

Cost Accounting Techniques

6

This Module Includes

- 6.1 Marginal Costing**
- 6.2 Standard Costing and Variance Analysis**
- 6.3 Budget and Budgetary Control**

Cost Accounting Techniques

SLOB Mapped against the Module:

To attain adequate knowledge to apply costing techniques in decision management and appreciate control techniques for cost optimization. (CMLO 3c, 5b)

Module Learning Objectives:

After studying this module, the students will be able to –

- ◉ Understand the fundamentals of CVP analysis and its relation to decision making.
- ◉ Conceptualise the fundamental aspects of standard costing and analysis of variance in material cost and labour cost.
- ◉ Contextualise the importance of budgets and budgetary control.

Marginal Costing

6.1

CIMA Official Terminology¹ defines absorption costing or traditional costing as ‘a costing system which assigns direct costs and all or part of overheads to cost units using one or more overheads absorption rates. It is also referred to as full costing although this is a misnomer if all costs are not attributed to cost units.’

Marginal Costing is not a method of costing like job, batch or contract costing. It is a technique of costing in which only variable manufacturing costs are considered while determining the cost of goods sold and also for valuation of inventories. This technique is based on the fundamental principle that the total costs can be divided into fixed and variable. While the total fixed costs remain constant at all levels of production, the variable costs go on changing with the production level.

Traditional costing or absorption costing is used exclusively for pricing and external reporting purpose. It is not to be used for the purpose of decision making.

Marginal costing alias variable costing, which is the subject of this study note, is used when short-term decisions on matters such as product/service profitability is under consideration, but if long-term decisions need to be made, long-run average costs are required which an absorption costing system provides.

Para 4.14 of CAS – 3 (Revised 2015) defines variable cost as the costs which tends to directly vary with the volume of activity.

Para 4.17 of CAS - 1 (Revised 2015) defines fixed costs as costs which do not vary with the change in the volume of activity. Fixed indirect costs are termed fixed overheads.

It is important to note that fixed cost remain fixed for a particular period and is thus referred as period cost and that also within the relevant range. Whereas, variable costs are treated as product costs as these costs are traceable to the product.

In this regard it is important to note that there are costs which cannot be classified as variable cost nor as fixed cost. These costs are referred as semi-variable costs.

Para 4.30 of CAS - 1 (Revised 2015) defines semi variable costs as the costs that contain both fixed and variable elements. They partly change with the change in the level of activity.

Semi-variable cost are to be segregated into fixed and variable elements specifically for the purpose of analysis under marginal costing system. The segregation of the semi-variable cost has been considered, in details, in Module 1 in this Study material.

¹ CIMA Official Terminology, 2005 Edition, The Chartered Institute of Management Accountants. (<https://www.e-bookdownload.net/search/cima-official-terminology>)

6.1.1 Concept of Marginal Cost and Marginal Costing

Definitions

Marginal cost

Fully absorbed product costs include fixed overheads, whereas the marginal cost of a product usually consists of variable costs only. It is defined as the change in aggregate costs due to change in the volume of production by one unit.

CIMA Official Terminology defines marginal cost as part of the cost of one unit of product or service that would be avoided if the unit were not produced, or that would increase if one extra unit were produced.

For example, if the total number of units produced are 800 and the total cost of production is ₹12,000, if one unit is additionally produced the total cost of production may become ₹12,010 and if the production quantity is decreased by one unit, the total cost may come down to ₹11,990. Thus the change in the total cost is by ₹10 and hence the marginal cost is ₹10. This change, particularly in the short run, is brought about by variable cost of production. The increase or decrease in the total cost is by the same amount because the variable cost always remains constant on per unit basis. The marginal production cost per unit of an item usually consists of the following:

- Direct materials
- Direct labour
- Variable production overheads

Marginal costing

Marginal costing is an alternative method of costing where, only variable costs are charged as a cost of sale and a contribution is calculated. Closing inventories of work in progress or finished goods are valued at marginal (variable) production cost. Fixed costs are treated as a period cost, and are charged in full against profit in the accounting period in which they are incurred. It is defined as ascertainment of cost and measuring the impact on profit of the change in the volume of output or type of output. This is subject to one assumption and that is the fixed cost will remain unchanged irrespective of the change. Thus marginal costing involves firstly the ascertainment of the marginal cost and measuring the impact on profit of alterations made in the production volume and type.

CIMA Official Terminology² defines marginal (or variable) costing as a technique which assigns only variable costs to cost units while fixed costs are written off as period costs.

The following example clarifies the issue of application of marginal costing:

Assume that company is manufacturing 45,000 units of product A, 50,000 units of product B and 30,000 units of product C in a particular year. If it decides to change the product mix and decides that the production of B is to be reduced by 5000 units and that of A should be increased by 5000 units, there will be impact on profits and it will be essential to measure the same before the final decision is taken. Marginal costing helps to prepare comparative statement and thus facilitates the decision-making. This decision is regarding the change in the volume of output. Now suppose if the company has to take a decision that product B should not be produced at all and the capacity, which will be available, should be utilized for A and B this will be change in the type of output and again the impact on profit will have to be measured. This can be done with the help of marginal costing by preparing comparative statement showing profits before the decision and after the decision. This is subject to one assumption and that is the fixed cost remains constant irrespective of the changes in the production. Thus, marginal costing is a very useful technique of costing for decision-making.

Contribution

Contribution is an important measure in marginal costing. It is calculated as the difference between sales value

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and marginal or variable cost.

CIMA Official Terminology¹ defines contribution as ‘sales value – variable cost of sales’.

The term ‘contribution’ is really short for ‘contribution towards covering fixed overheads and making a profit’. The term is derived from the concept that the sales revenue generated through sales after covering up for variable cost of sales (without which the sales revenue cannot be generated) contributes towards fixed cost and after recouping the fixed cost the residue contributes towards profit.

Example 1

Let us assume that a fountain pen named Shikhar is sold by Lotus Ltd. for ₹14,500. The direct material cost (cost of blank, nib, clip and trims) per unit is ₹3,200, the direct labour cost per unit is ₹ 4100 and the variable production overheads cost per unit is ₹1,320. Fixed overheads per month are ₹1,00,000 and the budgeted production level is 100 units in a particular month.

The contribution is calculated as below:

Particulars	(₹)	(₹)
Sale Price (per unit)		14,500
Less: Variable cost of production		
Direct material	3,200	
Direct Labour	4,100	
Variable production overheads	2,320	9,620
Contribution per unit		4,880

In the above example there is a contribution of ₹4,880 for each unit of sale of Shikhar. This implies that sale of one unit of the fountain pen contributes ₹4,880 initially towards fixed overheads of ₹1,00,000 which is spent for the month and after such fixed overheads is recovered, towards profit. In the given situation the budgeted production level is 100 units in a particular month. Thus, ₹4,88,000 is the total contribution for the month which contributes towards the recovery of fixed cost for the month (₹1,00,000). Thus, profit (contribution – fixed cost) is ₹3,88,000.

Features of Marginal costing

Marginal costing, also known as variable costing, is a costing technique where only variable costs are considered in product costing. Below mentioned are the key features of marginal costing:

- **Simple Costing Method:** Marginal costing is relatively simple compared to absorption costing because it does not involve allocating fixed overheads costs to products. This simplicity makes it easier to understand and apply in decision-making
- **Avoidance of Arbitrary Cost Allocation:** Unlike absorption costing, marginal costing avoids the arbitrary allocation of fixed overheads costs to products, which can distort product costs and profitability analysis, especially in situations of fluctuating production levels.
- **Variable Costs Only:** Marginal costing includes only variable manufacturing costs (i.e., costs that vary with the level of production), such as direct materials, direct labour, and variable overheads. Fixed manufacturing costs are treated as period costs and are not allocated to products.
- **Contribution Margin:** Marginal costing focuses on the concept of contribution margin, which is the difference between total sales revenue and total variable costs. It helps in assessing the profitability of individual products and making decisions about product mix and pricing.

Cost Accounting

- **Decision-Making Tool:** Marginal costing is widely used as a tool for short-term decision making, such as pricing decisions, product mix decisions, and whether to accept or reject special orders. By focusing on variable costs and contribution margin, it provides insights into the incremental profitability of different alternatives.
- **Reporting Format:** The format of the marginal costing income statement typically separates costs into fixed and variable categories. This format helps management understand the behavior of costs and their impact on profitability.
- **Internal Reporting:** Marginal costing is often used for internal reporting purposes, providing managers with information to evaluate the performance of segments or departments based on their contribution to covering fixed costs and generating profit.

6.1.2 Absorption Costing vs Marginal costing

From the above discussion it is clear that marginal costing is a technique of costing which advocates that only variable costs should be taken into consideration while working out the total cost of production and while valuing the inventory, only variable costs should be taken into the computation. Fixed costs should not be absorbed in the cost of production but should be charged to the Costing Profit and Loss Account. On the other hand, under absorption costing all indirect costs i.e. overheads are first apportioned and then absorbed in the production units. The difference between the absorption costing and marginal costing is discussed in the subsequent lines.

Aspect	Marginal Costing	Absorption Costing
Cost Classification	Only variable manufacturing costs are considered.	Both variable and fixed manufacturing costs are included.
Treatment of Fixed Costs	Fixed manufacturing costs are treated as period costs and are not allocated to products.	Fixed manufacturing costs are allocated to products as part of inventory valuation.
Income Statement	Separates costs into fixed and variable categories.	Absorbs all manufacturing costs into the cost of goods sold, including fixed overheads.
Reporting Format	Emphasizes contribution margin.	Includes full absorption of all production costs.
Decision Making	Useful for short-term decision making and analyzing contribution margin.	Provides a comprehensive view of product costs but may lead to suboptimal decisions in some cases.
Performance Evaluation	Focuses on contribution to covering fixed costs and generating profit.	May provide distorted performance measures due to allocation of fixed overheads costs.

The impact on the profit under the two cost accounting systems may be summarized below:

- **Scenario one** –No opening and closing stock
In this situation, profit / loss under absorption and marginal costing will be equal.
- **Scenario two** – Value of opening stock is equal to value of closing stock
In this situation, profit / loss under two approaches will be equal provided the fixed cost element in both the stocks is same amount.
- **Scenario three** – Value of closing stock is more than value of opening stock

When production during a period is more than sales, then profit as per absorption approach will be more than that by marginal approach. The reason behind this difference is that a part of fixed overheads included in closing stock value is carried forward to next accounting period.

- **Scenario four** – Value of opening stock is more than the value of closing stock

When production is less than the sales, profit shown by marginal costing will be more than that shown by absorption costing. This is because, in absorption costing a part of fixed cost from the preceding period is added to the current year's cost of goods sold in the form of opening stock.

The income statements under the two systems are presented in the following lines:

Income Statement (Absorption Costing)

Particulars	(₹)	(₹)
Sales		----
• Direct material consumed		-----
• Direct labour cost		-----
• Variable manufacturing overheads		-----
• Fixed manufacturing overheads		-----
Cost of production		-----
Add: Opening stock of finished goods (Value at cost of previous year's production)		-----
Less: Closing stock of finished goods (Value at production cost of current period)		-----
Cost of Goods Sold		-----
Add:(or less) Under (or Over) absorption of Fixed Manufacturing overheads		-----
Add: Administration costs	-----	
Add: Selling and distribution costs	-----	
Total Cost		-----
Profit (Sales–Total cost)		-----

Income statement (Marginal Costing)

Particulars	(₹)
Sales	-----
Variable manufacturing costs:	
• Direct material consumed	-----
• Direct labour	-----
• Variable manufacturing overheads	-----
Cost of Goods Produced	-----
Add: Opening stock of finished goods (value at cost of previous period)	-----

Less: Closing stock of finished goods (Value at current variable cost)	-----
Cost of Goods Sold	-----
Add: Variable administration, Selling and distribution overheads	-----
Total Variable Cost	-----
Contribution (Sale–Total variable costs)	-----
Less: Fixed costs (production, administration, selling and distribution)	-----
Net profit	-----

Fundamental principle of marginal costing

Since fixed costs are constant within the relevant range of volume sales, the following is the net impact of selling one extra unit:

1. Revenue will increase by the sales price of one unit.
2. Costs will only increase by the variable cost per unit.
3. The increase in profit will equal sales value less variable costs, i.e. the contribution

If the volume of sales falls by one unit, then profit will fall by the contribution of that unit. If the volume of sales increases by one unit, profit will increase by the contribution of that unit.

