₹ 16,38,750 (₹ 7,12,500 + ₹ 9,26,250)

Gross Margin = ₹ 1,42,500

Gross margin (%) = $\frac{₹ 1,42,500}{₹ 17,81,250} \times 100 = 8\%$

(v) (c) Constant Gross Margin(%) NRV method

	Chocolate powder Liquor base	Milk chocolate liquor Base	Total
Final sales value of production	₹ 5,70,000	₹ 12,11,250	₹ 17,81,250
Less: Gross margin* 8%	₹ 45,600	₹ 96,900	₹ 1,42,500
Cost of goods available for sale	₹ 5,24,400	₹ 11,14,350	₹ 16,38,750
Less: Separable costs	₹ 3,02,812.50	₹ 6,23,437.50	₹ 9,26,250
Joint cost allocated	₹ 2,21,587.50	₹ 4,90,912.50	₹ 7,12,500

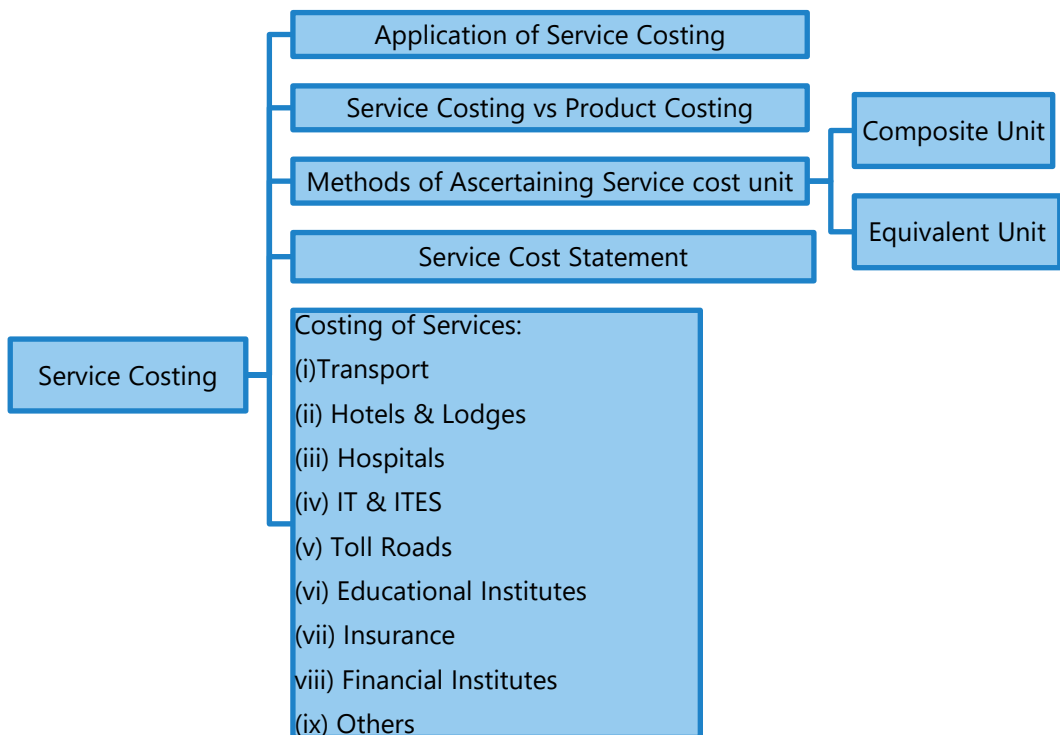
SERVICE COSTING



LEARNING OUTCOMES

- ◆ Discuss the cost accounting method for service sectors.
- ◆ State the units used in different service sectors.
- ◆ State the KPIs used in different service sectors.
- ◆ Calculate the costs for different service industries.

CHAPTER OVERVIEW





1. INTRODUCTION

Service sector, being a fastest growing sector and having a significant contribution towards the GDP in India, is a very important sector where the role of the cost and management accounting is inevitable. The competitiveness of a service entity is very much dependent on a robust cost and management accounting system for competitive pricing and identification of value adding activities. Providers of services like transportation, hotels, financial services & banking, insurance, electricity generation, transmission and distribution etc. are very much cost conscious and thrive to provide services in a cost-effective manner. Irrespective of regulatory requirements to maintain cost records and get the records audited, service costing becomes integral and inseparable part of each service entity. In this chapter we will be discussing how costing is done in service sectors like Transportation, Toll roads, Electricity generation, transmission and distribution, Hospitals, Canteen & Restaurants, Hotels & Lodges, Educational institutes, Financial institutions, Insurance, Information Technology (IT) & Information Technology Enabled Services (ITES) etc.

Service costing is also known as operating costing.

1.1 Application of Service Costing

Internal: The service costing is required for in-house services provided by a service cost centre to other responsibility centres as support services. Examples of support services are Canteen and hospital for staff, Boiler house for supplying steam to production departments, Captive Power generation unit, operation of fleet of vehicles for transport of raw material to factory or distribution of finished goods to the market outlets, IT department services used by other departments, research & development, quality assurance, laboratory etc.

External: When services are offered to outside customers as a profit centre in consonance with organisational objectives as an output like goods or passenger transport service provided by a transporter, hospitality services provided by a hotel, provision of services by financial institutions, insurance and IT companies etc.

In both the situation, all costs incurred are collected, accumulated for a certain period or volume, recorded in the cost accounting system and then expressed in terms of a cost unit of service.

1.2 Service Costing vs Product Costing

Service costing differs from product costing (such as job or process costing) in the following ways due to some basic and peculiar nature.

- (i) **Tangibility:** Unlike products, services are intangible and cannot be stored, hence, there is no inventory for the services.
- (ii) **Cost units:** Use of Composite cost units for cost measurement and to express the volume of outputs.
- (iii) **Material vs Employee cost:** Unlike a product manufacturing, employee (labour) cost constitutes a major cost element than material cost.
- (iv) **Traceability of costs:** Indirect costs like administration overheads are generally have a significant proportion in total cost of a service as unlike manufacturing sector, service sector heavily depends on support services and traceability of costs to a service may not economically feasible.



2. SERVICE COST UNIT AND KPI

To compute the Service cost, it is necessary to understand the unit for which the cost is to be computed. All the costs incurred during a period are collected and analyzed and then expressed in terms of a cost per unit of service.

One specific issue with service costing is the difficulty in defining a realistic cost unit that represents a suitable measure of the service provided. The cost unit to be applied needs to be defined carefully and frequently, a composite cost unit may be deemed more appropriate.

For example, Hotels may use the 'Occupied Room Days' as an appropriate unit for cost ascertainment and control.

Other typical cost unit that may be used include:

Service industry	Unit of cost (examples)
Transport Services	Passenger- km., (In public transportation) Quintal- km., or Tonne- km. (In goods carriage)
Electricity Supply service	Kilowatt- hour (kWh)

Hospital	Patient per day, room per day or per bed, per operation etc.
Canteen	Per item, per meal etc.
Cinema	Per ticket.
Hotels	Guest Days or Room Days
Bank or Financial Institutions	Per transaction, per services (e.g. per letter of credit, per application, per project etc.)
Educational Institutes	Per course, per student, per batch, per lecture etc.
IT & ITES	Cost per project, per module etc.
Insurance	Per policy, Per claim, Per TPA etc.

The costing should be comprehensive enough to show the effects like off-season and peak-season demand, full time, part time, etc.

Key Performance Indicator (KPI)

Key Performance Indicators (KPIs) are the quantitative and qualitative factors which are commonly used to assess the performance of an organization which are important to achieve its goal. Like calculation of cost for a cost unit, calculation of cost or revenue per KPI helps to the performance against industry standards. For example, in case of Telecom industry Average Return per User (ARPU) is a key indicator, shows average revenue generated from a user of its services. The list below shows few important KPIs for some Service Industries:

Industry	KPI	Meaning
Transportation	Number of Shipments,	This logistics metric monitors the number of orders that are shipped out of the warehouse.
	Truck Turnaround Rate (Truck Turning),	The time from when a delivery truck enters the warehouse to collect or deliver products to when it exits the facility.
	Lead Time (Order Cycle Time)	The amount of time in between order placement by customer and receipt of order.

	On-Time and In-Full (OTIF)	The number of orders delivered according to the schedule and quantity specified.
Hotel Industry	Cost per Occupied Room (CPOR)	The average cost per occupied room.
	Occupancy Rate	The ratio of rented or used rooms to the total amount of available rooms.
	Revenue per available room (RevPAR)	The average revenue per available room days.
Hospitals/ Health care Industry	Bed Occupancy Rate	The proportion of hospital beds in use at any one time.
	Staff-To-Patient Ratio	The number of staff resources present to attend to the patients in a hospital over a certain period of time.
	Average Treatment Charge	The average amount that a facility charges a patient for a treatment.
IT & ITES sector	Gross Burn Rate	The rate at which the company uses up its available cash to cover operating expenses.
	Customer Acquisition Cost (CAC)	The amount it takes to attract new customers.
	Customer Lifetime Value (CLV)	The typical net profit a company generates over the entire life cycle of a single customer.
	Monthly Recurring Revenue (MRR)	The amount earned each month through subscription renewals, new sales, upsells, and fluctuations on a monthly basis.
	Churn Rate	The percentage of customers that cancel their recurring subscriptions over a given time period.
	Cost Per Feature	How much a specific feature costs your business, based on usage and cloud costs.

Telecom	Average return per user (ARPU)	How much money a company is making for each person using its service.
	Subscriber acquisition cost (SAC)	Costs involved with gaining new subscribers.
	Network Operating Cost	Expenditure incurred on continual upkeep to telecom's network.
	Gross Revenue Retention (GRR)	How well a company is retaining its customers based on factors such as sales price increases, organic customer growth, and more.
Education Sector	Instructional Costs	The cost of part-time and full-time faculty members
	Administrative Costs Per Student.	How much an institution is spending on administrative services on a per-student basis.
	Tuition Costs	Costs accrued by students on a semester or annual basis.
	Student-to-Faculty Ratio	The number of students per faculty member, on a campus-wide basis or by department.
Insurance Sector	Average Cost Per Claim	The average cost of each claim made.
	Components of Claim Costs (CCC)	Costs which are associated with a claim like legal fees, time to settle, administration costs, and report delays.
	Cost Per Quote	The costs that the company incurs in order to get a quote in front of a potential client.
	Administrative Costs Per Policy	The cost of the policy administration to number of policies outstanding.
	Average Policy Size	The total amount of premium collected by the number of policies issued for a given time period.

2.1 Methods for ascertaining Service Cost Unit

Composite Cost Unit

Sometime two measurement units are combined together to know the cost of service or operation. These are called composite cost units. For example, a public transportation undertaking would measure the operating cost per passenger per kilometer.

Examples of Composite units are Tonne- km., Quintal- km, Passenger-km., Patient-day etc. **Composite unit may be computed in two ways.**

- (i) Absolute (Weighted Average) basis.
- (ii) Commercial (Simple Average) basis.

In both bases of computation of service cost unit, weightage is also given to qualitative factors rather quantitative (which are directly related with variable cost elements) factors alone.

(i) Weighted Average or Absolute basis – It is a summation of the products of qualitative and quantitative factors. For example, to calculate absolute Tonne-Km for a goods transport is calculated as follows.:

$$\sum (\text{Weight Carried} \times \text{Distance})_1 + (\text{Weight Carried} \times \text{Distance})_2 + \dots + (\text{Weight Carried} \times \text{Distance})_n$$

Similarly, in case of Cinema theatres, price for various classes of seats is fixed differently. For example–

First class seat may be provided with higher quality service and hence charged at a higher rate, whereas Second Class seat may be priced less. In this case, appropriate weight to be given effect for First Class seat and Second Class seat – to ensure proper cost per composite unit.

(ii) Simple Average or Commercial Basis – It is the product of average qualitative and total quantitative factors. For example, in case of goods transport, Commercial Tonne-Km is arrived at by multiplying total distance km., by average load quantity.

$$\sum (\text{Distance}_1 + \text{Distance}_2 + \dots + \text{Distance}_n) \times \left(\frac{W_1 + W_2 + \dots + W_n}{n} \right)$$

In both the example, variable cost is dependent of distance and is a quantitative factor. Since, the weight carried does not affect the variable cost hence and is a qualitative factor.

To understand the concept of absolute tonne-km., and commercial tonne-km., the following illustration may be referred.

ILLUSTRATION 1

A lorry starts with a load of 20 MT of goods from Station 'A'. It unloads 8 MT in Station 'B' and balance goods in Station 'C'. On return trip, it reaches Station 'A' with a load of 16 MT, loaded at Station 'C'. The distance between A to B, B to C and C to A are 80 Kms, 120 Kms and 160 Kms, respectively. COMPUTE "Absolute MT-Kilometer" and "Commercial MT – Kilometer".

(MT = Metric Ton or Ton).

SOLUTION

Weighted Average or Absolute basis – MT – Kilometer:

$$= (20 \text{ MT} \times 80 \text{ Kms}) + (12 \text{ MT} \times 120 \text{ Kms}) + (16 \text{ MT} \times 160 \text{ Kms})$$

$$= 1,600 + 1,440 + 2,560 = 5,600 \text{ MT - Kilometer}$$

Simple Average or Commercial basis – MT – Kilometer:

$$= \left[\frac{(20+12+16)}{3} \right] \text{ MT} \times \{(80+120+160) \text{ Kms}\}$$

$$= 16 \text{ MT} \times 360 \text{ Kms} = 5,760 \text{ MT – Kilometer}$$

Equivalent Cost Unit/ Equivalent Service Unit:

To calculate cost or pricing of two more different grade of services which uses common resources, **each grade of service is assigned a weight and converted into equivalent units**. Converting services into equivalent units make different grade of services equivalent and comparable.

For Example:

A hotel has three types of suites for its customers, viz., Standard, Deluxe and Luxurious.

Following information is given:

Type of suite	Number of rooms	Room Tariff
Standard	100	--
Deluxe	50	2.5 times of the Standard suites
Luxurious	30	Twice of the Deluxe suites

The rent of Deluxe suite is to be fixed at 2.5 times of the Standard suite and that of Luxurious suite as twice of the Deluxe suite.

Since, all three types of suites use same amount of overheads, but to attach qualitative weight, these rooms are required to be converted into equivalent units. This can be done in two ways

(i) Making all suites equivalent to Standard suites:

Nature of suite	Occupancy (Room-days)	Equivalent single room suites (Room-days)
Standard	36,000 (100 rooms × 360 days)	36,000 (36,000 × 1)
Deluxe	18,000 (50 rooms × 360 days)	45,000 (18,000 × 2.5)
Luxurious	10,800 (30 rooms × 360 days)	54,000 (10,800 × 5)
		1,35,000

Or

(ii) Making all suites equivalent to Luxurious suites:

Nature of suite	Occupancy (Room-days)	Equivalent Luxurious suites (Room-days)
Standard	36,000 (100 rooms × 360 days)	7,200 (36,000 × 1/5)
Deluxe	18,000 (50 rooms × 360 days)	9,000 (18,000 × 1/2)

Luxurious	10,800 (30 rooms × 360 days)	10,800 (10,800 × 1)
		27,000



3. STATEMENT OF COSTS FOR SERVICE SECTORS

For preparing a statement of cost or a cost sheet for service sector, costs are usually collected and accumulated for a specified period viz. A month, quarter or a year, etc.

The cost statement for services may be prepared either on the basis of functional classification as done for product costing or on the basis of variability. Cost sheet on the basis of variability is prepared classifying all the costs into three different heads:

1. Fixed costs or Standing charges
2. Variable costs or Operating expenses
3. Semi-variable costs or Maintenance expenses

Note: In the absence of information about semi-variable costs, the costs would be shown under fixed and variable heads only.

Treatment of Depreciation- Fixed or Variable?

If related to effluxion of time or calculated on time basis, will be treated as fixed. However, if the depreciation is calculated on the basis of activity level or usage, it will be treated as variable cost.

Treatment of Interest

Interest and finance charges shall be presented in the cost statement as a separate item of cost of sales. In general, interest is treated as fixed cost, unless otherwise given.

4. APPLICATIONS OF COSTING METHODS IN SERVICE COSTING

Costing techniques vis-a vis Service sector: So far in previous chapters we have learnt how to collect, accumulate and calculate cost for each cost elements like Material, Employee (labour), Direct expenses and Overheads. We also learnt the various methods of costing like Job & Contract costing, Process & operation costing, Joint products & By products costing. Then again Cost Management techniques like Standard Costing, Budget and budgetary control Marginal costing are also equally applied in service sector.

In general, the service sectors are either labour or capital intensive or both, that is the reason the proportion of costs of cost elements differs from manufacturing sectors. A manufacturing sector may have higher material cost than the labour, but in case of service sector the situation reverses.

The system and techniques for cost collection, accumulation and valuation is similar as that has been learnt in previous chapters for each cost elements. The overhead allocation, apportionment and absorption techniques are also very similar.

Method of costing vis-à-vis Service sector: The choice of method of costing depends on nature of service provided. For example, Job costing method may be suitable for a business which is engaged in development of customized software, healthcare etc. Process costing may be suitable for utility business like power, water supplies etc., Joint products costing may be suitable for businesses which are providing bundled service like telecom, event management, educational institutes etc.

5. COSTING OF TRANSPORT SERVICES

Transport organizations can be divided into two categories viz. Goods transport and Passenger transport.

The cost unit for Goods transport organization is Tonne– Kilometer – that means cost of carrying one Tonne of goods over a distance of one kilometer.

Cost unit for Passenger transport organization is Passenger– Kilometer – that means cost of carrying one Passenger over a distance of one kilometer.

The costs are shown under the suggestive following heads:

(i) **Standing Charges or Fixed costs:** These are the fixed costs that remain constant irrespective of the distance travelled. These costs include the following:

- Insurance
- License fees
- Salary to Driver, Conductor, Cleaners, etc if paid on monthly basis
- Garage costs, including garage rent
- Depreciation (if related to efflux of time)
- Taxes
- Administration expenses, etc.

(ii) **Variable costs or Running costs:** These costs are generally associated with the distance travelled. These costs include the following:

- Petrol and Diesel
- Lubricant oils,
- Wages to Driver, Conductor, Cleaners, etc. if it is related to operations
- Depreciation (if related to activity)
- Any other variable costs identified.

(iii) **Semi-Variable Costs or Maintenance Costs:** These costs include the following:

- Repairs and maintenance
- Tyres
- Spares, etc.

The heads for a cost may change as per the situation or condition. For an example salary of driver may be treated as standing charges or running cost depending on the situation and nature of his employment.

ILLUSTRATION 2

AXA Passenger Transport Company is running 5 buses between two towns, which are 40 kms apart. Seating capacity of each bus is 40 passengers. Following details are available from their books, for the month of April:

Particulars	Amount (₹)
Salary of Drivers, Cleaners and Conductors	24,000
Salary to Supervisor	10,000
Diesel and other Oil	40,000
Repairs and Maintenance	8,000
Tax and Insurance	16,000
Depreciation	26,000
Interest	20,000
	1,44,000

Actual passengers carried were 75% of the seating capacity. All the five buses run on all days for the month. Each bus made one round trip per day. CALCULATE cost per passenger – Kilometer.

SOLUTION**Working Note:**

Total Passenger Kilometres =

Number of Buses × Distance × Seating Capacity × Used Capacity × Number of days in the month × Number of trips

= 5 Buses × 40 kms. × 40 Seats × 75% × 30 Days × 2 Single trips (1 Round Trip)

= 3,60,000 Passenger-Kms.

Cost per Passenger-Km = Total costs ÷ Total Passenger Kilometers

Statement of Cost per Passenger – Km

Particulars	Cost Per Month	Cost per Passenger – Km
A. Standing Charges:		
Wages of Drivers, Cleaners and Conductors	24,000	
Salary to Supervisor	10,000	
Tax and Insurance	16,000	
Depreciation	26,000	
Interest	20,000	
Total Standing Charges	96,000	0.267
B. Running Charges		
Diesel and other Oil	40,000	0.111
C. Maintenance Charges		
Repairs and Maintenance	8,000	0.022
Total	1,44,000	0.400

Cost per Passenger-Km = ₹ 0.40

ILLUSTRATION 3

ABC Transport Company has given a route 40 kilometers long to run bus.

- The bus costs the company a sum of ₹ 10,00,000
- It has been insured at 3% p.a. and
- The annual tax will amount to ₹ 20,000
- Garage rent is ₹ 20,000 per month.
- Annual repairs will be ₹ 2,04,000
- The bus is likely to last for 2.5 years
- The driver's salary will be ₹ 30,000 per month and the conductor's salary will be ₹ 25,000 per month in addition to 10% of takings as commission [To be shared by the driver and conductor equally].

- (h) Cost of stationery will be ₹ 1,000 per month.
- (i) Manager-cum-accountant's salary is ₹ 17,000 per month.
- (j) Petrol and oil will be ₹ 500 per 100 kilometers.
- (k) The bus will make 3 up and down trips carrying on an average 40 passengers on each trip.
- (l) The bus will run on an average 25 days in a month.

Assuming 15% profit on takings, CALCULATE the bus fare to be charged per passenger-kilometer.

SOLUTION

Working Note:

(1) Total Kilometers run per annum:

= Number of Buses × Distance × Number of days in the Month × Number of trips × 12 months

= 1 Bus × 40 kms × 25 Days × 6 Single trips (3 Round Trips) × 12 months = 72,000 kms.

(2) Total Passenger Kilometers per annum:

Total Kilometers run per annum × Seating Capacity

= 72,000 Kms × 40 Seats = 28,80,000 Passenger-Kms.

(3) Petrol & oil Consumption per annum:

Total Kilometers run per annum × Petrol Consumption per KM

= 72,000 Kms × (₹500 / 100 Kms) = ₹ 3,60,000

Statement of Cost per Passenger – Km

Particulars	Per Annum	Per Passenger - Kilometer
A. Standing Charges:		
Insurance @ 3% on ₹10,00,000	30,000	
Annual Tax	20,000	
Garage rent (₹20,000 × 12)	2,40,000	

Depreciation	4,00,000	
Salary of Driver (fixed part)	3,60,000	
Salary of Conductor (fixed part)	3,00,000	
Stationary	12,000	
Manager-cum-accountant's salary	2,04,000	
Total Standing Charges	15,66,000	0.5438
B. Running Charges:		
Diesel and other Oil (WN-3)	3,60,000	
Commission to Driver* (10% × ₹28,40,000 × 1/2)	1,42,000	
Commission to Conductor* (10% × ₹28,40,000 × 1/2)	1,42,000	
Total Running Charges	6,44,000	0.2236
C. Maintenance Charges:		
Repairs	2,04,000	0.0708
Grand Total (A+B+C)	24,14,000	0.8382
Profit (15% × ₹28,40,000)	4,26,000	0.1479
Fare per Passenger Kilometer		0.9861

*Total takings = Standing Charges + (Running cost + Commission on takings)

+ Maintenance cost + Profit

Let Takings = X

Or, $X = 15,66,000 + (3,60,000 + 0.1X) + 2,04,000 + 0.15X$

Or, $X - 0.25X = 21,30,000$

Or, $X = 28,40,000$

ILLUSTRATION 4

SMC is a public school having five buses each plying in different directions for the transport of its school students. In view of a larger number of students availing of the bus service the buses work two shifts daily both in the morning and in the afternoon. The buses are garaged in the school. The work-load of the students has been so arranged that in the morning the first trip picks up senior students and the second trip plying an

hour later picks up the junior students. Similarly, in the afternoon the first trip takes the junior students and an hour later the second trip takes the senior students' home.

The distance travelled by each bus one way is 8 km. The school works 25 days in a month and remains closed for vacation in May, June and December. Bus fee, however, is payable by the students for all 12 months in a year.

The details of expenses for a year are as under:

Driver's salary	₹4,500 per month per driver
Cleaner's salary	₹3,500 per month
(Salary payable for all 12 months)	
(One cleaner employed for all the five buses)	
License fee, taxes, etc.	₹8,600 per bus per annum
Insurance	₹10,000 per bus per annum
Repairs & maintenance	₹35,000 per bus per annum
Purchase price of the bus	₹15,00,000 each
Life of each bus	12 years
Scrap value of buses at the end of life	₹3,00,000
Diesel cost	₹45.00 per litre

Each bus gives an average mileage of 4 km. per litre of diesel.

Seating capacity of each bus is 50 students.

The seating capacity is fully occupied during the whole year.

Students picked up and dropped within a range up to 4 km. of distance from the school are charged half fare and fifty per cent of the students travelling in each trip are in this category. Ignore interest. Since the charges are to be based on average cost you are required to:

- (i) PREPARE a statement showing the expenses of operating a single bus and the fleet of five buses for a year.
- (ii) WORK OUT the average cost per student per month in respect of –
 - (A) students coming from a distance of upto 4 km. from the school and
 - (B) students coming from a distance beyond 4 km. from the school.

SOLUTION**(i) Statement of Expenses of operating bus/ buses for a year**

Particulars	Rate (₹)	Per Bus per annum (₹)	Fleet of 5 buses p.a. (₹)
(i) Standing Charges:			
Driver's salary	4,500 p.m	54,000	2,70,000
Cleaner's salary	3,500 p.m	8,400	42,000
Licence fee, taxes etc.	8,600 p.a.	8,600	43,000
Insurance	10,000 p.a.	10,000	50,000
Depreciation (15,00,000 – 3,00,000) ÷ 12 yrs	1,00,000 p.a.	1,00,000	5,00,000
(ii) Maintenance Charges:			
Repairs & maintenance	35,000 p.a.	35,000	1,75,000
(iii) Operating Charges:			
Diesel (Working Note 1)		1,62,000	8,10,000
Total Cost [(i) + (ii) + (iii)]		3,78,000	18,90,000
Cost per month		31,500	1,57,500
Total no. of equivalent students		150	750
Total Cost per half fare equivalent student		₹ 210	₹ 210

(ii) Average cost per student per month:**A. Students coming from distance of upto 4 km. from school**

$$= \frac{\text{Total cost per month}}{\text{Total no. of equivalent students}} = \frac{₹ 31,500}{150 \text{ students}} = ₹ 210$$

B. Students coming from a distance beyond 4 km. from school

$$= \text{Cost of per half fare student} \times 2 = ₹ 210 \times 2 = ₹ 420$$

Working Notes:**1. Calculation of Diesel cost per bus :**

Distance travelled in a year:

(8 round trip × 8 km. × 25 days × 9 months)

Distance travelled p.a.: 14,400 km.

Cost of diesel (per bus p.a.): $\frac{14,400\text{km.}}{4\text{kmpl}} \times ₹ 45 = ₹ 1,62,000$

2. Calculation of equivalent number of students per bus :

Seating capacity of a bus	50 students
Half fare students (50% of 50 students)	25 students
Full fare students (50% of 50 students)	25 students

Total number of students equivalent to half fare students

Full fare students (25 students × 2)	50 students
Add: Half fare students	25 students
Total Equivalent number of students in a trip	75 students
Total number of equivalent students in two trips (Senior + Junior)	150 students

ILLUSTRATION 5

GTC has a lorry of 6-tonne carrying capacity. It operates lorry service from city A to city B for a particular vendor. It charges ₹ 2,400 per tonne from city 'A' to city 'B' and ₹ 2,200 per tonne for the return journey from city 'B' to city 'A'. Goods are also delivered to an intermediate city 'C' but no extra charges are billed for unloading goods in-between destination city and no concession in rates is given for reduced load after unloading at intermediate city. Distance between the city 'A' to 'B' is 300 km and distance from city 'A' to 'C' is 140 km.

In the month of January, the truck made 12 journeys between city 'A' and city 'B'. The details of journeys are as follows:

Outward journey	No. of journeys	Load (in tonne)
'A' to 'B'	10	6
'A' to 'C'	2	6
'C' to 'B'	2	4
Return journey	No. of journeys	Load (in tonne)
'B' to 'A'	5	8
'B' to 'A'	6	6
'B' to 'C'	1	6
'C' to 'A'	1	0

Annual fixed costs and maintenance charges are ₹6,00,000 and ₹1,20,000 respectively. Running charges spent during the month of January are ₹2,94,400 (includes ₹12,400 paid as penalty for overloading).

You are required to:

- (i) CALCULATE the cost as per (a) Commercial tonne-kilometer. (b) Absolute tonne-kilometer.
- (ii) CALCULATE Net Profit/ loss for the month of January.

SOLUTION

(i) Calculation of total monthly cost for running truck:

	Particulars	Amount per annum (₹)	Amount per month (₹)
(i)	Standing Charges:		
	Annual fixed costs	6,00,000	50,000
(ii)	Maintenance Charges:	1,20,000	10,000
(iii)	Running Cost:		
	Running charges 2,94,400		
Less:	Penalty paid for overloading (12,400)		2,82,000
	Total monthly cost		3,42,000

$$(a) \text{ Cost per commercial tonne-km.} = \frac{\text{₹ } 3,42,000}{44,856 \text{ ton-km.}} = \text{₹ } 7.62$$

(Refer to working note-1)

$$(b) \text{ Cost per absolute tonne-km.} = \frac{\text{₹ } 3,42,000}{44,720 \text{ ton-km.}} = \text{₹ } 7.65$$

(Refer to working note-2)

(ii) **Calculation of Net Profit/Loss for the month of January:**

Particulars	(₹)	(₹)
Truck hire charges received during the month:		
From Outward journey [(10 + 2) trips × 6 tonne × ₹ 2,400]	1,72,800	
From return journey {(5 trips × 8 tonne × ₹ 2,200) + [(6 + 1) trips × 6 tonne × ₹ 2,200]}	1,80,400	3,53,200
Less: Monthly running cost {as per (i) above}		(3,42,000)
Operating profit		11,200
Less: Penalty paid for overloading		(12,400)
Net Loss for the month		(1,200)

Working Notes:

1. Calculation of Commercial Tonne-km:

Particulars		Tonne-km.
A. Total Distance travelled		
To and fro (300 km × 2 × 12 trips) (in km)		7,200
B. Average weight carried:		
Outward (12 journeys × 6 tonne + 2 journeys × 4 tonne)	80	
Return (5 journeys × 8 tonne + 6 journeys × 6 tonne + 1 journey × 6 tonne)	82	

Total weight	162	
No. of journeys	26	
Average weight (in tonne) (162 ÷ 26)	6.23	
Total Commercial Tonne-km (A × B)		44,856

2. Calculation of Absolute Tonne-km:

Particulars	Tonne-km.	Tonne-km.
Outward journeys:		
From city A to city B (10 journey × 300 km. × 6 tonne)	18,000	
From city A to city C (2 journeys × 140 km. × 6 tonne)	1,680	
From city C to city B (2 journeys × 160 km. × 4 tonne)	1,280	20,960
Return journeys:		
From city B to city A (5 journeys × 300 km. × 8 tonne) + (6 journeys × 300 km. × 6 tonne)	22,800	
From city B to city C (1 journey × 160 km. × 6 tonne)	960	23,760
Total Absolute Tonne-km		44,720

Note: (i) While calculating absolute/commercial tonne-km., actual load carried are considered irrespective of the fact it attracts fines or penalty. (ii) Penalty paid for overloading is an abnormal expenditure and is not included in the operating cost of the lorry. This amount will be debited to Costing Profit and Loss A/c and hence deducted from operating profit to arrive at net profit/loss.



6. COSTING OF HOTELS AND LODGES

Service costing is an effective tool in respect of hotel industry. Hotels are run on commercial basis. Hence it is necessary to compute the cost - to fix the price of various services provided by the hotel and to find out the profit or loss at the end of a particular period.

In this case, the costs associated with different services offered should be identified and cost per unit should be worked out. The cost unit may be Guest-day or Room Day. For calculation of cost per Guest Day or Room Day, estimated occupancy rate – at different point of time, for example – Peak season or lean season, are taken in to account.

ILLUSTRATION 6

A company runs a holiday home. For this purpose, it has hired a building at a rent of ₹ 10,000 per month along with 5% of total taking. It has three types of suites for its customers, viz., single room, double rooms and triple rooms.

Following information is given:

Type of suite	Number	Occupancy percentage
Single room	100	100%
Double rooms	50	80%
Triple rooms	30	60%

The rent of double rooms suite is to be fixed at 2.5 times of the single room suite and that of triple rooms suite as twice of the double room's suite.

The other expenses for the year 2022-23 are as follows:

	(₹)
Staff salaries	14,25,000
Room attendants' wages	4,50,000
Lighting, heating and power	2,15,000
Repairs and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	1,53,000

Provide profit @ 20% on total taking and assume 360 days in a year.

You are required to CALCULATE the rent to be charged for each type of suite.

SOLUTION**Working Notes:****(i) Total equivalent single room suites**

Nature of suite	Occupancy (Room-days)	Equivalent single room suites (Room-days)
Single room suites	36,000 (100 rooms × 360 days × 100%)	36,000 (36,000 × 1)
Double rooms suites	14,400 (50 rooms × 360 days × 80%)	36,000 (14,400 × 2.5)
Triple rooms suites	6,480 (30 rooms × 360 days × 60%)	32,400 (6,480 × 5)
		1,04,400

(ii) Statement of total cost:

	(₹)
Staff salaries	14,25,000
Room attendant's wages	4,50,000
Lighting, heating and power	2,15,000
Repairs and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	1,53,000
	25,21,000
Building rent {(₹10,000 × 12 months) + 5% on total taking}	1,20,000 + 5% on total takings
Total cost	26,41,000 + 5% on total takings

Profit is 20% of total takings

$\therefore$ Total takings = ₹ 26,41,000 + 25% (5% + 20%) of total takings

Let R be rent for single room suite

Then $1,04,400 R = 26,41,000 + (0.25 \times 1,04,400 R)$

Or, $1,04,400 R = 26,41,000 + 26,100 R$

Or, $78,300 R = 26,41,000$

Or, $R = ₹33.73$

Alternatively

Let total takings be x

$\therefore X = 26,41,000 + .25X (5\% + 20\%)$

$\therefore X = 35,21,333$

Let the rent of single room be R

Then $1,04,400 R = 35,21,333$

Or, $R = ₹33.73$

Rent to be charged:

Rent to be charged for single room suite = ₹33.73

Rent for double rooms suites ₹ 33.73 $\times$ 2.5 = ₹84.33

Rent for triple rooms suites ₹33.73 $\times$ 5 = ₹168.65

ILLUSTRATION 7

A lodging home is being run in a small hill station with 100 single rooms. The home offers concessional rates during six off- season months in a year when numbers of visitor are limited. During this period, half of the full room rent is charged. The management's profit margin is targeted at 20% of the room rent. The following are the cost estimates and other details for the year ending on 31st March. [Assume a month to be of 30 days].

- (i) *Occupancy during the season is 80% while in the off- season it is 40% only.*
- (ii) *Total investment in the home is ₹ 200 lakhs of which 80% relate to buildings and balance for furniture and equipment.*

(iii) Expenses:

o Staff salary [Excluding room attendants] :	₹ 5,50,000
o Repairs to building :	₹ 2,61,000
o Laundry charges :	₹ 80, 000
o Interior :	₹ 1,75,000
o Miscellaneous expenses :	₹ 1,90,800

(iv) Annual depreciation is to be provided for buildings @ 5% and on furniture and equipment @ 15% on straight-line basis.

(v) Room attendants are paid ₹ 10 per room day on the basis of occupancy of the rooms in a month.

(vi) Monthly lighting charges are ₹ 120 per room, except in four months in winter when it is ₹ 30 per room.

You are required to WORK OUT the room rent chargeable per day both during the season and the off-season months on the basis of the foregoing information.

SOLUTION**Working Notes:****(i) Total Room days in a year**

Season	Occupancy (Room-days)	Equivalent Full Room charge days
Season – 80% Occupancy	100 Rooms × 80% × 6 months × 30 days in a month = 14,400 Room Days	14,400 Room Days × 100% = 14,400
Off-season – 40% Occupancy	100 Rooms × 40% × 6 months × 30 days in a month = 7,200 Room Days	7,200 Room Days × 50% = 3,600
Total Room Days	14,400 + 7,200 = 21,600 Room Days	18,000 Full Room days

(ii) Lighting Charges:

It is given in the question that lighting charges for 8 months is ₹120 per month and during winter season of 4 months it is ₹30 per month. Further it is also given that peak season is 6 months and off season is 6 months.

It should be noted that – being Hill station, winter season is to be considered as part of Off season. Hence, the non-winter season of 8 months include – Peak season of 6 months and Off season of 2 months.

Accordingly, the lighting charges are calculated as follows:

Season	Occupancy (Room-days)
Season & Non-winter – 80% Occupancy	100 Rooms × 80% × 6 months × ₹120 per month = ₹ 57,600
Off- season & non-winter – 40% Occupancy (8 – 6 months)	100 Rooms × 40% × 2 months × ₹120 per month = ₹ 9,600
Off- season & -winter – 40% Occupancy months)	100 Rooms × 40% × 4 months × ₹ 30 per month = ₹ 4,800
Total Lighting charges	₹ 57,600 + 9,600 + 4,800 = ₹ 72,000

Statement of total cost:

	(₹)
Staff salary	5,50,000
Repairs to building	2,61,000
Laundry & Linen	80,000
Interior	1,75,000
Sundries Expenses	1,90,800
Depreciation on Building (₹ 200 Lakhs × 80% × 5%)	8,00,000
Depreciation on Furniture & Equipment (₹ 200 Lakhs × 20% × 15%)	6,00,000
Room attendant's wages (₹ 10 per Room Day for 21,600 Room Days)	2,16,000
Lighting charges	72,000

Total cost	29,44,800
Add: Profit Margin (20% on Room rent or 25% on Cost)	7,36,200
Total Rent to be charged	36,81,000

Calculation of Room Rent per day:

Total Cost / Equivalent Full Room days = ₹ 36,81,000 / 18,000 = ₹204.50

Room Rent during Season – ₹204.50

Room Rent during Off season = ₹204.50 × 50% = ₹ 102.25



7. COSTING OF HOSPITALS

A Hospital is providing various types of medical services to the patients. Hospital costing is applied to decide the cost of these services.

A hospital may have different departments catering to varied services to the patients – such as

- Out Patient
- In Patient
- Medical services like X-Ray, Scanning, etc.
- General services like Catering, Laundry, Power house, etc.
- Miscellaneous services like Transport, Dispensary, etc.

7.1 Unit of Cost

Common unit of costs of various departments are as follows:

- Out Patient – Per Out-patient
- In Patient – Per Room Day
- Scanning – Per Case
- Laundry – Per 100 items laundered

7.2 Cost Segregation

The cost of hospital can be divided in to fixed costs and variable costs

Fixed costs are based on timelines and irrespective of services provided. For example, Staff salaries, Depreciation on Building and Equipment, etc.

Variable costs vary with the level of services rendered. For example, laundry charges, Cost of food supplied to patients, Power, etc.

ILLUSTRATION 8

ABC Hospital runs a Critical Care Unit (CCU) in a hired building. CCU consists of 35 beds and 5 more beds can be added, if required.

Rent per month - ₹ 75,000

Supervisors – 2 persons – ₹ 25,000 Per month – each

Nurses – 4 persons – ₹ 20,000 per month – each

Ward Boys – 4 persons – ₹ 5,000 per month – each

Doctors paid ₹ 2,50,000 per month – paid on the basis of number of patients attended and the time spent by them

Other expenses for the year are as follows:

Repairs (Fixed) – ₹ 81,000

Food to Patients (Variable) – ₹ 8,80,000

Other services to patients (Variable) – ₹ 3,00,000

Laundry charges (Variable) – ₹ 6,00,000

Medicines (Variable) – ₹ 7,50,000

Other fixed expenses – ₹ 10,80,000

Administration expenses allocated – ₹ 10,00,000

It was estimated that for 150 days in a year 35 beds are occupied and for 80 days only 25 beds are occupied.

The hospital hired 750 beds at a charge of ₹ 100 per bed per day, to accommodate the flow of patients. However, this does not exceed more than 5 extra beds over and above the normal capacity of 35 beds on any day.

You are required to –

- (a) CALCULATE profit per Patient day, if the hospital recovers on an average ₹2,000 per day from each patient
- (b) FIND OUT Breakeven point for the hospital.

SOLUTION**Working Notes:****(1) Calculation of number of patient days**

35 Beds × 150 days	=	5,250
25 Beds × 80 days	=	2,000
Extra beds	=	<u>750</u>
Total	=	<u>8,000</u>

Statement of Profitability

Particulars	Amount	Amount
Income for the year (₹ 2,000 per patient per day × 8,000 patient days)		1,60,00,000
Variable Costs:		
Doctor Fees (₹ 2,50,000 per month × 12)	30,00,000	
Food to Patients (Variable)	8,80,000	
Other services to patients (Variable)	3,00,000	
Laundry charges (Variable) – (₹)	6,00,000	
Medicines (Variable) – (₹)	7,50,000	
Bed Hire Charges (₹100 × 750 Beds)	75,000	
Total Variable costs		56,05,000
Contribution		1,03,95,000
Fixed Costs:		
Rent (₹ 75,000 per month × 12)	9,00,000	
Supervisor (2 persons × ₹25,000 × 12)	6,00,000	
Nurses (4 persons × ₹ 20,000 × 12)	9,60,000	

Ward Boys (4 persons × ₹ 5,000 × 12)	2,40,000	
Repairs (Fixed)	81,000	
Other fixed expenses – (₹)	10,80,000	
Administration expenses allocated – (₹)	10,00,000	
Total Fixed Costs		48,61,000
Profit		55,34,000

(1) Calculation of Contribution per Patient day

Total Contribution – ₹ 1,03,95,000

Total Patient days – 8,000

Contribution per Patient day – ₹ 1,03,95,000 / 8,000 = ₹ 1,299.375

(2) Breakeven Point = Fixed Cost / Contribution per Patient day

= ₹ 48,61,000 / ₹1,299.375

= 3,741 patient days

8. COSTING OF IT & ITES

Information Technology (IT) and Information Technology Enabled Services (ITES) organizations provide their customers with services or intangible products. These organizations are highly labour intensive.

The services of IT and ITES organizations may be used for – provision of services to outside customers or provision of services internally (captive consumption)

In this sector employee (labour) cost constitutes a significant portion of the total operating costs. The direct employee cost is traceable to services rendered.

In addition to employee cost, significant overhead costs for offering the services are incurred and are classified as service overhead. To arrive at the cost incurred for rendering the services, it is necessary to allocate / apportion such overheads to cost units.

8.1 Concept of Project

In general – IT & ITES industries, the jobs undertaken are considered as Project. Each project is unique in nature and varies in size, functionality requirements, duration and staffing requirements.

When a project is taken up, a detailed planning is done – by breaking down the project into number of activities and their dependencies. Based on the above, project scheduling are developed.

Then the skill level requirement for carrying out each of the activities is identified and the duration of each and every activity would be ascertained. This process is known as effort estimation.

Once the skill level and duration is identified, then required man-power is identified for carrying out the activities.

Normally, project scheduling and effort estimation is carried out together. The costs of development are primarily the costs of the effort involved, so the effort computation is used in both the cost and the schedule estimate

8.2 Effort Involved

Direct Manpower

In a typical software implementation project, three to four levels of man-power would be directly engaged, as mentioned below: -

- Software Engineers / Functional Consultants / Business Analysts
- Project Leaders
- Project Manager
- Program Manager, etc

Depending on the nature and complexities of the projects being implemented, the number of persons engaged, their levels and duration of the engagement varies. For example, in a multi-continental, multi-time zone software implementation projects, in addition to the above manpower, Customer Account Manager, Portfolio Manager, etc may be involved.

The costs incurred on the above listed manpower are traceable with a project and hence forming part of direct costs of the project.

Support Manpower

In addition to the above persons, who are directly engaged in project, there could be support persons or indirect manpower, who are indirectly involved in the project.

For example, Quality Assurance Team, Testing Team, Version Control team, Staffing Manager, etc who are indirectly support the projects by providing required level of support services over the life of the projects.

It is possible that the indirect manpower may be involved in more than one project, simultaneously. Their time spent, may or may not be traced on any particular project and will be used across multiple projects.

If their time can be identified with a project, they will be treated as direct manpower. Accordingly, the cost incurred on them will be treated as direct cost.

However, if their time is not traceable with a single project, then it may either be allocated or apportioned to various projects on some suitable basis. Accordingly, the cost incurred on them will be treated as overhead and the same will be apportioned to various projects on some suitable basis.

Effort Cost in these types of organizations are calculated on the basis of cost per Person Day or cost per Person week or cost per Person month. That means cost incurred for a person for rendering services per day or per week or per month.

Depending on the requirement of the customer, the periodicity will be defined. For example, implementation of new software may require eight to twelve person months. In such a case, the cost will be calculated on Per Person month basis. On the other hand, implementation of one or two new functionality in already implemented (existing) software may require one- or two-week's efforts. In such a case, the cost will be calculated on per Person week basis.

8.3 Parameters in Computation of Total Cost

A. Hardware and software costs involved

- If they are identifiable with a project, then they are directly allocated to the project
- If they are not directly identifiable with a project or not fully allocable to a project, then they are treated as service overhead

B. Travel and training costs

- If they are incurred for a project, then they are directly allocated to the project
- If they are not directly identifiable with a project or allocable over a number of projects, then they are treated as service overhead. For example, Java (software language) training provided to the software engineers, may be useful in multiple Java based projects. Hence treated as overhead costs

C. Effort costs

- Effort costs are basically identified with a project. They can be classified as direct cost, unless otherwise specified.
- Effort costs are not just the salaries of the software engineers or programmers who are involved in the project. Organisations compute effort costs in terms of overhead costs where they take the total cost of running the organisation and divide this by the number of productive staff. Therefore, the following costs are all part of the total effort cost:
 1. Costs of providing, heating and lighting office space
 2. Costs of support staff such as accountants, administrators, system managers, cleaners and technicians
 3. Costs of networking and communications
 4. Costs of central facilities such as a library or recreational facilities
 5. Costs of Social Security and employee benefits such as pensions and health insurance, etc.

In short, effort cost includes Salary of the staff concerned and part of common overhead.

ILLUSTRATION 9

Following are the data pertaining to Infotech Pvt. Ltd, for the year 2022-23:

	Amount (₹)
Salary to Software Engineers (5 persons)	15,00,000
Salary to Project Leaders (2 persons)	9,00,000
Salary to Project Manager	6,00,000
Repairs & maintenance	3,00,000
Administration overheads	12,00,000

The company executes a Project XYZ, the details of the same as are as follows:

Project duration – 6 months

One Project Leader and three Software Engineers were involved for the entire duration of the project, whereas Project Manager spends 2 months' efforts, during the execution of the project.

Travel expenses incurred for the project – ₹ 1,87,500

Two Laptops were purchased at a cost of ₹ 50,000 each, for use in the project and the life of the same is estimated to be 2 years

PREPARE Project cost sheet.

SOLUTION

Working Notes:

(1) Calculation of Cost per month and Overhead absorption rate

Particulars	Total Per Annum	Per Person Per Annum	Per Person Per Month
Salary to Software Engineer (5 Persons)	₹15,00,000	₹ 3,00,000	₹25,000
Salary to Project Leaders (2 persons)	₹ 9,00,000	₹ 4,50,000	₹ 37,500

Salary to Project Manager	₹ 6,00,000	₹ 6,00,000	₹ 50,000
Total	₹ 30,00,000		₹ 1,12,500

- (2) **Total Overhead** = Repairs & maintenance + Administration overheads
= ₹ 3,00,000 + ₹12,00,000 = ₹15,00,000

(3) **Calculation of Overhead absorption rate**

$$= \text{Total Overhead} / \text{Total Salary} = ₹15,00,000 / ₹30,00,000 = 50\%$$

Project Cost Sheet

		(₹)
Salary Cost:		
Salary of Software Engineers	(3 × ₹ 25,000 × 6 months)	4,50,000
Salary of Project Leader	(₹ 37,500 × 6 months)	2,25,000
Salary of Project Manager	(₹ 50,000 × 2 months)	1,00,000
Total Salary		7,75,000
Overheads	(50% of Salary)	3,87,500
Travel Expenses		1,87,500
Depreciation on Laptops	(₹1,00,000 / 2 years × 6 months)	25,000
Total Project Cost		13,75,000

9. COSTING OF TOLL ROADS

The Construction of roads brings about a variety of benefits that are enjoyed practically by all sectors of the economy. Highway economic analysis is a technique whereby the cost and benefit from a scheme are quantified over a selected time horizon and evaluated by a common yardstick.

The economic analysis involves comparison of project costs and benefits under the "with" and "without" project conditions.

The project is further subjected to sensitivity analysis by assessing the effects of adverse changes in the key variables. In addition, the combined effect of these

changes is also assessed. This helps to gauge the economic strength of the project to withstand future risks and uncertainties.

9.1 Cost Involved

The project cost consists of following two main components:

9.1.1 Capital Costs

The capital cost consists of cost incurred during the construction period. Generally, this sort of road construction projects run across multiple financial years. The total expenditure to be incurred during the construction period is termed as capital cost.

The total cost includes the cost of construction of road and other structures and consultancy charges. In addition to this cost, it also includes the cost of construction of tollbooths.

Construction expenses can be broadly classified as follows:

- Preliminary and pre-operative expenses
- Land Acquisition
- Materials
- Labour
- Overheads incurred in the course of actual construction
- Contingency allowance
- Interest during construction period

9.1.2 Operating and Maintenance Costs

Routine maintenance cost would be incurred once the Toll road is operational. Routine maintenance involves Patching of potholes, sealing of cracks, Edge Repair, Surface Renewal, Periodic maintenance for new highways would be met with in accordance with the analysis of the life cycle model carried out for the project.

Annual operating cost includes the cost of operating tollbooths, administrative expenses, emergency services, communications and security services and other costs of operation.

Maintenance cost includes the cost of annual maintenance (routine) and periodic maintenance.

- Annual maintenance cost includes primary maintenance of wearing surface, railings, roadside furniture, etc.
- Periodic maintenance cost includes the cost of overlays (wearing coats), painting of railings, etc.

Operating and Maintenance expenses can be broadly classified as follows:

- Toll collection expenses
- Administrative expenses for day-to-day operation.
- Maintenance expenses, which include routine and periodic maintenance.
- Interest expenses incurred for servicing term loans.

9.2 Build-Operate-Transfer (BOT) Approach

In recent years a growing trend emerged among Governments in many countries to solicit investments for public projects from the private sector under BOT scheme. BOT is an option for the Government to outsource public projects to the private sector.

With BOT, the private sector designs, finances, constructs and operate the facility and eventually, after specified concession period, the ownership is transferred to the Government. Therefore, BOT can be seen as a developing technique for infrastructure projects by making them amenable to private sector participation.

The fundamental principle in determining user levy is, 'if the price for a transport facility is set at a level that reflects the benefit, each user gains from improvements in the facility, it will result in traffic flow levels that equate social costs with user benefits.'

9.3 Toll Rate

In general, the toll rate should have a direct relation with the benefits that the road users would gain from its improvements. The benefits to road users are likely to be in terms of fuel savings, improvement in travel time and good riding quality.

To compute the toll rate following formula with rounding off to nearest multiple of five has been adopted:

User Fee = Total Distance × Toll Rate per km

ILLUSTRATION 10

BHG Toll Plaza Ltd built a 60 km. long highway and now operates a toll plaza to collect tolls from passing vehicles using the highway. The company has estimated that a total of 12 crore vehicles (only single type of vehicle) will be using the highway during the 10 years toll collection tenure.

Toll Operating and Maintenance cost for the month of April are as follows:

(i) Salary to –

- *Collection Personnel (3 Shifts and 4 persons per shift) - ₹ 550 per day per person*
- *Supervisor (2 Shifts and 1 person per shift) - ₹ 750 per day per person*
- *Security Personnel (3 Shifts and 6 persons per shift) - ₹ 450 per day per person*
- *Toll Booth Manager (2 Shifts and 1 person per shift) - ₹ 900 per day per person*

(ii) Electricity – ₹ 8,00,000

(iii) Telephone – ₹ 1,40,000

(iv) Maintenance cost – ₹ 30 Lakh

Monthly depreciation and amortisation expenses will be ₹ 1.50 crore. Further, the company needs 25% profit over total cost to cover interest and other costs.

Required:

- (i) CALCULATE cost per kilometer per month.
- (ii) CALCULATE the toll rate per vehicle.

SOLUTION**Calculation of cost for the month of April**

Particulars		(₹)
Salary to Collection Personnel	(3 Shifts × 4 persons per shift × 30 days × ₹ 550 per day)	1,98,000
Salary to Supervisor	(2 Shifts × 1 persons per shift × 30 days × ₹ 750 per day)	45,000
Salary to Security Personnel	(3 Shifts × 6 persons per shift × 30 days × ₹ 450 per day)	2,43,000
Salary to Toll Booth Manager	(2 Shifts × 1 persons per shift × 30 days × ₹ 900 per day)	54,000
Electricity		8,00,000
Telephone		1,40,000
Maintenance cost		30,00,000
Total operating cost (A)		44,80,000
Depreciation and amortisation expenses (B)		1,50,00,000
Total Cost (A + B)		1,94,80,000

(i) Calculation of cost per kilometer per month:

$$= \frac{\text{Total Cost}}{\text{Total km.}} = \frac{\text{₹ 1,94,80,000}}{60 \text{ km.}} = \text{₹ 3,24,666.67}$$

(ii) Calculation of toll rate per vehicle:

$$= \frac{\text{Total Cost} + 25\% \text{ profit}}{\text{Vehicles per month}} = \frac{\text{₹ 1,94,80,000} + \text{₹ 48,70,000}}{10,00,000 \text{ vehicles}} = \text{₹ 24.35}$$

Working:

No. of vehicles using the highway per month

$$\frac{\text{Total estimated vehicles}}{10 \text{ years}} \times \frac{1 \text{ month}}{12 \text{ months}} = \frac{12 \text{ crore}}{10 \text{ years}} \times \frac{1 \text{ month}}{12 \text{ months}} = 10 \text{ lakhs}$$

10. COSTING OF EDUCATIONAL INSTITUTIONS

Educational institutions like schools, colleges, technical institutes for education and training, are run to impart education and training to students. The objective of running these institutions may be 'Not-for profit' or 'For profit'. Like other business entities, cost and management accounting is also inevitable for this sector. The Government, Local body of any other organisation which provides education and training to students with an objective to benefit and upliftment of the society, are also need cost and management accounting system for cost-social benefit analysis, allocation of funds and budgeting (zero-based budgeting), performance measurement and evaluation etc.

10.1 Income of the Educational Institutions

The source of income of an institute may be classified on the basis of recurrence as follows:

One-time fees: These are the fees which are collected once in a course period or for a definite period like Admission fee, Development fee, Annual fee etc.

Recurring fees: Tuition fee, laboratory, computer and internet fee, library fee, training fee, amenities fee, sports fee, extracurricular activities fee etc.

The Government and other aided institutes may not be permitted to collect various fees like capitation fee and development fees etc. Further, unlike the trading and manufacturing organizations, these are not free to determine fees beyond a prescribed limit.

Other incomes: The indirect income like transport, hostel, mess and canteen for the students and staff are provided by the educational institutions normally on no profit no loss basis.

10.2 Expenditure of the Educational Institutions

(i) Operational Cost:

Following are the major operational costs incurred by an educational institution:

- The salary of the teaching and non-teaching staff
- Laboratory maintenance charges

- Computer maintenance and internet charges,
- Building maintenance,
- Repairs and maintenance of equipment,
- Administrative expenses,
- Finance charges etc.

Cost Centres and basis of cost allocation

Cost centres in educational institutions are classified as follows:

- Primary or Direct cost centres (like Civil Engineering department, Mechanical Engineering department, etc.)
- Service cost centres (like Laboratory, Library, Sports, etc.)
- Student's Self-Supporting Services (like Transport, Hostel & Mess, etc.)
- Administration Cost centres (like Research & Improvement, Examination)

Costs incurred are allocated to the respective cost centres, if they are identifiable with a cost centre and apportioned to service and administration cost centres on suitable basis.

(ii) Research and Development Cost

Educational institutions undertake academic research on various fields of specializations. The costs of such research including personal costs, books etc. are to be collected through a cost centre approach. All costs incurred in that cost centre are collected and set off against the revenue generated from such research projects.

If any balance is left out as undistributed, then such balance costs can be collectively distributed to all other course cost centre as a separate cost element namely "Research costs".

(iii) Cost of Publication of research and other materials

In an educational institution, there will be a separate department for conducting research publication related exercise. The cost incurred would be directly allocated to that department.

ILLUSTRATION 11

AD Higher Secondary School (AHSS) offers courses for 11th & 12th standard in three streams i.e. Arts, Commerce and Science. AHSS runs higher secondary classes along with primary and secondary classes, but for accounting purpose it treats higher secondary as a separate responsibility centre. The Managing committee of the school wants to revise its fee structure for higher secondary students. The accountant of the school has provided the following details for a year:

	Amount (₹)
Teachers' salary (25 teachers × ₹ 35,000 × 12 months)	1,05,00,000
Principal's salary	14,40,000
Lab attendants' salary (2 attendants × ₹ 15,000 × 12 months)	3,60,000
Salary to library staff	1,44,000
Salary to peons (4 peons × ₹ 10,000 × 12 months)	4,80,000
Salary to other staffs	4,80,000
Examinations expenditure	10,80,000
Office & Administration cost	15,20,000
Annual day expenses	4,50,000
Sports expenses	1,20,000

Other information:

(i)

	Standard 11 & 12			Primary & Secondary
	Arts	Commerce	Science	
No. of students	120	360	180	840
Lab classes in a year	0	0	144	156
No. of examinations in a year	2	2	2	2
Time spent at library by students per year	180 hours	120 hours	240 hours	60 hours

Time spent by principal for administration	208 hours	312 hours	480 hours	1,400 hours
Teachers for 11 & 12 standard	4	5	6	10

- (ii) One teacher who teaches economics for Arts stream students also teaches commerce stream students. The teacher takes 1,040 classes in a year, it includes 208 classes for commerce students.
- (iii) There is another teacher who teaches mathematics for Science stream students also teaches business mathematics to commerce stream students. She takes 1,100 classes a year, it includes 160 classes for commerce students.
- (iv) One peon is fully dedicated for higher secondary section. Other peons dedicate their 15% time for higher secondary section.
- (v) All school students irrespective of section and age participates in annual functions and sports activities.

Required:

- (a) CALCULATE cost per student per annum for all three streams.
- (b) If the management decides to take uniform fee of ₹ 1,000 per month from all higher secondary students, CALCULATE stream wise profitability.
- (c) If management decides to take 10% profit on cost, COMPUTE fee to be charged from the students of all three streams respectively.

SOLUTION

Calculation of Cost per annum

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Teachers' salary (W.N-1)	16,80,000	21,00,000	25,20,000	63,00,000
Re-apportionment of Economics & Mathematics teachers' salary (W.N- 2)	(84,000)	1,45,091	(61,091)	-

Principal's salary (W.N-3)	1,24,800	1,87,200	2,88,000	6,00,000
Lab assistants' salary (W.N-4)	-	-	1,72,800	1,72,800
Salary to library staff (W.N-5)	43,200	28,800	57,600	1,29,600
Salary to peons (W.N-6)	31,636	94,909	47,455	1,74,000
Salary to other staffs (W.N-7)	38,400	1,15,200	57,600	2,11,200
Examination expenses (W.N- 8)	86,400	2,59,200	1,29,600	4,75,200
Office & Administration expenses (W.N- 7)	1,21,600	3,64,800	1,82,400	6,68,800
Annual Day expenses (W.N-7)	36,000	1,08,000	54,000	1,98,000
Sports expenses (W.N- 7)	9,600	28,800	14,400	52,800
Total Cost per annum	20,87,636	34,32,000	34,62,764	89,82,400

(i) Calculation of cost per student per annum

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Total Cost per annum	20,87,636	34,32,000	34,62,764	89,82,400
No. of students	120	360	180	660
Cost per student per annum	17,397	9,533	19,238	13,610

(ii) Calculation of profitability

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Total Fees per annum	12,000	12,000	12,000	
Cost per student per annum	17,397	9,533	19,238	
Profit/ (Loss) per student per annum	(5,397)	2,467	(7,238)	
No. of students	120	360	180	
Total Profit/ (Loss)	(6,47,640)	8,88,120	(13,02,840)	

(iii) Computation of fees to be charged to earn a 10% profit on cost

Particulars	Arts (₹)	Commerce (₹)	Science (₹)
Cost per student per annum	17,397	9,533	19,238
Add: Profit @10%	1,740	953	1,924
Fees per annum	19,137	10,486	21,162
Fees per month	1,595	874	1,764

Working Notes:**(1) Teachers' salary**

Particulars	Arts	Commerce	Science
No. of teachers	4	5	6
Salary per annum (₹) (₹ 35,000 x 12)	4,20,000	4,20,000	4,20,000
Total salary	16,80,000	21,00,000	25,20,000

(2) Re-apportionment of Economics and Mathematics teachers' salary

Particulars	Economics		Mathematics	
	Arts	Commerce	Science	Commerce
No. of classes	832	208	940	160
Salary re-apportionment (₹)	(84,000)	84,000	(61,091)	61,091
	$\left(\frac{₹4,20,000}{1,040} \times 208 \right)$		$\left(\frac{₹4,20,000}{1,100} \times 160 \right)$	

- (3) Principal's salary has been apportioned on the basis of time spent by him for administration of classes.
- (4) Lab attendants' salary has been apportioned on the basis of lab classes attended by the students.
- (5) Salary of library staffs are apportioned on the basis of time spent by the students in library.

