

Cost-Volume-Profit (CVP) Analysis

4.1. COST-VOLUME-PROFIT (CVP) ANALYSIS

4.1.1. Meaning and Definition of Cost-Volume- Profit (CVP) Analysis

Cost-Volume-Profit (CVP) analysis is used for establishing the relationship between cost, volume and profit associated with a product. There are many factors which have impact on profitability of the business; however, the most important determinants are the cost of production, sales volume and selling price.

According to Herman C. Heiser, "The most significant single factor in profit planning of the average business is the relationship between the volume of business, costs and profits". The CVP relationship is an important tool used for the profit planning of a business.

CVP analysis uses costs, volume and profit figures. These factors are interrelated as sales price impacts profit of a concern and in turn are determined by the costs incurred for production. The costs are determined by volume of production which is impacted by the expected sales volume. CVP analysis endeavour to analyse the relationship between change in volume and change in costs.

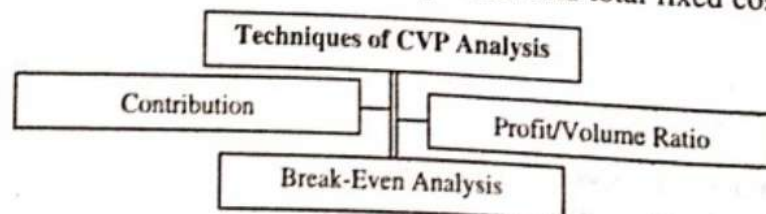
4.1.2. Assumption of CVP Analysis

CVP Analysis uses following assumptions:

- 1) Total costs comprises of fixed costs and variable costs.
- 2) Variable Costs tend to change with the level of output while Fixed Costs remain same regardless of output volume.
- 3) Selling Price per Unit remains same for different quantity of sales.
- 4) The business sells only one type of product. In case of multi-product business, the sales mix remains the same throughout.
- 5) Volume of production equals sales volume and thus, there is no opening or closing stock.
- 6) The efficiency and productivity level remains constant.
- 7) Material Price, wages rates and such other factors remain same for all the levels of production.

4.1.3. Techniques of CVP Analysis

CVP analysis uses sales volume, selling price, variable cost per unit and total fixed costs. The main techniques for CVP analysis are:



4.1.4. Contribution

Contribution is also known as "marginal cost of sales". It is calculated by deducting variable costs from sales. Other terms used for contribution are "Gross Margin" and "Contribution Margin". It denotes the excess of sales over variable costs. Contribution can be represented as:

Contribution = Sales – Variable (Marginal) Cost

Or Contribution (per unit) = Selling Price per unit – Variable (or Marginal) cost per unit

Or Contribution = Fixed Costs + Profit (– Loss)

4.1.4.1. Uses of Contribution

Contribution is useful for following purposes:

- 1) Contribution is useful for making the calculation easy of net income and for break-even analysis.
- 2) Contribution margin is used for calculating break-even point, desired income sales and product line decision. It is also helpful for pricing and bonus decisions.
- 3) Contribution explains the relationship between sales and profit.
- 4) Contribution Income Statement is used for the purpose of calculating contribution margin. This statement groups fixed and variable costs.

4.1.4.2. Advantages of Contribution

Following are the main advantages of contribution:

- 1) It helps managers in fixing sales price.
- 2) It is helpful in calculating break-even point.
- 3) It is helpful in determining suitable product mix.
- 4) It is helpful in determining most efficient production method.
- 5) It can be used for making make or buy decisions.
- 6) It can be used for making decisions like, adding and dropping of product line.

Marginal Cost Equation

Marginal cost equation exhibits the relationship between contribution, fixed cost and profit. It explains that the excess of sales over the variable cost is the contribution towards fixed cost and profit.

The marginal cost equation can be derived as follows:

$$\begin{aligned} \text{Sales} - \text{Variable Cost} &= \text{Contribution} \\ \text{Or } \text{Sales} &= \text{Variable Cost} + \text{Contribution} \\ \text{Or } \text{Sales} &= \text{Variable Cost} + \text{Fixed Cost} \pm \text{Profit/Loss} \\ \text{Or } \text{Sales} - \text{Variable Cost} &= \text{Fixed Cost} \pm \text{Profit/Loss} \\ \text{Or } S - V &= F \pm P \end{aligned}$$

where,

- 'S' = Sales
'V' = Variable Cost
'F' = Fixed Cost
'P' = Profit/Loss

The marginal cost equation helps in determining the value of fourth factor if any three factors are known.

Example 1: From the following information find out the amount of profit earned during the year using the marginal costing technique:

Particulars	₹
Fixed cost	2,00,000
Variable cost	15 per unit
Selling price	18 per unit
Output level	80,000

Solution: The marginal cost equation is:

$$\begin{aligned} \text{Sales} - \text{Variable Cost} &= \text{Fixed Cost} + \text{Profit} \\ \text{Sales} &= 80,000 \times ₹18 = ₹14,40,000 \\ \text{Variable Cost} &= 80,000 \times ₹15 = ₹12,00,000 \\ \text{Fixed Cost} &= ₹2,00,000 \\ \text{Profit} &= ? \\ \text{Sales} - \text{Variable Cost} &= \text{Fixed Cost} + \text{Profit} \\ 14,40,000 - 12,00,000 &= 2,00,000 + \text{Profit} \\ 2,40,000 &= 2,00,000 + \text{Profit} \\ \text{Profit} &= 2,40,000 - 2,00,000 \\ \text{Profit} &= ₹40,000 \end{aligned}$$

4.1.5. Profit-Volume Ratio (P/V Ratio or C/S Ratio)

The Profit/Volume ratio is also known as the 'Contribution Ratio' or 'Marginal Ratio'. It shows the relation between contribution to sales and can be expressed as under:

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

Since, Contribution = Sales - Variable Cost = Fixed Cost + Profit, P/V ratio can also be expressed as:

$$\text{P/V Ratio} = \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}}, \text{ i.e., } \frac{S - V}{S} \quad \text{Or} \quad \text{P/V Ratio} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}}, \text{ i.e., } \frac{F + P}{S}$$

In case, when the profit and sales amount of two different years are provided in the question, then the following formula of P/V Ratio is used:

$$\text{P/V Ratio} = \frac{\text{Change in Profit or Contribution}}{\text{Change in Sales}}$$

P/V ratio remains constant irrespective of level of output. P/V ratio may be used in conjunction with margin safety for proper analysis.

P/V ratio can be expressed in percentage form by multiplying it by 100. For example, P/V ratio for a product with selling price of ₹50 and variable cost of ₹40 may be shown as below:

$$\text{P/V Ratio} = \frac{50 - 40}{50} \times 100 = \frac{10}{50} \times 100 = 20\%$$

P/V ratio is useful for analysing the profitability of a business concern. It carries out the analysis by studying the relationship between contribution and sales. In the above example, every ₹100 of sales gives contribution of ₹20 towards fixed expenses and profit. Higher P/V ratio denotes more profit and *vice versa*.

Desired Profit using P/V Ratio

P/V ratio can be used for calculating break-even point, profit at a certain level of sales and sales volume required for achieving certain level of profit. Following formula is used for this purpose:

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 \quad \text{Or,} \quad \text{P/V Ratio} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}}$$

$$\text{Or,} \quad \text{Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{F + P}{\text{P/V Ratio}}$$

4.1.5.1. Improvements of P/V Ratio

P/V ratio depends on contribution margin of a product. Following measures can be taken to improve the margin of a product:

- 1) Increase in sale price.
- 2) Reducing marginal cost by optimum usage of 3M's, i.e., Men, Material and Machines.
- 3) Focusing on sale of products with relatively better P/V ratio.

4.1.5.2. Significance/Uses of P/V Ratio

P/V ratio is useful for the following purposes:

- 1) For determining variable cost for any volume of sales,
- 2) For calculating margin of safety and break-even point,
- 3) Calculating profit or loss for a given sales volume,
- 4) Determining sales volume for achieving desired profit,
- 5) Determining selling price,
- 6) Determining most profitable line or lines of products,
- 7) Designing optimal sales-mix, and
- 8) P/V ratio may also be used for comparing sales methods, companies and individual factories, etc.

Future Sales for Earning Current Profits

$$\text{Current Profit} = \text{Contribution} - \text{Fixed Cost} = 1,150 - 420 = ₹730$$

So, we have to find out the volume of Sales to earn a profit of ₹730.

$$\text{Sales} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{P/V ratio}} = \frac{420 + 730}{35.19\%} = \frac{1,150}{35.19} \times 100 = 3,267.97$$

$$\text{Sales (in units)} = \frac{3,267.97}{10.8} = 303 \text{ units.}$$

Example 4: The sales turnover and profit during two years were as follows:

Year	Sales (₹)	Profit (₹)
2016	1,60,000	20,000
2017	1,80,000	25,000

You are required to calculate:

- P/V ratio.
- Sales required to earn a profit of ₹60,000.
- Profit when sales are ₹1,40,000.

Solution:

$$\text{i) P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{5,000}{20,000} \times 100 = 25\%$$

- ii) Sales required to earn a profit of ₹60,000

$$\text{P/V Ratio} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}} \Rightarrow \frac{25}{100} = \frac{\text{Fixed Cost} + 20,000}{1,60,000} \Rightarrow \frac{1,60,000 \times 25}{100} = \text{Fixed Cost} + 20,000$$

$$40,000 - 20,000 = \text{Fixed Cost}$$

$$\text{Fixed Cost} = ₹20,000$$

$$\text{Desired Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{20,000 + 60,000}{25/100} = \frac{80,000 \times 100}{25} = ₹3,20,000.$$

- iii) Profit when sales are ₹1,40,000

$$\text{Sales} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{P/V Ratio}} \Rightarrow \text{Sales} \times \text{P/V ratio} = \text{Fixed Cost} + \text{Profit}$$

$$1,40,000 \times \frac{25}{100} = 20,000 + \text{Profit} \Rightarrow 35,000 = 20,000 + \text{Profit} \Rightarrow \text{Profit} = 35,000 - 20,000 = ₹15,000$$

4.1.6. Break-Even Analysis

Cost-Volume-Profit analysis is also known as **Break-Even analysis**. The latter term may be used in narrow or broad sense. In a broad view, break-even analysis studies the relationship between costs, volume and profit for different levels of production and sales. In the narrow sense, the term break-even analysis determines the level of operation which gives no profit and no loss. At this point, the total revenue is equal to total costs.

According to Matz, Curry and Frank, "A Break-even analysis indicates at what level costs and revenue are in equilibrium".

4.1.6.1. Assumptions of Break-Even Analysis

Break-even analysis makes following assumptions:

- 1) All components of cost can be divided into fixed and variable categories,
- 2) Total variable cost changes proportionately in response to change in production level,
- 3) Fixed cost remains same for all output levels,
- 4) Selling price per unit does not change with change in output quantity.

- 5) Cost is influenced only by production volume,
- 6) General price level does not change,
- 7) Sales mix remains the same and does not undergo change, and
- 8) Production and sales are inter-related.

4.1.6.2. Significance of Break-Even Analysis

Break-even analysis is important due to following reasons;

- 1) It is important to understand the relationship between costs, profits and volume for efficient forecasting of profit.
- 2) Break-even analysis helps in setting up flexible budget for showing costs for different output levels.
- 3) Break-even analysis helps in the process of performance evaluation.
- 4) Break-even analysis helps in the process of price fixation by showing the effect of different price structure on profits and costs.
- 5) Break-even analysis helps in determining the amount of overhead costs to be charged to product costs for different operation levels.
- 6) Break-even analysis is also useful for making various short-term decisions such as designing sales mix.

4.1.6.3. Limitations of Break-Even Analysis

Break-even analysis has following limitations:

- 1) Break-even analysis may give wrong results for different changes,
- 2) Segregating costs into fixed and variable parts is a difficult procedure,
- 3) Total fixed costs tend to change after certain point of activity volume,
- 4) It is difficult to predict sales mix in case of continuous change in demand,
- 5) Significant difference in opening and closing stock may affect results of the analysis, and
- 6) Break-even relationship changes in response to selling price and other factors such as wage rates and material prices.

4.1.7. Application of BEP for Various Business Problems

The Break Even Point can be used for decision making in many parts of an organisation. They are as follow:

- 1) It helps in determining whether to make the product or to buy it from the dealer, to deliver the service by itself or hire it from outside the organisation.
- 2) It helps in determining whether to drop a product from the particular product range or to drop a particular department in the organisation or to drop a service from various service.
- 3) It helps in deciding whether to accept a special order of product or service.
- 4) It helps in deciding when limited factors in form of raw material, labour, etc. are present, whether to produce a product or service or not.
- 5) The analysis of breakeven point helps in measuring the change in price, volume and cost.

The marginal costing techniques are used in all the above decision making. There are some basic rules which are as follows:

- 1) The BEP analysis should emphasis on relevant revenue and costs because these are future cost.
- 2) The historic costs are irrelevant cost.
- 3) The fixed cost cannot be use until they are direct fixed cost.
- 4) The apportioned costs are irrelevant cost.
- 5) Both sunk and committed costs are irrelevant.

4.1.8. Break-Even Point (BEP)

Break-even point denotes the quantity of sales where the firm neither earns any profit nor incurs any loss. At this volume level, sales revenue is equal to the total cost. Following equations elucidates the concept of break-even point:

$$\text{Break-Even Sales} = \text{Fixed Cost} + \text{Variable Cost}$$

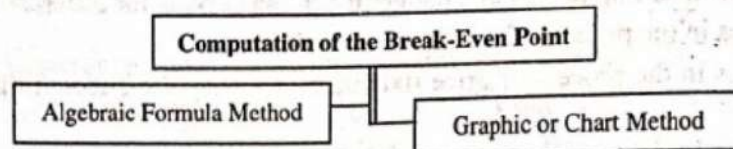
Break-even point is also known as **Balancing Point, Equilibrium Point, Critical Point or No-Profit No-Loss Point.**

According to Keller and Ferrara, "The break-even point of a company or a unit of a company is the level of sales income which will be equal to the sum of its fixed costs and variable costs".

According to Charles T. Horngren, "The break-even point is that point of activity (sales volume) where total revenues and total expenses are equal; it is the point of zero profit and zero loss".

4.1.8.1. Computation of the Break-Even Point

The break-even point can be calculated using algebraic formula method or graphic method.



4.1.8.2. Algebraic Formula Method for Computing the Break-Even Point

Following concepts are used for calculating break-even point:

- 1) **Break-Even Point in Units:** At Break-Even Point, contribution margin equals fixed costs. Following formula is used for the calculation of break-even point in terms of units:

$$\text{Break - Even Point (units)} = \frac{\text{Fixed Cost}}{\text{Selling Price per Unit} - \text{Variable Cost per Unit}} = \frac{\text{Fixed Cost}}{\text{Contribution per Unit}}$$

- 2) **Break-Even Point in Terms of Budget – Total or Money Value:** For calculating break-even point in terms of total value, following formula is used:

$$\text{Total Sales} = \text{Total Fixed Cost} + \text{Total Variable Cost}$$

$$\text{Or } S = F + V$$

(where, S = Sales, F = Fixed Cost and V = Variable Cost)

$$\text{Or } \frac{S - V}{S - V} = \frac{F}{S - V}$$

(Dividing both Sides by S - V)

$$\text{Or } S - V = F$$

$$\text{Or } 1 = \frac{F}{S - V}$$

$$\text{Or } S \times 1 = \frac{F \times S}{S - V}$$

(Multiplying both sides by S)

Hence, Break-Even Sales (in Rupee)

$$= \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} \times \text{Sales} = \frac{\text{Fixed Cost}}{\text{Contribution}} \times \text{Sales}$$

With the use of P/V Ratio,

$$\text{Break-Even Point} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} \left(\text{As, } \frac{\text{Contribution}}{\text{Sales}} = \text{P/V Ratio} \right)$$

- 3) **Break-Even Point as a Percentage of Estimated Capacity:** Break-Even Point can be calculated by dividing break-even sales by the total capacity sales. For example, if a firm's Break-Even Point is at 1,00,000 units and its total estimated capacity is at 2,00,000 units, then Break-Even Point is at 50% of capacity. Following formula may be used for this purpose:

$$\text{B.E.P (as \% age of capacity)} = \frac{\text{Fixed Cost}}{\text{Total Contribution}}$$

Example 5: From the following find out Break-even Point, Sales ₹1,00,000; Fixed Cost ₹20,000; Variable Cost ₹50,000.

$$\text{Solution: Break Even Point (in sales value)} = \frac{\text{Fixed Cost} \times \text{Sales}}{\text{Sales} - \text{Variable Cost}}$$

Given, Fixed Cost = ₹20,000

Sales = ₹1,00,000

Variable Cost = ₹50,000

$$\text{Hence, B.E.P. (in sales value)} = \frac{20,000 \times 1,00,000}{1,00,000 - 50,000} = \frac{20,000 \times 1,00,000}{50,000} = ₹40,000$$

Example 6: From the given data, you are required to calculate the break-even point in units and in sales value:

Output	4,000 units
Selling price per unit	₹35
Variable cost per unit	₹25
Total fixed cost	₹30,000

Solution:

$$\text{Break Even Point (in units)} = \frac{\text{Fixed Cost}}{\text{Selling Price per unit} - \text{Variable Cost per unit}}$$

$$= \frac{30,000}{35 - 25} = \frac{30,000}{10} = 3,000 \text{ units.}$$

$$\text{B.E.P (in sales value)} = \text{B.E.P (in units)} \times \text{Selling price per unit} = 3,000 \times 35 = ₹1,05,000$$

$$\text{Break Even Point (in sales value)} = \frac{\text{Fixed Cost} \times \text{Sales}}{\text{Sales} - \text{Variable Cost}}$$

$$\text{Fixed Cost} = ₹30,000 \text{ (given)}$$

$$\text{Sales} = 4,000 \text{ units} \times 35 \text{ per unit} = ₹1,40,000$$

$$\text{Variable Cost} = 4,000 \text{ units} \times 25 \text{ per unit} = ₹1,00,000$$

$$\text{Hence, B.E.P. (in sales value)} = \frac{30,000 \times 1,40,000}{1,40,000 - 1,00,000} = \frac{30,000 \times 1,40,000}{40,000} = ₹1,05,000$$

Example 7: XYZ Manufacturing, incurred following cost for a biscuit pack.

Fixed Factory Overheads Cost	₹70,000
Fixed Selling Overheads Cost	₹20,000
Variable Manufacturing Cost per unit	₹16
Variable Selling Cost per unit	₹4
Selling Price per unit	₹25

Calculate:

- Break-even point in terms of sales value and in units.
- Number of units that must be sold to earn a profit of ₹95,000.

Solution:

$$\text{i) Break - Even Point} = \frac{\text{Fixed Cost}}{\text{Selling Price per unit} - \text{Variable Cost per unit}}$$

$$\text{Variable Cost per unit} = ₹16 + 4 = ₹20$$

$$\text{Total Fixed Cost} = ₹70,000 + 20,000 = ₹90,000$$

$$\therefore \text{B.E.P} = \frac{90,000}{25 - 20} = 18,000 \text{ units}$$

$$\text{B.E.P (in sales values)} = \text{B.E.P (in units)} \times \text{Selling Price (Per unit)}$$

$$\text{B.E.P. (in sales values)} = 18,000 \times 25 = ₹4,50,000$$

- Number of units that must be sold to earn profit of ₹95,000

$$= \frac{\text{Fixed Cost} + \text{Profit}}{\text{Selling Price per unit} - \text{Variable Cost per unit}} = \frac{90,000 + 95,000}{25 - 20} = \frac{1,85,000}{5} = 37,000 \text{ units.}$$

Example 8: The fixed costs amount to ₹60,000 and the percentage of variable costs to sales is given to be $33\frac{1}{3}\%$. If at 100% capacity sales are ₹3,50,000, find out the break-even point and the percentage sales when it occurred. Determine profit at 75% capacity.

Solution: Percentage of Variable Cost to Sales = $33\frac{1}{3}\%$, i.e., $\frac{100}{3}$

$$\therefore \text{Percentage of Contribution to Sales} = 100 - \frac{100}{3} = \frac{200}{3}$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{200}{3} \times \frac{1}{100} \times 100 = \frac{200}{3} \text{ or } 66\frac{2}{3}\%$$

$$\text{Break-even Sales} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{60,000}{66\frac{2}{3}\%} \text{ or } \frac{60,000}{\frac{200}{3}} \times 300 = ₹90,000.$$

$$100\% \text{ Capacity Sales} = ₹3,50,000$$

$$\text{Hence, B.E.P. occurs at } \frac{90,000}{3,50,000} \times 100 = 25.71\% \text{ capacity.}$$

Profit at 75% Capacity

At 100% Capacity Sales are ₹3,50,000

$$\therefore 75\% \text{ Capacity Sales} = 3,50,000 \times \frac{75}{100} = ₹2,62,500$$

$$\text{Total Contribution at 75\% capacity} = 2,62,500 \times \frac{200}{3} \times \frac{1}{100} = 1,75,000$$

Less: Fixed Expenses

Profit at 75% Capacity

$$\frac{60,000}{\underline{₹1,15,000}}$$

4.1.8.3. Graphical Method of Break-Even Analysis or Break-Even Chart/Graph

The break-even point can also be computed graphically. A break-even chart is a graphical representation of marginal costing. The break-even charts 'portrays a pictorial view of the relationships between costs, volume and profits'. It shows the break-even point and also indicates the estimated profit or loss at various levels of output. The break-even point as indicated in the chart is the point at which the total cost line and the total sales line intersect.

Construction of Break-Even Charts

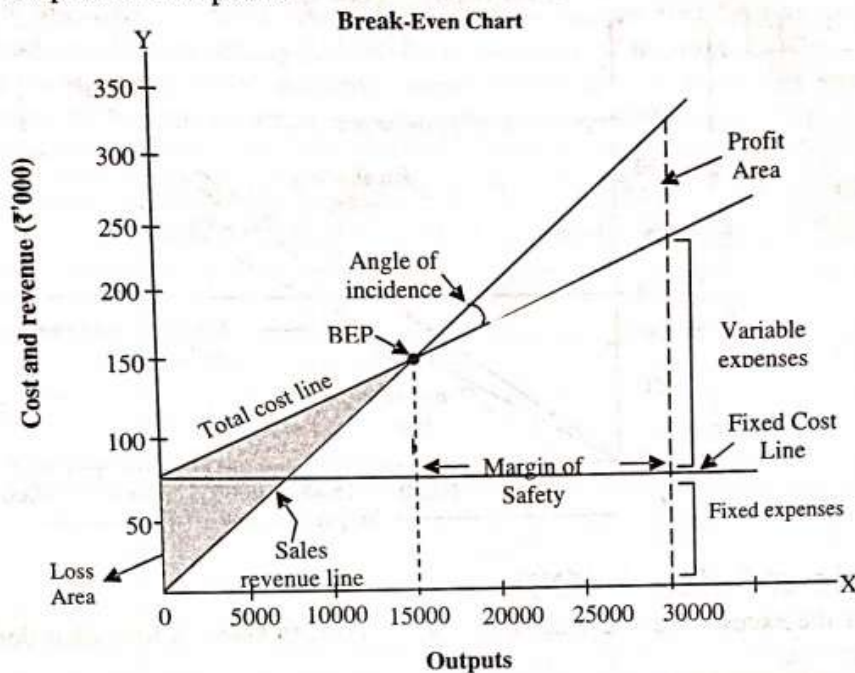
Break-Even chart can be drawn using fixed cost line, total cost line and sales line. Following procedure is used for this purpose:

- 1) Horizontal axis shows the scale for production while vertical axis is used for costs and revenue.
- 2) Fixed cost is plotted on the vertical axis and fixed cost line is drawn, parallel to horizontal axis and passing through this point.
- 3) Variable cost is plotted, starting from the fixed cost line and these points are joined, giving total cost line. Alternatively, total cost for different levels is obtained and are plotted starting from horizontal axis.
- 4) Plot any sales volume and draw the sales line by joining the point and zero.

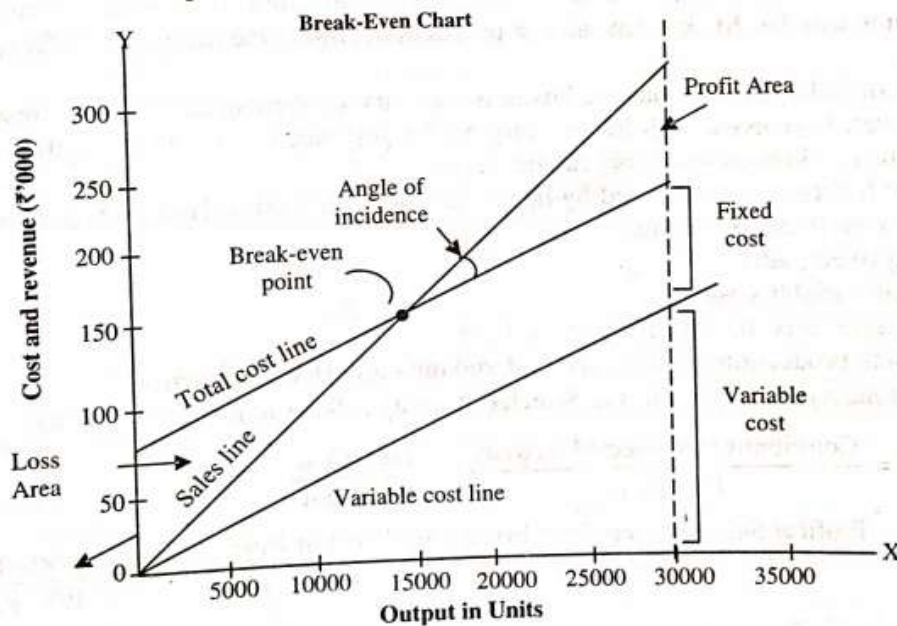
There are three methods of drawing a break-even chart/graph.

- 1) **First Method:** Under this method following steps are taken to draw the break-even chart:
 - i) Y-axis is used for representing costs and sales revenue.
 - ii) Since fixed expenses remain constant, the line is drawn parallel to X-axis.
 - iii) The variable costs for different volumes of production are plotted above the fixed cost line. The variable cost line meets fixed cost line at zero level of activity.
 - iv) Sales or revenue line is drawn by plotting sales value at different levels of output.
 - v) Break-even point is denoted by the intersection of revenue line and total cost line.
 - vi) A perpendicular line is drawn from the break-even point to determine the number of units to be produced for break-even.
 - vii) The sales revenue for break-even point is calculated by plotting a perpendicular line from the point of intersection of sales and cost line.

- viii) The area below the break-even point denotes loss as total sales is less than the total cost while the area above the break-even point shows profit.



- 2) **Second Method:** The break-even chart can be plotted by drawing variable cost line and the total cost line. This method is more useful for managerial decision making purpose.

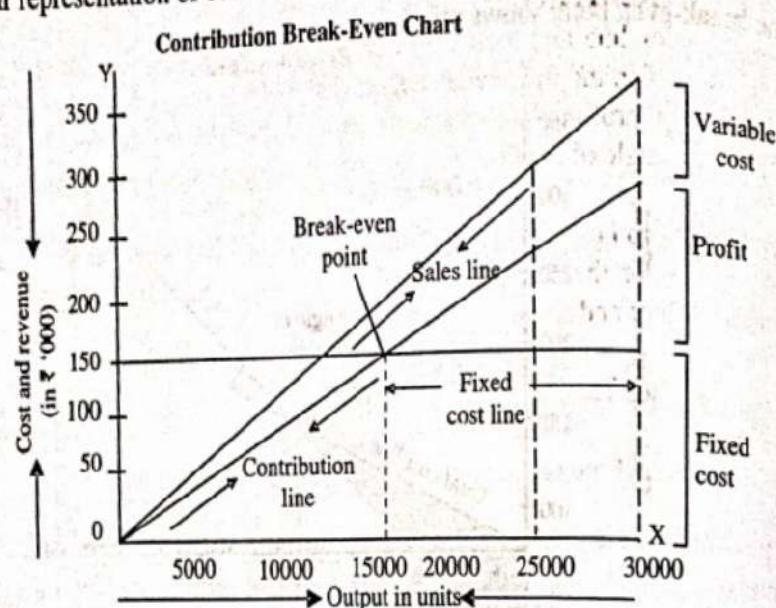


- The variable costs at various levels of sales are plotted.
 - Marginal contribution is depicted by the way of difference between sales and variable cost lines.
 - This type of graph shows the recovery of fixed costs for various levels of production.
- This method can be customised by showing different elements of fixed and variable costs such as variable factory overhead costs and labour costs.

- 3) **Third Method – Contribution Break-Even Chart:** This type of chart does not show total cost line. However, it uses contribution line which is drawn from the origin and goes up with increase in the output level. Fixed cost line is parallel to the x-axis and sales line is shown as usual.

The Break-even point is shown by the intersection of contribution line and fixed cost line. Since at this point, total contribution equals total fixed costs; there is neither any profit nor any loss.

This chart presents clear representation of contribution at different levels of output.



4.1.9. Margin of Safety (MOS)

Margin of Safety is the excess of actual sales over the break-even sales. It may also denote excess of budgeted sales over break-even sales.

$$\text{Margin of Safety} = \text{Total Sales} - \text{Break-Even Point (in Sales)}$$

Margin of Safety is calculated at a selected level of production. It involves finding the difference between sales/production and the Break-Even sales or production. Higher the Margin of Safety, the better is for business.

High Margin of Safety shows that the business can survive substantial fall in its revenue without undergoing losses. However, businesses with lower Margin of Safety need to be more careful. In case of unsatisfactory Margin of Safety, following measures can be taken:

- 1) Margin of Safety may be boosted by increasing the selling price. However, proper attention should be paid to the price elasticity of demand.
- 2) Curtailing fixed costs.
- 3) Controlling variable costs.
- 4) Changing sales mix. Increasing output volume.
- 5) Modernising production facilities and undertaking cost effective practices.
- 6) $\text{Margin of Safety (MOS)} = \text{Sales at Selected Activity} - \text{Sales at Break-Even Point}.$

$$\text{MOS} = \frac{\text{Contribution at Selected Activity}}{\text{P/V Ratio}} - \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

$$\text{MOS} = \frac{\text{Profit at Selected Activity} + \text{Fixed cost}}{\text{P/V Ratio}} - \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{\text{Profit at Selected Activity}}{\text{P/V Ratio}}$$

This Margin of Safety is also presented in ratio or percentages as, $= \frac{\text{Margin of Safety (Sales)}}{\text{Sales at Selected Activity}} \times 100$

Example 8: Calculate the margin of safety when the profit earned is ₹300 and the P/V ratio is 50%. Sales of ₹2,000 is the selected activity.