Fixed costs relate to time and is thus referred as the period cost, and do not change with increases or decreases in sales volume. It avoids the often arbitrary apportionment of fixed cost and highlights contribution, which is considered more appropriate for decision –making purposes.

Differential Cost Analysis

Differential costs are also known as incremental cost. This cost is the difference in total cost that will arise from the selection of one alternative to the other. In other words, it is an added cost of a change in the level of activity. This type of analysis is useful for taking various decisions like change in the level of activity, adding or dropping a product, change in product mix, make or buy decisions, accepting an export offer and so on. Thus, differential cost analysis is similar to marginal cost. In the following lines a conceptual understanding of the same is undertaken.

Differential cost represents the algebraic difference between the relevant costs for the alternatives being considered. Thus, when two levels of activities are being considered, the differential cost is obtained by subtracting the cost at one level from the cost of another level. The difference in total costs of two alternative courses of action will be the differential cost. The existing cost or original cost is compared with the prospective / expected or proposed cost. If the differential cost is negative (i.e. proposed cost less existing cost) then the proposal is acceptable else the proposal is rejected. Suppose, present cost is ₹ 1, 25,000 when the work is done by an existing machine and the estimated cost, when the work is done by new machine, is ₹ 1,05,000. There is a decrease in cost by ₹ 20,000 and the decision for replacement of machine should be implemented because there is an increase of profit by ₹ 25,000.

Essential features of differential costs are as follows:

1. Differential cost analysis is not made within the accounting records, rather it is made outside the accounting records. Differential costs may however, be incorporated in the flexible budget because the budget shows costs at various levels of activity.
2. The database which is considered for analysis of differential costs are total costs (both fixed and variable), total revenue and the investment factors which are relevant in the problem for which the analysis is undertaken.

3. Total differential costs are considered in differential cost analysis. Cost per unit is not taken into consideration.
4. Cost benefit analysis is done in evaluating alternate course of actions. Total differential revenues are compared with total differential costs before advocating an alternate course of action. A change in course of action is recommended only if incremental revenue exceeds incremental costs.
5. As the differences in the costs at two levels are considered, absolute costs at each level are not as relevant as the difference between the two. Thus, items of costs which do not change but are identical for the alternative under consideration, are ignored.
6. The changes in costs are measured from a common base point which may be present course of action or present level of production.
7. Differential costs analysis is related to the future course of action or future level of output, so it deals with future costs. Historical costs or standard cost may be used but they should be adjusted to future conditions.
8. For making a choice among the various alternatives, the alternative which gives the maximum difference between the incremental revenue and incremental cost is recommended to be adopted.

Differential Cost Analysis and Marginal Costing

Differential costs are often considered as marginal costs but that is really too simplistic and the two terms are used to mean different things. Differential costs are simply, as stated above, the difference of total cost between two alternative courses of action and are therefore calculated on the basis of absorption costing or total costing but in marginal costing technique, analysis are made on the basis of variable costs and the fixed costs are considered as period costs and thus are excluded for the purpose of analysis. If the alternate course of action does not involve any extra fixed cost then change in variable costs will be equal to the differential costs and there will be no difference between differential costs and marginal costs.

Limitations of Marginal Costing

Marginal costing technique is used for internal reporting purpose and for the purpose of decision making. For external reporting purpose, total costing or absorption costing is still the preferred method. The discussion made, in the above paragraphs, so far highlights only the positive aspects of marginal costing. In the following lines, some of the limitations of the technique are noted.

1. The breakeven analysis assumes that cost and revenue behaviour patterns are known and that the change in activity levels can be represented by a straight line.
2. It may not always be feasible to split costs precisely into variable and fixed categories. Costs often show mixed behaviour and then, simple techniques of segregation fail.
3. The breakeven analysis assumes that fixed costs remain constant over the relevant range under consideration. If that is not the case, then the graph of total costs will have a step in it where the fixed costs are expected to increase.
4. Breakeven analysis assumes input and output volumes are the same, so that there is no build-up of stocks and work-in-progress.
5. Breakeven charts and simple analysis can only deal with one product at a time.
6. The entire gamut of break-even analysis is based on the assumption that cost behaviour depends entirely on volume.

These limitations may be overcome by modifying the breakeven analysis. However, that would involve considerably more computation work and is beyond the scope of this study note.

6.1.3 Cost –Volume – Profit (CVP) Analysis

Managers are concerned about the impact of their decisions on profit. The decisions managers make basically about volume of sales, pricing of products, or incurring a cost. Therefore, managers require an understanding of the relations among revenues, costs, volume, and profit. The cost accounting department supplies the data and analysis, called Cost-Volume-Profit (CVP) analysis, which facilitates managers to take their decisions. The term CVP analysis is interchangeably used with the term marginal costing.

CIMA's Official Terminology defines Cost–Volume–Profit (CVP) analysis as ‘the study of the effects on future profit of changes in fixed cost, variable cost, sales price, quantity and mix’.

The terms CVP analysis and the term breakeven analysis are used interchangeably. However, this is somewhat misleading, since the term break even analysis seems to imply that the focus of the analysis is the breakeven point – that is, the level of activity which produces neither profit nor loss.

Tools and techniques of CVP analysis

Contribution analysis

It has been already discussed that the fundamental aspect of CVP analysis alias marginal costing is that the excess of sales value and the variable cost of sales contributes to the fixed cost (period cost) and after recouping fixed cost the residue contributes towards profit. Thus, the issue of contribution is fundamental to CVP analysis.

- ⊙ Contribution per unit = Sales per unit – Variable Cost per unit
- ⊙ Total Contribution = per unit contribution × number of units sold
- ⊙ Total Contribution – Fixed Cost = Profit

If more than one product is produced, contributions of all products are added and out of aggregate contribution fixed costs are deducted to arrive at profit. Contribution is helpful in determination of profitability of the products. When there are two or more products, the product having more contribution is more profitable.

For example, the following are the three products with selling price and cost details :

Particulars	A	B	C
Selling Price p.u. (₹)	100	150	200
Variable Cost p.u. (₹)	50	70	100
Contribution p.u. (₹)	50	80	100

In the above example, one can say that the Product C is more profitable because, it has higher contribution. This proposition of product having higher contribution is more profitable is valid, as long as, there are no limiting factor.

Breakeven point

Contribution is so called because it contributes initially towards fixed costs (which is for a particular period and remains fixed within a relevant range) and then towards profit. As sales revenues grow from zero, the contribution also grows until it just covers the fixed costs. This is the breakeven point where neither profits nor losses are made. Thus, it is obvious that to break even, the amount of contribution must be exactly equal to the fixed costs. Thus, once the contribution per unit is calculated³, the number of units required to break even can be calculated as follows:

$$\text{Breakeven point in units} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

³ For the student, in solving a analytical question, the first step is to attempt to calculate the contribution per unit.

Example 2

Suppose that ASA Ltd. manufactures a particular fountain pen called ASA Durga, incurring variable costs of ₹30 per unit and fixed costs of ₹20,000 per month. If the product sells for ₹50 per unit, then the breakeven point can be calculated as follows:

$$\text{Breakeven point in units} = \frac{\text{₹ } 20,000}{\text{₹ } (50 - 30)} = 1000 \text{ units per month}$$

This implies that if ASA Ltd. manufactures 1000 units of the fountain pen called ASA Durga then the income statement of the manufacturer for the particular month would be as follows;

Particulars	(₹) (per unit)	(₹) (1000 units)
Sale Price per unit	50	
Variable cost per unit	30	
Contribution per unit		20
Total contribution (for 1000 units)		20,000
Fixed cost for the month		20,000
Profit		Nil

Thus ASA Ltd. breaks even (no profit/no loss) at 1000 units per month.

It is obvious that;

$$\text{Break-even point (in Amount)} = \text{Break-even point (in units)} \times \text{Selling price per unit}$$

In the above example, the Break-even point (in Amount) of ASA Ltd. is

$$\begin{aligned} &= \text{Break-even point (in units)} \times \text{Selling price per unit} \\ &= 1000 \text{ units} \times \text{₹ } 50.00 = \text{₹ } 50,000.00 \end{aligned}$$

Thus ASA Ltd. breaks even (no profit/no loss) when it's sales revenue per month is ₹ 50000.

6.1.4 Margin of Safety

The margin of safety is the difference between the expected level of sales and the breakeven point. It is a reflection of the cushion. The larger the margin of safety, the more likely a profit will be made, i.e. if sales start to fall there is more leeway before the organisation begins to incur losses.

In the above example if for a particular month ASA Ltd. forecasts sales to be 1,700 units, the margin of is calculated as:

$$\text{Margin of safety} = \text{projected sales} - \text{breakeven point}$$

$$\text{Margin of safety} = 1700 - 1000 = 700 \text{ units or } 41\% \text{ of Sales } \left(\frac{700}{1,700} \times 100 \right)$$

The margin of safety should be expressed as a percentage of projected sales. To quote a margin of safety of 700 units without relating it to the projected sales figure provides a partial picture.

The margin of safety might also be expressed as a percentage of the breakeven value, that is, 70 per cent of the breakeven value in this case.

The margin of safety can also be used as a way of profit calculation. We have seen that the contribution goes towards fixed costs and profit. Once breakeven point is reached the fixed costs are covered. After the breakeven point, there are no more fixed costs to be covered and all of the contribution goes towards making profits.

In our example the monthly profit from sales of 1,700 units would be ₹14,000 (₹20 per unit contribution × Margin of safety = ₹20 × 700 units). This is so because the Fixed cost of ₹20,000 is covered by ASA Ltd. by selling 1000 units of the ASA Durga in the particular month).

4. Contribution to Sales ratio (C/S) or Profit Volume Ratio (P/V)

The Contribution to Sales ratio (C/S) also referred as the Profit Volume Ratio (P/V) expresses the relationship between contribution to sales.

P/V Ratio may be expressed as follows:

- P/V Ratio is 1/4 th of sales.
- Sales is 4 times that of contribution.
- P/V Ratio is 25%.
- P/V Ratio is 0.25 of sales.

$$\text{P/V Ratio (C/S ratio)}^4 = \frac{\text{contribution per unit}}{\text{sales}} \times 100$$

A higher contribution to sales ratio means that contribution grows quicker as sales levels increase. Once the breakeven point has been passed, profits will accumulate more quickly than for a product with a lower contribution to sales ratio. This ratio is based on the fundamental assumption that unit selling price and unit variable cost remain constant. When there is a change in selling price or variable cost of sales then the P/V ratio changes.

If it is assumed that a unit's variable cost and selling price remains constant, then the C/S ratio (P/V ratio) will also remain constant.

In the above example, the P/V ratio is calculated as follows:

$$\begin{aligned}\text{P/V Ratio (C/S ratio)} &= \frac{\text{Contribution per unit}}{\text{Selling price per unit}} \times 100 \\ &= \frac{\text{₹ } 20}{\text{₹ } 50} \times 100 = 40\%\end{aligned}$$

Or,

$$\begin{aligned}\text{P/V Ratio (C/S ratio)} &= \frac{\text{Total Contribution}}{\text{Total Sales}} \times 100 \\ &= \frac{20,000}{50,000} \times 100 = 40\%\end{aligned}$$

$$\therefore \text{The Breakeven point (₹)} = \frac{\text{Fixed Cost}}{\text{P / V Ratio}}$$

⁴ This can also be calculated on per unit basis. This is also referred as the contribution margin.

In the above example,

$$= \frac{\text{Fixed cost}}{\text{P/V Ratio}} = \frac{20,000}{40\%} = ₹ 50,000$$

Thus, ASA Ltd. breaks even (no profit/no loss) when it's sales revenue per month is ₹50,000

There are situations when data for two periods is given and the per unit sale price or per unit variable cost of sales is not given then a modified version of the ratio is used. In such case the ratio is given as:

$$\text{P/V Ratio} = \frac{\text{change in contribution}}{\text{change in sales}} \times 100$$

$$\text{Or, P/V Ratio}^5 = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100$$

5. Variable Cost Ratio

The variable cost ratio is a cost accounting tool used to express a company's variable production costs as a percentage of its net sales. The primary motive of calculating the ratio is to consider costs that may be subject to variations with the changes in production levels and compare them to the amount of revenues generated by the sales of that particular cycle of production.