- (6) Salary of Peons are apportioned on the basis of number of students. The peons' salary allocable to higher secondary classes is calculated as below:

	Amount (₹)
Peon dedicated for higher secondary (1 peon × ₹10,000 × 12 months)	1,20,000
Add: 15% of other peons' salary {15% of (3 peons × ₹10,000 × 12 months)}	54,000
	1,74,000

- (7) Salary to other staffs, office & administration cost, Annual day expenses and sports expenses are apportioned on the basis of number of students.
- (8) Examination expenses has been apportioned taking number of students into account (It may also be apportioned on the basis of number of examinations).



11. COSTING IN INSURANCE COMPANIES

Insurance or assurance industry operates in providing social security to the persons who subscribe for the policy. The Insurance companies are broadly classified as Life insurer and Non-Life Insurer (General Insurance providers). Life insurers provide assurance to the policy holders' life for the insured value. The Non-life insurers are providing insurance to the policyholder for actual loss upto insured value for the policy.

The insurance companies are need to analyse it various insurance product for profitability. The product offered by insurance companies may include:

- (i) Life Insurance policies- with or without maturity benefits
- (ii) General insurance- Health, Fire, Property, Travel Insurance etc.
- (iii) Others services- Re-insurance, Fund management- Pension, Gratuity and other etc.

11.1 Income of Insurance Companies

Income of insurance companies may include

- (i) Premium on policy (periodic or onetime)
- (ii) Commission on re-insurance
- (iii) Fund administration fee and return on investment of funds etc.

11.2 Expenditure of Insurance Companies

The Expenditure of an insurance company can be classified as direct and indirect to a policy or product.

Direct- Commission paid to agents, claim settlement, cost of valuation, premium for re-insurance, legal and other costs etc.

Indirect Cost- Actuarial fees, market and product development costs, administration cost, asset management cost etc.

11.3 Method of Costing in an Insurance Company

The cost object in an insurance company may be a product, a policy, a department or region, an agent etc.

Activity Based Costing in Insurance Companies

Activity based costing (ABC) is used for analysis of cost-benefit of a product (Direct Product Profitability), policy profitability (Customer Profitability Analysis) etc.

Costs that occur in insurance companies are to be identified with appropriate activities that have caused its occurrence. Then costs must be reassigned from activities to cost objects (insurance contracts and policies, customers, delivery channels) based on identified cost drivers.

Identification of activities and assignment of costs are the most critical for the implementation of activity-based costing. The activities can be divided into two parts i.e. (i) Pre-product development activities and (ii) Post product development activities.

(i) Pre-product development activities: These are the activities which are carried out before a product is made. It includes market research, product

development like specification of coverage, conditions, amount of premium, insurance contract, policy forms and provision for sales channel etc.

(ii) Post product development activities: This activity is further divided into parts i.e. (a) Selling of policy and (b) Processing of claims. (a) Selling of policy refers to appointment of distribution of sales channel (direct selling or through agencies), soliciting for policy, processing of applications etc. (b) Processing of claim includes claim inception, claim estimation, claim settlement and legal actions.

The activities costs are assigned to the products on the basis of appropriate cost drivers. The cost drivers may include no. of hours spent on processing of an application and claim processing, no. of application, no. of policy, no. of claim etc.

ILLUSTRATION 12

Sanziet Lifecare Ltd. operates in life insurance business. Last year it launched a new term insurance policy for practicing professionals 'Professionals Protection Plus'. The company has incurred the following expenditures during the last year for the policy:

	₹
Policy development cost	11,25,000
Cost of marketing of the policy	45,20,000
Sales support expenses	11,45,000
Policy issuance cost	10,05,900
Policy servicing cost	35,20,700
Claims management cost	1,25,600
IT cost	74,32,000
Postage and logistics	10,25,000
Facilities cost	15,24,000
Employees cost	5,60,000
Office administration cost	16,20,400

Number of policies sold- 528

Total insured value of policies- ₹1,320 crore

Required:

- (i) CALCULATE total cost for Professionals Protection Plus policy segregating the costs into four main activities namely (a) Marketing and Sales support, (b) Operations, (c) IT and (d) Support functions.
- (ii) CALCULATE cost per policy.
- (iii) CALCULATE cost per rupee of insured value.

SOLUTION**(i) Calculation of total cost for 'Professionals Protection Plus policy**

Particulars		Amount (₹)	Amount (₹)
1.	Marketing and Sales support:		
	- Policy development cost	11,25,000	
	- Cost of marketing	45,20,000	
	- Sales support expenses	11,45,000	67,90,000
2.	Operations:		
	- Policy issuance cost	10,05,900	
	- Policy servicing cost	35,20,700	
	- Claims management cost	1,25,600	46,52,200
3.	IT Cost		74,32,000
4.	Support functions		
	- Postage and logistics	10,25,000	
	- Facilities cost	15,24,000	
	- Employees cost	5,60,000	
	- Office administration cost	16,20,400	47,29,400
	Total Cost		2,36,03,600

(ii) **Calculation of cost per policy** = $\frac{\text{Total cost}}{\text{No. of policies}} = \frac{₹2,36,03,600}{528} = ₹ 44,703.79$

(iii) **Cost per rupee of insured value** = $\frac{\text{Total cost}}{\text{Total insured value}} = \frac{₹ 2.36 \text{ crore}}{₹ 1,320 \text{ crore}}$
 = ₹ 0.0018



12. COSTING IN FINANCIAL INSTITUTIONS

In the past two-decade financial institutions have undergone major changes – in terms to increased regulations, competition from new entrants from both locally and globally, innovation of new products and services, technological advancement and increased expectations of new generation customers, etc.

Over and above the challenges posed by the prevailing environment as described above, financial institutions underwent considerable changes in terms of its high quality, sensitive staffing requirements and its productivity.

Manpower cost, other than interest cost and finance charges, is one of the largest single cost components in financial institutions. Hence, it is needless to say, that financial institutions are more interested in understanding and discovering the ways to more accurately allocate such costs to various product ranges offered by them and its customers.

If the financial institution is to survive under the present challenging economic conditions, it will have to add value to its products and services. It is imperative to note that the financial institution needs to know the contribution of its products, services and customers to value creation.

12.1 Cost Measurement in Financial Institutions

The objectives of cost measurement include –

- Understand the profitability by products offered and by customers
- Establishing a mechanism for pricing the products, by identifying the product level and activity level unit costs
- Understanding productivity issues and their relationship with strategic goals of the organization

In nutshell, financial institutions need to understand their position in various product lines and to find out how they can stay in competing edge or becomes a leader.

12.2 Activity Based Costing in Financial Institutions

Activity based costing can be a useful tool in allocating the cost elements to various products offered and the customers being serviced.

Activity based costing can help financial institutions to –

- Identify and analyze the profitability by product
- Analyze the profitability by customer
- Identify the activity level unit costs and build up product level costs, which in turn forms basis for product level pricing / customer level pricing

Financial institutions can improve their profitability by –

- Concentrating on products that are more profitable
- Focus on high margin customers

Costs that occur in financial institutions are to be identified with appropriate activities that have caused its occurrence. Then costs must be reassigned from activities to cost objects (various loan products offered by the organization, customers, etc.) based on identified cost drivers.

The concepts on activity-based costing as discussed under Costing of Insurance Companies also applicable to financial institutions. Please refer the same.

ILLUSTRATION 13

The loan department of a bank performs several functions in addition to home loan application processing task. It is estimated that 25% of the overhead costs of loan department are applicable to the processing of home-loan application. The following information is given concerning the processing of a loan application:

Direct professional labor:

	(₹)
Loan processor monthly salary:	<u>2,40,000</u>
(4 employees @ ₹60,000 each)	
Loan department overhead costs (monthly)	
Chief loan officer's salary	75,000
Telephone expenses	7,500

<i>Depreciation Building</i>	<i>28,000</i>
<i>Legal advice</i>	<i>24,000</i>
<i>Advertising</i>	<i>40,000</i>
<i>Miscellaneous</i>	<i>6,500</i>
<i>Total overhead costs</i>	<i>1,81,000</i>

You are required to COMPUTE the cost of processing home loan application on the assumption that five hundred home loan applications are processed each month.

SOLUTION

Statement showing computation of the cost of processing a typical home loan application

	(₹)
Direct professional labour cost	2,40,000
(4 employees @ ₹ 60,000 each)	
Service overhead cost (25% of ₹ 1,81,000)	<u>45,250</u>
Total processing cost per month	2,85,250
No. of applications processed per month	500
Total processing cost per home loan application	570.5

13. OTHER SERVICES- COSTING FOR POWER HOUSES

Power houses are engaged either in electricity generation or steam generation use the concepts of service costing i.e., 'Powerhouse Costing.' Service cost statement can be prepared by identifying the costs associated with the power generation or steam generation.

Cost unit is different for electricity generation and steam generation.

The cost unit for electricity generation organization is cost per kilowatt-hour (kWh) – that means cost of generating one kilowatt of power per hour. Please note that kWh is commonly known as a "Unit".

The costs are shown under the following heads:

- (i) **Standing Charges or Fixed costs:** These are the fixed costs that remain constant irrespective of the power or stream generated. These costs include the following:
- Rent, Rates & Taxes
 - Insurance
 - Depreciation
 - Salaries, if paid on Time (Monthly) basis
 - Administration expenses, etc.
- (ii) **Variable costs or Running costs:** These costs are generally associated with the power or stream generated. These costs include the following:
- Fuel Charges
 - Water Charges
 - Wages / Labour charges, if paid on the basis of production
 - Any other variable costs identified.
- (iii) **Semi-variable costs or Maintenance costs:** These costs include the following:
- Meters
 - Furnaces
 - Service materials
 - Tools, etc.

ILLUSTRATION 14

PREPARE the cost statement of Ignus Thermal Power Station showing the cost of electricity generated per kWh, from the data provided below pertaining to the year 2022-23.

Total units generated 20,00,000 kWh

	Amount (₹)
<i>Operating labour</i>	<i>30,00,000</i>

Repairs & maintenance	10,00,000
Lubricants, spares and stores	8,00,000
Plant supervision	6,00,000
Administration overheads	40,00,000

5 kWh. of electricity generated per kg of coal consumed @ ₹ 4.25 per kg. Depreciation charges @ 5% on capital cost of ₹ 5,00,00,000.

SOLUTION

Cost Statement of Ignus Thermal Power Station

Total units generated

20,00,000 kwh.

	Per annum (₹)	Per kWh (₹)
Fixed costs:		
Plant supervision	6,00,000	
Administration overheads	40,00,000	
Depreciation (5% of ₹ 5,00,00,000 p.a.)	25,00,000	
Total fixed cost: (A)	71,00,000	3.55
Variable costs:		
Operating labour	30,00,000	
Lubricants, spares and stores	8,00,000	
Repairs & maintenance	10,00,000	
Coal cost (Refer to working note)	17,00,000	
Total variable cost: (B)	65,00,000	3.25
Total cost [(A) + (B)]	1,36,00,000	6.80

Working Note:

Coal cost (20,00,000 kwh. ÷ 5 kwh) × ₹ 4.25 per kg. = ₹ 17,00,000

ILLUSTRATION 15

Solar Power Ltd. has a power generation capacity of 1000 Megawatt per day. On an average it operates at 85% of its installed capacity. The cost structure of the plant is as under:

	Cost particulars	Amount (₹ in Lakh)
1.	Employee cost per year	2500
2.	Solar panel maintenance cost per year	250
3.	Site maintenance cost per year	150
4.	Depreciation per year	5940

CALCULATE cost of generating 1kW of power.

[1 Megawatt = 1,000 kW]

SOLUTION

Working:

- Estimated power generated in a year
 $= 1000 \text{ Megawatt} \times 85\% \times 365 \text{ days}$
 $= 3,10,250 \text{ Megawatt}$

Calculation of 1 kW power generation cost:

	Cost particulars	Amount (₹ in Lakh)
A.	Employee cost per year	2500
B.	Solar panel maintenance cost per year	250
C.	Site maintenance cost per year	150
D.	Depreciation per year	5940
E.	Total Cost [A+B+C+D]	8840
F.	Estimated power generated (in Megawatt) (Refer working note-1)	3,10,250
G.	Cost of generating 1 Megawatt (₹) [(E÷F)×1,00,000]	2,849.31
H.	Cost of 1 kW (₹) [G÷1,000]	2.849

SUMMARY

- ♦ **Service Costing:** It is application of cost concepts in ascertainment of cost or providing services. It is also known as operating costing as relates to operating of a service.
- ♦ **Composite Cost Unit:** Unit of service cost consists of two different units.
- ♦ **Key Performance Indicators (KPIs):** KPIs are the quantitative and qualitative factors which are commonly used to assess the performance of an organization which are important to achieve its goal.
- ♦ **Equivalent Service unit:** To calculate cost or pricing of two more different grade of services which uses common resources, each grade of service is assigned a weight and converted into equivalent units. Converting services into equivalent units make different grade of services equivalent and comparable.
- ♦ **Build-Operate-Transfer (BOT):** With BOT, the private sector designs, finances, constructs and operate the facility and eventually, after specified concession period, the ownership is transferred to the Government. Therefore, BOT can be seen as a developing technique for infrastructure projects by making them amenable to private sector participation.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *Composite cost unit for a hospital is:*
 - (a) *Per patient*
 - (b) *Per patient-day*
 - (c) *Per day*
 - (d) *Per bed*
2. *Cost of diesel and lubricant is an example of:*
 - (a) *Operating cost*
 - (b) *Fixed charges*

- (c) *Semi-variable cost*
 - (d) *None of the above*
3. *Cost units used in power sector is:*
- (a) *Kilo meter (K.M)*
 - (b) *Kilowatt-hour (kWh)*
 - (c) *Number of electric points*
 - (d) *Number of hours*
4. *Absolute Tonne-km. is an example of:*
- (a) *Composite units in power sector*
 - (b) *Composite unit of transport sector*
 - (c) *Composite unit for bus operation*
 - (d) *Composite unit for oil and natural gas*
5. *Depreciation is treated as fixed cost if it is related to:*
- (a) *Activity level*
 - (b) *Related with machine hours*
 - (c) *Efflux of time*
 - (d) *None of the above*
6. *Jobs undertaken by IT & ITES organizations are considered as:*
- (a) *Project*
 - (b) *Batch work*
 - (c) *Contract*
 - (d) *All the above*
7. *In Toll Road costing, the repetitive costs include:*
- (a) *Maintenance cost*
 - (b) *Annual operating costs*

- (c) *None of the above*
 - (d) *Both (a) and (b)*
8. *BOT approach means:*
- (a) *Build, Operate and Transfer*
 - (b) *Buy, Operate and Transfer*
 - (c) *Build, Operate and Trash*
 - (d) *Build, Own and Trash*
9. *Pre-product development activities in insurance companies, include:*
- (a) *Processing of Claim*
 - (b) *Selling of policy*
 - (c) *Provision of conditions*
 - (d) *Policy application processing*
10. *Which of the following costing method is not appropriate for costing of educational institutes:*
- (a) *Batch Costing*
 - (b) *Activity Based Costing*
 - (c) *Absorption Costing*
 - (d) *Process Costing*

Theoretical Questions

1. *EXPLAIN briefly, what do you understand by Service Costing.*
2. *STATE how are composite units computed.*
3. *STATE the features of service costing.*

Practical Problems

1. *SLS Infrastructure built and operates 110 k.m. highway on the basis of Built-Operate-Transfer (BOT) for a period of 25 years. A traffic assessment carried out to estimate the traffic flow per day shows the following figures:*

Sl. No.	Type of vehicle	Daily traffic volume
1.	Two wheelers	44,500
2.	Car and SUVs	3,450
3.	Bus and LCV	1,800
4.	Heavy commercial vehicles	816

The following is the estimated cost of the project:

Sl. No.	Activities	Amount (₹ in lakh)
1	Site clearance	170.70
2	Land development and filling work	9,080.35
3	Sub base and base courses	10,260.70
4	Bituminous work	35,070.80
5	Bridge, flyovers, underpasses, Pedestrian subway, footbridge, etc	29,055.60
6	Drainage and protection work	9,040.50
7	Traffic sign, marking and road appurtenance	8,405.00
8	Maintenance, repairing and rehabilitation	12,429.60
9	Environmental management	982.00
	Total Project cost	114,495.25

An estimated cost of ₹1,120 lakh has to be incurred on administration and toll plaza operation.

On the basis of the vehicle specifications (i.e. weight, size, time saving etc.), the following weights has been assigned to the passing vehicles:

Sl. No.	Type of vehicle	
1.	Two wheelers	5%
2.	Car and SUVs	20%
3.	Bus and LCV	30%
4.	Heavy commercial vehicles	45%

Required:

- (i) *CACULATE the total project cost per day of concession period.*
- (ii) *COMPUTE toll fee to be charged for per vehicle of each type, if the company wants to earn a profit of 15% on total cost.*

[Note: Concession period is a period for which an infrastructure is allowed to operate and recovers its investment]

2. *Mr. X owns a bus which runs according to the following schedule:*

(i)	<i>Delhi to Chandigarh and back, the same day.</i>	
	<i>Distance covered:</i>	<i>250 km. one way.</i>
	<i>Number of days run each month:</i>	<i>8</i>
	<i>Seating capacity occupied</i>	<i>90%.</i>
(ii)	<i>Delhi to Agra and back, the same day.</i>	
	<i>Distance covered:</i>	<i>210 km. one way</i>
	<i>Number of days run each month:</i>	<i>10</i>
	<i>Seating capacity occupied</i>	<i>85%</i>
(iii)	<i>Delhi to Jaipur and back, the same day.</i>	
	<i>Distance covered:</i>	<i>270 km. one way</i>
	<i>Number of days run each month:</i>	<i>6</i>
	<i>Seating capacity occupied</i>	<i>100%</i>
(iv)	<i>Following are the other details:</i>	
	<i>Cost of the bus</i>	<i>₹ 12,00,000</i>
	<i>Salary of the Driver</i>	<i>₹ 24,000 p.m.</i>
	<i>Salary of the Conductor</i>	<i>₹ 21,000 p.m.</i>
	<i>Salary of the part-time Accountant</i>	<i>₹ 5,000 p.m.</i>
	<i>Insurance of the bus</i>	<i>₹ 4,800 p.a.</i>
	<i>Diesel consumption 4 km. per litre at</i>	<i>₹ 56 per litre</i>
	<i>Road tax</i>	<i>₹ 15,915 p.a.</i>

	Lubricant oil	₹ 10 per 100 km.
	Permit fee	₹ 315 p.m.
	Repairs and maintenance	₹ 1,000 p.m.
	Depreciation of the bus	@ 20% p.a.
	Seating capacity of the bus	50 persons.

Passenger tax is 20% of the total takings.

CALCULATE the bus fare to be charged from each passenger to earn a profit of 30% on total takings. The fares are to be indicated per passenger for the journeys:

(i) Delhi to Chandigarh (ii) Delhi to Agra and (iii) Delhi to Jaipur.

3. A company is considering three alternative proposals for conveyance facilities for its sales personnel who has to do considerable traveling, approximately 20,000 kilometers every year. The proposals are as follows:

- (i) Purchase and maintain its own fleet of cars. The average cost of a car is ₹ 6,00,000.
- (ii) Allow the Executive use his own car and reimburse expenses at the rate of ₹ 10 per kilometre and also bear insurance costs.
- (iii) Hire cars from an agency at ₹ 1,80,000 per year per car. The company will have to bear costs of petrol, taxes and tyres.

The following further details are available:

Petrol ₹ 6 per km.	Repairs and maintenance ₹ 0.20 per km.
Tyre ₹ 0.12 per km.	Insurance ₹ 1,200 per car per annum
Taxes ₹ 800 per car per annum	Life of the car: 5 years with annual mileage of 20,000 km.

Resale value: ₹ 80,000 at the end of the fifth year.

WORK OUT the relative costs of three proposals and rank them.

4. From the following data pertaining to the year 2022-23 *PREPARE* a cost statement showing the cost of electricity generated per kwh by Chambal Thermal Power Station.

Total units generated	10,00,000 kWh
	(₹)
Operating labour	15,00,000
Repairs & maintenance	5,00,000
Lubricants, spares and stores	4,00,000
Plant supervision	3,00,000
Administration overheads	20,00,000

5 kWh. of electricity generated per kg. of coal consumed @ ₹ 4.25 per kg.
Depreciation charges @ 5% on capital cost of ₹ 2,00,00,000.

Case Scenarios

1. A LMV Pvt. Ltd, operates cab/ car rental service in Delhi/NCR. It provides its service to the offices of Noida, Gurugram and Faridabad. At present it operates CNG fuelled cars but it is also considering to upgrade these into Electric vehicle (EV). The following details related with the owning of CNG & EV propelled cars are as tabulated below:

Particulars	CNG Car	EV Car
Car purchase price (₹)	9,20,000	15,20,000
Govt. subsidy on purchase of car (₹)	--	1,50,000
Life of the car	15 years	10 years
Residual value (₹)	95,000	1,70,000
Mileage	20 km/kg	240 km per charge
Electricity consumption per full charge	--	30 Kwh
CNG cost per Kg (₹)	60	--
Power cost per Kwh (₹)	--	7.60
Annual Maintenance cost (₹)	8,000	5,200
Annual insurance cost (₹)	7,600	14,600

Tyre replacement cost in every 5 - year (₹)	16,000	16,000
Battery replacement cost in every 8- year (₹)	12,000	5,40,000

Apart from the above, the following are the additional information:

Particulars	
Average distance covered by a car in a month	1,500 km
Driver's salary (₹)	20,000 p.m
Garage rent per car (₹)	4,500 p.m
Share of Office & Administration cost per car (₹)	1,500 p.m

You have been approached by the management of A LMV Pvt. Ltd. for consultation on the two options of operating the cab service. The expected questions that may be asked by the management are as follows:

- (i) What would be the depreciable value of EV Car?
 - (a) ₹13,50,000
 - (b) ₹15,20,000
 - (c) ₹14,40,000
 - (d) ₹12,00,000
- (ii) What would be the monthly cost of electricity for an EV car?
 - (a) ₹1,425
 - (b) ₹1,500
 - (c) ₹1,450
 - (d) ₹1,525
- (iii) What would be the total cost to be incurred for replacement of tyres for EV car?
 - (a) ₹32,000
 - (b) ₹24,000

- (c) ₹12,000
- (d) ₹16,000
- (iv) Calculate the operating cost of vehicle per month per car for CNG options.
- (a) ₹36,627.78
- (b) ₹24,000.50
- (c) ₹43,708.33
- (d) ₹16,605.55
- (v) Calculate the operating cost of vehicle per month per car for EV options
- (a) ₹36,627.78
- (b) ₹24,000.50
- (c) ₹43,708.33
- (d) ₹16,605.55

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(b)	2.	(a)	3.	(b)	4.	(b)	5.	(c)	6.	(a)
7.	(a)	8.	(a)	9.	(c)	10.	(d)				

Answers to the Theoretical Questions

1. Please refer paragraph 1
2. Please refer paragraph 2
3. Please refer paragraph 1

Answer to the Practical Problems

1. (i) Calculation of total project cost per day of concession period:

Activities	Amount (₹ in lakh)
Site clearance	170.70
Land development and filling work	9,080.35
Sub base and base courses	10,260.70
Bituminous work	35,070.80
Bridge, flyovers, underpasses, Pedestrian subway, footbridge, etc	29,055.60
Drainage and protection work	9,040.50
Traffic sign, marking and road appurtenance	8,405.00
Maintenance, repairing and rehabilitation	12,429.60
Environmental management	982.00
Total Project cost	114,495.25
Administration and toll plaza operation cost	1,120.00
Total Cost	115,615.25
Concession period in days (25 years × 365 days)	9,125
Cost per day of concession period (₹ in lakh)	12.67

(ii) Computation of toll fee:

Cost to be recovered per day = Cost per day of concession period + 15% profit on cost

$$= ₹12,67,000 + ₹1,90,050$$

$$= ₹14,57,050$$

$$\text{Cost per equivalent vehicle} = \frac{₹14,57,050}{76,444 \text{ units (Refer working note)}}$$

$$= ₹19.06 \text{ per equivalent vehicle}$$

Vehicle type-wise toll fee:

Sl. No.	Type of vehicle	Equivalent cost [A]	Weight [B]	Toll fee per vehicle [A×B]
1.	Two wheelers	₹ 19.06	1	19.06
2.	Car and SUVs	₹ 19.06	4	76.24
3.	Bus and LCV	₹ 19.06	6	114.36
4.	Heavy commercial vehicles	₹ 19.06	9	171.54

Working Note:

The cost per day has to be recovered from the daily traffic. The each type of vehicle is to be converted into equivalent unit. Let's convert all vehicle types equivalent to Two-wheelers.

Sl. No.	Type of vehicle	Daily traffic volume [A]	Weight	Ratio [B]	Equivalent Two-wheeler [A×B]
1.	Two wheelers	44,500	0.05	1	44,500
2.	Car and SUVs	3,450	0.20	4	13,800
3.	Bus and LCV	1,800	0.30	6	10,800
4.	Heavy commercial vehicles	816	0.45	9	7,344
	Total				76,444

2. Working Notes:**Total Distance (in km.) covered per month**

Bus route	Km. per trip	Trips per day	Days per month	Km. per month
Delhi to Chandigarh	250	2	8	4,000
Delhi to Agra	210	2	10	4,200
Delhi to Jaipur	270	2	6	3,240
				11,440

Passenger- km. per month

	Total seats available per month (at 100% capacity)	Capacity utilised		Km. per trip	Passenger-Km. per month
		(%)	Seats		
Delhi to Chandigarh & Back	800 (50 seats × 2 trips × 8 days)	90	720	250	1,80,000 (720 seats × 250 km.)
Delhi to Agra & Back	1,000 (50 seats × 2 trips × 10 days)	85	850	210	1,78,500 (850 seats × 210 km.)
Delhi to Jaipur & Back	600 (50 seats × 2 trips × 6 days)	100	600	270	1,62,000 (600 seats × 270 km.)
Total					5,20,500

Monthly Operating Cost Statement

	(₹)	(₹)
(i) Running Costs		
Diesel {(11,440 km ÷ 4 km) × ₹ 56}	1,60,160	
Lubricant oil {(11,440 km ÷ 100) × ₹ 10}	1,144	1,61,304
(ii) Maintenance Costs		
Repairs & Maintenance		1,000
(iii) Standing charges		
Salary to driver	24,000	
Salary to conductor	21,000	
Salary of part-time accountant	5,000	
Insurance (₹ 4,800 ÷ 12)	400	
Road tax (₹ 15,915 ÷ 12)	1,326.25	
Permit fee	315	
Depreciation {(₹ 12,00,000 × 20%) ÷ 12}	20,000	72,041.25

Total costs per month before Passenger Tax (i)+(ii)+(iii)		2,34,345.25
Passenger Tax*		93,738.10
Total Cost		3,28,083.35
Add: Profit*		1,40,607.15
Total takings per month		4,68,690.50

*Let, total takings be X then

$X = \text{Total costs per month before passenger tax} + 0.2 X (\text{passenger tax}) + 0.3 X (\text{profit})$

$X = ₹ 2,34,345.25 + 0.2 X + 0.3 X$

$0.5 X = ₹ 2,34,345.25$ or, $X = ₹ 4,68,690.50$

Passenger Tax = 20% of ₹4,68,690.50 = ₹ 93,738.10

Profit = 30% of ₹4,68,690.50 = ₹ 1,40,607.15

Calculation of Rate per passenger km. and fares to be charged for different routes

$$\begin{aligned} \text{Rate per Passenger-Km.} &= \frac{\text{Total takings per month}}{\text{Total Passenger-Km. per month}} \\ &= \frac{₹ 4,68,690.50}{5,20,500 \text{ Passenger-Km.}} = ₹ 0.90 \end{aligned}$$

Bus fare to be charged per passenger.

Delhi to Chandigarh	=	₹ 0.90 × 250 km	=	₹ 225.00
Delhi to Agra	=	₹ 0.90 × 210 km	=	₹ 189.00
Delhi to Jaipur	=	₹ 0.90 × 270 km	=	₹ 243.00

3. Calculation of relative costs of three proposals and their ranking

	per annum (₹)	I Use of company's car per km. (₹)	II Use of own car per km. (₹)	III Use of hired car per km. (₹)
Reimbursement		--	10.00	9.00*
Fixed cost:				
Insurance	1,200	0.06	0.06	--
Taxes	800	0.04	--	0.04
Depreciation (₹ 6,00,000 - ₹80,000) ÷ 5 year	1,04,000	5.20	--	--
Running and Maintenance Cost:				
Petrol	--	6.00	--	6.00
Repairs and Maintenance	--	0.20	--	--
Tyre	--	0.12	--	0.12
Total cost per km.	--	11.62	10.06	15.16
Cost for 20,000 km.		2,32,400	2,01,200	3,03,200
Ranking of proposals		II	I	III

* (₹ 1,80,000 ÷ 20,000 km.)

The Second alternative i.e., use of own car by the executive and reimbursement of expenses by the company is the best alternative from company's point of view.

4. Cost Statement of Chambal Thermal Power Station

Total units generated 10,00,000 kWh.

	Per annum (₹)	Per kWh. (₹)
Fixed costs:		
Plant supervision	3,00,000	
Administration overheads	20,00,000	
Depreciation (5% of ₹ 2,00,00,000 p.a.)	10,00,000	
Total fixed cost: (A)	33,00,000	3.30

Variable costs:		
Operating labour	15,00,000	
Lubricants, spares and stores	4,00,000	
Repairs & maintenance	5,00,000	
Coal cost (Refer to working note)	8,50,000	
Total variable cost: (B)	32,50,000	3.25
Total cost [(A) + (B)]	65,50,000	6.55

Working Note:

Coal cost (10,00,000 kWh. ÷ 5 kWh) × ₹ 4.25 per kg. = ₹ 8,50,000

ANSWERS TO THE CASE SCENARIOS**1.**

i.	(d)	ii.	(a)	iii.	(d)	iv.	(a)	v.	(c)

(i) (d) ₹12,00,000**Calculation of Depreciation per month:**

	Particulars	CNG Car	EV Car
A	Car purchase price (₹)	9,20,000	15,20,000
B	Less: Govt. subsidy (₹)	--	(1,50,000)
C	Less: Residual value (₹)	(95,000)	(1,70,000)
D	Depreciable value of car (₹) [A-B-C]	8,25,000	12,00,000
E	Life of the car	15 years	10 years
F	Annual depreciation (₹) [D÷E]	55,000	1,20,000
G	Depreciation per month (₹) [F÷12]	4,583.33	10,000

(ii) (a) ₹1,425**Fuel/ Electricity consumption cost per month:**

	Particulars	CNG Car	EV Car
A	Average distance covered in a month (KM)	1,500	1,500

B	Mileage (KM)	20	240
C	Qty. of CNG/ Full charge required $[A \div B]$	75 kg.	6.25
D	Electricity Consumption $[C \times 30\text{kwh}]$	-	187.5
E	Cost of CNG per kg (₹)	60	-
F	Power cost per Kwh (₹)	-	7.60
G	CNG Cost per month (₹) $[C \times E]$	4,500	-
H	Power cost per month (₹) $[D \times F]$	-	1,425

(iii) (d) ₹16,000

Amortised cost of Tyre replacement:

	Particulars	CNG Car	EV Car
A	Life of vehicle	15 years	10 years
B	Replacement interval	5 years	5 years
C	No. of time replacement required	2 times	1 time
D	Cost of tyres for each replacement (₹)	16,000	16,000
E	Total replacement cost (₹) $[C \times D]$	32,000	16,000
F	Amortised cost per year (₹) $[E \div A]$	2,133.33	1,600
E	Cost per month (₹) $[F \div 12]$	177.78	133.33

(iv) (a) ₹ 36,627.78

(v) (c) ₹ 43.708.33

Amortised cost of Battery replacement:

	Particulars	CNG Car	EV Car
A	Life of vehicle	15 years	10 years
B	Replacement interval	8 years	8 years
C	No. of time replacement required	1 time	1 time
D	Cost of battery for each replacement (₹)	12,000	5,40,000
E	Total replacement cost (₹) $[C \times D]$	12,000	5,40,000
F	Amortised cost per year (₹) $[E \div A]$	800	54,000
E	Cost per month (₹) $[F \div 12]$	66.67	4,500

Calculation of Operating cost per month

	Particulars	CNG Car (₹)	EV Car (₹)
A	Running cost:		
	Fuel cost/ Power consumption cost [Refer WN-2]	4,500	1,425
B	Maintenance cost:		
	Annual Maintenance cost [Annual cost ÷ 12]	666.67	433.33
	Annual Insurance cost [Annual cost ÷ 12]	633.33	1,216.67
	Amortised cost of Tyre replacement [Refer WN-3]	177.78	133.33
	Amortised cost of Battery replacement [Refer WN-4]	66.67	4,500
		1,544.45	6,283.33
C	Fixed cost:		
	Depreciation [Refer WN-1]	4,583.33	10,000
	Driver's salary	20,000	20,000
	Garage rent	4,500	4,500
	Share of Office & Administration cost	1,500	1,500
		30,583.33	36,000
D	Operating cost per month [A+B+C]	36,627.78	43,708.33

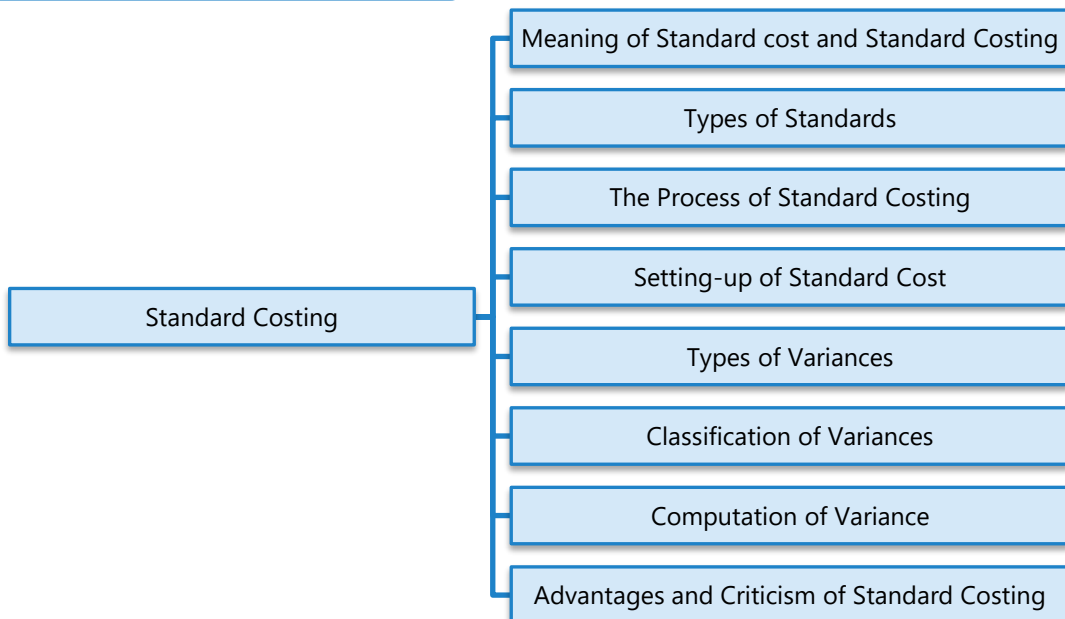
STANDARD COSTING



LEARNING OUTCOMES

- ◆ Discuss the meaning of standard cost and variances.
- ◆ Differentiate between controllable and uncontrollable variances.
- ◆ Analyse and compute variances related to material, labour and overheads.

CHAPTER OVERVIEW





1. INTRODUCTION

Cost control is one of the objectives of cost management. Management of an organisation setups predetermined cost to compare the actual cost with the predetermined cost. Predetermined costs are standard costs used for cost control and performance evaluation. Standard costing is a method of cost and management accounting which starts with setting of standards and ends with reporting of variances to management for taking corrective actions. The Official Terminology of CIMA, London defines standard costing as “Control technique that reports variances by comparing actual costs to pre-set standards so facilitating action through management by exception.”

In this chapter we will learn how standards are set for each cost component i.e. material, labour and overheads of a cost object.

1.1 What is a Standard or Standard Cost?

Standard cost is defined in the CIMA Official Terminology as “the planned unit cost of the product, component or service produced in a period. The standard cost may be determined on a number of bases. The main use of standard costs is in performance measurement, control, stock valuation and in the establishment of selling prices.” From the above definition Standard costs can be said as

- Planned cost
- Determined on a base or number of bases.

1.2 Why Standard Costing is Needed?

Standards or Standard costs are established to evaluate performance of a responsibility centre. Apart from performance evaluation and cost control, standard costs are also used to value inventory where actual figures are not reliably available and to determine selling prices particularly while preparing quotations.

Standard costing system is widely accepted as it serves different needs of an organisation. The standard costing is preferred for the following reasons:

- (a) **Prediction of future cost for decision making:** Standard costs are set after taking all present conditions and future possibilities into consideration. Hence,

standard cost is future cost for the purpose of cost estimation and profitability from a proposed project/ order/ activity.

- (b) **Provide target to be achieved:** Standard costs are the target cost which should not be crossed by the responsibility centres. Performance of a responsibility centre is continuously monitored and measured against the set standards. Any variance from the standard is noted and reported for appropriate action.
- (c) **Used in budgeting and performance evaluation:** Standard costs are used to set budgets and based on these budgets managerial performance is evaluated. This is of two benefits, one managers of a responsibility centre will not compromise with the quality to fulfill the budgeted quantity and second, variances can be traced with the responsible department or person.
- (d) **Interim profit measurement and inventory valuation:** Actual profit can only be known after the closure of the accounts. But an organisation may need to prepare profitability statement for interim periods for managerial reporting and decision making. To arrive at profit figure, standard costs are deducted from the revenue.



2. TYPES OF STANDARDS

Types of standards are as below:

- (i) **Ideal Standards:** These represent the level of performance attainable when prices for material and labour are most favourable, when the highest output is achieved with the best equipment and layout and when the maximum efficiency in utilisation of resources results in maximum output with minimum cost.

These types of standards are criticised on three grounds:

- (a) Since such standards would be unattainable, no one would take these seriously.
- (b) The variances disclosed would be variances from the ideal standards. These would not, therefore, indicate the extent to which they could have been reasonably and practically avoided.
- (c) There would be no logical method of disposing of these variances.

(ii) **Normal Standards:** These are standards that may be achieved under normal operating conditions. The normal activity has been defined as “the number of standard hours which will produce at normal efficiency sufficient good to meet the average sales demand over a term of years”.

These standards are, however, difficult to set because they require a degree of forecasting. The variances thrown out under this system are deviations from normal efficiency, normal sales volume, or normal production volume.

If the actual performance is found to be abnormal, large variances may result and necessitate revision of standards.

(iii) Basic or Bogey Standards: These standards are used only when they are likely to remain constant or unaltered over a long period. According to this standard, a base year is chosen for comparison purposes in the same way as statisticians use price indices. Since basic standards do not represent what should be attained in the present period, current standards should also be prepared if basic standards are used. Basic standards are, however, well suited to businesses having a small range of products and long production runs. Basic standards are set, on a long-term basis and are seldom revised. When basic standards are in use, variances are not calculated. Instead, the actual cost is expressed as a percentage of basic cost. The current cost is also similarly expressed and the two percentages are compared to find out how much the actual cost has deviated from the current standard. The percentages are next compared with those of the previous periods to establish the trend of actual and current standard from basic cost.

(iv) Current Standards: These standards reflect the management's anticipation of what actual costs will be for the current period. These are the costs which the business will incur if the anticipated prices are paid for the goods and services and the usage corresponds to that believed to be necessary to produce the planned output.

The variances arising from expected standards represent the degree of efficiency in usage of the factors of production, variation in prices paid for materials and services and difference in the volume of production.

3. THE PROCESS OF STANDARD COSTING

The process of standard cost is as below:

- (i) **Setting of Standards:** The first step is to set standards which are to be achieved, the process of standard setting is explained below.
- (ii) **Ascertainment of actual costs:** Actual cost for each component of cost is ascertained. Actual costs are ascertained from books of account, material invoices, wage sheet, charge slip etc.
- (iii) **Comparison of actual cost with standard cost:** Actual costs are compared with the standards costs and variances are determined.
- (iv) **Investigate the reasons for variances:** Variances arises are investigated for further action. Based on this, performance is evaluated and appropriate actions are taken.
- (v) **Disposition of variances:** Variances arise are disposed-off by transferring it the relevant accounts (costing profit and loss account) as per the accounting method (plan) adopted.

4. SETTING-UP OF STANDARD COST

Standard cost is set on the basis of management's estimation. Cost is estimated on the basis of technical specification provided by the engineering department or other expert such as production engineer. Generally, while setting standards, consideration is given to historical data, current production plan and expected conditions of future. For the sake of detailed analysis and control, standard cost is set for each element of cost i.e. material, labour, variable overheads and fixed overheads. Standard are also set for the sales quantity and sales value; this is generally known as budgeted sales.

Standards are set in both quantity (units or hours) and in cost (price or rate). It is thus measure in quantities, hours and value of the factors of production.

Standard costs are divided into three main cost components, such as

- (a) Direct Material Cost
- (b) Direct Employee (Labour) Cost and

(c) Overheads

Standards are set in both physical and monetary terms for each cost components. Details are as follows:

4.1 Physical Standards

Physical standards refer to expression of standards in units or hours. At this stage standard quantity and standard hours are determined for a particular product or service. The purpose of setting standards is to secure economies in scale of production and to set selling price for quotation purpose.

In manufacturing organisations, the task of setting physical standards is assigned to the industrial engineering department. While setting standards consideration is given to :

- Company's operating plan i.e. budgets
- Final output to be produced
- Material specification, in both quantity and quality provided by the engineering department.
- Proportion of material to be used in case of multiple inputs.
- Method of production i.e. fully automated, semi-automated or manual.
- Skill set of workers and availability of workers.
- Working conditions and internal factors.
- External factors (such as Labour Law, Factories Act, Govt. policy etc.).

PROCEDURE OF SETTING MATERIAL QUANTITY STANDARDS

The following procedure is usually followed for setting material quantity standards.

- (a) **Standardisation of products:** At this phase, products to be produced are decided based on production plan and customer's order. Generally following questions are answered at this stage: (i) What to be produced? (ii) Which type to be produced and (iii) How much to be produced?

- (b) **Product study:** Product to be produced is analysed and studied for developments and production. Product study is carried out by the engineering department or product consultants. At this phase answers to the following questions are satisfied: (i) How can it be produced? (ii) What are the pre-requisites? (iii) Which type of materials to be used? (iv) How products can be accepted in the market? etc.
- (c) **Preparation of specification list:** After the product study a list of material is prepared. It specifies types (quality) and quantity of materials to be used, substitute of the materials, quantity and proportion of materials to be used, process to be followed, pre-requisites and condition required etc. While preparing specification list consideration to expected amount of wastage is given. It must be customised to adopt changes in the product.
- (d) **Test runs:** Sample or test runs under specified conditions are carried out and sample products are tested for the desired quality and quantity. Any deviation from the specification is noted down and specification list is updated.

PROCEDURE OF SETTING LABOUR TIME STANDARDS

The following are the steps involved in setting labour standards:

- (a) **Standardisation** of product and product study is carried out as explained above.
- (b) **Labour specification:** Types of labour and labour time is specified. Labour time specification is based on past records and it takes into account normal wastage of time.
- (c) **Standardisation of methods:** Selection of proper machines to use proper sequence and method of operations.
- (d) **Manufacturing layout:** A plan of operation for each product listing the operations to be performed is prepared.
- (e) **Time and motion study:** It is conducted for selecting the best way of completing the job or motions to be performed by workers and the standard time which an average worker will take for each job. This also takes into account the learning efficiency and learning effect.

- (f) **Training and trial:** Workers are trained to do the work and time spent at the time of trial run is noted down.

PROCEDURE OF SETTING OVERHEADS TIME/ QUANTITY STANDARDS

Variable overhead time/ quantity is estimated based on specification made by the engineering departments. Variable overheads may either be based on direct material quantity or labour hour. Generally, it is based on labour time worked.

Fixed overhead time is based on budgeted production volume.

4.1.1 Problems faced while setting physical standards

The problems involved while setting physical standards will vary from industry to industry and may be illustrated as under:

- (a) A situation may arise where the company is introducing the manufacture of a new line of product. In such case, it may be necessary to employ workers who have no experience in the job. This creates a problem of setting standard time because it is necessary to make adjustment for the inexperience of workers.
- (b) Changes in technology may necessitate installation of sophisticated machines. When such machines are installed, the precise estimation of output and standard of efficiency achievable will pose a problem until after a long time when the working conditions are settled. Thus, setting standards for these machines and estimating the standard costs will need considerable amount of work.
- (c) Often manufacturers prefer to product diversification to improve profitability. One of the most important problems that arise with the proposed change in product is re-setting of production facilities. For example, when an old copper part is to be changed into one made of bronze to suit the new product, special care has to be taken to order new tools which in turn, pose the problem of setting up of standard time in respect of the new tools.
- (d) Standards of material specifications are established and if the materials are not available as per specifications, the standards may not be achievable.

- (e) Very often the cost accountant is confronted with the problem of choosing the type of standards to be adopted. For example, the industrial engineer has furnished the standard time for all direct labour operations as under:
1. Standard time attainable by the best operations is 2 hours per unit of product including allowances for personal fatigue and delay.
 2. Attainable good performance for the average trained operator is 2.10 hours per unit of product.
 3. Average past performance is 2.60 hours per unit.

The problem is, should direct labour standard hour be based on maximum efficiency or attainable good performance or average past performance? If costs are to represent maximum efficiency, the unit cost used in selling price will relatively be low but a high debit variance may arise if the standard efficiency is not achieved.

If, however, the standard cost is based on attainable good performance, the variances may tend to be nil. If efficiency is to be gauged, maximum efficiency standard will reflect the off standard performance, thereby enabling the departmental head to exercise control.

Similar problems as those mentioned above, may also arise in setting of waste standards. For example, the question may arise as to whether only absolutely unavoidable wastage should be provided or the past average level of wastage may be provided. This will again have different impact on the standard cost of production.

4.2 Price or Rate Standards

Broadly, the price or rate standards can be set on either of the following bases:

- (a) Actual average or mean price expected to prevail during the coming period, say one year; or
- (b) Normal prices expected to prevail during a cycle of seasons which may be of a number of years.

PROCEDURES OF SETTING MATERIAL PRICE STANDARDS

Material prices are not altogether within the control of the manufacturer; but the purchasing department, on being apprised of production quantities required, should be able, from its knowledge of current market conditions and trends, to state with reasonable accuracy price for the constituent items. The standards for prices of materials should be based on the following factors, if price fluctuations are small and are not serious.

- (a) Stock of materials on hand and the prices at which they are held;
- (b) The prices at which orders for future deliveries of materials (agreement entered into) have already been placed,
- (c) Minimum support price fixed by the appropriate authority and
- (d) Anticipated fluctuation in price levels

In case there are unsystematic fluctuations in the market price, it may be difficult to determine standard costs of materials; fluctuations in the market price may be of different sorts; prices may be different from month to month, from one season to another or from one year to another. There may be a secular trend which, on the whole, is pushing price upwards or downwards. The nature of difficulties encountered in fixing standard costs of materials will naturally be different in each case. In addition, the purchasing policy of the company and the objective to be achieved (from cost accounting) will make a difference.

The difficulty in determining the standard cost of material in such a situation can be resolved as follows:

- (a) In case prices fluctuate from month to month, the average of prices of a year corrected for the known secular changes and any other expected change can very well serve as the standard price for the next year.
- (b) If the fluctuations are seasonal, but the whole year's requirements are purchased at one time, the weighted average of the likely prices to be paid should be treated as the standard price. But, if buying is also spread over the whole year, the weighted average of the prices for the whole year should be the standard price.

- (c) If prices fluctuate from one year to another, a careful estimate of the price likely to prevail next year, based on a statistical study, should be adopted as the standard price.

PROCEDURES OF SETTING WAGE RATE STANDARD

The type of labour required for performing a specific job would be the most important factor for deciding the rate of wage to be paid to workers. Standard wage rate for skilled and unskilled workers are set based on the following basis:

- Time taken by the workers to complete a unit of production.
- Time or piece rate prevailing in the industry. It can be known from the peers.
- Wage agreement entered into between the management and workers' union.
- Law prevailing in the area of operation, law like Payment of minimum wages Act, Payment of bonus Act etc.

PROCEDURES OF SETTING OVERHEAD EXPENSE STANDARDS

In computing the overhead expense standards, consideration should be given to the level of output and the budgeted expenses. A budgeted output is fixed considering practical manufacturing capacity and anticipated sales demand. Expenditures can be budgeted under different heads for the level of output chosen. These expenditures are classified as fixed and variable. Thus, the overhead expense standards are set by computing the optimum level of output for a production departments followed by budgets for fixed and variable overheads. If production is seasonal or it fluctuates during the year, a flexible budget may be prepared to facilitate comparison between the set target and actual expenditure for the period.

5. TYPES OF VARIANCES

Controllable and un-controllable variances: For effective cost control it is necessary to investigate into the reasons for cost variances and to take corrective actions. For this purpose variances are classified as controllable and uncontrollable variances. **Controllable variances are those which can be controlled under the**

normal operating conditions if a responsibility centre takes preventive measures and acts prudently. **Uncontrollable variances are those which occurs due to conditions which are beyond the control** of a responsibility centre and cannot be controlled even though all preventive measures are in place. Responsibility centres are answerable for all adverse variances which could have been controlled. Controllability is a subjective matter and varies from situation to situation. If the uncontrollable variances are of significant nature and are persistent, the standard may need revision.

Favourable and Adverse variance: Favourable variances are those which are profitable for the company and adverse variances are those which causes loss to the company. While computing cost variances favourable variance means actual cost is less than standard cost. On the other hand, adverse variance means actual cost is exceeding standard cost. The situation will be reversed for sales variance. Favourable variances mean actual is more than budgeted and adverse when actual is less than budgeted. Favourable variance in short denoted by capital 'F' and adverse variances by capital 'A'.

Students may note that signs of favourable and adverse variance may or may not match exactly with mathematical signs i.e. (+) or (-).



6. CLASSIFICATION OF VARIANCES

Variances are broadly classified into two parts namely Revenue variance and Cost variance. At Revenue side variances is calculated by comparing actual sales from budgeted (standard) sales. On the other hand, Cost side reflects variances in cost components. Cost variance classification is shown below with the help of a structured diagram.

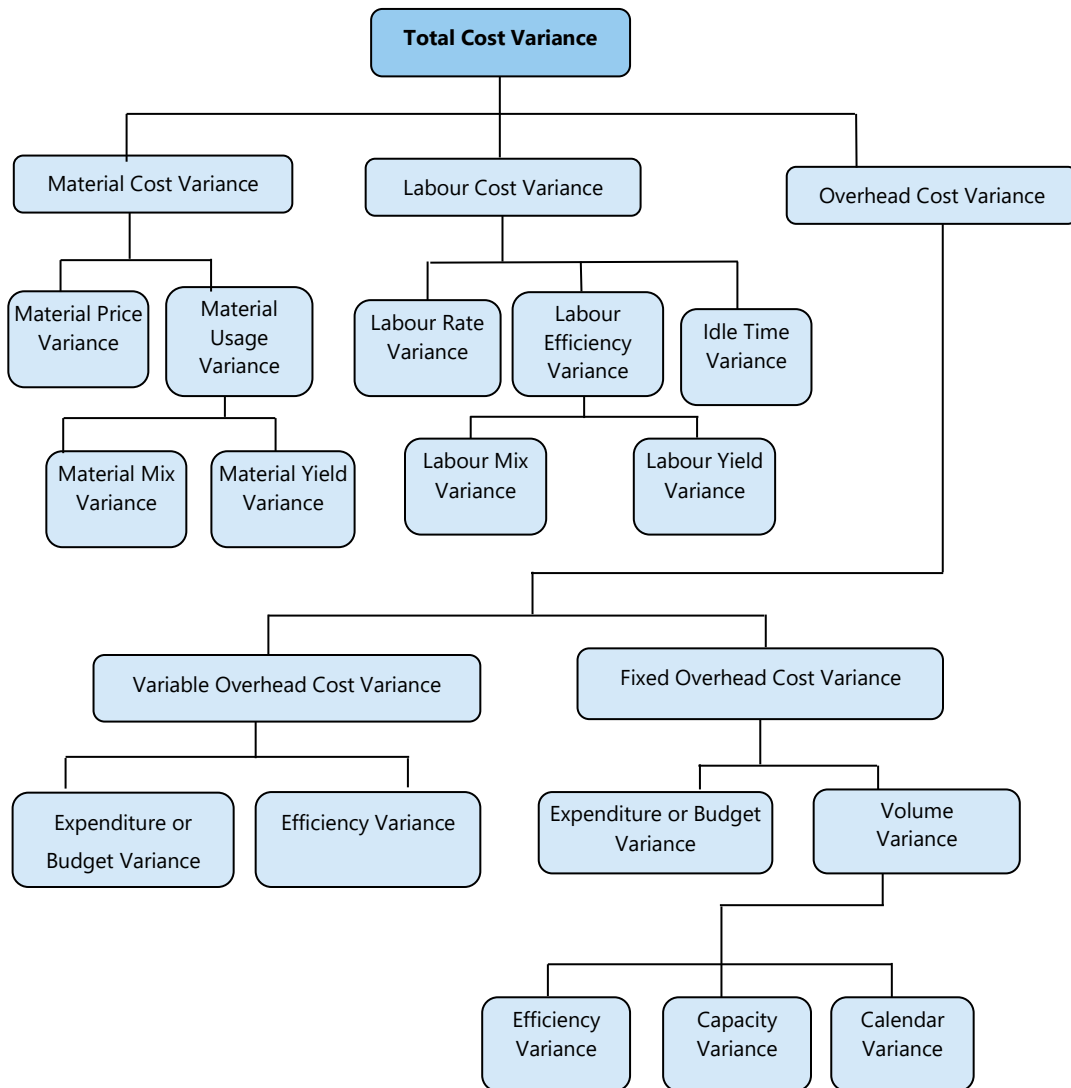


Fig 13.1. Classification of Variances

7. COMPUTATION OF VARIANCES

As discussed earlier variances are classified into two parts. Here we will start from cost side and discuss all cost components one by one with the help of appropriate example and illustrations.

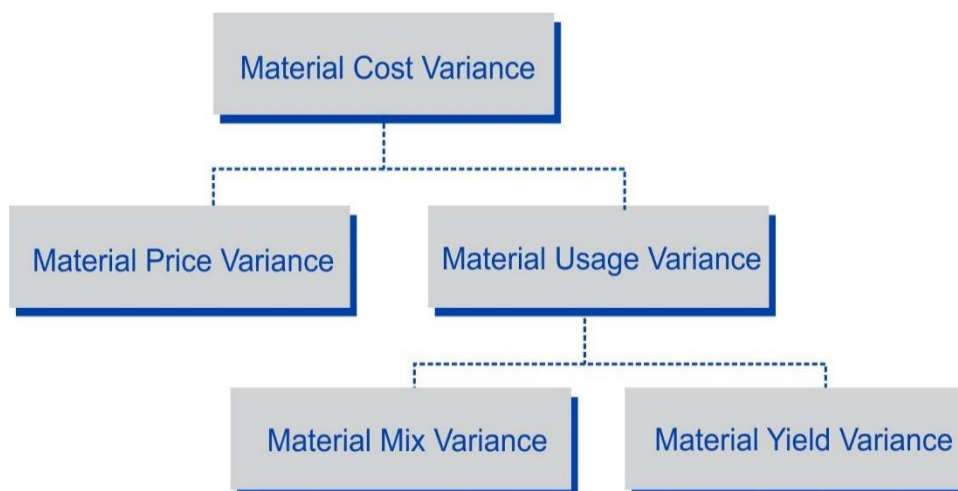
7.1 Material Cost Variance

Material cost variance is the **difference between standard cost of materials used and the actual cost of materials**. Mathematically it is written as.

$$\begin{aligned}\text{Material Cost Variance} &= [\text{Standard Cost} - \text{Actual Cost}] \\ \text{Or} \\ &[(\text{Std. Quantity} \times \text{Std. Price}) - (\text{Actual Quantity} \times \text{Actual Price})]\end{aligned}$$

(The difference between the Standard Material Cost of the actual production volume and the Actual Cost of Material)

Reasons for variance: Material cost variance arises mainly because of either difference in material price from the standard price or difference in material consumption from standard consumption or both the reasons. Analysis of material cost variance is done dividing it into two parts namely Material Price variance and Material Usage variance.



(A) Material Price Variance

It measures variance arises in the material cost due to **difference in actual material purchase price from standard material price**. Mathematically it is written as:

Material Price Variance = [Standard Cost of Actual Quantity* – Actual Cost]

Or

Actual Quantity (AQ) × {Std. Price (SP) – Actual Price(A)}

Or

[(SP × AQ) – (AP × AQ)]

(The difference between the Standard Price and Actual Price for the Actual Quantity Purchased)

*Here actual quantity means actual quantity of material purchased. If in the question material purchase is not given, it is taken as equal to material consumed.

Explanation: Material price variance can also be calculated taking material used as actual quantity instead of material purchased. This method is also correct but does not serve the purpose of variance computation. Material price variance may arise from variety of reasons out of which some may be controllable and some may be beyond the control of the purchase department. If price variance arises due to inefficiency of purchase department or any other reason within the control of the company, then it is very important to report variance as early as possible and this can be done by taking purchase quantity as actual quantity for price variance computation.

Responsibility for Material Price Variance: Generally, purchase department purchases materials from the market. Purchase department is expected to perform its function very prudently so that company never suffers loss due to its inefficiency. Purchase department is held responsible for adverse price variance arises due to the factors controllable by the department.

(B) Material Usage Variance

It measures variance in material cost due to usage/ consumption of materials. It is computed as below:

Material Usage Variance = [Standard Cost of Standard Quantity for Actual Production – Standard Cost of Actual Quantity*]

Or

Std. Price (SP) × {Std. Quantity (SQ) - Actual Quantity (AQ)}

Or

[(SQ × SP) – (AQ × SP)]

(The difference between the Standard Quantity specified for actual production and the Actual Quantity used, at Standard Price)

*Here actual quantity means actual quantity of material used.

Responsibility for material usage variance: Material usage is the responsibility of production department and it is held responsible for adverse usage variance.

Reasons for variance: Actual material consumption may differ from the standard quantity either due to difference in proportion used from standard proportion or due to difference in actual yield from standard yield.

Material usage variance is divided into two parts (a) Material usage mix variance and (b) Material yield variance.

(a) Material Mix Variance

Variance in material consumption may arise due to **difference in proportion actually used from the standard mix/ proportion**. It only arises when two or more inputs are used to produce a product. Mathematically,

Material Mix Variance = [Standard Cost of Actual Quantity in Standard Proportion – Standard Cost of Actual Quantity]

Or

Std. Price (SP) × {Revised Std. Quantity (RSQ) – Actual Quantity (AQ)}

Or

[(RSQ × SP) – (AQ × SP)]

(The difference between the Actual Quantity in standard proportion and Actual Quantity in actual proportion, at Standard Price)

(b) Material Yield Variance (Material Sub-usage Variance)

Variance in material consumption which arises due to yield or productivity of the inputs. It may arise due to use of sub- standard quality of materials, inefficiency of workers or due to wrong processing.

Material Yield Variance = [Standard Cost of Standard Quantity for Actual Production – Standard Cost of Actual Quantity in standard proportion]

Or

Std. Price (SP) × {Std. Quantity (SQ) – Revised Standard Quantity (RSQ)}

Or

[(SQ × SP) – (RSQ × SP)]

(The difference between the Standard Quantity specified for actual production and Actual Quantity in standard proportion, at Standard Purchase Price)

Verification of the formulae:

Material Cost Variance= Material Usage Variance + Material Price Variance*

Or, Material Cost Variance= (Material Mix Variance + Material Revised usage Variance) + Material price variance

*If material purchased quantity and material consumed quantity is same

Meaning of the terms used in the formulae:

Term	Meaning
Standard Quantity (SQ)	Quantity of <u>inputs</u> to be used to produce actual <u>output</u> .
Actual Quantity (AQ)	Quantity of <u>inputs</u> actually used to produce actual <u>output</u> .
Revised Standard Quantity (RSQ)	If <u>Actual total quantity</u> of <u>inputs</u> were used in standard proportion.

ILLUSTRATION 1

The standard and actual figures of product 'Z' are as under:

	Standard	Actual
Material quantity	50 units	45 units
Material price per unit	₹ 1.00	₹ 0.80

CALCULATE material cost variances.

SOLUTION

The variances may be calculated as under:

- (a) Standard cost = Std. Qty × Std. price = 50 units × ₹1.00 = ₹50
 (b) Actual cost = Actual qty. × Actual price = 45 units × ₹0.80 = ₹ 36

Variances:

- (i) Price variance = Actual qty (Std. price – Actual price)
 = 45 units (₹1.00 – ₹0.80) = ₹ 9 (F)
 (ii) Usage variance = Std. price (Std. qty – Actual qty.)
 = ₹1 (50 units – 45 units) = ₹ 5 (F)
 (iii) Material cost variance = Standard cost – Actual cost
 (Total variance) = ₹ 50 – ₹ 36 = ₹ 14 (F)

ILLUSTRATION 2

NXE Manufacturing Concern furnishes the following information:

Standard:	Material for 70 kg finished products	100 kg
	Price of material	₹ 1 per kg
Actual:	Output	2,10,000 kg
	Material used	2,80,000 kg
	Cost of Materials	₹ 2,52,000

CALCULATE: (a) Material usage variance, (b) Material price variance, (c) Material cost variance.