Solution: Margin of Safety (in value) $= \frac{\text{Profit at Selected Activity}}{\text{P/V Ratio}} = \frac{300 \times 100}{50} = ₹600$

Margin of Safety (in %) $= \frac{\text{Margin of Safety (Sales)}}{\text{Sales at Selected Activity}} \times 100 = \frac{₹600}{₹2,000} \times 100 = 30\%$

4.1.10. Angle of Incidence

The angle formed by sales line and total cost line at break-even point is called "**Angle of Incidence**". This angle shows the rate at which the firm generates profits above the break-even point. Larger angle is considered better as it shows higher profitability while narrower angle shows the converse. The management should endeavour to increase its angle of incidence and correspondingly its margin of safety.

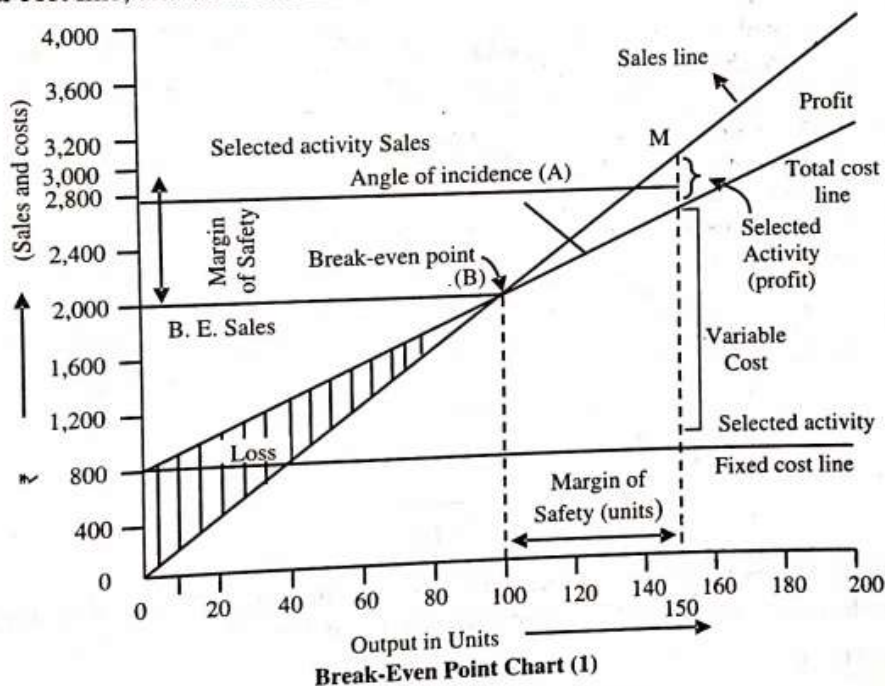
Example 9: A company produces a single article and sells at ₹20 each. The marginal cost of production is ₹8 each and total fixed cost of the concern is ₹600 per annum. Assuming the output at 40, 80, 120 and 200. Construct a break-even chart and show:

- 1) Break-Even Point;
- 2) Margin of Safety at sales ₹2,000;
- 3) Angle of Incidence;
- 4) Increase in selling price if the break-even point is reduced to 100 units.

Solution: A break-even chart is prepared by obtaining the information at these levels:

Output	40 (₹)	80 (₹)	120 (₹)	200 (₹)
Sales	800	1600	2,400	4,000
Fixed cost	600	600	600	600
Variable cost	320	640	960	1,600
Total	1,720	2,840	3,960	6,200

Fixed cost line, total cost line, and sales line are drawn one after another.



This chart shows clearly the break-even point, margin of safety and angle of incidence:

- 1) **Break-Even Point:** This is the point at which the sales line and the total cost line intersect. Here B is the break-even point equivalent to a sale of ₹2,000 or 100 units.
- 2) **Margin of Safety:** This is the difference in sales or units of production from the break-even point. Thus margin of safety at M is sales of (₹3,000 – ₹2,000), i.e., ₹1,000 or 50 units of production.
- 3) **Angel of Incidence:** This is the angle formed by the sales line and the total cost line at the break-even point. A large angle of incidence shows a high rate of profit being made. At 80 units the total cost (from the table) = ₹2,840 = Sales value of 100 units.
Hence, selling price for break-even at 80 units = ₹2,840/100 = ₹28.4 per unit.
- 4) Increase in selling price is ₹8.40 or 10% over the original selling price or ₹20 per unit.

Example 10: ABC Ltd. produces a single product and sells it at ₹10 each. The variable cost per unit is ₹4 and total fixed cost is ₹40,000 per annum of the company. Assuming the output at 4,000, 6,000, 8,000. At present the production capacity is of 10,000 units.

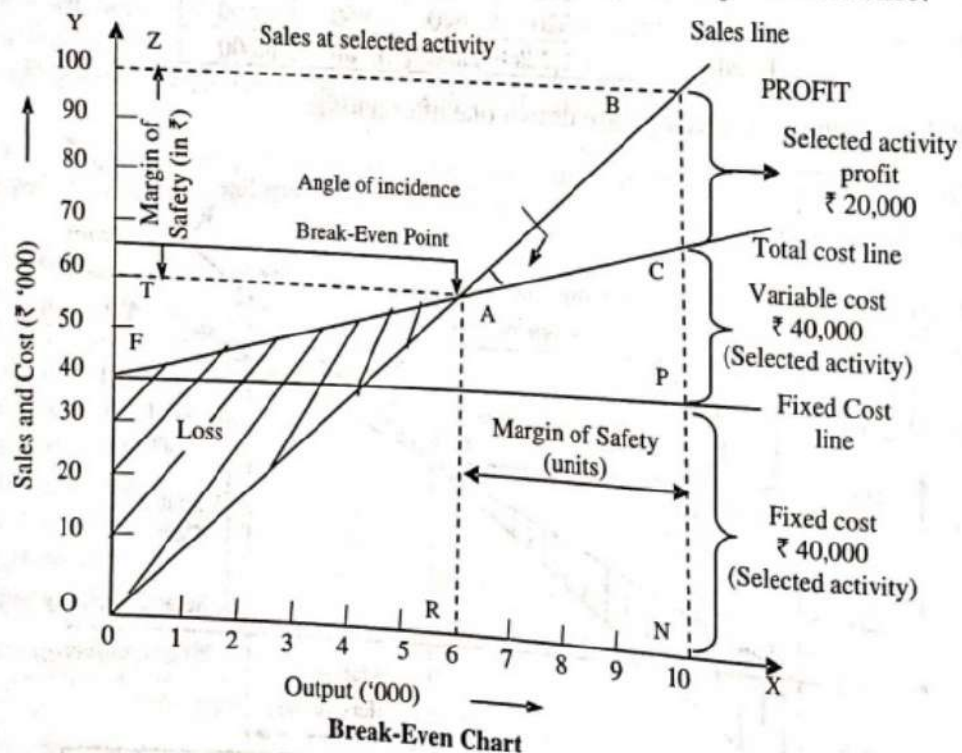
Construct a break-even chart and show:

- 1) B.E.P.;
- 2) Margin of safety at sales ₹1,00,000;
- 3) Angle of incidence;
- 4) Increase in selling price if the B.E.P. is reduced to 6,000 units.

Solution: Statement showing the parameters to be used for plotting points in the graph showing fixed cost line, total cost line, sales line and profit at different levels.

Output (units)	4,000	6,000	8,000	10,000
Sales (₹)	40,000	60,000	80,000	1,00,000
Variable Cost (₹)	16,000	24,000	32,000	40,000
Fixed Cost (₹)	40,000	40,000	40,000	40,000
Total Cost (₹)	56,000	64,000	72,000	80,000
Profit/(Loss)	(16,000)	(4,000)	8,000	20,000

Following chart shows clearly the break-even point, margin of safety and angle of incidence:



- 1) **Break-Even Point:** This is the point at which total cost line intersects the sales line. Here A is the break-even point equivalent to a sale of ₹66,670 (from graph) or $(66,670 \div 10) = 6,670$ units.

$$\text{BEP} = \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{40,000}{6} = 6,667 \text{ units or } 6,667 \times 10 = ₹66,670$$
- 2) **Margin of Safety:** This is the difference between sales or units of production at selected activity and sales or units of production at B.E.P. Hence margin of safety at B is sales of $₹(1,00,000 - 66,670) = ₹33,330$ or 3,333 units.
- 3) **Angle of Incidence:** This is the angle formed between total cost line and the sales line at break-even point. A wider angle of incidence shows a high rate of profit and vice versa.
- 4) At 6,000 units the total cost (from the table above) = ₹64,000 = Sales value of 6,000 units.
 Selling price per unit for break-even at 6,000 units = $₹(64,000 \div 6,000) = ₹10.67$ per unit.
 Increase in selling price is Re. 0.67 or 6.7% over the original selling price of ₹10 per unit.

Example 11: P/V ratio is 60% and marginal cost of product is ₹20. What will be the selling price?

$$\text{Ans: Selling Price} = \frac{\text{Variable Cost}}{100 - \text{P/V Ratio}} = \frac{20}{100 - 60\%} = \frac{20}{40} \times 100 = ₹50$$

Example 12: A Company had incurred fixed expenses of ₹2,25,000 with sales of ₹7,50,000 and earned a profit of ₹1,50,000 during the first half year. In the second half year, it suffered a loss of ₹75,000.

Calculate:

- 1) The profit volume ratio; break-even point and margin of safety for the first half year.
- 2) Expected sales volume for the second half year assuming that selling price and fixed expenses remained unchanged during the second half year.

Solution: Calculations for the First Half-Year

$$\text{P/V Ratio} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}} \times 100 = \frac{2,25,000 + 1,50,000}{7,50,000} \times 100 = 50\%$$

$$\text{BEP} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{2,25,000}{50\%} = ₹4,50,000$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{Sales at BEP} = 7,50,000 - 4,50,000 = ₹3,00,000$$

Expected Sales Volume for Second Half-Year

$$= \frac{\text{Fixed Cost} - \text{Loss}}{\text{P/V Ratio}} = \frac{2,25,000 - 75,000}{50\%} = \frac{1,50,000}{50} \times 100 = ₹3,00,000$$

Example 13: From the following given data:

Sales Price	₹400 per unit
Variable Cost	₹300 per unit
Fixed Cost	₹17,50,000

You are required to calculate:

- 1) Break-even point
- 2) Selling price per unit if break-even point is brought upto 20,000 units; and
- 3) Selling price per unit if break-even point is brought down to 15,000 units.

Solution:

1) **Calculation of Break-even Point**

$$\text{BEP} = \frac{\text{Fixed Cost}}{\text{Contribution per unit}}$$

$$\text{Contribution per unit} = \text{Sales Price per Unit} - \text{Variable Cost per Unit} \\ = 400 - 300 = 100$$

$$\text{BEP} = \frac{17,50,000}{100} = 17,500 \text{ units}$$

2) **Selling Price per unit if break-even point is brought upto 20,000 units.**

$$\text{BEP} = \frac{\text{Fixed Cost}}{\text{Sales Price per Unit} - \text{Variable Cost per Unit}} \Rightarrow 20,000 = \frac{17,50,000}{\text{Contribution per Unit}}$$

$$\text{Contribution per Unit} = \frac{17,50,000}{20,000} = ₹87.50 \text{ per unit}$$

$$\text{Sales Price per Unit} = \text{Variable Cost per Unit} + \text{Contribution per Unit} \\ = 300 \text{ per unit} + ₹87.50 \text{ per unit} \\ = ₹387.50 \text{ per unit}$$

- 3) Selling price per unit if break-even point is brought down to 15,000 units.

$$BEP = \frac{\text{Fixed Cost}}{\text{Contribution per unit}}$$

$$15,000 = \frac{17,50,000}{\text{Contribution per unit}}$$

Contribution per Unit = ₹116.67 per unit

Sales Price per Unit = Variable cost per unit + Contribution per unit
= 300 per unit + 116.67 per unit
= ₹416.67 per unit.

Example 14: From the following information:

Break-even Sales	₹1,00,000
Fixed Cost	₹25,000

Calculate:

- 1) P/V ratio
- 2) Profit when sales are ₹1,50,000
- 3) Sales to earn a profit of ₹50,000 and margin of safety at the level.
- 4) If the selling price is reduced by 10%, what will be new break-even point?

Solution:

- 1) **P/V Ratio** = Fixed cost/Break-even Sales = 25,000/1,00,000 = 25%

- 2) **Profit when sales are ₹1,50,000**

$$\text{Profit} = (\text{Sales} \times \text{P/V Ratio}) - \text{Fixed Cost} = (1,50,000 \times 25\%) - 25,000 = ₹12,500$$

- 3) **Sales to earn a profit of ₹ 50,000**

$$\text{Sales} = (\text{Fixed Costs} + \text{Profit})/\text{P/V Ratio} = (25,000 + 50,000)/25\% = ₹3,00,000$$

$$\text{Margin of Safety} = \text{Profit}/\text{P/V Ratio} = 50,000/25\% = ₹2,00,000$$

- 4) **If the selling price is reduced by 10%, New Break-Even Point**

Assuming the following data:

Particulars	Old (₹)	New (₹)
Selling price	100	90
Less: Variable Cost	75	75
Contribution	25	15

Break-Even Point (in sales) = Fixed Cost/P/V Ratio

New, P/V Ratio = 15/90 = 1/6 or, 16.667%

Break-Even Point (in sales) = 25,000/1/6 = ₹1,50,000

Example 15: The following information is furnished by JANTA Limited, Noida for the year 2016-17:

- 1) Sales Price ₹100 per unit
- 2) Number of Units sold 80,000
- 3) Direct Material Cost ₹40 per unit
- 4) Direct Labour Cost ₹20 per unit
- 5) Overheads ₹20 per unit [40% are variable]

You are required to find out:

- 1) P/V Ratio
- 2) Break-Even Point and
- 3) Margin of Safety

Solution:

$$1) \text{ P/V Ratio} = \frac{\text{Contribution per Unit}}{\text{Selling Price per Unit}} \times 100$$

Contribution per Unit = Selling Price per Unit – Variable Overhead per Unit

Variable Overhead per Unit = Direct Material Cost + Direct Labour Cost + Variable Overhead
 $= 40 + 20 + 8 = ₹68 \text{ per unit}$

Contribution per Unit = $100 - 68 = ₹32$

$$\text{P/V Ratio} = \frac{32}{100} \times 100 = 32\%$$

$$2) \text{ Break – Even Point (in Units)} = \frac{\text{Fixed Cost}}{\text{Contribution per Unit}}$$

$$= \frac{(20 \times 60\%)12 \times 80,000}{32} = \frac{9,60,000}{32} = ₹30,000 \text{ units}$$

$$\text{Break – Even Point (in value)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{9,60,000}{32} \times 100 = ₹30,00,000$$

$$3) \text{ Margin of Safety} = \text{Actual Sales} - \text{B.E.P. Sales} = (80,000 \times 100) - 30,00,000$$

$$= 80,00,000 - 30,00,000 = ₹50,00,000$$

Example 16: From the following information you are required to calculate:

- 1) Contribution
- 2) Fixed cost
- 3) Break-even point (in sales)
- 4) Margin of safety as percentage of sales.

Particulars	2016	2017
Sales	3,00,000	4,00,000
Total cost	2,80,000	3,60,000
Profit	20,000	40,000

Solution:

$$1) \text{ Contribution} = \text{Sales} - \text{Variable Cost}$$

$$\text{Variable Cost to Sales Ratio} = \frac{\text{Change in Cost}}{\text{Change in Sales}} \times 100 = \frac{80,000}{100,000} \times 100 = 80\%$$

Variable Cost is 80% of the total sales.

Variable Cost for 2016 = $3,00,000 \times 80\% = ₹2,40,000$

Variable Cost for 2017 = $4,00,000 \times 80\% = ₹3,20,000$

Contribution for 2016 = $3,00,000 - 2,40,000 = ₹60,000$

Contribution for 2017 = $4,00,000 - 3,20,000 = ₹80,000$

$$2) \text{ Fixed Cost} = \text{Total Cost} - \text{Variable Cost}$$

Fixed Cost for 2016 = $2,80,000 - 2,40,000 = ₹40,000$

Fixed Cost for 2017 = $3,60,000 - 3,20,000 = ₹40,000$

$$3) \text{ Break Even Point} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

$$\text{P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{20,000}{1,00,000} \times 100 = 20\%$$

$$\text{Break Even Point (in Value)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{40,000}{20\%} = ₹2,00,000$$

$$4) \text{ Margin of Safety as Percentage of Sale} = \frac{\text{Margin of Safety}}{\text{Actual Sales}} \times 100$$

$$\text{Margin of Safety (in value) for 2016} = \text{Actual Sales} - \text{Break-even Sales} \\ = 3,00,000 - 2,00,000 = ₹1,00,000$$

$$\text{Margin of Safety (in Percentage)} = \frac{1,00,000}{3,00,000} \times 100 = 33\frac{1}{3}\%$$

$$\text{Margin of Safety (in value) for 2017} = \text{Actual Sales} - \text{Break-even Sales} \\ = 4,00,000 - 2,00,000 = ₹2,00,000$$

$$\text{Margin of Safety (in Percentage)} = \frac{2,00,000}{4,00,000} \times 100 = 50\%$$

Example 17: The turnover and profits of the two years were as follows:

Particulars	Sales Units (₹)	Profit/Loss (₹)
I Year	8,000	15,000 Loss
II Year	10,000	15,000 Profit

The Selling Price per Unit is ₹120.

Calculate:

- 1) P/V Ratio
- 2) Fixed Cost
- 3) Sales at Break-Even Point
- 4) The number of units to be sold to earn a profit of ₹45,000.
- 5) Profit when sales are 30,000 units.

Solution:

$$1) \text{ P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{15,000 - (-15,000)}{12,00,000 - 9,60,000} \times 100 = \frac{30,000}{2,40,000} \times 100 = 12.5\%$$

$$2) \text{ Fixed Cost} = \text{Contribution} - \text{Profit}$$

$$\text{Contribution} = \text{Sales} \times \text{P/V Ratio}$$

$$\text{Contribution I Year} = 9,60,000 \times 12.5\% = ₹1,20,000$$

$$\text{Contribution II Year} = 12,00,000 \times 12.5\% = ₹1,50,000$$

$$\text{Fixed Cost I Year} = 1,20,000 - (-15,000) = ₹1,35,000$$

$$\text{Fixed Cost II Year} = 1,50,000 - 15,000 = ₹1,35,000$$

$$3) \text{ Sales at Break-even Point} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{1,35,000}{12.5\%} = ₹10,80,000$$

$$4) \text{ Number of units to be sold to earn a profit of ₹45,000}$$

$$= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{1,35,000 + 45,000}{12.5\%} = ₹14,40,000$$

$$5) \text{ Profit when sales are 30,000 units}$$

$$\text{Profit} = \text{Contribution} - \text{Fixed Cost}$$

$$= (\text{P/V Ratio} \times \text{Sales}) - \text{Fixed Cost}$$

$$= (12.5\% \times 36,00,000) - 1,35,000 = 4,50,000 - 1,35,000 = ₹3,15,000$$

$$\text{Sales} = 30,000 \text{ units} \times 120 \text{ per unit} = ₹36,00,000$$

Example 18: A company has annual fixed cost of ₹14,00,000. In 2019 sales amounted to ₹60,00,000 as compared with ₹45,00,000 in 2018 and profit in 2019 was ₹4,20,000 higher than in 2018.

- 1) At what level of sales, does the company break even?
- 2) Determine profit or loss on a pre-cast sales of ₹80,00,000.
- 3) If there is reduction in selling price in 2020 by 10% and the company desires to earn the same amount of profit as in 2019. What would be the required sales volume?

Solution:

$$P/V \text{ Ratio} = \frac{\text{Increase in Profit}}{\text{Increase in Sales}} \times 100 = \frac{4,20,000}{15,00,000} \times 100 = 28\%$$

$$1) \text{ Break-even Sales} = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}} = \frac{14,00,000}{28\%} = ₹50,00,000$$

2) Profit on Sales of ₹80,00,000

$$\begin{aligned} \text{Required Profit} &= (\text{Sales} \times P/V \text{ Ratio}) - \text{Fixed Cost} \\ &= \left(80,00,000 \times \frac{28}{100} \right) - 14,00,000 \\ &= 22,40,000 - 14,00,000 = ₹8,40,000 \end{aligned}$$

3) Calculation of Sales on Desired Profit

If Present Selling Price is	₹100
Variable Cost is (Selling Cost – Contribution)	₹72
(100 – 28) as Selling Cost is Assumed as ₹100	
New Selling Price (100 – 10)	₹90
New Contribution	₹18
(New Selling Cost – Variable Cost) (90 – 72)	
New P/V Ratio $\left(\frac{\text{Contribution}}{\text{Sales}} \times 100 \right)$	20%

Profit in 2012

$$\text{Desired Profit} = (\text{Sales} \times P/V \text{ Ratio}) - \text{Fixed Cost}$$

$$\begin{aligned} &= \left(60,00,000 \times \frac{28}{100} \right) - 14,00,000 \\ &= 16,80,000 - 14,00,000 = ₹2,80,000 \end{aligned}$$

$$\begin{aligned} \text{Sales for Desired Profit} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{New P/V Ratio}} \\ &= \frac{14,00,000 + 2,80,000}{20\%} = \frac{16,80,000}{20\%} = ₹84,00,000 \end{aligned}$$

Example 19: The sales and profits during the two years were as follows:

Particulars	Sales (₹)	Profit (₹)
I Year	50,00,000	5,00,000
II Year	70,00,000	9,00,000

Assuming that the Cost Structure and Selling Prices remain the same in the two years, calculate:

- 1) Profit Volume Ratio
- 2) Break-Even Point (in Sales)
- 3) The Sales required to earn a profit of ₹8,00,000
- 4) Margin of Safety in II Year
- 5) Profit when sales are ₹40,00,000

Solution:

$$1) \text{ Profit Volume Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{4,00,000}{20,00,000} \times 100 = 20\%$$

$$2) \text{ Break-Even Point (in Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

Fixed Cost = Contribution – Profit

Contribution = Sales × P/V Ratio

$$\text{I Year} = 50,00,000 \times \frac{20}{100} = ₹10,00,000$$

$$\text{II Year} = 70,00,000 \times \frac{20}{100} = ₹14,00,000$$

$$\text{Fixed Cost} = 10,00,000 - 5,00,000 = ₹5,00,000 \quad \text{or} \quad = 14,00,000 - 9,00,000 = ₹5,00,000$$

$$\therefore \text{Break-even Point (in Sales)} = \frac{5,00,000}{20\%} = ₹25,00,000$$

3) Sales required to earn a profit of ₹8,00,000

$$\text{Desired Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{5,00,000 + 8,00,000}{20\%} = ₹65,00,000$$

4) Margin of Safety (II Year) = Actual Sales – Break-Even Point Sales

$$= 70,00,000 - 25,00,000 = ₹45,00,000$$

5) Profit when Sales are 40,00,000

$$\text{Required Profit} = (\text{Sales} \times \text{P/V Ratio}) - \text{Fixed Cost} = \left(40,00,000 \times \frac{20}{100} \right) - 5,00,000 = ₹3,00,000$$

Example 20: The following figures of sales and profits for two months are available in respect of a concern:

Particulars	Sales (₹)	Profit (₹)
1 st Month	1,50,000	20,000
2 nd Month	1,60,000	24,000

You are required to find-out:

- 1) P/V ratio
- 2) Fixed cost
- 3) Break-even point
- 4) Profit on estimated sale of ₹1,50,000
- 5) Sales required to earn a profit of ₹40,000

Solution:

1) Calculation of P/V Ratio

$$\text{P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{24,000 - 20,000}{1,60,000 - 1,50,000} \times 100 = \frac{4,000}{10,000} \times 100 = 40\%$$

2) Calculation of Fixed Cost

$$\text{Fixed Cost} = \text{Sales} \times \text{P/V Ratio} - \text{Profit} = 1,50,000 \times \frac{40}{100} - 20,000 = ₹40,000$$

3) Calculation of Break-Even Point

$$\text{B.E.P. (in Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{40,000}{40} \times 100 = ₹1,00,000$$

4) **Calculation of Profit at an Estimated Sale of ₹1,50,000 .**

$$\text{Profit} = (\text{Sales} \times \text{P/V Ratio}) - \text{Fixed Cost} = (1,50,000 \times 40\%) - 40,000 = ₹20,000$$

5) **Calculation of sales required to earn a profit of ₹40,000**

$$\begin{aligned} \text{Sales to earn a profit of ₹40,000} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} \\ &= \frac{40,000 + 40,000}{40\%} = \frac{80,000}{40} \times 100 = ₹2,00,000 \end{aligned}$$

Example 21: Following information of Zee Co. Ltd. are given.

Cost Element	Variable Cost (% of Sales)	Fixed Cost (₹)
Direct material	32	—
Direct labour	28	—
Factory overheads	12	2,00,000
Distribution overheads	5	60,000
Administration overheads	3	68,000

Budgeted sales are ₹19,00,000

You are required to calculate:

- 1) The break-even sales volume
- 2) The profit if actual sales:
 - i) Decreased by 10%, and
 - ii) Increased by 8% from budgeted sales.
- 3) The sales required to earn a profit of ₹1,50,000.

Solution:

Statement Showing Contribution and Profit on Budgeted Sales

Particulars	₹
Sales	19,00,000
Less: Variable cost (80%) of sales	15,20,000
Contribution	3,80,000
Less: Fixed cost:	
Factory overheads	2,00,000
Distribution overheads	60,000
Administration overheads	68,000
Profit on Budgeted Sales	52,000

$$1) \text{ B.E.P (in sales value)} = \frac{\text{Fixed Costs}}{\text{Total Contribution}} \times \text{Sales} = \frac{3,28,000}{3,80,000} \times 19,00,000 = ₹16,39,999.99 \text{ or } 16,40,000$$

2) i) **Profit if 10% Sales Decreased from Budgeted Sales:**

Budgeted Sales	19,00,000
Less: 10% of Budgeted Sales	1,90,000
	17,10,000
Less: Total Cost:	
Variable Cost (80% of ₹17,10,000)	13,68,000
Fixed Costs	3,28,000
Profit	14,000

ii) Profit if 8% Sales Increased of Budgeted Sales:

Budgeted Sales		19,00,000
Add: 8% of Budgeted Sales		1,52,000
		20,52,000
Less: Total Cost:	16,41,600	
Variable Cost (80% of ₹20,52,000)	3,28,000	19,69,600
Fixed Cost		
Profit		82,400

3) The Sales Required to Earn a Profit of ₹1,50,000

$$\text{Sales for Desired Profit} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}}$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{3,80,000}{19,00,000} \times 100 = 20\%$$

$$\text{Sales for Desired Profit} = \frac{3,28,000 + 1,50,000}{20} \times 100 = ₹23,90,000$$

Example 22: X. Ltd. furnishes you the following information relating to the half year ended on 30th September 20

Sales	₹3,00,000
Fixed Overheads	₹90,000
Profit	₹60,000

During the second half of the year the company had projected a loss of ₹20,000/-

Calculate:

- 1) BEP and margin of safety for 6 months ending on September, 2015.
- 2) Expected sales volume for the second half of the year assuming that P.V. ratio and fixed overheads remain constant in the second half also.
- 3) BEP and margin of safety for the whole year 2015-16.

Solution:

1) Calculation of BEP and Margin of Safety for 6 Months

$$\text{Break-Even Point (in Sales Value)} = \frac{\text{Fixed Cost or Overheads}}{\text{P/V Ratio}}$$

Where, Fixed Cost or Overheads = ₹90,000

$$\text{P/V Ratio} = \frac{\text{Fixed Cost or Overheads} + \text{Profit}}{\text{Sales}} \times 100 = \frac{90,000 + 60,000}{3,00,000} \times 100 = 50\%$$

$$\therefore \text{Break - Even Point (in Sales Value) for 6 Months} = \frac{90,000}{50\%} = ₹1,80,000$$

$$\begin{aligned} \text{Margin of Safety for 6 Months} &= \text{Total Sales} - \text{Break-Even Point (in Sales Value)} \\ &= 3,00,000 - 1,80,000 \\ &= ₹1,20,000 \end{aligned}$$

2) Calculation of Expected Sales Volume for the Second Half assuming that P/V Ratio and Fixed Overheads remains Constant

$$\text{Expected Sales Volume} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}}$$

Where, Fixed Cost/Overheads = ₹90,000

Desired Profit/Loss = ₹20,000

P/V Ratio = 50%

$$\therefore \text{Expected Sales Volume} = \frac{90,000 + (-20,000)}{50\%} = \frac{70,000}{50\%} = ₹1,40,000$$

3) Calculation of BEP and Margin of Safety for the whole year 2015-16

$$\text{Break-Even Point (in Sales Value)} = \frac{\text{Fixed Cost / Overheads}}{\text{P/V Ratio}}$$

Where, Fixed Cost/Overheads = ₹90,000 × 2 = ₹1,80,000 for whole year
P/V Ratio = 50%

$$\therefore \text{Break-Even Point (in Sales Value)} = \frac{1,80,000}{50\%} = ₹3,60,000$$

$$\text{Margin of Safety} = \frac{\text{Profit}}{\text{P/V Ratio}}$$

Where, Profit = ₹60,000 – ₹20,000 (Loss) = ₹40,000
P/V Ratio = 50%

$$\therefore \text{Margin of Safety} = \frac{40,000}{50\%} = ₹80,000$$

Example 23: Following is the marginal cost statement of a Company:

Particulars	₹
Sales @ ₹15 p.u.	2,40,000
Variable Cost @ ₹12 p.u.	1,92,000
Contribution	48,000
Fixed Cost	36,000
Profit	12,000

Calculate the following:

- 1) Required sales to achieve no profit and no loss situation.
- 2) How many units the company must sell to earn profit of ₹48,000.
- 3) How much sales (in ₹) the company must make in order to earn a net profit of ₹11,000. Corporate tax being 45%.
- 4) How many units must be sold to earn a profit of 10% of selling price.
- 5) What should be the selling price if Break-Even Point is brought down to 1,0000 units.