The formula for the calculation of the variable cost ratio is as follows:

$$\text{Variable Cost Ratio} = \frac{\text{Variable Cost}}{\text{Net Sales}}$$

An alternate formula is given below:

$$\text{Variable Cost Ratio} = 1 - \text{Contribution Margin}$$

$$\text{Variable Cost Ratio}^6 = 1 - \text{P/V Ratio.}$$

If P/V ratio is 40% (0.4). This implies that the Variable Cost ratio is $1 - 0.4 = 0.6$ or 60%

6. Sales to earn target profit

Besides being able to determine the break-even point, CVP analysis determines the sales required to attain a particular income level or target profit. There are two ways in which target net income can be expressed:

1. As a specific rupee amount
2. As a percentage of sales

As a specific rupee amount – As a specific rupee amount, the cost-volume equation specifying target profit is given as,

$$\text{Sales} = \text{VC} + \text{FC} + \text{target profit}$$

If q = volume in units, the above relationship can be rewritten as,

$$pq = uq + \text{FC} + \text{target profit}$$

Where,

$$p = \text{sale price per unit}$$

⁵ It is assumed that fixed cost remains fixed over the two periods.

⁶ Expressed as a fraction.

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q = quantity sold

u = Variable cost per unit

The above equation can be written as,

$$q(p - u) = FC + \text{target profit}$$

Here⁷ (p - u) = contribution per unit

$$\Rightarrow q = \frac{FC + \text{target profit}}{(p - u)}$$

$$\Rightarrow \text{target profit sales volume} = \frac{FC + \text{target profit}}{\text{contribution per unit}}$$

Specifying target profit as a percentage of sales, the cost-volume equation is,

$$pq = uq + FC + \% (pq)$$

$$\Rightarrow q = \frac{FC}{(p - u) - \% (p)}$$

$$\Rightarrow q = \frac{FC}{\text{per unit contribution} - \text{profit as a \% of unit sale price}}$$

Example 3

Suppose that ASA Ltd. manufactures a student level fountain pen and sales each fountain pen @ ₹25 per unit, the variable cost of sales of each fountain pen is ₹10 each and the fixed cost for a month is ₹15,000.

assume that ASA Ltd. wishes to attain:

Case 1. A target profit of ₹15,000 before tax

Case 2. A target income of 20% of sales

Now,

In Case 1, target profit sales volume (in units) required is,

$$q_{\text{target profit}} = \frac{\text{Fixed cost} + \text{Target profit}}{(p - u)} = \frac{15,000 + 15,000}{(25 - 10)} = 2,000 \text{ units}$$

Check,

at 2000 units the income statement is:

	(₹)
Sales @ ₹25 per unit	50,000
Less: Variable cost @ ₹10 per unit	20,000
Contribution	30,000
Less: Fixed Cost	15,000
Target profit	15,000

In Case 2, the target income volume required is,

$$\Rightarrow q = \frac{FC}{(p - u) - \% (p)}$$

⁷ Selling price per unit – variable cost per unit = contribution per unit. This is elaborately discussed a previous section.

$$\Rightarrow q = \frac{15000}{(25 - 10) - (20\% \times 25)}$$

$$q = \frac{15000}{(15 - 5)} = 1500 \text{ units}$$

Check,

at 1500 units, the income statement is:

	(₹)
Sales @ ₹25 per unit	37,500
Less: Variable cost @ ₹10 per unit	15,000
Contribution	22,500
Less: Fixed Cost	15,000
Target profit	7,500

Profit is targeted at 20% of sales = 20% of 37,500 = ₹7,500 (as calculated in the above income statement).

7. Break-even analysis

Break-even analysis, a branch of CVP analysis, determines the break-even sales, which is the level of sales at which total costs equal total revenue. It refers to the identifying of the point where the revenue of the company starts exceeding its total cost i.e., the point when the project or company under consideration will start generating the profits by the way of studying the relationship between the revenue of the company, its fixed cost, and the variable cost. The break-even point, the point of no profit and no loss, provides managers with insights into profit planning. It can be computed in three different ways:

- (i) The equation approach
- (ii) The contribution approach
- (iii) The graphical approach
- (i) **The Equation Approach** is based on the cost-volume equation, which shows the relationships among sales, variable and fixed costs, and profit:

$$S = VC + FC + \text{Profit}$$

Where,

S = Sales revenue

VC = total variable cost

FC = total fixed cost

At the break-even sales volume,

$$S = VC + FC + 0 \text{ (by definition)}$$

If q = volume in units, the above relationship can be rewritten as

$$pq = uq + FC$$

Where,

p = sale price per unit

q = quantity sold

u = Variable cost per unit

To find the break-even point in units, simply solve the equation for q .

Example 4

If it is assumed that ASA Ltd. manufactures a student level fountain pen and sales each fountain pen @ ₹25 per unit, the variable cost of sales of each fountain pen is ₹10 each and the fixed cost for a month is ₹15,000.

We know,

At the break-even sales volume,

$$S = VC + FC + 0.$$

And

If q = volume in units, the above relationship can be rewritten as,

$$pq = uq + FC$$

Where,

p = sale price per unit

q = quantity sold

u = Variable cost per unit

Therefore,

$$25 \times q = 10 \times q + 15000$$

$$\text{or, } 15q = 15,000$$

$$\text{or, } q = 1000 \text{ units}$$

Therefore, ASA Ltd. breaks even at a sales volume of 1,000 units.

(ii) The Contribution Margin Approach, another technique for computing the break-even point, is based on solving the cost-volume equation stated earlier.

Solving the equation, $pq = uq + FC$ for q yields:

$$q_{BE} = \frac{FC}{(p - u)} = \frac{FC}{\text{Contribution per unit}}$$

Here q_{BE} = break-even unit sales volume

If the break-even point is desired in terms of Rupees, then

Break – even point in Rupees = Break-even point in units $\times$ Unit sales price

$$\text{Break – even point in Rupees} = \frac{\text{Fixed Cost}}{P / V \text{ Ratio}}$$

8. Angle of Incidence

The angle formed at the break-even point by the intersection of the sales line and the total cost line is known as the angle of incidence. It should be the aim of the management to have a wider angle. The size of the angle indicates the rate of profit earned after break-even point. A wider angle means a high rate of profit accruing after the fixed costs are absorbed. On the contrary, a narrow angle means a relatively low rate of profit indicating that variable costs constitute a large part of cost of sales.

- (iii) **The Graphical Approach** is based on the so-called break-even chart as shown in Fig. 6.1. Sales revenue, variable costs, and fixed costs are plotted on the vertical axis, while volume, x , is plotted on the horizontal axis. The break-even point is the point where the total sales revenue line intersects the total cost line. The chart can also effectively report profit potentials over a wide range of activity. The profit-volume (P-V) chart, as shown in Fig. 6.2, focuses more directly on how profits vary with changes in volume. Profits are plotted on the vertical axis, while units of output are shown on the horizontal axis. Note that the slope of the chart is the unit contribution margin. The main advantage of the profit-volume chart is that it is capable of depicting clearly the effect on profit and breakeven point of any changes in the variables.

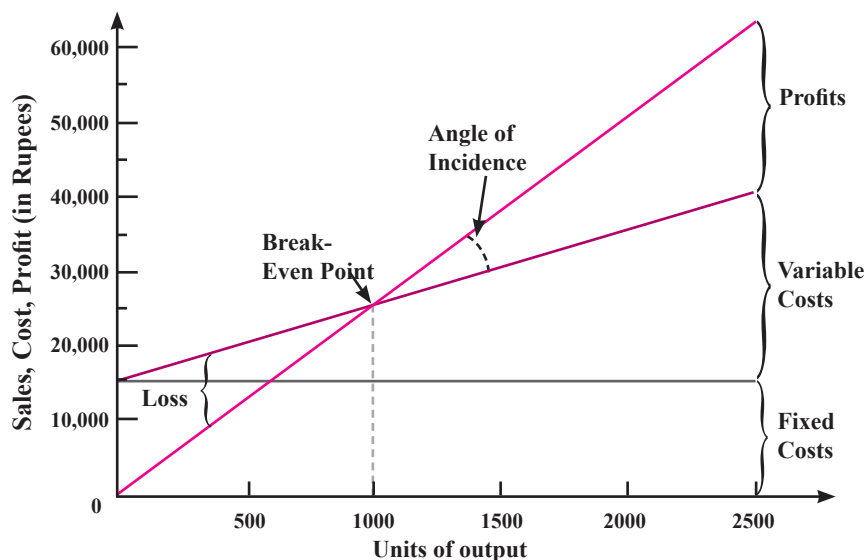


Figure 6.1: Break Even Chart

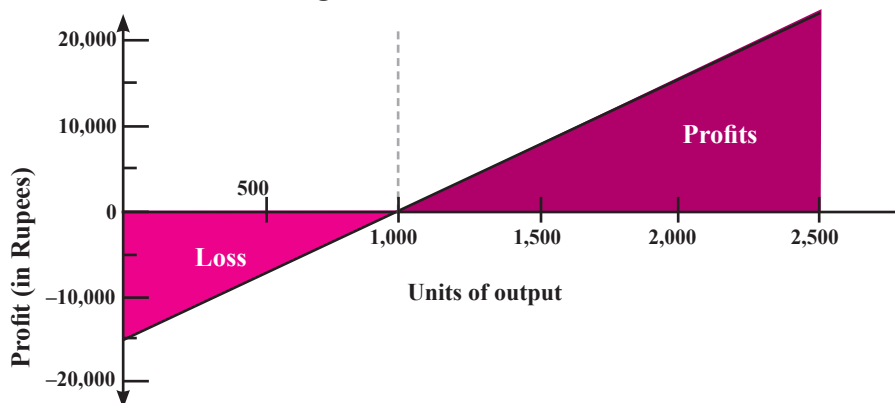


Figure 6.2 Profit-Volume Chart

The change in profit can be studied through Break even charts in different situations as mentioned below:

1. Increase in No. of Units

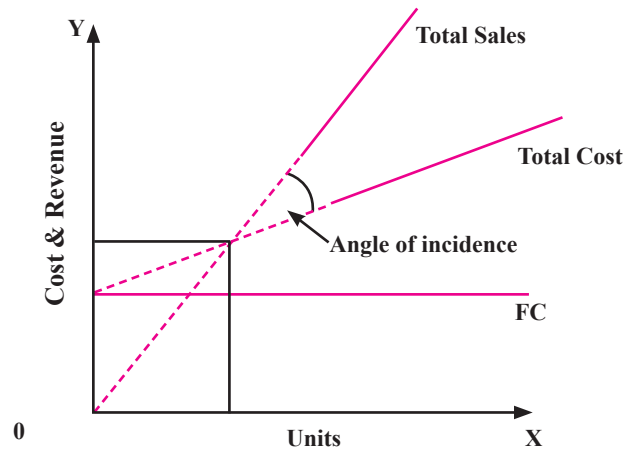


Figure 6.3: Change in BEP due to increase in No. of Units

In the above chart, if we clearly observe we find that there is no change in BEP even if there is increase or decrease in number of units.

2. Increase in Sales due to increase in selling price

NTS = New Total Sales line

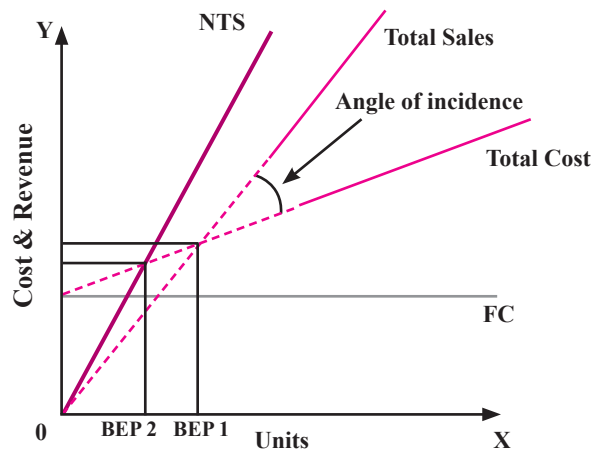


Figure 6.4: Change in BEP due to increase in Selling Price

From the above chart, we observe that profit is increased by increasing the selling price and also, if there is change in selling price, BEP also changes. If selling price is increased, then BEP decreases. If selling price is decreased, then BEP increases. Thus, we say that there is an inverse relationship between selling price and BEP.