SOLUTION

$$\begin{aligned}\text{Standard Quantity of input for actual output (SQ)} &= 2,10,000 \text{ kg} \times \frac{100 \text{ kg}}{70 \text{ kg}} \\ &= 3,00,000 \text{ kg.}\end{aligned}$$

$$\text{Actual Price (AP)} = (\text{₹}2,52,000 \div 2,80,000 \text{ kg}) = \text{₹} 0.90 \text{ per kg.}$$

$$\begin{aligned}\text{(a) Material Usage Variance} &= (\text{SQ} - \text{AQ}) \times \text{SP} \\ &= (3,00,000 - 2,80,000) \times 1 = \text{₹} 20,000 \text{ (F)}\end{aligned}$$

$$\begin{aligned}\text{(b) Material Price Variance} &= (\text{SP} - \text{AP}) \times \text{AQ} \\ &= (1 - 0.90) \times 2,80,000 = \text{₹} 28,000 \text{ (F)}\end{aligned}$$

$$\begin{aligned}\text{(c) Material Cost Variance} &= (\text{SQ} \times \text{SP}) - (\text{AQ} \times \text{AP}) \\ &= (3,00,000 \times 1) - (2,80,000 \times 0.90) \\ &= \text{₹} 48,000 \text{ (F)}\end{aligned}$$

$$\begin{aligned}\text{Check MCV} &= \text{MPV} + \text{MUV} \\ \text{₹} 48,000 \text{ (F)} &= \text{₹} 28,000 \text{ (F)} + \text{₹} 20,000 \text{ (F)}\end{aligned}$$

ILLUSTRATION 3

The standard cost of a chemical mixture is as follows:

40% material A at ₹ 20 per kg

60% material B at ₹ 30 per kg

A standard loss of 10% of input is expected in production. The cost records for a period showed the following usage:

90 kg material A at a cost of ₹ 18 per kg

110 kg material B at a cost of ₹ 34 per kg

The quantity produced was 182 kg of good product.

CALCULATE (a) Material cost variance, (b) Material price variance, (c) Material usage variance.

SOLUTION**Basic Calculation**

Material	Standard for 180 kg. output			Actual for 182 kg. output		
	Qty. Kg.	Rate (₹)	Amount (₹)	Qty Kg.	Rate (₹)	Amount (₹)
A	80	20	1,600	90	18	1,620
B	<u>120</u>	30	<u>3,600</u>	<u>110</u>	34	<u>3,740</u>
Total	200		5,200	200		5,360
Less: Loss	20	–	–	18	–	–
	180		5,200	182		5,360

$$\text{Std. cost of actual output} = ₹5,200 \times \frac{182}{180} = ₹ 5, 257.78$$

Calculation of Variances

- Material Cost Variance = (Std. cost of actual output – Actual cost)
= (5,257.78 – 5,360) = ₹ 102.22 (A)
- Material Price Variance = (SP – AP) × AQ
 Material A = (20 – 18) × 90 = ₹ 180.00 (F)
 Material B = (30 – 34) × 110 = ₹ 440.00 (A)
 MPV = ₹ 260.00 (A)
- Material Usage Variance = (Std. Quantity for actual output – Actual Quantity) × Std. Price
 Material A = $\left(80 \times \frac{182}{180} - 90\right) \times 20 = ₹ 182.22 (A)$
 Material B = $\left(120 \times \frac{182}{180} - 110\right) \times 30 = ₹ 340.00 (F)$
 MUV = ₹ 157.78 (F)

Check

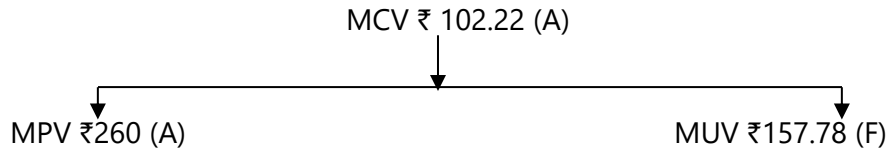


ILLUSTRATION 4

ABC Ltd. produces an article by lending two basic raw materials. It operates a standard costing system and the following standards have been set for raw materials:

Material	Standard mix	Standard price (₹ per kg)
A	40%	4
B	60%	3

The standard loss in processing is 15%. During April, the company produced 1,700 kgs. of finished output.

The position of stock and purchases for the month of April are as under:

Material	Stock on 01.04.2021	Stock on 30.04.2021	Purchased during April 2021	
	(Kg.)	(Kg.)	(Kg.)	(₹)
A	35	5	800	3,400
B	40	50	1,200	3,000

Opening stock of material is valued at standard price.

CALCULATE the following variances:

- (i) Material price variance
- (ii) Material usage variance
- (iii) Material yield variance

Material mix variance

Total Material cost variance

SOLUTION

Types of material	Standard			Actual		
	Qty. (Kg.)	Rate (₹)	Amount (₹)	Qty. (Kg.)	Rate (₹)	Amount (₹)
A	800	4	3,200	35	4	140.00
				795	4.25	3,378.75
B	1200	3	3,600	40	3	120.00
				1,150	2.50	2,875.00
Total	2,000		6,800	2,020		6,513.75

(i) Material price variance

= Actual qty. (Std. price – Actual price)

Material A: Since the actual price and standard price in respect of 35 kg. of raw materials A are same i.e. ₹ 4, there will be no price variance in respect of this quantity. Price variance will be in respect of only 795 kg. as given below:

= 795 kg. (₹ 4 – ₹ 4.25) = ₹ 198.75 (A)

Material B: For Material B also, price variance will only be in respect of 1,150 kg. as given below:

= 1,150 kg. (₹ 3 – ₹ 2.50) = ₹ 575 (F)

Total = ₹ 198.75 (A) + 575 (F) = ₹ 376.25(F)

(ii) Material usage variance

= (Std. qty. for actual output – Actual qty.) × Std. price

Material A	= (800 – 830) × 4	= 120 (A)
Material B	= (1,200 – 1,190) × 3	= 30 (F)
		₹ 90 (A)

(iii) Material yield variance

$$= (\text{Std. qty.} - \text{Revised Std. qty.}) \times \text{Std. Price}$$

$$\text{Material A} = (800 - 808) \times 4 = 32 \text{ (A)}$$

$$\text{Material B} = (1,200 - 1,212) \times 3 = \underline{36 \text{ (A)}}$$

$$\underline{\underline{\text{₹ 68 (A)}}}$$

(iv) Material mix variance

$$= (\text{Revised std. qty.} - \text{Actual qty.}) \times \text{Std. Price}$$

$$\text{Material A} = (808 - 830) \times 4 = 88 \text{ (A)}$$

$$\text{Material B} = (1,212 - 1,190) \times 3 = \underline{66 \text{ (F)}}$$

$$\underline{\underline{\text{₹ 22 (A)}}}$$

Check

$$\text{MUV} = \text{MMV} + \text{MYV}$$

$$90 \text{ (A)} = 22 \text{ (A)} + 68 \text{ (A)}$$

(v) Total material cost variance

$$= \text{Std. cost for actual output} - \text{Actual cost} = 6,800 - 6,513.75 = 286.25 \text{ (F)}$$

Check

$$\text{MCV} = \text{MPV} + \text{MUV}$$

$$286.25 \text{ (F)} = 376.25 \text{ (F)} + 90 \text{ (A)}$$

Working Notes:**1. Standard quantity for actual output**

The standard loss being 15%. It means to produce, 1,700 kg. of the article, standard quantity of material required is:

$$= \frac{100}{85} \times 1,700 \text{ kgs.} = 2,000 \text{ kg.}$$

Out of 2,000 kg. of material used, 40% is of type A and 60% is of type B, i.e.,

Standard quantity for actual output for:

$$\text{Material A} = 2,000 \times \frac{40}{100} = 800 \text{ kg.}$$

$$\text{Material B} = 2,000 \times \frac{60}{100} = 1,200 \text{ kg.}$$

2. Actual quantity of material

= Opening stock + Purchases – Closing stock

$$\text{Material A} = 35 + 800 - 5 = 830 \text{ kg.}$$

$$\text{Material B} = 40 + 1,200 - 50 = 1,190 \text{ kg.}$$

3. Standard cost per unit

$$= \frac{\text{Total standard cost}}{\text{Total standard output of std. mix}}$$

$$= \frac{\text{₹ 6,800}}{1,700 \text{ kg.}} = \text{₹ 4 per kg.}$$

4. Revised Standard Quantity

$$\text{Material A} = \frac{2,020}{2,000} \times 800 = 808 \text{ kg.}$$

$$\text{Material B} = \frac{2,020}{2,000} \times 1,200 = 1,212 \text{ kg.}$$

7.2 Labour Cost Variance

Amount paid to employees for their labour is generally known as employee or labour cost. In this chapter labour cost is used to denote employees cost. Labour (employee) cost variance is **the difference between actual labour cost and standard cost**. Mathematically it can be written as:

Labour Cost Variance = [Standard Cost – Actual Cost]

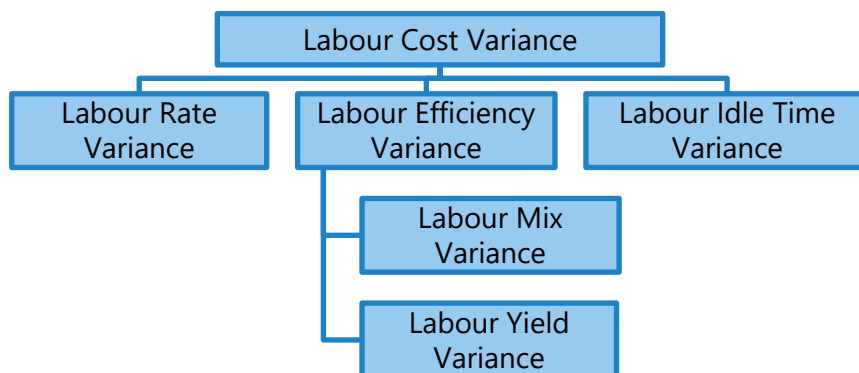
Or

$[(SH \times SR) - (AH^* \times AR)]$

(The difference between the Standard Labour Cost and the Actual Labour Cost incurred for the production achieved)

* Actual hours paid.

Reasons for variance: Difference in labour cost arises either due to difference in the actual labour rate from the standard rate or difference in numbers of hours worked from standard hours. Labour cost variance can be divided into three parts namely (i) Labour Rate Variance (ii) Labour Efficiency Variance and (iii) Labour Idle time Variance.



(A) Labour Rate Variance:

Labour rate variance arises due to **difference in actual rate paid from standard rate**. It is very similar to material price variance. It is calculated as below:

Labour Rate Variance = [Standard Cost of Actual Time – Actual Cost]

Or

$Actual\ Hours\ (AH^*) \times \{Std.\ Rate\ (SR) - Actual\ Rate\ (AR)\}$

Or

$[(SR \times AH^*) - (AR \times AH^*)]$

(The difference between the Standard Rate per hour and Actual Rate per hour for the Actual Hours paid)

* Actual hours paid.

Responsibility for labour rate variance: Generally labour rates are influenced by the external factors which are beyond the control of the organisation. However, personnel manager is responsible for labour rate negotiation.

(B) Labour Efficiency Variance:

Labour efficiency variance arises due to deviation in the working hours from the standard working hours.

Labour Efficiency Variance =
[Standard Cost of Standard Time for Actual Production – Standard Cost of Actual Time]

Or

Std. Rate (SR) × {Std. Hours (SH) – Actual Hours (AH*)}

Or

$[(SH \times SR) - (AH^{\#} \times SR)]$

(The difference between the Standard Hours specified for actual production and Actual Hours worked at Standard Rate).

Actual Hours worked

Responsibility for labour efficiency variance: Efficiency variance may arise due to ability of the workers, inappropriate team of workers, inefficiency of production manager or foreman etc. However, production manager or foreman can be held responsible for the adverse variance which otherwise can be controlled.

Labour efficiency variance is further divided into the following variances:

- (a) Labour Mix Variance or Gang variance
- (b) Labour Yield Variance (or Labour Revised-efficiency Variance)

(a) Labour Mix Variance:

Labour efficiency **variance which arises due to change in the mix or combination of different skill set** i.e. number of skilled workers, semi-skilled workers and un-skilled workers. Mathematically,

Labour Mix Variance Or Gang Variance =
[Standard Cost of Actual Time *Worked* in Standard Proportion – Standard Cost of Actual Time *Worked*]

Or

Std. Rate (SR) × {Revised Std. Hours (RSH) – Actual Hours Worked (AH)}

Or

$$[(RSH \times SR) - (AH^{\#} \times SR)]$$

(The difference between the Actual Hours worked in standard proportion and Actual Hours worked in actual proportion, at Standard Rate).

Actual Hours worked

(b) Labour Yield Variance:

Labour efficiency variance **which arises due to productivity of workers.**

Labour Yield Variance Or Sub-Efficiency Variance =

[Standard Cost of Standard Time for Actual Production – Standard Cost of Actual Time Worked in Standard Proportion]

Or

$$\text{Std. Rate (SR)} \times \{\text{Std. Hours (SH)} - \text{Revised Std. Hours (RSH)}\}$$

Or

$$[(SH \times SR) - (RSH \times SR)]$$

(The difference between the Standard Hours specified for actual production and Actual Hours worked in standard proportion, at Standard Rate).

(c) Idle Time Variance:

It is calculated for the idle hours. It is difference between paid and worked hours.

It is calculated as below:

Labour Idle Time Variance = [Standard Rate per Hour × Actual Idle Hours]

Or

$$\text{Std. Rate (SR)} \{ \text{Actual Hours}_{\text{Paid}} - \text{Actual Hours}_{\text{Worked}} \}$$

Or

$$[(AH^* \times SR) - (AH^{\#} \times SR)]$$

(The difference between the Actual Hours paid and Actual Hours worked at Standard Rate)

* Actual hours paid; # Actual Hours worked

$$\text{Labour Cost Variance} = \text{Labour Rate Variance} + \text{Labour Efficiency Variance (if hours paid and hours worked is same)}$$
$$\text{Labour Cost Variance} = \text{Labour Rate Variance} + \text{Idle Time Variance} + \text{Labour Efficiency Variance}$$
$$\text{Labour Efficiency Variance} = \text{Labour Mix Variance} + \text{Labour Yield Variance}$$

The standard and actual figures of a firm are as under

CALCULATE variances.

(a)	Std. labour cost	(₹)
	(1,000 hours × ₹50)	50,000
(b)	Actual wages paid	36,000
(c)	Actual rate per hour: ₹ 36,000/900 hours = ₹40	

(i) Labour Rate variance	= Actual time (Std. rate – Actual rate)
	= 900 hours (₹50 – ₹40) = ₹9,000 (F)
(ii) Efficiency variance	= Std. rate per hr. (Std. time – Actual time)
	= ₹50 (1,000 hrs. – 900 hrs.) = ₹5,000 (F)
(iii) Total labour cost variance	= Std. labour cost – Actual labour cost
	= {(₹50 × 1,000 hours) – ₹36,000}
	= (₹50,000 – ₹36,000) = ₹14,000 (F)

ILLUSTRATION 6

The standard output of product 'EXE' is 25 units per hour in manufacturing department of a company employing 100 workers. The standard wage rate per labour hour is ₹6.

In a 42 hours week, the department produced 1,040 units of 'EXE' despite 5% of the time paid being lost due to an abnormal reason. The hourly wages actually paid were ₹6.20, ₹6 and ₹5.70 respectively to 10, 30 and 60 of the workers.

CALCULATE relevant labour variances.

SOLUTION**Working Notes:****1. Calculation of standard man hours**

When 100 worker works for 1 hr., then the std. output is 25 units.

$$\text{Std. man hour per unit} = \frac{100 \text{ hrs.}}{25 \text{ units}} = 4 \text{ hrs.}$$

2. Calculation of std. man hours for actual output

$$\text{Total std. man hours} = 1,040 \text{ units} \times 4 \text{ hrs.} = 4,160 \text{ hrs.}$$

Standard for actual			Actual					
Hours	Rate (₹)	Amount (₹)	No. of workers	Actual hours paid	Idle time hrs.	Production hours	Rate (₹)	Amount paid (₹)
4,160	6	24,960	10	420	21	399	6.20	2,604
			30	1,260	63	1,197	6.00	7,560
			60	2,520	126	2,394	5.70	14,364
4,160	6	24,960	100	4,200	210	3,990		24,528

1. Labour cost variance

$$= \text{Std. labour cost} - \text{Actual labour cost}$$

$$= 24,960 - 24,528 = ₹ 432 \text{ (F)}$$

2. Labour rate variance

$$\begin{aligned}
 &= (SR - AR) \times AH_{\text{Paid}} \\
 &= (6 - 6.20) \times 420 = 84 \text{ (A)} \\
 &= (6 - 6) \times 1260 = \text{NIL} \\
 &= (6 - 5.70) \times 2,520 = \underline{756 \text{ (F)}} \\
 &= \underline{672 \text{ (F)}}
 \end{aligned}$$

3. Labour efficiency variance

$$\begin{aligned}
 &= (SH - AH) \times SR \\
 &= (4,160 - 3,990) \times 6 = 1,020 \text{ (F)}
 \end{aligned}$$

4. Labour Idle time variance

$$\begin{aligned}
 &= \text{Idle Hours} \times SR \\
 &= 210 \times 6 = 1,260 \text{ (A)}
 \end{aligned}$$

ILLUSTRATION 7

NPX Ltd. uses standard costing system for manufacturing of its product X. Following is the budget data given in relation to labour hours for manufacture of 1 unit of Product X :

Labour	Hours	Rate (₹)
Skilled	2	6
Semi-Skilled	3	4
Un- Skilled	5	3
Total	10	

In the month of January, total 10,000 units were produced following are the details:

Labour	Hours	Rate (₹)	Amount (₹)
Skilled	18,000	7	1,26,000
Semi-Skilled	33,000	3.5	1,15,500
Un-Skilled	58,000	4	2,32,000
Total	1,09,000		4,73,500

Actual Idle hours (abnormal) during the month:

Skilled:	500
Semi- Skilled:	700
Unskilled:	800
Total	2,000

CALCULATE:

- (a) Labour Variances.
- (b) Also show the effect on Labour Rate Variance if 5,000 hours of Skilled Labour are paid @ ₹5.5 per hour and balance were paid @ ₹7 per hour.

SOLUTION

Working Notes:

	Budget			Standard for actual			Actual		
	Hours	Rate (₹)	Amount (₹)	Hours	Rate (₹)	Amount (₹)	Hours	Rate (₹)	Amount (₹)
Skilled	2	6	12	20,000	6	1,20,000	18,000	7	1,26,000
Semi-skilled	3	4	12	30,000	4	1,20,000	33,000	3.5	1,15,500
Unskilled	5	3	15	50,000	3	1,50,000	58,000	4	2,32,000
	10		39	1,00,000		3,90,000	1,09,000		4,73,500

	Idle Hours	Hours worked
Skilled	500	17,500
Semi-skilled	700	32,300
Unskilled	800	57,200
	2,000	1,07,000

(a) (i) **Labour Cost Variance = (SH×SR – AH×AR)**

Skilled $20,000 \times 6 - 18,000 \times 7 = ₹ 6,000 (A)$

Semi-Skilled $30,000 \times 4 - 33,000 \times 3.5 = ₹ 4,500 (F)$

Unskilled	$50,000 \times 3 - 58,000 \times 4$	=	₹ 82,000 (A)
Total			₹ 83,500 (A)

(ii) Labour Rate Variance = (SR – AR) × AH_{Paid}

Skilled	$(6 - 7) \times 18,000$	=	₹ 18,000 (A)
Semi-Skilled	$(4 - 3.5) \times 33,000$	=	₹ 16,500 (F)
Unskilled	$(3 - 4) \times 58,000$	=	₹ 58,000 (A)
Total			₹ 59,500 (A)

(iii) Labour Efficiency Variance = (SH – AH) × SR

Skilled	$(20,000 - 17,500) \times 6$	=	₹ 15,000 (F)
Semi- Skilled	$(30,000 - 32,300) \times 4$	=	₹ 9,200 (A)
Unskilled	$(50,000 - 57,200) \times 3$	=	₹ 21,600 (A)
Total			₹ 15,800 (A)

(iv) Labour Idle Time Variance = (Idle Hours × SR)

Skilled	500×6	=	₹ 3,000 (A)
Semi- Skilled	700×4	=	₹ 2,800 (A)
Unskilled	800×3	=	₹ 2,400 (A)
Total			₹ 8,200 (A)

(v) Labour Mix Variance = (RSH – AH_{Worked}) × SR

$$\text{Revised Std. hours (RSH)} = \frac{\text{Std.Hours}}{\text{TotalStd.hours}} \times \text{TotalActual Hours}$$

$$\text{Skilled} \quad \left(\frac{20,000}{1,00,000} \times 1,07,000 - 17,500 \right) \times 6 = ₹ 23,400 (F)$$

$$\text{Semi- Skilled} \quad \left(\frac{30,000}{1,00,000} \times 1,07,000 - 32,300 \right) \times 4 = ₹ 800 (A)$$

$$\text{Unskilled} \quad \left(\frac{50,000}{1,00,000} \times 1,07,000 - 57,200 \right) \times 3 = ₹ 11,100 (A)$$

Total			₹ 11,500 (F)

(vi) Labour Yield Variance = (SH – RSH) × SR

$$\text{Skilled} \quad (20,000 - \frac{20,000}{1,00,000} \times 1,07,000) \times 6 = ₹ 8,400 \text{ (A)}$$

$$\text{Semi- Skilled} \quad (30,000 - \frac{30,000}{1,00,000} \times 1,07,000) \times 4 = ₹ 8,400 \text{ (A)}$$

$$\text{Unskilled} \quad (50,000 - \frac{50,000}{1,00,000} \times 1,07,000) \times 3 = ₹ 10,500 \text{ (A)}$$

Total**₹ 27,300 (A)****(b) Labour Rate Variance = (SR – AR) × AH_{Paid}**

$$\text{Skilled} \quad (6 - 5.5) \times 5,000$$

$$(6 - 7) \times 13,000 = ₹ 10,500 \text{ (A)}$$

$$\text{Semi- Skilled} \quad (4 - 3.5) \times 33,000 = ₹ 16,500 \text{ (F)}$$

$$\text{Unskilled} \quad (3 - 4) \times 58,000 = ₹ 58,000 \text{ (A)}$$

Total**₹ 52,000 (A)****ILLUSTRATION 8**

The standard labour employment and the actual labour engaged in a week for a job are as under:

	Skilled workers	Semi-skilled workers	Unskilled workers
<i>Standard no. of workers in the gang</i>	32	12	6
<i>Actual no. of workers employed</i>	28	18	4
<i>Standard wage rate per hour</i>	3	2	1
<i>Actual wage rate per hour</i>	4	3	2

During the 40 hours working week, the gang produced 1,800 standard labour hours of work. CALCULATE:

- (a) Labour Cost Variance (b) Labour Rate Variance
 (c) Labour Efficiency Variance (d) Labour Mix Variance
 (e) Labour Yield Variance

SOLUTION**Workings:**

1. Standard hours (SH) for actual hours produced are calculated as below:

$$\text{Skilled} = \frac{1,800}{2,000} \times 1,280 = 1,152 \text{ hrs.}$$

$$\text{Semi-skilled} = \frac{1,800}{2,000} \times 480 = 432 \text{ hrs.}$$

$$\text{Unskilled} = \frac{1,800}{2,000} \times 240 = 216 \text{ hrs.}$$

2. Actual hours (AH) paid are calculated as below:

Category	No. of Worker	Hours in a week	Total Hours
Skilled	28	40	1,120
Semi-skilled	18	40	720
Unskilled	4	40	160
			2,000

3. For 40 hours week total Revised standard hours (RSH) will be calculated as below:

Category	No. of Worker	Hours in a week	Total Hours
Skilled	32	40	1,280
Semi-skilled	12	40	480
Unskilled	6	40	240
			2,000

Calculations

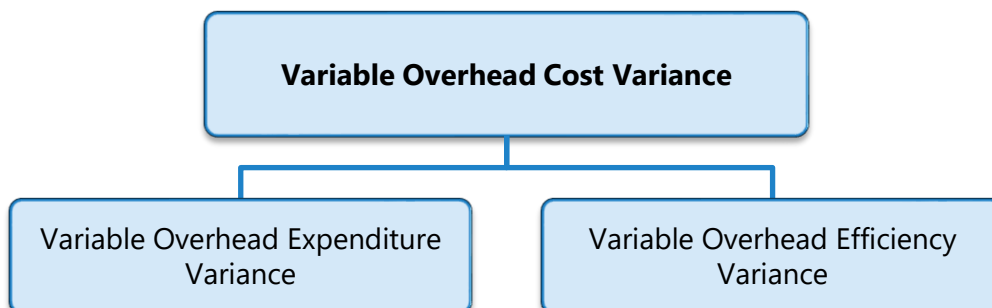
Category of workers	SH × SR	AH × SR	AH × AR	RSH × SR
Skilled	1,152 × 3 = 3,456	1,120 × 3 = 3,360	1,120 × 4 = 4,480	1,280 × 3 = 3,840
Semi-skilled	432 × 2 = 864	720 × 2 = 1,440	720 × 3 = 2,160	480 × 2 = 960
Unskilled	216 × 1 = 216	160 × 1 = 160	160 × 2 = 320	240 × 1 = 240
Total	₹ 4,536	₹ 4,960	₹ 6,960	₹ 5,040

- (i) Labour Cost Variance = Std. Cost for hours worked – Actual cost paid
 $= (SH \times SR) - (AH \times AR)$
 $= ₹4,536 - 6,960 = ₹2,424 (A)$
- (ii) Labour Rate Variance = $AH (SR - AR)$ or $(AH \times SR) - (AH \times AR)$
 Skilled = $3,360 - 4,480 = ₹1,120 (A)$
 Semi-skilled = $1,440 - 2,160 = ₹720 (A)$
 Unskilled = $160 - 320 = ₹160 (A)$ 2,000 (A)
- (iii) Labour Efficiency Variance = $SR (SH - AH)$ or $(SR \times SH) - (SR \times AH)$
 Skilled = $3,456 - 3,360 = ₹96 (F)$
 Semi-skilled = $864 - 1,440 = ₹576 (A)$
 Unskilled = $216 - 160 = ₹56 (F)$ ₹424 (A)
- (iv) Labour Mix Variance = $SR (RSH - AH)$ or $(SR \times RSH) - (SR \times AH)$
 Skilled = $3,840 - 3,360 = ₹480 (F)$
 Semi-skilled = $960 - 1,440 = ₹480 (A)$
 Unskilled = $240 - 160 = ₹80 (F)$ ₹80 (F)
- (v) Labour Yield Variance = $SR (SH - RSH)$ or $(SR \times SH) - (SR \times RSH)$
 Skilled = $3,456 - 3,840 = ₹384 (A)$
 Semi-skilled = $864 - 960 = ₹96 (A)$
 Unskilled = $216 - 240 = ₹24 (A)$ ₹504 (A)

Check

- (i) LCV = LRV + LEV
 $₹2,424 (A) = ₹2,000 (A) + ₹424 (A)$
- (ii) LEV = LMV + LYV
 $₹424 (A) = ₹80 (F) + ₹504 (A)$

7.3 Variable Overhead Cost Variance



Variable overheads consist of expenses other than direct material and direct labour which vary with the level of production. If variable overhead consist of indirect materials, then in this case it varies with the direct material used. On the other hand, if variable overhead is depending on number of hours worked then in this case it will vary with labour hour or machine hours. If nothing is mentioned specifically then we take labour hour as basis. Variable overhead cost variance calculation is similar to labour cost variance. Variable overhead cost variance is divided into two parts (i) Variable Overhead Expenditure Variance and (ii) Variable Overhead Efficiency Variance.

Variable Overhead Cost Variance (Standard Variable Overheads for Actual Production – Actual Variable Overheads)	
Variable Overhead Expenditure (Spending) Variance (Standard Variable Overheads for Actual Hours [#]) Less (Actual Variable Overheads) $[(SR - AR) \times AH^{\#}]$ Or $[(SR \times AH^{\#}) - (AR \times AH^{\#})]$	Variable Overhead Efficiency Variance (Standard Variable Overheads for Production) Less (Standard Variable Overheads for Actual Hours [#]) $[(SH - AH^{\#}) \times SR]$ Or $[(SH \times SR) - (AH^{\#} \times SR)]$

[#] Actual Hours (Worked)

Meaning of the terms used in the formulae:

Term	Meaning
Standard Hours (SH)	Hours required producing actual <u>output</u> .
Actual Hours (AH)	Actual Hours taken to produce actual <u>output</u> .
Revised Standard Hours (RSH)	If actual labour hours worked were worked by standard mix (combination) of labour.
Actual Yield (AY)	Actual Hours worked
Standard Yield (SY)	Actual hours if labour worked in standard ratio
Standard Labour Cost (SLC)	Standard labour cost for actual output

ILLUSTRATION 9

From the following information of G Ltd., calculate (i) Variable Overhead Cost Variance; (ii) Variable Overhead Expenditure Variance and (iii) Variable Overhead Efficiency Variance:

Budgeted Production	6,000 units
Budgeted Variable Overhead	₹ 1,20,000
Standard time for one Unit of output	2 hours
Actual Production	5,900 units
Actual Overhead Incurred	₹ 1,22,000
Actual Hours Worked	11,600 hours

SOLUTION**Workings:**

- Standard cost per unit = $\frac{₹1,20,000}{6,000\text{units}} = ₹20$
- Standard cost per hour = $\frac{₹1,20,000}{6,000\text{units} \times 2\text{hours}} = ₹10$

(i) Variable Overhead Cost Variance:

$$\begin{aligned}
 &= \text{Std. Overhead for actual production} - \text{Actual overhead incurred} \\
 &= ₹20 \times 5,900 \text{ units} - ₹1,22,000 = ₹4,000 \text{ (A)}
 \end{aligned}$$

(ii) Variable Overhead Expenditure Variance:

= Std. overhead for Actual hours – Actual Overhead

= ₹10 × 11,600 hours - ₹1,22,000 = ₹6,000 (A)

(iii) Variable Overhead Efficiency Variance:

= Std.rate per hour × (Std. hours for actual production – Actual hours)

= ₹10 (2 hours × 5,900 units – 11,600 hours) = ₹2,000 (F)

7.4 Fixed Overhead Cost Variance

The recovery of the fixed components of the estimated overheads depends upon capacity utilization.

In case a company produces less than the projected utilization it shall not be able to recover all the budgeted fixed overheads. This unrecovered portion is known as production volume variance.

The other variance is because of variations in actual spending when compared with both estimated fixed and estimated variable overheads. Such a variance is known as Overhead expenses variance.

The following detailed discussion shall help you have a clear understanding of these two variances.

(1) Production Volume Variance: The term fixed overheads implies that the element of cost does not vary directly in proportion to the output. In other words, fixed overheads do not change within a given range of activity.

However, the unit cost changes even though the fixed overheads are constant in total within the given range of output. So, higher the level of activity, the lower will be the unit cost or vice versa.

The management is, therefore, faced with a costing difficulty because it requires a representative rate for charging fixed overheads irrespective of changes in volume of output. For example, if the fixed overheads are ₹ 10,000 and the output varies from 8,000 to 11,000 units, the cost per unit of output would be as under:

Fixed Overheads	Output in units	Cost per unit of output (₹)
10,000	8,000	1.25
10,000	9,000	1.11
10,000	10,000	1.00
10,000	11,000	0.91

We have, however, seen that in standard costing, a predetermined rate of overhead recovery is established for costing purposes. This involves the establishment of a predetermined capacity.

If we take, for example; 10,000 units as predetermine volume/capacity, the pre-determined rate will be ₹1 per unit. If the factory produces only 8,000 units, there will be a loss due to under-recovery which can be explained in two-ways:

- (a) The actual cost will be $\text{₹}10,000 \div 8,000 \text{ units} = \text{₹}1.25$ per unit whereas the absorbed cost is ₹1 per unit. Since the cost is more by ₹0.25 per unit, the total loss is $8,000 \text{ units} \times \text{₹} 0.25$ or ₹ 2,000.
- (b) Since the factory has produced only 8,000 units, the amount of overheads recovered is $8,000 \text{ units} \times \text{₹}1$ or ₹ 8,000. Since fixed overheads are constant, the amount which should have been ideally incurred for the department is ₹10,000. Hence there is a difference of ₹2,000 between the overheads recovered and the overheads estimated. This variance is known as production volume variance.

This shows the cost of failure on the part of the factory to produce at the planned activity of 10,000 units. If the company produces 11,000 units, the variance will show the benefits of operating at a level above the budgeted activity. If, however, the factory has produced 10,000 units, there will be no production volume variance because the actual activity equals what was budgeted i.e. the production of 10,000 units.

(2) Overhead Expenses Variance: As discussed above, the Production Volume Variance analyses the unrecovered fixed overheads. Apart from this, there can be variations in the actual spending of both fixed and variable overheads when compared to what was established as a standard. Such variations can be accounted for by analyzing an overhead expenses variance.

The analysis of overhead variances is different from that of material and labour variances. As overhead is the aggregate of indirect materials, indirect labour and indirect expenses, this variance is considered to be a difficult part of variance analysis. It is important to understand that overhead variance is nothing but under or over-absorption of overhead.

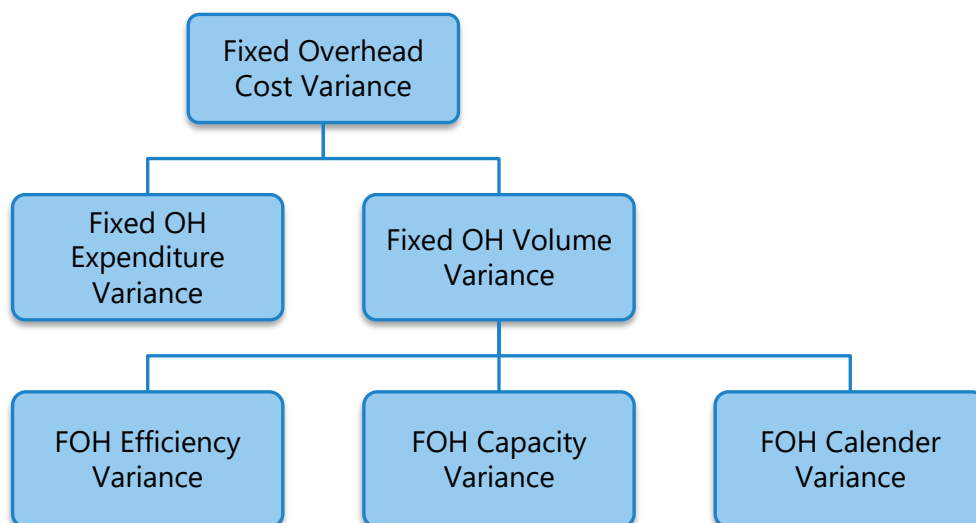
Fixed Overhead Cost Variance: Fixed overhead cost variance is the **difference between actual fixed overhead and absorbed fixed overhead**. Fixed overhead variance is divided into two parts (A) Fixed Overhead Expenditure Variance and (B) Fixed Overhead Volume Variance.

(A) Fixed Overhead Expenditure Variance: This is the difference between the actual fixed overhead incurred and budgeted fixed overhead.

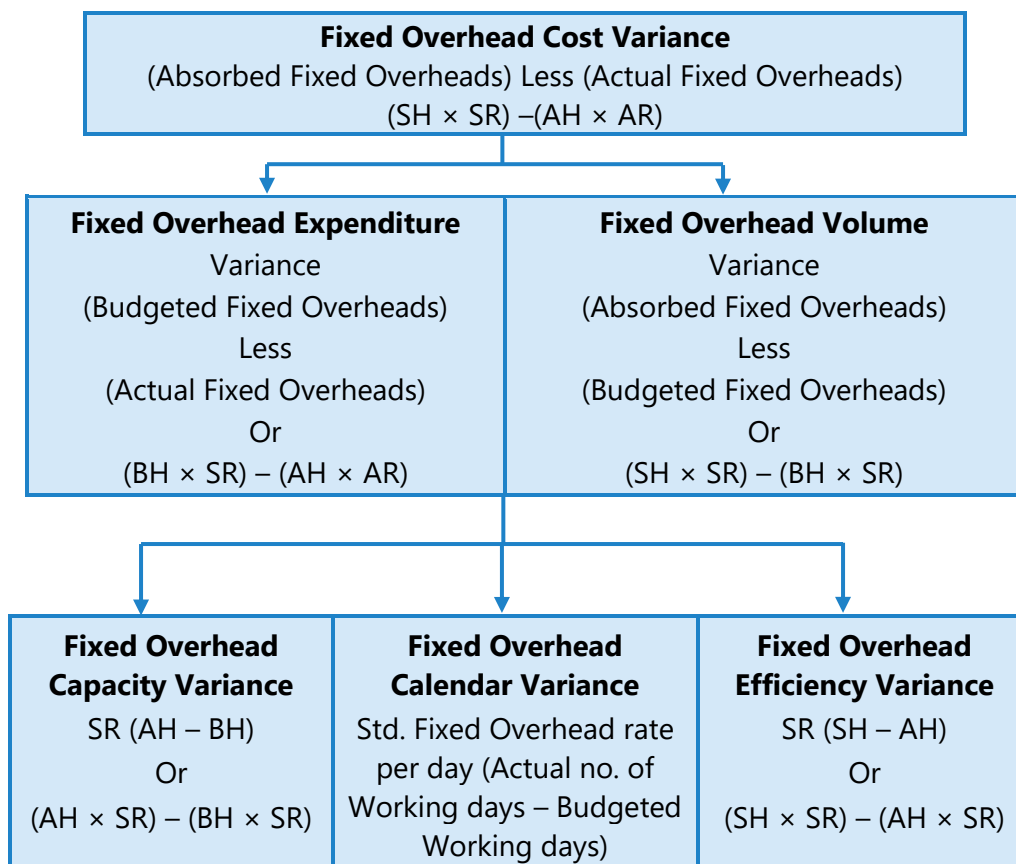
(B) Fixed Overhead Volume Variance: Variance in fixed overhead which arise due to the volume of production is called fixed overhead volume variance.

Fixed overhead volume variance is further divided into the three variances:

- (a) Efficiency Variance
- (b) Capacity Variance and
- (c) Calendar Variance



Mathematically these can be written as follows:



- (a) **Fixed Overhead Efficiency Variance:** This is the difference between fixed overhead absorbed and standard fixed overhead.
- (b) **Fixed Overhead Capacity Variance:** This is the difference between standard fixed overhead and budgeted overhead.
- (c) **Fixed Overhead Calendar Variance:** This variance arises due to difference in number of actual working days and the standard working days.

Note: When calendar variance is computed, there will be a modification in the capacity variance. In that case revised capacity variance will be calculated and the formula is:

Revised Capacity Variance = (Actual hours – Revised budgeted hours) × Std. fixed rate per hour

Verification of formulae:

F.O. Cost Variance = F.O. Expenditure Variance + F.O. Volume Variance

F.O. Volume Variance = Efficiency Variance + Capacity Variance + Calendar Variance

Basic terms used in the computation of overhead variance

$$\text{Standard overhead rate (per hour)} = \frac{\text{Budgeted Overhead}}{\text{Budgeted hours}}$$

Or

$$\text{Standard overhead rate (per unit)} = \frac{\text{Budgeted Overhead}}{\text{Budgeted output in units}}$$

Note: Separate overhead rates will be computed for fixed and variable overheads.

Basic calculations before the computation of overhead variances:

The following basic calculation should be made before computing variances.

(i) When overhead rate per hour is used:

(a) Standard hours for actual output (SHAO)

$$\text{SHAO} = \frac{\text{Budgeted Hours}}{\text{Budgeted Output}} \times \text{Actual Output}$$

(b) Absorbed (or Recovered) overhead = Std. hours for actual output × Std. overhead rate per hour

(c) Standard overhead = Actual hours × Std. overhead rate per hour

(d) Budgeted overhead = Budgeted hours × Std. overhead rate per hour

(e) Actual overhead = Actual hours × Actual overhead rate per hour

(ii) When overhead rate per unit is used

(a) Standard output for actual hours (SOAH)

$$\text{SOAH} = \frac{\text{Budgeted Output}}{\text{Budgeted Hours}} \times \text{Actual Hours}$$

(b) Absorbed overhead = Actual output × Std. overhead rate per unit

- (c) Standard overhead = Std. output for actual time × Std. overhead rate per unit
- (d) Budgeted overhead = Budgeted output × Std. overhead rate per unit
- (e) Actual overhead = Actual output × Actual overhead rate per unit
- (f) Overhead cost variance = Absorbed overhead – Actual overhead
- (g) OCV = (Std. hours for actual output × Std. overhead rate) – Actual overhead

ILLUSTRATION 10

The cost detail of J&G Ltd. for the month of September is as follows:

	Budgeted	Actual
<i>Fixed overhead</i>	₹ 15,00,000	₹ 15,60,000
<i>Units of production</i>	7,500	7,800
<i>Standard time for one unit</i>	2 hours	-
<i>Actual hours worked</i>	-	16,000 hours

Required:

CALCULATE (i) Fixed Overhead Cost Variance (ii) Fixed Overhead Expenditure Variance (iii) Fixed Overhead Volume Variance (iv) Fixed Overhead Efficiency Variance and (v) Fixed Overhead Capacity Variance.

SOLUTION

- (i) Fixed Overhead Cost Variance:
- $$= \text{Overhead absorbed for actual production} - \text{Actual overhead incurred}$$
- $$= \left(\frac{₹15,00,000}{7,500} \times 7,800 \right) - ₹15,60,000 = 0$$
- (ii) Fixed Overhead Expenditure Variance:
- $$= \text{Budgeted overhead} - \text{Actual overhead}$$
- $$= ₹15,00,000 - ₹15,60,000 = ₹60,000 \text{ (A)}$$

(iii) Fixed Overhead Volume Variance:

= Absorbed overhead – Budgeted overhead

$$= \left(\frac{₹15,00,000}{7,500} \times 7,800 \right) - ₹15,00,000 = ₹60,000 \text{ (F)}$$

(iv) Fixed Overhead Efficiency Variance:

= Std. Rate (Std. hours for actual production - Actual hours)

$$= \frac{₹15,00,000}{7,500 \times 2} \times \{(2 \text{ hours} \times 7,800 \text{ hours}) - 16,000 \text{ hours}\}$$

$$= ₹100 (15,600 - 16,000) = ₹40,000 \text{ (A)}$$

(v) Fixed Overhead Capacity Variance:

= Std. Rate (Actual hours - Budgeted hours)

$$= \frac{₹15,00,000}{7,500 \times 2} \times (16,000 \text{ hours} - 15,000 \text{ hours})$$

$$= ₹100 (16,000 - 15,000) = ₹1,00,000 \text{ (F)}$$

ILLUSTRATION 11

A company has a normal capacity of 120 machines, working 8 hours per day of 25 days in a month. The fixed overheads are budgeted at ₹ 1,44,000 per month. The standard time required to manufacture one unit of product is 4 hours.

In April 2021, the company worked 24 days of 840 machine hours per day and produced 5,305 units of output. The actual fixed overheads were ₹ 1,42,000.

COMPUTE the following Fixed Overhead variance:

1. *Efficiency variance*
2. *Capacity variance*
3. *Calendar variance*
4. *Expenditure variance*
5. *Volume variance*
6. *Total Fixed overhead variance*

SOLUTION**Working Notes:**

		Budget	Actual
(1)	Fixed overheads for the month	1,44,000	1,42,000
(2)	Working days per month	25	24
(3)	Working hours per month	(120 machines × 8 hrs. × 25 days) = 24,000	(840 machines hours × 24 days) = 20,160
(4)	Production units per month	$\frac{24,000 \text{ hrs.}}{4 \text{ hrs.}} = 6,000$	5,305

(5) Standard hours for actual production

= Actual production units × Std. hours per unit

= 5,305 × 4 = 21,220 hrs.

(6) Standard fixed overhead rate per unit = $\frac{₹1,44,000}{6000 \text{ units}} = ₹ 24$

(7) Standard fixed overhead rate per hour = $\frac{₹1,44,000}{24,000 \text{ hrs.}} = ₹ 6$

(8) Standard fixed overhead per day = $\frac{₹1,44,000}{25 \text{ days}} = ₹ 5,760$

1. Efficiency variance

= Std. rate per hr. (Std. hrs. for actual production – Actual hrs.)

= 6 × (21,220 – 20,160) = ₹ 6,360 (F)

2. Capacity variance

= Std. Rate (Actual hours - Budgeted hours)

= 6 × {20,160 – (24 days × 120 machine × 8 hrs.)} = ₹ 17,280 (A)

3. Calendar variance

= (Actual No. of days – Budgeted No. of days) × Std. rate per day

= (24 – 25) × 5,760 = ₹ 5,760 (A)

4. Expenditure variance

= Budgeted overhead – Actual overhead

= 1,44,000 – 1,42,000 = ₹ 2,000 (F)

5. Volume variance

= Absorbed overhead – Budgeted overhead

= (5,305 × 24) – 1,44,000 = ₹ 16,680 (A)

6. Total fixed overhead Variance

= Absorbed overhead – Actual overhead incurred

= (5,305 × 24) – 1,42,000 = ₹ 14,680 (A)

ILLUSTRATION 12

The overhead expense budget for a factory producing to a capacity of 200 units per month is as follows:

Description of overhead	Fixed cost per unit in ₹	Variable cost per unit in ₹	Total cost per unit in ₹
Power and fuel	1,000	500	1,500
Repair and maintenance	500	250	750
Printing and stationary	500	250	750
Other overheads	1,000	500	1,500
	₹ 3,000	₹ 1,500	4,500

The factory has actually produced only 100 units in a particular month. Details of overheads actually incurred have been provided by the accounts department and are as follows:

Description of overhead	Actual cost
Power and fuel	₹ 4,00,000
Repair and maintenance	₹ 2,00,000
Printing and stationary	₹ 1,75,000
Other overheads	₹ 3,75,000

You are required to CALCULATE the Overhead volume variance and the overhead expense variances.

SOLUTION**Overheads volume variance (in case of fixed overhead):**

Standard fixed overheads per unit (SR): ₹3,000 (Given)

Actual production : 100 units

Standard production (capacity) : 200 units

Fixed Overhead Volume Variance:

$$\begin{aligned}
 &= \text{Absorbed overhead} - \text{Budgeted Overhead} \\
 &= (\text{₹}3,000 \times 100 \text{ units}) - (\text{₹}3,000 \times 200 \text{ units}) \\
 &= \text{₹}3,00,000 - \text{₹}6,00,000 = \text{₹}3,00,000 \text{ (Adverse)}
 \end{aligned}$$

Overhead expense variances

$$\begin{aligned}
 &= \text{Budgeted Overhead} - \text{Actual Overhead} \\
 &= (\text{₹}3,000 \times 200 \text{ units}) - (\text{Total overhead} - \text{Variable overhead}) \\
 &= (\text{₹}3,000 \times 200 \text{ units}) - (\text{₹}11,50,000 - \text{₹}1,50,000 \times 100 \text{ units}) \\
 &= \text{₹}6,00,000 - (\text{₹}11,50,000 - \text{₹}1,50,000) \\
 &= \text{₹}6,00,000 - \text{₹}10,00,000 = \text{₹}4,00,000 \text{ (Adverse)}
 \end{aligned}$$

ILLUSTRATION 13

The following information was obtained from the records of a manufacturing unit using standard costing system.

	Standard	Actual
Production	4,000 units	3,800 units
Working days	20	21
Machine hours	8,000 hours	7,800 hours
Fixed Overhead	₹ 4,00,000	₹ 3,90,000
Variable Overhead	₹ 1,20,000	₹ 1,20,000

You are required to CALCULATE the following overhead variance:

- Variable overhead variances
- Fixed overhead variances

SOLUTION**(a) Variable Overhead Variances**

(i) Variable Overhead Variance:

= Std. overhead for actual production – Actual overhead

$$= \left(\frac{₹1,20,000}{4,000 \text{ units}} \times 3,800 \text{ units} \right) - ₹1,20,000$$

$$= ₹1,14,000 - ₹1,20,000 = ₹6,000 \text{ (A)}$$

(ii) Variable Overhead Expenditure Variance:

= Std. overhead for actual hours – Actual overhead

$$= \left(\frac{₹1,20,000}{8,000 \text{ hours}} \times 7,800 \text{ hours} \right) - ₹1,20,000$$

$$= ₹15 \times 7,800 \text{ hours} - ₹1,20,000 = ₹3,000 \text{ (A)}$$

(iii) Variable Overhead Efficiency Variance:

= Std. Rate per hour (Std. hours for actual production – Actual hours)

$$= \frac{₹1,20,000}{8,000 \text{ hours}} \times \left[\left(\frac{8,000 \text{ hours}}{4,000 \text{ units}} \times 3,800 \text{ units} \right) - 7,800 \text{ hours} \right]$$

$$= ₹15 \times (7,600 \text{ hours} - 7,800 \text{ hours}) = ₹3,000 \text{ (A)}$$

(b) Fixed Overhead Variance:

(i) Fixed Overhead Variance:

= Absorbed overhead – Actual overhead

$$= \left(\frac{₹4,00,000}{4,000 \text{ units}} \times 3,800 \text{ units} \right) - ₹3,90,000$$

$$= ₹3,80,000 - ₹3,90,000 = ₹10,000 \text{ (A)}$$

(ii) Fixed Overhead Expenditure Variance:

= Budgeted Overhead – Actual Overhead

$$= ₹4,00,000 - ₹3,90,000 = ₹10,000 \text{ (F)}$$

(iii) Fixed Overhead Volume Variance:

= Absorbed overhead – Budgeted Overhead

$$= \left(\frac{₹ 4,00,000}{4,000 \text{ units}} \times 3,800 \text{ units} \right) - ₹ 4,00,000$$

$$= ₹ 3,80,000 - ₹ 4,00,000 = ₹ 20,000 \text{ (A)}$$

(iv) Fixed Overhead Efficiency Variance:

= SR × (Std. hours for actual production – Actual hours)

$$= ₹ 50 \times \{(2 \text{ hours} \times 3,800 \text{ units}) - 7,800 \text{ hours}\}$$

$$= ₹ 3,80,000 - ₹ 3,90,000 = ₹ 10,000 \text{ (A)}$$

(v) Fixed Overhead Capacity Variance:

= SR × (Actual hours – Revised budgeted hours)

$$= ₹ 50 \times \left[7,800 \text{ hours} - \frac{8,000}{20 \text{ days}} \times 21 \text{ days} \right]$$

$$= ₹ 50 \times (7,800 \text{ hours} - 8,400 \text{ hours}) = ₹ 30,000 \text{ (A)}$$

(vi) Fixed Overhead Calendar Variance:

= Rate per day (Budgeted days – Actual days)

$$= \frac{₹ 4,00,000}{20 \text{ days}} \times (20 \text{ days} - 21 \text{ days}) = 20,000 \text{ (F)}$$

8. ADVANTAGES AND CRITICISM OF STANDARD COSTING

8.1 Advantages of Standard Costing

Following are the advantages of standard costing.

- (i) **It serves as a basis for measuring operating performance and cost control.** It is possible by setting standards, proper classification and determination of variances. It serves as a signal for prompt corrective action. It helps to report exceptional variances i.e. the only matters which are not

proceeding according to plan are reported. This enables the managers to concentrate on essential matters only.

- (ii) **It aids price fixing.** Standard costing can be used to predict costs. Although actual cost may vary from day to day, standard costs will remain stable over a period of time and, where demand for a product is elastic, this information can be used as a basis for fixing the selling price.
- (iii) **Introduction of standard costing facilitates evaluation of jobs and introduction of incentives.** Job values can be determined by the use of evaluation and scale of wages fixed according to the responsibility involved in each job.
- (iv) Standard costing **facilitates the estimation of the cost of new products** with greater accuracy.
- (v) It serves as a **basis for inventory valuation.** Standard costs are used for inventory valuation. A further advantage of this procedure is that material stock can be recorded in terms of quantities only.
- (vi) Standard costing is also **used for the measurement of profit.** The question of correct approach of calculating profit is very much related to methods of stock valuation and absorption of fixed overheads. Standard costing eliminates any variations in profit due to changes in stock values from one period to another thus provides a basis for the measurement of profit.
- (vii) Standard costing is **used in planning, budgeting and decision making.** Standard costs being the pre-determined costs, are particularly useful in planning and budgeting.
- (viii) Standard costing is **used in standardisation of products, operations and processes,** it improves the overall production efficiency and reduces costs.
- (ix) It provides objectives and targets to be achieved by each level of management and defines the responsibilities of departmental managers. Thus, the system **serves as an incentive to the departmental head to achieve the targets set by the company.**
- (x) Standard costing sets a uniform basis for comparison of all elements of costs. Since care is taken in setting standards, the standards become unchanging units of comparison. The standard hour may be used as a basic unit to compare dissimilar products or processes.

- (xi) The maximum use of working capital, plant facilities and current assets is assured because wastage of materials and loss due to idle time are closely controlled.

8.2 Criticism of Standard Costing

The following are some of the criticism which may be leveled against the standard costing system. The arguments have been suitably answered as stated against each by advocates of the standard costing and hence they do not invalidate the usefulness of the system to business enterprises.

(i) Variation in price: One of the chief problem faced in the operation of the standard costing system is the precise estimation of likely prices or rate to be paid. The variability of prices is so great that even actual prices are not necessarily adequately representative of cost. But the use of sophisticated forecasting techniques should be able to cover the price fluctuation to some extent. Besides this, the system provides for isolating uncontrollable variances arising from variations to be dealt with separately.

(ii) Varying levels of output: If the standard level of output set for pre-determination of standard costs is not achieved, the standard costs are said to be not realised. However, the statement that the capacity utilisation cannot be precisely estimated for absorption of overheads may be true only in some industries of jobbing type. In vast majority of industries, use of forecasting techniques, market research, etc., help to estimate the output with reasonable accuracy and thus the variation is unlikely to be very large. Prime cost will not be affected by such variation and, moreover, variance analysis helps to measure the effects of idle time.

(iii) Changing standard of technology: In case of industries that have frequent technological changes affecting the conditions of production, standard costing may not be suitable. This criticism does not affect the system of standard costing. Cost reduction and cost control is a cardinal feature of standard costing because standards once set do not always remain stable. They have to be revised.

(iv) Attitude of technical people: Technical people are accustomed to think of standards as physical standards and, therefore, they will be misled by standard

costs. Since technical people can be educated to adopt themselves to the system through orientation courses, it is not an insurmountable difficulty.

(v) Mix of products: Standard costing presupposes a pre-determined combination of products both in variety and quantity. The mixture of materials used to manufacture the products may vary in the long run but since standard costs are set normally for a short period, such changes can be taken care of by revision of standards.

(vi) Level of Performance: Standards may be either too strict or too liberal because they may be based on (a) theoretical maximum efficiency, (b) attainable good performance or (c) average past performance. To overcome this difficulty, the management should give thought to the selection of a suitable type of standard. The type of standard most effective in the control of costs is one which represents an attainable level of good performance.

(vii) Standard costs cannot possibly reflect the true value in exchange. If previous historical costs are amended roughly to arrive at estimates for ad hoc purposes, they are not standard costs in the strict sense of the term and hence they cannot also reflect true value in exchange. In arriving at standard costs, however, the economic and technical factors, internal and external, are brought together and analysed to arrive at quantities and prices which reflect optimum operations. The resulting costs, therefore, become realistic measures of the sacrifices involved.

(viii) Fixation of standards may be costly: It may require high order of skill and competency. Small concerns, therefore, feel difficulty in the operation of such system.

SUMMARY

- ◆ **Standard Costing:** A technique which uses standards for costs and revenues for the purposes of control through variance analysis.
- ◆ **Standard Price:** A predetermined price fixed on the basis of a specification of a product or service and of all factors affecting that price.
- ◆ **Standard Time:** The total time in which task should be completed at standard performance.

- ◆ **Variance:** A divergence from the predetermined rates, expressed ultimately in money value, generally used in standard costing and budgetary control systems.
- ◆ **Variance Analysis:** The analysis of variances arising in standard costing system into their constituent parts.
- ◆ **Revision Variance:** It is the difference between the original standard cost and the revised standard cost of actual production.
- ◆ **Basic Standard:** A standard fixed for a fairly long period.
- ◆ **Current Standard:** A standard fixed for a short period.
- ◆ **Estimated Cost:** An estimate of what the cost is likely to be during a given period of time.
- ◆ **Ideal Cost:** A cost which should be incurred during a period under ideal conditions.

Important Formulas

- ◆ **Material Variance:**

Material Costs Variance = (Std. qty × Std. Price) – (Actual qty × Actual price)

Material Usage Variance = Std. price (Std. Qty. – Actual qty.)

Material Price Variance = Actual qty. (Std. price – Actual price)

Material Cost Variance = Material usage variance + Material price variance

Material Mix Variance = SP (RSQ – AQ)

Material Yield Variance = SP (SQ – RSQ)

- ◆ **Labour Variance:**

Labour Cost Variance = (Std. time × Std. Rate) – (Actual time × Actual rate)

Labour Efficiency Variance = Std. rate (Std. time – Actual time)

Labour Rate Variance = Actual time (Std. rate – Actual rate)

Labour Idle Time Variance = Idle time × Std. rate

Labour Cost Variance = Labour Efficiency Variance + Labour Rate Variance

Labour Mix Variance = SR (RSH – AH)

Labour Yield Variance = SR (SH – RSH)

♦ **Fixed Overhead Variances:**

F.O. Cost Variance = Recovered Overhead – Actual Overhead

F.O. Expenditure Variance = Budgeted Overhead – Actual Overhead

F.O. Volume Variance = Recovered Overhead – Budgeted Overhead

F.O. Efficiency Variance = Recovered Overhead – Standard Overhead

F.O. Capacity Variance = Standard Overhead – Budgeted Overhead

F.O. Calendar Variance = SR (Actual no. of working days – Std. no. working days)

♦ **Variable Overhead Variances**

V.O. Cost variance = Recovered Overhead – Actual Overhead

V.O. Expenditure Variance = Standard Overhead – Actual Overhead

V.O. Efficiency Variance = Recovered Overhead – Standard Overhead

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. Under standard cost system the cost of the product determined at the beginning of production is its:
 - (a) Direct cost
 - (b) Pre-determined cost
 - (c) Historical cost
 - (d) Actual cost
2. The deviations between actual and standard cost is known as:
 - (a) Multiple analysis
 - (b) Variable cost analysis

- (c) *Variance analysis*
 - (d) *Linear trend analysis*
3. *The standard which is attainable under favourable conditions is:*
- (a) *Theoretical standard*
 - (b) *Expected standard*
 - (c) *Normal standard*
 - (d) *Basic standard*
4. *The standard most suitable from cost control point of view is:*
- (a) *Normal standard*
 - (b) *Theoretical standard*
 - (c) *Expected standard*
 - (d) *Basic standard*
5. *Overhead cost variances is:*
- (a) *The difference between overheads recovered on actual output - actual overhead incurred.*
 - (b) *The difference between budgeted overhead cost and actual overhead cost.*
 - (c) *Obtained by multiplying standard overhead absorption rate with the difference between standard hours for actual output and actual hours worked.*
 - (d) *None of the above*
6. *Which of the following variance arises when more than one material is used in the manufacture of a product:*
- (a) *Material price variance*
 - (b) *Material usage variance*
 - (c) *Material yield variance*
 - (d) *Material mix variance*

7. *If standard hours for 100 units of output are 400 @ ₹ 2 per hour and actual hours take are 380 @ ₹ 2.25 per, then the labour rate variance is:*
- (a) ₹ 95 (adverse)
 - (b) ₹ 100 (adverse)
 - (c) ₹ 25 (favourable)
 - (d) ₹ 120 (adverse)
8. *Controllable variances are best disposed-off by transferring to:*
- (a) Cost of goods sold
 - (b) Cost of goods sold and inventories
 - (c) Inventories of work-in-progress and finished goods
 - (d) Costing profit and loss account
9. *Idle time variance is obtained by multiplying:*
- (a) The difference between standard and actual hours by the actual rate of labour per hour
 - (b) The difference between actual labour hours paid and actual labour hours worked by the standard rate
 - (c) The difference between standard and actual hours by the standard rate of labour per hour
 - (d) None of the above.
10. *Basic standards are:*
- (a) Those standards, which require high degree of efficiency and performance.
 - (b) Average standards and are useful in long term planning.
 - (c) Standards, which can be attained or achieved
 - (d) Assuming to remain unchanged for a long time.

Theoretical Questions

1. DISCUSS the process of setting standards.
2. DISCUSS the types of standards.
3. HOW material usage standard is set
4. DISCUSS the various types of fixed overhead variances.

Practical Problems

1. For making 10 kg. of CEMCO, the standard material requirements is:

Material	Quantity	Rate per kg. (₹)
A	8 kg	6.00
B	4 kg	4.00

During April, 1,000 kg of CEMCO were produced. The actual consumption of materials is as under:

Material	Quantity (Kg.)	Rate per kg. (₹)
A	750	7.00
B	500	5.00

CALCULATE (A) Material Cost Variance; (b) Material Price Variance; (c) Material usage Variance.