Solution:

1) Required Sales to Achieve No Profit and Loss Situation

$$\text{Break-even Sales} = \frac{\text{Fixed Cost}}{\text{Contribution}} \times \text{Sales} = \frac{36,000}{48,000} \times 2,40,000 = ₹1,80,000$$

2) Number of Units to be Sold to Earn Profit ₹48,000

$$= \frac{\text{Fixed Cost} + \text{Profit}}{\text{Selling Price per Unit} - \text{Variable Cost per Unit}}$$

$$= \frac{36,000 + 48,000}{15 - 12} = \frac{84,000}{3} = 28,000 \text{ units}$$

3) Sales to Earn Profit of ₹11,000

$$\text{Sales} = \frac{\text{Fixed Cost} + \frac{\text{Profit}}{1 - t}}{\text{Contribution per unit}}$$

$$\text{Where, Profit Volume Ratio} = \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} = \frac{2,40,000 - 1,92,000}{2,40,000} = 20\%$$

$$\text{Contribution per unit} = 20\% \text{ of sales per unit} = \frac{20}{100} \times 15 = 3 \text{ units}$$

$$\text{Sales (units)} = \frac{36,000 + \frac{11,000}{1 - 0.45}}{3} = \frac{36,000 + 20,000}{3} = 18,667 \text{ units}$$

4) **No. of Units to be Sold to Earn a Profit of 10% on Sales**

Let Sales = x and Desired Profit = 0.10x

$$x = \frac{\text{Fixed Cost} + 0.10x}{\text{P/V Ratio}} \Rightarrow x = \frac{36,000 + 0.10x}{20\%}$$

$$0.20x - 0.10x = 36,000$$

$$x = \frac{36,000}{0.10} = 3,60,000$$

$$\text{Required Sales (in Units)} = \frac{3,60,000}{15} = 24,000 \text{ units}$$

$$5) \text{ Break-Even Point (in Units)} = \frac{\text{Fixed Cost}}{\text{Contribution per Unit}}$$

$$10,000 = \frac{36,000}{\text{Contribution per Unit}}$$

$$\text{Contribution per Unit} = \frac{36,000}{10,000} = 3.6 \text{ per unit}$$

$$\begin{aligned} \text{Selling Price per Unit} &= \text{Contribution per Unit} + \text{Variable Cost per Unit} \\ &= 3.6 + 12 = 15.5 \text{ per unit} \end{aligned}$$

Example 24: ZINETH Limited, Meerut has given the following information of Product XY and Product YZ produced and sold during the year 2016-2017:

Particulars	Product XY	Product YZ
Number of units sold	30,000	25,000
Sales Price	₹170	₹160
Cost (Per Unit):		
Direct Material	₹80	₹70
Direct Labour	₹40	₹50
Variable Overheads	₹30	₹30

Fixed Overheads – ₹5 per unit.

You are required to calculate:

- 1) Profit Volume Ratio, Break-even Point and Margin of Safety and the net amount of profit at the current level of sales.
- 2) What would be the amount of profit if the Current Sales of both the products is increased by 15%.

Solution:

Particulars	Product XY	Product YZ
Sale Price (per unit)	170	160
Less: Direct Material	80	70
Direct Labor	40	50
Variable Overhead	30	30
Contribution (per unit)	20	10
Less: Fixed Cost (per unit)	5	5
Profit (per unit)	15	5
Total Profit on Present Sale	15 × 30,000 = 4,50,000	5 × 25,000 = 1,25,000

$$1) \text{ i) Profit Volume Ratio} = \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} = \frac{\text{Contribution}}{\text{Sales}}$$

$$\text{For Product XY} = \frac{20}{170} = 0.1176 \text{ or } 12\%$$

$$\text{For Product YZ} = \frac{10}{160} = 0.625 \text{ or } 6.25\%$$

$$\text{ii) Break-Even Point} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

$$\text{Fixed Cost for Product XY} = 5 \times 30,000 = 1,50,000$$

$$\text{Fixed Cost for Product YZ} = 5 \times 25,000 = 1,25,000$$

$$\text{Break-Even Point (in Sales) for Product XY} = \frac{1,50,000}{12\%} = ₹12,50,000$$

$$\text{Break-Even Point (in Sales) for Product YZ} = \frac{1,25,000}{6.25\%} = ₹20,00,000$$

$$\text{Break-Even Point (in units)} = \frac{\text{Fixed Cost}}{\text{Contribution per units}}$$

$$\text{Break-Even Point (in units) for Product XY} = \frac{1,50,000}{20} = 7,500$$

$$\text{Break-Even Point (in units) for Product YZ} = \frac{1,25,000}{10} = 12,500$$

$$\text{iii) Margin of Safety} = \text{Actual Sales} - \text{Break-Even Point Sales}$$

$$\text{Actual Sales of Product XY} = 30,000 \times 170 = ₹51,00,000$$

$$\text{Actual Sales of Product YZ} = 25,000 \times 160 = ₹40,00,000$$

$$\text{Margin of Safety for Product XY} = 51,00,000 - 12,50,000 = ₹38,50,000$$

$$\text{Margin of Safety for Product YZ} = 40,00,000 - 20,00,000 = ₹20,00,000$$

$$\text{iv) Net amount of the Profit on the Current Level Sale} = \text{Profit} \times \text{No. of Units sold}$$

$$\text{For Product XY} = 15 \times 30,000 = ₹4,50,000$$

$$\text{For Product YZ} = 5 \times 25,000 = ₹1,25,000$$

$$2) \text{ Amount of profit when sales increased by } 15\%$$

$$\text{Increased Sales of Product XY} = 30,000 + \left(30,000 \times \frac{15}{100} \right) = 34,500$$

$$\text{Increased Sales of Product YZ} = 25,000 + \left(25,000 \times \frac{15}{100} \right) = 28,750$$

$$\text{New Profit for Product XY} = \text{Increased Sales} \times \text{Profit (Per Unit)} = 34,500 \times 15 = ₹5,17,500$$

$$\text{New Profit for Product YZ} = 28,750 \times 5 = ₹1,43,750$$

Example 25: The following data is obtained from a company for 2016-17:

Particulars	₹
Sales	20,000
Variable Cost	10,000
Fixed Cost	6,000

Find Profit Volume ratio, Breakeven point and margin of safety at this level, and the effect of:

- 1) 20% decrease in fixed cost.
- 2) 10% increase in fixed cost.
- 3) 10% decrease in variable cost.
- 4) 10% increase in selling price.
- 5) 10% increase in selling price together with an increase of fixed cost by ₹1,200.
- 6) 10% decrease in sales price.
- 7) 10% decrease in sales price accompanied by 10% decrease in variable cost.

$$\text{Solution: P/V Ratio} = \frac{\text{Contribution (i.e., Sales - Variable Cost)}}{\text{Sales}} \times 100 = \frac{₹20,000 - ₹10,000}{₹20,000} \times 100 = 50\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹6,000}{50\%} = ₹12,000$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹20,000 - ₹12,000 = ₹8,000$$

- 1) **20% decrease in fixed cost, whereas other items remain the same:**

$$\text{Decreased Fixed Costs} = ₹6,000 - (20\% \text{ of } 6,000) = ₹6,000 - ₹1,200 = ₹4,800$$

$$\text{P/V} = \frac{₹10,000}{₹20,000} \times 100 = 50\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹4,800}{50\%} = ₹9,600$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹20,000 - ₹9,600 = ₹10,400$$

- 2) **10% increase in fixed costs, whereas other items remain the same:**

$$\text{Increased Fixed Costs} = ₹6,000 + (10\% \text{ of } ₹6,000) = ₹6,000 + ₹600 = ₹6,600$$

$$\text{P/V} = \frac{₹10,000}{₹20,000} \times 100 = 50\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹6,600}{50\%} = ₹13,200$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹20,000 - ₹13,200 = ₹6,800$$

- 3) **10% decrease in variable costs whereas other times remain the same:**

$$\text{Decreased Variable Costs} = ₹10,000 - (10\% \text{ of } 10,000) = ₹10,000 - ₹1,000 = ₹9,000$$

$$\text{Total Contribution} = \text{Sales} - \text{Variable Cost} = ₹20,000 - ₹9,000 = ₹11,000$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹11,000}{₹20,000} \times 100 = 55\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹6,000}{55\%} = ₹10,909.09$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹20,000 - ₹10,909.09 = ₹9,090.91$$

- 4) **10% increase in selling price whereas other items remain the same:**

$$\text{Increased Sales} = ₹20,000 + (10\% \text{ of } 20,000) = ₹20,000 + ₹2,000 = ₹22,000$$

$$\text{Total Contribution} = \text{Sales} - \text{Variable Cost} = ₹22,000 - ₹10,000 = ₹12,000$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹12,000}{₹22,000} \times 100 = 54.55\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹6,000}{54.55\%} = ₹10,999.08$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹22,000 - ₹10,999.08 = ₹11,000.92$$

- 5) **10% increase in selling price together with an increase of fixed cost by ₹1,200 whereas other items remain the same:**

$$\text{Increased Sales as shown above} = ₹22,000$$

$$\text{Therefore, Contribution will also be same as above} = ₹12,000$$

$$\text{Increased Fixed Cost} = ₹6,000 + ₹1,200 = ₹7,200$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹12,000}{₹22,000} \times 100 = 54.55\%$$

$$\text{B.E.P (Sales)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{₹7,200}{54.55\%} = ₹13,199 \text{ (Approx.)}$$

$$\begin{aligned} \text{Margin of Safety} &= \text{Actual Sales} - \text{BEP (Sales)} \\ &= ₹22,000 - ₹13,199 = ₹8,801 \end{aligned}$$

- 6) **10% decrease in selling price whereas other items remain unchanged:**

Decreased Sales = ₹20,000 – (10% of ₹20,000) = ₹20,000 – ₹2,000 = ₹18,000

Total Contribution = Sales – Variable Cost = ₹18,000 – ₹10,000 = ₹8,000

$$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹8,000}{₹18,000} \times 100 = 44.44\%$$

$$B.E.P(\text{Sales}) = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}} = \frac{₹6,000}{44.44\%} = ₹13,501 \text{ (Approx.)}$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹18,000 - ₹13,501 = ₹4,499$$

- 7) **10% decrease in sales price accompanied by 10% decrease in variable cost whereas other items remain unchanged:**

Decreased Sales shown above = ₹18,000

Decreased Variable Cost = ₹10,000 – (10% of 10,000) = ₹10,000 – ₹1,000 = ₹9,000

Total Contribution = Sales – Variable Cost = ₹18,000 – ₹9,000 = ₹9,000

$$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹9,000}{₹18,000} \times 100 = 50\%$$

$$B.E.P(\text{Sales}) = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}} = \frac{₹6,000}{50\%} = ₹12,000$$

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP (Sales)} = ₹18,000 - ₹12,000 = ₹6,000$$

4.2. FORMULAS AT GLANCE IN MARGINAL COSTING

Measures in Terms of Units/Quantity

- 1) **Break-Even Point**

$$\text{Break - even Point} = \frac{\text{Fixed Cost}}{\text{Contribution per Unit}}$$

$$\therefore \text{Contribution per Unit} = \text{Selling Price per Unit} - \text{Variable Cost per Unit}$$

- 2) **Units Sold to Earn a Desired Profit**

$$\text{Sales (Units)} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{Contribution per Unit}}$$

- 3) **Margin of Safety**

$$M/S = \text{Total Units Sold} - \text{Units Sold at BEP}$$

- 4) **Profit = (Sales × Contribution per Unit) – Fixed Cost**

Measures in Terms of Figure/Amount

- 1) **Break-Even Point**

$$\text{Break - even Point (BEP)} = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}}$$

$$\therefore P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 \text{ Or } \frac{\text{Change in Profits}}{\text{Change in Sales}} \times 100$$

- 2) **Sales to Earn a Desired Profits**

$$\text{Sales} = \frac{\text{Fixed Cost} + \text{Desired Profits}}{P/V \text{ Ratio}}$$

- 3) **Margin of Safety**

$$M/S = \text{Total Sales} - \text{Sales at B.E.P}$$

Or

$$M/S = \frac{\text{Profits}}{P/V \text{ Ratio}}$$

- 4) **Profit/Present Profits = (Sales × P/V Ratio) – Fixed Cost**

Equation: Sales – Variable Cost = Contribution – Fixed Cost = Profit

Note: Measures in terms of quantity or figure is to be calculated as per the information given in the question.

5.1 OPERATING COSTING

5.1.1. Concept of Operating Costing

Operating costing is a type of costing technique which is mainly used by the business engaged in providing services instead of producing commodities. Operating costing denotes a type of operation costing like unit costing or process costing.

The operating costing mainly concerns itself with ascertaining cost of providing services instead of finding the costs attributed to producing goods. This type of costing is used by various concerns including gas works, water works, hospitals, theatres, transport companies and schools. Various departments such as internal transport, maintenance department and powerhouse in an organization engage in providing ancillary services to various departments such as production department.

Operation costing is an important tool for the purpose of controlling. It helps in computing unit operation cost for every operation. The unit operation cost is calculated by dividing the aggregate operation cost to total unit of input. This is a basic costing technique which is used for goods or services produced using repetitive and continuous operations. It is also used for processes where costs are allocated before those are spread over the total number of units manufactured during the given time period. Service costing and Process costing are the two methods comprising operation costing.

5.1.2. Meaning and Definition of Operating Costing

Operating costing denotes the method employed for calculating the cost of each per unit of service. It is a procedure for accumulating costs and is intended to find the cost associated with the services. This method is also known as **Service Costing**. The technique is mainly employed where the process of offering service is not fully standardized. It can be used in various concerns such as hospitals, transport and supply services.

Operating costing is a type of **Output or Unit Costing**. Operating costs are similar to process cost and are aggregated periodically.

According to CIMA London defines Operating costing as, "That form of operation costing which applies where standardized services are rendered either by an undertaking or by a service cost centre within an undertaking".

5.1.3. Features of Operating Costing

Following are the main characteristics of operating costing:

- 1) This method is used by the concerns which are engaged in the production of tangible goods. These concerns render services to their clients.
- 2) The cost unit employed by these concerns is composite unit, as opposed to simple cost units used by other undertakings. Following are the main composite units employed by various concerns.

Railways	-	Passenger – kilometre/ ton-kilometre
Hospitals	-	Patient-day
Hotel (Lodging)	-	Room-day
Hotel (Boarding)	-	Plate-meals
Gas distribution	-	Cubic-meter

- 3) It is important to properly classify the expenses into variable and fixed category. Variable cost affects the cost of providing additional services.
- 4) In general, the raw-material goes through various processes to be converted into the final service.
- 5) The costs are calculated period-wise. Under special cases, these may be calculated order-wise as well. This is applicable in cases such as use of road roller and utilization of vehicles.
- 6) The industries using this costing technique generally experience fluctuating demand for their services, making it difficult to find out the costs precisely.
- 7) Valuation of closing stock and work in progress poses no specific challenges.
- 8) Industries dealing in services and manufacturing are generally medium or large sized. They may be public utility companies or monopolistic concerns.

5.1.4. Classification of Costs

Following three are the main categories for classifying various kinds of costs:

- 1) **Standing or Fixed Costs:** These costs are concerned with time period and are incurred irrespective of the fact whether services are offered or not. Main **examples** of these costs are salary, depreciation, garage rent, license fees and insurance charges, etc.
- 2) **Maintenance Cost:** This category includes the expenses which are required to be incurred for keeping various assets of the business in functioning mode. It is very important to properly service the machines, vehicles and other assets to enhance and preserve their efficiency. Some **examples** of these costs are repairs, sundry expenses, etc.
- 3) **Running Costs or Variable Costs or Operating Expenses:** These are the expenses which are incurred for using the machine. These charges vary with the usage of the machine. Higher usage leads to more expenses and vice versa. These expenses are variable. The main **examples** of such expenses are wages, depreciation, petrol and electricity, etc.

5.1.5. Cost Unit

Various technical and related factors having impact on the operating cost should be considered before deciding the unit for which the operating cost needs to be calculated. Following are the two main types of cost unit:

- 1) **Simple Cost Unit:** A simple cost unit occurs when only single cost unit is employed. Following are the main **examples** of simple cost unit:

Business	Cost Unit
i) Transport	per kilometre
ii) Canteen	per item, per meal
iii) Water	per 1000 litres

- 2) **Composite Cost Unit:** When two units are combined to form one unit, such unit is known as composite cost unit. Following are the main **examples** of composite cost unit:

Business	Cost Unit
i) Passenger Transport	per passenger-km
ii) Goods Transport	per tonne-km
iii) Hotel	per room per day
iv) Hospital	per bed per day
v) Electricity	per kilowatt hour

5.1.6. Applications of Operating Costing

This type of costing is used by the organizations which provide services to the general public or to internal departments. Services provided to the outsiders may include gas supply, water supply and electricity. Internal services include storage, internal transportation and repairs, etc.

These services have different accounting treatments. The main purpose of accounting for external service is to determine the aggregate cost incurred on manufacturing such services and profits there-upon. In case of internal services accounting, the main purpose is to enable apportionment of such costs to other departments.

Following concerns use operating costing:

- 1) Municipal concerns providing street lights, water, etc.
- 2) Transport companies such as tramways, roadways and railways.
- 3) Hotels offering boarding and lodging services.
- 4) Educational concerns.
- 5) Steam undertakings and electricity concerns.
- 6) Public Libraries.
- 7) Service departments.
- 8) Air compressors, air conditioning and gas distribution.
- 9) Hospitals.
- 10) Cinemas.
- 11) Services including water pumping and road roller.
- 12) Sports clubs.

5.2. TRANSPORT COSTING

5.2.1. Introduction

This method is used for finding the cost of services offered by transportation business. It may also be used for calculating cost of services provided by:

- 1) Transportation companies carrying items.
- 2) Transportation companies carrying passengers.
- 3) Companies with fleets of vehicles offering distribution of finished products and materials.

5.2.2. Objectives of Transport Costing

The main objectives behind transport costing are as below:

- 1) Transport costing is employed for determining the operating cost of vehicle on per mile or km basis.
- 2) For fixing the rate for transporting goods and passengers.
- 3) For fixing the hire charges.
- 4) For comparing the cost of using self-owned vehicle vs. alternative transportation method.
- 5) For determining the price to be charged for offering internal transport services.

5.2.3. Components of Transport Costing

The relevant expenses may be classified into the following three categories:

- 1) Standing Charges or Fixed Costs
- 2) Repair and Maintenance Charges
- 3) Running or Operating Costs

5.2.4. Standing Charges or Fixed Costs

These are the fixed costs which do not change with the usage of the vehicle. These expenses remain the same irrespective of the distance covered by the automobile. The main examples are depreciation, insurance premium and taxes.

There are different views on the treatment of depreciation. The depreciation can be treated as standing (fixed) cost or running (variable) cost. Generally, if time factor is considered, it is treated as standing cost and in case of km, tonnes, mileage it is treated as running cost.

5.2.5. Repair and Maintenance Charges

These charges are semi-variable and may contain wear and tear costs. The main examples of these costs are servicing costs, overheads and repairs, etc. Expenses incurred on hiring vehicles while the concerns own vehicles were under repair must be added to the maintenance cost.

5.2.6. Running or Operating Costs

These are the costs which vary with the usage of the vehicle. These costs are sustained only when the automobile is in fact operated. Main examples are gas, petrol expenses etc. Such expenses help in computing per unit charges.

5.2.7. Units of Costs in Transport Costing

Following cost units may be used for the purpose of calculating transport costing:

1) **Ton-Kilometre:** This measure can be divided in two categories:

i) **Absolute Ton-Kilometre:** This is the unit cost incurred for transporting one ton of articles for a distance of 1 Km. This can be expressed in the following formula:

Absolute tonne kilometre = Weight carried × Kilometre run for each area of the trip.

ii) **Commercial Ton-Kilometre:** This measure was developed to counter the limitation faced while computing the unloaded capacity for different distances travelled. This method assumes that the automobile travels with half load for the full distance. It is denoted by the following formula:

$$\text{Commercial Tonne Kilometer} = \frac{\text{Tonnage loaded on lorry} + \text{Distance traveled}}{2}$$

- 2) **Kilometre Run:** It is used for determining the performance level of vehicles which are not used for carrying goods. This type of cost may be used for vehicles used for carrying company staff.
- 3) **Cost per Hour:** Such method is used in cases where vehicles are rented to clients for fixed rate per hour. All the costs incurred for using the vehicle as well as profit margin is included in this type of cost. The unit of hours used for this scenario refers to "hired-out hour".

5.2.8. Recording of Cost Under Transport Costing

Following are two most important documents which are used for the purpose of transport costing:

- 1) Log Sheet/Daily Report Sheet, and
- 2) Cost Sheet/Cost Summary Performance Statement.

5.2.9. Log Sheet or Daily Report Sheet

Each vehicle has its own Log Sheet or Daily Report Sheet. This document offers all the necessary information for exercising control over a vehicle. It shows various pieces of information such as load carried, number of passengers carried, delays and distance travelled. It also records supplies issued to the vehicle and repair costs. In-house repair costs are also accumulated for each vehicle or groups of vehicles. Each vehicle should be issued a repair ticket, which will record the various instances of repairs provided.

Following is the sample proforma of a Log Sheet or Daily Report Sheet:

Log Sheet

Vehicle No.....					Date....			
Driver.....					Time left Garage.....			
Route No.....					Time returned....			
Particulars of Trips								
Tonnes of Package					Km Reading		Time	
Trip no.	From	To	At start	Collected Route	Out	In	Out	In
Suppliers:			Worker's time		Exceptional delays			
Petrol			Driver		Loading delays			
Oil			Assistant		Traffic delays			
Grease			Cleans		Accidents			
Km. travelled:			Mechanics		No. of trips:			
			Summary					
			Goods/passenger carried					

5.2.10. Cost Sheet/Cost Summary Performance Statement

It shows the periodic compilation of cost of services for each vehicle or for group of vehicles. It is used for preparing a performance report for management.

Following is the sample proforma of Cost Sheet:

Vehicle No.		Capacity:		Month ended....	
Distance (km):		Tonnes carried:		Tonne-km	
Particulars		Total		Per tonne-km or Passenger-km	
1) Standing or Fixed Charges:					
Insurance					
Garage Rent					
Licence Fee					
Road Taxes					
Interest on Capital					
Supervision					
Wages of Drivers, conductors, etc.					
Administrative Expenses					
Salary of Foreman, Manager, Accountant, etc.					
Others					
Total Standing Charges					
2) Maintenance Charges:					
Tyres & Tubes					
Repairs & Renewals					
Overhaul					
Painting					
Cleaning					
Spare Vehicle					
Others					
Total Maintenance Charges					
3) Running or Operating Charges:					
Fuel					
Oil					
Depreciation					
Grease					
Drivers Wages (variable portion)					
Water					
Others					
Total Running Charges					
Total Operating Costs					

Note:

- 1) Cost summary sheet may be arranged for one vehicle or a group consisting of comparable vehicles.
- 2) The rate is calculated for passenger-km/tonne km for the vehicles used for carrying passengers/baggage.

5.2.11. Advantages of Transport Costing

Following are the main benefits of using transport costing:

- 1) It helps in deciding whether to hire a vehicle or to own one.
- 2) It helps in apportioning expenses of service departments to different production departments.
- 3) It aids the process of deciding regular and special fare rates including concessions.
- 4) It helps in measuring efficiency by comparing maintenance and running costs.
- 5) It helps in deciding between two different methods of transportation.

Example 1: From the following information calculate total kms:

No. of Buses 10

25 Days operated in the month

Trips by each bus 4

Distance route 40kms long (one side)

Solution: Calculation of Total Kilometers

$$\begin{aligned}\text{Total kms.} &= \text{No. of Buses} \times \text{Distance} \times \text{Round trip} \times \text{No. of days} \\ &= 10 \times 40 \times 4 \times 25 \\ &= 40,000 \text{ kms.}\end{aligned}$$

Example 2: Calculate total kilometre run – A company is having 5 buses running between Town A and Town B. Two buses make 3 trips per day, while two buses make 2 trips per day and the last bus makes 1.5 trip per day. Distance between two towns is 45kms. Total operating days in a month are 25.

Solution: Calculation of Total Kilometre Run

Total Kilometre Run = No. of Buses × Distance × Round Trip × No. of Days

I	=	2 × 45 × (2 × 3) × 25	=	13,500
II	=	2 × 45 × (2 × 2) × 25	=	9,000
III	=	1 × 45 × (2 × 1.5) × 25	=	3,375
Total Kilometre Run				= 25,875 kms

Example 3: Jaspal transport company provide following information:

No. of buses	2
Days operated in a month	15
Trips made by each bus	1
Distance of route	50km (one side)
Capacity of each	20 passengers
Average passenger traveling	37.5% of capacity

Calculate:

1) Total kilometers

2) Total passenger kms.

Solution:

$$\begin{aligned}\text{Total Kms.} &= \text{No. of Buses} \times \text{Distance} \times \text{Round trip} \times \text{No. of days} \\ &= 2 \times 50 \times (2 \times 1) \times 15 \\ &= 100 \times 2 \times 15 \\ &= 3,000 \text{ kms.}\end{aligned}$$

$$\begin{aligned}\text{Passenger Kms.} &= \text{No. of Buses} \times \text{Distance} \times \text{Round trip} \times \text{No. of days} \times \text{Capacity} \\ &= 2 \times 50 \times (2 \times 1) \times 15 \times (20 \times 37.5\%) \\ &= 3,000 \times 7.5 \\ &= 22,500 \text{ Passenger kms.}\end{aligned}$$

Example 4: A bus journey started from Lucknow for Delhi with 25 passengers on board. 10 passengers departed at Kanpur and the remaining passengers continued the journey. The same bus left Delhi in the evening with 25 passengers, 5 passengers departed at Kanpur and the remaining passengers continued its journey for Lucknow.

The distance between Lucknow and Kanpur is 20km, and
The distance between Kanpur to Delhi it is 280km.

Compute the cost per passenger km, if the total cost of running the bus comes out to be ₹2,500

Solution: Total Passengers Kilometres Covered:

- 1) Lucknow to Kanpur = Number of Passengers × Total Distance Between Two Cities
 = 25 Passengers × 20km
 = 500km
- 2) Kanpur to Delhi = Number of Passengers × Total Distance Between Two Cities
 = 15 Passengers × 280km (10 Passengers got off at Kanpur)
 = 4,200km

Back journey in the evening

- 1) Delhi to Kanpur = Number of Passengers × Total Distance Between Two Cities
 = 25 Passengers × 280km
 = 7,000km
- 2) Kanpur to Lucknow = Number of Passengers × Total Distance Between Two Cities
 = 20 Passengers × 20km (5 Passengers got off at Kanpur)
 = 400km

Total cost of running bus = ₹2,500

Total Passenger kilometres Covered = 500 + 4,200 + 7,000 + 400 = 12,100km

$$\text{Cost per Passenger km} = \frac{\text{Total Cost of Running Bus}}{\text{Total Passengers Kilometre Covered}} = \frac{2,500}{12,100} = ₹0.2066$$

Example 5: A transport company is running 8 buses between two city which are 100 km apart. The each bus has seating capacity of 80 passengers. The following information are found for the month of April, 2018:

Particulars	₹
Wages of Drivers, Conductors and Cleaners	4,800
Salaries of Office and Supervisory Staff	2,000
Diesel Oil and Other Oil	8,000
Repairs and Maintenance	1,600
Taxes, Insurance, etc.	3,200
Depreciation	5,200
Interest and Other Charges	4,000
Total	28,800

75% seating capacity was utilised. All the eight buses run on all days of the month. Each bus had made one round trip daily. You are required to find out the cost per passenger km.

Solution:

Operating Cost Sheet		
Particulars	Total Cost p.a.	Cost per Passenger
Standing Charges:		
Wages of Drivers, Conductors and Cleaners	4,800	
Salaries of office and Supervisory Staff	2,000	
Taxes, Insurance, etc.	3,200	
Interest and Other Charges	4,000	
	14,000	
Maintenance Charges:		
Repair and Maintenance	1,600	
	1,600	
Running Charges:		
Diesel Oil and Other Oil	8,000	
Depreciation	5,200	
	13,200	
Total Operating Cost	28,800	₹0.01

$$\text{Cost per Passenger} = \frac{\text{Total Operating Cost}}{\text{Total Passenger Kilometer}} = \frac{28,800}{28,80,000} = ₹0.01 \text{ per passenger km}$$

Working Notes:

$$\begin{aligned}\text{Total Kilometer} &= \text{No. of Buses} \times \text{Distance} \times \text{Round trip} \times \text{No. of days} \\ &= 8 \times 100 \times 2 \times 30 \\ &= 48,000 \text{ kms}\end{aligned}$$

$$\begin{aligned}\text{Total Passenger Kilometer} &= \text{Total Kilometer} \times \text{Passenger} \times \text{Capacity} \\ &= 48,000 \times 80 \times 75/100 \\ &= 28,80,000 \text{ passenger kms}\end{aligned}$$

Example 6: A company gives you the following data and ask you to calculate the cost per vehicle per km.

Particulars	₹
Value of vehicle	30,000
Driver's salary per month	400
Cost of petrol per litre	1.60
Kms per litre	8.00
Charges for tyre and tube maintenance per km.	0.40
Estimated life	1,50,000 kms
Estimated annual kms	6,000 kms
Road licence fees per year	₹1,000
Insurance per year	₹200
Garage rent per year	₹1,200

Solution:

Operating Cost Sheet

(Estimated km: 6000km p.a.)

Particulars	Total Cost p.a. (₹)	Cost per Mile (₹)
Standing Charges:		
Road License Fee	1,000	
Insurance Charges	200	
Garage Rent	1,200	
Driver's Salary (400 × 12)	4,800	
	7,200	1.20
Running Charges:		
Depreciation		0.20
Petrol		0.20
Tyre and Tube Maintenance		0.40
		0.80
Total Operating Cost of Vehicle per kms.		2.00

Working Note:

- 1) Depreciation p.a. = (Value of Vehicle/Estimated Life)
= (30,000/1,50,000) = ₹0.2
- 2) Cost of Petrol per km. = Cost of Petrol Per litre × kms per Litre = 1.60/8km = ₹0.2

Example 7: From the following data calculate the cost per mile of a vehicle.

Particulars	₹
Value of Vehicle	30,000
Road License for the Year	1,000
Insurance Charges per Year	200
Garage Rent per Year	1,200
Driver's wages per Month	400
Cost of Petrol per Liter	1.6
Miles per Liter	16
Maintenance per Mile	0.40
Estimated Life	3,00,000 miles
Estimated Annual Mileage	12,000 miles

Ignore interest on capital.

Solution:

Operating Cost Sheet
(Estimated mileage: 12,000 miles p.a.)