3. Decrease in variable cost

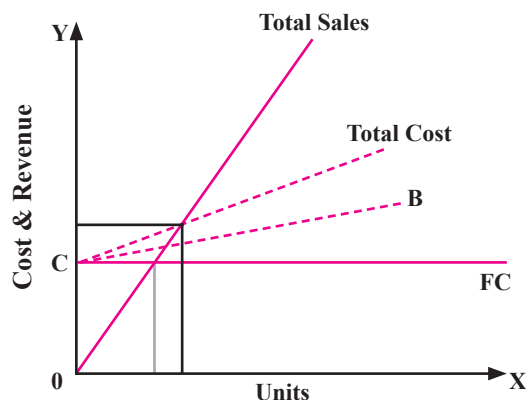


Figure 6.5: Change in BEP due to decrease in Variable cost

The CB line indicates decreased total cost line which also implies a decrease in BEP

From the above chart, it is observed that when variable costs are decreased profit increases. If there is change in variable cost, then BEP also changes. If variable cost decreases, then BEP also decreases. If variable cost is increases, then BEP also increases. Thus, there is direct relationship between variable cost and BEP.

4. Change in fixed cost

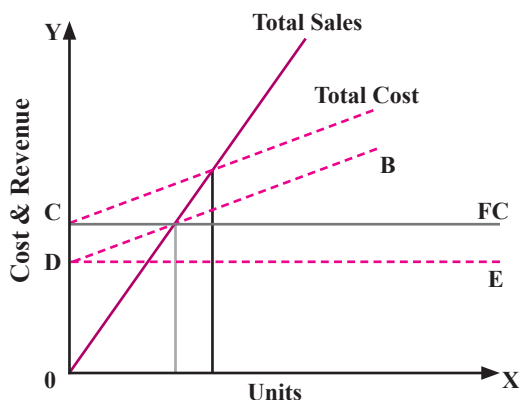


Figure 6.6: Change in BEP due to change in Fixed Cost

The DE and DB line indicate decrease in fixed cost and total cost respectively.

From the above chart, it may be observed that there is increase in profit due to decrease in fixed cost. If fixed cost increases then BEP also increases. If fixed cost decreases, then BEP also decreases.

Thus, there is a direct relationship between fixed cost and BEP.

Non-linear break-even analysis

In break-even analysis discussed above, linear (straight line) relationships are assumed. Sale price per unit and variable cost per unit are assumed to remain constant but in all practical scenario it is reasonable to think that increased sales can be obtained only if sales prices are reduced. Variable cost per unit also does not remain constant, given price rises and other external as well as internal factors. Empirical studies suggest that the average variable cost per unit falls over some range of output and then begins to rise. Thus, non-linear relationships between cost

curves and sale price may have to introduced though it complicates matters. In such case there would be two or more break even points. In such a case the optimum profit is earned where the difference between the sales and the total costs is the largest. It is obvious that the business should produce only upto this level. This is being illustrated in the below mentioned chart.

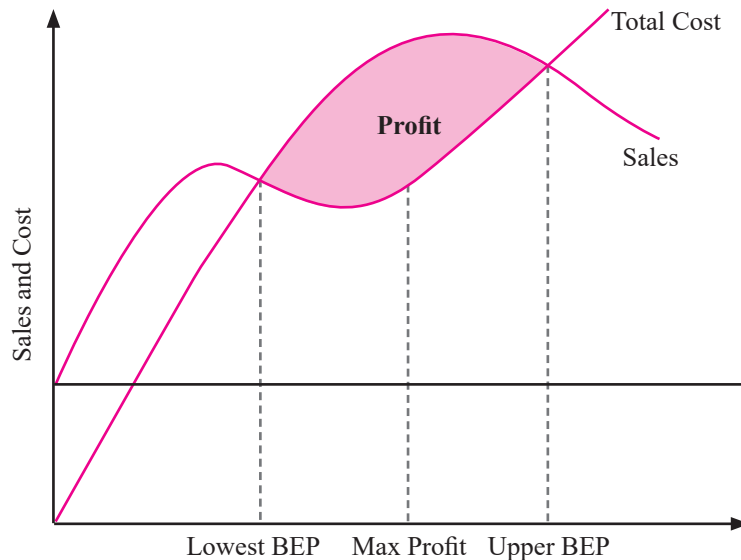


Figure 6.7: Non-Linear Break-Even Chart

Cash Break-Even Point

When break-even point is calculated only with those fixed costs which are payable in cash, such a break-even point is known as cash break-even point. This means that depreciation and other non-cash fixed costs are excluded from the fixed costs in computing cash break-even point. It is stated as:

$$\text{Cash break-even point} = \frac{\text{Cash Fixed Cost}}{\text{Contribution per unit}}$$

Applications of Marginal Costing

Marginal costing is a very useful technique of costing and is extensively used in various managerial tasks and the decision-making process. The applications of marginal costing are discussed in the following lines:

1. **Cost Control:** One of the important challenges in front of the management is the control of cost. In the modern competitive environment, increase in the selling price for improving the profit margin can be dangerous as it may lead to loss of market share. The other way to improve the profit is cost reduction and cost control. Cost control aims at not allowing the cost to rise beyond the present level. Marginal costing technique helps in this task by segregating the costs between variable and fixed. While fixed costs remain unchanged irrespective of the production volume, variable costs vary according to the production volume. Certain items of fixed costs are not controllable at the middle management or lower management level. In such situation it will be more advisable to focus on the variable costs for cost control purpose. Since the segregation of costs between fixed and variable is done in the marginal costing, concentration can be made on variable costs rather than fixed cost and in this way unnecessary efforts to control fixed costs can be avoided.

2. **Profit Planning:** Another important application of marginal costing is the arena of profit planning. Profit planning is defined as the planning of future operations to attain a pre-determined profit goal. The marginal costing technique helps to generate data required for profit planning and decision-making. For example, computation of profit if there is a change in the product mix, impact on profit if there is a change in the selling price, change in profit if one of the products is discontinued or if there is an introduction of new product, decision regarding the change in the sales mix are some of the areas of profit planning in which necessary information can be generated by marginal costing for decision making. The segregation of costs between fixed and variable is thus extremely useful in profit planning.
3. **Key Factor Analysis:** The management has to prepare a plan after taking into consideration the constraints, if any, on the various resources. These constraints are also known as limiting factors or principal budget factors as discussed in the topic of 'Budgets and Budgetary Control'. These key factors may be availability of raw material, availability of skilled labour, machine hours availability, or the market demand of the product. Marginal costing helps the management to decide the best production plan by using the scarce resources in the most beneficial manner and thus optimize the profits. For example, if raw material is the key factor and its availability is limited to a particular quantity and the company is manufacturing three products, A, B and C. In such cases marginal costing technique helps to prepare a statement, which shows the amount of contribution per kg of material. The product, which yields highest contribution per kg of raw material, is given the priority and produced to the maximum possible extent. Then the other products are taken up in the order of priority. Thus, the resultant product mix will yield highest amount of profit in the given situation.
4. **Decision Making:** Managerial decision-making is a very crucial function in any organization. Decision – making should be on the basis of the relevant information. Through the marginal costing technique, information about the cost behaviour is made available in the form of fixed and variable costs. The segregation of costs between fixed and variable helps the management in predicting the cost behaviour in various alternatives. Thus, it becomes easy to take decisions. Some of the decisions are to be taken on the basis of comparative cost analysis while in some decisions the resulting income is the deciding factor. Marginal costing helps in generating both the types of information and thus the decision making becomes rational and based on facts rather than based on intuition. Some of the crucial areas of decision-making are mentioned below:
 - Pricing decisions in special circumstances:
 - ⊙ Pricing in periods of recession
 - ⊙ Use of differential selling prices
 - Acceptance of offer and submission of tenders.
 - Make or buy decisions.
 - Shutdown or continue decisions or alternative use of production facilities.
 - Retain or replace a machine.
 - Decisions as to whether to sell in the export market or in the home market.
 - Whether to expand or contract.
 - Product mix decisions like for example:
 - ⊙ Selection of optimal product mix
 - ⊙ Product substitution
 - ⊙ Discontinuance of a product.

Some of the more important applications for the purpose of decision making are elaborated below:

6.1.5 Application of Marginal Costing for Decision Making

It is reiterated that breakeven analysis is a particular example of the more general technique of cost– volume–profit (CVP) analysis. Marginal costing is a term loosely used to mean entire gamut of CVP analysis. This analysis emphasises the relationship between sales revenue, costs and profit in the short term. It is important to note that the short term is a period of time over which some costs are fixed, whatever the level of output within a range⁸ limited by the existing capacity of the business.

In the long term, all costs become variable because the capacity of a business can be altered by acquiring new premises, hiring more employees or investing in more equipment.

CVP analysis is used by the management accountant for the purpose of decision making. In the short term, decisions have to be made within the constraints of the capacity of the business and the aim of that decision making will be to maximise short-term profit. Typical decision-making situations based on CVP analysis mentioned above can be basically categorised as:

- ◉ accepting a special order to use up spare capacity
- ◉ abandoning a line of business
- ◉ the existence of a limiting factor
- ◉ carrying out an activity in – house rather than buying in a service under contract.

In the following lines each of them are discussed in brief:

Special order to use up spare capacity

In the short term, a business must ensure that the revenue from each item of activity at least covers variable costs and makes a contribution to fixed costs. Once the fixed costs are covered by contribution, the greater is the sales, greater is the profits (contribution results in profit when the organisation is working in margin of safety). When the business reaches full capacity there will be a new element of fixed cost to consider should the business decide to increase its capacity. If there is no increase in capacity, then the business should concentrate on those activities producing the highest contribution per unit or per item, but supposing the business is not operating at full capacity. Should it lower its sales price in an attempt to increase the volume of activity? The question may arise in the form of a request from a customer for a special price for a particular order. Should the business accept the special order?

CVP analysis gives the Solution: that the special order is acceptable provided the sales price per item covers the variable costs per item and provided there is no alternative use for the spare capacity which could result in a higher contribution per item.

Abandonment of a line of business

The management of a business may be concerned because one line of business appears not to be covering all its costs. This situation may arise particularly where costs are being used for score-keeping purposes and all fixed costs have been allocated to products. The allocation of fixed costs to products is a process which is somewhat arbitrary in nature, and is not relevant to decision making because the fixed costs are incurred irrespective of whether any business activity takes place.

When a line of business comes under scrutiny as to its profitability, CVP analysis shows that in the short term it is worth continuing with the line if it makes a contribution to fixed costs. If the line of business is abandoned and nothing better takes its place, then that contribution is lost but the fixed costs run on regardless.

⁸ Referred as relevant range

Existence of a limiting factor

In the short term, it may be that one of the inputs to a business activity is restricted in its availability. There may be a shortage of raw materials or a limited supply of skilled labour. There may be a delivery delay on machinery or a planning restriction which prevents the extension of a building on the business premises. There may then be a need to choose from a range of possible activities so as to maximise short-term profit. The item which is restricted in availability is called the limiting factor.

CVP analysis shows that maximisation of profit will occur if the activity is chosen which gives the highest contribution per unit of limiting factor.

In-house activity versus bought-in contract⁹

For a manufacturing business, there may be a decision between making a component in-house as compared with buying the item ready-made. For a service business there may be a decision between employing staff in-house and using the services of an agency which supplies staff as and when required.

CVP analysis shows that the decision should be based on comparison of variable costs per unit. If there is a difference between the fixed cost of the two options, then the comparison of the variable costs should be related this difference in fixed costs between the options.

Illustration 1

MAXWEL Ltd. produces a single product 'Boost'. The following figures relate to Boost for the period: 2021 - 2022.

Activity Level	50%	100%
Sales and production (units)	400	800
	(₹)	(₹)
Sales	8,00,000	16,00,000
Production costs:		
- Variable	3,20,000	6,40,000
- Fixed	1,60,000	1,60,000
Selling and distribution costs:		
- Variable	1,60,000	3,20,000
- Fixed	2,40,000	2,40,000

The normal level of activity for the year is 800 units. Fixed costs are incurred evenly throughout the year, and actual fixed costs are the same as budgeted. There were no stocks of Boost at the beginning of the year.