2. The standard mix to produce one unit of a product is as follows:

Material X	60 units @ ₹ 15 per unit	=	900
Material Y	80 units @ ₹ 20 per unit	=	1,600
Material Z	<u>100 units @ ₹ 25 per unit</u>	=	<u>2,500</u>
	<u>240 units</u>		<u>5,000</u>

During the month of April, 10 units were actually produced and consumption was as follows:

Material X	640 units @ ₹ 17.50 per unit	=	11,200
Material Y	950 units @ ₹ 18.00 per unit	=	17,100

Material Z	<u>870 units @ ₹ 27.50 per unit</u>	=	<u>23,925</u>
	<u>2,460 units</u>		<u>52,225</u>

CALCULATE all material variances.

3. *GAP Limited operates a system of standard costing in respect of one of its products which is manufactured within a single cost centre. Following are the details.*

Budgeted data:

Material	Qty	Price (₹)	Amount (₹)
A	60	20	1200
B	<u>40</u>	30	<u>1200</u>
Inputs	100		2400
Normal loss	<u>20</u>		<u> </u>
Output	<u>80</u>		<u>2400</u>

Actual data:

Actual output 80 units.

Material	Qty	Price (₹)	Amount (₹)
A	70	?	?
B	?	30	?

Material Price Variance (A) ₹ 105A

Material cost variance ₹ 275A

You are required to CALCULATE:

- (i) *Actual Price of material A*
- (ii) *Actual Quantity of material B*
- (iii) *Material Price Variance*
- (iv) *Material Usage Variance*

- (v) *Material Mix Variance*
- (vi) *Material Sub Usage Variance*
4. *One kilogram of product K requires two chemicals A and B. The following were the details of product K for the month of June 2023:*
- (a) *Standard mix for chemical A is 50% and chemical B is 50%.*
- (b) *Standard price kilogram of chemical A is ₹ 12 and chemical B is ₹ 15.*
- (c) *Actual input of chemical B is 70 kilograms.*
- (d) *Actual price per kilogram of chemical A is ₹ 15*
- (c) *Standard normal loss is 10% of total input*
- (d) *Total Material cost variance is ₹ 650 adverse.*
- (e) *Total Material yield variance is ₹ 135 adverse.*
- You are required to CALCULATE:*
- (i) *Total Material mix variance*
- (ii) *Total Material usage variance*
- (iii) *Total Material price variance*
- (iv) *Actual loss of actual input*
- (v) *Actual input of chemical A*
- (vi) *Actual price per kg. of chemical B*
5. *The following standards have been set to manufacture a product:*

Direct Material:	(₹)
2 units of A @ ₹ 4 per unit	8.00
3 units of B @ ₹ 3 per unit	9.00
15 units of C @ ₹ 1 per unit	<u>15.00</u>
	32.00
Direct Labour: 3 hours @ ₹ 8 per hour	<u>24.00</u>
Total standard prime cost	<u>56.00</u>

The company manufactured and sold 6,000 units of the product during the year. Direct material costs were as follows:

12,500 units of A at ₹ 4.40 per unit

18,000 units of B at ₹ 2.80 per unit

88,500 units of C at ₹ 1.20 per unit

The company worked 17,500 direct labour hours during the year. For 2,500 of these hours, the company paid at ₹ 12 per hour while for the remaining, the wages were paid at standard rate.

CALCULATE

(i) Materials price variance & Usage variance

(ii) Labour rate & Efficiency variances.

6. The following information is available from the cost records of Novell & Co. for the month of March 2021:

Materials purchased	20,000 units @ ₹ 88,000
Materials consumed	19,000 units
Actual wages paid for 4,950 hrs.	₹ 24,750
Units produced	1,800 units
Standard rates and pieces are:	
Direct material	₹ 4 per unit
Standard output	10 number for one unit
Direct labour rate	₹ 4.00 per hour
Standard requirement	2.5 hours per unit

You are required to **CALCULATE** relevant material and labour variance for the month.

7. XYZ Company has established the following standards for factory overheads.

Variable overhead per unit: ₹ 10/-

Fixed overheads per month ₹ 1,00,000

Capacity of the plant 20,000 units per month.

The actual data for the month are as follows:

Actual overheads incurred ₹ 3,00,000

Actual output (units) 15,000 units

Required:

CALCULATE overhead variances viz:

(i) Production volume variance

(ii) Overhead expense variance

8. Following information is available from the records of a factory:

	Budget	Actual
Fixed overhead for the month of June	₹ 10,000	₹ 12,000
Production in June (units)	2,000	2,100
Standard time per unit (hours)	10	–
Actual hours worked in June	–	21,000

CALCULATE:

(i) Fixed overhead cost variance,

(ii) Expenditure variance,

(iii) Volume variance.

9. XYZ Ltd. has furnished you the following information for the month of August:

	Budget	Actual
Output (units)	30,000	32,500
Hours	30,000	33,000
Fixed overhead	₹ 45,000	50,000
Variable overhead	₹ 60,000	68,000
Working days	25	26

CALCULATE overhead variances.

10. S.V. Ltd. has furnished the following data:

	Budget	Actual (for the month of July)
No. of working days	25	27
Production in units	20,000	22,000
Fixed overheads	₹ 30,000	₹ 31,000

Budgeted fixed overhead rate is ₹ 1.00 per hour. In July, the actual hours worked were 31,500.

CALCULATE the following variances:

- (i) Expenditure variance.
 - (ii) Volume variance.
 - (iii) Total overhead variance.
11. The following data for Pijee Ltd. is given:

	Budget	Actual
Production (in units)	400	360
Man hours to produce above	8,000	7,000
Variable overheads (in ₹)	10,000	9,150

CALCULATE relevant Variable overhead variances.

12. The following data has been collected from the cost records of a unit for computing the various fixed overhead variances for a period:

Number of budgeted working days	25
Budgeted man-hours per day	6,000
Output (budgeted) per man-hour (in units)	1
Fixed overhead cost as budgeted	₹ 1,50,000
Actual number of working days	27
Actual man-hours per day	6,300
Actual output per man-hour (in-units)	0.9
Actual fixed overhead incurred	₹ 1,56,000

CALCULATE fixed overhead variances:

- (i) *Expenditure Variance*
- (ii) *Volume Variance,*
- (iii) *Fixed Cost Variance.*

13. *J.K. Ltd. manufactures NXE by mixing three raw materials. For every batch of 100 kg. of NXE, 125 kg. of raw materials are used. In the month of April, 60 batches were prepared to produce an output of 5,600 kg. of NXE. The standard and actual particulars for the month of April, are as follows:*

Raw Materials	Standard		Actual		Quantity of Raw Materials Purchased
	Mix	Price per kg.	Mix	Price per Kg.	
	(%)	(₹)	(%)	(₹)	
A	50	20	60	21	5,000
B	30	10	20	8	2,000
C	20	5	20	6	1,200

You are required to CALCULATE:

- (i) *Material Price variance*
 - (ii) *Material Usage Variance*
14. *Following data is extracted from the books of XYZ Ltd. for the month of January:*
- (i) *Estimation-*

Particulars	Quantity (kg.)	Price (₹)	Amount (₹)
Material-A	800	?	--
Material-B	600	30.00	18,000
			--

Normal loss was expected to be 10% of total input materials.

(ii) Actuals-

1480 kg of output produced.

Particulars	Quantity (kg.)	Price (₹)	Amount (₹)
Material-A	900	?	--
Material-B	?	32.50	--
			59,825

(iii) Other Information-

Material Cost Variance = ₹3,625 (F)

Material Price Variance = ₹175 (F)

You are required to CALCULATE:

- (i) Standard Price of Material-A;
- (ii) Actual Quantity of Material-B;
- (iii) Actual Price of Material-A;
- (iv) Revised standard quantity of Material-A and Material-B; and
- (v) Material Mix Variance.

15. Paras Synthetics uses Standard costing system in manufacturing of its product 'Star 95 Mask'. The details are as follows;

Direct Material 0.50 Meter @ ₹60 per meter	₹30
Direct Labour 1 hour @ ₹20 per hour	₹20
Variable overhead 1 hour @ ₹10 per hour	₹10
Total	₹60

During the month of August, 10,000 units of 'Star 95 Mask' were manufactured.

Details are as follows:

Direct material consumed 5700 meters @ ₹58 per meter

Direct labour Hours ? @ ? ₹2,24,400

Variable overhead incurred ₹1,12,200

Variable overhead efficiency variance is ₹2,000 A. Variable overheads are based on Direct Labour Hours.

You are required to calculate the missing data and all the relevant Variances.

Case Scenarios

1. K Ltd. is a manufacturer of a single product A. 8,000 units of the product A has been produced in the month of March 2024. At the beginning of the year a total 1,20,000 units of the product-A has been planned for production. The cost department has provided the following estimates of overheads:

Fixed	₹ 12,00,000	Variable	₹ 6,00,000
Semi-Variable	₹ 1,80,000		

Semi-variable charges are considered to include 60 per cent expenses of fixed nature and 40 per cent of variable nature.

The records of the production department shows that the company could have operated for 20 days but there was a festival holiday during the month.

The actual cost data for the month of March 2024 are as follows:

Fixed	₹ 1,19,000	Variable	₹ 48,000
Semi-Variable	₹ 19,200		

The cost department of the company is now preparing a cost variance report for managerial information and action. You being an accounts officer of the company are asked to calculate the following information for preparation of the variance report:

- i. What is the amount of variable overhead cost variance for the month of March 2024:
 - (a) ₹ 10,200 (A)
 - (b) ₹ 10,400 (A)
 - (c) ₹ 10,800 (A)
 - (d) ₹ 10,880 (A)

- ii. What is the amount of fixed overhead volume variance for the month of March 2024:
- (a) ₹ 9,000 (F)
 - (b) ₹ 9,000 (A)
 - (c) ₹ 21,800 (A)
 - (d) ₹ 11,000 (A)
- iii. What is the amount of fixed overhead expenditure variance for the month of March 2024:
- (a) ₹ 21,520 (A)
 - (b) ₹ 21,500 (A)
 - (c) ₹ 21,400 (A)
 - (d) ₹ 21,480 (A)
- iv. What is the amount of fixed overhead calendar variance for the month of March 2024:
- (a) ₹ 5,400 (A)
 - (b) ₹ 5,450 (A)
 - (c) ₹ 5,480 (A)
 - (d) ₹ 5.420 (A)
- v. What is the amount of fixed overhead cost variance for the month of March 2024:
- (a) ₹ 43,320 (A)
 - (b) ₹ 43,300 (A)
 - (c) ₹ 43,200 (A)
 - (d) ₹ 43,380 (A)

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(b)	2.	(c)	3.	(a)	4.	(c)	5.	(a)	6.	(d)
7.	(a)	8.	(d)	9.	(b)	10.	(d)				

Answers to the Theoretical Questions

1. Please refer paragraph 4
2. Please refer paragraph 2
3. Please refer paragraph 7.1
4. Please refer paragraph 7.4

Answers to the Practical Problems

1. Basic Calculations

	Standard for 1,000 kg.			Actual for 1,000 kg.		
	Qty.	Rate	Amount	Qty.	Rate	Amount
	Kg.	(₹)	(₹)	Kg.	(₹)	(₹)
A	800*	6	4,800	750	7	5,250
B	400*	4	1,600	500	5	2,500
Total	1,200		6,400	1,250		7,750

(* A- $8 \div 10 \times 1000 = 800$ B- $4 \div 10 \times 1000 = 400$)

Calculation of Variances:

(a) Material Cost Variance = Std. cost for actual output – Actual cost

MCV = $6,400 - 7,750 = ₹1,350$ (A)

(b) Material Price Variance = $(SP - AP) \times AQ$

A = $(6 - 7) \times 750 = ₹750$ (A)

B = $(4 - 5) \times 500 = ₹500$ (A)

MPV = ₹1,250 (A)

$$(c) \text{ Material Usages Variance} = (SQ - AQ) \times SP$$

$$A = (800 - 750) \times 6 = ₹ 300 (F)$$

$$B = (400 - 500) \times 4 = ₹ 400 (A)$$

$$\text{MUV} = ₹ 100 (A)$$

Check

$$\text{MCV} = \text{MPV} + \text{MUV}$$

$$1,350 (A) = 1,250 (A) + 100 (A)$$

2.

Material	Standard for 10 units			Actual for 10 units		
	Qty. Units	Rate (₹)	Amount (₹)	Qty. units	Rate (₹)	Amount (₹)
X	600	15	9,000	640	17.50	11,200
Y	800	20	16,000	950	18.00	17,100
Z	1,000	25	25,000	870	27.50	23,925
Total	2,400		50,000	2,460		52,225

$$1. \text{ Material Cost Variance} = \text{Standard cost} - \text{Actual cost}$$

$$= ₹ 50,000 - ₹ 52,225$$

$$\text{MCV} = ₹ 2,225 (A)$$

$$2. \text{ Material Price Variance} = (\text{Std. Price} - \text{Actual Price}) \times \text{Actual Qty.}$$

$$\text{Material X} = (15 - 17.50) \times 640 = ₹ 1,600 (A)$$

$$\text{Material Y} = (20 - 18) \times 950 = ₹ 1,900 (F)$$

$$\text{Material Z} = (25 - 27.50) \times 870 = ₹ 2,175 (A)$$

$$\text{MPV} = ₹ 1,875 (A)$$

$$3. \text{ Material Usage Variance} = (\text{Std. Qty.} - \text{Actual Qty.}) \times \text{Std. Price}$$

$$\text{Material X} = (600 - 640) \times 15 = ₹ 600 (A)$$

$$\text{Material Y} = (800 - 950) \times 20 = ₹ 3,000 (A)$$

$$\text{Material Z} = (1,000 - 870) \times 25 = ₹ 3,250 (F)$$

$$\text{MUV} = ₹ 350 (A)$$

$$\begin{aligned}\text{Check} \quad \text{MCV} &= \text{MPV} + \text{MUV} \\ ₹ 2,225 \text{ (A)} &= ₹ 1,875 \text{ (A)} + ₹ 350 \text{ (A)}\end{aligned}$$

$$\begin{aligned}4. \quad \text{Material Mix Variance} &= (\text{Revised Std. Qty.} - \text{Actual Qty.}) \times \text{Std. Price} \\ \text{Material X} &= (615^* - 640) \times 15 &= ₹ 375 \text{ (A)} \\ \text{Material Y} &= (820^* - 950) \times 20 &= ₹ 2,600 \text{ (A)} \\ \text{Material Z} &= (1,025 - 870) \times 25 &= ₹ 3,875 \text{ (F)} \\ \text{MMV} & &= ₹ 900 \text{ (F)}\end{aligned}$$

*Revised Standard Quantity (RSQ) is calculated as follows:

$$\begin{aligned}\text{Material X} &= \frac{2460}{2400} \times 600 = 615 \text{ units} \\ \text{Material Y} &= \frac{2460}{2400} \times 800 = 820 \text{ units} \\ \text{Material Z} &= \frac{2460}{2400} \times 1,000 = 1,025 \text{ units}\end{aligned}$$

$$\begin{aligned}5. \quad \text{Material Yield Variance} &= (\text{Std. Qty} - \text{Revised Std. Qty.}) \times \text{Std. Price} \\ \text{Material X} &= (600 - 615) \times 15 &= ₹ 225 \text{ (A)} \\ \text{Material Y} &= (800 - 820) \times 20 &= ₹ 400 \text{ (A)} \\ \text{Material Z} &= (1,000 - 1,025) \times 25 &= ₹ 625 \text{ (A)} \\ \text{MYV} & &= ₹ 1,250 \text{ (A)}\end{aligned}$$

Check

$$\begin{aligned}\text{MUV} &= \text{MMV} + \text{MYV (Or MRUV)} \\ ₹ 350 \text{ (A)} &= ₹ 900 \text{ (F)} + ₹ 1,250 \text{ (A)}\end{aligned}$$

or

$$\begin{aligned}\text{MCV} &= \text{MPV} + \text{MMV} + \text{MYV (Or MRUV)} \\ ₹ 2,225 \text{ (A)} &= ₹ 1,875 \text{ (A)} + ₹ 900 \text{ (F)} + ₹ 1,250 \text{ (A)}\end{aligned}$$

3. (i) Actual Price of Material A

Let Actual Price of Material A be 'X'

Material Price Variance (A) = ₹ 105 (A)

Material Price Variance = (SP – AP) × AQ

$(20 - X) \times 70 = 105 \text{ (A)}$

$1,400 - 70X = -105$

$X = 1,505 \div 70 = 21.5$

Therefore X (Actual Price) = ₹ 21.5

(ii) Actual Quantity of Material B

Let Actual Quantity of Material B be 'X'

Material Cost Variance = (SQ × SP) – (AQ × AP)

Material Cost Variance = 275 (A)

$\{(60 \times 20) - (70 \times 21.5)\} + \{(40 \times 30) - ('X' \times 30)\} = 275 \text{ (A)}$

$\{(1,200 - 1,505) + (1,200 - 30X)\} = -275$

$(895 - 30X) = -275$

$X = 1,170 \div 30 = 39 \text{ units}$

(iii) Material Price Variance = (SP – AP) × AQ

Material A = $(20 - 21.5) \times 70 = ₹ 105 \text{ (A)}$

Material B = $(30 - 30) \times 39 = ₹ 0$

Total = ₹ 105 (A)

(iv) Material Usage Variance = (SQ – AQ) × SP

Material A = $(60 - 70) \times 20 = ₹ 200 \text{ (A)}$

Material B = $(40 - 39) \times 30 = ₹ 30 \text{ (F)}$

Total = ₹ 170 (A)

(v) Material Mix Variance = (RSQ – AQ) × SP

$$\text{Material A} = \left(\frac{109}{100} \times 60 - 70 \right) \times 20 = ₹ 92 \text{ (A)}$$

$$\text{Material B} = \left(\frac{109}{100} \times 40 - 39 \right) \times 30 = ₹ 138 \text{ (F)}$$

$$\text{Total} = ₹ 46 \text{ (F)}$$

(vi) Material Yield Variance = (SQ – RSQ) × SP

$$\text{Material A} = \left(60 - \frac{109}{100} \times 60 \right) \times 20 = ₹ 108 \text{ (A)}$$

$$\text{Material B} = \left(40 - \frac{109}{100} \times 40 \right) \times 30 = ₹ 108 \text{ (A)}$$

$$\text{Total} = ₹ 216 \text{ (A)}$$

4. Working Notes:

- (1)** Calculation of standard mix of input (assuming Standard input as 100 kg)

	Qty. (Kg)	Price (₹)	Amount (₹)
Chemical A	50	12	600
Chemical B	50	15	750
	100	13.50	1,350
Normal Loss (10%)	(10)		
	90		1,350

- (2)** Let the actual input of chemical A be X kg. and the actual price of chemical B be ₹ Y.

Given,

Material yield variance = (Total standard input – Total Actual input) × Standard cost per unit of input

$$= [100 - (70 + X)] \times 13.5 = 135 \text{ (A)}$$

Therefore, X = 40 kg.

Also, Material cost variance = (Standard quantity x Standard price) – (Actual quantity x Actual price)

$$= 1,350 - \{(40 \times 15) + (70 \times Y)\} = 650 \text{ (A)}$$

$$= 1,350 - 600 - 70Y = 650 \text{ A}$$

Therefore, $Y = ₹ 20$

(i) Material mix variance

= (Revised Std. Quantity* – Actual quantity) x Standard Price

$$\text{Chemical A} = (55 - 40) \times 12 = 180 \text{ (F)}$$

$$\text{Chemical B} = (55 - 70) \times 15 = \underline{225 \text{ (A)}}$$

$$= \underline{₹ 45 \text{ (A)}}$$

*Revised Std. Quantity:

$$\text{Chemical A} = (70 + 40) \times 50\% = 55$$

$$\text{Chemical B} = (70 + 40) \times 50\% = 55$$

(ii) Material usage variance

= (Std. qty. – Actual qty.) x Std. price

$$\text{Chemical A} = (50 - 40) \times 12 = 120 \text{ (F)}$$

$$\text{Chemical B} = (50 - 70) \times 15 = \underline{300 \text{ (A)}}$$

$$= \underline{₹ 180 \text{ (A)}}$$

(iii) Material price variance

= (Std. price – Actual price) x Actual qty.

$$\text{Chemical A} = (12 - 15) \times 40 = 120 \text{ (A)}$$

$$\text{Chemical B} = (15 - 20) \times 70 = \underline{350 \text{ (A)}}$$

$$= \underline{₹ 470 \text{ (A)}}$$

(iv) Actual loss of actual input

$$\text{Actual total input} = 110 \text{ kg.}$$

$$\text{Less: Actual output} = \underline{90 \text{ kg.}}$$

$$\text{Actual loss} = \underline{20 \text{ kg.}}$$

(v) **Actual input of chemical A** = 40 kg. [As calculated in Working note (2)].

(vi) **Actual price per kg. of chemical B** = ₹ 20 [As calculated in Working note (2)].

5. For Material Cost Variances

	SQ × SP	AQ × AP	AQ × SP
A	12,000 × 4 = 48,000	12,500 × 4.40 = 55,000	12,500 × 4 = 50,000
B	18,000 × 3 = 54,000	18,000 × 2.80 = 50,400	18,000 × 3 = 54,000
C	90,000 × 1 = 90,000	88,500 × 1.20 = 1,06,200	88,500 × 1 = 88,500
Total	₹ 1,92,000	₹ 2,11,600	₹ 1,92,500

Variances:

Material Price Variance = Actual quantity (Std. price – Actual price)

Or, = (AQ × SP) – (AQ × AP)

Or, = ₹ 1,92,500 – ₹ 2,11,600

= ₹ 19,100 (A)

Material Usage Variance = Standard Price (Std. Quantity – Actual Quantity)

Or, = (SP × SQ) – (SP × AQ)

Or, = ₹ 1,92,000 – ₹ 1,92,500 = ₹ 500 (A)

For Labour Cost Variance :

	SH × SR	AH × AR	AH × SR
Labour	(6,000 × 3) × ₹ 8 = 1,44,000	2,500 × 12 = 30,000 15,000 × 8 = 1,20,000	17,500 × 8 = 1,40,000
Total	₹ 1,44,000	₹ 1,50,000	₹ 1,40,000

Variances:

Labour Rate Variance: Actual Hours (Std. Rate – Actual Rate)

Or, = (AH × SR) – (AH × AR)

$$\begin{aligned} \text{Or,} &= ₹1,40,000 - ₹1,50,000 = ₹10,000 \text{ (A)} \\ \text{Labour Efficiency Variance:} &\text{Standard Rate (Std. Hours – Actual Hours)} \\ \text{Or,} &= (SR \times SH) - (SR \times AH) \\ \text{Or,} &= ₹1,44,000 - ₹1,40,000 = ₹4,000 \text{ (F)} \end{aligned}$$

6. Material variances

1. Material cost variance

$$\begin{aligned} &= (\text{Std. qty for actual output}^* \times \text{Std. price}) - (\text{Actual qty.} \times \text{Actual price}) \\ &= (18,000 \times 4) - (19,000 \times 4.40) \\ &= 72,000 - 83,600 = ₹ 11,600 \text{ (A)} \end{aligned}$$

$$^* \text{ Std. qty. for actual output} = 1,800 \times 10 = 18,000 \text{ units}$$

2. Material price variance

$$\begin{aligned} &= (\text{Std. price} - \text{Actual price}) \times \text{Actual qty.} \\ &= (4 - 4.40) \times 19,000 = 0.40 \times 19,000 = ₹ 7,600 \text{ (A)} \end{aligned}$$

3. Material usage variance

$$\begin{aligned} &= (\text{Std. qty.} - \text{Actual qty.}) \times \text{Std. price} \\ &= (18,000 - 19,000) \times 4 = 1,000 \times 4 = ₹ 4,000 \text{ (A)} \end{aligned}$$

Labour variances

1. Labour cost variance

$$\begin{aligned} &= (\text{Std. hours for actual output}^* \times \text{Std. price}) - \text{Actual cost} \\ &= (4,500 \times 4) - 24,750 \\ &= 18,000 - 24,750 = ₹ 6,750 \text{ (A)} \end{aligned}$$

$$^* \text{Std. hours for actual output} = 1,800 \times 2.5 = 4,500 \text{ hrs.}$$

2. Labour rate variance

$$\begin{aligned} &= (\text{Std. rate} - \text{Actual rate}) \times \text{Actual hrs.} \\ &= (4 - 5) \times 4,950 = ₹ 4,950 \text{ (A)} \end{aligned}$$

3. Labour efficiency variance

$$= (\text{Std. hrs. for actual output} - \text{Actual hrs.}) \times \text{Std. rate}$$

$$= (4,500 - 4,950) \times 4 = ₹ 1,800 \text{ (A)}$$

7. Production/ Overhead volume variance (only for fixed overhead)

Fixed Overhead Volume Variance:

$$= \text{Absorbed overhead} - \text{Budgeted Overhead}$$

$$= (₹5 \times 15,000 \text{ units}) - (₹5 \times 20,000 \text{ units})$$

$$= ₹75,000 - ₹1,00,000 = ₹25,000 \text{ (Adverse)}$$

Overhead expense variances

$$= \text{Budgeted Overhead} - \text{Actual Overhead}$$

$$= (₹5 \times 20,000 \text{ units}) - (\text{Total overhead} - \text{Variable overhead})$$

$$= (₹5 \times 20,000 \text{ units}) - (₹3,00,000 - ₹10 \times 15,000 \text{ units})$$

$$= ₹1,00,000 - (₹3,00,000 - ₹1,50,000)$$

$$= ₹1,00,000 - ₹1,50,000 = ₹ 50,000 \text{ (Adverse)}$$

8. For fixed overhead variances:

Actual F.O. incurred (given)	₹12,000

Budgeted F.O. for the period	₹10,000

Standard F.O. for production	

2,100 units $\times$ {₹10,000 $\div$ 2,000 units}	₹10,500

(i) Fixed Overhead Variance = Standard F.O. – Actual F.O.

$$= ₹ 10,500 - ₹12,000$$

$$= ₹1,500 \text{ (A)}$$

(ii) F.O. Expenditure Variance = Budgeted F.O – Actual F.O.

$$= ₹10,000 - ₹12,000$$

$$= ₹2,000 \text{ (A)}$$

(iii) F.O. Volume Variance = Standard F.O – Budgeted F.O.

$$= ₹10,500 - ₹ 10,000 = ₹ 500 \text{ (F)}$$

9. Basic Calculations:

$$\text{Standard hours per unit} = \frac{\text{Budgeted hours}}{\text{Budgeted units}} = \frac{30,000}{30,000} = 1 \text{ hour}$$

$$\text{Std. hrs. for actual output} = 32,500 \text{ units} \times 1 \text{ hr} = 32,500$$

$$\text{Standard overhead rate per hour} = \frac{\text{Budgeted overhead}}{\text{Budgeted hours}}$$

$$\text{For fixed overhead} = \frac{45,000}{30,000} = ₹1.50 \text{ per hour}$$

$$\text{For variable overhead} = \frac{60,000}{30,000} = ₹2 \text{ per hour}$$

$$\text{Std. F.O. rate per day} = ₹45,000 \div 25 \text{ days} = ₹1,800$$

$$\text{Recovered overhead} = \text{Std. hrs. for actual output} \times \text{St. rate}$$

$$\text{For fixed overhead} = 32,500 \text{ hrs.} \times ₹1.50 = ₹48,750$$

$$\text{For variable overhead} = 32,500 \text{ hrs.} \times ₹2 = ₹65,000$$

$$\text{Standard overhead} = \text{Actual hours} \times \text{Std. rate}$$

$$\text{For fixed overhead} = 33,000 \times 1.50 = ₹49,500$$

$$\text{For variable overhead} = 33,000 \times 2 = ₹66,000$$

$$\text{Revised budget hours} = \frac{\text{Budgeted hours}}{\text{Budgeted days}} \times \text{Actual days}$$

$$= \frac{30,000}{25} \times 26 = 31,200 \text{ hours}$$

$$\text{Revised budgeted overhead (for fixed overhead)} = 31,200 \times 1.50 = ₹46,800$$

Calculation of variances**Fixed Overhead Variances:**

$$\begin{aligned} \text{(i) F.O. cost Variance} &= \text{Recovered Overhead} - \text{Actual Overhead} \\ &= 48,750 - 50,000 \\ &= ₹1,250 \text{ (A)} \end{aligned}$$

- (ii) F.O. Expenditure Variance = Budgeted Overhead – Actual Overhead
 $= 45,000 - 50,000$
 $= ₹ 5,000 \text{ (A)}$
- (iii) F.O. Volume Variance = Recovered Overhead – Budgeted Overhead
 $= 48,750 - 45,000$
 $= ₹ 3,750 \text{ (F)}$
- (iv) F.O. Efficiency Variance = Recovered Overhead – Standard Overhead
 $= 48,750 - 49,500 = ₹ 750 \text{ (A)}$
- (v) F.O. Capacity Variance = Standard Overhead - Revised Budgeted Overhead
 $= 49,500 - 46,800 = ₹ 2,700 \text{ (F)}$
- (v) Calendar Variance = (Actual Days - Budget Days) × St. rate per day.
 $= (26 - 25) \times 1,800 = ₹ 1,800 \text{ (F)}$

Variable Overhead Variances

- (i) V.O. Cost variance = Recovered Overhead – Actual Overhead
 $= 65,000 - 68,000 = ₹ 3,000 \text{ (A)}$
- (ii) V.O. Expenditure Variance = Standard Overhead – Actual Overhead
 $= 66,000 - 68,000 = ₹ 2,000 \text{ (A)}$
- (iii) V.O. Efficiency Variance = Recovered Overhead – Standard Overhead
 $= 65,000 - 66,000 = ₹ 1,000 \text{ (A)}$

Check

- (i) F.O. Cost Variance = Expenditure variance + Volume variance
 $1,250 \text{ (A)} = 5,000 \text{ (A)} + 3,750 \text{ (F)}$
- (ii) F.O. Volume Variance = Efficiency Variance + Capacity Variance + Calendar Variance
 $3,750 \text{ (F)} = 750 \text{ (A)} + 2,700 \text{ (F)} + 1,800 \text{ (F)}$

$$\begin{aligned}
 \text{(iii) V.O. Cost Variance} &= \text{Expenditure Variance} + \text{Efficiency Variance} \\
 3,000 \text{ (A)} &= 2,000 \text{ (A)} + 1,000 \text{ (A)}.
 \end{aligned}$$

10. For Fixed Overhead Variances

Actual fixed overhead incurred	₹ 31,000
Budgeted fixed overhead for the period	₹30,000
Standard fixed overhead for production (₹ 30,000 ÷ 20,000 units) × 22,000	₹33,000

Computation of Variances:

(i) *Fixed overhead expenditure variance:*

$$\begin{aligned}
 &= \text{Budgeted fixed overhead} - \text{Actual fixed overhead} \\
 &= ₹ 30,000 - ₹ 31,000 = ₹ 1,000 \text{ (A)}
 \end{aligned}$$

(ii) *Fixed overhead volume variance:*

$$\begin{aligned}
 &= \text{Standard fixed overhead} - \text{Budgeted fixed overhead} \\
 &= ₹ 33,000 - ₹ 30,000 = ₹ 3,000 \text{ (F)}
 \end{aligned}$$

(iii) *Fixed overhead variance:*

$$\begin{aligned}
 &= \text{Standard fixed overhead} - \text{Actual fixed overhead} \\
 &= ₹ 33,000 - ₹ 31,000 = ₹ 2,000 \text{ (F)}
 \end{aligned}$$

11. Working Notes:

1. Calculation of standard variable overhead per unit

$$= \frac{\text{Budgeted variable overhead}}{\text{Budgeted production}} = \frac{10,000}{400} = ₹ 25 \text{ per unit}$$

2. Calculation of standard variable overhead per hour

$$= \frac{\text{Budgeted variable overhead}}{\text{Budgeted man hours}} = \frac{10,000}{8,000} = ₹ 1.25 \text{ per hour}$$

3. Calculation of Std. variable overhead for actual output
= Actual output $\times$ Std. variable overhead per unit
= 360 units $\times$ ₹ 25 = ₹ 9,000
 4. Calculation of Budgeted variable overhead based on actual hours worked
= Actual hours worked $\times$ Std. variable overhead per hour
= 7,000 $\times$ 1.25 = ₹ 8,750
 5. Calculation of standard hours for actual output
= Actual output $\times$ Std. hours per unit
= 360 units $\times$ 20 hours = 7,200 hours
- (i) **Variable overhead cost variance**
= Std. variable overhead for actual output – Actual Variable Overheads
= 9,000 – 9,150 = ₹ 150 (A)
- (ii) **Variable overhead expenditure variance**
= Std. overhead for Actual hours – Actual Overhead
= 8,750 – 9,150 = ₹ 400 (A)
- (iii) **Variable overhead efficiency variance**
= (Std. hours for actual output – Actual hours) $\times$ Std. rate per hour
= (7,200 – 7,000) $\times$ 1.25 = ₹ 250 (F)

12. For Fixed overheads Variances:

Actual fixed overhead incurred = ₹ 1,56,000

Budgeted fixed overhead for the period = 1,50,000

Standard fixed overhead for production (Standard output for actual time $\times$ Standard Fixed Overhead per unit)

(6,300 hrs $\times$ 27 days $\times$ 0.9) $\times$ (₹ 1,50,000 $\div$ 1,50,000 units) = ₹ 1,53,090

- (a) Fixed Overhead = Budgeted fixed overhead –
Expenditure Actual fixed overhead
Variance = ₹1,50,000 – ₹1,56,000 = ₹ 6,000 (A)
- (b) Fixed Overhead = Standard fixed overhead –
Volume Variance Budgeted fixed overhead
= ₹1,53,090 – ₹ 1,50,000 = ₹ 3,090 (F)
- (c) Fixed Overhead = Standard fixed overhead –
Variance Actual fixed overhead
= ₹1,53,090 – ₹ 1,56,000 = ₹ 2,910 (A)

13. Actual material used = 125 kg × 60 = 7,500 kg.

Actual cost of actual material used (AQ × AR)			(₹)
A	(60%)	4,500 kg × ₹21 =	94,500
B	(20%)	1,500 kg × ₹ 8 =	12,000
C	(20%)	<u>1,500</u> kg × ₹ 6 =	<u>9,000</u>
		<u>7,500</u>	<u>1,15,500</u>

Standard cost of actual material used (AQ × SR)			(₹)
A		4,500 kg × ₹20 =	90,000
B		1,500 kg × ₹10 =	15,000
C		<u>1,500</u> kg × ₹ 5 =	<u>7,500</u>
		<u>7,500</u>	<u>1,12,500</u>

Standard cost of material, if it had been used in standard proportion

(Standard Proportion × Standard Rate)			(₹)
A	(50%)	3,750 kg × ₹20 =	75,000
B	(30%)	2,250 kg × ₹10 =	22,500
C	(20%)	<u>1,500</u> kg × ₹ 5 =	<u>7,500</u>
		<u>7,500</u>	<u>1,05,000</u>

Standard cost of production (SQ for actual production × SR)

Standard cost of output for 100 kg:			(₹)
A	62.50 kg × ₹20 =		1,250
B	37.50 kg × ₹10 =		375
C	<u>25.00 kg × ₹ 5 =</u>		<u>125</u>
	<u>125.00</u>		<u>1,750</u>

Standard cost for output of 5,600 kg.

$$= \frac{1,750}{100} \text{ kg} \times 5,600 \text{ kg} = ₹ 98,000$$

Material Price Variance = Standard cost of actual material used – Actual cost of actual material used = ₹ 1,12,500 – ₹ 1,15,500 = ₹ 3,000 (A)

Material Usage Variance = Standard cost of production – Standard cost of actual material used = ₹ 98,000 – ₹ 1,12,500 = ₹ 14,500 (A)

Note: Material Price Variance can be calculated at the time of purchase as well. In that case, material variance will be as follows:

Actual cost of material purchased

A	5,000 kg × ₹ 21 =	₹ 1,05,000
B	2,000 kg × ₹ 8 =	₹ 16,000
C	1,200 kg × ₹ 6 =	<u>₹ 7,200</u>
		<u>₹ 1,28,200</u>

Standard cost of material purchased

A	5,000 kg × ₹ 20 =	₹ 1,00,000
B	2,000 kg × ₹ 10 =	₹ 20,000
C	1,200 kg × ₹ 5 =	<u>₹ 6,000</u>
		<u>₹ 1,26,000</u>

Material Price variance (if calculated at the time of purchase)

= Standard cost of actual material used – Actual cost of actual material used

= ₹ 1,26,000 – ₹ 1,28,200 = ₹ 2,200 (A)

14. (i) Material Cost Variance (A + B) = {(SQ × SP) – (AQ × AP)}

$$₹3,625 = (SQ \times SP) - ₹59,825$$

$$(SQ \times SP) = ₹ 63,450$$

$$(SQ_A \times SP_A) + (SQ_B \times SP_B) = ₹ 63,450$$

$$(940 \text{ kg} \times SP_A) + (705 \text{ kg} \times ₹30) = ₹ 63,450$$

$$(940 \text{ kg} \times SP_A) + ₹21,150 = ₹ 63,450$$

$$(940 \text{ kg} \times SP_A) = ₹ 42,300$$

$$SP_A = \frac{₹ 42,300}{940 \text{ kg}}$$

Standard Price of Material-A = ₹ 45

Working Note:

SQ i.e. quantity of inputs to be used to produce actual output

$$= \frac{1,480 \text{ kg}}{90\%} = 1,645 \text{ kg}$$

$$SQ_A = \frac{800 \text{ kg}}{(800 + 600)} \times 1,645 \text{ kg} = 940 \text{ kg}$$

$$SQ_B = \frac{600 \text{ kg}}{(800 + 600)} \times 1,645 \text{ kg} = 705 \text{ kg}$$

(ii) Material Price Variance (A + B) = {(AQ × SP) – (AQ × AP)}

$$₹ 175 = (AQ \times SP) - ₹ 59,825$$

$$(AQ \times SP) = ₹ 60,000$$

$$(AQ_A \times SP_A) + (AQ_B \times SP_B) = ₹ 60,000$$

$$[900 \text{ kg} \times ₹ 45 \text{ (from (i) above)}]$$

$$+ (AQ_B \times ₹ 30) = ₹ 60,000$$

$$₹ 40,500 + (AQ_B \times ₹ 30) = ₹ 60,000$$

$$(AQ_B \times ₹ 30) = ₹ 19,500$$

$$AQ_B = \frac{19,500}{30} = 650 \text{ kg}$$

Actual Quantity of Material B = 650 kg.

$$(iii) (AQ \times AP) = ₹ 59,825$$

$$(AQ_A \times AP_A) + (AQ_B \times AP_B) = ₹ 59,825$$

$$(900 \text{ kg} \times AP_A) + (650 \text{ kg (from (ii) above)} \times ₹ 32.5) = ₹ 59,825$$

$$(900 \text{ kg} \times AP_A) + ₹ 21,125 = ₹ 59,825$$

$$(900 \text{ kg} \times AP_A) = ₹ 38,700$$

$$AP_A = \frac{38,700}{900} = 43$$

Actual Price of Material-A = ₹ 43

$$(iv) \text{ Total Actual Quantity of Material-A and Material-B}$$

$$\begin{aligned} = AQ_A + AQ_B &= 900 \text{ kg} + 650 \text{ kg (from (ii) above)} \\ &= 1,550 \text{ kg} \end{aligned}$$

Now,

$$\text{Revised } SQ_A = \frac{800 \text{ kg}}{(800 + 600)} \times 1,550 \text{ kg} = \mathbf{886 \text{ kg}}$$

$$\text{Revised } SQ_B = \frac{600 \text{ kg}}{(800 + 600)} \times 1,550 \text{ kg} = \mathbf{664 \text{ kg}}$$

$$\begin{aligned} (v) \text{ Material Mix Variance (A + B)} &= \{(RSQ \times SP) - (AQ \times SP)\} \\ &= \{(RSQ_A \times SP_A) + (RSQ_B \times SP_B) - 60,000\} \\ &= (886 \text{ kg (from (iv) above)} \times ₹ 45 \text{ (from (i) above)}) + (664 \text{ kg (from (iv) above)} \\ &\quad \times ₹ 30) - ₹ 60,000 \\ &= (39,870 + 19,920) - 60,000 = \mathbf{₹ 210 (A)} \end{aligned}$$

15. (i) Material Variances

	Budget			Std. for actual			Actual		
	Quantity	Price (₹)	Amount (₹)	Quantity	Price (₹)	Amount (₹)	Quantity	Price (₹)	Amount (₹)
Material	0.5	60	30	5,000	60	3,00,000	5,700	58	3,30,600

$$\text{Material Cost Variance} = (\text{SQ} \times \text{SP} - \text{AQ} \times \text{AP})$$

$$3,00,000 - 3,30,600 = ₹ 30,600(\text{A})$$

$$\text{Material Price Variance} = (\text{SP} - \text{AP}) \text{AQ}$$

$$(60 - 58) 5,700 = ₹ 11,400 (\text{F})$$

$$\text{Material Usage Variance} = (\text{SQ} - \text{AQ}) \text{SP}$$

$$(5,000 - 5,700) 60 = ₹ 42,000 (\text{A})$$

(ii) Variable Overheads variances

Variable overhead cost Variance = (Standard variable overhead – Actual Variable Overhead)

Standard Variable Overheads: 10,000 units × 10 = 1,00,000

$$(1,00,000 - 1,12,200) = ₹ 12,200(\text{A})$$

Variable overhead Efficiency Variance = (Standard Hours – Actual Hours) × Standard Rate per Hour

Let Actual Hours be 'X'

$$(10,000 - X) \times 10 = 2,000 (\text{A})$$

$$1,00,000 - 10X = -2,000$$

$$X = 1,02,000 \div 10$$

$$\text{Therefore, Actual Hours (X)} = 10,200$$

Variable overhead Expenditure Variance = (Variable Overhead at Actual Hours - Actual Variable Overheads)

$$10,200 \times 10 - 1,12,200 = ₹ 10,200 (\text{A})$$

(iii) Labour variances

	Budget			Std. for actual			Actual		
	Hours	Rate (₹)	Amount (₹)	Hours	Rate (₹)	Amount (₹)	Hours	Rate (₹)	Amount (₹)
Labour	1	20	20	10,000	20	2,00,000	10,200	22	2,24,400

Actual Rate = ₹ 2,24,400 ÷ 10,200 hours = ₹22

Labour Cost Variance = (SH × SR) – (AH × AR)

10,000 × 20 – 10,200 × 22 = ₹ 24,400 (A)

Labour Rate Variance = (SR – AR) × AH

(20 – 22) × 10,200 = ₹ 20,400 (A)

Labour Efficiency Variance = (SH – AH) × SR

(10,000 – 10,200) × 20 = ₹ 4,000 (A)

Answers to the Case Scenarios

1.

i.	(d)	ii.	(c)	iii.	(a)	iv.	(b)	v.	(a)

i. d **Variable Overhead Cost Variance** = Standard Variable Overheads for Production – Actual Variable Overheads

= ₹ 44,800 – ₹ 55,680

= ₹ 10,880 (A)

ii. c **Fixed Overhead Volume Variance** = Absorbed Fixed Overheads – Budgeted Fixed Overheads

= ₹ 87,200 – ₹ 1,09,000

= ₹ 21,800 (A)

- iii. a **Fixed Overhead Expenditure Variance** = Budgeted Fixed Overheads – Actual Fixed Overheads
 = ₹ 10.9 × 10,000 units – ₹ 1,30,520
 = **₹ 21,520 (A)**
- iv. b **Calendar Variance** = Possible Fixed Overheads – Budgeted Fixed Overheads
 = ₹ 1,03,550 – ₹ 1,09,000
 = **₹ 5,450 (A)**
- v. a **Fixed Overhead Cost Variance** = Absorbed Fixed Overheads – Actual Fixed Overheads
 = ₹ 87,200 – ₹ 1,30,520
 = **₹ 43,320 (A)**

WORKING NOTE

Fixed Overheads = $\frac{\text{Budgeted Fixed Overheads}}{\text{Budgeted Output}}$ = 12,00,000 ÷ 1,20,000	₹ 10.00
Fixed Overheads element in <i>Semi-Variable</i> Overheads i.e. 60% of ₹ 1,80,000	₹ 1,08,000
Fixed Overheads = $\frac{\text{Budgeted Fixed Overheads}}{\text{Budgeted Output}}$ ₹ 1,08,000/120,000	₹ 0.90
Standard Rate of Absorption of Fixed Overheads <i>per unit</i> (₹ 10.00 + ₹ 0.90)	₹ 10.90
Fixed Overheads Absorbed on 8,000 units @ ₹10.90	₹ 87,200
Budgeted Variable Overheads	₹ 6,00,000
Add: Variable element in <i>Semi-Variable</i> Overheads 40% of ₹ 1,80,000	<u>₹ 72,000</u>
Total Budgeted Variable Overheads	₹ 6,72,000
Standard Variable Cost <i>per unit</i>	₹5.60

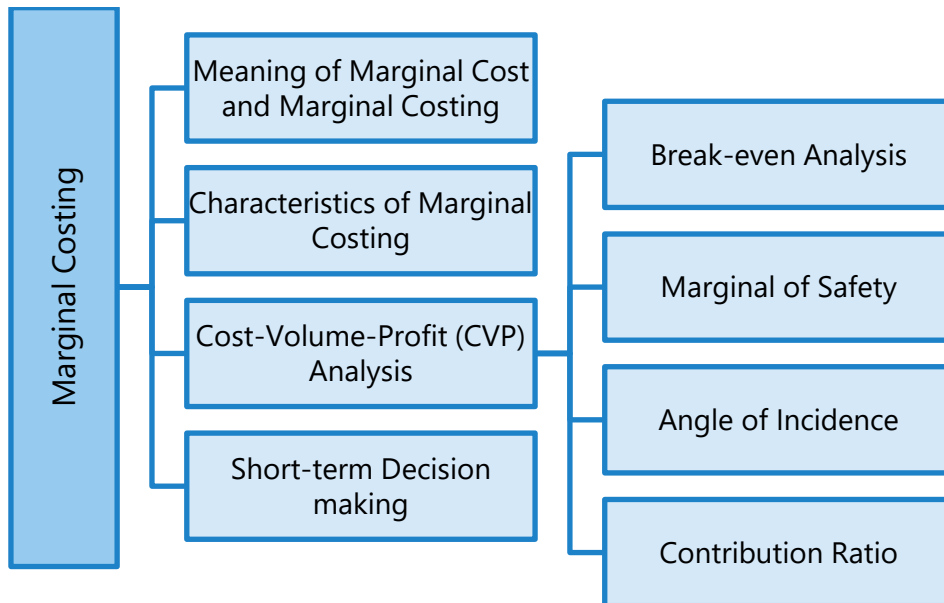
$= \frac{\text{Budgeted Variable Overheads}}{\text{Budgeted Output}}$	
Standard Variable Overheads for 8,000 units @ ₹5.60	₹ 44,800
Budgeted Annual Fixed Overheads (₹ 12,00,000 + 60% of ₹ 1,80,000)	₹ 13,08,000
Possible Fixed Overheads $= \frac{\text{Budgeted Fixed Overheads}}{\text{Budgeted Days}} \times \text{Actual Days}$ $= 1,09,000/20 \text{ days} \times 19 \text{ days}$	₹ 1,03,550
Actual Fixed Overheads (₹ 1,19,000 + 60% of ₹ 19,200)	₹ 1,30,520
Actual Variable Overheads (₹ 48,000 + 40% of ₹ 19,200)	₹ 55,680

MARGINAL COSTING



LEARNING OUTCOMES

- ◆ Explain the meaning and characteristics of Marginal Costing.
- ◆ Describe the meaning of CVP Analysis and apply the same in making short-term managerial decisions.
- ◆ Describe the meaning and application of Break-even point, Margin of safety, Angle of incidence etc. and apply the same in making computations.
- ◆ Calculate and explain the various formulae used in CVP analysis.
- ◆ Apply the concepts of marginal costing and CVP analysis in short-term decision making.
- ◆ Differentiate between Marginal Costing and Absorption Costing.

CHAPTER OVERVIEW **1. INTRODUCTION**

As discussed in the first chapter 'Introduction to Cost and Management Accounting', the cost and management accounting system by provision of information, enables management to take various decisions. Marginal Costing is a technique of cost and management accounting which is used to analyse relationship between cost, volume and profit.

In order to appreciate the concept of marginal costing, it is necessary to study the definition of marginal costing and certain other terms associated with this technique. The important terms have been defined as follows:

1. Marginal Cost: Marginal cost as understood in economics is **the incremental cost of production** for producing one additional unit of product. As we understood, variable costs have direct relationship with volume of output and fixed costs remains constant irrespective of volume of production. Hence, marginal cost is measured by the total variable cost attributable to one

additional unit. For example, the total cost of producing 10 units and 11 units of a product is ₹10,000 and ₹10,500 respectively. The marginal cost for 11th unit i.e. 1 unit extra from 10 units is ₹500.

Marginal cost can precisely be the sum of prime cost and variable overhead.

Example 1: Arnav Ltd. produces 10,000 units of product Z by incurring a total cost of ₹ 3,50,000. Break-up of costs are as follows:

- (i) Direct Material @ ₹ 10 per unit, ₹ 1,00,000,
- (ii) Direct employee (labour) cost @ ₹ 8 per unit, ₹ 80,000
- (iii) Variable overheads @ ₹2 per unit, ₹ 20,000
- (iv) Fixed overheads ₹ 1,50,000 (upto a volume of 50,000 units)

In this example, if Arnav Ltd. wants to know marginal cost of producing one extra unit from the current production i.e. 10,001st unit. The marginal cost would be the change in the total cost due production of this 10,001st extra unit. The extra cost would be ₹20, as calculated below:

	10,000 units	10,001 units	Change in Cost
	(A)	(B)	(c) = (B) - (A)
(i) Direct Material @ ₹10 per unit	1,00,000	1,00,010	10
(ii) Direct employee (labour) cost @ ₹8 per unit	80,000	80,008	8
(iii) Variable overheads @ ₹2 per unit	20,000	20,002	2
(iv) Fixed overheads	1,50,000	1,50,000	0
Total Cost	3,50,000	3,50,020	20

2. Marginal Costing: It is a costing system where products or services and inventories are valued at variable costs only. It does not take consideration of fixed costs. This system of costing is also known as direct costing as only direct costs forms the part of product and inventory cost. Costs are classified on the basis of behavior of cost (i.e. fixed and variable) rather functions as done in absorption costing method.

3. Direct Costing: Direct costing and Marginal Costing is used synonymously at various places. But the relation of costs with respect to activity level must be

understood. Some costs are variable at batch level but fixed for unit level whereas others are variable at production line level but fixed for batches and units.

Example 2: Arnav Ltd. produces 10,000 units of product Z by incurring a total cost of ₹4,80,000. Break-up of costs are as follows:

- (i) Direct Material @ ₹10 per unit, ₹1,00,000,
- (ii) Direct employee (labour) cost @ ₹8 per unit, ₹80,000
- (iii) Variable overheads @ ₹2 per unit, ₹20,000
- (iv) Machine set up cost @ ₹1,200 for a production run (100 units can be manufactured in a run)
- (v) Depreciation of a machine specifically used for production of Z ₹10,000
- (iv) Apportioned fixed overheads ₹1,50,000.

Analysis of the costs:

	10,000 units	10,001 units	Change in Cost	Direct Cost
	(A)	(B)	(c) = (B) - (A)	
(i) Direct Material @ ₹10 per unit	1,00,000	1,00,010	10	Unit level Direct Cost.
(ii) Direct employee (labour) cost @ ₹8 per unit	80,000	80,008	8	Unit level Direct Cost.
(iii) Variable overheads @ ₹2 per unit	20,000	20,002	2	Unit level Direct Cost.
(iv) Machine set up cost	1,20,000	1,21,200	1,200	Batch level Direct Cost
(v) Depreciation of a machine	10,000	10,000	0	Product level Direct Cost.
(vi) Apportioned fixed overheads	1,50,000	1,50,000	0	Department level Direct Cost
Total Cost	4,80,000	4,81,220	1,220	

In the example, the direct cost of producing 10,001st unit is 1,220 but it is not the marginal cost of producing one extra unit rather marginal cost of running one extra production run (batch).

4. Differential and Incremental Cost: Differential cost is difference between the costs of two different production levels. It is a relative representation of costs for two different levels that results in the increase or decrease in cost. Incremental cost, on the other hand, is the increase in the costs due to change in the volume or process of production activities. Incremental costs are sometime compared with marginal cost but in reality, there is a thin line difference between the two. Marginal cost is the change in the total cost due to production of one extra unit while incremental cost can be both for increase in one unit or in total volume. In the Example 2 above, ₹ 1,220 is the incremental cost of producing one extra unit but not marginal cost for producing one extra unit.

2. CHARACTERISTICS OF MARGINAL COSTING

The technique of marginal costing is based on the distinction between product costs and period costs. Only the variable costs are treated as the costs of the products while the fixed costs are treated as period costs which will be incurred during the period regardless of the volume of output. The main characteristics of marginal costing are as follows:

1. **All elements of cost are classified into fixed and variable components.** Semi-variable costs are also analyzed into fixed and variable elements.
2. The marginal or **variable costs** (as direct material, direct labour and variable factory overheads) **are treated as the cost of product.**
3. Under marginal costing, **the value of finished goods and work-in-progress is also comprised only of marginal costs.** Variable selling and distribution are excluded for valuing these inventories. Fixed costs are not considered for valuation of closing stock of finished goods and closing WIP.
4. **Fixed costs are treated as period costs** and are charged to profit and loss account for the period for which they are incurred.
5. Prices are determined with reference to marginal costs and contribution margin.

6. Profitability of departments and products is determined with reference to their contribution margin.

3. FACTS ABOUT MARGINAL COSTING

Some of the facts about marginal costing are depicted below:

Not a distinct method: Marginal costing is not a distinct method of costing like job costing, process costing, operating costing, etc., but a special technique used for managerial decision making. Marginal costing is used to provide a basis for the interpretation of cost data to measure the profitability of different products, processes and cost centres in the course of decision making. It can, therefore, be used in conjunction with the different methods of costing such as job costing, process costing, etc., or even with other techniques such as standard costing or budgetary control.

Cost Ascertainment: In marginal costing, cost ascertainment is made on the basis of the nature of cost. It gives consideration to behaviour of costs. In other words, the technique has developed from a particular conception and expression of the nature and behaviour of costs and their effect upon the profitability of an undertaking.

Decision Making: According to traditional or total cost method, as opposed to marginal costing, the classification of costs is based on functional basis. Under this method the total cost is the sum total of the cost of direct material, direct labour, direct expenses, manufacturing overheads, administration overheads, selling and distribution overheads. In this system, other things being equal, the total cost per unit will remain constant only when the level of output or mixture is the same from period to period. Since these factors are continually fluctuating, the actual total cost will vary from one period to another. Thus, it is possible for the costing department to say one day that an item cost ₹20 and the next day it costs ₹18. This situation arises because of changes in volume of output and the peculiar behavior of fixed expenses included in the total cost. Such fluctuating manufacturing activity, and consequently the variations in the total cost from period to period or even from day to day, poses a serious problem to the management in taking sound decisions. Hence, the application of marginal costing has been given wide recognition in the field of decision making.



4. DETERMINATION OF COST AND PROFIT UNDER MARGINAL COSTING

For the determination of cost of a product or service under marginal costing, costs are classified into variable and fixed. All the variable costs are part of product and services while fixed costs are charged against contribution margin.

Cost and Profit Statement under Marginal Costing

	Amount (₹)	Amount (₹)
Revenue (A)		xxx
Product Cost:		
- Direct Materials	xxx	
- Direct employee (labour)	xxx	
- Direct expenses	xxx	
- Variable manufacturing overheads	xxx	
Product (Inventoriable) Costs: (B)	xxx	xxx
Product Contribution Margin {A – B}		xxx
- Variable Administration overheads	xxx	
- Variable Selling & Distribution overheads	xxx	xxx
Contribution Margin: (C)		xxx
Period Cost: (D)		
Fixed Manufacturing expenses	xxx	
Fixed non-manufacturing expenses	xxx	xxx
Profit/ (loss) {C – D}		xxx

(i) Product (Inventoriable) Costs: In the case of merchandise inventory, these are the costs which are associated with the purchase and sale of goods. In the production scenario, **such costs are associated with the acquisition and conversion of materials and all other manufacturing inputs into finished product for sale.** Hence, under marginal costing, variable manufacturing costs constitute inventoriable or product costs.

Finished goods are measured at product cost. Work-in-process (WIP) inventories are also measured at product cost on the basis of percentage of completion (Please refer Process & Operation costing chapter)

(ii) Contribution: Contribution or contribution margin is the difference between sales revenue and total variable costs irrespective of manufacturing or non-manufacturing.

$$\text{Contribution (C)} = \text{Sales Revenue (S)} - \text{Total Variable Cost (V)}$$

It is obtained by subtracting variable costs from sales revenue. It can also be defined as excess of sales revenue over the variable costs. The contribution concept is based on the theory that the profit and fixed expenses of a business is a 'joint cost' which cannot be equitably apportioned to different segments of the business. In view of this difficulty the contribution serves as a measure of efficiency of operations of various segments of the business. The contribution forms a fund for fixed expenses and profit as illustrated below:

Example:

Variable Cost	= ₹50,000, Fixed Cost = ₹ 20,000,
Selling Price	= ₹ 80,000
Contribution	= Selling Price – Variable Cost
	= ₹ 80,000 – ₹ 50,000 = ₹ 30,000
Profit	= Contribution – Fixed Cost
	= ₹ 30,000 – ₹ 20,000 = ₹10,000

Since, contribution exceeds fixed cost; the profit is of the magnitude of ₹ 10,000. Suppose the fixed cost is ₹ 40,000 then the position shall be:

$$\begin{aligned}\text{Contribution} - \text{Fixed cost} &= \text{Profit or,} \\ &= ₹ 30,000 - ₹ 40,000 = - ₹ 10,000\end{aligned}$$

The amount of ₹ 10,000 represent extent of loss since the fixed costs are more than the contribution. At the level of fixed cost of ₹ 30,000, there shall be no profit and no loss.

(iii) **Period Cost:** These are the **costs, which are not assigned to the products but are charged as expenses against the revenue of the period in which they are incurred.** All fixed costs either manufacturing or non-manufacturing are recognised as period costs in marginal costing.

5. ABSORPTION COSTING

Absorption Costing is the practice of charging all costs, both variable and fixed to operations, processes or product.

In absorption costing the classification of expenses is based on functional basis whereas in marginal costing it is based on the nature of expenses. In absorption costing, the fixed expenses are distributed over products on absorption costing basis that is, based on a pre-determined level of output. Since fixed expenses are constant, such a method of recovery will lead to over or under-recovery of expenses depending on the actual output being greater or lesser than the estimate used for recovery. This difficulty will not arise in marginal costing because the contribution is used as a fund for meeting fixed expenses.

(For understanding the difference between marginal and absorption costing along with the presentation of information to management under the said two costing techniques, students are advised to refer Para 14.14)

6. ADVANTAGES AND LIMITATIONS OF MARGINAL COSTING

ADVANTAGES

1. ***Simplified Pricing Policy:*** *The marginal cost remains constant per unit of output whereas the fixed cost remains constant in total. Since marginal cost per unit is constant from period to period within a short span of time, firm decisions on pricing policy can be taken. If fixed cost is included, the unit cost will change from day to day depending upon the volume of output. This will make decision making task difficult.*
2. ***Proper recovery of Overheads:*** *Overheads are recovered in costing on the basis of pre-determined rates. If fixed overheads are included on the basis of pre-determined rates, there will be under- recovery of overheads if*

production is less or if overheads are more. There will be over- recovery of overheads if production is more than the budget or actual expenses are less than the estimate. This creates the problem of treatment of such under or over-recovery of overheads. Marginal costing avoids such under or over recovery of overheads.

3. **Shows Realistic Profit:** Advocates of marginal costing argues that under the marginal costing technique, the stock of finished goods and work-in-progress are carried on marginal cost basis and the fixed expenses are written off to profit and loss account as period cost. This shows the true profit of the period.
4. **How much to produce:** Marginal costing helps in the preparation of break-even analysis which shows the effect of increasing or decreasing production activity on the profitability of the company.
5. **More control over expenditure:** Segregation of expenses as fixed and variable helps the management to exercise control over expenditure. The management can compare the actual variable expenses with the budgeted variable expenses and take corrective action through analysis of variances.
6. **Helps in Decision Making:** Marginal costing helps the management in taking a number of business decisions like make or buy, discontinuance of a particular product, replacement of machines, etc.
7. **Short term profit planning:** It helps in short term profit planning by B.E.P charts.

LIMITATIONS

1. **Difficulty in classifying fixed and variable elements:** It is difficult to classify exactly the expenses into fixed and variable category. Most of the expenses are neither totally variable nor wholly fixed. For example, various amenities provided to workers may have no relation either to volume of production or time factor.
2. **Dependence on key factors:** Contribution of a product itself is not a guide for optimum profitability unless it is linked with the key factor.
3. **Scope for Low Profitability:** Sales staff may mistake marginal cost for total cost and sell at a price; which will result in loss or low profits. Hence, sales staff should be cautioned while giving marginal cost.
4. **Faulty valuation:** Overheads of fixed nature cannot altogether be excluded particularly in large contracts, while valuing the work-in- progress. In order

to show the correct position, fixed overheads have to be included in work-in-progress.