Particulars	Total Cost p.a. (₹)	Cost per Mile (₹)
Standing Charges:		
Road License Fee	1,000	
Insurance Charge	200	
Garage Rent	1,200	
Driver's Wages (₹400 × 12)	4,800	
	7,200	0.60
Running Charges:		
Depreciation		0.10
Petrol		0.10
Tyre and Maintenance		0.40
		0.60
Total Operating Cost of Vehicle per Mile		1.20

Working Notes:

- 1) Depreciation per mile = (Value of Vehicle/Estimated Life) = (₹30,000/3,00,000 miles) × = ₹0.10
- 2) Cost of Petrol per mile = ₹1.6/16 miles = ₹0.10

Example 8: Kapoor Transport Co. Ltd. started taxi business with 5 cars. The life of a car is 1,50,000kms at end of which it is scrap value will be ₹10,000. The mileage of a car is on an average 2,000kms per month. Petrol consumption is 6kms per litre of petrol costing ₹15 per litre. Expenses of operating the cars are given below:

Particulars	₹
Cost of each car	1,90,000
Salary of Office and Garage Staff	19,000 p.m.
Rent of Garage	6,000 p.m.
Driver's Salary per car	2,000 p.m.
Insurance, Tax and Sundry Expenses per Car	27,600 per year

- 1) Prepare a statement of operating cost showing the cost of running car per km.
- 2) Find out the profit Kapoor Transport Co. Ltd may expect to earn during the first month of operations if hire charge is ₹20 per km. Assume that during the month each car runs on an average 2,000km of which 400km it runs empty.

Solution:

1)

Kapoor Transport Co. Ltd.
Operating Cost Statement
(For the Month of....)

Particulars	Total Cost p.m. (Each Car) (₹)	Cost per km (₹)
Standing Charges:		
Salary of Office and Garage Staff (19,000 ÷ 5)	3,800	
Rent of Garages (6,000 ÷ 5)	1,200	
Driver's Salary	2,000	
Insurance, Tax and Sundry Expenses (27,600 ÷ 12)	2,300	
Fixed Charges per car per km = $\frac{\text{Total Standing Charge}}{\text{Effective Running}} = \frac{9,300}{1,600}$	9,300	5.812
Running/Variable Charges:		
Depreciation	2,400	
Petrol Cost	5,000	
Variable Cost per Car per km = $\frac{\text{Total Variable Cost}}{\text{Effective Running}} = \frac{7,400}{1,600}$	7,400	4.625
Total Cost per km per car	16,700	10.437

2) Profit during the month

$$\text{Profit per km} = \text{Hire Charges per km} - \text{Total Cost per km} \\ = 20 - 10.437 = ₹9.563$$

$$\text{Total Profit per car} = \text{Profit per km} \times \text{Effective Running} \\ = 9.563 \times 1,600 = ₹15,301$$

$$\text{Total Profit for 5 cars} = \text{Total Profit per car} \times \text{no. of cars} \\ = 15,301 \times 5 = ₹76,505$$

Working Note:

1) Calculation of Cost of Running a car per km

$$\text{Total Running} = 2,000\text{km}$$

$$\text{Effective Running} = 2,000\text{km} - 400\text{km} = 1,600\text{km}$$

2) Calculation of Depreciation = $\frac{\text{Cost of Each car} - \text{Scrap Value}}{\text{Life of car}} \times \text{Average kilometer a car runs in a month}$

$$= \frac{1,90,000 - 10,000}{1,50,000} \times 2,000 = ₹2,400$$

3) Calculation of Petrol Cost = $\frac{\text{Average kilometer a car runs in a month} \times \text{Cost of petrol}}{\text{Total Petrol Consumption}}$

$$= \frac{2,000 \times 15}{6} = ₹5,000$$

Example 9: A transport company runs 5 buses between two towns, which are 25 km away from each other. Each bus seating capacity is 20 passengers. 80% of actual passengers were carried from seating capacity. All the five buses run on all the days of the month. Each bus made one round trip per day.

The following particulars were obtained for the May 2016:

Particulars	₹
Wages and Salaries	1,500
Staff Salaries	625
Diesel Oil and other Oils	2,500
Repair and Maintenance	500
Taxation, Insurance, etc.	1,000
Depreciation	1,625
Interest and other Charges	1,250

Find out the cost per passenger km.

Solution: Passengers-Km = Normal capacity × Number of trips per day × Number of days × Distance run per trip

$$\text{Passengers-Km} = 80 \times 2 \times 30 \times 25 \text{ passengers-km} = 1,20,000 \text{ passengers-km.}$$

Where,

Normal capacity of the fleet = 5 buses × 16 passengers, i.e., 80 passengers

Normal capacity utilization = 80% of 20, i.e., 16 passengers

Operating Cost Sheet

Particulars	Total Cost p.m. (₹)	Passenger-km: 1,20,000 Per Passenger km (₹)
Standing Charges:	625	
Staff Salaries	1,000	
Taxation, Insurance, etc.	1,250	
Interest and other Charges	2,875	0.0239

Working Notes:

$$\begin{aligned} \text{i) Running kms} &= \text{Distance Between the Location} \times \text{No. of Rounds} \times \text{No. of Trips} \times \text{No. of Days} \times \text{No. of Weeks} \\ &= 20\text{kms} \times 2 \times 2 \text{ trips} \times 5 \text{ days} \times 4 \text{ weeks} \\ &= 1,600\text{kms} \end{aligned}$$

$$\text{ii) Running tonne-kms} = \frac{\text{Running kilometer}}{\text{No. of Rounds}} \times \text{Capacity} = \frac{1,600}{2} \times 5 \text{ tonnes} = 4,000\text{km}$$

$$\begin{aligned} \text{iii) Total Cost of tyres} &= \frac{\text{Cost of Tyre}}{\text{Life of Tyre}} \times \text{Running Kilometer} \\ &= \frac{3,150}{12,500} \times 1,600 = ₹403.2 \end{aligned}$$

$$\begin{aligned} \text{iv) Depreciation} &= \frac{\text{Cost of Truck} - \text{Scrap Value}}{\text{Life of Truck}} \times \text{Running kilometer} \\ &= \frac{2,25,000 - 25,000}{40,000} \times 1,600 = ₹8,000 \end{aligned}$$

Example 11: A transport company supplies the following details in respect of a truck of 5 tonne capacity.

Particulars	₹
Cost of Truck	18,00,000
Diesel, Oil, Grease (per trip each way)	300
Repairs and Maintenance per Month	15,000
Driver's Wages per Month	15,000
Cleaner's Wages per Month	7,500
Annual Insurance	90,000
Annual license Fees	36,000
General Supervision Charges p.a.	60,000
Estimated Life of Truck (years)	10 Years

The truck carries goods to and from the city covering a distance of 50kms each way. While going to the city, freight is available for the full load of the truck and on its return journey it can fetch freight only up to 20% of its capacity. On the assumption that the truck runs on an average 25 days in a month, you are required to calculate the following:

- 1) Operating cost per tonne km.
- 2) Rate per tonne per trip that the company should charge if profit of 100% on cost is to be earned.
- 3) What price would you charge if one wants to engage the truck for one day for a trip to the city and back?

Solution:

Calculation of Operating Cost Per Tonne Km		
Operating Cost Sheet		Estimated Tonne-Kms: 7,500
Particulars	Per Month (₹)	Per Tonne-Km (₹)
Standing Charges:	15,000	
Driver's Wage	7,500	
Cleaner's Wage	7,500	
Annual Insurance (₹90,000/12)	3,000	
Annual License Fees (₹36,000/12)	5,000	
General Supervision Charges (₹60,000/12)	38,000	5.07
Running (or Variable) Charges:	15,000	
Diesel, Oil, Grease (₹300 × 2 × 25)	15,000	
Repairs and Maintenance	15,000	
Depreciation $\left(18,00,000 \times \frac{1}{10} \times \frac{1}{12}\right)$	45,000	6
Total	83,000	11.07

Maintenance Charges:		
Repair and Maintenance	500	
	500	0.0041
Running Charges:		
Diesel Oil and other Oils	2,500	0.0208
Wages and Salaries	1,500	0.0125
Depreciation	1,625	0.0135
	5,625	0.0468
Total Operating Cost	9,000	0.075

$$\text{Operating Cost per Passenger km} = \frac{\text{Total Operating Cost}}{\text{Total Passenger}} = \frac{9,000}{1,20,000} = 0.075$$

Example 10: Jai Automobiles had its distribution using a truck. The locations are 20 kilometres away. The truck has a capacity of 5 tonnes. The truck visits twice a day with full load on it, and the return journey is empty truck. The truck operates on a five-day week. The following information is available for a four-weekly period during the year 2017.

Particulars	₹
Petrol Consumption	4 kilometres
Petrol Cost	₹6.5 per litre
Oil	₹50 per week
Driver's Wages	₹200 per week
Repairs	₹50 per week
Garage Rent	₹75 per week
Cost of Truck (Excluding Tyres)	₹2,25,000
Life of Truck	40,000 kilometres
Insurance	₹3,250 p.a.
Cost of Tyres	₹3,150
Life of Tyres	12,500 kilometres
Estimated Sale Value of Lorry at the End of its Life	₹25,000
Vehicle Licence Cost	₹650 p.a.
Other Overhead Cost	₹20,800 p.a.

- 1) Prepare a statement of operating cost of the truck.
- 2) Calculate the truck cost per tonne-kilometre.

Solution:

Jai Automobile
Operating Cost Sheet
(For during the year 2017)

Particulars	Total Tonne-kms (₹)	Per Tonne-kms (₹)
Standing Charges:		
Garage Rent (75 × 4)	300	
Insurance (3,250/52 × 4)	250	
Licence Cost (650/52 × 4)	50	
Other Overheads (20,800/52 × 4)	1,600	
	2,200	0.55
Maintenance Charges:		
Repairs (50 × 4)	200	
Cost of Tyres	403.2	
	603.2	0.150
Running Charges:		
Cost of Petrol (1600 km/4 km × 6.5)	2,600	
Oil (50 × 4)	200	
Driver's Wages (200 × 4)	800	
Depreciation	8,000	
	11,600	2.9
Total Operating Cost	14,403.2	3.60

4) **Charge Per Round Trip**

Total number of round trips per month = 4 round trips × 25 days = 100 round trips

$$\text{Charge per Round Trip} = \frac{25,714}{100} = ₹257.14$$

5.3. CANTEN COSTING

5.3.1. Introduction

A large number of factory/office canteens are fully or partly subsidised. Generally, the supervisor which operates the canteen is liable to the personnel manager or to the work manager. The canteen usually provides with the main meals, snacks and tea.

The employees usually like simple, well-cooked and nicely served food so the supervisor plans a weekly cycle for the sake of convenience and to provide variety of items. But it is difficult to give varieties daily. The canteen supervisor also works to control costs and so he collects the cost in such a manner that it helps in controlling the cost.

5.3.2. Objectives of Canteen Costing

The objectives of canteen costing are as follows:

- 1) It helps in computing the cost per lunch and dinner daily.
- 2) It helps in computing the cost per cup of tea and coffee.
- 3) It helps in measuring the performance of two or more canteens.
- 4) It helps in collecting various cost data for controlling various canteens cost.
- 5) For examining the canteen cost for decision-making.

5.3.3. Collection of Cost Data

The cost is collected regularly in the following account:

- 1) **Provision:** Meat, eggs, fish, vegetables, fruits, flour, rice, milk, vegetable oil, tea, coffee, sugar, soft drinks, etc.
- 2) **Labour:** Supervisor, cooks, waiters, kitchen assistants, porters, etc.
- 3) **Services:** Gas, power, electricity, steam, water, etc.
- 4) **Consumable Stores:** Table linen, cutlery, glassware, crockery, cleaning materials, brushes, dustbins, etc.
- 5) **Miscellaneous Overheads:** Rent and rates, depreciation, insurance premium, etc.
- 6) **Sales:** Revenue from meals, tea and coffee, sale of snacks, etc.

5.3.4. Unit of Cost in Canteen Costing

The calculation of cost with aim of setting the prices for the main meals, snacks, etc. is not easy because it needs comparing one food with another so that the same amount can be attained for calculating the average cost per meal. But if the same amount cannot be found, the cost per employee is calculated to control the cost. While it is difficult to find out the cost per meal, the supervisor uses his experience to calculate it.

The supervisor should know about the number of meals which are served with various uses of meat, fish and vegetable. The supervisor should also know the number of cups of tea that can be provided with one kilogram of tea or five litre of milk.

5.3.5. Costs Control

The supervisor must calculate the number of meals required daily. For controlling the cost, the wastage should be avoided. The manager and supervisor must check the waste-food bin periodically. This will help in reducing the waste of materials and food.

For keeping the watch on the trend, the average charts should be moved according to the main heading of expenses and income earned.

5.3.6. Recording of Costs Under Canteen Costing

The three different accounts are made for helping in proper accounting.

The accounts are as follows:

- 1) **Stock Register:** It records the issue made for knowing the cost of material consumed in canteen. It is maintained by the store-keeper.
- 2) **Wage Analysis Sheet:** It records the labour costs and supervision of the canteen. It is maintained by personnel department.
- 3) **Overhead Analysis Sheet:** It helps in calculating the cost of overhead proportionate charge.

5.3.7. Proforma of Canteen Costing

The proforma operating cost sheet of a canteen firm is as follows:

XYZ Ltd. Canteen Operating Cost Sheet for the Month of	
Particulars	₹
Food Provisions Costs	
Meat	xxx
Fish	xxx
Eggs	xxx
Vegetable	xxx
Bakery items	xxx
Fruits	xxx
Milk	xxx
Beverages	xxx
Sundry Food Supplies	xxx
(A)	xxx
Labour and Supervision Cost	
Supervisors' Salary	xxx
Cooks Salary	xxx
Helpers Salary	xxx
Cleaners Salary	xxx
Sweepers Salary	xxx
Waiter	xxx
Porter	xxx
(B)	xxx
Maintenance Cost	
Crockery/Cutlery	xxx
Cleaning Materials	xxx
Towels	xxx
Consumable Store	xxx
Gas	xxx
Power	xxx
Steam	xxx
Water	xxx
(C)	xxx
Administration Cost/Overheads	
Management Salaries	xxx
Premises Rent	xxx
Insurance	xxx
Repairs and Maintenance	xxx
Other Administrative Expenses	xxx
(D)	xxx
1) Total Operating Cost (A)+(B)+(C)+(D)	xxx
Less: (i) Income from Sale	xxx
(ii) Company Subsidy	xxx
2) Net Total Operating Cost	xxx
3) No. of Meals Served	xxx
Cost per Meal Served (2)/(3)	xxx

Example 21: From the following data relating to a staff canteen for the year ended 31st December 2016. Find out the cost per meal served:

Particulars	₹
Meat Purchased	10,000
Fish Purchased	6,000
Eggs Purchased	1,000
Vegetables Purchased	3,000
Bakery Items Purchased	2,000
Fruits Purchased	1,000
Milk Purchased	1,000
Beverages Purchased	2,000
Sundry Food Supplies	1,000
Supervisors Salary	12,000
Cooks Salary	12,000
Helpers Salary	3,600
Cleaners Salary	2,400
Sweepers Salary	2,400
Crockery and Cutlery Purchased	600
Cleaning Materials Purchased	200
Towels Purchased	200
Consumable Stores Purchased	400
Gas Purchased	1,200
Management Salaries	24,000
Premises Rent	4,000
Insurance Premium	2,000
Repairs and Maintenance	1,000
Other Administrative Expenses	3,000
Number of Meals Served during the Period	2,400

Solution:

Canteen Operating Cost Sheet
(For the Year Ended 31st December, 2016)

Particulars	(₹)
Food Provisions Costs:	
Meat	10,000
Fish	6,000
Eggs	1,000
Vegetables	3,000
Bakery Items	2,000
Fruits	1,000
Milk	1,000
Beverages	2,000
Sundry Food	1,000
(A)	27,000
Labour and Supervision Costs:	
Supervisor's Salary	12,000
Cooks Salary	12,000
Helpers Salary	3,600
Cleaners Salary	2,400
Sweepers Salary	2,400
(B)	32,400
Maintenance Costs:	
Crockery and Cutlery	600
Cleaning Materials	200
Towels	200
Consumable Stores	400
Gas	1,200
(C)	2,600

Administration Costs:		
Management Salaries		24,000
Premises Rent		4,000
Insurance Premium		2,000
Repairs and Maintenance		1,000
Other Administrative Expenses		3,000
	(D)	34,000
(1) Total Cost (A+B+C+D)	(A+B+C+D)	96,000
(2) No. of Meals Served		2,400
(3) Cost per Meal Served	(1)/(2)	40

Example 22: A company has a canteen for the benefit of its workman and provide necessary funding to the canteen. During the month of March 2017, the following purchases were made:

Commodity	Quantity	Rate Per Kg.
Tea Powder	2	20
Sugar	25	4
Milk	30	2
Flour	100	3
Oil	15	15
Dal	15	4
Potato	50	2
Green Vegetables	10	1

Other expenses for the month were:

Particulars	₹
Auto Charges	10
Salary to a Cook	125 p.m.
Wages of Two Waiters	75 per month each
Supervisor Salary	150 p.m.
Fuel, Gas, Coal	200 p.m.
Table Cloth	50 p.m.
Depreciation on Utensils and Furniture	25

Prepare Operating Cost Sheet and find out cost per customer charged by the canteen, assume that 1500 employees were working in the factory.

Solution:

Canteen Operating Cost Sheet
(For the month of March, 2017)

Particulars	(₹)
Food Provisions Costs:	
Tea Powder (2 × 20)	
Sugar (25 × 4)	40
Milk (30 × 2)	100
Flour (100 × 3)	60
Oil (15 × 15)	300
Dal (15 × 4)	225
Potato (50 × 2)	60
Green Vegetables (10 × 1)	100
	10
(A)	895
Labour and Supervision Cost:	
Cook Salary	
Waiters Wages (75 × 2)	125
Supervisors Salary	150
(B)	425
Administration Cost:	
Auto Charges	10
Fuel, Coal, Gas, etc.	200

Depreciation		25
Table Cloth		50
	(C)	285
(1) Total Operating Cost	(A + B + C)	1,605
(2) Number of Workers Served		1,500
(3) Cost per Worker	(1)/(2)	1.07

Example 23: From the following data for the month of April 2017, calculate cost per meal for the canteen run by management of Sunshine Pvt Ltd.:

- 1) Purchases for the month of April:
 - Meat 10 kgs @ ₹30 per kg
 - Eggs 72 dozens @ ₹10 per dozen
 - Vegetables ₹600
 - Bread, etc., ₹800
 - Rice ₹1,200
- 2) Wages and Salaries:
 - 2 Cooks @ ₹800 p.m. each
 - 1 Counter clerk @ ₹500 p.m.
 - 5 Helpers @ ₹200 p.m. each
 - 1 Manager who is paid ₹100 p.m. as allowance (because he is already an employee)
- 3) Consumable stores ₹10,000 p.a.
- 4) Gas and Electricity ₹400 p.m.
- 5) Overheads allocated to the canteen ₹2,400 p.a.
- 6) Company subsidy ₹4,000 p.a.
- 7) No. of meals served in the month of April - 4,000.

Solution:

Sunshine Pvt Ltd Canteen Operating Cost Sheet
(For the Month of April, 2017)

Particulars	₹
Food Provisions Costs:	
Meat (10 × 30)	300
Eggs (72 × 10)	720
Vegetables	600
Bread, etc.	800
Rice	1,200
(A)	3,620
Labour and Supervision Costs:	
Cooks (800 × 2)	1,600
Counter Clerk	500
Helpers (200 × 5)	1,000
Manager's Allowance	1,000
(B)	3,200
Maintenance Costs:	
Consumable Stores (10,000 ÷ 12)	833
Gas, Electricity, etc.	400
(C)	1,233
Administration Cost/Overheads: (2,400 ÷ 12)	200
(D)	
(A+B+C+D)	8,253
(1) Total Operating Cost	8,253
Less: Subsidy Received (4,000 ÷ 12)	333
(2) Net Total Operating Cost	7,920
(3) No. of Meals Served	4,000
(2)/(3)	1.98
(4) Cost per Meal	

Solution:

Comparative Canteen Operating Cost Sheet
(For the month of)

Particulars	Total Amount This Month (₹)	Total Amount This Month of Last Year (₹)
Food Provision Cost (Material Consumed) (A)	1,00,000	60,000
Labour and Supervision Cost (B)	60,000	44,000
Administration Cost /Overheads (C)	78,000	68,000
(1) Total Costs (A+B+C)	2,38,000	1,72,000
Less: Sales through Coupons	70,000	60,000
(2) Net Operating Cost	1,68,000	1,12,000
(3) No. of Employees	8,000	7,000
(4) Cost per Employees (2)/(3)	21	16

So, increase in subsidy by company this month (₹21 – ₹16) is ₹5 per head.

5.4. HOSPITAL COSTING

5.4.1. Introduction

The operating cost system is helpful for determining the hospital cost. The hospital costing is associated with estimating the medical service cost which is provided by the dispensary belonging to a factory or a hospital or the nursing home owned by a government or private doctors. The basic aim of hospital costing is to determine the cost of rendering service per patient per day. For helping in costing, the hospital services are divided into various cost centers which are follows:

- 1) Outpatients department,
- 2) Wards,
- 3) Pathology Center,
- 4) Operation Theatre,
- 5) Kitchen,
- 6) Laundry, and
- 7) Cleaning.

For determining the hospital cost, it is very important to know the cost of each cost centre individually and the cost per unit of output is ascertained with respect to the cost of all such centres. Although the measurement of output of cost unit is different for different cost centres. The appropriate cost unit is chosen according to the demand of managers who require meaningful information for calculating cost per unit, decision-making and cost control.

5.4.2. Objectives of Hospital Costing

Different objectives of hospital costing are as follows:

- 1) Helps in determining the cost per unit.
- 2) Helps in decision-making by analysing cost.
- 3) Helps in comparing performance between two firms.
- 4) Helps in collecting and examining the cost for controlling the cost.

5.4.3. Collection of Cost Data

The recording of various costs is done under natural accounts. Costs which are matched with the specific cost centre are recorded there directly. All the same costs are recorded to the specific cost center on the basis of equality. The fixed and variable costs are shown individually in cost sheet.

5.4.4. Unit of Cost in Hospital Costing

The cost-output relationship and all the factors are considered by the management before selecting a cost unit. In hospital industry, possible cost units are 'bed-day available' or bed - days occupied'. Whereas, the service given in the hospital is different according to the illness of the patient, so a single cost will not be given the accurate measurement of cost effectiveness of various cost centers. So, it is better to use different cost- units for different cost centres.

For example, to determine the cost of an operation theatre, the cost of each operation is recorded. In the same way, the 'in-patient day' will be used for kitchen and laundry cost-unit; 'out-patient visit' will be used for out-patient department cost-unit. The proper examination of all cost drivers is required for selection of the cost unit.

For example, the cost of operation theatre can be stated in terms of 'cost per standard operation and each operation' to have effective control over the cost; the minor or major operation should be converted into the number of standard operation. It's not easy to appoint a correct cost-unit for hospital service.

5.4.5. Proforma of Hospital Costing

The proforma operating cost sheet of a hospital firm is given below:

XYZ Ltd.

Hospital Operating Cost Statement for the Month of

No. of Patient Days:

Particulars	₹
A) Fixed Costs:	
Salaries to Staff	xxx
Premises Rent	xxx
Repairs and Maintenance	xxx
General Administration Expenses	xxx
Cost of Oxygen, X-ray, etc.	xxx
Depreciation	xxx
Total Fixed Cost (A)	xxx
B) Variable Costs:	
Doctor's fees	xxx
Food	xxx
Medicines	xxx
Diagnostic Services	xxx
Laundry	xxx
Hire Charges for Extra Beds	xxx
Total Variable Cost (B)	xxx
C) Total Operating Cost (A) + (B)	xxx
No. of Patient Days	xxx
Cost per Patient Day = $\frac{\text{Total Operating Cost}}{\text{No. of Patient Days}}$	xxx

Example 26: Karuna Hospital has 25 beds. It has run at full capacity for 180 days. For 45 days, only 10 beds were occupied. At times when all the beds were full, extra beds had been hired at ₹10 per day. You are required to compute the cost per patient day for the year ended on 31st March, 2017;

Particulars	₹
Salaries to Staff	25,000
Rent of Premises	5,000
Repairs and Maintenance	1,000
General Administration Expenses	3,000
Cost of Oxygen, X-ray Film, etc.	2,500

Depreciation	6,000
Doctors Fees	25,000
Food	15,000
Medicines	10,000
Diagnostic Services	7,500
Laundry	750
Hire Charges for Extra Beds	1,000

Solution:

Karuna Hospital Operating Cost Statement
(For the year ended 31st March, 2017)

No. of Patient Days: 5,050

Particulars	(₹)
A: Fixed Costs	
Salaries to Staff	25,000
Premises Rent	5,000
Repairs and Maintenance	1,000
General Administrative Expenses	3,000
Cost of Oxygen, etc.	2,500
Depreciation	6,000
(A)	42,500
B: Variable Costs	
Doctor's Fees	25,000
Food	15,000
Medicines	10,000
Diagnostic Services	7,500
Laundry	750
Hire Charges for Extra Beds	1,000
(B)	59,250
C: Total Operating Cost	(A + B)
	1,01,750
No. of Patient Days	5,050
Cost per Patient Day = $\frac{\text{Total Operating Cost}}{\text{No. of Patient Days}} = \frac{1,01,750}{5,050}$	20.15

Working Notes:

Calculation of Cost Unit – No. of Patient days

Particulars	Patient Days
1) Full Capacity – 180 days × 25 beds	4,500
2) Partial Capacity – 45 days × 10 beds	450
3) Extra Bed Days: $\frac{\text{Total Hire Charges for Extra Beds}}{\text{Hire Charges per Bed}} = \frac{1,000}{10}$	100
4) ∴ No. of Patient Days (Step 1 + Step 2 + Step 3)	5,050

Example 27: Kirti Healthcare Centre consists of 10 beds. The unit is open for 150 days in a year. For 100 days, the unit has a full capacity of 10 patients per day and for the remaining 50 days, it has only, on an average 8 beds occupied per day. The two expert doctors were hired from outside to attend the patients and the fees were paid on the basis of number of patients attended by them on an average of ₹10,000 per month.

Following are the expense:

Particulars	₹
Rent	7,500 p.m.
Repair and Maintenance (fixed)	5,000
Food supplied to patients (variable)	36,000
Laundry charges (variable)	18,000
Medicines (variable)	30,000
Other expenses (fixed)	36,000
2 Supervisor	1,000 p.m. per Supervisor
4 Nurses	1,000 p.m. per nurse
2 Ward boys	500 p.m. per Ward boys

Calculate:

- 1) Charge per day per patient to earn a profit of 100 percent on cost.
- 2) Number of patient days required by the unit to break even assuming above charge per patient day.

Solution:

Kriti Healthcare Centre Operating Cost Sheet
(For the year ended)

No. of Patient Days: 1,400

Particulars	₹
A. Fixed Cost:	
Repairs and Maintenance	5,000
Rent (₹7,500 × 12)	90,000
Other Expenses	36,000
Salary:	
Supervisor (₹1,000 × 2 × 12)	24,000
Nurses (₹1,000 × 4 × 12)	48,000
Ward Boys (₹500 × 2 × 12)	12,000
(A)	2,15,000
B. Variable Cost:	
Foods	36,000
Laundry Charges	18,000
Medicines	30,000
Doctor Fees (₹10,000 × 2 × 12)	2,40,000
(B)	3,24,000
C. Total Operating Costs	(A + B)
No. of Patient Days	5,39,000
	1,400
Cost per Patient Day = $\frac{\text{Total Operating Cost}}{\text{No. of Patient Days}} = \frac{5,39,000}{1,400}$	385

Statement Showing Total Revenue Required

Particulars	₹
Total Operating Cost	5,39,000
Add: Profit @ 100% on Cost	5,39,000
Total Revenue Required	10,78,000

1) Calculation of fee to be charged per patient per day:

$$\text{Charge per Patient per Day} = \frac{\text{Total Revenue Required}}{\text{No. of Patient Days}}$$

$$= \frac{10,78,000}{1,400} = ₹770$$

2) Calculation of patients days required to break-even:

Calculation of per Day Variable Cost = ₹3,24,000/1,400 = ₹231

Contribution per Day = Revenue Required per Patient – Variable Cost per Patient
= 770 – 231 = ₹539

$$\text{Patient Days Required} = \frac{\text{Fixed Cost}}{\text{Contribution per Patient Day}}$$

$$= \frac{₹2,15,000}{₹539} = 399 \text{ Patient days}$$

Working Notes:

Calculation of Cost Unit – No. of Patient days

Particulars	Patient Days
1) Full Capacity – 100 days × 10 beds	1,000
2) Partial Capacity – 50 days × 8 beds	400
3) ∴ No. of Patient Days (Step 1 + Step 2)	1,400

Example 28: In special healthcare department of a hospital has 80 bed capacity. The department charges ₹850 per bed day from the patient for its services. The data relating to fees collections and costs incurred for the year 2016 are as under:

Particulars	₹
Fees Collected during the Year	69,91,250
Variable Costs Based on Patient Days	27,14,250
Departmental Fixed Costs	12,45,000
Apportioned Costs of the Hospital Administration Charges	20,00,000

Besides the above, nursing staff were hired as per the following scale at ₹96,000 per annum per nurse.

Annual Patient Days	No. of Nurses Required
Less than 5000	3
5000-7000	4
7000-9000	6
Above 9000	8

The projections for the year 2017 are as under:

- 1) The costs other than apportioned overheads will go up by 10%.
- 2) The apportioned overheads will increase by ₹5,00,000 per annum.
- 3) The salary of the nursing staff will increase to ₹1,08,000 per annum per nurse.
- 4) The occupancy of the bed capacity will remain same as in 2016 and consequently the management is considering a proposal to close down the department. In that case, the departmental fixed costs can be avoided.

Calculate:

- 1) Profitability of the department for the years 2016 and 2017.
- 2) Break-even bed capacity for the year 2017.
- 3) Increase in fee per bed day required to justify continuation of the department.

Chapter 6

Budgeting and Budgetary Control

6.1. BUDGETARY CONTROL

6.1.1. Concept of Budget

A **budget** may be defined as a financial tool which is used for planning and for projecting future values, using past experience. It is a quantitative statement which states future course of action in a numerical form. It covers a definite period of future and presents written operational plan. A budget uses money and quantity to express its plan. It charts out the policy to be followed for the achievement of organisational objectives. The main goal of the budget is to achieve organisational goals in a specified manner.

According to CIMA Terminology, a budget is "A plan expressed in money. It is prepared and approved prior to the budget period and may show income, expenditure, and the capital to be employed. It may be drawn up showing incremental effects on former budgeted or actual figures, or be compiled by zero-based budgeting".

According to Crown and Howard, "A budget is a pre-determined statement of management policy during a given period which provides a standard for comparison with the results actually achieved".

Thus, a budget is a tool for financial administration and holds a prime position in financial planning. It is a financial statement and is used for correlating various operations in public finance. The statement of budget is put forward to the management for the approval and sanction. It provides forecast of future fiscal policies. Budgets are also used by governments to report their financial performance and to forecast their fiscal policies.