In the first quarter, 220 units were produced and 160 units were sold.

Required:

- What would be the fixed production costs absorbed by Boost if absorption costing is followed?
- What would be the under/over-recovery of overheads during the period?
- What would be the profit as per absorption costing?
- What would be the profit as per marginal costing?

⁹ This is simply referred as the 'Make or Buy' decision.

Solution:

Fixed production costs absorbed

Particlars	(₹)
Budgeted fixed production costs	1,60,000
Budgeted output (normal level of activity 800 units)	
Therefore, the absorption rate: $1,60,000/800 = ₹ 200$ per unit	
During the first quarter, the fixed production cost absorbed by Boost would be $(220 \text{ units} \times ₹ 200)$	44,000

Under / over recovery of overheads during the period

Particulars	(₹)
Actual fixed production overheads (1/4 quarters of ₹ 1,60,000)	40,000
Absorbed fixed production overheads	44,000
Over-recovery of overheads	4,000

Profit for the Quarter (Absorption Costing)

	(₹)	(₹)
Sales revenue $(160 \text{ units} \times ₹ 2,000)$: (A)		3,20,000
Less: Production costs:		
- Variable cost $(220 \text{ units} \times ₹ 800)$	1,76,000	
- Fixed overheads absorbed $(220 \text{ units} \times ₹ 200)$	44,000	2,20,000
Less: Opening Stock		-----
Add: Closing Stock $(₹ 2,20,000/220 \text{ units} \times 60 \text{ units})$		60,000
Cost of Goods sold		1,60,000
Less: Adjustment for over-recovery of fixed production overheads		4,000
Add: Selling & Distribution Overheads:		
-Variable $(160 \text{ units} \times ₹ 400)$	64,000	
- Fixed $(1/4^{\text{th}}$ of ₹ 2,40,000)	60,000	1,24,000
Cost of Sales (B)		2,80,000
Profit {(A) – (B)}		40,000

Profit for the Quarter (Marginal Costing)

Particulars	(₹)	(₹)
Sales revenue $(160 \text{ units} \times ₹ 2,000)$: (A)		3,20,000
Less: Production costs:		
- Variable cost $(220 \text{ units} \times ₹ 800)$	1,76,000	
Add: Opening Stock		-----
Less: Closing Stock $(₹ 1,76,000/220 \text{ units} \times 60 \text{ units})$	48,000	
Variable cost of goods sold		1,28,000

Particulars	(₹)	(₹)
Add: Selling & Distribution Overheads:		
-Variable (160 units × ₹ 400)		64,000
Total Variable Cost (B)		1,92,000
Contribution {(C) = (A) – (B)}		1,28,000
Less: Fixed Costs:		
- Production cost	(40,000)	
- Selling & distribution cost	(60,000)	(1,00,000)
Profit		28,000

Illustration 2

ABC Ltd. incurs fixed costs of ₹ 3,00,000 per annum. It is a single product company with annual sales budgeted to be 70,000 units at a sales price of ₹ 300 per unit. Variable costs are ₹ 285 per unit.

The company is deliberating upon an increase in the selling price of the product to ₹ 350 per unit. This shall be required in order to improve the quality of the product. It is anticipated that despite increase in the selling price the sales volume shall remain unaffected. However, the fixed costs shall increase to ₹ 4,50,000 per annum and the variable costs to ₹ 330 per unit.

You are required to draw a profit volume graph, and determine the breakeven point. Also draw on the same graph a second profit volume graph and give your comments.

Solution:

Particulars	Present Situation (₹)	Proposed Situation (₹)
Selling Price per unit	300	350
Less: Variable Cost per unit	285	330
Contribution Per unit	15	20
Budgeted Sales 70,000 units:		
Total Contribution	10,50,000	14,00,000
Less: Fixed Cost	3,00,000	4,50,000
Profit	7,50,000	9,50,000
Break Even Point (units)		
= $\frac{\text{Fixed costs}}{\text{Contribution per unit}}$	$\frac{3,00,000}{15} = 20,000$	$\frac{4,50,000}{20} = 22,500$
Indifference point of sales (i.e. sales unit when both situation have equal profits)	Let x be the units of sales where profit will remain same under both the situation. $15x - 3,00,000 = 20x - 4,50,000$ or, $x = \frac{1,50,000}{5} = 30,000$ units So, beyond 30,000 units of sales Proposed situation will have more profit and below 30,000 units of sales present situation will have more profit.	

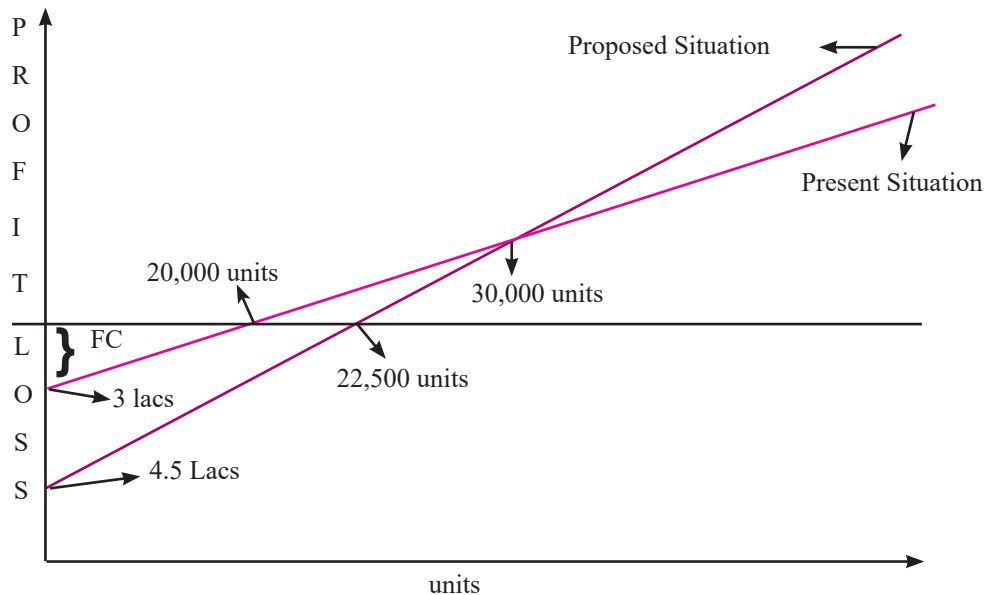


Figure 6.8: Profit Volume Graph

It is clear from the graph that break even point for present situation is 20,000 units and 22,500 units in proposed situation. Upto the sales of 30,000 units present situation will yield more profit and beyond 30,000 units of sales proposed situation will give more profits. This is because once the fixed cost in proposed situation is recovered the profitability rate is more because of higher contribution per unit in comparison to the present situation.

Illustration 3

The sports material manufacturing company budgeted the following data for the coming year:

	Amount (₹)
Sales (1,00,000 units)	1,00,000
Variable cost	40,000
Fixed cost	50,000

Find out

(a) P/V Ratio, BEP and Margin of Safety

(b) Evaluate the effect of

- 20% increase in physical sales volume
- 20% decrease in physical sales volume
- 5% increase in variable costs
- 5% decrease in variable costs
- 10% increase in fixed costs
- 10% decrease in selling price and 10% increase in sales volume
- 10% increase in selling price and 10% decrease in sales volume
- ₹ 5,000 variable cost decrease accompanied by ₹ 15,000 increase in fixed costs.

Solution:

(a)	Income Statement	(₹)
	Sales (1,00,000 × ₹ 1 per unit)	1,00,000
	Less: Variable Cost (1,00,000 × ₹ 0.40)	40,000
	Contribution	60,000
	Less: Fixed Cost	50,000
	Profit	10,000

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{60,000}{1,00,000} \times 100 = 60\%$$

$$\text{BE Sales} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{\text{₹ } 50,000}{60\%} = \text{₹ } 83,333$$

$$\text{Margin of Safety} = \text{Sales} - \text{BEP Sales} = \text{₹ } 1,00,000 - \text{₹ } 83,333 = \text{₹ } 16,667$$

	Income Statement	P/V Ratio	BE Sales	MOS
(i) Increase in volume by 20%	₹ Sales (1,20,000 × 1) 1,20,000 Less: VC (1,20,000 × 0.4) 48,000 Contribution 72,000 FC 50,000	$= \frac{72,000}{1,20,000} \times 100$ $= 60\%$	$= \frac{50,000}{60\%}$ $= \text{₹ } 83,333$	$= 1,20,000 - 83,333$ $= \text{₹ } 36,667$
(ii) Decrease in volume by 20%	₹ Sales (80,000 × 1) 80,000 Less: VC (80,000 × 0.4) 32,000 Contribution 48,000 FC 50,000	$= \frac{48,000}{80,000} \times 100$ $= 60\%$	$= \frac{50,000}{60\%}$ $= \text{₹ } 83,333$	$= 80,000 - 83,333$ $= - \text{₹ } 3,333$
(iii) 5% Increase in Variable Cost	₹ Sales (1,00,000 × 1) 1,00,000 Less: VC (1,00,000 × 0.42) 42,000 Contribution 58,000 FC 50,000	$= \frac{58,000}{1,00,000} \times 100$ $= 58\%$	$= \frac{50,000}{58\%}$ $= \text{₹ } 86,207$	$= 1,00,000 - 86,207$ $= \text{₹ } 13,793$
(iv) 5% Decrease in Variable Cost	₹ Sales (1,00,000 × 1) 1,00,000 Less: VC (1,00,000 × 0.38) 38,000 Contribution 62,000 FC 50,000	$= \frac{62,000}{1,00,000} \times 100$ $= 62\%$	$= \frac{50,000}{62\%}$ $= \text{₹ } 80,645$	$= 1,00,000 - 80,645$ $= \text{₹ } 19,355$

	Income Statement	P/V Ratio	BE Sales	MOS
(v) 10% Increase in Fixed Cost	₹ Sales (1,00,000×1) 1,00,000 Less: VC (1,00,000 × 0.40) 40,000 Contribution 60,000 FC 55,000	$= \frac{60,000}{1,00,000} \times 100$ = 60%	$= \frac{55,000}{60\%}$ = ₹ 91,667	= 1,00,000 – 91,667 = ₹ 8,333
(vi) 10% Decrease in Fixed Cost	₹ Sales (1,00,000×1) 1,00,000 Less: VC (1,00,000 × 0.40) 40,000 Contribution 60,000 FC 45,000	$= \frac{60,000}{1,00,000} \times 100$ = 60%	$= \frac{45,000}{60\%}$ = ₹ 75,000	= 1,00,000 – 75,000 = ₹ 25,000
(vii) 10% Decrease in selling price and 10% increase in sales volume	₹ Sales (1,10,000 × 0.9) 99,000 Less: VC (1,10,000 × 0.40) 44,000 Contribution 55,000 FC 50,000	$= \frac{55,000}{99,000} \times 100$ 55.55%	$= \frac{50,000}{55.55\%}$ = ₹ 90,009	= 99,000 – 90,009 = ₹ 8,991
(viii) 10% Increase in selling price and 10% decrease in sales volume	₹ Sales (90,000 × 1.10) 99,000 Less: VC (90,000 × 0.40) 36,000 Contribution 63,000 FC 50,000	$= \frac{63,000}{99,000} \times 100$ = 63.63%	$= \frac{50,000}{63.63\%}$ = ₹ 78,579	= 99,000 – 78,597 = ₹ 20,421
(ix) ₹ 5,000 variable cost decrease accompanied by ₹15,000 increase in fixed cost	₹ Sales (1,00,000×1) 1,00,000 Less: VC (40,000 - 5,000) 35,000 Contribution 65,000 FC 65,000	$= \frac{65,000}{1,00,000} \times 100$ = 65%	$= \frac{65,000}{65\%}$ = ₹ 1,00,000	= 1,00,000 - 1,00,000 = Nil

Illustration 4

Two businesses AB Ltd and CD Ltd sell the same type of product in the same market. Their budgeted profits and loss accounts for the year ending 30th June, 2021 are as follows: Amount (₹)

	AB Ltd		CD Ltd	
Sales		1,50,000		1,50,000
Less: Variable costs	1,20,000		1,00,000	
Fixed Cost	15,000	1,35,000	35,000	1,35,000
Profit		15,000		15,000

You are required to calculate the BEP of each business and state which business is likely to earn greater profits in the following conditions:

- (a) Heavy demand for the product
- (b) Low demand for the product

Solution:

Statement showing computation of P/V Ratio, BEP and determination of Profitability in different conditions:

Particulars	AB Ltd (₹)	CD Ltd (₹)
Sales	1,50,000	1,50,000
Less: Variable Cost	1,20,000	1,00,000
Contribution	30,000	50,000
Less: Fixed Cost	15,000	35,000
Profit	15,000	15,000
$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sale}} \times 100$	$\frac{30,000}{1,50,000} \times 100 = 20\%$	$\frac{50,000}{1,50,000} \times 100 = 33\frac{1}{2}\%$
$BE \text{ Sales} = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}}$	$= \frac{15,000}{20\%} = ₹ 75,000$	$\frac{35,000}{33\frac{1}{2}\%} = ₹ 1,05,000$

- (a) When there is heavy demand for the product – Product produced by CD Ltd is profitable because the P/V Ratio is higher than AB Ltd.
- (b) When there is low demand for the product – Product produced by AB Ltd is profitable because fixed cost is less than CD Ltd. This is also revealed from the break even sales. The break even sales for AB Ltd is less than CD Ltd because the fixed cost of AB Ltd is less in comparison to CD Ltd.