5. ***Unpredictable nature of Cost:*** Some of the assumptions regarding the behaviour of various costs are not necessarily true in a realistic situation. For example, the assumption that fixed cost will remain static throughout is not correct. Fixed cost may change from one period to another. For example, salaries bill may go up because of annual increments or due to change in pay rate etc. The variable costs do not remain constant per unit of output. There may be changes in the prices of raw materials, wage rates etc. after a certain level of output has been reached due to shortage of material, shortage of skilled labour, concessions of bulk purchases etc.
6. ***Marginal costing ignores time factor and investment:*** The marginal cost of two jobs may be the same but the time taken for their completion and the cost of machines used may differ. The true cost of a job which takes longer time and uses costlier machine would be higher. This fact is not disclosed by marginal costing.
7. ***Understating of W-I-P:*** Under marginal costing stocks and work in progress are understated.

7. COST-VOLUME-PROFIT (CVP) ANALYSIS

Meaning: It is a managerial tool showing the relationship between various ingredients of profit planning viz., cost, selling price and volume of activity. As the name suggests, cost volume profit (CVP) analysis **is the analysis of three variables, cost, volume and profit**. Such an analysis explores the relationship between costs, revenue, activity levels and the resulting profit. It aims at measuring variations in cost and volume.

Assumptions:

1. **Changes in the levels of revenues and costs arise only because of changes in the number of product (or service) units produced and sold** – for example, the number of television sets produced and sold by Sony Corporation or the number of packages delivered by Overnight Express. The number of output units is the only revenue driver and the only cost driver.

Just as a cost driver is any factor that affects costs, a revenue driver is a variable, such as volume, that causally affects revenues.

2. **Total costs can be separated into two components;** a fixed component that does not vary with output level and a variable component that changes with respect to output level. Furthermore, variable costs include both direct variable costs and indirect variable costs of a product. Similarly, fixed costs include both direct fixed costs and indirect fixed costs of a product
3. When represented graphically, **the behaviours of total revenues and total costs are linear** (meaning they can be represented as a straight line) in relation to output level within a relevant range (and time period).
4. **Selling price, variable cost per unit, and total fixed costs (within a relevant range and time period) are known and constant.**
5. The analysis either covers a single product or assumes that **the proportion of different products when multiple products are sold will remain constant** as the level of total units sold changes.
6. All revenues and costs can be added, subtracted, and compared **without taking into account the time value of money**. (Refer to the FM study material for a clear understanding of time value of money).

Importance

It provides the information about the following matters:

1. The behavior of cost in relation to volume.
2. Volume of production or sales, where the business will break-even.
3. Sensitivity of profits due to variation in output.
4. Amount of profit for a projected sales volume.
5. Quantity of production and sales for a target profit level.

Impact of various changes on profit:

An understanding of CVP analysis is extremely useful to management in budgeting and profit planning. It elucidates the impact of the following on the net profit:

- (i) Changes in selling prices,
- (ii) Changes in volume of sales,

- (iii) Changes in variable cost,
- (iv) Changes in fixed cost.

7.1 Marginal Cost Equation

The contribution theory explains the relationship between the variable cost and selling price. It tells us that selling price minus variable cost of the units sold is the contribution towards fixed expenses and profit. If the contribution is equal to fixed expenses, there will be no profit or loss and if it is less than fixed expenses, loss is incurred. Since the variable cost varies in direct proportion to output, therefore if the firm does not produce any unit, the loss will be there to the extent of fixed expenses. These points can be described with the help of following marginal cost equation:

$$\text{Marginal Cost Equation} = S - V = C = F \pm P$$

Where,

S = Sales value, V = Variable cost, C = Contribution,
F = Fixed Cost,

Marginal Cost Statement

	(₹)
Sales	XXXX
Less: Variable Cost	XXXX
Contribution	XXXX
Less: Fixed Cost	XXXX
Profit	XXXX

7.2 Contribution to Sales Ratio (Profit Volume Ratio or P/V Ratio)

This ratio shows the **proportion of sales available to cover fixed costs and profit**. Contribution represents the sales revenue after deducting variable costs. This ratio is usually expressed in percentage.

$$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 \text{ or, } P/V \text{ Ratio} = \frac{\text{Change in contribution / Profit}}{\text{Change in sales}} \times 100$$

A higher contribution to sales ratio implies that the rate of growth of contribution is faster than that of sales. This is because, once the breakeven point is reached, profits shall grow at a faster rate when compared to a product with a lesser contribution to sales ratio.

By transposition, we have derived the following equations:

$$(i) \quad C = S \times P/V \text{ ratio}$$

$$(ii) \quad S = \frac{C}{P/V \text{ Ratio}}$$

7.3 Break-Even Analysis

Break-even analysis is a generally used method to study the CVP analysis. This technique can be explained in two ways:

- (i) In narrow sense it is concerned with computing the break-even point. At this point of production level and sales there will be no profit and loss i.e. total cost is equal to total sales revenue.
- (ii) In broad sense this technique is used to determine the possible profit/loss at any given level of production or sales.



8. METHODS OF BREAK-EVEN ANALYSIS

Break even analysis may be conducted by the following two methods:

- (A) Algebraic computations
- (B) Graphic presentations

(A) ALGEBRAIC CALCULATIONS

8.1 Break-even Point

The word contribution has been given its name because of the fact that it literally contributes towards the recovery of fixed costs and the making of profits. The contribution grows along with the sales revenue till the time it just covers the fixed cost. This is the point where neither profits nor losses have been made is known as a break-even point. This implies that in order to break even the amount of contribution generated should be exactly equal to the fixed costs incurred. Hence, if we know how much contribution is generated from each unit sold, we shall have sufficient information

for computing the number of units to be sold in order to break even. Mathematically,

$$\text{Break-even point in units} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

Example 3: ABC Ltd. manufacturing a single product, incurring variable costs of ₹ 300 per unit and fixed costs of ₹ 2,00,000 per month. If the product sells for ₹ 500 per unit, the breakeven point shall be calculated as follows;

$$\text{Break- even point in units} = \frac{\text{Fixed costs}}{\text{Contribution per unit}} = \frac{\text{₹ 2,00,000}}{\text{₹ 200}} = 1,000 \text{ units}$$

$$\text{Break- even points (in Value)} = \frac{\text{Total fixed cost}}{\text{Contribution}} \times \text{Sales}$$

$$\text{Break- even point (in Value)} = \frac{\text{Total fixed cost}}{\text{P / V Ratio}}$$

8.2 Cash Break-even Point

When break-even point is calculated only with those fixed costs which are payable in cash, such a break-even point is known as cash break-even point. This means that depreciation and other non-cash fixed costs are excluded from the fixed costs in computing cash break-even point. Its formula is –

$$\text{Cash break- even point} = \frac{\text{Cash fixed costs}}{\text{Contribution per unit}}$$

ILLUSTRATION 1

MNP Ltd sold 2,75,000 units of its product at ₹ 37.50 per unit. Variable costs are ₹ 17.50 per unit (manufacturing costs of ₹ 14 and selling cost ₹ 3.50 per unit). Fixed costs are incurred uniformly throughout the year and amounting to ₹ 35,00,000 (including depreciation of ₹ 15,00,000). There is no beginning or ending inventories.

Required:

COMPUTE breakeven sales level quantity and cash breakeven sales level quantity.

SOLUTION

$$\begin{aligned}\text{Break even Sales Quantity} &= \frac{\text{Fixed cost}}{\text{Contribution margin per unit}} = \frac{\text{₹ } 35,00,000}{\text{₹ } 20} \\ &= 1,75,000 \text{ units}\end{aligned}$$

$$\begin{aligned}\text{Cash Break-even Sales Quantity} &= \frac{\text{Cash Fixed Cost}}{\text{Contribution margin per unit}} = \frac{\text{₹ } 20,00,000}{\text{₹ } 20} \\ &= 1,00,000 \text{ units.}\end{aligned}$$

8.3 Multi-Product Break-Even Analysis

In a multi-product environment, where more than one product is manufactured by using a common fixed cost, the break-even point formula needs some adjustments.

The contribution is calculated by taking weights for the products. The weights may be of sales mix quantity or sales mix values. The calculation of Multi-Product Break-even analysis can be understood with the help of the following example.

Example 4: Arnav Ltd. sells two products, J and K. The sales mix is 4 units of J and 3 units of K. The contribution margins per unit are ₹ 40 for J and ₹ 20 for K. Fixed costs are ₹ 6,16,000 per month.

Sales mix (in quantity) is 4 units of Product- J and 3 units of Product- K

i.e. Sales ratio is 4 : 3

Composite contribution per unit by taking weights for the product sales quantity
 $= \text{Product J- } ₹ 40 \times \frac{4}{7} + \text{Product K- } ₹ 20 \times \frac{3}{7} = ₹ 22.86 + ₹ 8.57 = ₹ 31.43$

$$\begin{aligned}\text{Composite Break-even point} &= \frac{\text{Common Fixed Cost}}{\text{Composite Contribution per unit}} = \frac{\text{₹ } 6,16,000}{\text{₹ } 31.43} \\ &= 19,600 \text{ units}\end{aligned}$$

$$\text{Break-even units of Product-J} = 19,600 \times \frac{4}{7} = 11,200 \text{ units}$$

$$\text{Break-even units of Product- K} = 19,600 \times \frac{3}{7} = 8,400 \text{ units}$$

ILLUSTRATION 2

You are given the following particulars

- i. Fixed cost ₹ 1,50,000
- ii. Variable cost ₹ 15 per unit
- iii. Selling price is ₹ 30 per unit

CALCULATE:

- (a) Break-even point
- (b) Sales to earn a profit of ₹ 20,000

SOLUTION

$$(a) \text{ Break-even point (BEP)} = \frac{\text{Fixed cost}}{\text{Contribution per unit}^*} = \frac{₹1,50,000}{₹15} = 10,000 \text{ Units}$$

* (Contribution per unit = Sales per unit – Variable cost per unit = ₹ 30 - ₹15)

- (b) Sales to earn a Profit of ₹ 20,000:

$$= \frac{\text{Fixed cost} + \text{Desired profit}}{\text{Contribution per unit}} \times \text{Selling price per unit}$$

$$= \frac{₹1,50,000 + ₹20,000}{₹15} \times ₹30 = ₹ 3,40,000$$

Or

$$\frac{\text{Fixed cost} + \text{Desired profit}}{\text{P/V Ratio}} = \frac{₹1,70,000}{\text{P/V Ratio}} = \frac{₹1,70,000}{50\%} = ₹3,40,000$$

$$\text{PV Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

ILLUSTRATION 3

A company has a P/V ratio of 40%. COMPUTE by what percentage must sales be increased to offset: 20% reduction in selling price?

SOLUTION

$$\text{Revised Sales Value} = \frac{\text{Desired Contribution}}{\text{Revised P / V Ratio}^*} = \frac{0.40}{0.25} = 1.6$$

This means sales value to be increased by 60% of the existing sales.

$$^*\text{Revised P/V Ratio} = \frac{\text{Revised Contribution}}{\text{Revised Selling Price}} = \frac{0.80 - 0.60}{0.80} = 0.25$$

$$\text{Required Sales Quantity} = \frac{\text{Desired Contribution}}{\text{Revised P / V Ratio}^* \times \text{Revised Selling Price}} = \frac{0.40}{0.25 \times 0.80} = 2$$

Therefore, Sales value to be increased by 60% and sales quantity to be doubled to offset the reduction in selling price.

Proof:

Let selling price per unit is ₹10 and sales quantity is 100 units.

Data before change in selling price:

	(₹)
Sales (₹10 × 100 units)	1,000
Contribution (40% of 1,000)	400
Variable cost (balancing figure)	600

Data after the change in selling price:

Selling price is reduced by 20% that means it became ₹8 per unit. Since, we have to maintain the earlier contribution margin i.e. ₹400 by increasing the sales quantity only. Therefore, the target contribution will be ₹400.

The new P/V Ratio will be

	(₹)
Sales	8.00
Variable cost	6.00
Contribution per unit	2.00
P/V Ratio	25%

$$\text{Sales Value} = \frac{\text{Desired Contribution}}{\text{Revised P/V Ratio}} = \frac{₹400}{0.25} = ₹1,600$$

$$\text{Sales quantity} = \frac{\text{Sales value}}{\text{Selling price per unit}} = \frac{₹1,600}{₹8} = 200 \text{ units}$$

ILLUSTRATION 4

PQR Ltd. has furnished the following data for the two years:

	2021-22	2022-23
Sales	₹ 8,00,000	?
Profit/Volume Ratio (P/V ratio)	50%	37.5%
Margin of Safety sales as a % of total sales	40%	21.875%

There has been substantial savings in the fixed cost in the year 2022-23 due to the restructuring process. The company could maintain its sales quantity level of 2021-22 in 2022-23 by reducing selling price.

You are required to CALCULATE the following:

- Sales for 2022-23 in Value,
- Fixed cost for 2022-23 in Value,
- Break-even sales for 2022-23 in Value.

SOLUTION

In 2021-22, PV ratio = 50%

Variable cost ratio = 100% - 50% = 50%

Variable cost in 2021-22 = ₹ 8,00,000 × 50% = ₹ 4,00,000

In 2022-23, sales quantity has not changed. Thus, variable cost in 2022-23 is ₹ 4,00,000.

In 2022-23, P/V ratio = 37.50%

Thus, Variable cost ratio = 100% - 37.5% = 62.5%

$$(i) \quad \text{Thus, sales in 2022-23} = \frac{4,00,000}{62.5\%} = ₹6,40,000$$

In 2022-23, Break-even sales = 100% - 21.875% (Margin of safety) = 78.125%

- (ii) Break-even sales $= 6,40,000 \times 78.125\% = ₹ 5,00,000$
- (iii) Fixed cost $= \text{B.E. sales} \times \text{P/V ratio}$
 $= 5,00,000 \times 37.50\% = ₹ 1,87,500.$

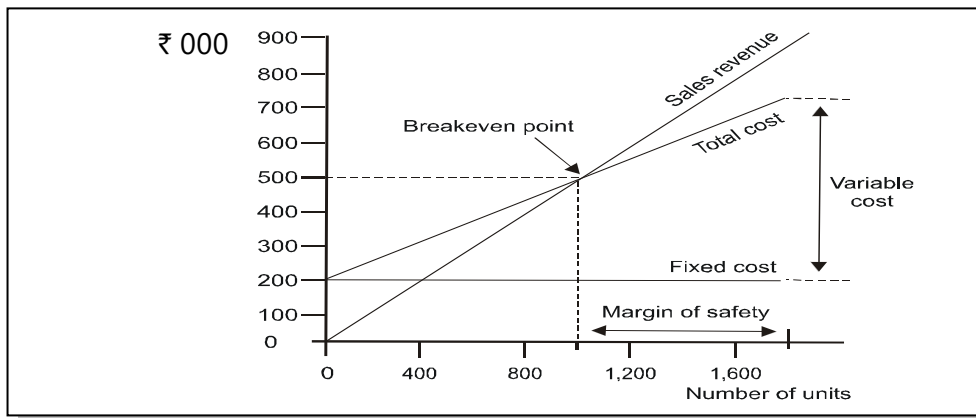
(B) GRAPHICAL PRESENTATION OF BREAK-EVEN CHART

8.4 Break-even Chart

A breakeven chart records costs and revenues on the vertical axis and the level of activity on the horizontal axis. The making of the breakeven chart would require you to select appropriate axes. Subsequently, you will need to mark costs/revenues on the Y axis whereas the level of activity shall be traced on the X axis. Lines representing (i) Fixed costs (horizontal line at ₹ 2,00,000 for ABC Ltd), (ii) Total costs at maximum level of activity (joined to the Y-axis where the Fixed cost of ₹ 2,00,000 is marked) and (iii) Revenue at maximum level of activity (joined to the origin) shall be drawn next.

The breakeven point is that point where the sales revenue line intersects the total cost line. Other measures like the margin of safety and profit can also be measured from the chart.

The breakeven chart for ABC Ltd (Example-3) is drawn below.

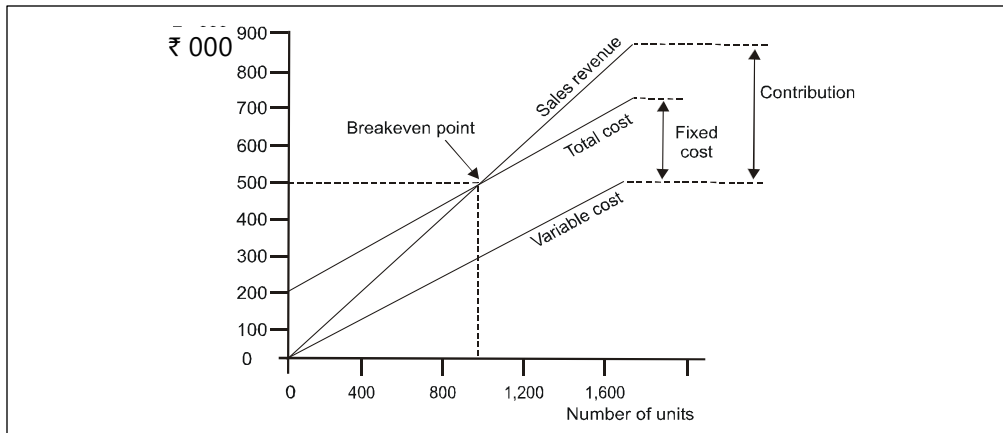


8.5 Contribution Breakeven Chart

It is not possible to use a breakeven chart as described above to measure contribution. This is one of its major limitations especially so because contribution analysis is literally the backbone of marginal costing. To overcome such a limitation, accountants frequently resort to the making of a contribution breakeven chart which is based on the same principles as a conventional breakeven chart except for

that it shows the variable cost line instead of the fixed cost line. Lines for Total cost and Sales revenue remain the same. The breakeven point and profit can be read off in the same way as with a conventional chart. However, it is also possible to read the contribution for any level of activity.

Using the same example of ABC Ltd as for the conventional chart, the total variable cost for an output of 1,700 units is $1,700 \times ₹300 = ₹5,10,000$. This point can be joined to the origin since the variable cost is nil at zero activity.

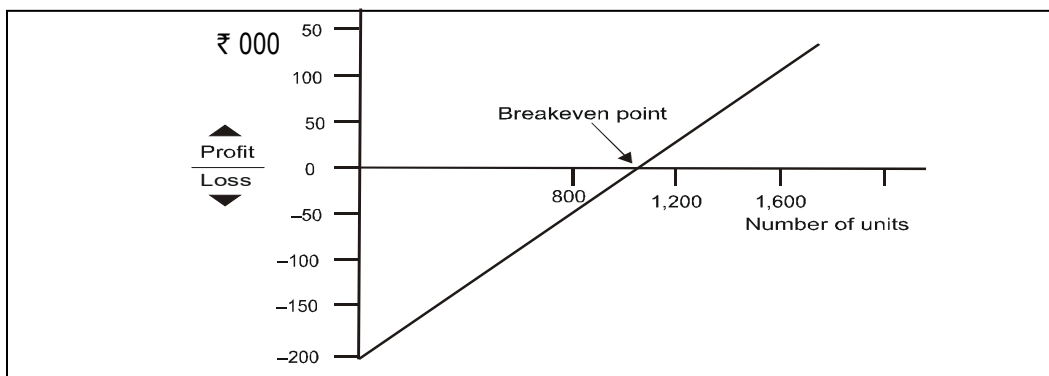


The contribution can be read as the difference between the sales revenue line and the variable cost line.

8.6 Profit-Volume Chart

This is also very similar to a breakeven chart. In this chart the vertical axis represents profits and losses, and the horizontal axis is drawn at zero profit or loss.

In this chart each level of activity is taken into account and profits marked accordingly. The breakeven point is where this line intersects the horizontal axis. A profit-volume graph for our example (ABC Ltd) will be as follows,



The loss at a nil activity level is equal to ₹ 2,00,000, i.e. the amount of fixed costs. The second point used to draw the line could be the calculated breakeven point or the calculated profit for sales of 1,700 units.

Advantages of the profit-volume chart

1. The biggest advantage of the profit-volume chart is its capability of depicting clearly the effect on profit and breakeven point of any changes in the variables. The following example illustrates this characteristic,

Example 5

A manufacturing company incurs fixed costs of ₹3,00,000 per annum. It is a single product company with annual sales budgeted to be 70,000 units at a sales price of ₹300 per unit. Variable costs are ₹ 285 per unit.

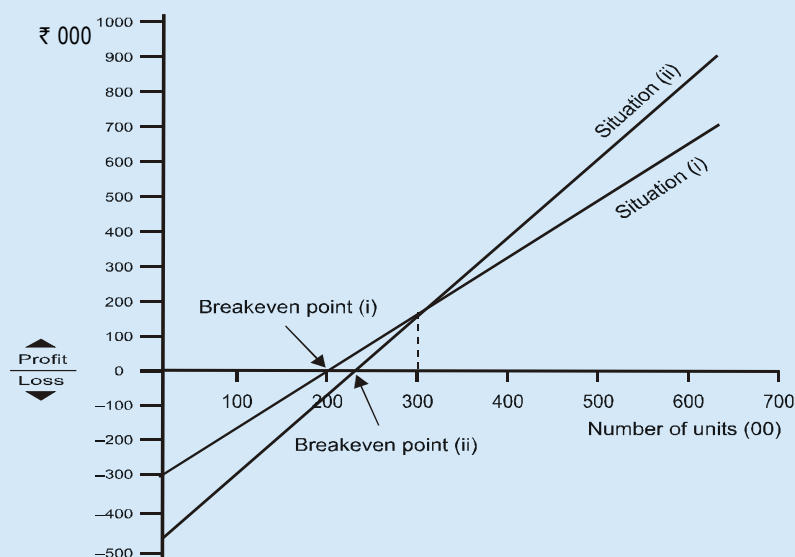
- (i) Draw a profit volume graph, and use it to determine the breakeven point.

The company is deliberating upon an increase in the selling price of the product to ₹ 350 per unit. This shall be required in order to improve the quality of the product. It is anticipated that despite increase in the selling price the sales volume shall remain unaffected, however, the fixed costs shall increase to ₹ 4,50,000 per annum and the variable costs to ₹ 330 per unit.

- (ii) Draw on the same graph as for part (a) a second profit volume graph and give your comments.

Solution

Figure showing changes with a profit-volume chart



Working notes (i)

The profit for sales of 70,000 units is ₹ 7,50,000.

	(₹'000)
Contribution 70,000 × (₹300 – ₹285)	1050
Fixed costs	<u>300</u>
Profit	<u>750</u>

This point is joined to the loss at zero activity, ₹ 3,00,000 i.e., the fixed costs.

Working notes (ii)

The profit for sales of 70,000 units is ₹ 9,50,000.

	(₹'000)
Contribution 70,000 × (₹350 – ₹330)	1400
Fixed costs	<u>450</u>
Profit	<u>950</u>

This point is joined to the loss at zero activity, ₹ 4,50,000 i.e., the fixed costs.

Comments:

It is clear from the graph that there are larger profits available from option (ii). It also shows an increase in the break-even point from 20,000 units to 22,500 units, however, the increase of 2,500 units may not be considered large in view of the projected sales volume. It is also possible to see that for sales volumes above 30,000 units the profit achieved will be higher with option (ii). For sales volumes below 30,000 units option (i) will yield higher profits (or lower losses).

ILLUSTRATION 5

You are given the following data for the current financial year of Rio Co. Ltd:

Variable cost	60,000	60%
Fixed cost	30,000	30%
Net profit	10,000	10%
Sales	1,00,000	100%

FIND OUT (a) Break-even point, (b) P/V ratio, and (c) Margin of safety. Also **DRAW** a break-even chart showing contribution and profit.

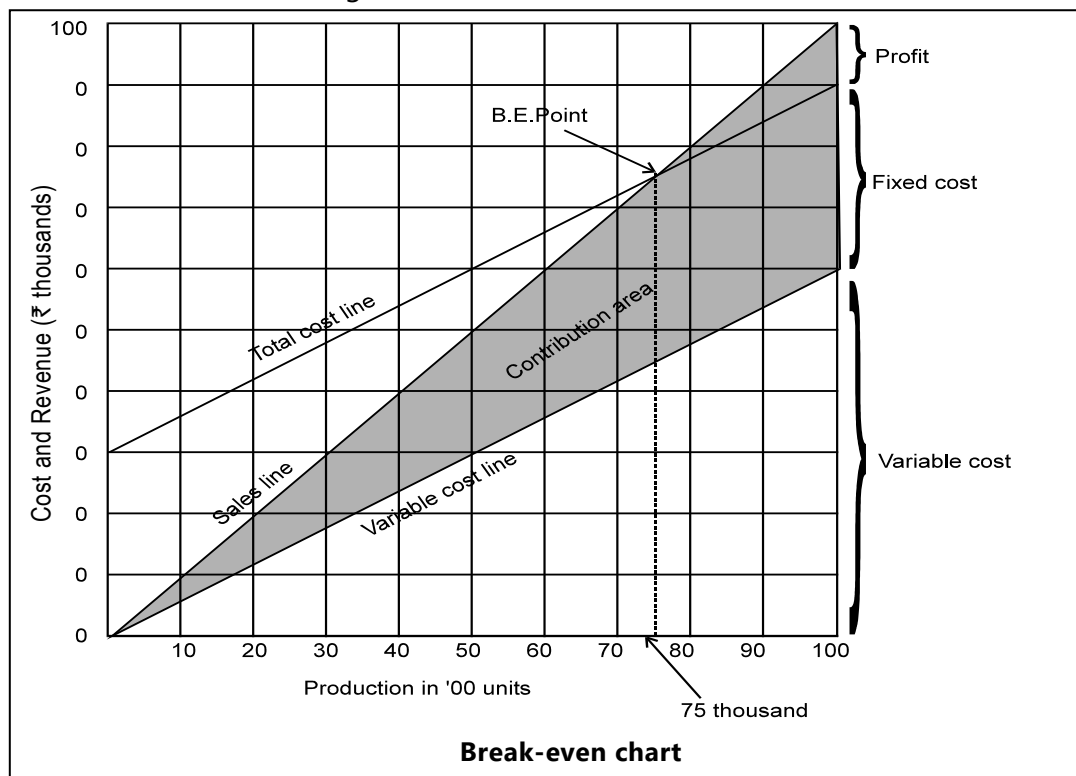
SOLUTION

$$P/V \text{ ratio} = \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} = \frac{1,00,000 - 60,000}{1,00,000} = 40\%$$

$$\text{Break Even Point} = \frac{\text{Fixed Cost}}{P/V \text{ ratio}} = \frac{30,000}{40\%} = ₹ 75,000$$

$$\text{Margin of safety} = \text{Actual Sales} - \text{BE point} = 1,00,000 - 75,000 = ₹ 25,000$$

Break even chart showing contribution is shown below:

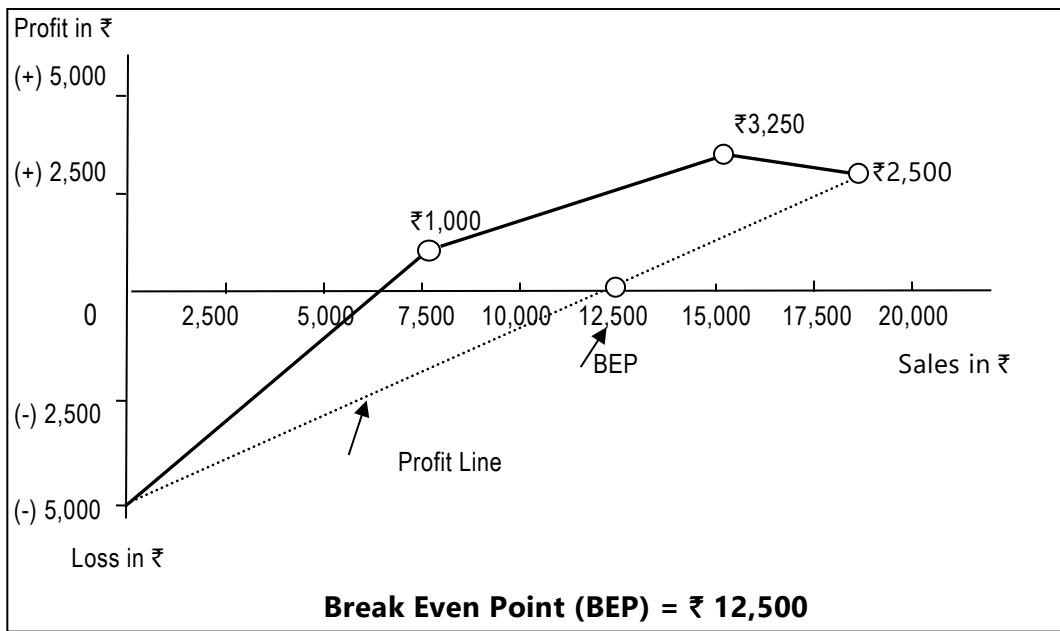
**ILLUSTRATION 6**

PREPARE a profit graph for products A, B and C and find break-even point from the following data:

Products	A	B	C	Total
Sales (₹)	7,500	7,500	3,750	18,750
Variable cost (₹)	1,500	5,250	4,500	11,250
Fixed cost (₹)	---	---	---	5,000

SOLUTION**Statement Showing Cumulative Sales & Profit**

Sales	Cumulative Sales		Variable Cost	Contribution	Cumulative Contribution	Cumulative Profit
	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
A	7,500	7,500	1,500	6,000	6,000	1,000
B	7,500	15,000	5,250	2,250	8,250	3,250
C	3,750	18,750	4,500	(750)	7,500	2,500



9. LIMITATIONS OF BREAK-EVEN ANALYSIS

The limitations of the **practical applicability of breakeven analysis and breakeven charts stem mostly from the assumptions underlying CVP** which have been mentioned above. Assumptions like costs behaving in a linear fashion or sales revenue remain constant at different sales levels or the stocks shall remain constant period after period are unrealistic. Similarly, the assumption that the only factor which influences costs is the 'activity level achieved' is erroneous because other factors like inflation also have a bearing on costs.

10. MARGIN OF SAFETY

The margin of safety can be defined as **the difference between the expected level of sale and the breakeven sales**. The larger the margin of safety, the higher is the chances of making profits. In the Example-3 if the forecast sale is 1,700 units per month, the margin of safety can be calculated as follows,

$$\begin{aligned}
 \text{Margin of Safety} &= \text{Projected sales} - \text{Breakeven sales} \\
 &= 1,700 \text{ units} - 1,000 \text{ units} \\
 &= 700 \text{ units or } 41\% \text{ of sales.}
 \end{aligned}$$

The Margin of Safety can also be calculated by identifying the difference between the projected sales and breakeven sales in units multiplied by the contribution per unit. This is possible because, at the breakeven point all the fixed costs are recovered and any further contribution goes into the making of profits. It also can be calculated as:

$$\text{Margin of Safety} = \frac{\text{Profit}}{\text{P/V Ratio}}$$

ILLUSTRATION 7

A company earned a profit of ₹ 30,000 during the year. If the marginal cost and selling price of the product are ₹ 8 and ₹ 10 per unit respectively, FIND OUT the amount of margin of safety.

SOLUTION

$$\text{P/V ratio} = \frac{\text{Selling price} - \text{Variable cost per unit}}{\text{Selling price}} = \frac{₹10 - ₹8}{₹10} = 20\%$$

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P/V ratio}} = \frac{30,000}{20\%} = ₹ 1,50,000$$

ILLUSTRATION 8

A Ltd. Maintains margin of safety of 37.5% with an overall contribution to sales ratio of 40%. Its fixed costs amount to ₹ 5 lakhs.

CALCULATE the following:

- i. Break-even sales
- ii. Total sales
- iii. Total variable cost
- iv. Current profit
- v. New 'margin of safety' if the sales volume is increased by 7 ½ %.

SOLUTION

(i) We know that: Break- even Sales (BES) × P/V Ratio = Fixed Cost

$$\text{Break-even Sales (BES)} \times 40\% = ₹ 5,00,000$$

$$\text{Break- even Sales (BES)} = ₹ 12,50,000$$

(ii) Total Sales (S) = Break Even Sales + Margin of Safety

$$S = ₹ 12,50,000 + 0.375S$$

$$\text{Or, } S - 0.375S = ₹ 12,50,000$$

$$\text{Or, } S = ₹ 20,00,000$$

(iii) Contribution to Sales Ratio = 40%

Therefore, Variable cost to Sales Ratio = 60%

$$\text{Variable cost} = 60\% \text{ of sales} = 60\% \text{ of } 20,00,000$$

$$\text{Variable cost} = 12,00,000$$

(iv) Current Profit = Sales – (Variable Cost + Fixed Cost)

$$= ₹ 20,00,000 - (12,00,000 + 5,00,000) = ₹ 3,00,000$$

(v) If sales value is increased by 7 ½ %

$$\text{New Sales value} = ₹ 20,00,000 \times 1.075 = ₹ 21,50,000$$

$$\text{New Margin of Safety} = \text{New Sales value} - \text{BES}$$

$$= ₹ 21,50,000 - ₹ 12,50,000 = ₹ 9,00,000$$



11. VARIATIONS OF BASIC MARGINAL COST EQUATION AND OTHER FORMULAE

$$\text{Sales} - \text{Variable cost} = \text{Fixed cost} \pm \text{Profit/ Loss}$$

By multiplying and dividing L.H.S. by S

$$\text{ii. } \frac{S(S - V)}{S} = F + P$$

$$\text{iii. } S \times \text{P/V Ratio} = F + P \text{ or Contribution} \quad \left(\because \text{P/V Ratio} = \frac{S - V}{S} \right)$$

$$\text{iv } \text{BES} \times \text{P/V Ratio} = F \quad (\because \text{at BEP profit is zero})$$

$$\text{v } \text{BES} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

$$\text{vi } \text{P/V Ratio} = \frac{\text{Fixed Cost}}{\text{BES}}$$

$$\text{vii } S \times \text{P/V Ratio} = \text{Contribution (Refer to iii)}$$

$$\text{viii } \text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}}$$

$$\text{ix } (\text{BES} + \text{MS}) \times \text{P/V Ratio} = \text{Contribution (Total sales} = \text{BES} + \text{MS})$$

$$\text{x } (\text{BES} \times \text{P/V Ratio}) + (\text{MS} \times \text{P/V Ratio}) = F + P$$

By deducting $(\text{BES} \times \text{P/V Ratio})$ from L.H.S. and F from R.H.S. in (x) above, we get:

$$\text{xi } \text{M.S.} \times \text{P/V Ratio} = P$$

$$\text{xii } \text{P/V Ratio} = \frac{\text{Change in profit}}{\text{Change in sales}}$$

$$\text{xiii } \text{P/V Ratio} = \frac{\text{Change in contribution}}{\text{Change in sales}}$$

$$\text{xiv } \text{Profitability} = \frac{\text{Contribution}}{\text{Key factor}}$$

$$\begin{aligned} \text{xv} \quad \text{Margin of Safety} &= \text{Total Sales} - \text{BES} \text{ or } \frac{\text{Profit}}{\text{P/V ratio}} \\ \text{xvi} \quad \text{BES} &= \text{Total Sales} - \text{MS} \\ \text{Margin of Safety Ratio} &= \frac{\text{Total sales} - \text{BES}}{\text{Total sales}} \end{aligned}$$

ILLUSTRATION 9

By noting "P/V will increase or P/V will decrease or P/V will not change", as the case may be, STATE how the following independent situations will affect the P/V ratio:

- (i) An increase in the physical sales volume;
- (ii) An increase in the fixed cost;
- (iii) A decrease in the variable cost per unit;
- (iv) A decrease in the contribution margin;
- (v) An increase in selling price per unit;
- (vi) A decrease in the fixed cost;
- (vii) A 10% increase in both selling price and variable cost per unit;
- (viii) A 10% increase in the selling price per unit and 10% decrease in the physical sales volume;
- (ix) A 50% increase in the variable cost per unit and 50% decrease in the fixed cost.
- (x) An increase in the angle of incidence.

SOLUTION

Item no.	P/V Ratio	Reason
(i)	Will not change	The ratio of sales value and variable cost will remain same irrespective of change in sales volume.
(ii)	Will not change	Fixed cost is not considered in calculation of P/V ratio.
(iii)	Will increase	Decrease in variable cost increases contribution

		margin so does the P/V ratio.
(iv)	Will decrease	Decrease in contribution margin decreases the P/V ratio.
(v)	Will increase	Increase in selling price per unit increases the contribution margin per unit and the P/V ratio.
(vi)	Will not change	Fixed cost is not considered in calculation of P/V ratio.
(vii)	Will not change	The increase in selling price and variable cost by the same ratio will not change the P/V ratio. Please refer the example note- 1 below.
(viii)	Will increase	The increase in selling price will increase the contribution margin but the change in sales volume in any direction will not affect P/V ratio. Thus, increase in selling price with decrease in sales volume will increase the P/V ratio.
(ix)	Will decrease	The increase in variable cost reduces the contribution margin thus decreases the PV ratio. Increase or decrease in fixed cost will not affect the P/V ratio.
(x)	Will increase	Angle of incidence represents the rate of profit earning, after reaching the break-even point. Increase in angle of incidence means increase in rate of profit earning which is nothing but the P/V ratio that contributes towards the profitability after recovering the fixed cost. (Please also refer para 14.12)

A 10% increase in both selling price and variable cost per unit.

Example note-1:

Assumptions:

- a) Variable cost is less than selling price.
- b) Selling price ₹100 variable cost ₹ 90 per unit.

$$c) \quad P/V \text{ ratio} = \frac{100 - 90}{100} = 10\%$$

10% increase in S.P. = ₹110

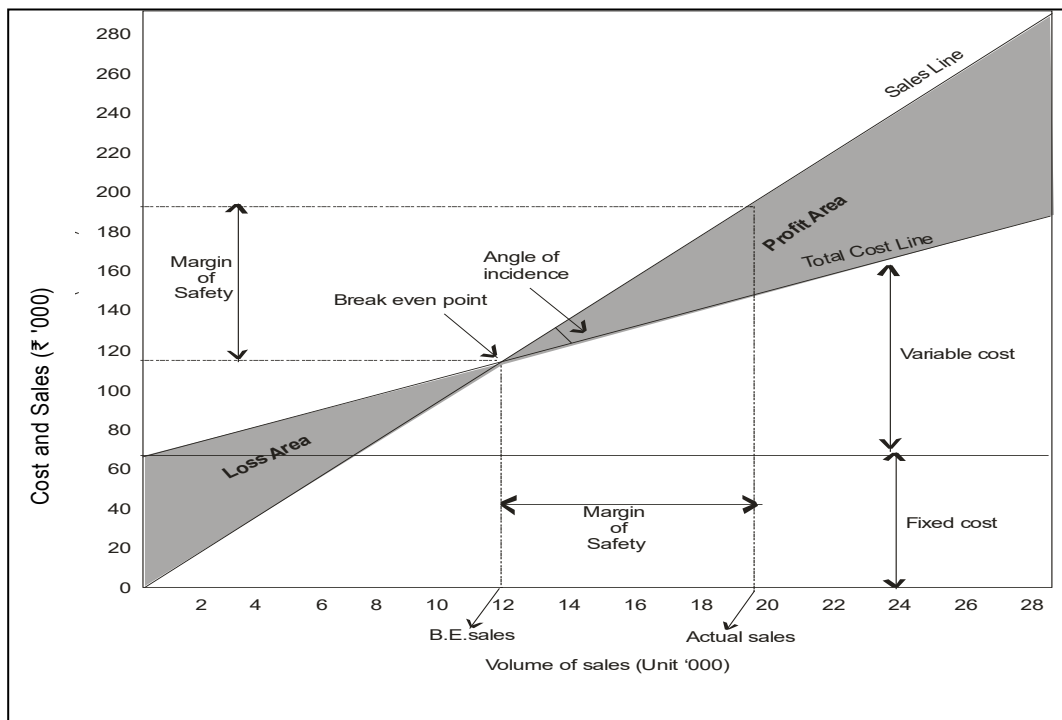
10% increase in variable cost = ₹99

$$P/V \text{ ratio} = \frac{110 - 99}{10} = 10\% \text{ i.e. } P/V \text{ ratio will not change}$$

12. ANGLE OF INCIDENCE

This angle is formed by the intersection of sales line and total cost line at the break-even point. **This angle shows the rate at which profit is earned once the break-even point is reached.** The wider the angle the greater is the rate of earning profits. A large angle of incidence with a high margin of safety indicates extremely favourable position.

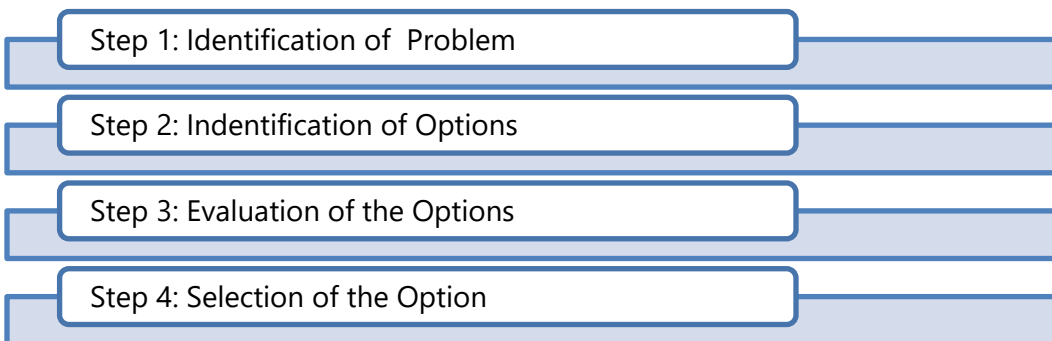
The shaded area in the graph given below is representing the angle of incidence. The angle above and below the break-even point shows the rate of earning profitability (loss). Wider angle denotes higher rate of earnings and vice-versa.



13. APPLICATION OF CVP ANALYSIS IN DECISION MAKING

As discussed earlier CVP analysis is used as an evaluation tool for managerial decisions. In this chapter we will discuss the use of CVP Analysis for short term decision making. Before going into illustration, let us discuss the decision making framework.

13.1 Framework for Decision Making



Step-1: Identification of Problem

Every organisation has its own objectives, and goals are set to achieve these objectives. To reach at the goal, actions are to be taken. For example, if an organisation wants to be a cost leader in the industry it operates in, it has to achieve 3Es in its all activities. 3Es means economy in inputs, efficiency in process and operations and effectiveness in output. An entity that exists for profit may identify few areas (problem areas) which if worked on can add to the profit or wealth maximisation. For example, Arnav Ltd. a manufacturer of Steel products, has identified that it can be leader in the industry if it can produce steel products at lower cost than its rival. Here the goal should be (problem area) low-cost production.

Step- 2: Identification of Options

After identification of problem(s), the next step is identification of options to achieve the goal (to answer the problem). All possible options need to be explored. In the above example, the Arnav Ltd. may have the following options for low-cost production:

- (a) Purchase of inputs from specialised market- Local vs Import

- (b) Make the input in its own factory- Make or Buy
- (c) Bulk purchase to avail discount offer- How much to purchase
- (d) Make in-house- Make vs Outsource
- (e) Bulk processing- How much to produce
- (f) Using efficient machine for manufacturing- Old machine vs New machine
- (g) Optimisation of key resources- Product mix decisions etc.

Step- 3: Evaluation of the Options

After identification of options, each option is to be evaluated against the objective criteria. An entity with objective of making profit may evaluate options on the basis of financial measures like impact of profit or loss, market share, overall impact on profitability, return on investment etc. Non-financial factors like customer satisfaction, impact on existing market/ customer, ethics of decision are also evaluated.

This step is a very important and may be grouped into two tasks

- (i) Identification of Cost and Benefits of each option
- (ii) Estimation of amount of each option

Step-4: Selection of option:

After evaluation of the options, the best option is selected and implemented.

13.2 Principles for Identification of Cost and Benefits for Measurement

The cost and benefit of an option is identified for measurement if it passes the principles of Controllability and Relevance.

(i) Controllability: Those cost and benefits which arise due to choice of an option. In other words, benefits received, and cost incurred are directly related with the choice of the option. Thus, the costs and benefits which are controllable are considered for measurement for making decision.

(ii) Relevance: The costs which are controllable need to be relevant for decision making. This means all controllable costs are not relevant for decision making unless it differs under the two options. Thus, **a cost is treated is relevant only if (a) it is a future cost and (b) it differs under two options under consideration.**

For Example, Arnav Ltd. wants to manufacture 1,000 additional units of Product X. It is considering either to manufacture in its own factory or to outsource to job workers. In this example cost of raw materials to manufacture additional 1,000 units is controllable as it arises due to management's decision to make additional units. But it is not relevant for making choice between manufacturing in-house and outsource to job workers, as under the both options, the raw materials cost would be same.

Hence, for decision making purpose only those cost and benefits are identified for measurement which are both Controllable and Relevant.

Below is an analysis of few costs for its relevance:

Cost	Relevance	Reason
(i) Historical Cost	Irrelevant	The cost has already been incurred and do not affect the decision. Example: Book value of machinery etc.
(ii) Sunk Cost	Irrelevant	The cost which are already paid either for goods or services availed or to be availed. Example: Raw material purchased and held in store without having replacement cost, Cost of drawing, blueprint etc.
(iii) Committed Cost	Irrelevant	The committed costs are the pre-agreed cost which cannot be revoked under the normal circumstances. This is also a sunk cost. Examples: Cost of materials as per rate agreement, Salary cost to employees etc.
(iv) Opportunity Cost	Relevant	The opportunity cost is represented by the forgone potential benefit from the best rejected course of action. Had the option under consideration not chosen, the benefit would come to the organisation.
(v) Notional or Imputed Cost	Relevant	Notional costs are relevant for the decision making only if company is actually forgoing benefits by employing its resources to alternative course of action. For example, notional interest on internally generated

		fund is treated as relevant notional cost only if company could earn interest from it.
(vi) Shut-down Cost	Relevant	When an organization suspends its manufacturing operations, certain fixed expenses can be avoided and certain extra fixed expenses may be incurred depending upon the nature of the industry. By closing down the manufacturing, the organization will save variable cost of production as well as some discretionary fixed costs. This particular discretionary cost is known as shut-down cost.

13.3 Principles of Estimation of Costs and Benefits

After identification of the costs and benefits, it is now required to be quantified i.e., the cost and benefit should be measured and estimated. The estimation is done by following the two principles as discusses below:

(i) Variability: Variability means by how much a cost or benefit increased or decreased due to the choice of the option. Variable costs are the cost which differs under the different volume or activities. On the other hand, fixed costs remain same irrespective of volume and activities.

(ii) Traceability: Traceability of cost means degree of relationship between the cost and the choice of the option. Direct costs are directly assigned to the option on the other hand indirect costs needs to be apportioned to the option on some reasonable basis.

For Example, Arnav Ltd. wants to manufacture 1,000 units of Product X. It is considering to manufacture the same in its own factory. To manufacture in its own factory, it requires 1,000 hours of employees and a specialised machine. In this example, employee cost for labour of 1,000 hours is variable cost for in-house manufacturing and it is directly traceable. Cost of machinery is also direct cost but so far as traceability of the machinery cost is concerned it is direct cost for 1,000 units as a whole but indirect cost for a unit.

Hence, the cost and benefits of an option is measured at directly traceable and variable costs.

13.4 Short-term Decision-Making using concepts of CVP Analysis

Management uses marginal costing and CVP concepts for making various decisions. In this chapter we will learn how the concepts of marginal costing and CVP is applied for analysis of identified options for short-term decision making. Generally, short-term decisions are related with temporary gaps between demand and supply for available resources. The areas of short term decision may be classified into two broad categories:

(i) Decisions related with excess supply, such as:

- (a) Processing of Special Order
- (b) Determination of price for stimulating demand
- (c) Local vs Export sale
- (d) Determination of minimum price for price quotations
- (e) Shut-down or continue decision etc.

(ii) Decisions related with excess demand, such as:

- (a) Make or Buy/ In-house-processing vs Outsourcing
- (b) Product mix decision under resource constraints (limiting factors)
- (c) Sales mix decisions
- (d) Sale or further processing etc.

What is a Limiting Factor? Limiting factor is anything which limits the activity of an entity. The factor is a key to determine the level of sale and production, thus it is also known as Key factor. From the supply side the limiting factor may either be Men (employees), Materials (raw material or supplies), Machine (capacity), or Money (availability of fund or budget) and from demand side it may be demand for the product, other factors like nature of product, regulatory and environmental requirement etc. The management, while making decisions, has objective to optimise the key resources upto maximum possible extent.

ILLUSTRATION 10

A company can make any one of the 3 products X, Y or Z in a year. It can exercise its option only at the beginning of each year.

Relevant information about the products for the next year is given below.

	X	Y	Z
Selling Price (₹ / unit)	10	12	12
Variable Costs (₹ / unit)	6	9	7
Market Demand (unit)	3,000	2,000	1,000
Production Capacity (unit)	2,000	3,000	900
Fixed Costs (₹)	30,000		

Required

COMPUTE the opportunity costs for each of the products.

SOLUTION

	X	Y	Z
I. Contribution per unit (₹)	4	3	5
II. Units (Lower of Production / Market Demand)	2,000	2,000	900
III. Possible Contribution (₹) [I × II]	8,000	6,000	4,500
IV. Opportunity Cost* (₹)	6,000	8,000	8,000

(*) Opportunity cost is the maximum possible contribution forgone by not producing alternative product i.e. if Product X is produced then opportunity cost will be maximum of (₹ 6,000 from Y, ₹ 4,500 from Z).

ILLUSTRATION 11

M.K. Ltd. manufactures and sells a single product X whose selling price is ₹ 40 per unit and the variable cost is ₹ 16 per unit.

- If the Fixed Costs for this year are ₹ 4,80,000 and the annual sales are at 60% margin of safety, CALCULATE the rate of net return on sales, assuming an income tax level of 40%
- For the next year, it is proposed to add another product line Y whose selling price would be ₹ 50 per unit and the variable cost ₹ 10 per unit. The total fixed costs are estimated at ₹ 6,66,600. The sales mix values of X : Y would be 7 : 3. DETERMINE at what level of sales next year, would M.K. Ltd. break even? Give separately for both X and Y the break-even sales in rupee and quantities.

SOLUTION

$$(i) \quad \text{Contribution per unit} = \text{Selling price} - \text{Variable cost}$$

$$= ₹40 - ₹16 = ₹24$$

$$\text{Break-even Point} = \frac{₹4,80,000}{₹24} = 20,000 \text{ units}$$

$$\text{Percentage Margin of Safety} = \frac{\text{Actual Sales} - \text{Break - even Sales}}{\text{Actual Sales}}$$

$$\text{Or, } 60\% = \frac{\text{Actual Sales} - 20,000 \text{ units}}{\text{Actual Sales}}$$

$$\therefore \text{Actual Sales} = 50,000 \text{ units}$$

	(₹)
Sales Value (50,000 units × ₹40)	20,00,000
Less: Variable Cost (50,000 units × ₹16)	8,00,000
Contribution	12,00,000
Less: Fixed Cost	4,80,000
Profit	7,20,000
Less: Income Tax @ 40%	2,88,000
Net Return	4,32,000

$$\text{Rate of Net Return on Sales} = 21.6\% \left(\frac{₹4,32,000}{₹20,00,000} \times 100 \right)$$

(ii) Products

	X	Y
	(₹)	(₹)
Selling Price	40	50
Less: Variable Cost	16	10
Contribution per unit	24	40
Sales Ratio	7	3
Contribution in sales Ratio	168	120

Based on Weighted Contribution

$$\text{Weighted Contribution} = \frac{24 \times 7 + 40 \times 3}{10} = ₹ 28.8 \text{ per unit}$$

$$\text{Total Break-even Point} = \frac{\text{Total Fixed Cost}}{\text{Weighted Contribution}} = \frac{6,66,600}{28.8} = 23,145.80 \text{ units}$$

Break-even Point

$$X = \frac{7}{10} \times 23,145.80 = 16,202 \text{ units}$$

$$\text{or } 16,202 \times ₹ 40 = ₹ 6,48,080$$

$$Y = \frac{3}{10} \times 23,145.80 = 6,944 \text{ units or } 6,944 \times ₹ 50 = ₹ 3,47,200$$

Based on distributing fixed cost in the weighted Contribution Ratio

Fixed Cost

$$X = \frac{168}{288} \times 6,66,600 = ₹ 3,88,850$$

$$Y = \frac{120}{288} \times 6,66,600 = ₹ 2,77,750$$

Break-even Point

$$X = \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{3,88,850}{24} = 16,202 \text{ units or } ₹ 6,48,000$$

$$Y = \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{2,77,750}{40} = 6,944 \text{ units or } ₹ 3,47,200$$

ILLUSTRATION 12

X Ltd. supplies spare parts to an air craft company Y Ltd. The production capacity of X Ltd. facilitates production of any one spare part for a particular period of time. The following are the cost and other information for the production of the two different spare parts A and B:

	Part A	Part B
<i>Per unit</i>		
<i>Alloy usage</i>	1.6 kgs.	1.6 kgs.
<i>Machine Time: Machine P</i>	0.6 hrs	0.25 hrs.
<i>Machine Time: Machine Q</i>	0.5 hrs.	0.55 hrs.
<i>Target Price (₹)</i>	145	115
<i>Total hours available</i>	Machine P 4,000 hours Machine Q 4,500 hours	

Alloy available is 13,000 kgs. @ ₹ 12.50 per kg.

Variable overheads per machine hours Machine P: ₹ 80

Machine Q: ₹ 100

Required

- IDENTIFY the spare part which will optimize contribution at the offered price.
- If Y Ltd. reduces target price by 10% and offers ₹ 60 per hour of unutilized machine hour, CALCULATE the total contribution from the spare part identified above?

SOLUTION

(i)

	Part A	Part B
Machine "P" (4,000 hrs)	6,666	16,000
Machine "Q" (4,500 hrs)	9,000	8,181
Alloy Available (13,000 kg.)	8,125	8,125
Maximum Number of Parts to be manufactured (Minimum of the above three)	6,666	8,125

	(₹)	(₹)
Material (₹12.5 × 1.6 kg.)	20.00	20.00
Variable Overhead: Machine "P"	48.00	20.00
Variable Overhead: Machine "Q"	50.00	55.00

Total Variable Cost <i>per unit</i>	118.00	95.00
Price Offered	145.00	115.00
Contribution <i>per unit</i>	27.00	20.00
Total Contribution <i>for units produced</i> (I)	1,79,982	1,62,500

Spare Part A will optimize the contribution.

(ii)

	Part A
Parts to be manufactured numbers	6,666
Machine P : to be used	4,000
Machine Q : to be used	3,333
Underutilized Machine Hours (4,500 hrs. – 3,333 hrs.)	1,167
Compensation for unutilized machine hours (1,167hrs. × ₹60) (II)	70,020
Reduction in Price by 10%, Causing fall in Contribution of ₹14.50 <i>per unit</i> (6,666 units × ₹14.5) (III)	96,657
Total Contribution (I + II – III)	1,53,345

ILLUSTRATION 13

The profit for the year of R.J. Ltd. works out to 12.5% of the capital employed and the relevant figures are as under:

Sales.....	₹ 5,00,000
Direct Materials.....	₹ 2,50,000
Direct Labour.....	₹ 1,00,000
Variable Overheads.....	₹ 40,000
Capital Employed.....	₹ 4,00,000

The new Sales Manager who has joined the company recently estimates for next year a profit of about 23% on capital employed, provided the volume of sales is increased by 10% and simultaneously there is an increase in Selling Price of 4% and an overall cost reduction in all the elements of cost by 2%.

Required

FIND OUT by computing in detail the cost and profit for next year, whether the proposal of Sales Manager can be adopted.

SOLUTION**Statement Showing "Cost and Profit for the Next Year"**

Particulars	Existing Volume, etc.	Volume, Costs, etc. after 10% Increase	Estimated Sale, Cost, Profit, etc.*
	(₹)	(₹)	(₹)
Sales	5,00,000	5,50,000	5,72,000
Less: Direct Materials	2,50,000	2,75,000	2,69,500
Direct Labour	1,00,000	1,10,000	1,07,800
Variable Overheads	40,000	44,000	43,120
Contribution	1,10,000	1,21,000	1,51,580
Less: Fixed Cost [#]	60,000	60,000	58,800
Profit	50,000	61,000	92,780

(*) for the next year after increase in selling price @ 4% and overall cost reduction by 2%.

(#) Fixed Cost = Existing Sales – Existing Marginal Cost – 12.5% on ₹4,00,000

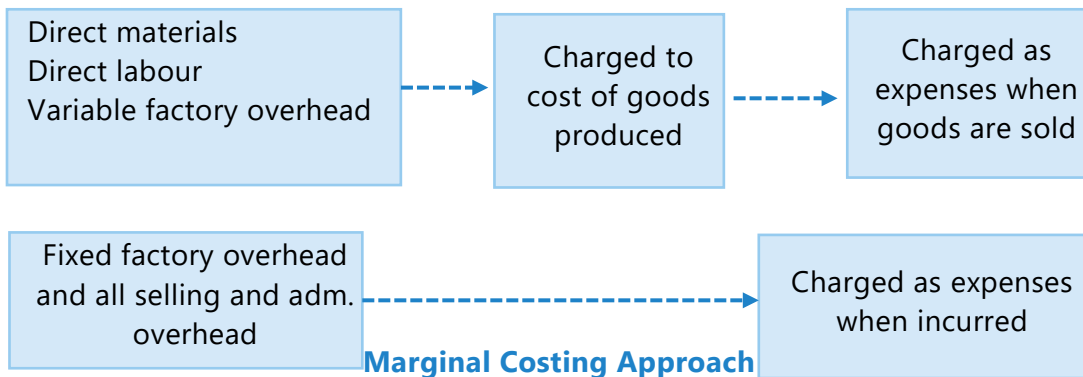
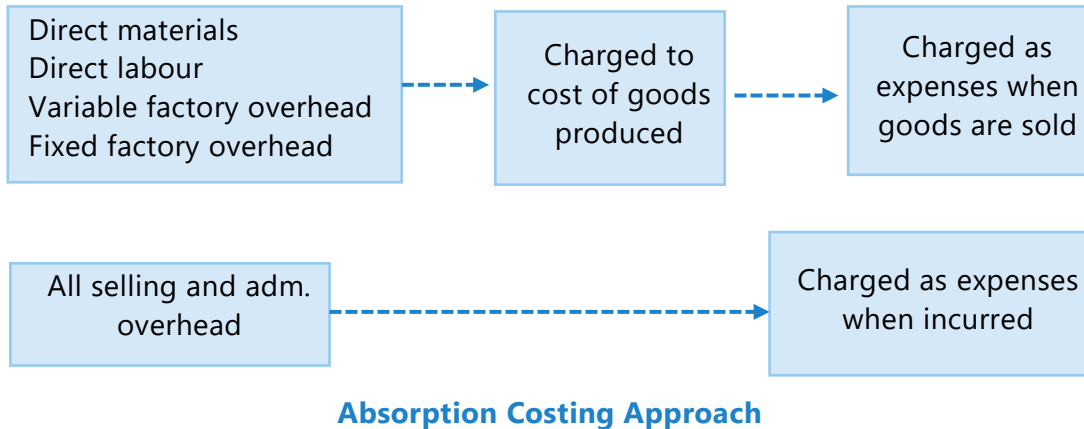
$$= ₹5,00,000 - ₹3,90,000 - ₹50,000 = ₹60,000$$

Percentage Profit on Capital Employed equals to 23.19% $\left(\frac{₹92,780}{₹4,00,000} \times 100 \right)$

Since the Profit of ₹92,780 is more than 23% of capital employed, the proposal of the Sales Manager can be adopted.

14. DISTINCTION BETWEEN MARGINAL AND ABSORPTION COSTING

The distinctions in these two techniques are illustrated by the following diagrams:



14.1 Main Points of distinction between Marginal Costing and Absorption Costing

	Marginal costing	Absorption costing
1.	Only variable costs are considered for product costing and inventory valuation.	Both fixed and variable costs are considered for product costing and inventory valuation.
2.	Fixed costs are regarded as period costs. The Profitability	Fixed costs are charged to the cost of production. Each product bears a reasonable share of fixed cost and thus the

	of different products is judged by their P/V ratio.	profitability of a product is influenced by the apportionment of fixed costs.
3.	Cost data presented highlight the total contribution of each product.	Cost data are presented in conventional pattern. Net profit of each product is determined after subtracting fixed cost along with their variable costs.
4.	The difference in the magnitude of opening stock and closing stock does not affect the unit cost of production.	The difference in the magnitude of opening stock and closing stock affects the unit cost of production due to the impact of related fixed cost.
5.	In case of marginal costing the cost per unit remains the same, irrespective of the production as it is valued at variable cost	In case of absorption costing the cost per unit reduces, as the production increases as it is fixed cost which reduces, whereas, the variable cost remains the same per unit.

14.2 Difference in Profit under Marginal and Absorption costing

The above two approaches will compute the different profit because of the difference in the stock valuation. This difference is explained as follows in different circumstances.

1. **No opening and closing stock:** In this case, profit / loss under absorption and marginal costing will be equal.
2. **When opening stock is equal to closing stock:** In this case, profit / loss under two approaches will be equal provided the fixed cost element in both the stocks is same amount.
3. **When closing stock is more than opening stock:** In other words, when production during a period is more than sales, then **profit as per absorption approach will be more** than that by marginal approach. The reason behind this difference is that a part of fixed overhead included in closing stock value is carried forward to next accounting period.
4. **When opening stock is more than the closing stock:** In other words, when production is less than the sales, **profit shown by marginal costing will be more** than that shown by absorption costing. This is because a part of fixed cost from the preceding period is added to the current year's cost of goods sold in the form of opening stock.