6.1.2. Concept of Budgeting

Budgeting is the course of preparing, implementing and processing of budgets. It involves formulation of plans in numerical terms for a specified period of time in future. Budgeting attempts to prevent future issues and to resolve them. A business is required to evaluate its position in the current economic environment. It helps in establishing goals and objectives for all the levels in an organisation. Business transactions are required to be undertaken for the purpose of achieving these goals. Budgets are prepared for summarising the forecasted data. In nutshell, budgeting involves resource allocation. This tool can be used by a variety of business organisations including non-profit concerns.

Budgeting is a managerial tool and is used for the purpose of short-term planning and control. It denotes the complete cycle of designing, implementing and operating budgets. The main purpose of short-term budgets is to ensure that the plans are provided with adequate resources.

According to Shillonglow, "Budgeting is the preparation of comprehensive operating and financial plans for specific intervals of time".

According to William J. Vatter, "Budgeting is a kind of 'future tense' accounting in which the problems of future are met on paper before the transactions actually occur".

6.1.3. Meaning and Definition of Budgetary Control

Budgetary control involves determining budgeted figures for definite period of future, comparing actual figures with the budgeted ones and finding out the variances. This process helps in finding deviations and the reasons behind them. It aids in implementing corrective measures for improving the situation. It is an ongoing process

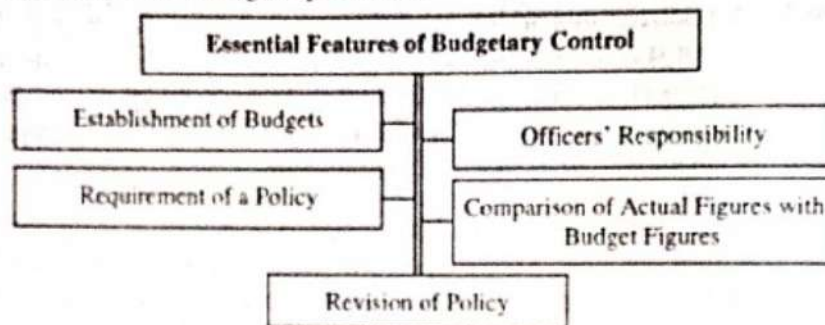
and helps in planning and coordination. Budget is a tool by which implementation of budgeting processes are made to achieve the end result of budgetary control. The first step is to prepare all the budgets. This is followed by the recording of actual results and their comparison. In case of discrepancies, the management is required to take remedial actions.

According to Brown and Howard, "Budgetary control is a system of controlling costs which includes the preparation of budgets, coordinating the department and establishing responsibilities, comparing actual performance with the budgeted and acting upon results to achieve maximum profitability".

According to CIMA, "The establishment of budgets relating the responsibilities of executives to the requirement 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".

6.1.4. Essential Features of Budgetary Control

Following are the essential features of budgetary control:



- 1) **Establishment of Budgets:** Budgets are prepared for each and every functional area in the business. These functional budgets are then merged to create a master budget, which is applicable throughout the organisation.
- 2) **Officers' Responsibility:** Every officer is given certain responsibilities and tasks. Such responsibilities and tasks contribute towards the accomplishment of organisational goal.
- 3) **Requirement of a Policy:** It is a policy statement and shows the future plans of the business. It also states a course of action for the implementation of such plans.
- 4) **Comparison of Actual Figures with Budget Figures:** Budgeting is also used as a control tool. It helps in setting up future plans, measuring actual performance and comparing it against budgeted figures. In case of deviations, the reasons are found out and are corrected.
- 5) **Revision of Policy:** In case of deviation from budgeted figures, several actions may be taken. Revision of policy may also be required in order to achieve the budgeted numbers. Therefore, the policies must be flexible to incorporate the corrective actions.

6.1.5. Objectives of Budgetary Control

Budgetary control has the following objectives:

- 1) **Basic Purpose:** A budgetary control system helps in planning, coordinating and controlling, which are its primary objectives.
- 2) **Cooperative Spirit:** Departmental and organisational budgets help in aligning different objectives. Budgetary control helps them in working towards a common goal.
- 3) **Maximum Profitability:** A budget is a planning tool and helps in increasing profit potential of the business.
- 4) **Centralised Control:** Budgets also help in facilitating control as it helps in delegation of authority and responsibility.
- 5) **Best Use of Resources:** Budgeting helps the organisation to stay on its course for the achievement of common objectives. It helps in making the best use of its resources.

- 6) **Coordination:** Budgeting helps in coordinating the activities of various parts of an organisation. It also coordinates various activities such as purchase, sales and administration.
- 7) **Execution:** Budgeting also helps in overseeing execution of the plans. It helps in ensuring that the plans are being followed properly. It also takes prompt remedial actions if there are any deviations from the standards.
- 8) **Remedial Measures:** Budgetary controls are meant to take corrective measures as and when actual numbers deviate from the budgeted ones.

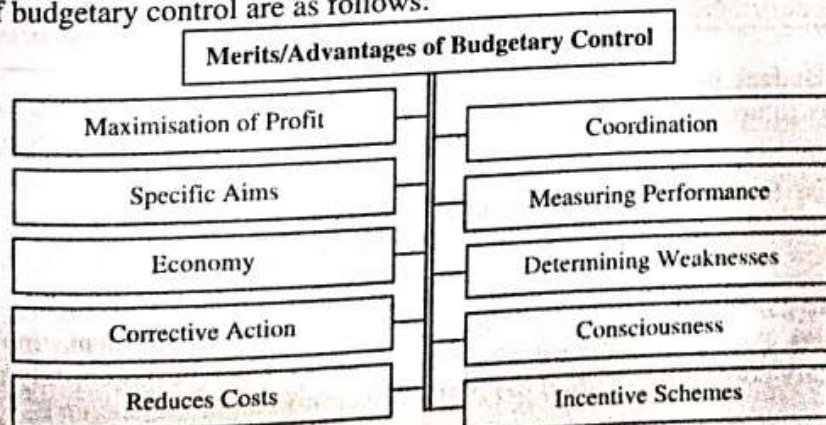
6.1.6. Prerequisites of Budgetary Control System

Following are the main requirements for the implementation of effective budgetary control system:

- 1) **Organisational Structure:** An effective organisational chart illustrates the responsibilities of each executive. It also shows the flow of authority, delegation and relative position of the executive in the hierarchical system.
- 2) **Budget Centres:** It is a section of the organisation which is entrusted with the specific purpose of achieving goals. An organisation should establish its budget centres with utmost care. Each budget centre should get its own separate budget.
- 3) **Clear Goals:** An effective budget should enumerate its goals in clear-cut manner. This ensures that the budget serves its purpose effectively.
- 4) **Budget Committee:** For smaller organisations, the process of budgeting is undertaken by Cost and Works Accountant. However, in bigger organisations, a budget committee is formed for this purpose. Such committees should be carefully designed.
- 5) **Key Factor or Budget Factor:** A key factor or budget factor forms the basis of effective budgetary system. An organisation should carefully identify its budget factors as these factors are generally large and variable.
- 6) **Budget Manual:** This document illustrates the roles and responsibilities for each of the executives involved in the process of budgeting. A budget manual consists of procedures and plans which are to be implemented by the executives. It serves as a guiding tool for the functional heads.
- 7) **Budget Period:** Selection of budget period depends on the nature of business and the factor of control. A long-term budget is replaced by short-term budgets.
- 8) **Level of Activity:** A budget specifies the normal level of activity. Such level of activity should be carefully established to ensure the efficient achievement of budget goals. Past results, labour efficiency and various other factors are considered for determining normal level of activity.
- 9) **Accounting System:** A sound accounting system is necessary for the achievement of budgetary goals. Such system helps in providing and recording the data.
- 10) **Communication:** A clear and smooth flow of information between various levels of management is essential for proper implementation and operation of budget.

6.1.7. Merits/Advantages of Budgetary Control

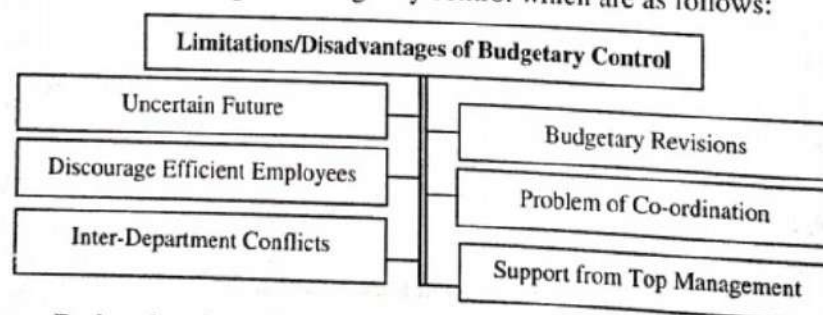
Various advantages of budgetary control are as follows:



- 1) **Maximisation of Profit:** The budgetary controls help the organisation in achieving maximum profits by properly planning and coordinating various activities. It also controls expenditure of capital and revenue nature. Thus, budgeting ensures that resources are used in the best possible manner.
- 2) **Coordination:** The working of different areas of an organisation is coordinated through the use of budgetary controls. Such coordination helps in the efficient achievement of organisational objectives. The success of budgeting depends on coordination.
- 3) **Specific Aims:** Budgetary controls help in setting up specific aims which are important for the purpose of planning and control. This also helps in setting up targets for various departments. Top management is responsible for setting up plans and policies to be followed.
- 4) **Measuring Performance:** Budgetary controls are important measuring tools as these help in setting up specific targets which help in measuring the performance. The actual performance is compared with the budgeted ones to find out the deviations. This helps in the implementation of 'management by exception' system.
- 5) **Economy:** Budgetary controls help in controlling expenditures as well. Systematic planning through budgeting is important for this purpose. The efficient use of resources is not only important for firms but has economy-wide impact. It also helps in reducing the wastage of precious resources and increases performance.
- 6) **Determining Weaknesses:** Comparison of actual performance helps in finding out weak spots. This leads to better performance as corrective measures can be taken for improving the performance.
- 7) **Corrective Action:** Budgetary control helps in timely identification of deviations. These deviations are required to be reported regularly to the management. In the absence of such controls, these deviations would be reported only at the end of the reporting period.
- 8) **Consciousness:** Budgetary control helps employees in getting acquainted with organisational goals and objectives. It also clearly demonstrates the targets that are required to be achieved.
- 9) **Reduces Costs:** Budgetary controls are also helpful in controlling costs which further helps in increasing profit by reducing the production cost. These controls help in designing product mix which is more profitable.
- 10) **Incentive Schemes:** Budgetary control helps in setting up of targets and measurement of actual performance. This facilitates the implementation of incentive schemes.

6.1.8. Limitations/Disadvantages of Budgetary Control

There are several limitations/disadvantages of budgetary control which are as follows:

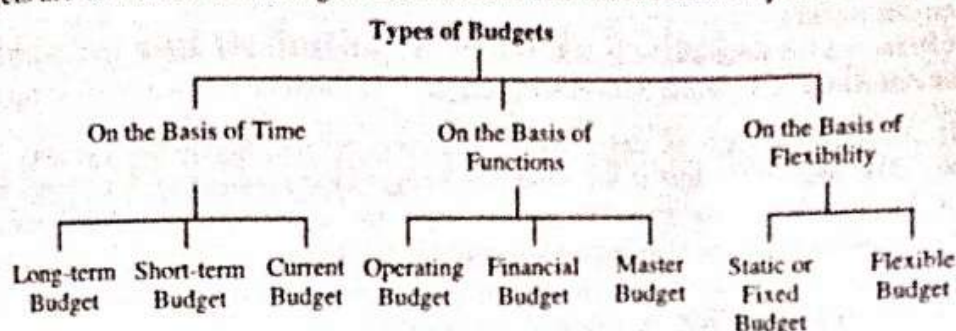


- 1) **Uncertain Future:** Budget involves future projections and future is uncertain. This greatly reduces the efficacy of budgets as future cannot be predicted with certainty. Any significant change in conditions may require change in budget as well. Such changes may increase the running costs of the organisation.
- 2) **Budgetary Revisions:** Since future is uncertain, the budgets may be required to be revised. However, frequent change in budgets is not desirable as it may affect the efficiency of employees. Such revisions are also expensive.
- 3) **Discourage Efficient Employees:** Budgetary control may demoralise efficient employees as it involves setting up of the targets. People tend to work towards the achievement of targets only and not beyond them. In such cases, budgetary control may curtail the performance instead of enhancing it.

- 4) **Problems of Coordination:** The coordination between various departments helps in proper implementation of budgetary control. The organisation may appoint a budgetary officer for the purpose of coordination. However, many organisations cannot bear additional employees which may impact the performance of budgetary control.
- 5) **Inter-Department Conflicts:** Budgetary control may lead to inter-departmental conflicts as they may fight for the limited resources. Different departments are provided with their own goals to be achieved and they may try to accomplish such goals at the expense of overall organisational objectives.
- 6) **Support from Top Management:** Budgetary control requires proper support from top management as it involves use of resources. Top management should cooperate with all the levels to ensure the success of budgetary control.

6.1.9. Types of Budgets

Normally budgets are classified according to their nature. The most commonly used budgets are:



6.1.9.1. On the Basis of Time

Budget on the basis of time are as follows:

- 1) **Long-Term Budgets:** These budgets have longer perspective which is in the range of 5 to 10 years. This type of budget is designed at top level. The various areas covered by these budgets are research and development, capital expenditure and long-term finances etc. These budgets are especially useful for industries with long gestation period. The main examples are infrastructure and power industry.
- 2) **Short-Term Budgets:** These budgets are designed for one to two years time period. These types of budgets are used for consumer industry like clothing, beverage, food production, electronics, etc.
- 3) **Current Budgets:** These budgets generally last from a few weeks to a couple of months. This budget involves current activities. According to I.C.W.A. London, "Current budget is a budget which is established for use over a short period of time and is related to current conditions".

6.1.9.2. On the Basis of Functions/ Functional Budget

Budget on the basis of functions/functional budget are as follows:

- 1) **Operating Budgets:** These budgets are related to various operations or activities of a firm. Different organisations have different budgets, depending on their organisational structure and processes. The most common operating budgets are as follows:
 - i) **Material Budget:** This type of budget deals with raw materials, packing materials and components which are consumed for the purpose of production. It presents quantitative and monetary representation.
 - ii) **Production Budget:** This budget forms a part of the master budget. It involves determination of future production targets. This budget projects the number of units to be produced for each product.
 - iii) **Sales Budget:** This budget estimates the expected sales during the budget period. This budget is comprehensive in nature and forms the plan for sales department.
 - iv) **Labour Budget:** This budget is drawn in conjunction with production budget. Once the production quantity is budgeted, the next step is to calculate the requirement of labour for carrying out production. This budget also projects labour cost by multiplying budgeted labour hours with wage rate.
 - v) **Overhead Budget:** This budget is required for the preparation of Production Budget. This budget takes care of indirect expenses. It collates the information from various departments.

- If a firm constructs its budget in the form of programmes or responsibility areas, it may involve following:
- i) **Programme Budget:** This budget enumerates expected revenue and costs related to various projects or products. This budget shows revenue, cost and estimated profit of various programmes run by the organisation.
 - ii) **Responsibility Budget:** An operating budget designed for a responsibility area is known as responsibility budget. It shows the plans for people responsible for accomplishing them. It can also be used for control purpose. This budget can be used for evaluating the performance of various managers who are in charge of different programmes.
- 2) **Financial Budget:** This type of budget involves working capital, capital expenditure, cash receipts and disbursement and financial position of the business. Most commonly used financial budgets are as follows:
- i) Cash Budget.
 - ii) Working Capital Budget.
 - iii) Capital Expenditure Budget.
 - iv) Income Statement Budget.
 - v) Statement of Retained Earnings Budget, and
 - vi) Budgeted Balance Sheet or Position Statement Budget.
- 3) **Master Budget:** A master budget is designed by merging several functional budgets. According to I.C.W.A. London, "The Master Budget is the summary budget incorporating its functional budgets". This budget is useful for top level management and is used for coordinating the activities of different departments. This type of budget can also be used as control measure.

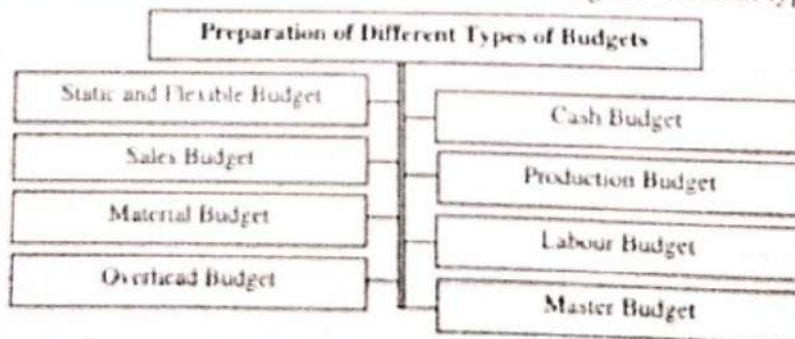
6.1.9.3. On the Basis of Flexibility

Budget on the basis of flexibility are as follows:

- 1) **Static or Fixed Budget:** The static budgets are designed for a particular level of activity. It is prepared before the beginning of the financial year. This budget is not adjusted in response to actual circumstances. There is generally a gap of more than 12 months between budgeted and actual figures.
- 2) **Flexible Budgets:** A flexible budget involves a series of budgets dealing with different levels of activities. As suggested by its name, the budget varies according to the level of activities. It classifies various costs into fixed, semi-fixed and variable cost categories.

6.2. PREPARATION OF DIFFERENT TYPES OF BUDGETS

A master budget is the end product after preparing other types of budget in the budgetary process. It is the summary of the objectives of various sub-units of the business such as finance, marketing and distribution. A master budget consists of two parts, which are operating budgets and financial budgets. It presents forecast pertaining to financial position, future income and allied activities in numerical form. Following are the main types of budgets:



6.3. STATIC AND FLEXIBLE BUDGET

6.3.1. Meaning and Definition of Static (Fixed) Budget

A static budget is useful in situations where budgeted output can be estimated as much similar to actual output. In such conditions, the use of static budget helps in better managerial control. The comparison of actual performance and budgeted figures is useful for performance measurement.

However, static budget is not useful where actual output tends to differ significantly from budgeted figures. Wide fluctuations in income and expenditure can affect the utility of fixed budget. Static or fixed budgets present the figures in relation to one level of activity and using such projection for some other level of activities is not likely to yield good results. Static budgets come with various limitations as these budgets are designed for a particular level of activities.

According to I.C.W.A. London, "Fixed budget is a budget which is designed to remain unchanged irrespective of the level of activity actually attained". Fixed budgets are suitable under static conditions. If sales, expenses and costs can be forecasted with greater accuracy then this budget can be advantageously used.

Due to these reasons, static budgets are not frequently used. Such budgets do not serve any purpose in situations where there is wide difference in budgeted and actual production figures. This limitation restricts the use of budget as a control measure. The conclusion revealed by this budget does not provide true performance of the business and thus it is not useful for the management for future decision-making.

6.3.2. Meaning and Definition of Flexible Budget

A flexible budget incorporates a number of budgets at different production output/levels. A flexible budget takes into account various circumstances which may lead to change in actual production level. It recognises different types of costs viz. fixed, semi-fixed and variable costs. This concept helps in making these budgets more realistic and close to actual life situations.

According to C.I.M.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 such as number of employees, is designed to change appropriately with such fluctuations".

For the purpose of designing a flexible budget, a company should study the impact of change in circumstances on its final production. Such circumstances may relate to the installation of new machinery or change in the production policies. **For example**, the company may project its costs for different production levels of 8000, 10000 and 12000 units. Flexible budgets are most useful in the following circumstances:

- 1) When the firm's revenue cannot be forecasted.
- 2) When the level of production depends on a key element and the supply of that element cannot be estimated with certainty.
- 3) When the firm is engaged in a new product and the estimates of sales are very tough to forecast.

6.3.3. Features of Flexible Budget

Following are the main features of a flexible budget:

- 1) **Covers a Range of Activities:** Future events are uncertain and managers attempt to minimise the impact of such uncertainties. A flexible budget shows expected results at various different levels of activities while a fixed budget enumerates only one estimate. A flexible budget helps the managers in obtaining information about activities at different levels.
- 2) **Dynamic in Nature:** Flexible budgets help managers in adjusting the plans according to change in situation. It can accommodate change in level of activity. This type of budget is helpful in decision-making process.
- 3) **Facilitate Performance Measurement:** These budgets are helpful in efficiency measurement and thus play a major role in performance reporting.

6.3.4. Advantages of Flexible Budget

Following are the main benefits accruing from a flexible budget:

- 1) A flexible budget helps to establish future plan for any level of activity as it is possible to make predictions within the relevant range.
- 2) A flexible budget can be used for control purpose as it makes easy assess to the performance of the managers in relation to the activities level achieved.
- 3) Flexible budgets can be used for the purpose of controlling overheads.
- 4) It also helps in ascertaining costs at various levels of activities. This further helps in fixing quotation prices.
- 5) It helps to ascertain the impact of different volume of activities on total revenue, costs and profits.

6.3.5. Disadvantages of Flexible Budget

Following are the main limitations of flexible budget:

- 1) It assumes costs to be linear and ignore various factors such as bulk discounts. However, in real life scenario, costs are not linear and hence such budgets lose their utility.
- 2) Flexible budgets assume continuing operations and do not take into account erratic behaviour of costs.
- 3) Flexible budgets divide costs into fixed and variable elements in an arbitrary fashion. Therefore, budgeted numbers do not bear close resemblance to actual costs.
- 4) Flexible budgets keep fixed costs at the same level for all activity levels, while in reality, even fixed costs change after crossing relevant output range.

6.3.6. Difference between Static & Flexible Budget

Basis of Difference	Static (Fixed) Budget	Flexible Budget
1) Rigidity	A fixed budget remains static even if there is change in volume of business.	A flexible budget is dynamic and is adjusted to reflect changes in business requirements.
2) Conditions	A fixed budget works on the assumption that conditions will remain the same.	This budget is changed as and when there is change in level of activity.
3) Cost Classification	Fixed budget considers costs in aggregate and does not classify them into different categories.	The costs are segregated as per their nature into fixed, variable, semi-variable categories.
4) Changes in Volume	Change in the level of activity makes comparison of budgeted and actual results impossible because of change in basis.	The budgets are recast according to change in volume, making comparison between budgeted and actual figures possible.
5) Forecasting	Forecasting through fixed budget is a difficult task.	Flexible budgets clearly illustrate the impact of expenses on operations and thus make accurate forecasts.
6) Cost Ascertainment	Costs cannot be reliably determined if there is change in circumstances,	The costs are easily ascertainable for different levels of activity. This is useful in fixing prices.

6.3.7. Format of Flexible Budget

Following is a format of a flexible budget:

Flexible Budget Normal Level of Activity..... (period ending.....)			
Particulars	Capacity 60% (₹)	Capacity 80% (₹)	Capacity 100% (₹)
Prime Cost			
Variable Overheads			
Marginal Cost (A)			
Sales (B)			
Contribution (D) = (B - A)			
Fixed Cost (C)			
Profit (D - C)			

Example 1: Following are the budgeted expenses for a factory operating at 70% level of activity with 1,400 hours:

Variable	2,800
Semi-variable	3,200
Fixed	4,000

The semi-variable expenses go up by 15% between 80 and 90 percent level of activity, and by 20% above 90 percent activity. Prepare a flexible budget for 80, 90, and 100 percent level of activity, and calculate recovery rate per hour.

Solution:

Flexible Budget				
Level of Activity	70%	80%	90%	100%
Budgeted Hours	1400	1600	1800	2000
	(₹)	(₹)	(₹)	(₹)
Variable Expenses	2,800	3,200	3,600	4,000
Semi-variable Expenses	3,200	3,680	3,680	3,840
Fixed Expenses	4,000	4,000	4,000	4,000
Total Cost	10,000	10,880	11,280	11,840
Recovery Rate Per Hour = $\frac{\text{Total Cost}}{\text{Budgeted Hours}}$	$\frac{10,000}{1,400} = 7.143$	$\frac{10,880}{1,600} = 6.8$	$\frac{11,280}{1,800} = 6.267$	$\frac{11,840}{2,000} = 5.92$

Working Note:

- 1) A semi-variable expense between 80% and 90% of activity is: $3,200 + 15\% \text{ of } 3,200 = ₹3,680$.
- 2) Semi-variable expenses above 90% level of activity is: $3,200 + 20\% \text{ of } 3,200 = ₹3,840$

Example 2: A company had budgeted following expenses for producing 12,000 units

Particulars	Per Unit (₹)
Materials	60
Labour	30
Variable overheads	25
Fixed overheads (₹1,20,000)	10
Direct variable overheads	6
Selling and distribution expenses (25% fixed)	24
Administrative expenses (₹60,000 rigid for all levels of production)	5
	160

Prepare a budget for the production of 10,000 units.

Solution:

Flexible Budget				
Production Particulars	12,000 Units		10,000 Units	
	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)
Production Cost:				
Materials	60.00	7,20,000	60.00	6,00,000
Labour	30.00	3,60,000	30.00	3,00,000
Variable Overheads	25.00	3,00,000	25.00	2,50,000
Direct Variable Overheads	6.00	72,000	6.00	60,000
Fixed overheads (1,20,000)	10.00	1,20,000	12.00	1,20,000
Selling and Distribution Expenses:				
Fixed	6.00	72,000	7.20	72,000
Variable	18.00	2,16,000	18.00	1,80,000
Administration Expenses	5.00	60,000	6.00	60,000
Total Cost	160.00	19,20,000	164.20	16,42,000

Working Note:

25% of Selling and Distribution Expenses (i.e. $24 \times 25\% = 6 \times 12,000 = ₹72,000$) are fixed and the remaining 75% of Selling and Distribution Expenses (i.e. $24 \times 75\% = 18 \times 12,000 = ₹2,16,000$) are variable expense. Therefore, the fixed selling and distribution expense for actual output of 10,000 units unit will be = ₹72,000 and variable selling and distribution expense for actual output of 10,000 units will be = $18 \times 10,000 = ₹1,80,000$.

Example 3: The expenses for the production of 6,000 units in a factory are given as follows:

Particulars	Per Unit (₹)
Materials	40
Labour	15
Variable Overheads	20
Fixed Overheads (₹42,000)	7

Administrative Expenses (10% variable)	15
Selling Expenses (10% Fixed)	10
Distribution Expenses (20% Fixed)	8
Total cost of sales per unit	115

You are required to prepare a budget for the production of 5,000 units.

Solution:

Production Particulars	Flexible Budget Output 6,000 Units		Output 5,000 Units	
	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)
Materials	40.00	2,40,000	40.00	2,00,000
Labour	15.00	90,000	15.00	75,000
Prime Cost	55.00	3,30,000	55.00	2,75,000
Factory Overheads:				
Variable Overheads	20.00	1,20,000	20.00	1,00,000
Fixed Overheads	7.00	42,000	8.40	42,000
Works Cost/Factory Cost	82.00	4,92,000	83.40	4,17,000
Administrative Expenses:				
Fixed Expenses	13.5	81,000	16.2	81,000
Variable Expenses	1.5	9,000	1.5	7,500
Cost of Production	97.00	5,82,000	101.1	5,05,500
Selling and Distribution Expenses:				
Selling Expenses:				
Fixed Expenses	1	6,000	1.2	6,000
Variable Expenses	9	54,000	9	45,000
Distribution Expenses:				
Fixed Expenses	1.6	9,600	1.92	9,600
Variable Expenses	6.4	38,400	6.4	32,000
Total Cost of Sales	115.00	6,90,000	119.62	5,98,100

Working Notes:

- 1) 10% of administrative expenses (i.e., $15 \times 10\% = 1.5 \times 6,000 = ₹9,000$) are variable and remaining 90% of administrative expenses (i.e., $15 \times 90\% = 13.5 \times 6,000 = ₹81,000$) are fixed expenses.

Therefore, the fixed administrative expenses for the actual output of 5,000 units will be = ₹81,000 and variable administrative expenses for actual output of 5,000 units will be = $1.5 \times 5,000 = ₹7,500$.

- 2) 10% of Selling expenses (i.e., $10 \times 10\% = 1 \times 6,000 = ₹6,000$) are fixed and remaining 90% (i.e., $10 \times 90\% = 9 \times 6,000 = ₹54,000$) are variable expenses.

Therefore, the fixed selling expenses for the actual output of 5,000 units will be = ₹6,000 and variable selling expenses for actual output of 5,000 units will be = $9 \times 5,000 = ₹45,000$.

- 3) 20% of distribution expenses (i.e., $8 \times 20\% = 1.6 \times 6,000 = ₹9,600$) are fixed. Therefore, remaining 80% (i.e., $8 \times 80\% = 6.4 \times 6,000 = ₹38,400$) are variable expenses.

Therefore, the Fixed distribution expenses for actual output of 5,000 units will be = ₹8,000 and the variable distribution expenses for actual output of 5,000 units will be = $6.4 \times 5,000 = ₹32,000$.

Example 4: Following is the budget for producing 1,00,000 units of the only product manufactured by ABC Ltd. for a costing period:

Particulars	₹
Direct Material	2.50 per unit
Direct Labour	0.80 per unit
Direct Expenses	0.20 per unit
Works Overheads (50% fixed)	2.40 per unit
Administration Overheads (75% fixed)	0.40 per unit
Selling Overheads (40% fixed)	0.25 per unit

The actual production for the said period was only 50,000 units. Prepare the revised schedule showing budgeted cost per unit.

Solution:

Revised (Flexible) Budget				
Production Particulars	Output 1,00,000 units		Output 50,000 units	
	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)
Direct Material	2.50	2,50,000	2.50	1,25,000
Direct Labour	0.80	80,000	0.80	40,000
Direct Expenses	0.20	20,000	0.20	10,000
Prime Cost	3.50	3,50,000	3.50	1,75,000
Works Overheads				
Fixed Overhead	1.2	1,20,000	2.4	1,20,000
Variable Overhead	1.2	1,20,000	1.2	60,000
Cost of Production	5.90	5,90,000	7.10	3,55,000
Administration Overheads:				
Fixed Overhead	0.3	30,000	0.6	30,000
Variable Overhead	0.1	10,000	0.1	5,000
Selling Overheads:				
Fixed Overhead	0.10	10,000	0.20	10,000
Variable Overhead	0.15	15,000	0.15	7,500
Total Cost of Sales	6.55	6,55,000	8.15	4,07,500

Working Notes:

- 50% of works overheads (i.e., $2.40 \times 50\% = 1.20 \times 1,00,000 = ₹1,20,000$) are fixed. Therefore, remaining 50% (i.e., $2.40 \times 50\% = 1.20 \times 1,00,000 = ₹1,20,000$) are variable overhead. Therefore, the Fixed works overheads for actual output of 50,000 units will be $= 1.2 \times 50,000 = ₹60,000$.
- 75% of administrative overhead (i.e., $.40 \times 75\% = 0.30 \times 1,00,000 = ₹30,000$) are fixed and remaining 25% of administrative overhead (i.e., $.40 \times 25\% = 0.10 \times 1,00,000 = ₹10,000$) are variable overheads. Therefore, the fixed administrative overheads for the actual output of 50,000 units will be $= ₹30,000$ and variable administration overhead for actual output of 50,000 units will be $= 0.1 \times 50,000 = ₹5,000$.
- 40% of Selling overheads (i.e., $.25 \times 40\% = 0.1 \times 1,00,000 = ₹10,000$) are fixed and remaining 60% (i.e., $0.25 \times 60\% = 0.15 \times 1,00,000 = ₹15,000$) are variable overhead. Therefore, the fixed selling overheads for the actual output of 50,000 units will be $= 10,000$ and variable selling overhead for actual output of 50,000 units will be $= 0.15 \times 50,000 = ₹7,500$.