Illustration 5

A factory is currently working to 40% capacity and produces 10,000 units. At 50% capacity the selling price falls by 3%. At 90% capacity the selling price falls by 5% accompanied by similar fall in prices of raw material. Estimate the profit of the company at 50% and 90% capacity production.

The cost at present per unit is:

Material ₹ 10

Labour ₹ 3

Overheads ₹ 5 (60% fixed)

The selling price per unit is ₹ 20 per unit.

Solution:

At 40% capacity, Production 10,000 units

Overheads per unit is ₹ 5 and 60% is fixed => Variable 40%

So, Variable cost per unit = $5 \times 40\% = ₹ 2$

Fixed Cost = $5 \times 60\% \times 10,000 = ₹ 30,000$

Statement showing Computation of Profit at 50% and 90% Capacity as well as at Current Capacity

Cost Accounting

	Particulars	40%		50%		90%	
	Production	10,000 units		$= \frac{10,000}{40\%} \times 50\%$ $= 12,500$ units		$= \frac{10,000}{40\%} \times 90\%$ $= 22,500$ units	
		Per unit	Total	Per unit	Total	Per unit	Total
		(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
i.	Selling Price	20.00	2,00,000	19.40	2,42,500	19	4,27,500
ii.	Variable Cost						
	Material	10.00	1,00,000	10.00	1,25,000	9.50	2,13,750
	Labour	3.00	30,000	3.00	37,500	3.00	67,500
	Variable Overheads	2.00	20,000	2.00	25,000	2.00	45,000
	Total Variable Cost	15.00	1,50,000	15.00	1,87,500	14.50	3,26,250
iii.	Contribution = Sales – Variable Cost	5.00	50,000	4.40	55,000	4.50	1,01,250
iv.	Fixed Cost		30,000		30,000		30,000
v.	Profit		20,000		25,000		71,250
vi.	BE Sales $= \frac{\text{Fixed Cost}}{\text{Contribution p.u.}} \times \text{Selling price p.u.}$		1,20,000		1,32,272		1,26,667

Illustration 6

The sales turnover and profit during two periods were as follows:

Period	Sales (₹)	Profit (₹)
1	2,00,000	20,000
2	3,00,000	40,000

What would be probable trading results with sales of ₹ 1,80,000? What amount of sales will yield a profit of ₹ 50,000?

Solution:

$$\text{P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{40,000 - 20,000}{3,00,000 - 2,00,000} \times 100 = \frac{20,000}{1,00,000} \times 100 = 20\%$$

	Period 1 (₹)	Period 2 (₹)	Proposed sales (₹)
Contribution	$2,00,000 \times 20\%$	$3,00,000 \times 20\%$	$1,80,000 \times 20\%$
= Sales × P/V Ratio	= 40,000	= 60,000	= 36,000
Less: Fixed Cost (Bal. fig.)	20,000	20,000	20,000
Profit	20,000	40,000	16,000

$$\text{So, Desired Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{20,000 + 50,000}{20\%} = \frac{70,000}{20} \times 100 = ₹ 3,50,000$$

Illustration 7

The following results of a company for the last years are as follows:

Year	Sales (₹)	Profit (₹)
2020	1,50,000	20,000
2021	1,70,000	25,000

You are required to calculate:

- P/V Ratio
- BEP
- The sales required to earn a profit of ₹ 40,000
- Profit when sales are ₹ 2,50,000
- Margin of safety at a profit of ₹ 50,000, and
- Variable Costs of the two periods

Solution:

$$(i) \quad P/V \text{ Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100$$

$$= \frac{25,000 - 20,000}{1,70,000 - 1,50,000} \times 100 = \frac{5,000}{20,000} \times 100 = 25\%$$

$$(ii) \quad \text{BEP (i.e. Break Even Sales)} = \frac{\text{Fixed Cost}}{P/V \text{ Ratio}} = \frac{\text{Sales} \times P/V \text{ Ratio} - \text{Profit}}{P/V \text{ Ratio}}$$

$$= \frac{1,50,000 \times 25\% - 20,000}{25\%} = \frac{17,500}{25\%} = ₹ 70,000$$

$$\text{Alternatively,} \quad = \frac{1,70,000 \times 25\% - 25,000}{25\%} = \frac{17,500}{25\%} = ₹ 70,000$$

$$(iii) \quad \text{Desired Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{P/V \text{ Ratio}}$$

$$= \frac{17,500 + 40,000}{25\%} = \frac{57,500}{25\%} = ₹ 2,30,000$$

$$(iv) \quad \text{Profit} = \text{Sales} \times P/V \text{ Ratio} - \text{Fixed Cost} = 2,50,000 \times 25\% - 17,500 = ₹ 45,000$$

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

$$(vi) \quad \text{Variable Cost Ratio} = 1 - P/V \text{ Ratio} = 1 - 25\% = 75\%$$

Variable Cost = Sales × Variable Cost Ratio

$$\text{Variable Cost for 2020} = 1,50,000 \times 75\% = ₹ 1,12,500$$

$$\text{Variable Cost for 2021} = 1,70,000 \times 75\% = ₹ 1,27,500$$

Illustration 8

The following is the statement of a Radical Co. for the month of June

Particulars	Products		Total (₹)
	L (₹)	M (₹)	
Sales	60,000	60,000	1,20,000
Less: Variable Costs	42,000	30,000	72,000
Contribution	18,000	30,000	48,000
Less: Fixed Cost			36,000
Net Income			12,000

You are required to compute the P/V Ratio for each product and then compute the P/V Ratio, Break Even Point and Net Income for the following assumption:

- Sales revenue divided as 60% to Product L & 40% to Product M
- Sales revenue divided as 40% to Product L & 60% to Product M

	Product L (₹)	Product M (₹)	Total (₹)
$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$	$= \frac{18,000}{60,000} \times 100 = 30\%$	$= \frac{30,000}{60,000} \times 100 = 50\%$	$= \frac{48,000}{1,20,000} \times 100 = 40\%$

Solution:

- Sales revenue divided 60% to Product L & 40% to Product M

Statement showing computation of P/V Ratio, Break Even Point and Net Income

	Product L (₹)	Product M (₹)	Total (₹)
Sales	$1,20,000 \times 60\% = 72,000$	$1,20,000 \times 40\% = 48,000$	1,20,000
Less: Variable Cost (Sales × Variable Cost Ratio)	$72,000 \times 70\% = 50,400$	$48,000 \times 50\% = 24,000$	74,400
Contribution (Sales × P/V Ratio)	$72,000 \times 30\% = 21,600$	$48,000 \times 50\% = 24,000$	45,600
Less: Fixed Cost			36,000
Net Income			9,600
$P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$	$\frac{21,600}{72,000} \times 100 = 30\%$	$\frac{24,000}{48,000} \times 100 = 50\%$	$\frac{45,600}{1,20,000} \times 100 = 38\%$
Break Even Sales $= \frac{\text{Fixed Cost}}{P/V \text{ Ratio}}$			$= \frac{36,000}{38\%} = 94,737$

- Sales revenue divided 40% to Product L & 60% to Product M

Statement showing computation of P/V Ratio, Break Even Point and Net Income

	Product L (₹)		Product M (₹)		Total (₹)
Sales	$1,20,000 \times 40\%$	48,000	$1,20,000 \times 60\%$	72,000	1,20,000
Less: Variable Cost	$48,000 \times 70\%$	33,600	$72,000 \times 50\%$	36,000	69,600
(Sales $\times$ Variable Cost Ratio)					
Contribution	$48,000 \times 30\%$	14,400	$72,000 \times 50\%$	36,000	50,400
(Sales $\times$ P/V Ratio)					
Less: Fixed Cost					36,000
Net Income					14,400
P/V Ratio	$\frac{14,400}{48,000} \times 100$		$\frac{36,000}{72,000} \times 100$		$\frac{50,400}{1,20,000} \times 100$
$= \frac{\text{Contribution}}{\text{Sales}} \times 100$	$= 30\%$		$= 50\%$		$= 42\%$
Break Even Sales					$= \frac{36,000}{42\%}$
$= \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$					$= 85,714$

Illustration 9

Accelerate Co. Ltd manufactures and sells four types of products under the brand name of A, B, C and D. The Sales Mix in value comprises $33\frac{1}{3}\%$, $41\frac{2}{3}\%$, $16\frac{2}{3}\%$ and $8\frac{1}{3}\%$, of products A, B, C and D respectively. The total budgeted sales at 100% are ₹ 60,000 p.m. Operating Costs are:

Variable Costs:

Product A 60% of selling price

Product B 68% of selling price

Product C 80% of selling price

Product D 40% of selling price

Fixed Costs: ₹ 14,700 p.m.

(a) Calculate the break even point for the products on overall basis

(b) Also calculate break even point, if the sales mix is changed as follows the total sales per month remaining the same. Mix: A – 25%, B – 40%, C – 30%, D – 5%.

Solution:

Calculation of Contribution of the Products

Particulars	Product A (₹)	Product B (₹)	Product C (₹)	Product D (₹)	Total (₹)
Sales	$60,000 \times 33\frac{1}{3}\%$ $= 20,000$	$60,000 \times 41\frac{2}{3}\%$ $= 25,000$	$60,000 \times 16\frac{2}{3}\%$ $= 10,000$	$60,000 \times 8\frac{1}{3}\%$ $= 5,000$	60,000
Less: Variable Cost	$60\% \times 20,000$ $= 12,000$	$68\% \times 25,000$ $= 17,000$	$80\% \times 10,000$ $= 8,000$	$40\% \times 5,000$ $= 2,000$	39,000

Cost Accounting

Particulars	Product A (₹)	Product B (₹)	Product C (₹)	Product D (₹)	Total (₹)
Contribution	8,000	8,000	2,000	3,000	21,000
Less: Fixed Cost					14,700
Profit					6,300
P/V Ratio = $\frac{\text{Contribution}}{\text{Sales}} \times 100$	$\frac{8,000}{20,000} \times 100$ = 40%	$\frac{8,000}{25,000} \times 100$ = 32%	$\frac{2,000}{10,000} \times 100$ = 20%	$\frac{3,000}{5,000} \times 100$ = 60%	$\frac{21,000}{60,000} \times 100$ = 35%

$$(a) \quad \text{Break Even Sales} = \frac{\text{Fixed Cost}}{\text{P / V Ratio}} = \frac{14,700}{35\%} = ₹ 42,000$$