The presentation of information to management under the two costing techniques is as under:

Income Statement (Absorption costing)

	(₹)
Sales	<u>XXXXXX</u>
Production Costs:	
Direct material consumed	XXXXXX
Direct labour cost	XXXXXX
Variable manufacturing overhead	XXXXXX
Fixed manufacturing overhead	<u>XXXXXX</u>
Cost of Production	XXXXXX
Add: Opening stock of finished goods	<u>XXXXXX</u>
(Value at cost of previous period's production)	
	XXXXXX
Less: Closing stock of finished goods	XXXXXX
(Value at production cost of current period)	
Cost of Goods Sold	<u>XXXXXX</u>
Add: (or less) Under (or over) absorption of fixed	
Manufacturing overhead	XXXXXX
Add: Administration costs	XXXXXX
Selling and distribution costs	<u>XXXXXX</u>
Total Cost	XXXXXX
Profit (Sales – Total cost)	XXXXXX

Income Statement (Marginal costing)

	(₹)
Sales	<u>XXXXXX</u>
<u>Variable manufacturing costs:</u>	
– Direct material consumed	XXXXXX
– Direct labour	XXXXXX
– Variable manufacturing overhead	<u>XXXXXX</u>

<i>Cost of Goods Produced</i>	XXXXXX
Add: <i>Opening stock of finished goods</i> <i>(Value at cost of previous period)</i>	XXXXXX
Less: <i>Closing stock of finished goods (Value at current variable cost)</i>	
Cost of Goods Sold	XXXXXX
Add: <i>Variable administration, selling and dist. overhead</i>	XXXXXX
<i>Total Variable Cost</i>	XXXXXX
Add: <i>Selling and distribution costs</i>	
Contribution (Sales – Total variable costs)	XXXXXX
Less: <i>Fixed costs (Production, admin., selling and dist.)</i>	<u>XXXXXX</u>
<i>Net Profit</i>	XXXXXX

It is evident from the above that under marginal costing technique the contributions of various products are pooled together and the fixed overheads are met out of such total contribution. The total contribution is also known as gross margin. The contribution minus fixed expenses yields net profit. In absorption costing technique cost includes fixed overheads as well.

ILLUSTRATION 14

Wonder Ltd. manufactures a single product, ZEST. The following figures relate to ZEST for a one-year period:

Activity Level	50%	100%
<i>Sales and production (units)</i>	400	800
	(₹)	(₹)
<i>Sales</i>	8,00,000	16,00,000
<i>Production costs:</i>		
- Variable	3,20,000	6,40,000
- Fixed	1,60,000	1,60,000
<i>Selling and distribution costs:</i>		
- Variable	1,60,000	3,20,000
- Fixed	2,40,000	2,40,000

The normal level of activity for the year is 800 units. Fixed costs are incurred evenly throughout the year, and actual fixed costs are the same as budgeted. There were no stocks of ZEST at the beginning of the year.

In the first quarter, 220 units were produced and 160 units were sold.

Required:

- COMPUTE the fixed production costs absorbed by ZEST if absorption costing is used?
- CALCULATE the under/over-recovery of overheads during the period?
- CALCULATE the profit using absorption costing?
- CALCULATE the profit using marginal costing?

SOLUTION

(a) Fixed production costs absorbed: (₹)

Budgeted fixed production costs 1,60,000

Budgeted output (normal level of activity 800 units)

Therefore, the absorption rate: $1,60,000/800 = ₹ 200$ per unit

During the first quarter, the fixed production

cost absorbed by ZEST would be (220 units × ₹ 200) 44,000

(b) Under /over-recovery of overheads during the period: (₹)

Actual fixed production overhead 40,000

(1/4 of ₹ 1,60,000)

Absorbed fixed production overhead 44,000

Over-recovery of overheads 4,000

(c) Profit for the Quarter (Absorption Costing)

	(₹)	(₹)
Sales revenue (160 units × ₹ 2,000): (A)		3,20,000
Less: Production costs:		
- Variable cost (220 units × ₹ 800)	1,76,000	

- Fixed overheads absorbed (220 units × ₹ 200)	44,000	2,20,000
Add: Opening stock		--
Less: Closing Stock $\left(\frac{₹2,20,000}{220\text{units}} \times 60\text{units} \right)$		(60,000)
Cost of Goods sold		1,60,000
Less: Adjustment for over-absorption of fixed production overheads		(4,000)
Add: Selling & Distribution Overheads:		
- Variable (160 units × ₹400)	64,000	
- Fixed (1/4 th of ₹ 2,40,000)	60,000	1,24,000
Cost of Sales (B)		2,80,000
Profit {(A) – (B)}		40,000

(d) Profit for the Quarter (Marginal Costing)

	(₹)	(₹)
Sales revenue (160 units × ₹ 2,000): (A)		3,20,000
Less: Production costs:		
- Variable cost (220 units × ₹ 800)		1,76,000
Add: Opening stock		--
Less: Closing Stock $\left(\frac{₹1,76,000}{220\text{units}} \times 60\text{units} \right)$		(48,000)
Variable cost of goods sold		1,28,000
Add: Selling & Distribution Overheads:		
- Variable (160 units × ₹400)		64,000
Cost of Sales (B)		1,92,000
Contribution {(C) = (A) – (B)}		1,28,000
Less: Fixed Costs:		
- Production cost	(40,000)	
- Selling & distribution cost	(60,000)	(1,00,000)
Profit		28,000

SUMMARY

- ◆ **Marginal Cost:** Marginal cost as understood in economics is the incremental cost of production which arises due to one-unit increase in the production quantity. Marginal cost is measured by the total variable cost attributable to one unit.
- ◆ **Marginal Costing:** It is a costing system where products or services and inventories are valued at variable costs only. It does not take consideration of fixed costs.
- ◆ **Absorption Costing:** A method of costing by which all direct cost and applicable overheads are charged to products or cost centers for finding out the total cost of production. Absorbed cost includes production cost as well as administrative and other cost.
- ◆ **Contribution:** Contribution or contribution margin is the difference between sales revenue and total variable costs irrespective of manufacturing or non-manufacturing.
- ◆ **Cost-Volume-Profit (CVP) Analysis:** It is an analysis of reciprocal effect of changes in cost, volume and profitability. Such an analysis explores the relationship between costs, revenue, activity levels and the resulting profit. It aims at measuring variations in cost and volume.
- ◆ **Contribution to Sales Ratio (Profit Volume Ratio or P/V ratio):** This ratio shows the proportion of sales available to cover fixed costs and profit. Contribution represents the sales revenue after deducting variable costs.
- ◆ **Break-even Point (BEP):** The level of sales where an entity neither earns profit nor incurs loss. BEP is indicated in both quantity and monetary value terms.
- ◆ **Margin of Safety (MOS):** The margin between sales and the break-even sales is known as margin of safety. It can either be indicated in quantitative or monetary terms.
- ◆ **Angle of Incidence:** This angle is formed by the intersection of sales line and total cost line at the break-even point. This angle shows the rate at which profits is earned once the break-even point is reached.
- ◆ **Limiting (Key) factor:** Limiting factor is anything which limits the activity of an entity. The factor is a key to determine the level of sale and production, thus it is also known as Key factor.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. Under marginal costing the cost of product includes:
 - (a) Prime costs only.
 - (b) Prime costs and variable overheads.
 - (c) Prime costs and fixed overheads.
 - (d) Prime costs and factory overheads.
2. Reporting under marginal costing is accomplished by:
 - (a) Treating all costs as period costs.
 - (b) Eliminating the work-in-progress inventory account.
 - (c) Matching variable costs against revenue and treating fixed costs as period costs.
 - (d) Including only variable costs in income statement.
3. Period costs are:
 - (a) Variable costs.
 - (b) Fixed costs.
 - (c) Prime costs.
 - (d) Overheads costs.
4. When sales and production (in units) are same then profit under:
 - (a) Marginal costing is higher than that of absorption costing.
 - (b) Marginal costing is lower than that of absorption costing.
 - (c) Marginal costing is equal to that of absorption costing.
 - (d) None of the above.
5. When sales exceed production (in units) then profit under:
 - (a) Marginal costing is higher than that of absorption costing.
 - (b) Marginal costing is lower than that of absorption costing.

- (c) *Marginal costing is equal than that of absorption costing.*
 - (d) *None of above.*
6. *The main difference between marginal costing and absorption costing is regarding the treatment of:*
- (a) *Prime cost.*
 - (b) *Fixed overheads.*
 - (c) *Direct materials.*
 - (d) *Variable overheads.*
7. *Under profit volume ratio, the term profit:*
- (a) *Means the sales proceeds in excess of total costs.*
 - (b) *Means the same thing as is generally understood.*
 - (c) *Is a misnomer, it in fact refers to contribution i.e. (sales revenue-variable costs).*
 - (d) *None of the above.*
8. *Factors which can change the break-even point:*
- (a) *Change in fixed costs.*
 - (b) *Change in variable costs.*
 - (c) *Change in the selling price.*
 - (d) *All of the above.*
9. *If P/V ratio is 40% of sales then what about the remaining 60% of sales:*
- (a) *Profit.*
 - (b) *Fixed cost.*
 - (c) *Variable cost.*
 - (d) *Margin of safety.*

10. The P/V ratio of a product is 0.6 and profit is ₹ 9,000. The margin of safety is:
- (a) ₹ 5,400
 - (b) ₹ 15,000
 - (c) ₹ 22,500
 - (d) ₹ 3,600

Theoretical Questions

1. EXPLAIN and ILLUSTRATE break-even point with the help of break-even chart.
2. WRITE a short note on Angle of Incidence.
3. DISCUSS basic assumptions of Cost Volume Profit analysis.
4. DISCUSS the practical application of Marginal Costing.
5. DISCUSS the points of difference between Absorption Costing and Marginal Costing.
6. WRITE a short note on Margin of Safety.

Practical Problems

1. If P/V ratio is 60% and the Marginal cost of the product is ₹ 20. CALCULATE the selling price?
2. The ratio of variable cost to sales is 70%. The break-even point occurs at 60% of the capacity sales. Find the capacity sales when fixed costs are ₹ 90,000. Also COMPUTE profit at 75% of the capacity sales.
3. You are required to-

		(₹)
(i)	DETERMINE profit, when sales	= 2,00,000
	Fixed Cost	= 40,000
	BEP	= 1,60,000
(ii)	DETERMINE sales, when fixed cost	= 20,000
	Profit	= 10,000
	BEP	= 40,000

4. A company has made a profit of ₹ 50,000 during the year. If the selling price and marginal cost of the product are ₹ 15 and ₹ 12 per unit respectively, FIND OUT the amount of margin of safety.
5. (a) If margin of safety is ₹ 2,40,000 (40% of sales) and P/V ratio is 30% of AB Ltd, CALCULATE its (1) Break even sales, and (2) Amount of profit on sales of ₹ 9,00,000.
(b) X Ltd. has earned a contribution of ₹ 2,00,000 and net profit of ₹ 1,50,000 of sales of ₹ 8,00,000. What is its margin of safety?
6. A company sells its product at ₹ 15 per unit. In a period, if it produces and sells 8,000 units, it incurs a loss of ₹ 5 per unit. If the volume is raised to 20,000 units, it earns a profit of ₹ 4 per unit. CALCULATE break-even point both in terms of Value as well as in units.
7. You are given the following data:

	Sales	Profit
Year 2021-22	₹ 1,20,000	8,000
Year 2022-23	₹ 1,40,000	13,000

FIND OUT –

- (i) P/V ratio,
 - (ii) B.E. Point,
 - (iii) Profit when sales are ₹ 1,80,000,
 - (iv) Sales required earn a profit of ₹ 12,000,
 - (v) Margin of safety in year 2022-23.
8. The product mix of a Gama Ltd. is as under:

	Products	
	M	N
Units	54,000	18,000
Selling price	₹ 7.50	₹ 15.00
Variable cost	₹ 6.00	₹ 4.50

FIND the break-even points in units, if the company discontinues product 'M' and replace with product 'O'. The quantity of product 'O' is 9,000 units and its selling price and variable costs respectively are ₹ 18 and ₹ 9. Fixed Cost is ₹ 15,000.

9. *Mr. X has ₹ 2,00,000 investments in his business firm. He wants a 15 per cent return on his money. From an analysis of recent cost figures, he finds that his variable cost of operating is 60 per cent of sales, his fixed costs are ₹ 80,000 per year. Show COMPUTATIONS to answer the following questions:*
 - (i) *What sales volume must be obtained to break even?*
 - (ii) *What sales volume must be obtained to get 15 per cent return on investment?*
 - (iii) *Mr. X estimates that even if he closed the doors of his business, he would incur ₹ 25,000 as expenses per year. At what sales would he be better off by locking his business up?*
10. *A company had incurred fixed expenses of ₹ 4,50,000, with sales of ₹ 15,00,000 and earned a profit of ₹ 3,00,000 during the first half year. In the second half, it suffered a loss of ₹ 1,50,000.*

CALCULATE:

- (i) *The profit-volume ratio, break-even point and margin of safety for the first half year.*
 - (ii) *Expected sales volume for the second half year assuming that selling price and fixed expenses remained unchanged during the second half year.*
 - (iii) *The break-even point and margin of safety for the whole year.*
11. *The following information is given by Star Ltd.:*

<i>Margin of Safety</i>	<i>₹ 1,87,500</i>
<i>Total Cost</i>	<i>₹ 1,93,750</i>
<i>Margin of Safety</i>	<i>3,750 units</i>
<i>Break-even Sales</i>	<i>1,250 units</i>

Required:

CALCULATE Profit, P/V Ratio, BEP Sales (in ₹) and Fixed Cost.

12. A single product company sells its product at ₹ 60 per unit. In 2021-22, the company operated at a margin of safety of 40%. The fixed costs amounted to ₹ 3,60,000 and the variable cost ratio to sales was 80%.

In 2022-23, it is estimated that the variable cost will go up by 10% and the fixed cost will increase by 5%.

- (i) FIND the selling price required to be fixed in 2022-23 to earn the same P/V ratio as in 2021-22.
- (ii) Assuming the same selling price of ₹ 60 per unit in 2022-23, FIND the number of units required to be produced and sold to earn the same profit as in 2021-22.
13. (a) You are given the following data for the coming year for a factory.

Budgeted output	8,00,000 units
Fixed expenses	₹ 40,00,000
Variable expenses per unit	₹ 100
Selling price per unit	₹ 200

DRAW a break-even chart showing the break-even point.

- (b) If price is reduced to ₹ 180, what will be the new break-even point?
14. A company has three factories situated in north, east and south with its Head Office in Mumbai. The management has received the following summary report on the operations of each factory for a period:

(₹ in '000)

	Sales		Profit	
	Actual	Over/(Under) Budget	Actual	Over/(Under) Budget
North	1,100	(400)	135	(180)
East	1,450	150	210	90
South	1,200	(200)	330	(110)

CALCULATE for each factory and for the company as a whole for the period:

- (i) the fixed costs. (ii) break-even sales.

15. An automobile manufacturing company produces different models of Cars. The budget in respect of model 007 for the month of March is as under:

Budgeted Output			40,000 Units
		₹ In lakhs	₹ In lakhs
Net Realisation			2,10,000
Variable Costs:			
Materials		79,200	
Labour		15,600	
Direct expenses		37,200	1,32,000
Specific Fixed Costs		27,000	
Allocated Fixed Costs		33,750	60,750
	Total Costs		1,92,750
	Profit		17,250
	Sales		2,10,000

CALCULATE:

- Profit with 10 percent increase in selling price with a 10 percent reduction in sales volume.
 - Volume to be achieved to maintain the original profit after a 10 percent rise in material costs, at the originally budgeted selling price per unit.
16. An Indian soft drink company is planning to establish a subsidiary company in Bhutan to produce mineral water. Based on the estimated annual sales of 40,000 bottles of the mineral water, cost studies produced the following estimates for the Bhutanese subsidiary:

	Total annual costs	Percent of Total Annual Cost which is variable
Material	2,10,000	100%
Labour	1,50,000	80%
Factory Overheads	92,000	60%
Administration Expenses	40,000	35%

The Bhutanese production will be sold by manufacturer's representatives who will receive a commission of 8% of the sale price. No portion of the Indian office expenses is to be allocated to the Bhutanese subsidiary. You are required to

- (i) COMPUTE the sale price per bottle to enable the management to realize an estimated 10% profit on sale proceeds in Bhutan.
 - (ii) CALCULATE the break-even point in rupees sales as also in number of bottles for the Bhutanese subsidiary on the assumption that the sale price is ₹ 14 per bottle.
17. XYZ Ltd. has a production capacity of 2,00,000 units per year. Normal capacity utilisation is reckoned as 90%. Standard variable production costs are ₹ 11 per unit. The fixed costs are ₹3,60,000 per year. Variable selling costs are ₹ 3 per unit and fixed selling costs are ₹2,70,000 per year. The unit selling price is ₹20.
- In the year just ended on 31st March, the production was 1,60,000 units and sales were 1,50,000 units. The closing inventory on 31st March was 20,000 units. The actual variable production costs for the year were ₹35,000 higher than the standard.
- (i) CALCULATE the profit for the year
 - (a) by absorption costing method and
 - (b) by marginal costing method.
 - (ii) EXPLAIN the difference in the profits.
18. The following are cost data for three alternative ways of processing the clerical work for cases brought before the LC Court System:

	A Manual (₹)	B Semi- Automatic (₹)	C Fully- Automatic (₹)
Monthly fixed costs:			
Occupancy	15,000	15,000	15,000
Maintenance contract	---	5,000	10,000
Equipment lease	---	25,000	1,00,000

Unit variable costs (per report):			
Supplies	40	80	20
Labour	₹200 (5 hrs × ₹40)	₹60 (1 hr × ₹60)	₹20 (0.25 hr × ₹80)

Required:

- (i) CALCULATE cost indifference points. Interpret your results.
 - (ii) If the present case load is 600 cases and it is expected to go up to 850 cases in near future, SELECT most appropriate on cost considerations?
19. XY Ltd. makes two products X and Y, whose respective fixed costs are F_1 and F_2 . You are given that the unit contribution of Y is one-fifth less than the unit contribution of X, that the total of F_1 and F_2 is ₹1,50,000, that the BEP of X is 1,800 units (for BEP of X, F_2 is not considered) and that 3,000 units is the indifference point between X and Y. (i.e. X and Y make equal profits at 3,000 unit volume, considering their respective fixed costs). There is no inventory buildup as whatever is produced is sold.

Required

FIND OUT the values F_1 and F_2 and units contributions of X and Y.

20. Prisha Limited manufactures three different products and the following information has been collected from the books of accounts:

	Products		
	A	B	C
Sales Mix	40%	35%	25%
Selling Price	₹300	₹400	₹200
Variable Cost	₹150	₹200	₹120
Total Fixed Costs	₹18,00,000		
Total Sales	₹60,00,000		

The company has currently under discussion, a proposal to discontinue the manufacture of Product C and replace it with Product E, when the following results are anticipated:

	Products		
	A	B	E
<i>Sales Mix</i>	45%	30%	25%
<i>Selling Price</i>	₹ 300	₹400	₹ 300
<i>Variable Cost</i>	₹ 150	₹200	₹ 150
<i>Total Fixed Costs</i>	₹ 18,00,000		
<i>Total Sales</i>	₹ 64,00,000		

Required:

- (i) *CALCULATE the total contribution to sales ratio and present break-even sales at existing sales mix.*
- (ii) *CALCULATE the total contribution to sales ratio and present break-even sales at proposed sales mix.*
- (iii) *STATE whether the proposed sales mix is accepted or not?*

Case Scenarios

1. *A meeting of the heads of departments of the Arnav Ltd. has been called to review the operating performance of the company in the last financial year. The head of the production department appraised that during the last year the company could operate at 70% capacity level but in the coming financial year 95% capacity level can be achieved if an additional amount of ₹100 Crore on capex and working capital is incurred.*

The head of the finance department has presented that during the last financial year the company had a P/V ratio of 40%, margin of safety and the break-even were ₹50 crore and ₹200 crore respectively.

To the reply to the proposal of increasing the production capacity level to 95%, the head of the finance department has informed that this could be achieved if the selling price and variable cost are reduced by 8% and 5% of sales respectively. Fixed cost will also increase by ₹20 crore due to increased depreciation on additional assets. The additional capital will be arranged at a cost of 15% p.a. from a bank.

In the coming financial year, it has been aimed to achieve an additional profit of ₹10 crore over and above the last year's profit after adjusting the interest cost on the additional capital.

The following points is required to be calculated on urgent basis to put the same in the meeting. You being an assistant to the head of finance, has been asked the followings:

- i. *What will be the revised sales for the coming financial year?*
 - (a) ₹ 322.22 Crore
 - (b) ₹ 311.11 Crore
 - (c) ₹ 300.00 Crore
 - (d) ₹ 324.24 Crore
- ii. *What will be the revised break-even point for the coming financial year?*
 - (a) ₹ 222.22 Crore
 - (b) ₹ 252.22 Crore
 - (c) ₹ 244.44 Crore
 - (d) ₹ 255.56 Crore
- iii. *What will be the revised margin of safety for the coming financial year?*
 - (a) ₹ 100 Crore
 - (b) ₹ 58.89 Crore
 - (c) ₹ 55.56 Crore
 - (d) ₹ 66.66 Crore
- iv. *The profit of the last year and for the coming year are:*
 - (a) ₹ 50 Crore & ₹ 95 Crore respectively
 - (b) ₹ 20 Crore & ₹ 65 Crore respectively
 - (c) ₹ 20 Crore & ₹ 30 Crore respectively
 - (d) ₹ 45 Crore & ₹ 66.66 Crore respectively

v. The total cost of the last year and for the coming year are:

- (a) ₹ 230 Crore & ₹292.22
- (b) ₹ 230 Crore & ₹275 Crore
- (c) ₹ 220 Crore & ₹282.22 Crore
- (d) ₹ 220 Crore & ₹292.22 Crore

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(b)	2.	(c)	3.	(b)	4.	(c)	5.	(a)	6.	(b)
7.	(c)	8.	(d)	9.	(c)	10.	(b)				

Answers to the Theoretical Questions

1. Please refer paragraph 8
2. Please refer paragraph 12
3. Please refer paragraph 7
4. Please refer paragraph 3
5. Please refer paragraph 5
6. Please refer paragraph 10

Answers to the Practical Problems

1. Variable Cost = 100 – P/V Ratio
= 100 – 60 = 40

If Variable cost is 40, then selling price = 100

If Variable cost is 20, then selling price = $(100/40) \times 20 = ₹ 50$

2. Variable cost to sales = 70%, Contribution to sales = 30%,
Or P/V Ratio 30%

We know that: $BES \times P/V \text{ Ratio} = \text{Fixed Cost}$

$$BES \times 0.30 = ₹ 90,000$$

Or $BES = ₹ 3,00,000$

It is given that break-even occurs at 60% capacity.

$$\text{Capacity sales} = ₹ 3,00,000 \div 0.60 = ₹ 5,00,000$$

Computation of profit of 75% Capacity

$$75\% \text{ of capacity sales (i.e. } ₹ 5,00,000 \times 0.75) = ₹ 3,75,000$$

$$\begin{aligned} \text{Less: Variable cost (i.e. } ₹ 3,75,000 \times 0.70) &= ₹ 2,62,500 \\ &= ₹ 1,12,500 \end{aligned}$$

$$\text{Less: Fixed Cost} = ₹ \underline{90,000}$$

$$\text{Profit} = ₹ \underline{22,500}$$

3. (i) We know that: $B.E. \text{ Sales} \times P/V \text{ Ratio} = \text{Fixed Cost}$

$$\text{or } ₹ 1,60,000 \times P/V \text{ ratio} = ₹ 40,000$$

$$P/V \text{ ratio} = 25\%$$

We also know that $\text{Sales} \times P/V \text{ Ratio} = \text{Fixed Cost} + \text{Profit}$

$$\text{or } ₹ 2,00,000 \times 0.25 = ₹ 40,000 + \text{Profit}$$

$$\text{or Profit} = ₹ 10,000$$

(ii) Again $B.E. \text{ Sales} \times P/V \text{ ratio} = \text{Fixed Cost}$

$$\text{or } ₹ 40,000 \times P/V \text{ Ratio} = ₹ 20,000$$

$$\text{or } P/V \text{ ratio} = 50\%$$

We also know that: $\text{Sales} \times P/V \text{ ratio} = \text{Fixed Cost} + \text{Profit}$

$$\text{or } \text{Sales} \times 0.50 = ₹ 20,000 + ₹ 10,000$$

$$\text{or Sales} = ₹ 60,000.$$

$$\begin{aligned} 4. \quad P/V \text{ Ratio} &= \frac{\text{Contribution}}{\text{Sales}} \times 100 \\ &= [(15 - 12)/15] \times 100 \end{aligned}$$

$$= (3/15) \times 100 = 20\%$$

$$\begin{aligned}\text{Marginal of Safety} &= \text{Profit} \div \text{P/V Ratio} \\ &= 50,000 \div 20\% = ₹ 2,50,000\end{aligned}$$

$$5. \quad (a) \quad \text{Total Sales} = 2,40,000 \times \frac{100}{40} = ₹ 6,00,000$$

$$\text{Contribution} = 6,00,000 \times 30\% = ₹ 1,80,000$$

$$\text{Profit} = \text{M/S} \times \text{P/V ratio} = 2,40,000 \times 30\% = ₹ 72,000$$

$$\begin{aligned}\text{Fixed cost} &= \text{Contribution} - \text{Profit} \\ &= 1,80,000 - 72,000 = ₹ 1,08,000\end{aligned}$$

$$(1) \quad \text{Break-even Sales} = \frac{\text{Fixed Cost}}{\text{P/V ratio}} = \frac{1,08,000}{30\%} = ₹ 3,60,000$$

$$\begin{aligned}(2) \quad \text{Profit} &= (\text{Sales} \times \text{P/V ratio}) - \text{Fixed cost} \\ &= (9,00,000 \times 30\%) - 1,08,000 = ₹ 1,62,000\end{aligned}$$

$$(b) \quad \text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{2,00,000}{8,00,000} = 25\%$$

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P/V ratio}} = \frac{1,50,000}{25\%} = ₹ 6,00,000$$

Alternatively:

$$\begin{aligned}\text{Fixed cost} &= \text{Contribution} - \text{Profit} \\ &= ₹ 2,00,000 - ₹ 1,50,000 = ₹ 50,000\end{aligned}$$

$$\text{B.E. Point} = ₹ 50,000 \div 25\% = ₹ 2,00,000$$

$$\begin{aligned}\text{Margin of Safety} &= \text{Actual sales} - \text{B.E. sales} \\ &= 8,00,000 - 2,00,000 = 6,00,000\end{aligned}$$

$$6. \quad \text{We know that } S - V = F + P$$

$$\therefore \quad \text{Suppose variable cost} = x, \text{ Fixed Cost} = y$$

In first situation:

$$15 \times 8,000 - 8,000x = y - 40,000 \quad (1)$$

In second situation:

$$15 \times 20,000 - 20,000x = y + 80,000 \quad (2)$$

$$\text{or, } 1,20,000 - 8,000x = y - 40,000 \quad (3)$$

$$3,00,000 - 20,000x = y + 80,000 \quad (4)$$

From (3) & (4) we get $x = ₹ 5$, Variable cost per unit = ₹ 5

Putting this value in 3rd equation:

$$1,20,000 - (8,000 \times 5) = y - 40,000$$

$$\text{or, } y = ₹ 1,20,000$$

$$\text{Fixed Cost} = ₹ 1,20,000$$

$$\text{P/V ratio} = \frac{S - V}{S} = \frac{15 - 5}{15} \times 100 = \frac{200}{3} = 66 \frac{2}{3} \%$$

Suppose break-even sales = x

$$15x - 5x = 1,20,000 \quad (\text{at BEP, contribution will be equal to fixed cost})$$

$$x = 12,000 \text{ units.}$$

$$\begin{aligned} \text{or, Break-even sales in units} &= 12,000, \text{ Break-even sales in Value} \\ &= 12,000 \times 15 = ₹ 1,80,000. \end{aligned}$$

7.

	Sales	Profit
Year 2021-22	₹ 1,20,000	8,000
Year 2022-23	₹ 1,40,000	13,000
Difference	₹ 20,000	5,000

$$(i) \quad \text{P/V Ratio} = \frac{\text{Difference in profit}}{\text{Difference in Sales}} \times 100 = \frac{5,000}{20,000} \times 100 = 25\%$$

(₹)

Contribution in 2021-22 ($1,20,000 \times 25\%$) 30,000Less: Profit 8,000Fixed Cost* 22,000

*Contribution = Fixed cost + Profit

 $\therefore$ Fixed cost = Contribution - Profit

(ii) Break-even point = $\frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{22,000}{25\%} = ₹ 88,000$

(iii) Profit when sales are ₹1,80,000 (₹)

Contribution ($₹1,80,000 \times 25\%$) 45,000Less: Fixed cost 22,000Profit 23,000

(iv) Sales to earn a profit of ₹12,000

$$\frac{\text{Fixed cost} + \text{Desired profit}}{\text{P/V ratio}} = \frac{22,000 + 12,000}{25\%} = ₹1,36,000$$

(v) Margin of safety in 2022-23 –

Margin of safety = Actual sales – Break-even sales

= $1,40,000 - 88,000 = ₹ 52,000$.

8. N = 18,000 units

O = 9,000 units

Ratio (N : O) = 2:1

Let

t = No. of units of 'O' for BEP

2t = No. of units of 'N' for BEP

Contribution of 'N' = ₹ 10.5 per unit

Contribution of 'O' = ₹ 9 per unit

At Break Even Point:

$$\Rightarrow 10.5 \times (2t) + 9 \times t - 15,000 = 0$$

$$\Rightarrow 30t = 15,000$$

$$\Rightarrow t = 500 \text{ units}$$

$$\text{BEP of 'N'} = 2t$$

$$= 1,000 \text{ units}$$

$$\text{BEP of 'O'} = t = 500 \text{ units}$$

9.

Particulars		(₹)
Suppose sales		100
Variable cost		<u>60</u>
Contribution		<u>40</u>
P/V ratio		40%
Fixed cost		= ₹ 80,000
(i)	Break-even point = Fixed Cost ÷ P/V ratio = $80,000 \div 40\%$ or ₹ <u>2,00,000</u>	
(ii)	15% return on ₹ 2,00,000	30,000
	Fixed Cost	<u>80,000</u>
	Contribution required	<u>1,10,000</u>
	Sales volume required = $\text{₹ } 1,10,000 \div 40\%$ or ₹ 2,75,000	
(iii)	Avoidable fixed cost if business is locked up = ₹ 80,000 - ₹ 25,000 = ₹ 55,000	
	Minimum sales required to meet this cost: $\text{₹ } 55,000 \div 40\%$ or ₹ 1,37,500	

Mr. X will be better off by locking his business up, if the sale is less than ₹ 1,37,500

10. (i) In the First half year:

$$\begin{aligned}\text{Contribution} &= \text{Fixed cost} + \text{Profit} \\ &= 4,50,000 + 3,00,000 = ₹ 7,50,000\end{aligned}$$

$$\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{7,50,000}{15,00,000} \times 100 = 50\%$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{4,50,000}{50\%} \times 100 = ₹ 9,00,000$$

$$\begin{aligned}\text{Margin of safety} &= \text{Actual sales} - \text{Break-even point} \\ &= 15,00,000 - 9,00,000 = ₹ 6,00,000\end{aligned}$$

(ii) In the second half year:

$$\begin{aligned}\text{Contribution} &= \text{Fixed cost} - \text{Loss} \\ &= 4,50,000 - 1,50,000 = ₹ 3,00,000\end{aligned}$$

$$\text{Expected sales volume} = \frac{\text{Fixed cost} - \text{Loss}}{\text{P/V ratio}} = \frac{3,00,000}{50\%} = ₹ 6,00,000$$

(iii) For the whole year:

$$\text{B.E. point} = \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{4,50,000 \times 2}{50\%} = ₹ 18,00,000$$

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P/V ratio}} = \frac{3,00,000 - 1,50,000}{50\%} = ₹ 3,00,000.$$

$$\begin{aligned}\text{11. Margin of Safety (\%)} &= \frac{3,750\text{units}}{3,750\text{units}+1,250\text{units}} \\ &= 75\%\end{aligned}$$

$$\text{Total Sales} = \frac{₹1,87,500}{0.75} = ₹ 2,50,000$$

$$\begin{aligned}\text{Profit} &= \text{Total Sales} - \text{Total Cost} \\ &= ₹ 2,50,000 - ₹ 1,93,750 = ₹ 56,250\end{aligned}$$

$$\begin{aligned}
 \text{P/V Ratio} &= \frac{\text{Profit}}{\text{Margin of Safety (₹)}} \times 100 \\
 &= \frac{₹56,250}{₹1,87,500} \times 100 = 30\% \\
 \text{Break-even Sales} &= \text{Total Sales} \times [100 - \text{Margin of Safety \%}] \\
 &= ₹ 2,50,000 \times 0.25 = ₹ 62,500 \\
 \text{Fixed Cost} &= \text{Sales} \times \text{P/V Ratio} - \text{Profit} \\
 &= ₹ 2,50,000 \times 0.30 - ₹ 56,250 = ₹ 18,750
 \end{aligned}$$

12. (i) Profit earned in 2021-22:

Particulars	(₹)
Total contribution (50,000 × ₹ 12)	6,00,000
Less: Fixed cost	<u>3,60,000</u>
Profit	<u>2,40,000</u>
Selling price to be fixed in 2022-23:	
Revised variable cost (₹ 48 × 1.10)	52.80
Revised fixed cost (3,60,000 × 1.05)	3,78,000
P/V Ratio (Same as of 2021-22)	20%
Variable cost ratio to selling price	80%

Therefore, revised selling price per unit = ₹ 52.80 ÷ 80% = ₹ 66

(ii) No. of units to be produced and sold in 2022-23 to earn the same profit:

We know that Fixed Cost plus profit =	Contribution
	(₹)
Profit in 2021-22	2,40,000
Fixed cost in 2022-23	<u>3,78,000</u>
Desired contribution in 2022-23	<u>6,18,000</u>

$$\begin{aligned}\text{Contribution per unit} &= \text{Selling price per unit} - \text{Variable cost per unit.} \\ &= ₹ 60 - ₹ 52.80 = ₹ 7.20.\end{aligned}$$

No. of units to be produced in 2022-23 = ₹ 6,18,000 ÷ ₹ 7.20 = 85,834 units.

Workings:

1. PV Ratio in 2021-22

	(₹)
Selling price per unit	60
Variable cost (80% of Selling Price)	<u>48</u>
Contribution	<u>12</u>
P/V Ratio	20%

2. No. of units sold in 2021-22

$$\begin{aligned}\text{Break-even point} &= \text{Fixed cost} \div \text{Contribution per unit} \\ &= ₹ 3,60,000 \div ₹ 12 = 30,000 \text{ units.}\end{aligned}$$

Margin of safety is 40%. Therefore, break-even sales will be 60% of units sold.

$$\begin{aligned}\text{No. of units sold} &= \text{Break-even point in units} \div 60\% \\ &= 30,000 \div 60\% = 50,000 \text{ units.}\end{aligned}$$

13. (a) Contribution = S – V = ₹ 200 – ₹ 100 = ₹ 100 per unit.

$$\text{B.E. Point} = \frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{40,00,000}{₹100} = 40,000 \text{ unit}$$

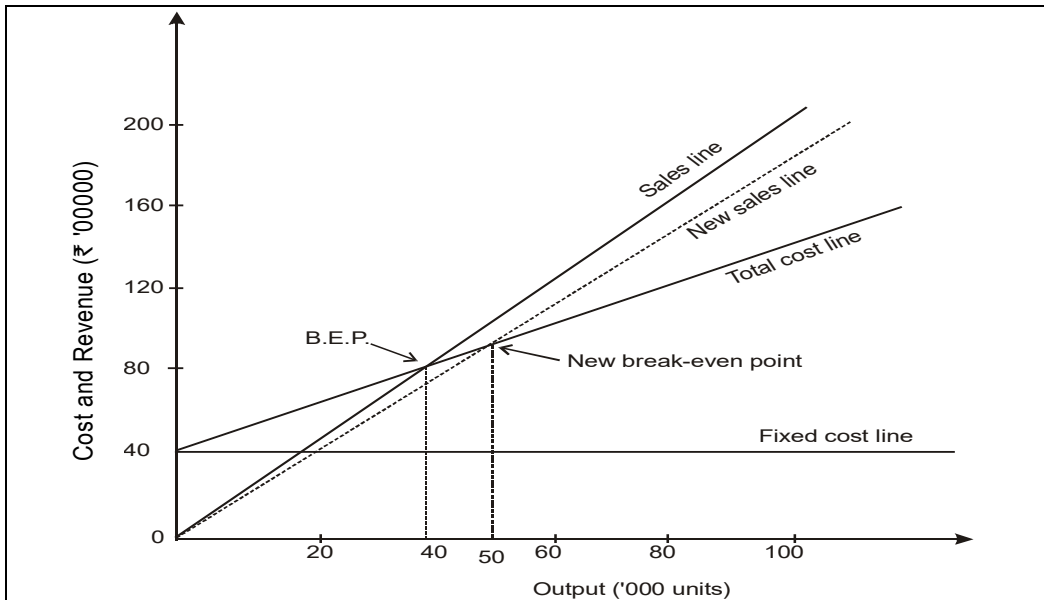
- (b) When selling price is reduced

$$\text{New selling price} = ₹ 180$$

$$\text{New Contribution} = ₹ 180 - ₹ 100 = ₹ 80 \text{ per unit.}$$

$$\text{New B.E. Point} = \frac{₹40,00,000}{₹ 80} = 50,000 \text{ units.}$$

The break-even chart is shown below:



14. Calculation of P/V Ratio (₹' 000)

	Sales	Profit
North : Actual	1,100	135
<i>Add : Under budgeted</i>	<u>400</u>	<u>180</u>
Budgeted	<u>1,500</u>	<u>315</u>

$$\text{P/V ratio} = \frac{\text{Difference in Profit}}{\text{Difference in Sales}} = \frac{315 - 135}{1,500 - 1,100} = \frac{180}{400} \times 100 = 45\%$$

(₹ '000)

	Sales	Profit
East : Actual	1,450	210
<i>Less : Over budgeted</i>	<u>(150)</u>	<u>(90)</u>
Budgeted	<u>1,300</u>	<u>120</u>

$$\text{P/V ratio} = \frac{90}{150} \times 100 = 60\%$$

(₹' 000)

	Sales	Profit
South : Actual	1,200	330
<i>Add: Under budgeted</i>	<u>200</u>	<u>110</u>
Budgeted	<u>1,400</u>	<u>440</u>

$$\text{P/V ratio} = \frac{110}{200} \times 100 = 55\%$$

(i) Calculation of fixed cost

Fixed Cost = (Actual sales × P/V ratio) – Profit

$$\text{North} = (1,100 \times 45\%) - 135 = 360$$

$$\text{East} = (1,450 \times 60\%) - 210 = 660$$

$$\text{South} = (1,200 \times 55\%) - 330 = \underline{330}$$

$$\text{Total Fixed Cost} = \underline{1,350}$$

(ii) Calculation of break-even sales (in ₹' 000)

$$\text{B.E. Sales} = \frac{\text{Fixed Cost}}{\text{P/V ratio}}$$

$$\text{North} = \frac{360}{45\%} = 800$$

$$\text{East} = \frac{660}{60\%} = 1,100$$

$$\text{South} = \frac{330}{55\%} = \underline{600}$$

$$\text{Total} = \underline{2,500}$$

15. (i) Budgeted selling price = 2,10,000 lakhs/ 40,000 units = ₹5,25,000 per unit.

Budgeted variable cost = 1,32,000 lakhs/ 40,000 units = ₹ 3,30,000 per unit.

Increased selling price = ₹5,25,000 + 10% = ₹ 5,77,500 per unit

New volume 40,000 – 10% = 36,000 units

Statement of Calculation of Profit:

	(₹ In lakhs)
Sales 36,000 units at ₹ 5,77,500 =	2,07,900
Less: Variable cost: 36,000 × ₹3,30,000 =	<u>1,18,800</u>
Contribution	89,100
Less: fixed costs	<u>60,750</u>
Profit	<u>28,350</u>

- (ii) Budgeted Material Cost = 79,200 Lakhs/ 40,000 Units = ₹1,98,000 per Unit

Increased material cost = ₹1,98,000×110% =	2,17,800
Labour cost 15,600 lakhs/ 40,000 units =	39,000
Direct expenses, 37,200 lakhs/ 40,000 units =	<u>93,000</u>
Variable cost per unit	3,49,800
Budgeted selling price per unit	<u>5,25,000</u>
Contribution per unit (5,25,000 – 3,49,800)	<u>1,75,200</u>

$$\text{Sales volume} = \frac{\text{Fixed costs} + \text{Profit}}{\text{Contribution Per Unit}} = \frac{60,750 \text{ lakhs} + 17,250 \text{ lakhs}}{₹ 1.752 \text{ lakhs}}$$

= 44,521 units are to be sold to maintain the original profit of ₹ 17,250 lakhs.

16. (i) Computation of Sale Price Per Bottle

Output: 40,000 Bottles

Particulars	(₹)
Variable Cost:	
Material	2,10,000
Labour (₹1,50,000 × 80%)	1,20,000
Factory Overheads (₹92,000 × 60%)	55,200
Administrative Overheads (₹40,000 × 35%)	14,000

Commission (8% on ₹6,00,000) (W.N.-1)	48,000
Fixed Cost:	
Labour (₹1,50,000 × 20%)	30,000
Factory Overheads (₹92,000 × 40%)	36,800
Administrative Overheads (₹40,000 × 65%)	26,000
Total Cost	5,40,000
Profit (W.N.-1)	60,000
Sales Proceeds (W.N.-1)	6,00,000
Sales Price <i>per bottle</i> $\left(\frac{₹6,00,000}{40,000 \text{ Bottles}} \right)$	15

(ii) Calculation of Break-even Point

$$\text{Sales Price per Bottle} = ₹14$$

$$\text{Variable Cost per Bottle} = \frac{₹4,44,000 \text{ (W.N.-2)}}{40,000 \text{ Bottles}} = ₹11.10$$

$$\text{Contribution per Bottle} = ₹14 - ₹11.10 = ₹2.90$$

Break -even Point:

$$\text{(in number of Bottles)} = \frac{\text{Fixed Costs}}{\text{Contribution per Bottle}}$$

$$= \frac{₹92,800}{₹2.90} = 32,000 \text{ Bottles}$$

$$\text{(in Sales Value)} = 32,000 \text{ Bottles} \times ₹14$$

$$= ₹4,48,000$$

Working Note**W.N.-1**

Let the Sales Price be 'x'

$$\text{Commission} = \frac{8x}{100}$$

$$\begin{aligned}
 \text{Profit} &= \frac{10x}{100} \\
 x &= 4,92,000 + \frac{8x}{100} + \frac{10x}{100} \\
 100x - 8x - 10x &= 4,92,00,000 \\
 82x &= 4,92,00,000 \\
 x &= 4,92,00,000 / 82 = ₹6,00,000
 \end{aligned}$$

W.N.-2

Total Variable Cost	(₹)
Material	2,10,000
Labour	1,20,000
Factory Overheads	55,200
Administrative Overheads	14,000
Commission [(40,000 Bottles × ₹14) × 8%]	44,800
	4,44,000

17. Income Statement (Absorption Costing) for the year ending 31st March

	(₹)	(₹)
Sales (1,50,000 units @ ₹20)		<u>30,00,000</u>
Production Costs:		
Variable (1,60,000 units @ ₹11)	17,60,000	
Add: Increase	<u>35,000</u>	17,95,000
Fixed (1,60,000 units @ ₹2*)		<u>3,20,000</u>
Cost of Goods Produced		21,15,000
Add: Opening stock (10,000 units @ ₹13)*		<u>1,30,000</u>
		22,45,000

Less: Closing stock $\left(\frac{₹ 21,15,000}{1,60,000 \text{ units}} \times 20,000 \text{ units} \right)$		<u>2,64,375</u>
Cost of Goods Sold		19,80,625
Add: Under absorbed fixed production overhead (3,60,000 – 3,20,000)		<u>40,000</u>
		20,20,625
Add: Non-production costs:		
Variable selling costs (1,50,000 units @ ₹3)		4,50,000
Fixed selling costs		<u>2,70,000</u>
Total cost		<u>27,40,625</u>
Profit (Sales – Total Cost)		<u>2,59,375</u>

*** Working Notes:**

1. Fixed production overhead is absorbed at a pre-determined rate based on normal capacity, i.e. $₹3,60,000 \div 1,80,000 \text{ units} = ₹ 2$.
2. Opening stock is 10,000 units, i.e., 1,50,000 units + 20,000 units – 1,60,000 units. It is valued at ₹13 per unit, i.e., ₹11 + ₹2 (Variable + fixed).

**Income Statement (Marginal Costing) for the year ended
31st March**

	(₹)	(₹)
Sales (1,50,000 units @ ₹20)		<u>30,00,000</u>
Variable production cost (1,60,000 units @ ₹11 + ₹35,000)		17,95,000
Variable selling cost (1,50,000 units @ ₹3)		<u>4,50,000</u>
		22,45,000
Add: Opening Stock (10,000 units @ ₹11)		<u>1,10,000</u>
		23,55,000
Less: Closing stock $\left(\frac{₹17,95,000}{1,60,000 \text{ units}} \times 20,000 \text{ units} \right)$		<u>2,24,375</u>

Variable cost of goods sold		<u>21,30,625</u>
Contribution (Sales – Variable cost of goods sold)		<u>8,69,375</u>
Less: Fixed cost – Production	3,60,000	
– Selling	<u>2,70,000</u>	<u>6,30,000</u>
Profit		<u>2,39,375</u>

Reasons for Difference in Profit:	(₹)
Profit as per absorption costing	2,59,375
Add: Op. stock under –valued in marginal costing (₹1,30,000 – 1,10,000)	<u>20,000</u>
	2,79,375
Less: Cl. Stock under –valued in marginal closing (₹2,64,375 – 2,24,375)	<u>40,000</u>
Profit as per marginal costing	<u>2,39,375</u>

18. (i) Cost Indifference Point

	A and B	A and C	B and C
	(₹)	(₹)	(₹)
Differential Fixed Cost (I)	₹30,000	₹1,10,000	₹80,000
	(₹45,000 – ₹15,000)	(₹1,25,000 – ₹15,000)	(₹1,25,000 – ₹45,000)
Differential Variable Costs (II)	₹100	₹200	₹100
	(₹240 – ₹140)	(₹240 – ₹40)	(₹140 – ₹40)
Cost Indifference Point (I/II)	300	550	800
(Differential Fixed Cost / Differential Variable Costs <i>per case</i>)	Cases	Cases	Cases

Interpretation of Results

At activity level below the indifference points, the alternative with lower fixed costs and higher variable costs should be used. At activity level

above the indifference point alternative with higher fixed costs and lower variable costs should be used.

No. of Cases	Alternative to be Chosen
Cases $\leq$ 300	Alternative 'A'
300 $\geq$ Cases $\leq$ 800	Alternative 'B'
Cases $\geq$ 800	Alternative 'C'

- (ii) Present case load is 600. Therefore, alternative B is suitable. As the number of cases is expected to go upto 850 cases, alternative C is most appropriate.

19. Let C_x be the Contribution per unit of Product X.

Therefore, Contribution per unit of Product Y $= C_y = 4/5 C_x = 0.8 C_x$

Given $F_1 + F_2 = 1,50,000$,

$F_1 = 1,800 C_x$ (Break even Volume $\times$ Contribution per unit)

Therefore, $F_2 = 1,50,000 - 1,800 C_x$.

$3,000 C_x - F_1 = 3,000 \times 0.8 C_x - F_2$ or $3,000 C_x - F_1 = 2,400 C_x - F_2$ (Indifference Point)

i.e., $3,000 C_x - 1,800 C_x = 2,400 C_x - 1,50,000 + 1,800 C_x$

i.e., $3,000 C_x = 1,50,000$, Therefore, $C_x = ₹ 50/-$ ($1,50,000 / 3,000$)

Therefore, Contribution per unit of X $= ₹ 50$

Fixed Cost of X $= F_1 = ₹ 90,000$ ($1,800 \times 50$)

Therefore, Contribution per unit of Y is $₹ 50 \times 0.8 = ₹ 40$ and

Fixed Cost of Y $= F_2 = ₹ 60,000$ ($1,50,000 - 90,000$)

The Value of $F_1 = ₹ 90,000$, $F_2 = ₹ 60,000$ and $X = ₹ 50$ and $Y = ₹ 40$

20. (i) **Calculation of Contribution to sales ratio at existing sales mix:**

	Products			Total
	A	B	C	
Selling Price (₹)	300	400	200	
Less: Variable Cost (₹)	150	200	120	

Contribution per unit (₹)	150	200	80	
P/V Ratio	50%	50%	40%	
Sales Mix	40%	35%	25%	
Contribution per rupee of sales (P/V Ratio × Sales Mix)	20%	17.5%	10%	47.5%
Present Total Contribution (₹ 60,00,000 × 47.5%)				₹ 28,50,000
Less: Fixed Costs				₹ 18,00,000
Present Profit				₹ 10,50,000
Present Break-Even Sales (₹ 18,00,000/0.475)				₹ 37,89,473.68

(ii) Calculation of Contribution to sales ratio at proposed sales mix:

	Products			Total
	A	B	E	
Selling Price (₹)	300	400	300	
Less: Variable Cost (₹)	150	200	150	
Contribution per unit (₹)	150	200	150	
P/V Ratio	50%	50%	50%	
Sales Mix	45%	30%	25%	
Contribution per rupee of sales (P/V Ratio × Sales Mix)	22.5%	15%	12.5%	50%
Proposed Total Contribution (₹ 64,00,000 × 50%)				₹ 32,00,000
Less: Fixed Costs				₹ 18,00,000
Proposed Profit				₹ 14,00,000
Proposed Break-Even Sales (₹ 18,00,000/0.50)				₹ 36,00,000

- (iii)** The proposed sales mix increases the total contribution to sales ratio from 47.5% to 50% and the total profit from ₹ 10,50,000 to ₹ 14,00,000. Thus, the proposed sales mix should be accepted.

Answers To The Case Scenarios

1.

i.	(a)	ii.	(d)	iii.	(d)	iv.	(c)	v.	(a)

$$\begin{aligned} \text{i. a Revised Sale} &= \frac{\text{Revised Fixed Cost} + \text{Expected Profit}}{\text{P / V Ratio}} \\ &= \{₹115 + (20+10)\} \div 45\% = ₹ 322.22 \text{ crores} \end{aligned}$$

$$\begin{aligned} \text{ii. d Revised Break – even Point} &= \frac{\text{Fixed Cost}}{\text{P / V Ratio}} \\ &= ₹115 \text{ Crore} \div 45\% = ₹255.56 \text{ Crore (Refer working notes)} \end{aligned}$$

$$\begin{aligned} \text{iii. d Revised Margin of Safety} &= \text{Revised Sales} - \text{Revised Break-even Sales} \\ &= ₹ 322.22 \text{ Crores} - ₹ 255.56 \text{ Crores} = ₹ 66.66 \text{ Crores.} \end{aligned}$$

$$\text{iv. c ₹ 20 Crore \& ₹30 Crore respectively (Refer working note)}$$

$$\begin{aligned} \text{v. a Total cost in last year} &= ₹230 \text{ Crore} \\ \text{Total cost in coming year} &= \text{Variable Cost} + \text{Fixed Cost} \\ &= \text{Revised sales} \times 55\% + 115 \text{ Crore} \\ &= ₹ 322.22 \text{ Crore} \times 55\% + ₹ 115 \text{ Crore} = ₹ 292.22 \text{ Crore} \end{aligned}$$

Working Note

Present Sales and Profit

$$\begin{aligned} \text{Total Sales} &= \text{Break – even Sales} + \text{Margin of Safety} \\ &= ₹ 200 \text{ Crores} + ₹ 50 \text{ Crores} \\ &= ₹ 250 \text{ Crores} \\ \text{P/V Ratio} &= 40\% \\ \text{Variable Cost} &= 60\% \text{ of Sales} \\ &= ₹ 250 \text{ Crores} \times 60\% \\ &= ₹ 150 \text{ Crores} \end{aligned}$$

$$\begin{aligned}
 \text{Fixed Cost} &= \text{Break – even Sales} \times \text{P/V Ratio} \\
 &= ₹ 200 \text{ Crores} \times 40\% \\
 &= ₹ 80 \text{ Crores} \\
 \text{Total Cost} &= ₹ 150 \text{ Crores} + ₹ 80 \text{ Crores} \\
 &= ₹ 230 \text{ Crores} \\
 \text{Profit} &= \text{Total Sales} - \text{Total Cost} \\
 &= ₹ 250 \text{ Crores} - ₹ 230 \text{ Crores} \\
 &= ₹ 20 \text{ Cores}
 \end{aligned}$$

Revised Sales	(₹ in Crores)
Present Fixed Cost	80.00
Increase in Fixed Cost	20.00
Interest at 15 <i>per cent</i> on Additional Capital (₹100Crores × 15%)	15.00
Total Revised Fixed Cost (in crore)	115.00
Assuming that the Present Selling Price is ₹ 100	
Revised Selling Price will be (8% Less)	92.00
New Variable Cost (Reduced from 60% to 55%) of Sales (₹ 92 × 55%)	50.60
Contribution (₹ 92.00 – ₹ 50.60)	41.40

$$\begin{aligned}
 \text{New P / V Ratio} &= \frac{₹ 41.40}{₹ 92.00} \times 100 \\
 &= 45\%
 \end{aligned}$$

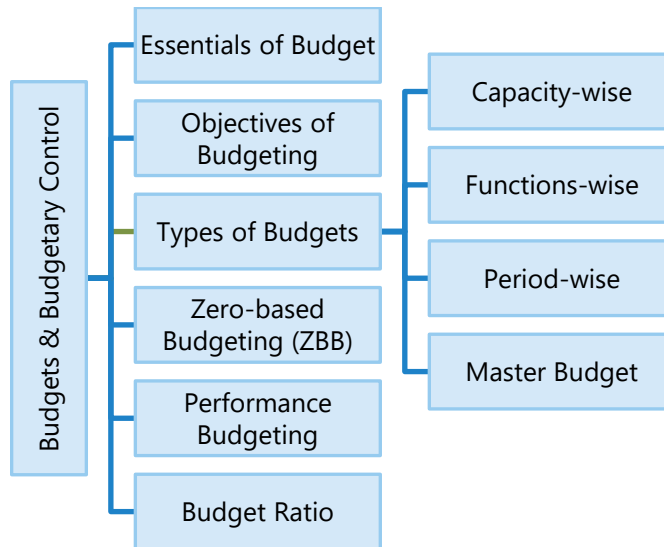
BUDGETS & BUDGETARY CONTROL



LEARNING OUTCOMES

- ◆ State the meaning of budget and budgetary control
- ◆ Essentials of budget.
- ◆ Discuss the objectives and importance of budget and budgetary control.
- ◆ Describe the process of preparing budgets.
- ◆ State the motivation in budget process.
- ◆ List the different types of budgets.
- ◆ Differentiate between fixed and flexible budget.
- ◆ Prepare fixed and flexible budget.

CHAPTER OVERVIEW



1. INTRODUCTION

An organization has its long-term objectives to achieve. The objectives are broken down into achievable goals and targets. When these goals and targets are translated into business plans, it is necessary to express the plans into quantifiable terms to make it achievable. Budget is a commonly used business language that expresses the business plans in quantifiable terms. When the targets are monitored and compared with the actual results with the objective to narrow down the deviations, make participants responsible and implement the preventive and corrective actions, is known as budgetary control.

Meaning of Budget and Budgeting

Budget: A budget is an instrument of management used as an aid in the planning, programming and control of business activity. The Chartered Institute of Management Accountants (CIMA), UK defines budget as "A financial and/or quantitative statement, prepared and approved prior to a defined period of time of the policy to be pursued during that period for the purpose of attaining a given objective. It may include income, expenditure and employment of capital" The budget is a blue-print of the projected plan of action expressed in quantitative terms for a specified period of time.

Budget and Forecast

There is some similarity between the budget and forecast as both relate to a defined period of time. A forecast is an assessment of probable future events. Budget a financial/quantitative plan of a business enterprise to be pursued over a period of time. Therefore, at the planning stage it is necessary to forecast a probable course of action for the business. Budget is a commitment or a target which the management seeks to attain on the basis of the forecasts made. Forecasts are made regarding sales, production cost and financial requirements of the business. A forecast denotes some degree of flexibility while a budget denotes a definite target.

Budgeting: Budgeting is the process of designing, implementing and operating of budget. The main emphasis in budgeting process is the provision of resources to support plans which are being implemented. It is a means of coordinating the combined intelligence of an entire organisation into a plan of action based on past performance and governed by rational judgment of factors that will influence the course of business in the future.

2. ESSENTIAL CHARACTERISTICS OF BUDGET

The main characteristics of budget are as follows:

1. A budget is concerned for a definite future period.
2. A budget is a written document.
3. A budget is a detailed plan of all the economic activities of a business.
4. All the departments of a business unit should co-operate for the preparation of a business budget.
5. Budget is a means to achieve business objectives and it is not an end in itself.
6. Budget needs to be updated, corrected and controlled every time circumstances change. Therefore, it is a continuous process.
7. Budget helps in planning, coordination and control.
8. Different types of budgets are prepared by industries according to business requirements.

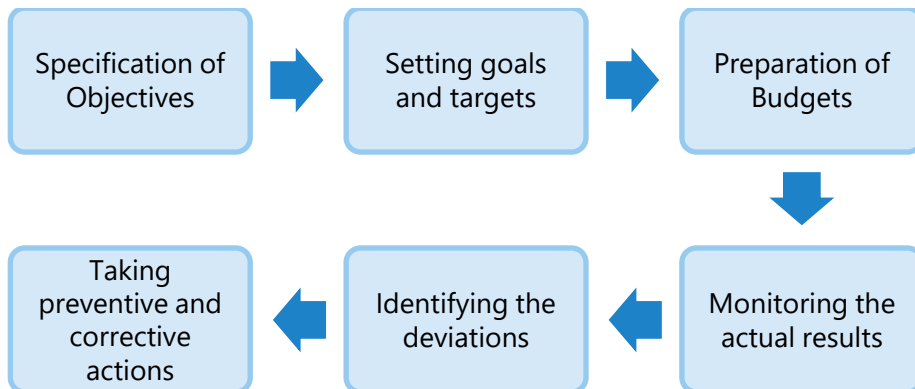
9. A budget acts as a business barometer.
10. Budget is usually prepared in the light of past experiences.
11. Budget is a constant endeavour of the Management.



3. ESSENTIAL STEPS FOR PREPARING BUDGET

Essential steps for preparing a budget are as follows:

1. Organisational structure must be clearly defined and responsibility should be assigned to identifiable units within the organisation.
2. Setting of clear objectives and reasonable targets. Objectives should be in consonance with the long-term plan of the organisation.
3. Objectives and responsibility should be clearly stated and communicated to the management or person responsible.
4. Budgets are prepared for the future periods based on expected course of actions.
5. Budgets are updated for the events that were not kept into the mind while establishing budgets. Hence, budgets should be flexible enough for mid-term revision.
6. The entire organisation must be committed to the preparation and implementing budgeting.
7. Budgets should be quantifiable and master budget should be broken down into various functional budgets.
8. Budgets should be monitored periodically. Variances of the actual outcomes should be compared with the actuals and variances analysed and responsibility should be fixed.
9. Budgetary performance needs to be linked effectively to the reward system.



4. OBJECTIVES OF BUDGETING



Planning

Planning is the beginning of any activity. Planning establishes the objectives of the firm and decides the course of action to achieve it. It is concerned with formulating short-term and long-term plans to achieve a particular end. Planning is a statement of what should be done, how it should be done and when it should be done. The process of preparing budget begins with the establishment of specific targets of performance and is followed by devising plans to achieve such desired goals. These targets include both the overall business targets as well as the specific targets for the individual units within the business. Establishing specific targets for future operations is part of the planning function of management, while executing actions to meet the goals is the directing function of management. It may be explained as

- Budget is prepared in synchronisation with the overall objectives of the organisation, keeping mission and corporate strategy into account. Individual plans at unit level should be in consonance with organisational plan.
- Budget reflects plans. Therefore, planning should precede the preparation of budget.
- Budgeted plans are quantified and responsibility is assigned to the persons who are responsible for execution of plan.

- Communication of business objectives through budget has helped many a company to reduce expenses during business recession.
- Planning not only motivates employees to attain goals but also improves overall decision making. During the planning phase of the budget process, all viewpoints are considered, options identified, and cost reduction opportunities assessed. This process may reveal opportunities or threats that were not known prior to the budget planning process.

Directing and Coordinating

- Once the budget plans are in place, these can be used to direct and coordinate operations in order to achieve the stated targets.
- A business, however, is much more complex and requires more formal direction and coordination.
- **The budget offers an important tool to direct and coordinate business activities and units to achieve stated targets of performance.**
- The budgetary units in an organisation are called responsibility centers. Each responsibility center is led by a manager who has the authority over and responsibility for the unit's performance.
- Objectives of each responsibility centre and degree of performance expected from them are separately communicated.