Example 5: Prepare a flexible budget of a manufacturing company and show the forecast of profit at 75% and 100% capacity operations, from the given data of 50% capacity:

50% Capacity Worked	₹	Total (₹)
Fixed Cost		
Salaries	84,000	2,90,000
Rent and Rates	56,000	
Depreciation	70,000	
Other Administrative Expense	80,000	
Variable Cost		
Materials	2,40,000	5,34,000
Labour	2,56,000	
Other expenses	38,000	

Possible sales at various levels of working are:

75% Capacity – Sales ₹11,50,000

100% Capacity – Sales ₹15,25,000

Solution:

Flexible Budget			
Particulars	Level of Capacity		
	50%	75%	100%
1) Sales	–	11,50,000	15,25,000
2) Variable Expenses:			
Material	2,40,000	3,60,000	4,80,000
Labour	2,56,000	3,84,000	5,12,000

Other Expenses	38,000	57,000	76,000
Total Variable Expenses	5,34,000	8,01,000	10,68,000
3) Fixed Cost:			
Salaries	84,000	84,000	84,000
Rent and Rates	56,000	56,000	56,000
Depreciation	70,000	70,000	70,000
Other Administrative Expense	80,000	80,000	80,000
Total Fixed Cost	2,90,000	2,90,000	2,90,000
4) Cost of Sales (2 + 3)	8,24,000	10,91,000	13,58,000
5) Profit (1 - 4)	-	59,000	1,67,000

Working Note:

Calculation of Variable Expenses:

$$\text{Material on 75\% Capacity} = 2,40,000 \times \frac{75\%}{50\%} = ₹3,60,000$$

$$\text{Material on 100\% Capacity} = 2,40,000 \times \frac{100\%}{50\%} = ₹4,80,000$$

$$\text{Labour on 75\% Capacity} = 2,56,000 \times \frac{75\%}{50\%} = ₹3,84,000$$

$$\text{Labour on 100\% Capacity} = 2,56,000 \times \frac{100\%}{50\%} = ₹5,12,000$$

$$\text{Other expense on 75\% Capacity} = 38,000 \times \frac{75\%}{50\%} = ₹57,000$$

$$\text{Other expense on 100\% Capacity} = 38,000 \times \frac{100\%}{50\%} = ₹76,000$$

Example 6: The production of ABC Textile Mills ranges from 15,000 metres to 30,000 metres per month. The costing department has given the following cost data relating to variable cost:

Items	Variable Cost Per Unit (in ₹)
Direct Material	14
Direct Labour	06
Variable Factory Expense	03
Selling and Administrative Expenses	01

The fixed cost is ₹4,50,000 for the whole range. The sales at different levels of activity were at 15,000 metres ₹7,50,000, at 20,000 metres ₹10,00,000, at 25,000 metres ₹15,00,000. Prepare a flexible budget showing:

- The contribution margin, and
- Profit/loss at different levels of production.

Solution:

Production Particulars	Flexible Budget					
	Activity (15,000 Metres)		Activity (20,000 Metres)		Activity (25,000 Metres)	
	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)
Sales		7,50,000		10,00,000		15,00,000
Variable Costs						
Direct Material	14	2,10,000	14	2,80,000	14	3,50,000
Direct Labour	6	90,000	6	1,20,000	6	1,50,000
Prime Cost	20	3,00,000	20	4,00,000	20	5,00,000
Variable Factory Expense	3	45,000	3	60,000	3	75,000
Selling and Administration Expenses	1	15,000	1	20,000	1	25,000
Total Cost	24	3,60,000	24	4,80,000	24	6,00,000
Contribution Margin (Sales - Total Cost)		3,90,000		5,20,000		9,00,000
Less: Fixed Cost		4,50,000		4,50,000		4,50,000
Total Profit/Loss		(60,000)		70,000		4,50,000

6.5.4. Format of Sales Budget

Area	Period	Budgeted in the Current Period			Actual Sales			Budgeted for the Future Period		
		Units	Rate (₹)	Amount (₹)	Units	Rate (₹)	Amount (₹)	Units	Rate (₹)	Amount (₹)
Northern Area										
Product X										
Product Y										
Southern Area										
Product X										
Product Y										
Eastern Area										
Product X										
Product Y										
Western Area										
Product X										
Product Y										
Grand Total										

Example 14: ABC Manufacturing Co. produces and sells Biscuit, Chips and Cold drink. The company bifurcates its market into Department A and Department B. Following are the sales figures for the previous year:

Products	Department A		Department B	
	Units	Unit Price (₹)	Units	Unit Price (₹)
1) Biscuit	3,000	1,100	2,000	1,100
2) Chips	3,500	1,600	3,000	1,600
3) Cold drink	2,000	1,500	2,500	1,500

Department A is expected to experience 20% increase in biscuit sales while chips sale is likely to be increased by 500 units in Department B. Cold drink sale is expected to be increased by 20% in both the regions. The company would keep biscuit and chips prices constant, though it will cut cold drink price by ₹100 in both Department A and Department B. Prepare quantitative cum-financial budget for sales in the next year.

Solution:

Sales Budget of ABC Manufacturing Company

Products	Biscuit			Chips			Cold drink			Total
	Units	Unit Price (₹)	Amount (₹)	Units	Unit Price (₹)	Amount (₹)	Units	Unit Price (₹)	Amount (₹)	Units
Department A	3,600	1,100	39,60,000	3,500	1,600	56,00,000	2,400	1,400	33,60,000	1,29,20,000
Department B	2,000	1,100	22,00,000	3,500	1,600	56,00,000	3,000	1,400	42,00,000	1,20,00,000
Total	5,600	2,200	61,60,000	7,000	3,200	1,12,00,000	5,400	2,800	75,60,000	2,49,20,000

Example 15: XYZ Ltd. sells two products which are shirt and t-shirt. Budgeted sales for the current year are given below:

Product	Division I	Division II
Shirt	300 at ₹110	400 at ₹110
T-shirt	220 at ₹100	200 at ₹100

Actual sales for the above period were as follows:

Product	Division I	Division II
Shirt	400 at ₹110	350 at ₹110
T-shirt	200 at ₹100	240 at ₹100

Following are various decisions taken by the company for future:

- The company decides to increase the price of T-shirt by ₹20, due to its high demand.
- The shirt is likely to have better demand if its price is reduced by ₹10.

Following are the estimates for percentage increase in demand of the products:

Product	Division I (%)	Division II (%)
Shirt	10	25
T-shirt	5	10

Prepare a sales budget incorporating all the changes.

Solution:

Sales Budget of XYZ Ltd.

Division	Product	Budget for Future Period			Budget for Current Period			Actual Sales for Current Period		
		Qty.	Price (₹)	Amount (₹)	Qty.	Price (₹)	Amount (₹)	Qty.	Price (₹)	Amount (₹)
I	Shirt	330	100	33,000	300	110	33,000	400	110	44,000
	T-shirt	231	120	27,720	220	100	22,000	200	100	20,000
	Total	561	220	60,720	520	210	55,000	600	210	64,000
II	Shirt	500	100	50,000	400	110	44,000	350	110	38,500
	T-shirt	220	120	26,400	200	100	20,000	240	100	24,000
	Total	720	220	76,400	600	210	64,000	590	210	62,500
Total	Shirt	830	100	83,000	700	110	77,000	750	110	82,500
	T-shirt	451	120	54,120	420	100	42,000	440	100	44,000
	Total	1,281	220	1,37,120	1,120	210	1,19,000	1,190	210	1,26,500

Example 16: ABC Ltd. manufactures two types of products X and Y. It sells them in Delhi and Chennai markets. The following information is made available for the current year:

Market	Types of Toy	Budgeted Sales	Actual Sales
Delhi	X	450 at ₹10 each	510 at ₹10 each
	Y	200 at ₹20 each	150 at ₹20 each
Chennai	X	500 at ₹10 each	600 at ₹10 each
	Y	400 at ₹20 each	300 at ₹20 each

Following market research reports, the company has decided to increase the price of product X by ₹2 and reduce the price of product Y by ₹5.

The Sales Manager has prepared following estimates:

Product	% Increase in Sales (Delhi)	Over current budget (Chennai)
X	20%	10%
Y	10%	15%

The company expects to have additional demand over and above the estimates presented by the sales manager:

Product	Delhi	Chennai
X	50 units	45 units
Y	60 units	30 units

Prepare a budget for sales using above given information.

Solution:

Sales Budget of ABC Ltd.

Area	Product	Budget for the Current Year			Actual Sales for the Current Year			Budget for the Future Period		
		Units	Price (₹)	Amount (₹)	Units	Price (₹)	Amount (₹)	Units	Price (₹)	Amount (₹)
Delhi	X	450	10	4,500	510	10	5,100	590	12	7,080
	Y	200	20	4,000	150	20	3,000	280	15	4,200
	Total	650	30	8,500	660	30	8,100	870	27	11,280

Chennai	X	500	10	5,000	600	10	6,000	595	12	7,140
	Y	400	20	8,000	300	20	6,000	490	15	7,350
	Total	900	30	13,000	900	30	12,000	1,085	27	14,490
Total	X	950	10	9,500	1,110	10	11,100	1,185	12	14,220
	Y	600	20	12,000	450	20	9,000	770	15	11,550
Total Sales		1,550	30	21,500	1,560	30	20,100	1,955	27	25,770

Working Notes:

Particulars	X (Units)	Y (Units)
Budget Sales for Delhi		
Budgeted	450	200
Add: Increase in Sales	(20%) 90	(10%) 20
	540	220
Add: Increase due to Advertisement	50	60
Total	590	280
Budgeted Sales for Chennai		
Budgeted	500	400
Add: Increase in Sales	(10%) 50	(15%) 60
	550	460
Add: Increase due to Advertisement	45	30
Total	595	490

6.6. PRODUCTION BUDGET

6.6.1. Meaning of Production Budget

Once sales budget is prepared, the management is required to design its production budget. This budget is also a part of master budget and deals with the forecast of level of production for the budgeted period. A production budget is an endeavour to determine the number of units to be produced during the budgeted period. Production budget is designed to ensure that there are enough units available for sales. It also ensures that no over-production is carried out. This budget takes into account the quantity of opening inventory. A production budget takes opening inventory into account to determine the units to be produced for the period under planning.

6.6.2. Advantages of Production Budget

Following are the main advantages of production budget:

- 1) This budget leads to best possible utilisation of equipments like plant and machinery.
- 2) It also ensures proper use of labour.
- 3) This budget helps in maintaining optimum level of inventory to ensure that there is no stock out or over-accumulation of goods.
- 4) It offers production of finished goods in accordance to delivery schedules.
- 5) It helps in proper routing and scheduling of labour.
- 6) It reduces cost by bringing uniformity in production process.
- 7) It helps in framing purchase budget which is helpful for reducing purchase costs.

6.6.3. Factors Considered while Preparing a Production Budget

Following are the salient factors to be considered while preparing a production budget:

- 1) **Sales:** Sales requirements such as quantity, product specifications, customer demands and other related variables.
- 2) **Inventory Policies:** Inventory policies pertaining the stock size of work-in-progress and finished goods required to be maintained at different point of time.
- 3) **Availability of Production Resources:** Factor considered in the availability of production resources, such as plant capacity, expansion of plant, plant improvement, availability of manpower.
- 4) **Key Factor:** Key factor such as labour, wages, etc. puts major restriction on the production process.
- 5) **Plant Maintenance:** Plant maintenance standards expected during the budget period.

- 6) **Technological Obsolescence:** The rate of technological obsolescence also reflects the production efficiency.
- 7) **Production Control:** Production control procedures, their effectiveness and flexibility.
- 8) **Time Lag:** Production budget get affected due to the time lag between production and sale.
- 9) **Time Involved:** The major considerations are given to the time involved in the production process.
- 10) **Changeover:** With the change in production of one product to another, related costs also changes.
- 11) **Economic Batch Quantity:** Economic batch quantity of production.
- 12) **Cost and Production Run:** The production budget effects the relation between cost and production run.

6.6.4. Format of Production Budget

A format of a detailed production budget is given as under:

.....Co. Ltd.
Production Budget
(January, February and March 20XX)

Particulars	January	February	March
Sales in Quantity (as per sales budget)	xxx	xxx	xxx
Add: Desired Inventory at the End	xxx	xxx	xxx
Total Quantity Required	xxx	xxx	xxx
Less: Stock at Beginning	xxx	xxx	xxx
Quantity to be Produced	xxx	xxx	xxx

Example 17: ABC Ltd. expects to sell 1,00,000 units of product A in the first fiscal quarter, 1,20,000 units in the second quarter, 1,45,000 units in the third quarter and 1,50,000 units in the fourth quarter and 1,25,000 units in the first quarter of the following year.

The closing stock is 24,000 units in the first fiscal quarter, 29,000 units in the second quarter, 30,000 units in the third quarter and 25,000 units in the fourth quarter. The opening stock at the beginning of the first quarter of the current year was at 15,000 units. The company plans to have closing inventory equal to one-fifth of the sales for the next fiscal quarter.

Prepare the Production budget for the year.

Solution:

Production Budget of ABC Ltd.

Particulars	First Quarter (Units)	Second Quarter (Units)	Third Quarter (Units)	Fourth Quarter (Units)
Sales Budget	1,00,000	1,20,000	1,45,000	1,50,000
Add: Desired stock/inventory at the end	24,000	29,000	30,000	25,000
Total	1,24,000	1,49,000	1,75,000	1,75,000
Less: Stock at beginning	15,000	24,000	29,000	30,000
Quantity to be Produced	1,09,000	1,25,000	1,46,000	1,45,000

Example 18: The following information has been made available from the records of precision tools Ltd. for the six months of 2018 (and the sales of January 2019), in respect of production X:

i) The units to be sold in different months are:

July 2018 = 1,100;

August 2018 = 1,100;

September 2018 = 1,700;

October 2018 = 1,900;

November 2018 = 2,500;

December 2018 = 2,300;

January 2019 = 2,000

ii) There will be no work in progress at the end of any month.

iii) Finished units equal to half the sales of the next month will be in stock at the end of every month (including June 2018).

You are required to prepare production budget for the six months of 2018.

Solution:

Production Budget
(For the six months ending Dec. 2018)

Particulars	July (₹)	Aug. (₹)	Sep. (₹)	Oct. (₹)	Nov. (₹)	Dec. (₹)	Total (₹)
Estimated Sales	1,100	1,100	1,700	1,900	2,500	2,300	
Add: Closing Stock	550	850	950	1,250	1,150	1,000	
	1,650	1,950	2,650	3,150	3,650	3,300	
Less: Opening Stock	550	550	850	950	1,250	1,150	
Production	1,100	1,400	1,800	2,200	2,400	2,150	11,050

Note: As per the adjustment given in the question, closing stock will be half of units sold of the following month and closing stock of previous month will be opening stock of the following next month.

6.7. MATERIAL BUDGET

6.7.1. Meaning of Material Budget

Material budget shows the quantity and cost of materials required for production. It deals with the direct material requirements for the budgeted output. This budget does not include indirect materials as such materials are treated as a part of factory overheads. It involves forecasting total quantity and cost of materials to be used for production process. Material budget shows the total quantities of each item of raw materials and its components. It also shows the total costs of such materials. The budget also takes cognizance of opening inventory and various organisational policies regarding the inventory. The budget can be presented for different months when the inventory is required. This type of budget involves forecasting of quantity as well as prevailing price level. Various steps need to be followed for the purpose of drafting a material budget.

6.7.2. Objectives of Material Budget

A material budget serves following objectives:

- 1) Determining the quantity and value of the raw material required for the budgeted production.
- 2) To ensure smooth production process.
- 3) To reduce the cost of production by curtailing the lag time.
- 4) To aid the process of drawing purchase schedules at the desired time.
- 5) To minimise the wastage of material.

6.7.3. Factors Considered while Preparing a Material Budget

Following factors need to be kept in mind for preparing the material budget:

- 1) Raw material required for producing budgeted output.
- 2) Previous records are to be used for calculating the percentage of raw materials to total cost of production. This percentage may be used as the basis for computing requirement of raw material for the budgeted output.
- 3) Required opening and closing inventory balances should be considered.
- 4) Time lag between ordering the raw material and its receipt should also be taken into account.
- 5) If the availability of the raw material is seasonal in nature then this factor should be considered while drawing the budget.
- 6) Attention must be paid to the price trend in the market.

6.7.4. Advantages of Material Budget

A material budget has following advantages:

- 1) This budget is helpful for estimating material prices during the production period.
- 2) It is helpful in analysing quantity of material required for the budgeted period.
- 3) It makes the process of inventory planning smoother.
- 4) It allows for longer purchase lead time.
- 5) Material budget helps to minimise cost incurred in transportation.
- 6) It helps in ensuring better supplier relationship.
- 7) Material budget helps in better coordination between the departments.
- 8) It also ensures smooth and continuous operations.

6.7.5. Format for Materials Budget

Material Budget
(For the year)

Particulars	Kinds of Raw Material (in Units)	
	A	B
Units of Raw Material Required as per Production Budget:		
For Product: A	xxx	xxx
B	xxx	xxx
Add: Desired Stock of Raw Material at the End of Year	xxx	xxx
Less: Available Stock of Raw Material at the Beginning of the Year	xxx	xxx
Material Budget Physical	xxx	xxx
Standard Price of Raw Material (P.V.) (in ₹)	xxx	xxx
Material Cost Budget (in ₹)	xxx	xxx

Example 19: The sales director of a manufacturing company expects to sell 50,000 units of product A. The production manager presented following figures:
 Product A needs raw materials, X and Y. Each unit of the product requires 2 units of X and 1 unit of Y. The estimated opening balances of the next year are:
 Product A - 12,000 units, X - 15,000 units, Y - 10,000 units.
 The firm wants following closing balances at the end of the next year are:
 Product A - 10,000 units, X - 11,000 units, Y - 14,000 units.
 Prepare a Material Purchase Budget for the next year.

Solution:

Material Purchase Budget (Quantitative)

Particulars	Product A (units)	Material	
		X (Units)	Y (Units)
Production Budget	50,000	1,00,000	50,000
Add: Opening Balances	12,000	15,000	10,000
	62,000	1,15,000	60,000
Less: Closing Balances	10,000	11,000	14,000
Estimated Sales of Product	52,000	-	-
Estimated Purchase of Materials	-	1,04,000	46,000

Example 20: A Ltd. expects to have following inventory as on the beginning:

Type of Material	Quantity	Price (₹)	Amount (₹)
A	1,200 units	5	6,000
B	40 tons	40	1,600
C	4,000 kg.	0.50	2,000
D	1,500 gallons	1.20	1,800
E	20,000 units	0.25	5,000
			16,400

Following statement shows the consumption of different types of raw material for various departments:

Material	Departments			
	I	II	III	IV
A (units)	8,000	-	5,000	2,000
B (tons)	20	10	-	5
C (kg)	-	1,000	1,200	2,500
D (gallons)	500	1,500	-	-
E (units)	11,000	12,000	3,500	1,500

Desired Closing Inventory	
A	1,500 units
B	30 tons
C	2,000 kg.
D	1,600 gallons
E	21,000 units

Prepare the Purchase Budget, assuming that all prices will remain constant.

Solution:

Purchase (Material) Budget							
Material	Units	Opening Stock	Expected Consumption	Closing Stock	Purchase Requirement	Price (₹)	Budget (₹)
A	Units	1,200	15,000	1,500	15,300	5.00	76,500
B	Tons	40	35	30	25	40.00	1,000
C	Kg	4,000	4,700	2,000	2,700	0.50	1,350
D	Gallons	1,500	2,000	1,600	2,100	1.20	2,520
E	Units	20,000	28,000	21,000	29,000	0.25	7,250
							88,620

Purchase Requirement = Closing Stock – Opening Stock + Expected Consumption

6.8. LABOUR BUDGET

6.8.1. Meaning of Labour Budget

Labour budget presents “the estimate of direct labour” in order to achieve the targets set under “production budget”. This budget is important as it involves an active factor of production. It enumerates the potential requirement for various types of labour for the budget period. It also calculates the estimated cost of labour. This budget is important as it involves an active factor of production.

Labour budget is drafted on the basis of “production budget”. It involves determination of standard time by using time and motion study. Requirement of labour for each department or cost centre is identified by converting the calculated hours into labour requirements. These hours are multiplied with wage rate to determine direct labour cost.

Departmental Labour Budget					
Cost Centre: Product		Output Quantity		Month: Standard Hours	
A					
B					
C					

Workers	Number	Hours	Rate of Wages	Direct Labour Cost	Total
Male:					
Skilled					
Semi-skilled					
Unskilled					
Female:					
Skilled					
Semi-skilled					
Unskilled					
Total:					

On the above basis, the manpower requirement is designed by the Production Manager. Requirement of indirect workers is also included. Both are added to reach total manpower requirement.

Note: Labour costs associated with indirect workers such as clerical staff and supervisors are included in appropriate budgets under Overheads.

6.8.2. Advantages of Labour Budget

The advantages associated with labour budget are as follows:

- 1) It shows the requirement of direct and indirect labour.
- 2) The personnel department can make plans about its recruitment and training programme. It helps in reducing labour turnover.
- 3) It forms the basis for preparing cash budget and manufacturing cost budget.
- 4) It helps in determining labour cost and rate per unit.
- 5) It helps in optimal production schedule, reducing idle hours as less as possible.
- 6) Labour budget acts as a cost control measure and helps in cost minimisation and profit maximisation.

Example 21: Prepare a labour cost budget for the next year from the following information of Paras Industries Ltd.:

1) **Production Forecast**

Production X	50,000 units
Production Y	40,000 units
Production Z	20,000 units

2)

Kinds of Labour Required (Per Unit)	Product		
	X	Y	Z
Skilled	2 hours	3 hours	3 hours
Semi-skilled	3 hours	3 hours	4 hours
Unskilled	4 hours	5 hours	3 hours

3) **Labour Rate (Per Hour)**

Skilled – ₹5; Semi-skilled – ₹4; Unskilled – ₹3

Solution:

Labour Cost Budget of Paras Industries Ltd.
(for the year ending)

Particulars	Kinds of Labour			Total
	Skilled	Semi-Skilled	Unskilled	
1) Labour Hours Required for Budgeted:				
Product X	1,00,000	1,50,000	2,00,000	4,50,000
Product Y	1,20,000	1,20,000	2,00,000	4,40,000
Product Z	60,000	80,000	60,000	2,00,000
Total Labour Hours	2,80,000	3,50,000	4,60,000	10,90,000
2) Labour Rates (₹)	5	4	3	—
3) Labour Cost for Budgeted Production:				
Product X	5,00,000	6,00,000	6,00,000	17,00,000
Product Y	6,00,000	4,80,000	6,00,000	16,80,000
Product Z	3,00,000	3,20,000	1,80,000	8,00,000
Total Labour Cost or Labour Cost Budget	₹14,00,000	₹14,00,000	₹13,80,000	₹41,80,000

Example 22: The direct labour hour requirements of three of the products manufactured in a factory, each involving more than one labour operation, are estimated as follows:

Operations	Direct Labour Hours per Unit (in minutes)		
	Products		
	1	2	3
Operation 1	18	42	30
Operation 2	-	12	24
Operation 3	9	6	-

The factory worked 8 hours per days in a week. The budget quarter is taken as 13 weeks, and during a quarter lost hours, due to leave and holidays and other causes, are estimated to be 124 hours.

The budgeted hourly rates for the workers manning the operation 1, 2 and 3 are ₹2.00; ₹2.50 and ₹3.00 respectively.

The budgeted sales for the products during the quarter are:

Product 1	9,000 units
Product 2	15,000 units
Product 3	12,000 units

There is a carryover of 5,000 Units of Product 2 and 4,000 units of product 3 and it is proposed to build up a stock at the end of the budget quarter as follows:

Product 1 1,000 units
Product 3 2,000 units

Prepare a man-power budget for the quarter showing for each operation, (i) direct labour hours, (ii) direct labour cost, and (iii) the number of workers.

Solution:

Quarterly Man-Power Budget

Operations	Hourly Rate	Product 1		Product 2		Product 3		Total		No. of Workers
		Direct Labour Hrs.	Cost (₹)	Direct Labour Hrs.	Cost (₹)	Direct Labour Hrs.	Cost (₹)	Direct Labour Hrs.	Cost (₹)	
1	2.00	3,000	6,000	7,000	14,000	5,000	10,000	15,000	30,000	30
2	2.50	-	-	2,000	5,000	4,000	10,000	6,000	15,000	12
3	3.00	1,500	4,500	1,000	3,000	-	-	2,500	7,500	5

Working Notes:

Production Budget

Particulars	Product (units)		
	1	2	3
Budgeted Sales	9,000	15,000	12,000
Add: Closing Stock	1,000	-	2,000
	10,000	15,000	14,000
Less: Opening Stock	-	5,000	4,000
Production Budget	10,000	10,000	10,000

Total Hours Available (per man in a quarter)

Total hours (8 hours × 6 days × 13 weeks) = 624

Less: Hours lost due to leaves etc. 124

Total hours available per man 500

i) Direct Labour Hours

Product 1

$$\text{Operation 1} \quad \frac{18 \times 10,000}{60} = 3,000$$

$$\text{Operation 3} \quad \frac{9 \times 10,000}{60} = 1,500$$

Product 2

$$\text{Operation 1} \quad \frac{42 \times 10,000}{60} = 7,000$$

$$\text{Operation 2} \quad \frac{12 \times 10,000}{60} = 2,000$$

$$\text{Operation 3} \quad \frac{6 \times 10,000}{60} = 1,000$$

Product 3

$$\text{Operation 1} \quad \frac{30 \times 10,000}{60} = 5,000$$

$$\text{Operation 2} \quad \frac{24 \times 10,000}{60} = 4,000$$

ii) Direct Labour Cost

Product 1

Operation 1 = 3,000 hours × ₹2 = ₹6,000

Operation 3 = 1,500 hours × ₹3 = ₹4,500

Product 2

Operation 1 = 7,000 hours × ₹2 = ₹14,000

Operation 2 = 2,000 hours × ₹2.50 = ₹5,000

Operation 3 = 1,000 hours × ₹3.00 = ₹3,000

Product 3

Operation 1 = 5,000 hours × ₹2.00 = ₹10,000

Operation 2 = 4,000 hours × ₹2.50 = ₹10,000

iii) Number of Workers/Men Required

Number of Men Required = $\frac{\text{Direct labour hours required}}{\text{Total available hours per man}}$

Operation 1 $\frac{15,000}{500} = 30$ men

Operation 2 $\frac{6,000}{500} = 12$ men

Operation 3 $\frac{2,500}{500} = 5$ men

6.9. OVERHEAD BUDGET

6.9.1. Meaning of Overhead Budget

Overhead budget is used for preparing production budget. It enumerates all the indirect expenses which are incurred in the production process. These expenses include production overheads, office and administration overheads and selling and distribution overheads. These overheads are illustrated separately in the budget.

6.9.2. Steps in Preparation of Overhead Budget

Following are the steps needed to be undertaken for the preparation of overhead budget:

- 1) The expenditure should be bifurcated into:
 - i) Fixed Costs, and
 - ii) Variable Costs.

The semi-variable costs should be appropriately divided into the above categories. "Fixed costs" remain constant irrespective of the production level while "variable costs" are expected to fluctuate with change in production level.

- 2) Various expenses should be apportioned and allocated among different departments on the basis of set policies. It helps in controlling various overheads.
- 3) Following types of overheads should prepare their own overheads budget as these expenses require different treatments:
 - i) Factory overhead budget,
 - ii) Administration overhead budget, and
 - iii) Selling and Distribution overhead budget.

Owing to their inherent natures, different overheads need to be treated differently. Production overheads vary with the quantum of production while selling and distribution overheads are more closely related to sales quantum.

- 4) For an effective control of overheads, it is important to segregate different overheads as these overheads cannot be subjected to the same measure of control. The overhead budgets should be prepared carefully for the purpose of controlling costs.

Example 23: The costs of manufacture in a factory in a particular year are as follows:

Particulars		₹
Direct Labour		40,000
Direct Material		1,00,000
Factory Overhead:		
Fixed	30,000	
Variable	50,000	80,000

The estimation of costs for the next year envisages the following changes:

- The average rate for direct labour will go up from ₹4 to ₹4.50 per hour;
- The production efficiency will decrease by 5%;
- Direct labour hours will increase by 10%; and
- The purchase price per unit of direct materials, and of the other materials and services included in the overhead will remain unchanged.

Draw up a budget and compute a factory overhead rate, the overheads being absorbed on a direct wages basis.

Solution:

Overhead Budget		
Particulars	Original Budget (₹)	Budget for Next Year (₹)
Direct Labour Cost	40,000	52,105
Direct Material Cost	1,00,000	1,10,000
Prime Cost	1,40,000	1,62,105
Factory Overhead:		
Fixed	30,000	30,000
Variable	50,000	55,000
Total Cost	2,20,000	2,47,105

Working Notes:

- Direct Labour Cost:** The production efficiency will go down by 5%. As such more labour to the extent of $\frac{100}{95}$ would be required to meet the production.

Secondly, direct labour hours will increase by 10% to have greater production. The present labour hours are $40,000 \div ₹4 = 10,000$ hrs.

$$\text{So } 10,000 \times \frac{100}{95} \times \frac{110}{100} = 11,579 \text{ hrs @ ₹4.50 per hour} = ₹52,105.$$

- Direct Material:** Due to increase in labour hours by 10%, it has been assumed that production will increase by $\frac{110}{100}$. So Material Cost will be $₹1,00,000 \times \frac{110}{100} = ₹1,10,000$.