Calculation of Contribution of the Products

Particulars	Product A (₹)	Product B (₹)	Product C (₹)	Product D (₹)	Total (₹)
Sales	$60,000 \times 25\% = 15,000$	$60,000 \times 40\% = 24,000$	$60,000 \times 30\% = 18,000$	$60,000 \times 5\% = 3,000$	60,000
Less: Variable Cost	$60\% \times 15,000 = 9,000$	$68\% \times 24,000 = 16,320$	$80\% \times 18,000 = 14,400$	$40\% \times 3,000 = 1,200$	40,920
Contribution	6,000	7,680	3,600	1,800	19,080
Less: Fixed Cost					14,700
Profit					4,380
P/V Ratio = $\frac{\text{Contribution}}{\text{Sales}} \times 100$	$\frac{6,000}{15,000} \times 100$ = 40%	$\frac{7,680}{24,000} \times 100$ = 32%	$\frac{2,600}{18,000} \times 100$ = 20%	$\frac{1,800}{3,000} \times 100$ = 60%	$\frac{19,080}{60,000} \times 100$ = 31.80%

$$(b) \quad \text{Break Even Sales} = \frac{\text{Fixed Cost}}{\text{P / V Ratio}} = \frac{14,700}{31.80\%} = ₹ 46,226$$

Illustration 10

Present the following information to show to management:

- The marginal product cost and the contribution per unit
- The total contribution and profits resulting from each of the following sales mix results:

Particulars	Product	Per unit
Direct Materials	A	10
Direct Materials	B	9
Direct Wages	A	3
Direct Wages	B	2

Fixed Expenses - ₹ 800

Variable expenses are allotted to products at 100% of Direct Wages

Sales Price A ₹ 20

Sales Price B ₹ 15

- Sales Mixtures:
- (a) 100 units of Product A and 200 units of Product B
 - (b) 150 units of Product A and 150 units of Product B
 - (c) 200 units of Product A and 100 units of Product B

Solution:

Statement showing Marginal Product Cost and Contribution per unit

Sl. No.	Particulars	Product A (₹)	Product B (₹)
i.	Selling Price per unit	20.00	15.00
ii.	Variable Cost		
	Direct Material cost per unit	10.00	9.00
	Direct Wages cost per unit	3.00	2.00
	Variable Expenses (100% of Direct Wages)	3.00	2.00
	Marginal Product Cost	16.00	13.00
iii.	Contribution per unit (i. – ii.)	4.00	2.00

Computation of Profit under Sales Mix (a)

Sl. No.	Particulars	Product A (₹)	Product B (₹)	Total (₹)
i.	No. of units	100	200	
ii.	Contribution per unit	4.00	2.00	
iii.	Total Contribution (i. × ii.)	400	400	800
iv.	Fixed Cost			800
v.	Profit (iii. – iv.)			Nil

Computation of Profit under Sales Mix (b)

Sl. No.	Particulars	Product A (₹)	Product B (₹)	Total (₹)
i.	No. of units	150	150	
ii.	Contribution per unit	4.00	2.00	
iii.	Total Contribution (i. × ii.)	600	300	900
iv.	Fixed Cost			800
v.	Profit (iii. – iv.)			100

Computation of Profit under Sales Mix (c)

Sl. No.	Particulars	Product A (₹)	Product B (₹)	Total (₹)
i.	No. of units	200	100	
ii.	Contribution per unit	4.00	2.00	
iii.	Total Contribution (i. × ii.)	800	200	1,000
iv.	Fixed Cost			800
v.	Profit (iii. – iv.)			200

Illustration 11

The following particulars are extracted from the records of a company:

		Per Unit	
		Product A	Product B
Sales	₹	100	120
Consumption of Material		2 kg	3 kg
Material cost	₹	10	15
Direct wages cost	₹	15	10
Direct expenses	₹	5	6
Machine hours used		3 hours	2 hours
Overheads expenses			
Fixed	₹	5	10
Variable	₹	15	20
Direct wages per hour is ₹ 5			

- (a) Comment on profitability of each product (both use the same raw material) when:
1. Total sales potential in units is limited;
 2. Total sales potential in value is limited;
 3. Raw material is in short supply;
 4. Production capacity (in terms of machine hours) is the limiting factor.
- (b) Assuming raw material as the key factor, availability of which is 10,000 kgs and each product cannot be sold more than 3,500 units, find out the product mix which will yield the maximum profit.

Solution:

- (a) Statement showing computation of contribution per unit of different factors of production and determination of profitability

Sl. No.	Particulars	Product A (₹)	Product B (₹)
i.	Selling price per unit	100	120
ii.	Variable Cost per unit		
	Material	10	15
	Labour	15	10
	Direct expenses	5	6
	Variable overheads	15	20
iii.	Total Variable Cost per unit	45	51
iv.	Contribution per unit (i. – iii.)	55	69
v.	$P/V \text{ Ratio} = \frac{\text{Contribution per unit}}{\text{Selling Price per unit}}$	55%	57.50%
vi.	Contribution per kg of material	$\frac{₹ 55}{2\text{kg}} = ₹ 27.50$	$\frac{₹ 69}{3\text{kg}} = ₹ 23$

Sl. No.	Particulars	Product A (₹)	Product B (₹)
vii.	Contribution per machine hour	$\frac{₹ 55}{3 \text{ hours}} = ₹ 18.33$	$\frac{₹ 69}{2 \text{ hours}} = ₹ 34.50$

From the above computation, we may comment upon the profitability in the following manner:

1. If total sales potential in units is limited, Product B is more profitable, it has more contribution per unit.
2. If total sales potential in value is limited, Product B is more profitable, because it has higher P/V Ratio.
3. If the raw material is in short supply, Product A is more profitable, because it has more contribution per kg of material.
4. If the production capacity is limited, Product B is more profitable, because it has more contribution per machine hour.

(b) Statement showing optimum product mix – when raw material is a limiting factor

Sl. No.	Particulars	Product A	Product B	Total
i.	No. of units	3,500	1,000	
		(₹)	(₹)	(₹)
ii.	Contribution per unit	55	69	
iii.	Total contribution	1,92,500	69,000	2,61,500
iv.	Fixed cost	$3,500 \times 5 = 17,500$	$3,500 \times 10 = 35,000$	52,500
v.	Profit (iii. – iv.)			2,09,000

Fixed cost is taken at maximum capacity

Working Notes

Available Material		10,000 kgs
Less: Utilized for Product A	$3,500 \text{ units} \times 2 \text{ kg/unit}$	7,000 kgs
Balance quantity available for Production of Product B		3,000 kgs

$$\text{Number of units of Production of Product B} = \frac{3000 \text{ kg}}{3 \text{ kg per unit}} = 1,000 \text{ units}$$

Illustration 12

A company has a capacity of producing 1 lakh units of a certain product in a month. The sales department reports that the following schedule of sales price is possible:

Volume of Production	Selling Price per unit
%	(₹)
60	0.90
70	0.80
80	0.75
90	0.67
100	0.61

Cost Accounting

The variable cost of manufacture between these levels is 15 paise per unit and fixed cost ₹ 40,000. Prepare a statement showing incremental revenue and differential cost at each stage. At which volume of production will the profit be maximum?

Solution:

Statement showing computation of differential cost, incremental revenue and determination of capacity at which profit is maximum:

Ca- pacity %	Units	Sales (₹)	Variable Cost @ ₹ 0.15 per unit (₹)	Fixed cost (₹)	Total Cost (₹)	Profit (₹)	Differ- ential Cost (₹)*	Incre- mental Revenue (₹)#
i.	ii.	iii.	iv.	v.	vi. = iv. + v.	vii. = iii. – vi.	viii.	ix.
60	60,000	54,000	9,000	40,000	49,000	5,000	-	-
70	70,000	56,000	10,500	40,000	50,500	5,500	1,500	2,000
80	80,000	60,000	12,000	40,000	52,000	8,000	1,500	4,000
90	90,000	60,300	13,500	40,000	53,500	6,800	1,500	300
100	1,00,000	61,000	15,000	40,000	55,000	6,000	1,500	700

*Differential Cost is the change in total cost with respect to previous year.

#Incremental Revenue is the change in the value of sales over previous year.

The incremental revenue is more than incremental cost up to 80% capacity, the profit is maximum at that capacity.

Illustration 13

A company is at present working at 90% of its capacity and producing 13,500 units per annum. It operates a flexible budgetary control system. The following figures are obtained from its budget:

	90% Amount (₹)	100% Amount (₹)
Sales	15,00,000	16,00,000
Fixed expenses	3,00,500	3,00,600
Semi-fixed expenses	97,500	1,00,500
Variable expenses	1,45,000	1,49,500
Units made	13,500	15,000

Labour and material costs per unit are constant under present conditions. Profit margin is 10%.

- You are required to determine the differential cost of producing 1,500 units by increasing capacity to 100%.
- What would you recommend for an export price for these 1,500 units taking into account that overseas prices are much lower than indigenous prices?

Solution:

Computation of Material and Labour cost

Particulars	Amount (₹)	Amount (₹)
Sales at present		15,00,000
Less: Profit @ 10%		1,50,000
Total Cost		13,50,000
Less: All costs other than material and labour		
Fixed expenses	3,00,500	
Semi fixed expenses	97,500	
Variable expenses	1,45,000	5,43,000
Material and Labour Cost		8,07,000

- (a) Statement showing differential cost of producing 1,500 units

Particulars	Amount (₹)
Material and Labour Cost = $\left(₹ 8,07,000 \times \frac{1,500 \text{ units}}{13,500 \text{ units}} \right)$	89,667
Fixed expenses (3,00,600 – 3,00,500)	100
Semi-fixed expenses (1,00,500 – 97,500)	3,000
Variable expenses (1,49,500 – 1,45,000)	4,500
Differential cost	97,267

- (b) Differential cost per unit =
- $\frac{₹ 97,267}{1,500 \text{ units}} = ₹ 64.84$

The minimum price for these 1,500 units should not be less than ₹ 64.84 for export.

Illustration 14

A company manufactures scooters and sells it at ₹ 3,000 each. An increase of 17% in cost of materials and of 20% of labour cost is anticipated. The increased cost in relation to the present sales price would cause at 25% decrease in the amount of the present gross profit per unit.

At present, material cost is 50%, wages 20% and overheads is 30% of cost of sales.

You are required to:

- Prepare a statement of profit and loss per unit at present
- Compute the new selling price to produce the same percentage of profit to cost of sales as before.

Solution:

Let the total cost per unit at present be ₹ X and Profit per unit be ₹ Y

Particulars	Present Cost Structure (₹)	Percentage increase/decrease	Anticipated Cost Structure (₹)
Material	0.50X	17% increase = $0.50X \times 117\%$	0.585X
Labour	0.20X	20% increase = $0.20X \times 120\%$	0.24X
Overheads	0.30X		0.30X
Total (Cost of Sales)	X		1.125X
Profit	Y	25% decrease = $Y \times 75\%$	0.75Y
Sales	3,000		3,000

So, two equations are $X + Y = 3,000$ (i)

and $1.125X + 0.75Y = 3,000$ (ii)

Multiplying equation (i) by 1.125 and subtracting equation (ii) from (i)

$$\begin{array}{rcl}
 1.125X + 1.125Y & = & 3,375 \\
 (-) \quad 1.125X + 0.75Y & = & 3,000 \\
 \hline
 0.375Y & = & 375
 \end{array}$$

or, $Y = 1,000$ or, Profit = ₹ 1,000

by putting the value of $Y = 1,000$ in equation (i)

or, $X + 1,000 = 3,000$

or, $X = 2,000$

or Total Cost = ₹ 2,000

(a) Statement showing Profit or Loss per unit at present

Particulars	Workings	(₹)
Material	$0.50 \times 2,000$	1,000
Labour	$0.20 \times 2,000$	400
Overheads	$0.30 \times 2,000$	600
Total Cost		2,000
Profit		1,000
Selling Price per unit		3,000

$$\text{Percentage of Profit on Sales} = \frac{\text{Profit}}{\text{Sales}} \times 100 = \frac{1,000}{3,000} \times 100 = 33 \frac{1}{3}\% = \frac{1}{3} \text{rd of Sales}$$

- (b) Computation of New Selling Price to get same percentage of profit on sales

Particulars	Workings	(₹)
Material	$0.585 \times 2,000$	1,170
Labour	$0.24 \times 2,000$	480
Overheads	$0.30 \times 2,000$	600
Total Cost		2,250
Profit	Bal. fig. on Sales $\times \frac{1}{3}$	1,125
Selling Price per unit	(Working Note)	3,375

Working Note

Cost + Profit = Sales

$$\text{or, } 2,250 + \frac{1}{3} \times \text{Sales} = \text{Sales}$$

$$\text{or, } \frac{1}{3} \times \text{Sales} = 2,250$$

$$\text{or Sales} = 3,375$$

Illustration 15

Mr. Young has ₹ 1,50,000 investment in a business. He wants a 15% profit on his money. From an analysis of recent cost figures, he finds that his variable cost of operating is 60% of sales; his fixed costs are ₹ 75,000 per year. Show supporting computations for each Solution:

- What sales volume must be obtained to break even?
- What sales volume must be obtained to his 15% return of investment?
- Mr. Young estimates that even if he closed the doors of his business, he would incur ₹25,000 expenses per year. At what sales would be better off by locking his sales up?