Controlling

- Control is the process of monitoring, measuring, evaluating and correcting actual results to ensure that a firm's goals and plans are achieved. Control is achieved through the process of feedback.
- As time passes, **the actual performance of an operation can be compared against the planned targets. This provides prompt feedback to employees about their performance.** If necessary, employees can use such feedback to fine-tune their activities in the future.
- Feedback received in the form of budget report from the responsibility centre is helpful to know the performance of the concerned unit.

- Any unforeseen changes into the conditions which were prevailing at the time of preparing budget are taken into account and budgets are revised to show true performance.
- Comparing actual results to the plan helps prevent unplanned expenditures. The budget helps employees to regulate their spending priorities.

The main objective of Budgeting is to help in achieving the overall objective of the organization.



5. BUDGETARY CONTROL

CIMA has defined the terms 'budgetary control' as the establishment of budgets relating to the responsibilities of executives to the requirements of a policy and the continuous comparison of actual with budgeted results, either to secure by individual action, the objective of that policy or to provide a basis for its revision.

It is the system of management control and accounting in which all the operations are forecasted and planned in advance to the extent possible and the actual results compared with the forecasted and planned results.

5.1 Budgetary Control Involves

1. Establishment of budgets
2. Continuous comparison of actuals with budgets for achievement of targets.
3. Revision of budgets after considering the changes in the circumstances.
4. Fixation of the responsibility for failure to achieve the budget targets.

5.2 Objectives of Budgetary Control System

1. **Portraying with precision the overall aims of the business** and determining targets of performance for each section or department of the business.
2. **Laying down the responsibilities** of each of the executives and other personnel so that everyone knows what is expected of him and how he will be judged. Budgetary control is one of the few ways in which an objective assessment of executives or department is possible.

3. **Providing a basis for the comparison** of actual performance with the predetermined targets and investigation of deviation, if any, of actual performance and expenses from the budgeted figures. This naturally helps in adopting corrective measures.
4. **Ensuring optimum use of available resources** to maximise profit or production, subject to the limiting factors. Since budgets cannot be properly drawn up without considering all aspects, usually there is good co-ordination when a system of budgetary control operates.
5. **Co-ordinating various activities** of the business, and centralising control and yet enabling management to decentralise responsibility and delegate authority in the overall interest of the business.
6. **Engendering a spirit of careful forethought**, assessment of what is possible and an attempt at it. It leads to dynamism without being reckless. Of course, much depends on the objectives of the firm and the dynamism of its management.
7. **Providing a basis for revision** of current and future policies.
8. **Drawing up long range plans** with a fair measure of accuracy.
9. **Providing a yardstick** against which actual results can be compared.

5.3 Steps for establishing Budgetary Control

The following steps are necessary for establishing a good budgetary control system:

1. **Determining the objectives to be achieved**, over the budget period, and the policy or policies that might be adopted for the achievement of these objectives.
2. **Determining the activities that should be undertaken** for the achievement of the objectives.
3. **Drawing up a plan or a scheme** of operation in respect of each class of activity, in quantitative as well as monetary terms for the budget period.
4. **Laying out a system of comparison** of actual performance by each person, or department with the relevant budget and determination of causes for the variation, if any.

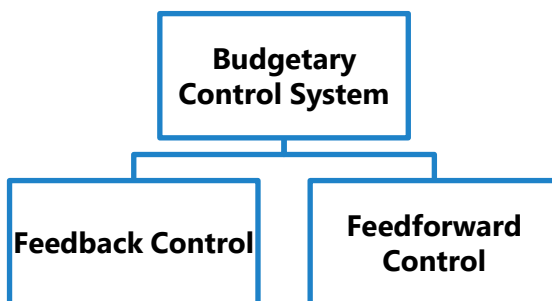
5. **Ensuring that corrective action will be taken** where the plan has not been achieved and, if that is not possible, for the revision of the plan.

In brief, it is a system to assist management in the allocation of responsibility and authority, to provide it with aid for making, estimating and planning for the future and to facilitate the analysis of the variation between estimated and actual performance.

In order to ensure effective functioning of budgetary control, it is necessary that the firm should develop a proper basis of measurement or standards with which to evaluate the efficiency of operations, *i.e.*, the firm should have in operation, a system of standard costing.

The organisation should be so integrated that all lines of authority and responsibility are properly defined. This is essential since the system of budgetary control postulates separation of functions and division of responsibilities and thus requires that the organisation shall be planned in such a manner that everyone, from the Managing Director down to the Shop Foreman, will have his duties properly defined.

5.4 Feedback and Feedforward Control



There are two types of budgetary control system based on timing of action:

Feedback Control: The feedback system of budgetary control, the actual results for the budgeted period are collected and compared with the budgeted figures. The exercise of variance identification is done after the completion of the budget period. The variances are reported and based on the report corrective actions are taken, responsibility is fixed and based on experience, modification in future targets is implemented. As the name suggests, it is an Ex-post Corrective control system of budget.

This system of budgetary control is common in organisations where Management Information System (MIS) is not so robust and where data is obtained only after the finalisation of books of account. Though this type of control system is less expensive to maintain but has limitations. Organisation has to remain on looser side in today's age of data warfare.

Feedforward Control: This is the opposite of feedback control system of budgetary control. It is Ex-Ante Preventive control mechanism of budgetary control. The budgets are set at the inception of the budgeted period and the actual results are continuously monitored and compared. The targets are kept realistic as far as possible and the targets are reviewed and reset if necessary.

This budgetary control system requires a robust MIS supported by integrated ERP system enabling an entity to get data as and when desired basis. This system is very expensive and beneficial for the organisations where the business environment is dynamic and information has important role in getting edge in competition and today's data warfare.

5.5 Budget Committee and Budget Officer

The budget committee is a group of representatives of various functions in an organisation. As all functions are inter-related and as any change in one's target will have its impact on that of the other, it is necessary to discuss the targets so that a mutually agreed programme is finally decided. This is called coordination in budget-making. It is a powerful force in knitting together various activities of the business and enforcing real control over operations.

The Chief Executive is ultimately responsible for the budget programme but it will be better if the large part of the supervisory responsibility is delegated to an official designated as Budget Officer. The budget Officer should have knowledge of the technical side of the business and should report to the president or CEO of the business entity.

The responsibility for successfully introducing and implementing Budgetary Control System rests with the Budget Committee acting through the Budget Officer. The Budget Committee would be composed of all functional heads and a member from the Board to preside over and guide the deliberations.

The main responsibilities of the Budget Committee/Budget Officer are to:

1. **Assist in the preparation of the separate budget for various departments** by coordinating the work of the accounts department, which is normally responsible to compile the budgets—with the relevant functional departments like Sales, Production, Plant maintenance etc.;
2. **Forward the budget to the individual departments heads who are responsible** to implement the budget. The Budget Officer should guide them in overcoming any practical difficulties, in its working;
3. **Prepare the periodical budget reports** for circulation to the individuals concerned;
4. **Follow-up action to be taken on the budget reports;**
5. **Prepare an overall budget working report** for discussion at the Budget Committee meetings and to ensure follow-up on the lines of action suggested by the Committee;
6. **Prepare periodical reports** for the Board meeting. Comparing budgeted Profit and Loss Account and the Balance Sheet with the actual results attained.

It is necessary that every budget should be thoroughly discussed with the functional heads before it is finalised.

It is the duty of the Budget Officer to see that the periodical budget reports are supplied to the recipients at regular intervals so as to enable them to take remedial action.

The efficiency of the Budget Officer, and through him of the Budget Committee, will be judged more by the smooth working of the system and the agreement between the actual figures and the budgeted figures.

Budgets provides basis for giving an incentive for better performance,; It is up to the Budget Officer to see that attention of the different functional heads is drawn to the deviations so as to face the challenge in a successful manner.

5.6 Advantages of Budgetary Control System

Points	Description
1. Efficiency	The use of budgetary control system enables the management of a business entity to conduct its business activities in an efficient manner.
2. Control on expenditure	It is a powerful instrument used by business entity for the control of their expenditure. It provides a yardstick for measuring and evaluating the performance of individuals and their departments.
3. Finding deviations	Budget reveals the deviations of the actual from the budgeted figures after making a comparison and communicating the deviation to management.
4. Effective utilisation of resources	Effective utilisation of various resources like—men, material, machinery and money—is made possible, as the production is planned after taking these into account.
5. Revision of plans	Budget helps in the review of current trends and framing of future policies.
6. Implementation of Standard Costing system	Budget creates suitable conditions for the implementation of standard costing system in a business organisation.
7. Cost Consciousness	Budgetary control system encourages cost consciousness and maximum utilisation of available resources.
8. Credit Rating	Management which has developed a well-ordered budget plans and which operate accordingly, receive greater favour from credit agencies.

5.7 Limitations of Budgetary Control System

Points	Description
1. Based on Estimates	Budgets are based on a series of estimates, which are based on the conditions prevalent or expected at the time budget is established. It requires revision in plan if conditions change.
2. Time factor	Budgets cannot be executed automatically. Some preliminary steps are required to be accomplished before budgets are implemented. It requires proper attention and time of management. Management must not expect too much during the initial development period.
3. Co-operation Required	Staff co-operation is usually not available during the initial budgetary control exercise. In a decentralised organisation, each unit has its own objective and these units enjoy some degree of discretion. In this type of organisation structure, coordination among different units is required. The success of the budgetary control depends upon willing co-operation and teamwork,
4. Expensive	The implementation of budget is somewhat expensive. For successful implementation of the budgetary control, proper organisation structure with responsibility is prerequisite. Budgeting process start from the collection of information to for preparing the budget and performance analysis. It consumes valuable resources (in terms of qualified manpower, equipment, etc.) for this purpose; hence, it is an expensive process.
5. Not a substitute for management	Budget is only a managerial tool and must be intelligently applied for management to get benefited. Budgets are not a substitute for good management.

6. Rigid document

Budgets are sometime considered as rigid documents. But in reality, an organisation is exposed to various uncertain internal and external factors. Budget should be flexible enough to incorporate ongoing developments in the internal and external factors affecting the very purpose of the budget.

5.8 Components of Budgetary Control System

The policy of a business for a defined period is represented by the master budget, the detailed components of which are given in a number of individual budgets called *functional budgets*. These functional budgets are broadly grouped under the following heads:

1. **Physical budgets:** Those budgets which contain information in quantitative terms such as the physical units of sales, production etc. This may include quantity of sales, quantity of production, inventories, and manpower budgets are physical budgets.
2. **Cost budgets:** Budgets which provides cost information in respect of manufacturing, administration, selling and distribution, etc. for example, manufacturing costs, selling costs, administration cost, and research and development cost budgets are cost budgets.
3. **Profit budgets:** A budget which enables the ascertainment of profit. For example, sales budget, profit and loss budget, etc.
4. **Financial budgets:** A budget which facilitates in ascertaining the financial position of a concern, for example, cash budgets, capital expenditure budget, budgeted balance sheet etc.



6 BUDGETS AND MOTIVATION

When pursuing some target, the end result of achieving the goal should be motivating one. Motivation is a factor which works like fuel to get hope lighted and ignites the aspirations. Therefore, motivation is the driving force which converts the efforts into results and thus the long-term objectives of the any person whether it would be an individual or a corporate.

The same principle of motivation also applies to a business entity to achieve its objectives in the course of pursuing its mission. Budget is a planning exercise which quantifies the desired results into targets. The budget targets are communicated to the executives at different levels and they are asked to strive to get the targets achieved. But the whole exercise is not so simple as it seems in script, implementation in practicality has bumpy rides. The behavioural aspect of human being comes into character, and it is not so difficult to guess why an executive put his/ her best efforts to achieve the communicated targets. There must be something motivating in achieving the targets, therefore, a budgeting process should have the following consideration to make it motivating one:

- (a) **Performance measurement:** The budget, at first be communicated to all executives so that everybody must be informed the desired performance expected from each of them. Secondly, the achievement of targets should have consideration in measurement and evaluation of performance an executive at individual level and at departmental level. Rewards such as promotion, increment, Performance related pay (Pay), bonus may be appropriate motivation factors.
- (b) **Achievable Targets:** While setting targets, the practical aspects such as availability of resources and realism of figures must be considered. The targets should be balance one, it neither be very easy nor too tough, means it should be realistic one. An unrealistic target has reverse impact and may be demotivate the executives.
- (c) **Optimum utilisation of resources:** A budget targets which is easily achievable may underutilise the resources such as potential skills of executives. Pressure sometime forcing to explore innovative ways to get things done. Thus, to keep motivation alive, a balanced approach should be applied for optimum utilisation of resources upto its effort zone, though beyond the comfort zone.
- (d) **Involvement in budgeting process:** The budgets which involves the executives from all department can capture the requirement of all the users. The participative budgeting motivates the executives and give them a sense of ownership. Involvement at planning stage of budget can take care of the requirements of the executives and force them accept the targets. However, involvement at every stage of budgeting process may distort the objective of budget and lands nowhere., thus, a balance approach may be followed.



7. PREPARATION OF BUDGETS

1. **Defining business or organisational objectives:** A budget is a plan for the achievement of certain organisational objectives. It is therefore desirable that these objectives are defined precisely. The organisational objectives should be written down; the areas of control demarcated; and items of revenue and expenditure to be covered by the budget clearly stated. This will give a clear understanding of the plan and its scope to all those who must cooperate to make it successful.
2. **Identification of the key budget factor:** There are usually one or two key budget factors (sometimes there may be more than two) which set a limit to the total activity. For instance, in India sometimes non-availability of power does not allow production to increase in spite of heavy demand. Similarly, lack of demand may limit production. Such a factor is known as key factor. For proper budgeting, it must be identified and its influence on production on sales estimated properly while preparing the budget.
3. **Appointment of controller/officer:** Formulation of a budget usually requires service of a whole time senior executive.; He must be assisted in this work by a Budget Committee, consisting of all the heads of departments along with the Managing Director as the Chairman. The Budget Controller/Officer is responsible for coordinating and development of budget programmes and preparing the manual of instruction, known as Budget manual.
4. **Budget Manual:** The budget manual is a booklet specifying the objectives of an organisation in relation to its strategy. The budget is made to decide how much an organisation would earn and spend and in what manner. In the budget, the organisation sets its priorities too.

CIMA, London, defines budget manual as, "A document which sets out the responsibilities of the persons engaged in, the routine of, and the forms and records required for, budgetary control."

Effective budgetary planning relies on the provision of adequate information to the individuals involved in the planning process. Many of these information needs are contained in the budget manual. A budget manual is a collection of documents that contains key information for those involved in the planning process.

Contents of a Budget Manual

Typical budget manual may include the following:

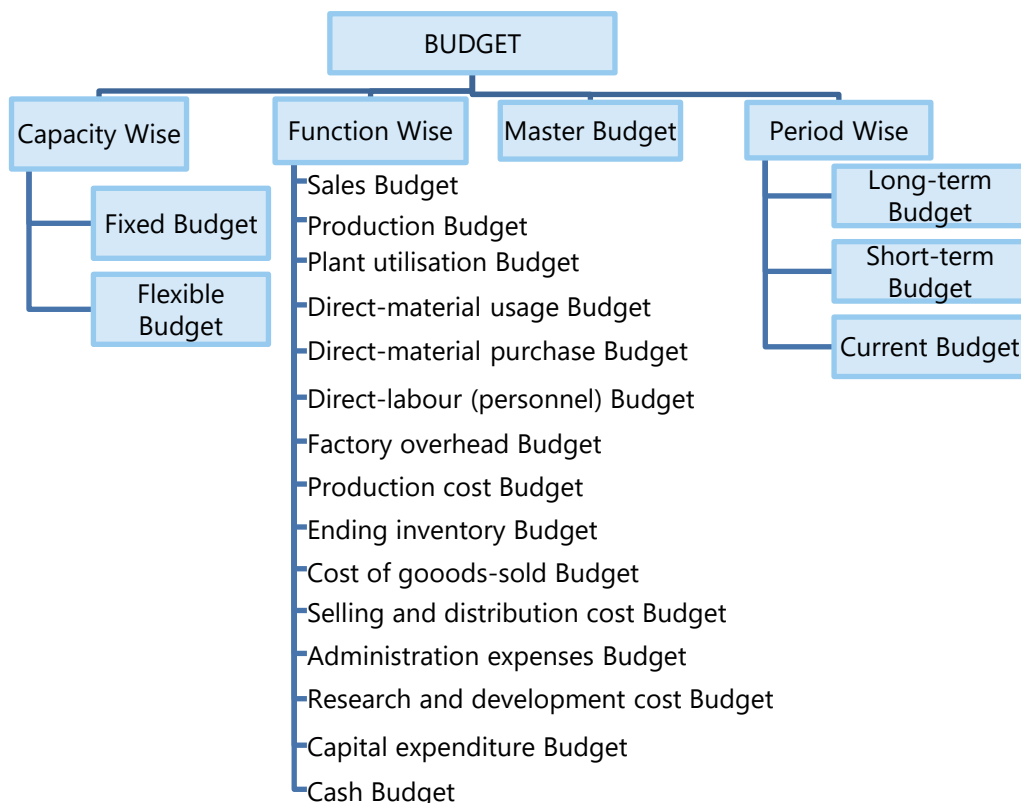
- (i) A statement regarding the objectives of the organisation and how they can be achieved through budgetary control;
- (ii) A statement about the functions and responsibilities of each executive, both regarding preparation and execution of budgets;
- (iii) Procedures to be followed for obtaining the necessary approval of budgets. The authority of granting approval should be stated in explicit terms. Whether, one two or more signatures are required on each document should be clearly stated;
- (iv) A form of organisation chart to show who are responsible for the preparation of each functional budget and the way in which the budgets are interrelated.
- (v) A timetable for the preparation of each budget.
- (vi) The manner of scrutiny and the personnel to carry it out;
- (vii) Reports, statements, forms and other record to be maintained;
- (viii) The accounts classification to be employed. It is necessary that the framework within which the costs, revenue and other financial accounts are classified must be identical both in the accounts and budget department;
- (ix) The reporting of the remedial action;
- (x) The manner in which budgets, after acceptance and issuance, are to be revised or the matter amended these are included in budgets and on which action can be taken only with the approval of top management

- (xi) This will prevent the formation of a 'bottleneck' with the late preparation of one budget holding up the preparation of all others.
 - (xii) Copies of all forms to be completed by those responsible for preparing budgets, with explanations concerning their completion.
 - (xiii) A list of the organization's account codes, with full explanations of how to use them.
 - (xiv) Information concerning key assumptions to be made by managers in their budgets, for example the rate of inflation, key exchange rates, etc.
5. **Budget period:** The period covered by a budget is known as budget period. There is no general rule governing the selection of the budget period. In practice the Budget Committee determines the length of the budget period suitable for the business. Normally, a calendar year or a period co-terminus with the financial year is adopted. The budget period for the calendar or financial year is then divided into shorter periods; it may be monthly or quarterly or for such periods as coincide with period of trading activity of the business.
6. **Standard of activity or output:** For preparing budgets for the future, past statistics, though important, cannot be completely relied upon. The past usually represents a combination of good and bad factors. Therefore, though results of the past should be studied, but these should only be applied when there is a likelihood of similar conditions repeating in the future. Also, while setting the targets for the future, it must be remembered that in a progressive business, the achievement of a year should normally exceed those of earlier years. Therefore, what was good in the past is only fair for the current year and should work for much better in the future.

In budgeting, fixing the budget of sales, expenses, and of capital expenditure is important since these budgets determine the extent of development activity. For budgeting sales, one must consider the trend of economic activity of the country, recommendations of salesmen, customers and employees, effect of price changes on sales, the provision for advertisement campaign plan capacity etc.



8. DIFFERENT TYPES OF BUDGETS



8.1 Classification on the basis of Capacity or Flexibility

These types of budgets are prepared on the basis of activity level or utilization of capacity. These are also known as “Budgets on the basis of flexibility”.

(i) Fixed Budget: A budget prepared on the basis of standard or fixed level of activity is known as fixed budget. It does not change with a change in the level of activities. According to CIMA, “**a fixed budget is a budget designed to remain unchanged irrespective of the level of activity actually attained**”. A fixed budget shows the expected results of a responsibility center for only one activity level.

Once the budget is prepared, it is not changed, even if the level of activity changes. Fixed budgeting is used by many service companies and for some administrative

functions of manufacturing companies, such as purchasing, engineering, and accounting.

Fixed Budget is used as an effective tool of cost control. In case, the level of activity attained is different from the level of activity for budgeting purposes, the fixed budget becomes ineffective. Fixed budget is suitable for fixed expenses. It is also known as a static budget.

Essential conditions:

1. When the nature of business is not seasonal.
2. There is no impact of external factors on the business activities.
3. The demand of the product is certain and stable.
4. Supply orders are received and issued regularly.
5. The market of the product is normally domestic but it can also apply in respect of service export, where fairly regular export orders are received
6. There is no need of special labour or material in the production of the products.
7. Supply of production inputs is regular.
8. There is a trend of price stability.

Generally, all above conditions are not found in practice. Hence fixed budget is not suitable in business concerns.

Merits and Demerits of fixed budgets are tabulated below:

Merits	Demerits
1. Very simple to understand 2. Less time consuming	1. It does not suite a dynamic organization and may give misleading results. A poor or good performance may remain un-noticed. 2. It is not suitable for long period. 3. It is also found unsuitable particularly when the business conditions are changing constantly. 4. Accurate estimates are not possible.

(ii) Flexible Budget: A flexible budget is a budget which, by recognising the difference in behaviour between fixed and variable costs in relation to fluctuations in output, turnover, or other variable factors, is designed to change appropriately with such fluctuations. According to CIMA, **"a flexible budget is defined as a budget which, by recognizing the difference between fixed, semi-variable and variable costs is designed to change in relation to the level of activity attained."** Unlike static (fixed) budgets, the flexible budgets show the expected results of a responsibility center for different activity levels.

One can view a flexible budget as a series of static budgets for different levels of activity. Such budgets are especially useful in estimating and controlling factory costs and operating expenses. It is more realistic and practicable because it gives due consideration to behaviour of revenue and cost at different levels of activity. While preparing a flexible budget, the expenses are classified into three categories viz.

- (i) Fixed,
- (ii) Variable, and
- (iii) Semi-variable.

Semi-variable expenses are further segregated into fixed and variable expenses.

Flexible budgeting may be resorted to under the following situations:

- (i) In the case of new business venture, due to its typical nature, it may be difficult to forecast the demand of a product accurately.
- (ii) Where the business is dependent upon the fluctuations of nature e.g., a person dealing in wool trade may have enough market demand, if temperature goes below the freezing point and much less demand if the weather is relatively warm.
- (iii) In the case of labour-intensive industry where the production of the entity is dependent upon the availability of labour.

Suitability for flexible budget:

1. Seasonal fluctuations in sales and/or production, for example in soft drinks industry;

2. a company which keeps on introducing new products or makes changes in the design of its products frequently;
3. industries engaged in make-to-order business like ship building;
4. an industry which is influenced by changes in fashion; and
5. general changes in sales.

Merits and Demerits of flexible budgets are tabulated below:

Merits	Demerits
1. With the help of flexible budget, the sales, costs and profit may be calculated easily by the business at various levels of production capacity. 2. In flexible budget, adjustment is very simple according to change in business conditions. 3. It also helps in determination of production level as it shows budgeted costs with classification at various levels of activity along with sales. Hence the management can easily select the level of production which shows the profit predetermined by the owners of the business. 4. It also shows the quantity of product to be produced to earn determined profit.	1. The formulation of flexible budget is possible only when there is proper accounting system maintained, perfect knowledge about the factors of production and various business circumstances is available. 2. Flexible Budget also requires the system of standard costing in business. 3. It is very expensive and labour oriented.

Difference between Fixed and Flexible Budgets:

Sl. No.	Fixed Budget	Flexible Budget
1.	It does not change with actual volume of activity achieved. Thus, it is known as rigid or inflexible budget.	It can be re-casted on the basis of activity level to be achieved. Thus, it is not rigid.

2.	It operates on one level of activity and under one set of conditions. It assumes that there will be no change in the prevailing conditions, which is unrealistic.	It consists of various budgets for different levels of activity.
3.	Here as all costs like - fixed, variable and semi-variable are related to only one level of activity so variance analysis does not give useful information.	Here analysis of variance provides useful information as each cost is analysed according to its behaviour.
4.	If the budgeted and actual activity levels differ significantly, then the aspects like cost ascertainment and price fixation do not give a correct picture.	Flexible budgeting at different levels of activity facilitates the ascertainment of cost, fixation of selling price and tendering of quotations.
5.	Comparison of actual performance with budgeted targets will be meaningless specially when there is a difference between the two activity levels.	It provides a meaningful basis of comparison of the actual performance with the budgeted targets.

ILLUSTRATION 1

A factory which expects to operate 7,000 hours, i.e., at 70% level of activity, furnishes details of expenses as under:

<i>Variable expenses</i>	<i>₹1,260</i>
<i>Semi-variable expenses</i>	<i>₹1,200</i>
<i>Fixed expenses</i>	<i>₹1,800</i>

The semi-variable expenses go up by 10% between 85% and 95% activity and by 20% above 95% activity. PREPARE a flexible budget for 80, 90 and 100 per cent activities.

SOLUTION

Head of Account	Control basis	70%	80%	90%	100%
Budgeted hours		7,000	8,000	9,000	10,000
		(₹)	(₹)	(₹)	(₹)
Variable expenses	Variable	1,260	1,440	1,620	1,800
Semi-variable expenses	Semi-variable	1,200	1,200	1,320	1,440
Fixed expenses	Fixed	1,800	1,800	1,800	1,800
Total expenses		4,260	4,440	4,740	5,040
Recovery rate per hour:					
Total expenses/Bud hours		0.61	0.55	0.53	0.50

Conclusion:

We notice that the recovery rate at 70% activity is ₹ 0.61 per hour. If in a particular month the factory works 8,000 hours, it will be incorrect to estimate the allowance as ₹4,880 @ ₹0.61. The correct allowance will be ₹4,440 as shown in the table. If the actual expenses are ₹4,500 for this level of activity, the company has not saved any money but has over-spent by ₹60 (₹4,500 – ₹4,440).

ILLUSTRATION 2

A department of Company X attains sale of ₹ 6,00,000 at 80 per cent of its normal capacity and its expenses are given below:

<i>Administration costs:</i>	(₹)
Office salaries	90,000
General expenses	2 per cent of sales
Depreciation	7,500
Rates and taxes	8,750
<i>Selling costs:</i>	
Salaries	8 per cent of sales
Travelling expenses	2 per cent of sales
Sales office expenses	1 per cent of sales
General expenses	1 per cent of sales

Distribution costs:

<i>Wages</i>	<i>15,000</i>
<i>Rent</i>	<i>1 per cent of sales</i>
<i>Other expenses</i>	<i>4 per cent of sales</i>

PREPARE flexible administration, selling and distribution costs budget, operating at 90 per cent, 100 per cent and 110 per cent of normal capacity.

SOLUTION

Flexible Budget of Department....of Company 'X'

	80% (₹)	90% (₹)	100%(₹)	110%(₹)
Sales	6,00,000	6,75,000	7,50,000	8,25,000
Administration Costs:				
Office Salaries (fixed)	90,000	90,000	90,000	90,000
General expenses (2% of Sales)	12,000	13,500	15,000	16,500
Depreciation (fixed)	7,500	7,500	7,500	7,500
Rent and rates (fixed)	8,750	8,750	8,750	8,750
(A) Total Adm. Costs	1,18,250	1,19,750	1,21,250	1,22,750
Selling Costs:				
Salaries (8% of sales)	48,000	54,000	60,000	66,000
Travelling expenses (2% of sales)	12,000	13,500	15,000	16,500
Sales office (1% of sales)	6,000	6,750	7,500	8,250
General expenses (1% of sales)	6,000	6,750	7,500	8,250
(B) Total Selling Costs	72,000	81,000	90,000	99,000
Distribution Costs:				
Wages (fixed)	15,000	15,000	15,000	15,000
Rent (1% of sales)	6,000	6,750	7,500	8,250
Other expenses (4% of sales)	24,000	27,000	30,000	33,000
(C) Total Distribution Costs	45,000	48,750	52,500	56,250
Total Costs (A + B + C)	2,35,250	2,49,500	2,63,750	2,78,000

Note: In the absence of information, it has been assumed that office salaries, depreciation, rates and taxes and wages remain the same at 110% level of activity also. However, in practice some of these costs may change if present capacity is exceeded.

ILLUSTRATION 3

Action Plan Manufacturers normally produce 8,000 units of their product in a month, in their Machine Shop. For the month of January, they had planned for a production of 10,000 units. Owing to a sudden cancellation of a contract in the middle of January, they could only produce 6,000 units in January.

Indirect manufacturing costs are carefully planned and monitored in the Machine Shop and the Foreman of the shop is paid a 10% of the savings as bonus when in any month the indirect manufacturing cost incurred is less than the budgeted provision.

The Foreman has put in a claim that he should be paid a bonus of ₹ 88.50 for the month of January. The Works Manager wonders how anyone can claim a bonus when the Company has lost a sizeable contract. The relevant figures are as under:

<i>Indirect manufacturing</i>	<i>Expenses for a normal month</i>	<i>Planned for January</i>	<i>Actual in costs January</i>
	(₹)	(₹)	(₹)
<i>Salary of foreman</i>	1,000	1,000	1,000
<i>Indirect labour</i>	720	900	600
<i>Indirect material</i>	800	1,000	700
<i>Repairs and maintenance</i>	600	650	600
<i>Power</i>	800	875	740
<i>Tools consumed</i>	320	400	300
<i>Rates and taxes</i>	150	150	150
<i>Depreciation</i>	800	800	800
<i>Insurance</i>	100	100	100
	5,290	5,875	4,990

Do you agree with the Works Manager? Is the Foreman entitled to any bonus for the performance in January? Substantiate your answer with facts and figures. EXPLAIN.

SOLUTION

Flexible Budget of "Action Plan Manufacturers"
(for the month of January)

Indirect manufacturing cost	Nature of cost	Expenses for a normal month (₹) (2)	Planned expenses (₹) (3)	Expenses as per flexible budget (₹) (4)	Actual expenses (₹) (5)	Difference (₹) (6) = (5) – (4)
	(1)					
Salary of foreman	Fixed	1,000	1,000	1,000	1,000	Nil
Indirect labour (WN 1)	Variable	720	900	540	600	60
Indirect material (WN 2)	Variable	800	1,000	600	700	100
Repair and maintenance (WN 3)	Semi-variable	600	650	550	600	50
Power (WN 4)	Semi-variable	800	875	725	740	15
Tools consumed (WN 5)	Variable	320	400	240	300	60
Rates and taxes	Fixed	150	150	150	150	Nil
Depreciation	Fixed	800	800	800	800	Nil
Insurance	Fixed	100	100	100	100	Nil
		5,290	5,875	4,705	4,990	285

Conclusion: The above statement of flexible budget shows that the concern's expenses in the month of January have increased by ₹285 as compared to flexible budget. Under such circumstances, assuming the expenses are controllable and based on the financial perspective the Foreman of the company should not be entitled for any performance bonus for the month of January.

Working notes:

$$1. \quad \text{Indirect labour cost per unit} = \frac{\text{₹ 720}}{8,000} = \text{₹ 0.09}$$

$$\text{Indirect labour for 6,000 units} = 6,000 \times \text{₹ 0.09} = \text{₹ 540.}$$

$$2. \quad \text{Indirect material cost per unit} = \frac{\text{₹ 800}}{8,000} = \text{₹ 0.10}$$

$$\text{Indirect material for 6,000 units} = 6,000 \times \text{₹ 0.10} = \text{₹ 600}$$

3. According to high and low point method of segregating semi-variable cost into fixed and variable components, following formulae may be used.

$$\text{Variable cost of repair and maintenance per unit} = \frac{\text{Change in expense level}}{\text{Change in output level}}$$

$$= \frac{\text{₹ 650} - \text{₹ 600}}{2,000} = \text{₹ 0.025}$$

For 8,000 units

$$\text{Total Variable cost of repair and maintenance} = \text{₹ 200}$$

$$\text{Fixed repair \& maintenance cost} = \text{₹ 400}$$

Hence at 6,000 units output level, total cost of repair and maintenance should be

$$= \text{₹ 400} + \text{₹ 0.025} \times 6,000 \text{ units} = \text{₹ 400} + \text{₹ 150} = \text{₹ 550}$$

$$4. \quad \text{Variable cost of power per unit} = \frac{\text{₹ 875} - \text{₹ 800}}{2,000 \text{ units}} = 0.0375$$

For 8,000 units

$$\text{Total variable cost of power} = \text{₹ 300}$$

$$\text{Fixed cost} = \text{₹ 500}$$

Hence, at 6,000 units output level, total cost of power should be

$$= \text{₹ 500} + \text{₹ 0.0375} \times 6,000 \text{ units} = \text{₹ 500} + \text{₹ 225} = \text{₹ 725}$$

5. Tools consumed cost for 8,000 units = ₹320

Hence, tools consumed cost for 6,000 units = $(₹320/8,000 \text{ units}) \times 6,000 \text{ units}$
= ₹240

8.2 Classification on the basis of Function

A functional budget is one which is related to function of the business as for example, production budget relating to the manufacturing function. Functional budgets are prepared for each function and they are subsidiary to the master budget of the business.

The various types of functional budgets to be prepared will vary according to the size and nature of the business.

The various commonly used functional budgets are:

- (i) Sales Budget
- (ii) Production Budget
- (iii) Plant Utilisation Budget
- (iv) Direct-Material Usage Budget
- (v) Direct-Material Purchase Budget
- (vi) Direct Labour (Personnel) Budget
- (vii) Production or Factory Overhead Budget
- (viii) Production Cost Budget
- (ix) Ending Inventory Budget
- (x) Cost of Goods Sold Budget
- (xi) Selling and Distribution Cost budget
- (xii) Administration Expenses Budget
- (xiii) Research and Development Cost Budget
- (xiv) Capital Expenditure Budget
- (xv) Cash Budget

The important functional budgets (also known as schedules to Master Budget) and the master budget are discussed and illustrated below:

(i) Sales Budget:

- **Sales forecast is the commencement of budgeting and hence sales budget assumes primary importance.** The quantity which can be sold may be the principal budget factor in many business undertakings. In any case in order to chalk out a realistic budget programme, there must be an accurate sales forecast.
- The sales budget is prepared for each product. This includes:
 1. the quantity of estimated sales and
 2. the expected unit selling price. These data are often reported by regions or by sales representatives.
- In estimating the quantity of sales for each product, past sales volumes are often used as a starting point. These amounts are adjusted (increased or decreased) for factors that are expected to affect future sales. Such as the factors listed below.
 - (i) Backlog of unfulfilled sales orders
 - (ii) Planned advertising and promotion
 - (iii) Expected industry and general economic conditions
 - (iv) Productive capacity
 - (v) Projected pricing
 - (vi) Findings of market research studies
 - (vii) Relative product profitability.
 - (viii) Competition.
- Once an estimate of the sales volume is obtained, **the expected sales revenue can be determined by multiplying the volume by the expected unit sales price.** The sales budget represents the total sales in physical quantities and values for a future budget period. Sales managers are constantly faced with problems like anticipation of customer requirements, new product needs, competitor strategies and various changes in distribution methods or promotional techniques.

- The purposes of sales budget are not to attempt to estimate or guess what the actual sales will be, but rather to develop a plan with clearly defined objectives towards which the operational effort is directed in order to attain or exceed the objective. Hence, sales budget is not merely a sales forecast. A budget is a planning and control document which shows what the management intends to accomplish. Thus, the sales budget is active rather than passive document.
- A sales forecast, , is a projection or estimate of the available customer demand. A forecast reflects the environmental or competitive situation facing the company whereas the sales budget shows how the management intends to react to this environmental and competitive situation.
- A good budget hinges on aggressive management control rather than on passive acceptance of whatever the market appears to offer. If the company fails to make this distinction, the budget will remain more a figure-work exercise than a working tool of dynamic management control.

The sales budget may be prepared under the following classification or combination of classifications:

1. Products or groups of products.
2. Areas, towns, salesmen and agents.
3. Types of customers as for example: (i) Government, (ii) Export, (iii) Home sales, (iv) Retail depots.
4. Period—months, weeks, etc.

The illustrative format of a sales budget is as under:

	Last Year		Budgeted		Northern		Southern		Central	
	Total		Year	Total	Region		Region		Region	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Product X										
1st Qtr.										
2nd Qtr.										
3rd Qtr.										
4th Qtr.										

Product Y										
1st Qtr.										
Total										

Example of sales budget:

XYZ COMPANY

Sales Budget for the year ending March, 20....

	Units	Selling price Per unit (₹)	Total (₹)
Product A	5,000	75	3,75,000
Product B	10,000	80	8,00,000
			11,75,000

(ii) **Production Budget:**

Production Budget is a forecast of the production for the budget period of an organisation. Production budget is prepared in two parts, viz. production volume budget for the physical units of the products to be manufactured and the cost of production or manufacturing budget detailing the budgeted cost under material, labour, and factory overhead in respect of the products. Production budget shows the production for the budget period based upon:

1. Sales budget,
2. Production capacity of the factory,
3. Planned increase or decrease in finished stocks, and
4. Policy governing outside purchase.

Production budget is normally stated in units of output. Production should be carefully coordinated with the sales budget to ensure that production and sales are kept in balance during the period. **The number of units to be manufactured to meet budgeted sales and inventory needs for each product is set forth in the *production budget*.**

The production facility available and the sales budget will be compared and coordinated to determine the production budget. If production facilities are not sufficient, consideration may be given to such factors as working overtime, introducing shift working, sub-contracting or purchasing of

additional plant and machinery. If, however, the production facilities are surplus, consideration should be given to promote advertising, reduction of prices to increase the sales, sub-contracting of surplus capacity, etc.

One of the conditions to be considered in all the compilation of production budget is the level of stock to be maintained.

- **The level of stocks will depend upon the following three factors viz.:**
 1. Seasonal industries in which stocks have to be built up during off season to cater to the peak season,
 2. A steady and uniform level of production to utilise the plant fully and to avoid retrenchment or lay-off of the workers, and
 3. To produce in such a way that minimum stocks are maintained at any time to avoid locking up of funds in inventory.
- **Production budget can, therefore, show:**
 1. Stabilised production every month, say, the maximum possible production or
 2. Stabilised minimum quantity of stocks which will reduce inventory costs.
 3. In the case of stabilised production, the production facility will be fully utilized, but the inventory carrying costs will vary according to stocks held. In the case of stabilised stocks method, however, the inventory carrying will be the lowest, but there may be under-utilisation of capacity.

Example of production budget:

XYZ COMPANY

Production budget in units for the year ending March 31, 20....

	Products	
	A	B
Budgeted sales	5,000	10,000
Add : Desired closing stock	500	1,000
Total quantity required	5,500	11,000

Less : Opening stock	1,500	2,000
Units to be produced	4,000	9,000

(iii) Plant Utilisation Budget:

Plant utilisation budget represents, in terms of working hours, weight or other convenient units of plant facilities required to carry out the programme laid down in the production budget.

The main purposes of this budget are:

1. To determine the load on each process, cost or groups of machines for the budget period.
2. To indicate the processes or cost centres which are overloaded so that corrective action may be taken such as: (i) working overtime (ii) sub-contracting (iii) expansion of production facility, etc.
3. To dovetail the sales production budgets where it is not possible to increase the capacity of any of the overloaded processes.
4. Where surplus capacity is available in any of the processes, to make effort to boost sales to utilise the surplus capacity.

(iv) Direct Material usage Budget:

The steps involved in the compilation of direct materials usage budget are as under:

1. The quality standards for each item of material have to be specified. In this connection, standardisation of size, quality, colour, etc., may be considered.
2. Standard requirement of each item of materials required should also be set. While setting the standard quality, consideration should be given to normal loss in process. The standard allowance for normal loss may be given on the basis of past performance, test runs, technical estimates etc.
3. Standard prices for each item of materials should be set after giving consideration to stock and contracts entered into.

After setting standards for quality, quantity and prices, the direct materials cost budget can be prepared by multiplying each item of material required for the production by the standard price.

Example of direct material usage budget is as under:

XYZ COMPANY Direct material usage in units and in amount for the year ending March 31, 20...					
	Direct Materials				
Type of material	Product A (4,000 units)	Product B (9,000 units)	Total direct material usage (Units)	Material cost per unit (₹)	Total cost of material used (₹)
X (12 units per finished product)	48,000	1,08,000	1,56,000	1.50	2,34,000
Y (4 units per product A & 2 units per product B)	16,000	18,000	34,000	2.50	85,000
				Total	3,19,000

(v) Direct Material Purchase Budget:

- **The production budget is the starting point for determining the estimated quantities of direct materials to be purchased.**
- Multiplying these quantities by the expected unit purchase price determines the total cost of direct materials to be purchased.

Two important considerations that govern purchase budgets are as follows:

- Economic order quantity.
 - Re-order point with safety stocks to cover fluctuations in demand.
- The direct material purchases budget helps management maintain inventory levels within reasonable limits. For this purpose, the timing of the direct materials purchases should be coordinated between the purchasing and production departments.

An example of material purchase budget is as under:

XYZ Company Direct material purchase budget for the year ending March 31, 20.....			
	Material X	Material Y	Total
Desired closing stock (units)	3,000	500	
Units required for production	1,56,000	34,000	
<i>Add:</i>			
Total Requirement	1,59,000	34,500	
<i>Less:</i> Opening stock (units)	4,000	300	
Units to be purchased	1,55,000	34,200	
Unit price (₹)	1.50	2.50	
Purchase cost (₹)	2,32,500	85,500	3,18,000

(vi) Direct Labour (Personnel) Budget:

- Once sales budget and Production budget are compiled and plant utilisation budget is decided detailed amount of the various machine operations involved and services required can be calculated. This will facilitate preparation of an estimate of different grades of labour required.

From this, the standard hours required to be worked can be calculated the total labour component thus budgeted can be divided into direct and indirect labour. Standard rates of wages for each grade of labour can be introduced and then the direct and indirect labour cost budget can be prepared.

Merits/advantages:

1. It defines the direct and indirect labour force required.
2. It enables the personnel department to plan ahead in recruitment and training of workers so that labour turnover can be reduced to the minimum.
3. It reveals the labour cost to be incurred in the manufacture, to facilitate preparation of manufacturing cost budgets and cash budgets for financing the wage bill.

Example of direct-labour cost budget:

XYZ COMPANY Direct-labour cost budget for the year ending March 31, 20...				
	Units to be produced	Direct labour hour, per unit	Total hours	Total budget cost (₹) @ ₹ 2 per hour
Product A	4,000	7	28,000	56,000
Product B	9,000	10	90,000	1,80,000
			1,18,000	2,36,000

(vii) Production or Factory Overhead Budget:

- Production overheads consist of all items such as indirect materials, indirect labour and indirect expenses. Indirect expenses. These include expenditures on factors such as power, fuel, fringe benefits, depreciation etc. The estimated overheads which are necessary for production in the factory are called factory overhead costs and included in the factory overhead budget.
- Factory overhead budget usually includes the total estimated cost for each item of factory overhead.
- The production overhead budget is useful for working out the pre-determined overhead recovery rates.
- A business may prepare supporting departmental schedules, in which the factory overhead costs are separated into their fixed and variable cost elements. Such schedules enable department managers to direct their attention to those costs for which they are responsible and to evaluate performance of each department.
- A careful study and determination of the behaviour of different types of costs will be essential in preparation of overhead budget.
- A few examples are given below to show how the expenses are estimated.
 1. Fixed expenses are normally policy costs and hence they are based on policy matters.
 2. For estimating indirect labour, work study is resorted to and a

estimate of number of indirect workers required for each level of direct workers employed is made—for example, one supervisor for every twenty direct workers.

3. In regard to the estimate of consumption of indirect materials, the age and condition of the plant and machinery are taken into consideration.

Example of factory overhead budget:

XYZ COMPANY		
Factory overhead budget for the year ending March 31, 20....		
<i>(Anticipated activity of 1,18,000 direct labour hours)</i>		
	(₹)	(₹)
Supplies	12,000	
Indirect labour	30,000	
Cost of fringe benefits	10,000	
Power (variable portion)	22,000	
Maintenance cost (variable portion)	<u>15,000</u>	
Total variable overheads		89,000
Depreciation	10,000	
Property taxes	2,000	
Property insurance	1,000	
Supervision	12,000	
Power (Fixed portion)	800	
Maintenance (Fixed portion)	<u>3,200</u>	
Total fixed overheads		<u>29,000</u>
Total factory overheads		<u>1,18,000</u>
Factory overhead recovery rate is:		
₹1,18,000		
<u>1,18,000 labour hours</u>	= ₹1 per direct labour hour	

(viii) Production Cost Budget:

Production Cost Budget is a forecast of the production for the budget period of an organisation. Production budget is prepared in two parts, viz. production volume budget for the physical units of the products to be manufactured and the cost of production or manufacturing budget detailing the budgeted cost under material, labour, and factory overhead in respect of the products.

Production cost budget covers direct material cost, direct labour cost and manufacturing expenses. After preparing direct material, direct labour and production overhead cost budget, one can prepare production cost budget.

(ix) Ending Inventory Budget:

This budget shows the cost of closing stock of raw materials and finished goods, etc. required to be maintained by the business entity. This information is required to prepare cost-of-goods-sold budget and budgeted financial statements *i.e.*, budgeted income statement and budgeted balance sheet.

Example of end of the year (or closing) inventory budget:

XYZ Company end of the year inventory budget March 31, 20....					
	Units	Unit cost (₹)	Amount (₹)	Total (₹)	
Direct material					
X	3,000	1.50	4,500		
Y	500	2.50	<u>1,250</u>	5,750	
Finished goods					
A	500	49.00*	24,500		
B	1,000	53.00*	<u>53,000</u>	<u>77,500</u>	
Total				<u>83,250</u>	

* Unit cost of finished goods have been computed as below:

	Unit cost of input (₹)	Product A		Product B	
		Units	Amount (₹)	Units	Amount (₹)
Material X	1.50	12	18.00	12.00	18.00
Material Y	2.50	4	10.00	2.00	5.00
Direct labour	2.00	7	14.00	10.00	20.00
Factory overhead	1.00	7	<u>7.00</u>	10.00	<u>10.00</u>
			<u>49.00</u>		<u>53.00</u>

(x) Cost of Goods Sold Budget:

This budget covers direct material cost, direct labour cost and manufacturing expenses. This is adjusted by addition of the cost of the opening inventory and reducing therefrom the cost of closing inventory of finished products.

We present below the cost-of-goods-sold budget on the basis of the data taken from the various budgets already illustrated:

**XYZ Company cost-of-goods-sold budget for the year ending
March 31, 20....**

	Amount (₹)
Direct materials used	3,19,000
Direct labour	2,36,000
Factory overhead	<u>1,18,000</u>
Total manufacturing costs	6,73,000
Add : Finished goods (opening)	<u>1,79,500*</u>
	8,52,500
Less : Finished goods (closing)	<u>77,500*</u>
Total cost of goods sold	<u>7,75,000</u>
*Assumed figure	

In the above budget if adjustments for opening and closing inventory of finished goods are not shown. The budget will be called production cost budget.

(xi) Selling and Distribution Cost Budget:

Selling and distribution are the essential aspects of the profit earning function. At the same time, the pre-determination of these costs is very difficult. Selling & Distribution Cost Budget is a forecast of the cost of selling & distribution of goods during the budget period. **Selling cost is defined as the cost of seeking to create and stimulate demand and of securing orders.** These costs are, therefore, incurred to maintain and increase the level of sales. All expenses connected with advertising, sales promotion, sales office, salesmen, credit collection, market research, after sales service, etc. are generally grouped together to form part of the responsibility of the sales manager.

While making a budget, selling costs are divided into fixed and variable. Semi-variable costs should also be separated into variable and fixed elements.

The problems faced in the preparation of selling cost budgets are:

1. Heavy expenditure on selling and sales promotion may have to be incurred when the volume of sales is falling off. This will increase the percentage of such costs to total sales, and

2. Sometimes intensive sales and promotion efforts are called for in one year and the benefit of such efforts accrue in the subsequent years. This makes it difficult to establish a proportion of selling cost to sales.
3. In spite of these problems, some relationship between selling cost and volume of sales has to be established and it is the duty of the Budget Controller to determine the amount of selling costs to be incurred to achieve the desired level of sales volume.

Using the past experience as a guide, consideration should be given to the future trend of sales, possible changes in competition etc., in pre-determination of selling costs.

- **Distribution cost has been defined as the cost of the sequence of operations which begins with making the packet of product available for dispatch and ends with making the re-conditioned return of empty package, if any available for re-use.** It includes transport cost, storage and warehousing costs, etc.
- Preparation of the advertising cost budget is the responsibility of the sales manager or advertisement manager. When preparing the advertisement cost budget, consideration should be given to the following factors:
 1. The best method of advertisement must be selected; costs will vary according to the method selected.
 2. The maximum amount to be spent in a period, say one year, has to be decided.
 3. Advertising and sales should be co-ordinated. It means that money should be spent on advertisement only when sufficient quantities of the product advertised are ready for sale.
 4. An effective control over advertisement expenditure should be exercised and the effectiveness of the advertisement should be measured.
 5. The choice of the method of advertising a product is based on the effectiveness of the money spent on advertisement in increasing or maintaining sales. If the output sold increases, the production cost will come down because of the economies of large-scale production.

- The amount to be spent on advertisement may be decided on the basis of the following factors:
 1. A percentage on the total sales value of the budget period or on the expected profit may be fixed on the basis of past experience.
 2. A sum which is expected to be incurred by the competitors may be fixed to be spent during the budget period.
 3. A fixed sum per unit of output can be fixed and added to cost.
 4. An amount is fixed on the basis of the ability of the company to spend on advertising.
 5. An advertisement plan is decided upon and the amount to be spent is determined.
- Depending upon the nature of the product and the effectiveness of the media of the advertising the company prepares a schedule of various methods of advertisement, to be used for effective sales promotion. The number of advertisements (insertions) are determined and the cost calculated as per the rates applicable to each of the media selected. This is a sound method.

Example of selling and distribution cost budget:

XYZ Company selling and distribution cost budget for the year ending March 31, 20....	
	Amount
<u>Direct selling expenses:</u>	(₹)
Salesmen's salaries	14,500
Salesmen's commission	7,000
Travelling expenses	<u>19,000</u>
	<u>40,500</u>
<u>Distribution expenses:</u>	
Warehouse wages	6,000
Warehouse rent, rates, electricity	4,500
Lorry expenses	<u>11,000</u>
	<u>21,500</u>

Sales office expenses:

Salaries	16,000
Rent, rates, electricity	12,000
Depreciation	2,000
Stationery, postage and telephone	12,500
General expenses	<u>3,000</u>
	<u>45,500</u>

Advertising:

Press	4,500
Radio and television	18,500
Shop window displays	<u>4,000</u>
	<u>27,000</u>
Total	<u>1,34,500</u>

(xii) Administrative Expenses Budget:

The administrative expenses are mostly policy costs and are, therefore, fixed in nature. **The most practical method to follow in preparing estimate of these expenses is to follow the past experience with due regard to anticipated changes either in general policy or the volume of business.** To bring such expenses under control, it is necessary to review them frequently and to determine at regular intervals whether or not these expenses continue to be adjusted. Examples of such expenses are: board meeting expenses, expenditure incurred on staff employed in human resources and finance departments, audit fees, depreciation of office equipment, insurance, subscriptions, postage, stationery, telephone, telegrams, office supplies, etc.

**XYZ Company administrative expenses budget
for the year ending March 31, 20...**

	(₹)
Salaries of clerical staff	28,000
Executives' salaries	8,000
Audit fee	600
Depreciation on office equipment	800
Insurance	250
Stationery	1,250

Postage and telegrams	950
Telephones	850
Miscellaneous	<u>5,300</u>
Total administrative expenses	<u>46,000</u>

(xiii) Research and Development Cost Budget:

Research and development expenditure is to be incurred so that the products or methods of production do not become obsolete. The research and development budget is the forecast of all such expenses. **Research is required in order to develop and/or improve products and methods. When research results in definite benefit to the company, development function begins.** After development, formal production can commence on commercial scale and then production function starts. Since the areas of research and development cannot be precisely defined, the costs incurred under both the functions are clubbed together as research and development costs. Research and Development (R & D) plays a vital role in maintaining the business. For example, automobile manufacturers, and those who produce drugs, spend considerable sums on R & D to improve their products.

Research may be either pure research or applied research. Pure research increases knowledge whereas applied research aims at producing definite results like improved methods of production, etc.

Research and development expenses should be controlled carefully and hence a limit on the spending is placed, *i.e.*, the amount to be spent is carefully determined or allocated.

- The following are the methods of allocation of R & D expenses.
 1. A percentage based on total sales value. This method is good if sales value is steady from year to year.
 2. A percentage based on net profit.
 3. A total sum is estimated on the basis of past experience and future R & D plans and policies.
 4. A sum is fixed on the basis of cash resources available with the company.

All factors which affect the importance of R & D are considered. For example, factors like demand for existing products, competition, economic conditions, etc., are considered carefully and a sum is set aside as R& D budget.

(xiv) Capital Expenditure Budget:

The capital expenditure budget represents the planned outlay on fixed assets like land, building, plant and machinery, etc. during the budget period. This budget is subject to strict management control because it entails large amount of expenditure. The budget is prepared to cover a long period of years and it projects the capital costs over the period in which the expenditure is to be incurred and the expected earnings.

The preparation of capital budget is based on the following considerations:

1. Capital Budget is a budget prepared for capital receipts and expenditure such as investment on land and building, plant and machinery obtaining loans, issue of shares, purchase of assets etc.
2. Future development plans to increase output by expansion of plant facilities.
3. Replacement requests from the concerned departments.
4. Factors like sales potential to absorb the increased output, possibility of price reductions, increased costs of advertising and sales promotion to absorb increased output, etc.
5. Overhead on production facilities of certain departments as indicated by the plant utilisation budget.

Merits/Advantages of capital budgeting

1. Capital budget outlines the capital development programme and estimated capital expenditure during the budget period.
2. It enables the company to establish a system of priorities. When there is a shortage of funds, capital rationing becomes necessary.
3. It serves as a tool for controlling expenditure.

4. It provides the amount of expenditure to be incorporated in the future budget summaries for calculation of estimated return on capital employed.
5. This enables the cash budget to be completed. With other cash commitments capital expenditure commitment should also be considered for the completion of the budget.
6. It facilitates cost reduction programme, particularly when modernisation and renovation is covered by this budget.

ILLUSTRATION 4

A single product company estimated its quarter-wise sales for the next year as under:

Quarter	Sales (Units)
<i>I</i>	30,000
<i>II</i>	37,500
<i>III</i>	41,250
<i>IV</i>	45,000

The opening stock of finished goods is 6,000 units and the company expects to maintain the closing stock of finished goods at 12,250 units at the end of the year. The production pattern in each quarter is based on 80% of the sales of the current quarter and 20% of the sales of the next quarter. The company maintains this 20% of sales of next quarter as closing stock of current quarter.

The opening stock of raw materials in the beginning of the year is 10,000 kg. and the closing stock at the end of the year is required to be maintained at 5,000 kg. Each unit of finished output requires 2 kg. of raw materials.

The company proposes to purchase the entire annual requirement of raw materials in the first three quarters in the proportion and at the prices given below:

Quarter	Purchase of raw materials % to total annual requirement in quantity	Price per kg. (₹)
<i>I</i>	30%	2
<i>II</i>	50%	3
<i>III</i>	20%	4

The value of the opening stock of raw materials in the beginning of the year is ₹ 20,000. You are required to PREPARE the following for the next year, quarter wise:

- (i) Production budget (in units).
- (ii) Raw material consumption budget (in quantity).
- (iii) Raw material purchase budget (in quantity and value).
- (iv) Priced stores ledger card of the raw material using First in First out method.

SOLUTION

Working Note:

Calculation of total annual production

	(Units)
Sales in 4 quarters	1,53,750
Add: Closing balance	12,250
	1,66,000
Less: Opening balance	(6,000)
Total number of units to be produced in the next year	1,60,000

(i) Production Budget (in units)

Quarters	I Units	II Units	III Units	IV Units	Total Units
Sales	30,000	37,500	41,250	45,000	1,53,750
Production in current quarter (80% of the sale of current quarter)	24,000	30,000	33,000	36,000	
Production for next quarter (20% of the sale of next quarter)	7,500	8,250	9,000	12,250	
Total production	31,500	38,250	42,000	48,250	1,60,000

(ii) Raw material consumption budget in quantity

Quarters	I	II	III	IV	Total
Units to be produced in each quarter: (A)	31,500	38,250	42,000	48,250	1,60,000
Raw material consumption p.u. (kg.): (B)	2	2	2	2	
Total raw material consumption (Kg.) : (A × B)	63,000	76,500	84,000	96,500	3,20,000

(iii) Raw material purchase budget (in quantity)

	Qty. (kg.)
Raw material required for production	3,20,000
Add : Closing balance of raw material	5,000
	3,25,000
Less : Opening balance	(10,000)
Material to be purchased	3,15,000

Raw material purchase budget (in value)

Quarters	% of annual requirement	Qty. of material	Rate per kg. (₹)	Amount (₹)
(1)	(2)	(3)	(4)	(5)=(3×4)
I	30	94,500 (3,15,000 kg. × 30%)	2	1,89,000
II	50	1,57,500 (3,15,000 kg. × 50%)	3	4,72,500
III	20	63,000 (3,15,000 kg. × 20%)	4	2,52,000
Total		3,15,000		9,13,500

Priced Stores Ledger Card
(of the raw material using FIFO method)

	Quarters											
	I			II			III			IV		
	Kg.	Rate (₹)	Value (₹)	Kg.	Rate (₹)	Value (₹)	Kg.	Rate (₹)	Value (₹)	Kg.	Rate (₹)	Value (₹)
Opening balance	10,000	2	20,000	41,500		83,000	1,22,500		3,67,500	38,500	3	1,15,500
(A)										63,000	4	2,52,000
Purchases: (B)	94,500	2	1,89,000	1,57,500	3	4,72,500	63,000	4	2,52,000	—	—	—
Consumption: (C)	63,000	2	1,26,000	41,500	2	83,000	84,000	3	2,52,000	38,500	3	1,15,500
				35,000	3	1,05,000				58,000	4	2,32,000
Balance: (D)	41,500	2	83,000	1,22,500	3	3,67,500	38,500	3	1,15,500	5,000	4	20,000
(D) = (A) + (B) – (C)							63,000	4	2,52,000			

(iv)

ILLUSTRATION 5

A company is engaged in the manufacture of specialised sub-assemblies required for certain electronic equipment. The company envisages that in the forthcoming month, December, the sales will be in the ratio of 3 : 4 : 2 respectively of sub-assemblies, ACB, MCB and DP.

The following is the schedule of components required for manufacture:

Component requirements					
Sub-assembly	Selling Price	Base board	IC08	IC12	IC26
ACB	520	1	8	4	2
MCB	500	1	2	10	6
DP	350	1	2	4	8
Purchase price (₹)		60	20	12	8

The direct labour time and variable overheads required for each of the sub-assemblies are:

	Labour hours		Variable overheads (₹)
	Grade A	Grade B	
ACB	8	16	36
MCB	6	12	24
DP	4	8	24
Direct wage rate per hour (₹)	5	4	—

The labourers work 8 hours a day for 25 days a month.

The opening stocks of sub-assemblies and components for December are as under:

Sub-assemblies		Components	
ACB	800	Base Board	1,600
MCB	1,200	IC08	1,200
DP	2,800	IC12	6,000
		IC26	4,000

Fixed overheads amount to ₹ 7,57,200 for the month and a monthly profit target of ₹ 12 lacs has been set.

The company is eager for a reduction of closing inventories for the month of December of sub-assemblies and components by 10% of quantity as compared to the opening stock. PREPARE the following budgets for the month of December:

- (a) Sales budget in quantity and value.
- (b) Production budget in quantity
- (c) Component usage budget in quantity.
- (d) Component purchase budget in quantity and value.
- (e) Manpower budget showing the number of workers and the amount of wages payable.