- Variable Overheads:** On the analogy of 10% increase in production, the Variable Factory Overheads shall be $₹50,000 \times \frac{110}{100} = ₹55,000$.

6.10. MASTER BUDGET

6.10.1. Meaning and Definition of Master Budget

The master budget presents the summary of various "functional budgets". It is prepared by consolidating different budgets and helps to project profit and loss account as well as budgeted balance sheet.

According to Rowland and William H. Harr, the master budget is, "A summary of the budget scheduled in capsule form made for the purpose of presenting in one report the highlights of the budget forecast".

According to The Institute of Management Accountant, London, "The summary budget, incorporating as component functional budgets and which is finally approved, adopted and employed".

The master budget is designed by the budget officer. It needs to be approved by the Budget Committee. The budget can be used for coordinating and controlling different functional departments.

6.10.2. Advantages of Master Budget

Following are the main advantages of master budget:

- 1) A glance of all the functional budgets is made available in this budget.
- 2) A master budget acts as a reference point to all functional budgets.
- 3) It helps in checking the accuracy of functional budgets as it contains the summary of these budgets.
- 4) It also provides estimates about profits during the budgeted period.
- 5) Master budget provides information related to forecasted balance sheet.
- 6) It sets targets for revenue, expenses, profits and cashflows. This budget also acts as a control tool and helps in setting managerial targets.

6.10.3. Steps Involved in Preparation of Master Budget

Following are the various steps involved in preparing master budget:

- 1) Sales budget, as the initial step;
- 2) Production budget;
- 3) Cost of production budget;
- 4) Cash budget; and
- 5) Projected income statement and the balance sheet.

And finally the results of all these steps are presented in the form of 'Master Budget'.

6.10.4. Format of Master Budget

Format for a master budget is given in table below:

Master Budget (For the period ending)						
Particulars	January		February		For the Period	
	Budget	Previous Period	Budget	Previous Period	Budget	Previous Period
Previous Period						
Less: Purchase (as per materials budget)						
Direct Labour (as per direct labour budget)						
Gross Profit						
Less:						
Factory Overheads-Variable						
Repairs and Maintenance						
Factory Overheads-Fixed						
Research and Development Expenses						
Administrative Overheads						
Selling and Distribution Overheads						
Operating Profit						

Example 24: XYZ Manufacturing requires you to draw the budget for the next year using following information:

Sales:	
Product X	₹4,00,000
Product Y	₹5,50,000
Direct Material	70% of Sales
Direct Wages	25 workers @ ₹200 per month
Factory Overheads:	
Indirect labour	

Works Manager ₹400 per month	
Foreman ₹500 per month	
Stores and Spares	3% on sales
Depreciation on Machinery	₹15,000
Light and Power	₹6,000
Repairs and Maintenance	₹10,000
Other Sundries	20% on direct wages
Administration, Selling and Distribution Expenses	₹15,000 per year

Solution:

**XYZ Manufacturing
Master Budget
(For the year.....)**

Particulars	₹
Sales Budget:	
Product X	4,00,000
Product Y	5,50,000
Total Sales	9,50,000
Less: Administration, Selling and Distribution Expenses	15,000
Net Sales Revenue (1)	9,35,000
Production Budget:	
Direct Materials (70% of Sales) (70% of ₹9,50,000)	6,65,000
Direct Wages (25 workers × ₹200 × 12)	60,000
Prime Cost	7,25,000
Factory Overhead:	
Variable: Stores & Spares (3% sales)	28,500
Light and Power	6,000
Repairs and Maintenance	10,000
	44,500
	7,69,500
Fixed: Indirect Labour:	
Works Manager (₹400 × 12)	4,800
Foreman (₹500 × 12)	6,000
Depreciation	15,000
Sundries (20% × ₹60,000)	12,000
	37,800
Works Cost (2)	8,07,300
Expected Profits (1 – 2)	1,27,700

Example 25: Prepare Master Budget for ABC Limited using the following information:

Sales	
Product A	₹7,00,000
Product B	₹5,00,000
Product C	₹6,00,000
Direct Materials	30% of sales
Direct Wages	15 workers @ ₹4,000 per month
Factory Overheads	
Salary of works manager	₹10,000 per month
Supervisor's salary	₹5,000 per month
Stores and spares	2% of sales
Depreciation on Machinery	₹50,000
Light and Power	₹20,000
Repairs and maintenance	₹22,000
Administration, selling and distribution expenses	₹75,000 per year

Solution:

**ABC Limited
Master Budget
(For the year ending on)**

Particulars	₹
Sales (as per sales budget):	
Product A	7,00,000
Product B	5,00,000
Product C	6,00,000
Total Sales	18,00,000

Chapter 7

Standard Costing

7.1. INTRODUCTION TO STANDARD COSTING

7.1.1. Concept of Standard Costs

Standard Costs are pre-decided costs, which are incurred in an ideal condition of optimum operational efficiency and utilisation of resources; they are compared with the actual costs with regard to certain factors such as work, operation or activity.

According to Chartered Institute of Management Accountants (CIMA), London has defined Standard Cost as "A pre-determined cost which is calculated from management's standards of efficient operation and the relevant necessary expenditure."

According to Morton Backer and L.E. Jacobsen, Standard cost has defined as "the amount the firm thinks a product or the operation of a process for a period of time should cost, based upon certain assumed conditions of efficiency, economic conditions and other factors."

7.1.2. Meaning and Definition of Standard Costing

Standard Costing is a sophisticated technique, under which the standards are decided in advance and the actual costs are compared with such standard costs. Causes of variations, especially the unfavourable ones, are analysed and appropriate corrective measures are initiated so as to have the optimum efficiency in production.

According to Chartered Institute of Management Accountants, London has defined the Standard Costing as "The preparation and use of standard costs, their comparison with actual costs, and the analysis of variance to their causes, and points of incidence."

According to Institute of Cost and Works Accountants, London has defined Standard Costing as "An estimated cost, prepared in advance of production or supply correlating a technical specification of material, and labour to the price and wage rates estimated for a selected period of time, with an addition of the apportionment of overheads expenses estimated for the same period within a prescribed set of working conditions."

7.1.3. Objectives of Standard Costing

The broad objectives of standard costing are summarised in the following points:

- 1) **Promoting and Measuring Efficiency:** Standard Costing, besides enhancing the competence and performance, also acts as a tool to measure them. If the actual cost happens to be less than the standard cost, it indicates efficiency and competency; on the other hand, if the actual cost happens to be more than the standard cost, it is indicative of inefficiency and competency.
- 2) **Controlling and Reducing Costs:** While computing the Standard Cost, appropriate provisions are made with regard to normal wastage, normal breakdown, normal idle capacity, normal mistakes, etc. This exercise ensures proper monitoring as well as reduction in the cost.
- 3) **Simplifying Costing Procedure:** The exercise of Standard Costing is invariably specific to a product / process / job. For every product, or process, or job a separate exercise of standard costing is required to be undertaken. This is generally done by the professionals (cost and management accountants) after having a thorough discussion with the management and the technical specialists, which ensures smoothening of the entire process.
- 4) **Valuing Inventories:** Undertaking the valuation exercise in respect of stock and issue of material on the basis of standard costs results in substantial savings of time and energy in the maintenance of stores ledger. Computation of stocks on the basis of standard cost is done by multiplication of the quantity of stock in hand with the standard cost.

- 5) **Fixing Selling Price:** Selling price of a product may be fixed either on the basis of actual cost or on the basis of standard cost. It has been experienced that due to various reasons, there are lot of fluctuations in actual cost and as such the selling price cannot be fixed on the basis of actual cost, because price of a product needs to be generally stable and not volatile.

Thus, the preferred basis of fixing the price of a product is standard cost, to which a suitable margin is added.

7.1.4. Types of Standards

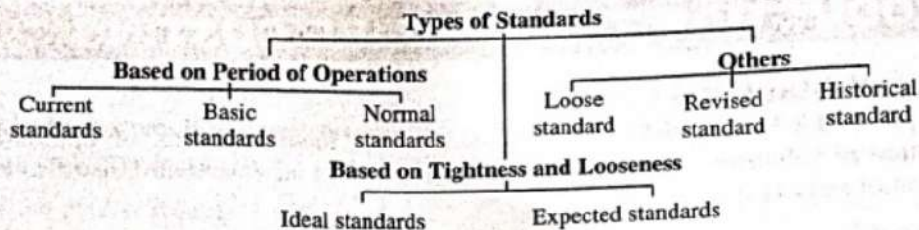


Figure 5.1

A brief description in respect of each type of standards is furnished in the following points:

1) Based on Period of Operations

- i) **Current Standards:** Current standards are those standards which are prescribed and fixed for the current period. They are the indicator of the expected level of performance under the existing conditions. It means that current standards predict modifications in standards from time to time so as to remain in coordination with the changed environment.
- ii) **Basic Standards:** Basic standards, by the name itself indicate, are the fundamental standards which do not undergo any change for a fairly long period of time. Because of this feature, they are also referred to as the bogey standards, fixed standards or static standards. Such standards are mostly used in the industries which are characterized by little or no changes in the product cost and product prices.
- iii) **Normal Standards:** Normal Standards are the most common average standards. They are considered to be the facilitators of the long-term planning and decision-making. Generally, one trade cycle is covered by such standards. It is presumed that the normal standards are achievable in the long run (normally a trade cycle) comprising of peak as well as non-peak periods.

2) Based on Tightness & Looseness

- i) **Strict or Tight or Ideal Standards:** Such type of standards also referred to as the **perfect or maximum efficiency standards**, are symbolic of absolute minimum costs. They are achievable under the operating conditions, which needs to be the best in all respects. Ideal standards demand a high level of performance and competence, which to some extent may not be considered practical. That is precisely the reason why they are also known as **theoretical standards**. A good trait may have a positive or negative impact on the workers, due to its association with human behaviour aspect. As a result, the workers may get motivated or demotivated.
- ii) **Expected or Attainable Standards:** Attainable standards are those which are considered realistic (as against the idealistic as in the case of ideal standards) and can be achieved with a fair level of efforts. As their foundation is on practical concerns, they are also referred to as **expected or practical standards**. As far as the control purpose is concerned, they are more handy and convenient in practice.

3) Others

- i) **Loose or Lax Standards:** These are the standards, which are intentionally fixed a mark less than the normal efficiency grade with a view to displaying the positive picture of the variations. It is a sort of window dressing, which is implemented under the presumption that a favourable variation may motivate the workers and ensure that their morale remains high.
- ii) **Revised Standards:** Revised standards are those standards which are subjected to frequent changes in order to keep moving with the flow of changing circumstances. The underlying premise of revised standards is that the conditions are dynamic in nature, and with a view to remain related with them, it is necessary to keep changing the standards.

- (ii) **Historical Standards:** Historical standards are average standards accomplished sometimes in the past. As far as the controlling is concerned, they are of little use; they may contain the efficiencies of the past. They are however useful at the outset of creation of a standard costing system, due to the convenience and flexibility associated with them.

7.1.5. Standard Costing as a Management Tool

Standard costing acts as an efficient tool in the hands of the management, which not only helps them in evaluating the current status of business performance, but also provides an opportunity to visualize the future that lies ahead. It is useful for the management of a company in the following manner:

- 1) It facilitates the management in formulating the policies with regard to the areas like 'inventory pricing', 'product pricing', 'profit planning', etc.
- 2) It acts as a perfect platform, as far as the comprehensiveness and stability are concerned, for comparing the actual costs and standard costs in terms of different elements of costs separately. It also shows the areas of shortcomings, where corrective measures are warranted and also ways and means to bring about further improvements.
- 3) Standard costing results in implanting a culture of cost-consciousness across the board from the top of the hierarchy to the lowest workman staff. It acts as a motivational force also for the efficient workers and executives of top, middle and lower levels.
- 4) It ensures that the future budgets are designed in a precise and result-oriented manner.
- 5) The management's job, regarding delegation of power and accountability to monitor and control the functioning of different departments, is made easy through the standard costing.
- 6) Standard costing facilitates the implementation of the principles of 'management by exception' successfully.
- 7) It is helpful in the management of the men, machines and materials in an effective manner. It also ensures that the organization gets its due share of a robust economy, efficiency, and better productivity.
- 8) As the determination of standard costing is based on scientific backing, it is considered to be of extreme utility for planning and control. In fact the combination of budgetary control system and standard costing system leads to a similar impact which is much more effective than the one obtained through the use of budgetary control system alone.

7.1.6. Historical Costing

Historical cost or actual cost is not a true representation of an economic cost. As historical cost is refers to cost associated with those events that has been already occurred. Actual cost is incurred on the actual expenditure of the organisation like acquisition of resources and bearing other official expenses. Actual cost may be derived from incompetency and loss of resources like loss of material, skilled labour and time. In order to face competition in the market, cost is required to be controlled to make it more rational and economical. To overcome the shortfalls of historical costing, standard costing has been evolved. Standard costing is a way to differentiate the actual cost with the standard cost. The Standards are set in advance to compare the actual performance.

7.1.7. Historical Costing and Standard Costing

Basis of Difference	Historical Cost	Standard Cost
1) Recording	In historical cost, the financial transactions are recorded after the actual performance.	Standard cost is arrived at and established before the actual performance results are available.
2) High Degree of Efficiency	Historical cost is an actual and real cost, which is based upon the past data.	Standard cost is considered to be an ideal cost to be achievable under normal conditions. It is a pre-set cost related to future.
3) Evaluation of Efficiency	Historical cost cannot be used as such a technique.	Standard cost can be used as a technique to make an assessment of the efficiency, as it helps the management in comparing the budgeted cost with the actual cost.
4) Cost Control	The historical cost cannot be used for cost control as the possible reasons for cost escalation cannot be ascertained through its use.	Standard cost acts as an important tool for monitoring, controlling and containing the cost factor.
5) Planning and Control	Historical cost is used in disclosing the financial position of an organization; it has little practical value, inasmuch as it fails to support the management in planning for variations and control.	Standard cost is considered to be used as a result-oriented management tool for cost control and planning.

7.1.10.2. Direct Labour Cost

The determination of direct labour cost standard is product-specific, for which the following are needed:

- 1) Finding out different labour class and their required labour hours in respect of each product. Time and motion study carried out should be the basis for the determination of the performance standards.
- 2) The rate of labour hours should be decided on the basis of assessment of wages, remuneration, pay-scale, etc. for each group of labours, i.e. unskilled, semi-skilled, skilled, etc.

7.1.10.3. Overhead Cost

The setting up of overhead cost standard entails the following:

- 1) **Variable Overhead Standard:** Changes in variable overheads is linked with the production level. In other words, with the change in the volume of production, the variable overheads also change. Variable overhead standard is determined on the basis of appropriate study and analysis with a scientific approach.
- 2) **Fixed Overhead Standard (FOS):** It is determined with a view to reduce the total cost. For ascertaining the FOS in respect of each unit of product, following inputs are required:
 - i) Assessment of fixed overhead budget for a time-period.
 - ii) Standard hours (budgeted output in units) during that period.
 - iii) Estimated number of hours to be worked during that period.

7.1.11. Essential Conditions of an Effective System of Standard Costing

To have a successful standard costing system in place, following stipulations are necessary to be fulfilled:

- 1) **Setting up of Standards for Each Element of Cost:** At the beginning, for every component of cost, e.g. direct material, direct labour, overheads, etc., standards need to be laid down.
- 2) **Preparation of Manual:** A manual containing details of the system of standard costing need to be prepared for the information and guidance of the staff members. Such manual should clearly spell out the authorities and responsibilities of the functionaries at various levels in respect of different activities. In this connection, segregating the supply of cost data is of paramount importance. The entire procedure to be followed under the system, different activities to be undertaken, benefits accrued from them, etc. should be adequately covered under the manual.
- 3) **Training of Staff:** There should be an inbuilt mechanism to get the personnel, appropriately trained who are expected to handle the system. At the time of actual introduction of the system, various changes may have to be effected in:
 - i) The design of making accounting entries, and
 - ii) The flow of documents.
- 4) **Setting Physical Standards:** A decision with regard to the standards of physical activity carried out in different departments need to be taken. As far as direct materials are concerned, standard quantity should be finalised with reference to quality and size of material required for every unit of production. This should be done by the technical section, drawing office or the laboratory and before doing so, a product study or engineering study, examining the details of material and plant conditions, may be undertaken.
- 5) **Study of Labour and Machine Operations:** Details in respect of every item to be manufactured should be studied with a view to find out various operations to be undertaken either by labour or machines. The class of labour to be employed and the types of machine to be used, etc. also need to be included in such study.
- 6) **Study of Market Conditions:** For the determination of cost standards, a detailed study of existing market conditions and the trend of prices during the past as well as forecasting in respect of future for a definite period should be undertaken. Such a study facilitates in the determination of material price standards. For the determination of the labour cost standards, data in respect of the wage rates to be paid needs to be analysed.

7.1.12. Advantages of Standard Costing

Following advantages accrue from the standard costing:

- 1) **Measuring Efficiency:** Standard costing may be used as a measuring tool for the management to measure efficiency. The difference between the actual costs and standard costs reflects the level of performance of different cost centres.

- 2) **Formulation of Production and Price Policy:** Creation of production policies is facilitated by the standard costing. On the basis of prevailing conditions, the standards are fixed. Standard costs are helpful in deciding production plans and in determining prices of different products.
- 3) **Determination of Variance:** Variances are determined by comparing actual cost and standard cost. Such variations brings core areas of incompetence, which in turn enables the management to fix staff accountability for inefficiencies and initiate remedial steps promptly and ensure better performance in future.
- 4) **Reduction of Work:** Under the historical costing, a number of records are required to be regulated for the determination of costs, whereas under the standard costing minimal records are required to be maintained, resulting in the reduction of clerical job to a great extent. Management is provided with only relevant data and unnecessary information is skipped.
- 5) **Management by Exception:** A system, which envisages that every individual should be given a target to be achieved within a defined timeframe, is referred to as management by exception. Day-to-day supervision of various activities and individual performance is not required under this system.
- 6) **Facilitates Cost Control:** The twin objective of any costing system is cost control and cost reduction. Both the objectives are achieved in the system of standard costing. The standards are scrutinised and analysed on an ongoing basis with a view to have further improvement in efficiency. Causes of variance, whenever takes place, are thoroughly studied and analysed, which is followed by initiation of prompt remedial steps.
- 7) **Eliminating Inefficiencies:** There is a different manner in which the standards are set for manufacturing, administrative, and selling expenses. Improvised techniques are applied for setting the above standards. For example, the standard for manufacturing expenses are set on the basis of item and motion study for labour, and effective material control devices for materials, etc. Similarly, in the case of other expenses also appropriate studies would be required.
- 8) **Helpful in Taking Important Decisions:** Through the system of standard costing vital feedback is received by the management, which facilitates decision-making process. Specific problems posed by inflationary forces, rising prices, etc. can be sorted out with the aid of standard costing. It can be effectively used as a tool for providing incentive plans for employees.

7.1.13. Disadvantages/Limitations of Standard Costing

The system of standard costing exhibits the following disadvantages:

- 1) **Fixation of Standards:** Fixation of realistic standards during the introduction of standard costing system is an extremely significant and challenging job. A wrong assessment of standards may lead to a faulty system. Fixation of standards on a realistic basis requires a technical expertise, which is difficult to implement.
- 2) **Frequent Technology Alterations:** Some of the industries are known for frequent technological alterations. Introduction of standard costing system in such industries may prove to be a costly affair, as the standards would need a frequent revision. Standard costing system, therefore, may not be suitable for such industries.
- 3) **Expensive Technique:** Expenses involved in setting up and continuing the system of standard costing are quite heavy. It is difficult for small-sized business organisations to afford such a costly system.
- 4) **Fixation of Responsibility:** In case of any lapse, the job of fixing staff accountability, *per se*, is a difficult one. In case of standard costing system, such accountability can be fixed only for the controllable variances and not for the uncontrollable variances. But to establish whether a variance is controllable or uncontrollable is also a tough exercise, due to the fact that the variances controllable at one point of time may become uncontrollable at another point of time.
- 5) **Analysis of Historical Events:** Variance analysis involves analysis of historical events, which cannot be changed. As such it is of limited use for the management.

7.1.14. Difference between Standard Costing and Marginal Costing

Basis of Difference	Standard Costing	Marginal Costing
1) Meaning	Standard costing is a control mechanism, which envisages comparison of actual costs with pre-determined standard costs and revenues. The resultant variances are taken as a base for enhancing the performance.	Marginal costing is a technique, which envisages bifurcation of costs into two categories, viz. fixed and variable, which differ from each other in nature.

2) Objective	The objective of standard costing is to have a check over the costs, for which the actual costs are compared with the pre-determined standard costs. The relationship between the cost of inputs and the value of outputs is made clear through the system.	The basic objective of marginal costing is cautious application of available resources with a view to improve profitability. Thus, marginal costing aims at planning the profit and not controlling costs.
3) Assumption	Standard costing and variance analysis are based on the underlying presumption of linearity regarding the behaviour of cost in relation to the level of activity. In other words, most of the components of product cost and profit calculation directly respond in a linear manner to change in the level of the activity.	The technique of marginal costing is based on the presumption that all the costs can be segregated into two categories, viz.: i) Fixed cost, and ii) Variable cost.
4) Limitation	Although there is an improvement in the profit planning after the development of standard costs in a scientific manner, prevalence of such standards is not necessarily required for applying marginal costing.	Approximation can be used by marginal costing and still a direction can be given to a company's profit planning decision.
5) Starting and Ending	Once the engineering costs are established in a scientific manner, standard costing ends. Engineering costs have a particular relationship with outputs in a regulated condition.	The identification of variable costs and fixed cost marks the starting of the marginal costing.

7.1.15. Difference between Standard Costing and Budgetary Control

Basis of Difference	Standard Costing	Budgetary Control
1) Concept	Setting of standards is specific to a product or service.	Preparation of budgets is carried out for a business organisation as a whole.
2) Basis	The basis for setting standard costs is technical inputs.	The basis for preparation of budgets are: i) Historical data, and ii) Future projections.
3) Scope	Standards are fixed for expenditures only. In case of manufacturing departments, standards are fixed for various elements of cost i.e., material, labour and overheads.	The scope of budgetary control is broad-based and includes incomes, expenditures and other activities, etc.
4) Emphasis	Under the system of standard costing, the standards are fixed and the focus is to ensure that the variance between the standard cost and the actual cost remain minimal.	Under the budgetary control, expenditure limits are prescribed, beyond which the expenditure is not allowed. The focus is to ensure that the expenditure remains within the targeted limits.
5) Objective	Standard costs are fixed on the basis of norms prescribed by the management.	Budgets are prepared keeping in view the existing level of competency.
6) Relationship	Standard costing has some relationship with cost accounts.	Budgetary Control has some relationship with the financial accounts.
7) Variance Analysis	Computation of standard costing variances is carried out for various components of cost, viz. material, labour and overheads. Such variances are analysed on the basis of their causes.	Under the budgetary control, the variances are dealt with in a holistic manner. They may be computed either for various individual departments or for the business organisation in its entirety.

7.2. EXERCISE

- 1) What do you mean by standard cost and standard costing?
- 2) What is difference between standard cost and estimate cost?
- 3) Explain the difference between standard cost and historical cost.
- 4) Write a short note on:
 - i) Utility of standard costing as management tool
 - ii) Direct material cost
 - iii) Direct labour cost
 - iv) Overhead cost
- 5) What are essential conditions of an effective system of standard costing?
- 6) Discuss the advantages and disadvantages of standard costing.
- 7) What is the difference between standard costing and marginal costing?
- 8) Discuss the difference between standard costing and budgetary control.

Chapter 8

Variance Analysis

8.1. VARIANCE ANALYSIS

8.1.1. Meaning and Definition of Variance & Variance Analysis

Variance is the difference between the actual amount of costs or revenue and the expected amount. Variance Analysis compares actual amounts with the standard amounts and calculates efficiency. The analysis also explains the reason behind the difference. Variance analysis helps management in finding the causes for variation. It aids the process of decision making.

According to Terminology of CIMA, Variance is "The difference between planned, budgeted or standard cost and actual costs (similarly in respect of revenue)".

Sometimes the situation of **Zero Variance** also occurs when the actual results are just equal to planned results.

According to C.I.M.A. London, Terminology, variance analysis is "The process of computing the amount of variance and isolating the causes of variance between actual and standard".

In nutshell, variance analysis is used to measure the efficiency of the business by comparing actual and standard costs as well as revenue.

8.1.2. Uses/Applications of Variance Analysis

Variance analysis has several uses which are as follows:

- 1) It is an important tool for cost control and cost reduction.
- 2) This analysis helps in exercising Management by exception.
- 3) Variance analysis is useful for planning purpose.
- 4) This analysis creates awareness about costs and revenue in the organisation.
- 5) Variance analysis helps the management in profit maximisation by bifurcating variance into controllable and uncontrollable costs.
- 6) Variance analysis helps management in taking timely action by detecting inefficiency at the earliest.

8.1.3. Forms of Variances

Variances are of two types:

- 1) **Positive/Favourable Variance:** When actual cost is less than standard cost, the variance is known as favourable. It may occur in the following situations:
 - i) Revenue is higher than the standard amount, and
 - ii) Costs are less than the budgeted amount.

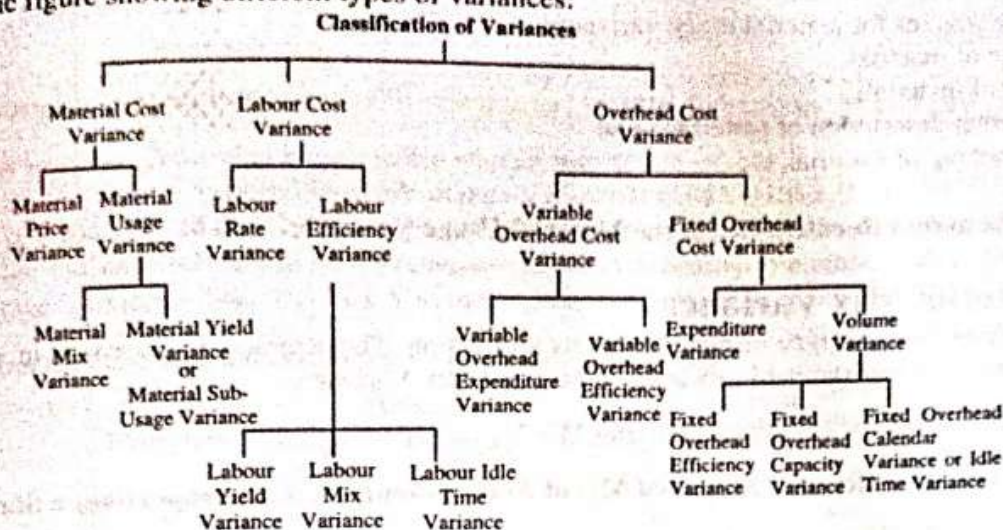
In accounting parlance, letter F (Fav), P or Positive (+pos) are used for denoting favourable variance. Managers stand to benefit from such variance.

- 2) **Adverse/Negative/Unfavourable Variance:** When actual costs are higher than standard costs, unfavourable variance is said to occur. Following are the various situations showing unfavourable variance:
 - i) The revenues were below expectations, and
 - ii) The costs were higher than standard, the variance would be termed unfavourable or adverse.

This kind of variance is reported using letter A (Adv.) with a negative sign (-) or U (unfavourable). This analysis helps the management in taking remedial actions. Managers get badly affected from adverse variance.

8.1.4. Classification of Variances

Variance analysis forms a major basis of Standard Costing. It explains the difference between actual and standard performance. Remedial actions are taken by appropriate authority when variances are unfavourable. Purchase managers are held responsible for adverse Material Price Variance while negative Material Usage Variance is the responsibility of the production manager. Following is the figure showing different types of variances:



8.2. DIRECT MATERIAL VARIANCE

8.2.1. Material Cost Variance (MCV)

Direct materials cost variance is the difference between the standard cost of specific direct material and the actual cost of direct material used in the production process.

According to Terminology of CIMA defines Material Cost Variance as "The difference between the standard direct material cost of the actual production volume and the actual cost of direct material".

It is the total variance caused by the variations in prices of materials, usage or mix, yield and other causes. Material cost variances are sub-divided into:

- 1) Material price variance, and
- 2) Material usage variance.

Material cost variance is calculated by using following formula:

Materials Cost Variance = Standard Material Cost – Actual Material Cost

Standard Material Cost = Standard price per unit × Standard quantity of materials

Actual Material Cost = Actual price per unit × Actual quantity of materials

The variance is considered favourable, if the standard cost is more than the actual cost. If the actual cost is more than the standard cost, the variance will be considered unfavourable or adverse.

8.2.2. Material Rate/Price Variance (MPV)

Material price variance is the difference between the standard price of material and the actual price of material used for production. Material price variance is stated as:

Materials Price Variance = Actual Quantity (Standard Price – Actual Price)

Following may be the various reasons behind material price variance:

- 1) Due to frequent variation in the market price of material,
- 2) Irregular and inefficient purchasing,
- 3) Change in the requirement of material quantity,
- 4) Change in the specification of materials, and
- 5) Change in the legal policy as a result of change in the amount of taxes and duties, etc.

8.2.3. Material Quantity/Usage Variance (MUV)

It is also known as material quantity variance. It explains the difference between the standard quantity of material purchased for actual production and the actual quantity of material used.

Following is the formula used for calculating Material Usage Variance:

$$\text{Materials Usage Variance} = \text{Standard Price (Standard Quantity - Actual Quantity)}$$

Following are the reasons for material usage variances:

- 1) Surplus waste of material,
- 2) Mishandling of materials,
- 3) Providing wrong description of materials, and
- 4) Improper checking of material, etc.

Following are the main sub-categories of the Material Usage Variance.

8.2.4. Material Mix Variance

A product uses more than one type of material for its production. These materials are mixed in a specific ratio. Difference in actual mix and standard mix leads to Material Mix Variance.

Following formula is used for calculating Material Mix Variance:

$$\text{Material Mix Variance} = (\text{Revised Standard Mix of Actual Input} - \text{Actual proportion}) \times \text{Standard Price}$$

The variance is calculated under two situations:

i) When Actual Weight and Standard Weight of Mix are Equal

Mix variance is calculated by using following formula:

$$= \text{Standard cost of standard mix} - \text{Standard cost of actual mix.}$$

$$= (\text{Standard Price} \times \text{Standard Quantity}) - (\text{Standard Price} \times \text{Actual Quantity})$$

$$\text{or, Standard unit cost (Standard Quantity - Actual Quantity)}$$

If standard quantity is revised due to shortage of one material, the formula will be:

$$= \text{Standard unit cost (Revised Standard Quantity - Actual Quantity).}$$

ii) When Actual Weight and Standard Weight of Mix are Different

When quantities of actual material mix and standard material mix are different, the formula will be:

$$\left\{ \frac{\text{Total Weight of Actual mix}}{\text{Total Weight of Standard mix}} \times \text{Standard cost of Standard mix} \right\} - \left\{ \text{Standard cost of actual mix} \right\}$$

In case the standard is revised due to the shortage of one material then revised standard will be used instead of standard, formula will become:

$$\left\{ \frac{\text{Total Weight of Actual mix}}{\text{Total Weight of Revised Standard mix}} \times \text{Standard cost of Revised Standard mix} \right\} - \left\{ \text{Standard cost of actual mix} \right\}$$

8.2.5. Materials Yield Variance

This is a type of material usage variance. It is caused by the difference between actual yield and standard yield.