SOLUTION

Working Note:

1. Statement showing contribution:

Sub- assemblies	ABC	MCB	DP	Total
	(₹)	(₹)	(₹)	(₹)
Selling price per unit (p.u.) : (A)	520	500	350	
Marginal Cost per unit.				
Components				
- Base board	60	60	60	
- IC08	160	40	40	
- IC12	48	120	48	
- IC26	16	48	64	
Labour				
- Grade A	40	30	20	
- Grade B	64	48	32	
Variable production overhead	36	24	24	
Total marginal cost per unit. : (B)	424	370	288	

Contribution per unit. : (C) = (A) – (B)	96	130	62	
Sales ratio : (D)	3	4	2	
Contribution × Sales ratio: [(E) = (C) × (D)]	288	520	124	932

2. Desired Contribution for the forthcoming month December

(₹)

Fixed overheads 7,57,200

Desired profit 12,00,000

Desired contribution 19,57,200

3. Sales mix required i.e. number of batches for the forthcoming month December

Sales mix required = Desired contribution/contribution × Sales ratio

= ₹19,57,200/932 (Refer to Working notes 1 and 2)

= 2,100 batches

Budgets for the month of December

(a) Sales budget in quantity and value

Sub-assemblies	ACB	MCB	DP	Total
Sales (Qty.)	6,300 (2,100×3)	8,400 (2,100×4)	4,200 (2,100×2)	
Selling price p.u. (₹)	520	500	350	
Sales value (₹)	32,76,000	42,00,000	14,70,000	89,46,000

(b) Production budget in quantity

Sub-assemblies	ACB	MCB	DP
Sales	6,300	8,400	4,200
Add : Closing stock	720	1,080	2,520

(Opening stock less 10%)	—	—	—
Total quantity required	7,020	9,480	6,720
Less : Opening stock	(800)	(1,200)	(2,800)
Production	6,220	8,280	3,920

(c) Component usage budget in quantity

Sub-assemblies	ACB	MCB	DP	Total
Production	6,220	8,280	3,920	—
Base board (1 each)	6,220	8,280	3,920	18,420
Component IC08 (8:2:2)	49,760 (6,220 × 8)	16,560 (8,280 × 2)	7,840 (3,920 × 2)	74,160
Component IC12 (4:10:4)	24,880 (6,220 × 4)	82,800 (8,280 × 10)	15,680 (3,920 × 4)	1,23,360
Component IC26 (2:6:8)	12,440 (6,220 × 2)	49,680 (8,280 × 6)	31,360 (3,920 × 8)	93,480

(d) Component Purchase budget in quantity and value

Sub-assemblies	Base board	IC08	IC12	IC26	Total
Usage in production	18,420	74,160	1,23,360	93,480	
Add: Closing stock (Opening stock less 10%)	1,440	1,080	5,400	3,600	
	19,860	75,240	1,28,760	97,080	
Less: Opening stock	(1,600)	(1,200)	(6,000)	(4,000)	
Purchase (Qty.)	18,260	74,040	1,22,760	93,080	
Purchase price (₹)	60	20	12	8	
Purchase value (₹)	10,95,600	14,80,800	14,73,120	7,44,640	47,94,160

(e) **Manpower budget showing the number of workers and the amount of wages payable**

Sub-assemblies	Budgeted Production	Direct labour				Total
		Grade A		Grade B		
		Hours p.u.	Total hours	Hours p.u.	Total hours	
ACB	6,220	8	49,760	16	99,520	
MCB	8,280	6	49,680	12	99,360	
DP	3,920	4	15,680	8	31,360	
(A) Total hours			1,15,120		2,30,240	
(B) Hours per man per month			200		200	
(C) Number of workers per month: (A/B)			576		1,152	
(D) Wage rate per month (₹)			1,000		800	
(E) Wages payable (₹) : (C × D)			5,76,000		9,21,600	14,97,600

(xv) **Cash Budget:**

Cash Budget is a detailed budget of cash receipts and cash payments incorporating both revenue and capital items for the budget period. This budget is usually of two parts giving detailed estimates of (i) cash receipts and (ii) cash disbursements. Estimates of cash-receipts are prepared on a monthly basis and depend upon estimated cash-sales, collections from debtors and anticipated receipts from other sources such as sale of assets, borrowings, etc. Estimates of cash disbursements are based on estimated cash purchases, payments to creditors, employees' remuneration, bonus, advances to suppliers, budgeted capital expenditure for expansion, etc.

Cash budget represents the cash requirements of the business during the budget period. **It is the plan of receipts and payments of cash for the budget period**, analysed to show the monthly flow of cash drawn up in such a way that the balance can be forecasted at regular intervals.

The cash budget is one of the most important elements of the budgeted balance sheet. Information from the various operating budgets, such as the sales budget, the direct materials purchases budget, and the selling and administrative expenses budget, affects the cash budget.

In addition, the capital expenditures budget, dividend policies, and plans for equity or long-term debt financing also affect the cash budget.

The main objectives of preparing cash budget are:

- (i) The probable cash position, as a result of planned operation, is assessed; and thus, the excess or shortage of cash becomes clear. This helps in arranging short-term borrowings in advance to meet the situations of shortage of cash or making investments when cash is in excess.
- (ii) Cash can be coordinated in relation to total working capital, sales investment and debt.
- (iii) A sound basis for credit for current control of cash position is established.
- (iv) The effect of sudden and seasonal requirements, large stocks, delay in collection of receipts, etc., on the cash position of the organization is revealed and things become under to the management.

Advantages of cash budget

- (i) It aids in securing option working capital need for smooth running of the operation and planning for payments to the shareholders.
- (ii) It eases strains of a cash shortage
- (iii) It facilitates temporary cash investment wherever, and to whatever extent, found in excess
- (iv) It provides for normal growth

8.3 Master Budget

CIMA, London, defines it as "the summary budget, incorporating its component functional budgets, which is finally approved, adopted and employed." When all the necessary functional budgets have been prepared, the budget officer will prepare the master budget which may consist of budgeted profit and loss account and budgeted balance sheet. These are in fact the budget summaries. When the master budget is approved by the board of directors, it represents a standard for the achievement of which all the departments will work. On the basis of the various

budgets (schedules) prepared earlier in this study, we prepare below budgeted income statement and budgeted balance sheet.

Example of budgeted income statement:

XYZ Company Budgeted Income Statement		
For the Year Ending March 31, 20....		
	(₹)	Amount (₹)
Sales		11,75,000
Less: Cost of goods sold		<u>7,75,000</u>
Gross margin		4,00,000
Less: Selling and distribution expenses	1,36,500	
Less: Administrative expenses	<u>46,000</u>	<u>1,82,500</u>
Profit before interest and taxes		2,17,500
Interest expenses (assumed)		<u>50,000</u>
Profit before tax		1,67,500
Income-tax (30% assumed)		<u>50,250</u>
Net profit		<u>1,17,250</u>

Example of budgeted balance sheet:

XYZ Company Budgeted Balance Sheet		
March 31, 20....		
	(₹)	(₹)
Share capital	3,50,000	
Retained income	<u>1,29,000</u>	4,79,000
<i>Represented by:</i>		
Plant and machinery	3,40,000	
Less: Provision for depreciation	<u>60,000</u>	2,80,000
Raw materials	5,750	
Finished goods	77,500	
Debtors	1,10,000	
Cash	<u>37,750</u>	2,31,000
Less: Creditors		<u>32,000</u>
		<u>4,79,000</u>

Note: Information not available in respect of share capital, opening balance of retained earnings, current assets and current liabilities, etc., has been assumed to complete the above balance sheet.

ILLUSTRATION 6

Float glass Manufacturing Company requires you to PREPARE the Master budget for the next year from the following information:

Sales:

Toughened Glass ₹ 6,00,000

Bent Glass ₹ 2,00,000

Direct material cost 60% of sales

Direct wages 20 workers @ ₹ 150 per month

Factory overheads:

Indirect labour –

Works manager ₹ 500 per month

Foreman ₹ 400 per month

Stores and spares 2.5% on sales

Depreciation on machinery ₹ 12,600

Light and power ₹ 3,000

Repairs and maintenance ₹ 8,000

Others sundries 10% on direct wages

Administration, selling and distribution expenses ₹ 36,000 per year

SOLUTION**Master Budget for the year ending ____**

Sales:			(₹)
Toughened Glass			6,00,000
Bent Glass			2,00,000
Total Sales			8,00,000
Less: Cost of production:			
Direct materials (60% of ₹8,00,000)		4,80,000	

Direct wages (20 workers × ₹150 × 12months)		36,000	
Prime Cost		5,16,000	
Fixed Factory Overhead:			
Works manager's salary (500 × 12)	6,000		
Foreman's salary (400 × 12)	4,800		
Depreciation	12,600		
Light and power (assumed fixed)	3,000	26,400	
Variable Factory Overhead:			
Stores and spares	20,000		
Repairs and maintenance	8,000		
Sundry expenses	3,600	31,600	
Works Cost			5,74,000
Gross Profit (Sales – Works cost)			2,26,000
Less: Adm., selling and distribution expenses			36,000
Net Profit			1,90,000

8.4 Classification on the basis of Time Period

These types of Budgets are classified on the basis of time periods. These types of budgets reflect the planning period of the organization.

Long term Budget: - Long Term Budget is a budget prepared covering a period of more than a year. The Budgets are prepared to depict long term planning of the business. The period of long-term Budgets varies between three to ten years. These budgets are useful for those industries where gestation period is long i.e., the business entities manufacturing machinery, electricity etc.

1. **Short term Budget:** - These budgets are generally for one or two years and are in the form of monetary terms. The consumer's good industries like Sugar, Cotton, and textile use short term budgets.

2. **Current Budgets:** - The period of current budgets is generally of months and weeks. These budgets relate to the current activities of the business. According to CIMA London "Current budget is a budget which is created which is established for use over a short period of time and is related to current conditions".



9. ZERO – BASED BUDGETING (ZBB)

Zero-based Budgeting (ZBB) is defined as a method of budgeting which requires each cost element to be specifically justified, though the activities to which the budget relates are not being undertaken for the first time. The cost of each activity has to be justified and without justification, the budget allowance is zero.

Zero based budgeting differs from the conventional system of budgeting because it mainly starts from scratch or zero and not on the basis of trends or historical levels of expenditure. In the customary budgeting system, the last year's figures are accepted as they are, or cut back or increases are granted. Zero based budgeting on the other hand, starts with the premise that the budget for next period is zero so long the demand for a function, process, project or activity is not justified for each rupee from the first rupee spent.

Zero-based Budgeting (ZBB) is an emergent form of budgeting which arises to overcome the limitations of incremental (traditional) budgeting system.

ZBB is an activity-based budgeting system where budgets are prepared for each activity rather than functional department. Justification in the form of cost benefits for the activity is required to be given. The activities are then evaluated and prioritized by the management on the basis of factors like synchronisation with organisational objectives, availability of funds, regulatory requirement etc.

ZBB is suitable for both corporate and non-corporate entities. In case of non-corporate entities like Government department, local bodies, not for profit organisations, where these entities need to justify the benefits of expenditures on social programmes like mid-day meal, installation of street lights, provision of drinking water etc.

In case of corporate entities, ZBB is best suited for discretionary costs like research and development cost, training programmes, advertisement etc.

9.1 Stages in Zero-based Budgeting

ZBB involves the following stages:

- (i) Identification and description of Decision packages
 - (ii) Evaluation of Decision packages
 - (iii) Ranking (Prioritisation) of the Decision packages
 - (iv) Allocation of resources
- (i) Identification and description of Decision packages:** Decision packages are the programmes or activities for which decision is required to be taken. The programmes or activities are described for technical specifications, financial impact in the form of cost benefit analysis and other issues like environmental, regulatory, social etc.
- (ii) Evaluation of Decision packages:** Once Decision packages are identified and described, it is evaluated against factors like synchronisation with organisational objectives, availability of funds, regulatory requirement etc.
- (iii) Ranking (Prioritisation) of the Decision packages:** After evaluation of the decision packages, it is ranked on the basis priority of the activities. Because of this prioritization feature **ZBB is also known as Priority-based Budgeting.**
- (iv) Allocation of resources:** After ranking of the decision packages, resources are allocated for decision packages. Budgets are prepared like it is done first time without taking reference to previous budgets.

9.2 Advantages of Zero-based Budgeting

The advantages of zero-based budgeting are as follows:

- It **provides a systematic approach for the evaluation of different activities** and rank them in order of preference for the allocation of scarce resources.
- It **ensures that the various functions undertaken by the organization are critical** for the achievement of its objectives and are being performed in the best possible way.

- It **provides an opportunity to the management to allocate resources** for various activities only after having a thorough cost-benefit-analysis. The chances of arbitrary cuts and enhancement are thus avoided.
- The **areas of wasteful expenditure can be easily identified and eliminated.**
- Departmental budgets are closely linked with corporation objectives.
- **The technique can also be used for the introduction and implementation of the system of 'management by objective.'** Thus, it cannot only be used for fulfillment of the objectives of traditional budgeting but it can also be used for a variety of other purposes.

Zero-based budgeting is superior to traditional budgeting: Zero based budgeting is superior to traditional budgeting in the following manner:

- It provides a systematic approach for evaluation of different activities.
- It ensures that the function undertaken are critical for the achievement of the objectives.
- It provides an opportunity for management to allocate resources to various activities after a thorough – cost benefit analysis.
- It helps in the identification of wasteful expenditure and then their elimination. It facilitates the close linkage of departmental budgets with corporate objectives
- It helps in the introduction of a system of Management by Objectives.

9.3 Difference between Traditional Budgeting and Zero-based budgeting

Following are the points of difference between traditional budgeting and zero-based budgeting:

- Traditional budgeting is accounting oriented. Main stress happens to be on previous level of expenditure. Zero-based budgeting makes a decision-oriented approach. It is very rational in nature and requires all programmes, old and new, to compete for scarce resources.

- In traditional budgeting, first reference is made to past level of spending and then demand for inflation and new programmes. In zero-based budgeting, management focuses attention to only on decision packages, which enjoy priority to others.
- In tradition budgeting, some managers deliberately inflate their budget request so that after the cuts they still get what they want. In zero-based budgeting, a rationale analysis of budget proposals is attempted. The managers, who unnecessarily try to inflate the budget request, are likely to be caught and exposed. Management accords its approval only to a carefully devised result-oriented package.
- Traditional budgeting is not as clear and as responsive as zero-base budgeting.
- In traditional budgeting, it is for top management to decide why a particular amount should be spent on a particular decision unit. In Zero-based budgeting, this responsibility is shifted from top management to the manager of decision unit.
- Traditional budgeting makes a routine approach. Zero-based budgeting makes a very straightforward approach and immediately spotlights the decision packages enjoying priority over others.

9.4 Limitations of Zero-based Budgeting

- The work involves in the creation of decision-making and their subsequent ranking has to be made on the basis of new data. This process is very tedious to management.
- The activities selected for the purpose of ZBB are on the basis of the traditional functional departments. So, the consideration scheme may not be implemented properly.



10. PERFORMANCE BUDGETING (PB)

Performance budgeting (PB) involves evaluation of the performance of an organisation in the context of both specific as well as overall objectives of the organisation. This requires complete clarity about both the short-term as well as

long-term organisational objectives. The responsibility of the various levels of management should be predetermined in terms of results expected from them and the authority vested in them. In other words, performance budgeting requires fixing of the responsibility of each executive in organisation and the continuous appraisal of his performance. It is, therefore, considered to be synonymous with responsibility accounting.

Performance Budgeting provide a meaningful relationship between estimated inputs and expected outputs as an integral part of the budgeting system. **A performance budget is one which presents the purposes and objectives for which funds are required**, the costs of the programmes proposed for achieving those objectives, and quantitative data measuring the accomplishments and work performed under each programme. Thus, PB is a technique of presenting budgets for costs and revenues in terms of functions. Programmes and activities are correlating the physical and financial aspect of the individual items comprising the budget.

10.1 Traditional Budgeting vs. Performance Budgeting

- The traditional budgeting gives more emphasis on the financial aspect than the physical aspects or performance. PB aims at establishing a relationship between the inputs and the outputs.
- Traditional budgets are generally prepared with the main basis towards the objects or items of expenditure i.e., it highlights the items of expenditure, namely, salaries, stores and materials, rates, rents and taxes and so on. In the PB emphasis is more on the functions of the organisation, the programmes to discharge this function and the activities which will be involved in undertaking these programmes.

10.2 Steps in Performance Budgeting

According to the Administrative Reforms Commission (ARC), the following steps are the basic ones in PB:

- Establishing a meaningful functional programme and activity classification of government operations.

- Bring the system of accounting and financial management in accordance with this classification.
- Evolving suitable norms, yardsticks, work units of performance and units costs, wherever possible under each programme and activity for their reporting and evaluation.

The Report of the ARC use the following terms in an integrated sequence:



The term 'function' is used in the sense of 'objective'. For achieving objectives 'programmes' will have to be evolved. In respect of time horizon, it is essentially a replacement of traditional annual fiscal budgeting by a more output-oriented, but still an annual, exercise.

For an enterprise that wants to adopt PB, it is thus imperative that:

- the objectives of the enterprise are spelt out in concrete terms.
- the objectives are then translated into specific functions, programmes, activities and tasks for different levels of management within the realities of fiscal; constraints;
- realistic and acceptable norms, yardsticks or standards and performance indicators should be evolved and expressed in quantifiable physical units.
- a style of management based upon decentralised responsibility structure should be adopted, and
- an accounting and reporting system should be developed to facilities monitoring, analysis and review of actual performance in relation to budgets.

Performance Reporting at various levels of management:

Report : A major part of the management accountant's job consists of preparing reports to provide information for purposes of control and planning.

The important consideration in drawing up of reports and determining their scope are the following:

Significance	:	Are the facts in the reports reliable? Does it either called for action or demonstrate the effect of action? It is material enough.
Timeliness	:	How late can the information be and still be of use? What is the earliest moment at which it could be used if it were available? How frequently is it required?
Accuracy	:	How small should be an inaccuracy which does not alter the significance of the information?
Appropriateness	:	Is the recipient the right person to take any action that is needed? Is there any other information which is required to support the information to anyone else jointly interested?
Discrimination	:	Will anything be lost by omitting the item? Will any of the items gain from the omission? Is the responsibility for suppressing the item acceptable?
Presentation	:	Is the report clear and unbiased? Is the form of it is suitable to the subject? Is the form of it suitable to the recipient?

The following are certain types of reports which are to be prepared and submitted to management regularly at predetermined time interval:

- 1. Top Management:** (Including Board of Directors and financial managers)
 - (i) Balance Sheet
 - (ii) Profit & Loss Statement
 - (iii) Position of stocks
 - (iv) Disposition of funds or working capital;
 - (v) Capital expenditure and forward commitments together with progress of projects in hands;
 - (vi) Cash-flow statements;
 - (vii) Sales, production, and other appropriate statistics.

2. Sales Management:

- (i) Actual sales compared with budgeted sales to measure performance by:
 - Products,
 - Territories
 - Individual salesmen, and
 - Customers.
- (ii) Standard profit and loss by product:
 - For fixing selling prices, and
 - To Concentrate on sales of most profitable products.
- (iii) Selling expenses in relation to budget and sales value analyzed by:
 - Products,
 - Territories
 - Individual salesmen, and
 - Customers.
- (iv) Bad debts and accounts which are slow and difficult in collection.
- (v) Status reports on new or doubtful customers.

3. Production Management:

- (i) To Buyer: Price variations on purchases analysed by commodities.
- (ii) To Foreman:
 - Operational efficiency for individual operators duly summarized as departmental average;
 - Labour utilization report and causes of lost time and controllable time;
 - Indirect shop expenses against the standard allowed; and
 - Scrap report.
- (iii) To Works Managers:
 - Departmental operating statement;

- General works operating statements (Expenses relating to all works expenses not directly allocable or controllable by departments);
- Plant utilization report;
- Department Scrap report; and
- Material usage report.

4. Special Reports:

These reports may be prepared at the request of general management or at the initiative of the management accountants. The necessity for them may, in some cases, arise on account of the need for more detailed information on matters of interest first revealed; by the routine, reports. These reports may range over a very wide area. Some of the matters in respect of which such reports may be required can be:

- (i) Taxation legislation and its effect on profits.
- (ii) Estimates of the earning capacity of a new project.
- (iii) Break-even analysis
- (iv) Replacement of capital equipment.
- (v) Special pricing analysis
- (vi) Make or buy certain components
- (vii) Statement of surplus available for payment of bonus under the labour appellate tribunal formula.



15.11. BUDGET RATIO

Ratio is a mathematical relationship between two or more related figures. Budget ratios provide information about the performance level, i.e., the extent of deviation of actual performance from the budgeted performance and whether the actual performance is favourable or unfavorable. If the ratio is 100% or more, the performance is considered as favourable and if ratio is less than 100% the performance is considered as unfavourable.

The following ratios are usually used by the management to measure development from budget.

Capacity Usage Ratio: This relationship between the budgeted number of working hours and the maximum possible number of working hours in a budget period.

Standard Capacity Employed Ratio: This ratio indicates the extent to which facilities were actually utilized during the budget period.

Level of Activity Ratio: This may be defined as the number of standard hours equivalent to work produced expressed as a percentage of the budget of standard hours.

Efficiency Ratio: This ratio may be defined as standard hours equivalent of work produced expressed as a percentage of the actual hours spent in producing the work.

Calendar Ratio: This ratio may be defined as the relationship between the number of working days in a period and the number of working as in the relative budget period.

Budget Ratios:

$$(i) \quad \text{Efficiency Ratio} = \frac{\text{Standard Hours}}{\text{Actual Hours}} \times 100$$

$$(ii) \quad \text{Activity Ratio} = \frac{\text{Standard Hours}}{\text{Budgeted Hours}} \times 100$$

$$(iii) \quad \text{Calendar Ratio} = \frac{\text{Available working days}}{\text{Budgeted working days}} \times 100$$

$$(iv) \quad \text{Standard Capacity Usage Ratio} = \frac{\text{Budgeted Hours}}{\text{Max. possible hours in the budgeted period}} \times 100$$

$$(v) \quad \text{Actual Capacity Usage Ratio} = \frac{\text{Actual Hours worked}}{\text{Max. possible working hours in a period}} \times 100$$

$$(vi) \quad \text{Actual Usage of Budgeted Capacity Ratio} = \frac{\text{Actual working Hours}}{\text{Budgeted Hours}} \times 100$$

ILLUSTRATION 7

Following data is available for DKG and Co:

Standard working hours	8 hours per day of 5 days per week
Maximum capacity	50 employees
Actual working	40 employees
Actual hours expected to be worked per four week	6,400 hours
Std. hours expected to be earned per four weeks	8,000 hours
Actual hours worked in the four- week period	6,000 hours
Standard hours earned in the four- week period	7,000 hours.

The related period is of 4 weeks. In this period there was a one special day holiday due to national event. CALCULATE the following ratios:

(1) Efficiency Ratio, (2) Activity Ratio, (3) Calendar Ratio, (4) Standard Capacity Usage Ratio, (5) Actual Capacity Usage Ratio. (6) Actual Usage of Budgeted Capacity Ratio.

SOLUTION

Maximum Capacity in a budget period

$$= 50 \text{ Employees} \times 8 \text{ Hrs.} \times 5 \text{ Days} \times 4 \text{ Weeks} = 8,000 \text{ Hrs.}$$

Budgeted Hours

$$40 \text{ Employees} \times 8 \text{ Hrs.} \times 5 \text{ Days} \times 4 \text{ Weeks} = 6,400 \text{ Hrs.}$$

Actual Hrs. = 6,000 Hrs. (given)

Standard Hrs. for Actual Output = 7,000 Hrs.

Budget No. of Days = 20 Days = 20 Days (4 Weeks x 5 Days)

Actual No. of Days = 20 – 1 = 19 Days

$$1. \quad \text{Efficiency Ratio} = \frac{\text{Standard Hrs}}{\text{Actual Hrs}} \times 100 = \frac{7,000 \text{ hours}}{6,000 \text{ hours}} \times 100 = 116.67\%$$

$$2. \quad \text{Activity Ratio} = \frac{\text{Standard Hrs}}{\text{Budgeted Hrs}} \times 100 = \frac{7,000 \text{ hours}}{6,400 \text{ hours}} \times 100 = 109.375\%$$

3. **Calendar Ratio** = $\frac{\text{Available working days}}{\text{Budgeted working days}} \times 100 = \frac{19 \text{ days}}{20 \text{ days}} \times 100 = 95\%$
4. **Standard Capacity Usage Ratio** = $\frac{\text{Budgeted Hours}}{\text{Max. possible hours in the budgeted period}} \times 100 = \frac{6,400 \text{ hours}}{8,000 \text{ hours}} \times 100 = 80\%$
5. **Actual Capacity Usage Ratio** = $\frac{\text{Actual Hours worked}}{\text{Max. possible working hours in a period}} \times 100$
 $= \frac{6,000 \text{ hours}}{8,000 \text{ hours}} \times 100 = 75\%$
6. **Actual Usage of Budgeted Capacity Ratio** = $\frac{\text{Actual working Hours}}{\text{Budgeted Hours}} \times 100$
 $= \frac{6,000 \text{ hours}}{6,400 \text{ hours}} \times 100 = 93.75\%$

SUMMARY

- ♦ **Budget:** Budget is a quantitative expression of a plan of action to be pursued over a defined period of time. It is statement of an estimated performance to be achieved in given time, expressed in monetary or quantitative or both terms.
- ♦ **Budget Centre:** A Budget Centre is a section of an organisation developed for the purpose of budgetary control, and is intended to facilitate formulation of various budgets with the help of head of the department.
- ♦ **Budgetary Control:** Budgetary Control is the establishment of budgets, relating the responsibilities of executives to the requirements of a policy, and the continuous comparison of actual with budgeted results, either to secure by individual action the objective of that policy or to provide a basis for its revision.
- ♦ **Budget Manual:** The Budget manual is a document or booklet which Contain guidelines for the preparation of budget in an organization.
- ♦ **Budget Period:** The period of time for which a budget is prepared and used. It may be a year, quarter or a month.
- ♦ **Classification of Budgets:**

Capacity based	-	Fixed and Flexible
Content based	-	Monetary and Physical/quantitative
Functional based	-	Purchase, Sale, Production Cost, Administrative, Selling & Distribution, Research & Development, Plant Capital Expenditure, Cash, Plant Utilization.

- ◆ **Fixed Budget:** a fixed budget, is a budget designed to remain unchanged irrespective of the level of activity actually attained
- ◆ **Flexible Budget:** a flexible budget is defined as a budget which, by recognizing the difference between fixed, semi-variable and variable costs is designed to change in relation to the level of activity attained.
- ◆ **Zero-based Budgeting (ZBB):** Zero-based Budgeting (ZBB) is defined as 'a method of budgeting which requires each cost element to be specifically justified, although the activities to which the budget relates are not being undertaken for the first time, without approval, the budget allowance is zero
- ◆ **Performance Budgeting (PB):** Performance Budgeting means that budget in which the responsibility of various levels of management is predetermined in terms of output or result keeping in view the authority vested with them.
- ◆ **Budget Ratios:** Ratio is a mathematical relationship between two or more related figures. Budget ratios provide information about the performance level, i.e., the extent of deviation of actual performance from the budgeted performance and whether the actual performance is favourable or unfavorable.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *If a company wishes to establish a factory overhead budget system in which estimated costs can be derived directly from estimates of activity levels, it should prepare a:*
 - (a) Master budget
 - (b) Cash budget

- (c) *Flexible budget*
 - (d) *Fixed budget*
2. *The classification of fixed and variable cost is useful for the preparation of:*
- (a) *Master budget*
 - (b) *Flexible budget*
 - (c) *Cash budget*
 - (d) *Capital budget*
3. *Budget manual is a document:*
- (a) *Which contains different type of budgets to be formulated only.*
 - (b) *Which contains the details about standard cost of the products to be made.*
 - (c) *Setting out the budget organization and procedures for preparing a budget including fixation of responsibilities, formats and records required for the purpose of preparing a budget and for exercising budgetary control system.*
 - (d) *None of the above*
4. *The budget control organization is usually headed by a top executive who is known as:*
- (a) *General manager*
 - (b) *Budget director/budget controller*
 - (c) *Accountant of the organization*
 - (d) *None of the above*
5. *"A favourable budget variance is always an indication of efficient performance". Do you agree, give reason?*
- (a) *A favourable variance indicates, saving on the part of the organization hence it indicates efficient performance of the organization.*
 - (b) *Under all situations, a favourable variance of an organization speaks about its efficient performance.*

- (c) *A favourable variance does not necessarily indicate efficient performance, because such a variance might have been arrived at by not carrying out the expenses mentioned in the budget.*
 - (d) *None of the above.*
6. *A budget report is prepared on the principle of exception and thus-*
- (a) *Only unfavourable variances should be shown*
 - (b) *Only favourable variance should be shown*
 - (c) *Both favourable and unfavourable variances should be shown*
 - (d) *None of the above*
7. *Purchases budget and materials budget are same:*
- (a) *Purchases budget is a budget which includes only the details of all materials purchased*
 - (b) *Purchases budget is a wider concept and thus includes not only purchases of materials but also other item's as well*
 - (c) *Purchases budget is different from materials budget; it includes purchases of other items only*
 - (d) *None of the above*
8. *Efficiency ratio is:*
- (a) *The extent of actual working days avoided during the budget period*
 - (b) *Activity ratio/ capacity ratio*
 - (c) *Whether the actual activity is more or less than budgeted activity*
 - (d) *None of the above*
9. *Activity Ratio depicts:*
- (a) *Whether actual capacity utilized exceeds or falls short of the budgeted capacity*
 - (b) *Whether the actual hours used for actual production were more or less than the standard hours*
 - (c) *Whether actual activity was more or less than the budgeted capacity*

- (d) None of the above
10. Which of the following is usually a short-term budget:
- (a) Capital expenditure budget
- (b) Research and development budget
- (c) Cash budget
- (d) Sales budget

Theoretical Questions

1. EXPLAIN briefly the concept of 'flexible budget'.
2. DISCUSS the components of budgetary control system.
3. LIST the eight functional budgets prepared by a business.
4. DISTINGUISH between Fixed and flexible budget.
5. EXPLAIN the Essentials of budget.
6. STATE the considerations on which capital expenditure budget is prepared.
7. DESCRIBE the steps involved in the budgetary control technique.
8. DESCRIBE the salient features of budget manual.

Practical Problems

1. B Ltd manufactures two products viz., X and Y and sells them through two divisions, East and West. For the purpose of Sales Budget to the Budget Committee, following information has been made available for the year 2022-23:

Product	Budgeted Sales		Actual Sales	
	East Division	West Division	East Division	West Division
X	800 units at ₹18	1,200 units at ₹18	1,000 units at ₹18	1,400 units at ₹18
Y	600 units at ₹42	1,000 units at ₹42	400 units at ₹42	800 units at ₹42

Adequate market studies reveal that product X is popular but underpriced. It is expected that if the price of X is increased by ₹ 2, it will, find a ready market. On the other hand, Y is overpriced and if the price of Y is reduced by ₹ 2 it will have more demand in the market. The company management has agreed for the aforesaid price changes. On the basis of these price changes and the reports of salesmen, following estimates have been prepared by the Divisional Managers:

Percentage increase in sales over budgeted sales

Product	East Division	West Division
X	+ 12.5%	+ 7.5%
Y	+ 22.5%	+ 12.5%

With the help of intensive advertisement campaign, following additional sales (over and above the above-mentioned estimated sales by Divisional Managers) are possible:

Product	East Division	West Division
X	120 units	140 units
Y	80 units	100 units

You are required to PREPARE Sales Budget for 2022-23 after incorporating above estimates and also SHOW the Budgeted Sales and Actual Sales of 2021-22.

2. During the FY 2021-22, P Limited has produced 60,000 units operating at 50% capacity level. The cost structure at the 50% level of activity is as under:

	(₹)
Direct Material	300 per unit
Direct Wages	100 per unit
Variable Overheads	100 per unit
Direct Expenses	60 per unit
Factory Expenses (25% fixed)	80 per unit
Selling and Distribution Exp. (80% variable)	40 per unit
Office and Administrative Exp. (100% fixed)	20 per unit

The company anticipates that in FY 2022-23, the variable costs will go up by 20% and fixed costs will go up by 15%.

The selling price per unit will increase by 10% to ₹880

Required:

- (i) CALCULATE the budgeted profit/ loss for the FY 2021-22.
 - (ii) PREPARE an Expense budget on marginal cost basis for the FY 2022-23 for the company at 50% and 60% level of activity and FIND OUT the profits at respective levels.
3. K Ltd. produces and markets a very popular product called 'X'. The company is interested in presenting its budget for the second quarter of 2022-23.

The following information are made available for this purpose:

- (i) It expects to sell 1,50,000 bags of 'X' during the second quarter of 2022-23 at the selling price of ₹1,200 per bag.
- (ii) Each bag of 'X' requires 2.5 mtr. of raw – material 'Y' and 7.5 mtr. of raw – material 'Z'.
- (iii) Stock levels are planned as follows:

Particulars	Beginning of Quarter	End of Quarter
Finished Bags of 'X' (Nos.)	45,000	33,000
Raw – Material 'Y' (mtr)	96,000	78,000
Raw – Material 'Z' (mtr)	1,71,000	1,41,000
Empty Bag (Nos.)	1,11,000	84,000

- (iv) 'Y' cost ₹160 per mtr., 'Z' costs ₹30 per mtr. and 'Empty Bag' costs ₹110 each.
- (v) It requires 9 minutes of direct labour to produce and fill one bag of 'X'. Labour cost is ₹70 per hour.
- (vi) Variable manufacturing costs are ₹60 per bag. Fixed manufacturing costs ₹40,00,000 per quarter.

- (vii) Variable selling and administration expenses are 5% of sales and fixed administration and selling expenses are ₹ 3,75,000 per quarter.

Required

- (i) PREPARE a production budget for the said quarter in quantity.
 - (ii) PREPARE a raw – material purchase budget for 'Y', 'Z' and 'Empty Bags' for the said quarter in quantity as well as in rupees.
 - (iii) COMPUTE the budgeted variable cost to produce one bag of 'X'.
4. ABC Ltd. is currently operating at 75% of its capacity. In the past two years, the levels of operations were 55% and 65% respectively. Presently, the production is 75,000 units. The company is planning for 85% capacity level during 2022-23. The cost details are as follows:

	55%	65%	75%
	(₹)	(₹)	(₹)
Direct Materials	11,00,000	13,00,000	15,00,000
Direct Labour	5,50,000	6,50,000	7,50,000
Factory Overheads	3,10,000	3,30,000	3,50,000
Selling Overheads	3,20,000	3,60,000	4,00,000
Administrative Overheads	<u>1,60,000</u>	<u>1,60,000</u>	<u>1,60,000</u>
	<u>24,40,000</u>	<u>28,00,000</u>	<u>31,60,000</u>

Profit is estimated @ 20% on sales.

The following increases in costs are expected during the year:

In percentage

Direct Materials	8
Direct Labour	5
Variable Factory Overheads	5
Variable Selling Overheads	8
Fixed Factory Overheads	10
Fixed Selling Overheads	15
Administrative Overheads	10

PREPARE flexible budget for the period 2022-23 at 85% level of capacity. Also ascertain profit and contribution.

5. The accountant of manufacturing company provides you the following details for year 2021-22:

	(₹)		(₹)
Direct materials	1,75,000	Other variable costs	80,000
Direct Wages	1,00,000	Other fixed costs	80,000
Fixed factory overheads	1,00,000	Profit	1,15,000
Variable factory overheads	1,00,000	Sales	7,50,000

During the year, the company manufactured two products A and B and the output and costs were:

	A	B
Output (units)	2,00,000	1,00,000
Selling price per unit	₹ 2.00	₹ 3.50
Direct materials per unit	₹ 0.50	₹ 0.75
Direct wages per unit	₹ 0.25	₹ 0.50

Variable factory overhead is absorbed as a percentage of direct wages. Other variable costs have been computed as: Product A ₹ 0.25 per unit; and B ₹ 0.30 per unit.

During 2022-23, it is expected that the demand for product A will fall by 25 % and for B by 50%. It is decided to manufacture a further product C, the cost for which is estimated as follows:

	Product C
Output (units)	2,00,000
Selling price per unit	₹ 1.75
Direct materials per unit	₹ 0.40
Direct wages per unit	₹ 0.25

It is anticipated that the other variable costs per unit will be the same as for product A.

PREPARE a budget to present to the management, showing the current position and the position for 2022-23. Comment on the comparative results.

6. *TQM Ltd. has furnished the following information for the month ending 30th June:*

	Master Budget	Actual	Variance
<i>Units produced and sold</i>	80,000	72,000	
<i>Sales (₹)</i>	3,20,000	2,80,000	40,000 (A)
<i>Direct material (₹)</i>	80,000	73,600	6,400 (F)
<i>Direct wages (₹)</i>	1,20,000	1,04,800	15,200 (F)
<i>Variable overheads (₹)</i>	40,000	37,600	2,400 (F)
<i>Fixed overhead (₹)</i>	40,000	39,200	800 (F)
<i>Total Cost</i>	2,80,000	2,55,200	

The Standard costs of the products are as follows:

	Per unit (₹)
<i>Direct materials (1 kg. at the rate of ₹1 per kg.)</i>	1.00
<i>Direct wages (1 hour at the rate of ₹ 1.50)</i>	1.50
<i>Variable overheads (1 hour at the rate of ₹ 0.50)</i>	0.50

Actual results for the month showed that 78,400 kg. of material were used and 70,400 labour hours were recorded.

Required:

- (i) *PREPARE Flexible budget for the month and compare with actual results.*
 - (ii) *CALCULATE Material, Labour, Variable Overhead and Fixed Overhead Expenditure variances.*
7. *Jigyasa Ltd. is drawing a production plan for its two products Minimax (MM) and Heavyhigh (HH) for the year 2022-23. The company's policy is to hold closing stock of finished goods at 25% of the anticipated volume of sales of the*

succeeding month. The following are the estimated data for two products:

	Minimax (MM)	Heavyhigh (HH)
Budgeted Production units	1,80,000	1,20,000
	(₹)	(₹)
Direct material cost per unit	220	280
Direct labour cost per unit	130	120
Manufacturing overhead	4,00,000	5,00,000

The estimated units to be sold in the first four months of the year 2022-23 are as under

	April	May	June	July
Minimax	8,000	10,000	12,000	16,000
Heavyhigh	6,000	8,000	9,000	14,000

PREPARE production budget for the first quarter in month-wise.

8. Concorde Ltd. manufactures two products using two types of materials and one grade of labour. Shown below is an extract from the company's working papers for the next month's budget:

	Product-A	Product-B
Budgeted sales (in units)	2,400	3,600
Budgeted material consumption per unit (in kg):		
Material-X	5	3
Material-Y	4	6
Standard labour hours allowed per unit of product	3	5

Material-X and Material-Y cost ₹ 4 and ₹ 6 per kg and labours are paid ₹ 25 per hour. Overtime premium is 50% and is payable, if a worker works for more than 40 hours a week. There are 180 direct workers.

The target productivity ratio (or efficiency ratio) for the productive hours worked by the direct workers in actually manufacturing the products is 80%. In

addition the non-productive down-time is budgeted at 20% of the productive hours worked.

There are four 5-days weeks in the budgeted period and it is anticipated that sales and production will occur evenly throughout the whole period.

It is anticipated that stock at the beginning of the period will be:

<i>Product-A</i>	<i>400 units</i>
<i>Product-B</i>	<i>200 units</i>
<i>Material-X</i>	<i>1,000 kg.</i>
<i>Material-Y</i>	<i>500 kg.</i>

The anticipated closing stocks for budget period are as below:

<i>Product-A</i>	<i>4 days sales</i>
<i>Product-B</i>	<i>5 days sales</i>
<i>Material-X</i>	<i>10 days consumption</i>
<i>Material-Y</i>	<i>6 days consumption</i>

Required:

CALCULATE the Material Purchase Budget and the Wages Budget for the direct workers, showing the quantities and values, for the next month.

Case Scenarios

1. *M Ltd. is a public sector undertaking (PSU), produces a product A. The company is in process of preparing its revenue budget for the year 2024. The company has the following information which can be useful in preparing the budget:*
 - (i) *It has anticipated 12% growth in sales volume from the year 2023 of 4,20,000 tonnes.*
 - (ii) *The sales price of ₹23,000 per tonne will be increased by 10% provided Wholesale Price Index (WPI) increases by 5%.*
 - (iii) *To produce one tonne of product A, 2.3 tonnes of raw material are required. The raw material cost is ₹4,500 per tonne. The price of raw material will also increase by 10% if WPI increase by 5%.*
 - (iv) *The projected increase in WPI for 2022 is 4%*

- (v) A total of 6,000 employees works for the company. The company works 26 days in a month.
- (vi) 85% of employees of the company are permanent and getting salary as per 5- year wage agreement. The earnings per manshift (means an employee cost for a shift of 8 hours) is ₹ 3,000 (excluding terminal benefits). The new wage agreement will be implemented from 1st July 2024 and it is expected that a 15% increase in pay will be given.
- (vii) The casual employees are getting a daily wage of ₹ 850. The wages in linked to Consumer Price Index (CPI). The present CPI is 165.17 points and it is expected to be 173.59 points in year 2024.
- (viii) Power cost for the year 2021 is ₹ 42,00,000 for 7,00,000 units (1 unit = 1 Kwh). 60% of power is used for production purpose (directly related to production volume) and remaining are for employee quarters and administrative offices.
- (ix) During the year 2023, the company has paid ₹ 60,00,000 for safety and maintenance works. The amount will increase in proportion to the volume of production.
- (x) During the year 2023, the company has paid ₹ 1,20,000 for the purchase of diesel to be used in car hired for administrative purposes. The cost of diesel will increase by 15% in year 2024.
- (xi) During the year 2023, the company has paid ₹ 6,00,000 for car hire charges (excluding fuel cost). In year 2024, the company has decided to reimburse the diesel cost to the car rental company. Doing this will attract 5% GST on Reverse Charge Mechanism (RCM) basis on which the company will not get GST input credit.
- (xii) Depreciation on fixed assets for the year 2023 is ₹ 80,40,00,000 and it will be 15% lower in 2024.

You being an associate to the budget controller of the company is expected to answer the following question:

- (i) What would be the sales volume for the FY 2024?
 - (a) 4,70,400 tonnes
 - (b) 4,70,000 tonnes
 - (c) 4,70,600 tonnes
 - (d) 4,70,200 tonnes

- (ii) What would be quantity of raw material in FY 2024?
- 9,66,000 tonnes
 - 1,81,000 tonnes
 - 10,81,900 tonnes
 - 10,81,920 tonnes
- (iii) What would be the car hire charges for the FY 2023?
- ₹6,00,000
 - ₹6,50,000
 - ₹6,40,000
 - ₹6,20,000
- (iv) What would be the car hire charges for the FY 2024?
- ₹6,00,000
 - ₹7,74,900
 - ₹6,83,000
 - ₹6,20,000
- (v) What would be the budgeted profit/ loss for the year 2024?
- ₹1273.043 lakhs
 - (₹5142 lakhs)
 - ₹5142 lakhs
 - (₹1273.043 lakhs)

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(c)	2.	(b)	3.	(c)	4.	(b)	5.	(c)	6.	(c)
7.	(b)	8.	(b)	9.	(c)	10.	(c)				

Answers to the Theoretical Questions

1. Please refer paragraph 8.1
2. Please refer paragraph 5.7
3. Please refer paragraph 8.2
4. Please refer paragraph 8.1
5. Please refer paragraph 2
6. Please refer paragraph 8.2
7. Please refer paragraph 5.3
8. Please refer paragraph 7

Answers to the Practical Problems

1. Statement Showing Sales Budget for 2022-23

Division	Product X			Product Y			Total
	Qty.	Rate (₹)	Amt. (₹)	Qty.	Rate (₹)	Amt. (₹)	Amt. (₹)
East	1,020 ¹	20	20,400	815 ³	40	32,600	53,000
West	1,430 ²	20	28,600	1,225 ⁴	40	49,000	77,600
Total	1,200		49,000	1,000		81,600	1,30,600

Workings

1. $800 \times 112.5\% + 120 = 1,020$ units
2. $1,200 \times 107.5\% + 140 = 1,430$ units
3. $600 \times 122.5\% + 80 = 815$ units
4. $1,000 \times 112.5\% + 100 = 1,225$ units

Statement Showing Sales Budget for 2021-22

Division	Product X			Product Y			Total
	Qty.	Rate (₹)	Amt. (₹)	Qty.	Rate (₹)	Amt. (₹)	Amt. (₹)
East	800	18	14,400	600	42	25,200	39,600
West	1,200	18	21,600	1,000	42	42,000	63,600
Total	2,000		36,000	1,600		67,200	1,03,200

Statement Showing Actual Sales for 2021-22

Division	Product X			Product Y			Total
	Qty.	Rate (₹)	Amt. (₹)	Qty.	Rate (₹)	Amt. (₹)	Amt. (₹)
East	1,000	18	18,000	400	42	16,800	34,800
West	1,400	18	25,200	800	42	33,600	58,800
Total	2,400		43,200	1,200		50,400	93,600

2. (i) Calculation of Budgeted profit for the FY 2021-22

	60,000 units	
	Per unit (₹)	Amount (₹)
Sales (A)	800.00	4,80,00,000
Variable Costs:		
- Direct Material	300.00	1,80,00,000
- Direct Wages	100.00	60,00,000
- Variable Overheads	100.00	60,00,000
- Direct Expenses	60.00	36,00,000
- Variable factory expenses (75% of ₹80 p.u.)	60.00	36,00,000
- Variable Selling & Dist. exp. (80% of ₹40 p.u.)	32.00	19,20,000
Total Variable Cost (B)	652.00	3,91,20,000
Contribution (C) = (A – B)	148.00	88,80,000

Fixed Costs:			
- Office and Admin. exp. (100%)		--	12,00,000
- Fixed factory exp. (25%)		--	12,00,000
- Fixed Selling & Dist. exp. (20%)		--	4,80,000
Total Fixed Costs	(D)	--	28,80,000
Profit	(C – D)	--	60,00,000

(ii) **Expense Budget of P Ltd. for the FY 2022-23 at 50% & 60% level**

	60,000 units		72,000 units	
	Per unit (₹)	Amount (₹)	Per unit (₹)	Amount (₹)
Sales (A)	880.00	5,28,00,000	880.00	6,33,60,000
Variable Costs:				
- Direct Material	360.00	2,16,00,000	360.00	2,59,20,000
- Direct Wages	120.00	72,00,000	120.00	86,40,000
- Variable Overheads	120.00	72,00,000	120.00	86,40,000
- Direct Expenses	72.00	43,20,000	72.00	51,84,000
- Variable factory expenses	72.00	43,20,000	72.00	51,84,000
- Variable Selling & Dist. exp.	38.40	23,04,000	38.40	27,64,800
Total Variable Cost (B)	782.40	4,69,44,000	782.40	5,63,32,800
Contribution (C) = (A – B)	97.60	58,56,000	97.60	70,27,200
Fixed Costs:				
- Office and Admin. exp. (100%)	--	13,80,000	--	13,80,000
- Fixed factory exp. (25%)	--	13,80,000	--	13,80,000
- Fixed Selling & Dist. exp. (20%)	--	5,52,000	--	5,52,000
Total Fixed Costs (D)	--	33,12,000	--	33,12,000
Profit (C – D)	--	25,44,000	--	37,15,200

3. (i) Production Budget of 'X' for the Second Quarter

Particulars	Bags (Nos.)
Budgeted Sales	1,50,000
Add: Desired Closing stock	33,000
Total Requirements	1,83,000
Less: Opening stock	(45,000)
Required Production	1,38,000

(ii) Raw-Materials Purchase Budget in Quantity as well as in ₹ for 1,38,000 Bags of 'X'

Particulars	'Y' Mtr.	'Z' Mtr.	Empty Bags Nos.
Production Requirements Per bag of 'X'	2.5	7.5	1.0
Requirement for Production	3,45,000 (1,38,000 × 2.5)	10,35,000 (1,38,000 × 7.5)	1,38,000 (1,38,000 × 1)
Add: Desired Closing Stock	78,000	1,41,000	84,000
Total Requirements	4,23,000	11,76,000	2,22,000
Less: Opening Stock	(96,000)	(1,71,000)	(1,11,000)
Quantity to be purchased	3,27,000	10,05,000	1,11,000
Cost per mtr./Bag	₹160	₹30	₹110
Cost of Purchase (₹)	5,23,20,000	3,01,50,000	1,22,10,000

(iii) Computation of Budgeted Variable Cost of Production of 1 Bag of 'X'

Particulars	(₹)
Raw – Material	
Y 2.5 mtr @160	400.00
Z 7.5 mtr @30	225.00
Empty Bag	110.00
Direct Labour (₹70× 9 minutes / 60 minutes)	10.50
Variable Manufacturing Overheads	60.00
Variable Cost of Production per bag	805.50

4.

ABC Ltd.

Budget for 85% capacity level for the period 2022-23

Budgeted production (units)		85,000
	Per Unit (₹)	Amount (₹)
Direct Material (note 1)	21.60	18,36,000
Direct Labour (note 2)	10.50	8,92,500
Variable factory overhead (note 3)	2.10	1,78,500
Variable selling overhead (note 4)	4.32	3,67,200
Variable cost	38.52	32,74,200
Fixed factory overhead (note 3)		2,20,000
Fixed selling overhead (note 4)		1,15,000
Administrative overhead		1,76,000
Fixed cost		5,11,000
Total cost		37,85,200
Add: Profit 20% on sales or 25% on total cost		9,46,300
Sales		47,31,500
Contribution (Sales – Variable cost)		14,57,300

Working Notes:

1. Direct Materials:

	(₹)		(₹)
75% Capacity	15,00,000	65% Capacity	13,00,000
65% Capacity	13,00,000	55% Capacity	11,00,000
10% change in capacity	2,00,000	10% change in capacity	2,00,000

For 10% increase in capacity, i.e., for increase by 10,000 units, the total direct material cost regularly changes by ₹ 2,00,000

Direct material cost (variable) = ₹ 2,00,000 ÷ 10,000 = ₹ 20

After 8% increase in price, direct material cost per unit = ₹ 20 × 1.08
= ₹ 21.60

Direct material cost for 85,000 budgeted units = 85,000 × ₹ 21.60
= ₹ 18,36,000

2. Direct Labour:

	(₹)		(₹)
75% Capacity	7,50,000	65% Capacity	6,50,000
65% Capacity	6,50,000	55% Capacity	5,50,000
10% change in capacity	1,00,000	10% change in capacity	1,00,000

For 10% increase in capacity, direct labour cost regularly changes by ₹ 1,00,000.

Direct labour cost per unit = ₹ 1,00,000 ÷ 10,000 = ₹ 10

After 5% increase in price, direct labour cost per unit = ₹ 10 × 1.05
= ₹ 10.50

Direct labour for 85,000 units = 85,000 units × ₹ 10.50 = ₹ 8,92,500.

3. Factory overheads are semi-variable overheads:

	(₹)		(₹)
75% Capacity	3,50,000	65% Capacity	3,30,000
65% Capacity	3,30,000	55% Capacity	3,10,000
10% change in capacity	20,000	10% change in capacity	20,000

Variable factory overhead = ₹ 20,000 ÷ 10,000 = ₹ 2

Variable factory overhead for 75,000 units = 75,000 × ₹ 2 = ₹ 1,50,000

Fixed factory overhead = ₹ 3,50,000 – ₹ 1,50,000 = ₹ 2,00,000.

Variable factory overhead after 5% increase = ₹ 2 × 1.05 = ₹ 2.10

Fixed factory overhead after 10% increase = ₹ 2,00,000 × 1.10
= ₹ 2,20,000.

4. Selling overhead is semi-variable overhead:

	(₹)		(₹)
75% Capacity	4,00,000	65% Capacity	3,60,000
65% Capacity	3,60,000	55% Capacity	3,20,000
10% change in capacity	40,000	10% change in capacity	40,000

Variable selling overhead = ₹ 40,000 ÷ 10,000 units = ₹ 4

Variable selling overhead for 75,000 units = 75,000 × ₹ 4 = ₹ 3,00,000.

Fixed selling overhead = ₹ 4,00,000 – ₹ 3,00,000 = ₹ 1,00,000

Variable selling overhead after 8% increase = ₹ 4 × 1.08 = ₹ 4.32

Fixed selling overhead after 15% increase = ₹ 1,00,000 × 1.15
= ₹ 1,15,000

5. Administrative overhead is fixed:

After 10% increase = ₹ 1,60,000 × 1.10 = ₹ 1,76,000

5.

Budget Showing Current Position and Position for 2022-23

	Position for 2021-22			Position for 2022-23			
	A	B	Total (A+B)	A	B	C	Total (A+B+C)
Sales (units)	2,00,000	1,00,000	–	1,50,000	50,000	2,00,000	–
	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
(A) Sales	4,00,000	3,50,000	7,50,000	3,00,000	1,75,000	3,50,000	8,25,000
Direct Material	1,00,000	75,000	1,75,000	75,000	37,500	80,000	1,92,500
Direct wages	50,000	50,000	1,00,000	37,500	25,000	50,000	1,12,500
Factory overhead (variable)	50,000	50,000	1,00,000	37,500	25,000	50,000	1,12,500
Other variable costs	50,000	30,000	80,000	37,500	15,000	50,000	1,02,500
(B) Marginal Cost	2,50,000	2,05,000	4,55,000	1,87,500	1,02,500	2,30,000	5,20,000
(C) Contribution (A-B)	1,50,000	1,45,000	2,95,000	1,12,500	72,500	1,20,000	3,05,000
Fixed costs – Factory			1,00,000				1,00,000
– Others			80,000				80,000
(D) Total fixed cost			1,80,000				1,80,000
Profit (C – D)			1,15,000				1,25,000

Comments: Introduction of Product C is likely to increase profit by ₹ 10,000 (i.e. from ₹ 1,15,000 to ₹ 1,25,000) in 2022-23 as compared to 2021-22. Therefore, introduction of product C is recommended.

6. (i) Statement showing Flexible Budget and its comparison with actual

		Master Budget 80,000 units	Flexible Budget (at standard cost)		Actual for 72,000 units	Variance
			Per unit	72,000 units		
A.	Sales	3,20,000	4.00	2,88,000	2,80,000	8,000 (A)
B.	Direct material	80,000	1.00	72,000	73,600	1,600 (A)
C.	Direct wages	1,20,000	1.50	1,08,000	1,04,800	3,200 (F)
D.	Variable overhead	40,000	0.50	36,000	37,600	1,600 (A)
E.	Total variable cost	2,40,000	3.00	2,16,000	2,16,000	–
F.	Contribution	80,000	1.00	72,000	64,000	–
G.	Fixed overhead	40,000	0.50	40,000	39,200	800 (F)
H.	Net profit	40,000	0.50	32,000	24,800	7,200 (A)

(ii) Variances:

Direct Material Cost Variance = Standard Cost for Actual output
– Actual cost

$$= ₹ 72,000 - ₹ 73,600 = ₹ 1,600 (A)$$

Direct Material Price Variance = Actual Quantity (Standard rate
– Actual Rate)

$$= 78,400 \text{ units} \left(₹ 1.00 - \frac{₹ 73,600}{78,400 \text{ units}} \right)$$

$$= ₹ 4,800 (F)$$

Direct Material Usage Variance = Standard Rate (Std. Qty. –
Actual Quantity)

$$= ₹ 1 (72,000 \text{ units} - 78,400 \text{ units})$$

$$= ₹ 6,400 (A)$$

$$\begin{aligned}
 \text{Direct Labour Cost Variance} &= \text{Standard Cost for actual output} - \text{Actual cost} \\
 &= ₹ 1,08,000 - ₹ 1,04,800 = ₹ 3,200 \text{ (F)} \\
 \text{Direct Labour Rate Variance} &= \text{Actual Hour (Std Rate - Actual Rate)} \\
 &= 70,400 \text{ hours} \left(₹ 1.5 - \frac{₹ 1,04,800}{70,400 \text{ units}} \right) \\
 &= ₹ 800 \text{ (F)} \\
 \text{Direct Labour Efficiency} &= \text{Standard Rate (Standard Hour - Actual Hour)} \\
 &= ₹ 1.5 (72,000 - 70,400) = ₹ 2,400 \text{ (F)} \\
 \text{Variable Overhead} &= \text{Recovered variable overhead} - \text{Actual variable overhead} \\
 &= (72,000 \text{ units} \times ₹ 0.50) - ₹ 37,600 \\
 &= ₹ 1,600 \text{ (A)} \\
 \text{Fixed Overhead Expenditure} &= \text{Budgeted fixed overhead} - \text{Actual fixed overhead} \\
 &= ₹ 40,000 - ₹ 39,200 = ₹ 800 \text{ (F)}
 \end{aligned}$$

7. Production Budget of Product Minimax and Heavyhigh (in units)

	April		May		June		Total	
	MM	HH	MM	HH	MM	HH	MM	HH
Sales	8,000	6,000	10,000	8,000	12,000	9,000	30,000	23,000
Add: Closing Stock (25% of next month's sale)	2,500	2,000	3,000	2,250	4,000	3,500	9,500	7,750
Less: Opening Stock	2,000*	1,500*	2,500	2,000	3,000	2,250	7,500	5,750
Production units	8,500	6,500	10,500	8,250	13,000	10,250	32,000	25,000

* Opening stock of April is the closing stock of March, which is as per company's policy 25% of next month's sale.

Production Cost Budget

Element of cost	Rate (₹)		Amount (₹)	
	MM (32,000 units)	HH (25,000 units)	MM	HH
Direct Material	220	280	70,40,000	70,00,000
Direct Labour	130	120	41,60,000	30,00,000
Manufacturing Overhead (4,00,000 ÷ 1,80,000 × 32,000)			71,111	
(5,00,000 ÷ 1,20,000 × 25,000)				1,04,167
			1,12,71,111	1,01,04,167

8. Number of days in budget period = 4 weeks × 5 days = 20 days

Number of units to be produced

	Product-A (units)	Product-B (units)
Budgeted Sales	2,400	3,600
Add: Closing stock		
$\left(\frac{2,400 \text{ units}}{20 \text{ days}} \times 4 \text{ days} \right) \left(\frac{3,600 \text{ units}}{20 \text{ days}} \times 5 \text{ days} \right)$	480	900
Less: Opening stock	400	200
	2,480	4,300

(i) Material Purchase Budget

	Material-X (Kg.)	Material-Y (Kg.)
Material required:		
Product-A	12,400 (2,480 units × 5 kg.)	9,920 (2,480 units × 4 kg.)

Product-B	12,900 (4,300 units × 3 kg.)	25,800 (4,300 units × 6 kg.)
Add: Closing stock	25,300	35,720
$\left(\frac{25,300\text{kgs.}}{20\text{days}} \times 10\text{days} \right)$	12,650	10,716
$\left(\frac{35,720\text{kgs.}}{20\text{days}} \times 6\text{days} \right)$		
Less: Opening stock	1,000	500
Quantity to be purchased	36,950	45,936
Rate per kg. of Material	₹ 4	₹ 6
Total Cost	₹ 1,47,800	₹ 2,75,616

(ii) Wages Budget

	Product-A (Hours)	Product-B (Hours)
Units to be produced	2,480 units	4,300 units
Standard hours allowed per unit	3	5
Total Standard Hours allowed	7,440	21,500
Productive hours required for production	$\frac{7,440\text{hours}}{80\%} = 9,300$	$\frac{21,500\text{hours}}{80\%} = 26,875$
Add: Non-Productive down time	1,860 hours. (20% of 9,300 hours)	5,375 hours. (20% of 26,875 hours)
Hours to be paid	11,160	32,250

Total Hours to be paid = 43,410 hours (11,160 + 32,250)

Hours to be paid at normal rate = 4 weeks × 40 hours × 180 workers
= 28,800 hours

Hours to be paid at premium rate = 43,410 hours – 28,800 hours = 14,610 hours

Total wages to be paid = 28,800 hours × ₹ 25 + 14,610 hours × ₹ 37.5
 = ₹ 7,20,000 + ₹ 5,47,875
 = ₹ 12,67,875

Answers To The Case Scenarios

1.

i.	(a)	ii.	(d)	iii.	(a)	iv.	(b)	v.	(d)

(i) (a) 4,70,400 tonnes

(ii) (d) 10,81,920 tonnes

(iii) (a) ₹ 6,00,000

(iv) (b) ₹7,74,900

(v) (d) (₹1273.043 lakhs)

Revenue Budget (Flexible Budget) of M Ltd. for the Year 2024

	Particulars	PY 2023	CY 2024
A	Sales Volume (Tonnes)	4,20,000	4,70,400 [112%×4,20,000]
B	Selling Price per tonne (₹)	23,000	23,000
		(₹ in lakh)	(₹ in lakh)
C	Sales value [A×B]	96,600	1,08,192
D	Raw material Cost:		
(i)	Qty. of Material [2.3 tonnes × A] (tonnes)	9,66,000	10,81,920
(ii)	Price per tonne (₹)	4,500	4,500

(iii)	Total raw material cost (₹ in lakh) [(i) × (ii)]	43,470	48,686.40
E	Wages & Salary Cost:		
(i)	Wages to casual employees (15% × 6,000 = 900 employees)	2,386.80 [900 × 26 × 12 × ₹850]	2,508.47 [900 × 26 × 12 × ₹893.33]
(ii)	Salary to permanent employees (85% × 6,000 = 5,100 employees)	47,736 [5100 × 26 × 12 × ₹3,000]	51,316.20 [(5100 × 26 × 6 × ₹3,000) + (5100 × 26 × 6 × ₹3,450)]
(iii)	Total wages & salary [(i) + (ii) + (iii)]	50,122.80	53,824.67
F	Power cost:		
(i)	For production (units)	4,20,000 [60% × 7,00,000]	4,70,400 [112% × 4,20,000]
(ii)	For employees & offices (units) [40% × 7,00,000]	2,80,000	2,80,000
(iii)	Total Power consumption (units) [(i) + (ii)]	7,00,000	7,50,400
(iv)	Power rate per unit (₹) [₹42,00,000 ÷ 7,00,000]	6.00	6.00
(v)	Total power cost [(iii) × (iv)]	42	45.024
G	Safety and maintenance Cost	60	67.20 [112% × 4,20,000]
H	Diesel cost	1.2	-

I	Car Hire charge:		
(i)	Car hire charge	6	6
(ii)	Fuel reimbursement cost	-	1.38 [115%×1.2]
(iii)	GST@5% on RCM basis [5%×(i+ii)]	-	0.369
(iv)	Total Car hire charge cost [(i) + (ii) + (iii)]	6	7.749
J	Depreciation	8,040	6,834 [85%×8040]
K	Total Cost [Sum of D to J]	1,01,742	1,09,465.043
L	Profit/ (Loss) [C-L]	(5,142)	(1,273.043)