Materials yield variance is defined as "that portions of the direct materials usage variance which is due to the standard yield specified and the actual yield obtained".

$$\text{Material Yield Variance} = \text{Standard Rate (Actual Yield - Standard Yield)}$$

Standard Rate is calculated as follows:

$$\text{Standard Rate} = \frac{\text{Standard Cost of Standard mix}}{\text{Net standard output i.e., Gross output - Standard loss}}$$

In certain situations, actual mix may be different from standard mix. Following formula is used when the standard is revised:

$$\text{Standard Rate} = \frac{\text{Standard Cost of Revised Standard mix}}{\text{Net standard output}}$$

Material yield variance is considered favourable when actual yield is higher than the standard yield.

For verification purpose, following relationship should match

- 1) Material Price Variance + Material Usage Variance = Material Cost Variance.
- 2) Material Mix Variance + Material Sub-usage or Yield Variance = Material Usage Variance.
- 3) Material Price Variance + Material Mix Variance + Material Sub-usage Variance = Material Cost Variance.
- 4) Material Usage Variance - Material Mix Variance = Material Sub-usage (or, Yield) Variance.

Example 1: From the following data calculate various material variances:

Materials	Standard		Actual	
	Quantity (Units)	Price per Unit	Quantity (Units)	Price per Unit
X	50	7	60	8
Y	100	4	120	3
	150		180	

Solution:

- 1) **Material Cost Variance** = (Standard Quantity × Standard Price) – (Actual Quantity × Actual Price)

Material X	= (50 × 7) – (60 × 8) = 350 – 480	= ₹130 (A)
Material Y	= (100 × 4) – (120 × 3) = 400 – 360	= ₹40 (F)
Material Cost Variance		= ₹90 (A)

- 2) **Material Price Variance** = Actual Quantity (Standard Price – Actual Price)

Material X	= 60 (7 – 8) = 60 (–1)	= ₹60 (A)
Material Y	= 120 (4 – 3) = 120 (1)	= ₹120 (F)
Material Price Variance		= ₹60 (F)

- 3) **Material Usage Variance** = Standard Price (Standard Quantity – Actual Quantity)

Material X	= 7 (50 – 60) = 7 (–10)	= ₹70 (A)
Material Y	= 4 (100 – 120) = 4 (–20)	= ₹80 (A)
Material Usage Variance		= ₹150 (A)

Example 2: Use following information to calculate (1) Material cost variance, (2) Material usage variance (3) Material price variance, separately for material A and B.

Materials	Standard Quantity (Kg.)	Standard Price (₹)	Actual Quantity (Kg.)	Actual Price (₹)
A	12	4	11	3.50
B	14	6	17	7.50
	26		28	

Solution:

- 1) **Material Cost Variance** = (Standard Quantity × Standard Price) – (Actual Quantity × Actual Price)

Material A	= (12 × 4) – (11 × 3.50) = ₹48 – 38.5	= ₹9.5 (F)
Material B	= (14 × 6) – (17 × 7.50) = ₹84 – 127.5	= ₹43.5 (A)
Material Cost Variance		= ₹34 (A)

2) **Material Usage Variance** = Standard Price (Standard Quantity – Actual Quantity)

Material A	= 4 (12 – 11)	= ₹4 (F)
Material B	= 6 (14 – 17)	= ₹18 (A)
Material Usage Variance		= ₹14 (A)

3) **Material Price Variance** = Actual Quantity (Standard Price – Actual Price)

Material A	= 11 (4 – 3.50)	= ₹5.5 (F)
Material B	= 17 (6 – 7.50)	= ₹25.5 (A)
Material Price Variance		= ₹20(A)

Example 3: Use following data to calculate Material Mix Variance:

Materials	Standard		Actual	
	Quantity (units)	Price per unit	Quantity (units)	Price per unit
A	40	1	50	1.50
B	110	2	90	3.00

For revised mix, the use of material A was increased by 5% and that of material B decreased by 10%

Solution:

Material Mix Variance = (Revised Standard Proportion of Actual Input – Actual Proportion) × Standard Price

Material A	= 1 (42 – 50) = 1 (-8)	= ₹8 (A)
Material B	= 2 (99 – 90) = 2 (9)	= ₹18 (F)
Material Mix Variance		= ₹10 (F)

Working Note:

In this question the standards will be revised. Revised standards will be:

Material A = 40 + (40 × 5/100) = 42 units

Material B = 110 – (110 × 10/100) = 99 units

Example 4: Use the following data to calculate the material price variance, the material usage variance and material mix variance.

Material	Standard	Actual
X	50 units @ ₹40 per unit	60 units @ ₹40 per unit
Y	40 units @ ₹60 per unit	40 units @ ₹65 per unit

Solution:

1) **Material Price Variance** = Actual Quantity (Standard Price – Actual Price)

Material X	= 60 (40 – 40)	= ₹Nil
Material Y	= 40 (60 – 65)	= ₹200 (A)
Material Price Variance		= ₹200 (A)

2) **When quantities of actual material mix and standard material mix are different:**

Material Mix Variance = (Revised Standard Proportion of Actual Input – Actual Proportion) × Standard Price

(**See working notes for revised standard proportion of actual input)		
Material A	= (56 – 60) 40	= ₹160 (A)
Material B	= (44 – 40) 60	= ₹240 (F)
Material Mix Variance		= ₹80 (F)

3) **Material Usage Variance** = Standard Price (Standard Quantity – Actual Quantity)

Material X	= 40 (50 – 60)	= ₹400 (A)
Material Y	= 60 (40 – 40)	= ₹Nil
Material Usage Variance		= ₹400(A)

Working Note:

Revised standard proportion of actual input = $\frac{\text{Standard Mix}}{\text{Total Standard Input}} \times \text{Total Actual Input}$

$$\text{Material A} = \frac{50}{90} \times 100 = 56 \text{ units, Material B} = \frac{40}{90} \times 100 = 44 \text{ units}$$

Example 5: Following is the data for standard mix of a product:

Material A	40 units at ₹20 per unit	₹800
Material B	60 units at ₹25 per unit	₹1,500
Material C	80 units at ₹30 per unit	₹2,400
	180	₹4,700

The above mentioned mix can produce 10 units of finished product. During the month of December, ten mixes were completed with the following consumption data:

Material A	500 units at ₹25 per unit	₹12,500
Material B	750 units at ₹20 per unit	₹15,000
Material C	600 units at ₹25 per unit	₹15,000
	1850	₹42,500

The actual output was 80 units.

Use the above given information to calculate various material variances.

Solution:

1) **Material Cost Variance = Standard Cost – Actual Cost**

Standard Cost for 100 Units = $4,700 \times 10 = ₹47,000$

Actual yield is 80 units, so standard cost will be adjusted accordingly.

Standard Cost for Actual Yield = $\frac{47,000}{100} \times 80 = ₹37,600$

Material Cost Variance = $37,600 - 42,500 = ₹4,900 \text{ (A)}$

2) **Material Price Variance = Actual Quantity (Standard Price – Actual Price)**

Material A	= 500 (20 – 25)	= $500 \times (-5)$	= ₹2,500 (A)
Material B	= 750 (25 – 20)	= 750×5	= ₹3,750 (F)
Material C	= 600 (30 – 25)	= 600×5	= ₹3,000 (F)
Material Price Variance			= ₹4,250 (F)

3) **Material Mix Variance**

Since standard quantity ($180 \times 10 = 1,800$) and actual quantity (1,850) are different, so the standard will be revised first. Revised standard quantity will be:

$$A = \frac{40}{180} \times 1,850 = 411; \quad B = \frac{60}{180} \times 1,850 = 617 \text{ (approx.)}; \quad C = \frac{80}{180} \times 1,850 = 822 \text{ (approx.)}$$

Material Mix Variance = (Revised Standard Proportion of Actual Input – Actual Proportion) × Standard Price

Material A	= (411 – 500) × ₹20	= ₹1,780 (A)
Material B	= (617 – 750) × ₹25	= ₹3,325 (A)
Material C	= (822 – 600) × ₹30	= ₹6,660 (F)
Material Mix Variance		= ₹1,555 (F)

4) **Material Yield Variance = Standard Rate (Actual Yield – Standard Yield)**

$$\text{Standard Rate} = \frac{\text{Standard Cost of Standard Mix}}{\text{Standard Output}} = \frac{4,700}{10} = ₹470$$

$$\text{Standard Yield} = \frac{10}{180} \times 1,850 = 102.777 \text{ units}$$

$$\text{Material Yield Variance} = 470 (80 - 102.777) = ₹10,705 \text{ (A)}$$

5) Material Usage Variance

The standard quantity will be revised in proportion to actual output. Revised quantity will be:

$$\text{Material A} = \frac{400}{100} \times 80 = ₹320, \quad \text{Material B} = \frac{600}{100} \times 80 = ₹480, \quad \text{Material C} = \frac{800}{100} \times 80 = ₹640$$

Materials Usage Variance = Standard Price (Standard Quantity – Actual Quantity)

Material A	= ₹20 (320-500)	= ₹3,600 (A)
Material B	= ₹25 (480-750)	= ₹6,750 (A)
Material C	= ₹30 (640-600)	= ₹1,200 (F)
Material Usage Variance		= ₹9,150 (A)

Verification:

i) **Material Cost Variance = Material Price Variance + Material Usage Variance**
 $4,900 (A) = 4,250 (F) + 9,150 (A)$

ii) **Material Usage Variance = Material Mix Variance + Material Yield Variance**
 $9,150 (A) = 1,555 (F) + 10,705 (A)$

Example 6: The standard cost of a certain chemical mixture is as follows:

40% of material A @ ₹20/-p. tonne

60% of material B @ ₹30/-p. tonne

A standard loss of 10% is expected in production. The following actual cost data is given for the period:

Material A – 180 tonnes at a cost of ₹18/- p. tonne.

Material B – 220 tonnes at a cost of ₹34/- p. tonne.

Total production for the period was 364 tonnes.

Calculate:

- 1) Material Cost Variance.
- 2) Material Rate Variance.
- 3) Material Mix Variance.
- 4) Material Yield Variance.

Solution:

Material	Standard for 364 Tonnes Output			Actual 364 Tonnes Output		
	Quantity (Tonnes)	Rate (₹)	Total (₹)	Quantity (Tonnes)	Rate (₹)	Total (₹)
A	162	20	3,240	180	18	3,240
B	242	30	7,260	220	34	7,480
Total	404	-	10,500	400	-	10,720
Less: Loss	40	-	-	36	-	-
	364	-	10,500	364	-	10,720

Working Note:

1) Calculation of Standard Quantity of Input of Actual Production

Particulars	₹
Standard Input of A and B (40 + 60)	100
Less: Expected Loss @ 10% (100×10/100)	10
∴ Expected Output	90

∴ Actual production is 364 tonnes and normal loss is 10. So, if 90 tonnes are produced then 100 tonnes is the standard quantity of material for 90 tonnes.

Thus, Total Standard Quantity = $\frac{364 \times 100}{90} = 404.44$ or 404 tonnes

- 2) Standard Quantity of Material A = $404 \times 40\% = 161.6$ or 162 tonnes
 Standard Quantity of Material B = $404 \times 60\% = 242.4$ or 242 tonnes
- 3) Standard Loss on Actual Input = $(180 + 220) \times 10/100 = 40$
- 4) Actual Loss on Standard Quantity = $364 \times 10/100 = 36.4$ or 36

Variance Analysis (Chapter 8)

Calculation of Variances:

1) **Material Cost Variance** = Standard Cost - Actual Cost
 Where, Standard Cost for Actual Output = $10,500 \times \frac{364}{364} = ₹10,500$

∴ Material Cost Variance = $10,500 - 10,720 = ₹220$ (A)

2) **Material Rate/Price Variance** = Actual Quantity (Standard Price - Actual Price)

Material A	=	180 (20 - 18)	=	₹360 (F)
Material B	=	222 (30 - 34)	=	₹880 (A)
Material Rate Variance			=	₹520 (A)

3) **Material Mix Variance** = (Revised Standard Mix of Actual Input - Actual Proportion) × Standard Price

Material A	=	(162 - 180) × 20	=	₹360 (A)
Material B	=	(242 - 220) × 30	=	₹660 (F)
Material Mix Variance			=	₹300 (F)

4) **Material Yield Variance** = Standard Rate × (Actual Yield - Standard Yield)

Where, Standard Rate per tonne of Output = $\frac{10,500}{364}$

∴ Material Yield Variance = $\frac{10,500}{364} (364 - 364) = ₹28.84$ or ₹29 (F)

Example 7: The Standard mix of product AZE is as follows:

Kgs	Material	Price per Kg (₹)
45	X	6.00
25	Y	4.50
30	Z	9.50

The standard loss in production is 10% of input. There is no scrap value. Actual production for a month was 7,425 Kgs of AZE from 80 mixes. Actual consumption and purchases of material during the month were:

Kgs	Material	Price per Kg (₹)
4,200	X	6.50
1,700	Y	4.25
2,600	Z	9.75

You are required to calculate the following variances for presentation to the management:

- 1) Material Cost variance
- 2) Material Price variance
- 3) Material Mix variance
- 4) Material Yield variance

Solution:

Standard Cost				Actual Cost			
Material	Kg	Price	₹	Material	Kg	Price	₹
X	80 × 45 = 3,600	6.00	21,600	X	4,200	6.50	27,300
Y	80 × 25 = 2,000	4.50	9,000	Y	1,700	4.25	7,225
Z	80 × 30 = 2,400	9.50	22,800	Z	2,600	9.75	25,350
Input	8,000		53,400	Input	8,500		59,875
Less: Standard Loss @ 10%	800		—	Less: Loss	1,075		—
Output	7,200		53,400	Output	7,425		59,875

Standard Cost per Unit = $\frac{53,400}{7,200} = 7.4167$ per kg

1) **Material Cost Variance (MCV)** = Standard Material Cost for Actual Production - Actual Material Cost

Where, Standard Cost of Actual Production = $7,425 \times 7.4167 = ₹55,069$

Material Cost Variance (MCV) = $55,069 - 59,875 = ₹4,806$ (A)

2) **Material Price Variance (MPV) = Actual Quantity (Standard Price – Actual Price)**

X	= 4,200 (6.00 – 6.50)	= 2,100 (A)
Y	= 1,700 (4.50 – 4.25)	= 425 (F)
Z	= 2,600 (9.50 – 9.75)	= 650 (A)
Material Price Variance		= ₹2,325 (A)

3) **Material Mix Variance (MMV) = (Revised Standard Mix of Actual Input – Actual Proportion) × Standard Price**

Where,

$$\text{Revised Standard Quantity of X} = \frac{45}{100} \times 8,500 = 3,825$$

$$\text{Revised Standard Quantity of Y} = \frac{25}{100} \times 8,500 = 2,125$$

$$\text{Revised Standard Quantity of Z} = \frac{30}{100} \times 8,500 = 2,550$$

X	= 6.00 (3,825 – 4,200)	= 2,250 (A)
Y	= 4.50 (2,125 – 1,700)	= 1,912.50 (F)
Z	= 9.50 (2,550 – 2,600)	= 475 (A)
Material Mix Variance		= 4,637.50 (A)

4) **Material Yield Variance (MYV) = Standard Material Cost Per unit of Output (Standard Output based on Actual Input – Actual output)**

Where,

$$\text{Standard Output Based on Actual Input} = \frac{\text{Standard Output}}{\text{Standard Material Input}} \times \text{Actual Material Input}$$

$$= \frac{7,200}{8,000} \times 8,500 = 7,650$$

$$\text{Standard Material Cost per unit of Output} = \frac{53,400}{7,200} = 7.41$$

$$\text{Material Yield Variance} = 7.41 (7,650 – 7,425) = 7.41 \times 225 = 1,667.25 (F)$$

Example 8: Compute (1) Material mix, (2) Material Price and (3) Material usage variance using following given information:

Materials	Standard			Actual		
	Quantity (Kilos)	Unit Price (₹)	Total (₹)	Quantity (Kilos)	Unit Price (₹)	Total (₹)
A	5	1	5	3	2	6
B	10	2	20	6	3	18
C	10	3	30	11	2	22
Total	25	6	55	20	7	46

Solution:

1) **Material Cost Variance = (Standard Quantity for Actual Output × Standard Price) – (Actual Quantity × Actual Price)**

Material A	= (5 × 1) – (3 × 2)	= ₹1 (A)
Material B	= (10 × 2) – (6 × 3)	= ₹2 (F)
Material C	= (10 × 3) – (11 × 2)	= ₹8 (F)
Material Cost Variance		= ₹9 (F)

2) **Material Price Variance = Actual Quantity (Standard Price – Actual Price)**

Material A	= 3(1 – 2)	= ₹3 (A)
Material B	= 6(2 – 3)	= ₹6 (A)
Material C	= 11(3 – 2)	= ₹11 (F)
Material Price Variance		= ₹2 (F)

3) **Material Mix Variance = (Revised Standard Proportion of Actual Input – Actual Proportion) × Standard Price**

Revised standard proportion in terms of actual input needs to be calculated for computing material mix variance. **Revised Standard Proportion** will be calculated on the basis of the following formula:

$$\frac{\text{Standard Proportion} \times \text{Actual Input}}{\text{Total Standard Quantity}}$$

$$\text{Material A} = \frac{5}{25} \times 20 = 4 \text{ kg, Material B} = \frac{10}{25} \times 20 = 8 \text{ kg, Material C} = \frac{10}{25} \times 20 = 8 \text{ kg}$$

The following formula is used to calculate mix variance:

Material A	= (4 – 3) × 1	= ₹1 (F)
Material B	= (8 – 6) × 2	= ₹4 (F)
Material C	= (8 – 11) × 3	= ₹9 (A)
Material Mix Variance		= ₹4 (A)

4) **Material Sub-usage Variance = (Standard Quantity – Revised Standard Proportion) × Standard Price**

Material A	= (5 – 4) × 1	= ₹1 (F)
Material B	= (10 – 8) × 2	= ₹4 (F)
Material C	= (10 – 8) × 3	= ₹6 (F)
Material Sub-usage Variance		= ₹11 (F)

5) **Material Usage (or Quantity) Variance = Standard Price × (Standard Quantity – Actual Quantity)**

Material A	= 1 × (5 – 3)	= ₹2 (F)
Material B	= 2 × (10 – 6)	= ₹8 (F)
Material C	= 3 × (10 – 11)	= ₹3 (A)
Material Usage Variance		= ₹7 (F)

Note: Material Usage or Quantity variance is the sum of material mix variance and material sub-usage variance. Therefore, Material Mix Variance + Material Sub-usage Variance = Material Usage Variance
 ₹4 (A) + ₹11 (F) = ₹7 (F)

Example 9: From the following information compute:

- 1) Material Cost Variance
- 2) Material Price Variance
- 3) Material Usage Variance
- 4) Material Mix Variance
- 5) Material Sub-usage Variance

Material	Standard			Actual		
	Quantity	Rate	Total (₹)	Quantity	Rate	Total (₹)
A	10	2	20	5	3	15
B	20	3	60	10	6	60
C	20	6	120	15	5	75
Total	50		200	30		150

Solution:

1) **Material Cost Variance = (Standard Quantity for Actual Output × Standard Price) – (Actual Quantity × Actual Price)**

Material A	= (10 × 2) – (5 × 3)	= ₹5 (F)
Material B	= (20 × 3) – (10 × 6)	= ₹0
Material C	= (20 × 6) – (15 × 5)	= ₹45 (F)
Material Cost Variance		= ₹50 (F)

2) **Material Price Variance** = Actual Quantity (Standard Price – Actual Price).

Material A	=	5 (2 – 3)	=	₹5 (A)
Material B	=	10 (3 – 6)	=	₹30 (A)
Material C	=	15 (6 – 5)	=	₹15 (F)
Material Price Variance	=		=	₹20 (A)

3) **Material Usage Variance** = Standard Price × (Standard Quantity – Actual Quantity)

Material A	=	2 × (10 – 5)	=	₹10 (F)
Material B	=	3 × (20 – 10)	=	₹30 (F)
Material C	=	6 × (20 – 15)	=	₹30 (F)
Material Usage Variance	=		=	₹70 (F)

4) **Material Mix Variance** = (Revised Standard Proportion of Actual Input – Actual Proportion) × Standard Price

Material A	=	(6 – 5) × 2	=	₹2 (F)
Material B	=	(12 – 10) × 3	=	₹6 (F)
Material C	=	(12 – 15) × 6	=	₹18 (A)
Material Mix Variance	=		=	₹10 (A)

Working Note:

$$\text{Revised Standard Proportion} = \frac{\text{Standard Proportion} \times \text{Actual Input}}{\text{Total Standard Quantity}}$$

$$\text{Material A} = \frac{10}{50} \times 30 = 6, \quad \text{Material B} = \frac{20}{50} \times 30 = 12, \quad \text{Material C} = \frac{20}{50} \times 30 = 12$$

5) **Material Sub-usage Variance** = (Standard Quantity – Revised Proportion) × Standard Price

Material A	=	(10 – 6) × 2	=	₹8 (F)
Material B	=	(20 – 12) × 3	=	₹24 (F)
Material C	=	(20 – 12) × 6	=	₹48 (F)
Material Sub-usage Variance	=		=	₹80 (F)

8.3. DIRECT LABOUR VARIANCE

8.3.1. Labour Cost Variance (LCV)

Labour cost variance is calculated in the same way as Material Cost Variance. It uses same techniques and formulas. Labour cost variance is the difference between actual labour cost and Standard Labour Cost, for a given quantity of production.

According to Terminology of CIMA defines Direct Labour Cost Variance as "The difference between the standard direct labour cost and actual direct labour cost incurred for the production achieved".

In the form of formula:

$$\text{LCV} = \text{Standard Cost} - \text{Actual Cost}$$

$$\text{i.e., } (\text{Standard Hours} \times \text{Standard Rate}) - (\text{Actual Hours} \times \text{Actual Rate})$$

In case where the actual output is different from standard output, standard labour cost of actual output is calculated and the following formula is used:

$$\text{LCV} = \text{Standard Cost of Actual Production} - \text{Actual Cost}$$

Labour cost variances are sub-divided into:

- 1) Labour rate of pay or wage rate variance, and
- 2) Labour efficiency or labour time variance.

8.3.2. Labour Rate of Pay or Wage Rate Variance (LRV)

Labour Rate Variance is "that portion of the wages variance which is due to the difference between the standard rate specified and the actual rate paid". Personnel department is entrusted with the responsibility of managing labour rate of pay variance. Following is the formula for calculating this variance:

$$\text{Labour Rate of Pay Variance} = \text{Actual Hour (Standard Rate - Actual Rate)}$$

In case where actual rate is lower than the standard, the variance is said to be **favourable**. Conversely, when the standard cost is lower than the actual cost, the variance is **adverse**.

8.3.3. Labour Efficiency or Labour Time Variance (LEV)

This variance calculates and explains the difference between standard labour hours and the actual labour hours spent. Following formula is used for the purpose of calculating this variance:

Labour efficiency variance is calculated as follows:

$$\text{Labour Efficiency Variance} = \text{Standard Rate (Standard Hour - Actual Hour)}$$

This variance is considered unfavourable if the actual time taken is more than the standard time calculated while in the opposite condition, the variance is deemed to be positive.

Labour efficiency variance has many variants which are as follows:

8.3.4. Labour Mix Variance

This variance explains change in labour cost due to the difference in actual gang composition and standard gang composition. Various reasons such as shortage of a type of labour may lead to the change in gang composition. This variance can be calculated in two different ways:

- 1) **When Standard and actual times of the labour mix are same:** Following formula is used for the purpose of calculating the variance:

$$\text{Labour Mix Variance} = \text{Standard Cost of Standard Labour Mix} - \text{Standard Cost of Actual Labour Mix}$$

Shortage or non-availability of one grade of labour may necessitate the change in standard labour mix. In such case, following formula is used:

$$\text{Labour Mix Variance} = \text{Standard Cost of Revised Standard Labour Mix} - \text{Standard Cost of Actual Labour Mix}$$

- 2) **When Standard and actual time of labour mix are different:** In such case, the following formula is used:

$$\left[\left(\frac{\text{Total Hour of Actual Labour Mix}}{\text{Total Hour of Standard Labour mix}} \times \text{Standard Cost of Standard Labour Mix} \right) - \left(\text{Standard Cost of Actual Labour Mix} \right) \right]$$

Revised standard mix is used in the formula, if there is any change in gang composition due to non-availability or shortage of any class of labour:

$$\left[\left(\frac{\text{Total Hour of Actual Labour Mix}}{\text{Total Hour of Revised Standard Labour mix}} \times \text{Standard Cost of Revised Standard Labour Mix} \right) - \left(\text{Standard Cost of Actual Labour Mix} \right) \right]$$

8.3.5. Idle Time Variance

This variance is the standard cost of actual time paid to workers. These are the hours which have not been worked due to abnormal reasons such as shortage of materials, power failure, shutdown for repairing, etc. This variance is calculated as follows:

$$\begin{aligned} \text{Idle Time Variance} &= \text{Standard Rate (Actual Hours Paid - Actual Hours Worked)} \\ &= \text{Standard Rate} \times \text{Actual Hours of Idle Time.} \end{aligned}$$

8.3.6. Labour Yield Variance

This variance explains the difference between actual output of workers and standard output of workers specified:

Labour Yield Variance = (Standard Output for Actual Hour – Actual Output) × Standard Cost per unit.

Variance is calculated for the purpose of exercising control. Many variances are controllable while others are not. For controllable variance, proper caution should be exercised to avoid their recurrence, while for non-controllable variance, there should be revision in future standards.

For verifying the answer, formula used is: $LCV = LRV + LEV$

Example 10: Following data pertains to two group of workmen and their standard and actual working hours and rate:

	Standard Hours	Rate per hour	Total
Worker A	25 hrs.	2	50
Worker B	10 hrs.	3	30
			₹80

	Actual Hours	Rate per hour	Total
Worker A	20 hrs.	2.50	50
Worker B	15 hrs.	4	60
			₹110

Calculate

- 1) Labour cost variance,
- 2) Labour efficiency variance,
- 3) Labour rate variance.

Solution:

- 1) **Labour Cost Variance** = (Standard Hours × Standard Rate) – (Actual Hours × Actual Rate)

Worker A	= (25 × 2) – (20 × 2.50)	= Nil
Worker B	= (10 × 3) – (15 × 4)	= ₹30(A)
Labour Cost Variance		= ₹30 (A)

- 2) **Labour Efficiency Variance** = Standard Rate (Standard Hours – Actual Hours)

Worker A	= 2(25 – 20)	= ₹10 (F)
Worker B	= 3 (10 – 15)	= ₹15 (A)
Labour Efficiency Variance		= ₹5 (A)

- 3) **Labour Rate Variance** = Actual Hours (Standard Rate – Actual Rate)

Worker A	= 20 (2.00 – 2.50)	= ₹10 (A)
Worker B	= 15 (3 – 4)	= ₹15 (A)
Labour Rate Variance		= ₹25 (A)

Verification:

Labour Cost Variance = Labour Efficiency Variance + Labour Rate Variance
 ₹30 (A) = ₹5 (A) + ₹25 (A)

Example 11: Following is the data given for a product:

Standard hours	20 hours
Standard rate	₹5 per hour
Actual output	1,000 units
Actual hours	20,500 hours
Actual rate	₹4 per hour

Calculate the following:

- 1) Labour cost variance,
- 2) Labour efficiency variance
- 3) Labour rate variance

Solution:

- 1) **Labour Cost Variance** = (Standard Hour for Actual Output × Standard Rate) – (Actual Hour × Actual Rate)
 $= (20,000 \times 5) - (20,500 \times 4)$
 $= 1,00,000 - 82,000 = ₹18,000(F)$
- 2) **Labour Efficiency Variance** = Standard Rate (Standard Hour – Actual Hour)
 $= 5 (20,000 - 20,500)$
 $= ₹2,500(A)$
- 3) **Labour Rate Variance** = Actual Hours (Standard Rate – Actual Rate)
 $= 20,500 (5 - 4)$
 $= ₹20,500 (F)$

Verifications:

Labour Cost Variance = Labour Efficiency Variance + Labour Rate Variance
 $₹18,000 (F) = ₹2,500 (A) + ₹20,500 (F)$

Working Note:

Standard hours for actual output

For 1 unit standard hours = 20 hours

1,000 units standard hours = $20 \times 1,000 = 20,000$ hours

Example 12: Using the following information calculate each of three labour variances for each department:

Particulars	Dept. A	Dept. B
Gross wages direct (₹)	25,000	20,000
Standard hours produced	10,000	7,500
Standard rate per hour (₹)	2	4
Actual hours worked	8,500	8,000

Solution:

- 1) **Labour Cost Variance** = (Standard Hours × Standard Rate) – (Actual Hours × Actual Rate)

Department A	$= (10,000 \times 2) - (8,500 \times 2.94)$	$= ₹4,990 (A)$
Department B	$= (7,500 \times 4) - (8,000 \times 2.50)$	$= ₹10,000 (F)$
Labour Cost Variance		$= ₹5,010 (F)$

- 2) **Labour Rate Variance** = Actual Hours (Standard Rate – Actual Rate)

Department A	$= 8,500 (2 - 2.94)$	$= ₹7,990 (A)$
Department B	$= 8,000 (4 - 2.50)$	$= ₹12,000 (F)$
Labour Rate Variance		$= ₹4,010 (F)$

- 3) **Labour Efficiency Variance** = (Standard Hours – Actual Hours) × Standard Rate

Department A	$= (10,000 - 8,500) \times 2$	$= ₹3,000 (F)$
Department B	$= (7,500 - 8,000) \times 4$	$= ₹2,000 (A)$
Labour Efficiency Variance		$= ₹1,000 (F)$

Working Note:

Calculation of Actual Rate = $\frac{\text{Gross Wages}}{\text{Actual Hour Worked}}$

$$A = \frac{25,000}{8,500} = 2.94, \quad B = \frac{20,000}{8,000} = 2.50$$