Solution:

Variable Cost Ratio = 60% (given)

$$\text{P/V Ratio} = 1 - \text{Variable Cost Ratio} = 1 - 60\% = 40\%$$

$$(a) \quad \text{Break Even Point (in ₹)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{75,000}{40\%} = ₹ 1,87,500$$

$$(b) \quad \text{Desired Profit} = 1,50,000 \times 15\% = ₹ 22,500$$

$$\text{Expected Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{75,000 + 22,500}{40\%} = ₹ 2,43,750$$

$$(c) \quad \text{Shut Down Sales} = \frac{\text{Fixed Cost} - \text{Shut Down Cost}}{\text{P/V Ratio}} = \frac{75,000 - 25,000}{40\%} = ₹ 1,25,000$$

Standard Costing and Variance Analysis

6.2

Efficient management of an organisation pivots on the two fundamental issues; planning and controlling. Planning is the fundamental management function, which involves deciding beforehand what is to be done, when is it to be done, how it is to be done and who is going to do it. Planning chalks out exactly, how to attain a specific goal. Controlling, on the other, enables the management to review the actual performance and locate the difference between the planned performance and actual performance. For evaluating performance, it is necessary to compare the actual performance with pre-determined targets. One of the important parameters of performance is the cost of production. It is of importance that the costs are monitored closely and there is a constant comparison of the actual costs with pre-determined targets.

It is important to note that costs may be classified either as historical cost or predetermined cost. Historical costs are 'incurred' costs and represent the cost of actual operational performance. However, for decision making purpose these costs are considered as irrelevant and pre-determined costs are considered as important. Pre-determined cost are also referred as future cost and are computed prior to actual production, on the basis of a specification of all the factors affecting cost. Pre-determined costs are estimated or standard costs.

6.2.1 Concept of Standard Cost and Standard Costing

Definitions

Standard cost

Para 4.32 of CAS 1 (Classification of Cost) defines standard cost as a predetermined cost of a product or service based on technical specifications and efficient operating conditions.

The same definition is reiterated in para 4.11 of CAS 6 (Material Cost) and para 4.15 of CAS 7 (Employee cost). However, the explanations provided by CAS, are different and elucidates two significant aspects of the notion of standard cost. In CAS 1 the following explanation to the definition is provided:

Standard costs are used as scale of reference to compare the actual cost with the standard cost with a view to determine the variances, if any, and analyse the causes of variances and take proper measure to control them.

While in CAS 6, the following explanation to the definition is provided:

The standard cost serves as a basis of cost control and as a measure of productive efficiency when ultimately posed with an actual cost. It provides management with a medium by which the effectiveness of current results is measured and responsibility for deviation is placed. Standard costs are used to compare the actual costs with the standard cost with a view to determine the variances, if any, and analyze the causes of variances and take proper measure to control them.

From the above it is obvious that standard costs are predetermined costs used for estimation and the following three points regarding standard cost emerge.

1. It is used as a scale of reference
2. It is used as a basis of cost control
3. It naturally fit in an integrated system of responsibility accounting.

CIMA Official Terminology¹ defines standard cost as planned unit cost of a product, component or service.

Standard Costing

Standard costing is a management accounting technique that is used to determine the expected costs of producing goods or services. It involves setting predetermined costs for various elements of production, such as materials, labour, and overheads, based on historical data, industry benchmarks, or engineering estimates. These predetermined costs, known as standard costs, serve as benchmarks against which actual costs are compared, allowing managers to identify variances and take corrective actions to control costs and improve efficiency.

CIMA Official Terminology¹ standard costing is a control technique that reports variances by comparing actual costs to pre-set standards so facilitating action through management by exception.

Thus we can state that Standard costing involves the following steps:

1. The establishment of predetermined estimates of the costs of products or services
2. The collection of actual costs
3. The comparison of the actual costs with the predetermined estimates.

The predetermined costs are known as standard costs and the difference between standard and actual cost is known as a variance. The process by which the total difference between standard and actual results is analyzed is known as variance analysis.

Two primary uses of standard costing are:

1. To value inventories and cost production for cost accounting purposes. It is an alternative method of valuation to methods like FIFO and LIFO.
2. To act as a control device by establishing standards (planned costs), highlighting (via variance analysis which we will cover in the next chapter) activities that are not conforming to plan and thus alerting management to areas which may be out of control and in need of corrective action.

Standard costing and Management by Exception (MBE)

Standard costs are average expected unit costs, because they are only averages and not a rigid specification actual results will vary to some extent. Standard costs can therefore be viewed as benchmarks for comparison purposes. Variances (the differences between standard costs and actual costs) should only be reported and investigated if there is a significant difference between actual and standard. The problem is in deciding whether a variation from standard should be considered significant and worthy of investigation. Tolerance limits can be set and only variances that exceed such limits would require investigation. Standard costing therefore enables the principle of management by exception.

CIMA Official Terminology¹ defines management by exception as 'the practice of concentrating on activities that require attention and ignoring those which appear to be conforming to expectations. Typically, standard cost variances or variances from budget are used to identify those activities that require attention.'

Standard Costs and Estimated Costs

Before proceeding with the intricacies it is important to distinguish between standard Costs and estimated costs.

¹ Certificate Paper C1 Fundamentals of Management Accounting, Chartered Institute of Management Accounting (CIMA)

Though both are predetermined costs, there are various differences, some of which are taken up for discussion, point wise:

1. Estimated Costs are intended to determine what the costs 'will' be. Standard Costs aim at what costs 'should' be.
2. Estimated cost is used in budgetary control system and historical costing system. Standard cost is ascertained and applied is standard costing system.
3. Estimated cost is used in decision making and selection of alternative with maximum profitability. It is also used in price fixation. Standard cost is used for analysis of variances and cost control purposes.
4. Estimated costs are based on average of past actual figures adjusted for anticipated changes in future. Anticipated wastes, spoilage and inefficiencies, all of which tend to increase costs are included in estimated costs. Standard costs are planned costs determined on a scientific basis and they are based upon certain assumed conditions of efficiency and other factors.
5. In estimated costing systems, stress is not so much on cost control, but costs are used for other purposes such as fixation of prices to be quoted in advance. Standard costs serve as effective tools for cost control.

Setting of Standard Costs

Setting of standard cost is an elaborate process which is sensitive as well. Exclusive operational knowledge is essential for setting standard costs. While setting production costs standards, the following preliminaries should be considered:

1. Study of the technical and operational aspects of the concern, such as methods of manufacture and the processes involved, management of organisation and line of assignment of responsibilities, division of the organisation into cost centres, units of measurement of input and output, anticipation of wastes, rejections and losses, expected efficiency, and capacity likely to be utilized.
2. Review of the existing costing system and the cost records and forms in use.
3. The type of standard to be used, i.e, whether current, basic, or normal standard costs are to be set. The choice of a particular type of standard will depend upon two factors, viz. which type would be most effective for cost control in the organisation, and whether the standards will be merged in the accounting system or kept outside the accounts as statistical data.
4. Proper classification of the accounts so that variances may be determined in the manner desired.
5. Fixation of responsibility for setting standards. As definite responsibility for variances from standards is ultimately to be laid on individuals or departments, it is but natural that all those individuals or departments should be associated with the setting of standards.
6. Further, two specific aspects need to be noted,
 - a. It is important to note that standards for each cost element are made up of a monetary component and a resources requirement component.
 - b. Though standard costs may be used in both absorption costing and in marginal costing systems it is generally designated to marginal costing systems.

Monetary Parts of Standards

Standard direct material prices - Direct material prices will be estimated by the purchasing department from their knowledge of the following:

- a. Purchase contracts already agreed
- b. Pricing discussions with regular suppliers

- c. The forecast movement of prices in the market
- d. The availability of bulk purchase discounts

Price inflation can cause difficulties in setting realistic standard prices. Suppose that a material costs ₹ 10 per kilogram at the moment and during the course of the next twelve months it is expected to go up in price by 20% to ₹ 12 per kilogram. What standard price should be selected?

- ⊙ If the current price of ₹ 10 per kilogram were used in the standard, the reported price variance will become adverse as soon as prices go up, which might be very early in the year. If prices go up gradually rather than in one big jump, it would be difficult to select an appropriate time for revising the standard.
- ⊙ If an estimated mid-year price (The average expected price for the year, say ₹ 11 per kilogram) were used, price variances should be favourable in the first half of the year and adverse in the second half of the year, again assuming that prices go up gradually throughout the year.

Standard direct labour rates - Direct labour rates per hour will be set by discussion with the personnel department and by reference to the payroll and to any agreements on pay rises with trade union representatives of the employees.

- a. A separate hourly rate or weekly wage will be set for each different labour grade/type of employee.
- b. An average hourly rate will be applied for each grade (even though individual rates of pay may vary according to age and experience).

Similar problems when dealing with inflation to those described for material prices can be met when setting labour standards.

Standard Resource Requirements

There are three aspects of standard resource requirement which are as follows:

- a. To estimate the materials required for making each product (material usage) and also the labour hours required (labour efficiency), technical specifications must be prepared for each product by production experts (either in the production department or the work study department).
- b. The 'standard product specification' for materials must list the quantities required per unit of each material in the product. These standard input quantities must be made known to the operators in the production department so that control action by management to deal with excess material wastage will be understood by them.
- c. The 'standard operation sheet' for labour will specify the expected hours required by each grade of labour in each department to make one unit of product. These standard times must be carefully set (for example by work study) and must be understood by the labour force. Where necessary, standard procedures or operating methods should be stated.

Taking account of wastage and losses

If, during processing, the quantity of material input to the process is likely to reduce (due to wastage, evaporation and so on), the quantity input must be greater than the quantity in the finished product and a material standard must take account of this.

Suppose that the fresh Lichi juice content of a litre of Purple Pop is 100ml and that there is a 10% loss of Lichi juice during process due to evaporation. The standard material usage of Lichi juice per litre of Purple Pop will be:

$$100 \text{ ml} \times \frac{100\%}{(100 - 10)\%} = 100 \text{ ml} \times \frac{100\%}{90\%} = 111.11 \text{ ml}$$

Problems in setting standards

The standard setting process is encountered with some difficulties in the stage of implementation. The below mentioned are some of the problems in the standard setting process:

1. Inflation needs to be incorporated into planned unit costs. The standard setting process must ensure the inclusion of methods to mitigate the issue inflation and rising prices into the planned costs.
2. It is an important issue that a performance standard is agreed upon by all who are instrumental in working with the performance standard which should be attainable and not too idealistic.
3. The quality of materials to be used is to be decided upon before a set of standard costs is agreed upon as a better quality of material will cost more, but perhaps reduce material wastage.
4. Estimating materials prices where seasonal price variations or bulk purchase discounts may be significant.
5. Finding sufficient time to construct accurate standards as standard setting can be a time-consuming process.
6. Incurring the cost of setting up and maintaining a system for establishing standards.
7. Dealing with possible behavioural problems, managers responsible for the achievement of standards possibly resisting the use of a standard costing control system for fear of being blamed for any adverse variances.

6.2.2 Advantages and Limitations

The advantages of standard costing

Though there are several advantages of standard costing, the following are more important:

1. Carefully planned standards aids the budgeting process.
2. Standard costs provide a yardstick against which actual costs can be measured.
3. The setting of standards involves determining the best materials and methods which may lead to cost economies.
4. A target of efficiency is set for employees to reach and cost consciousness is stimulated.
5. Variances can be calculated which enable the principle of 'management by exception' to be operated.
6. Only the variances which exceed acceptable tolerance limits need to be investigated by management with a view to control action.
7. Standard costs simplify the process of bookkeeping in cost accounting, because they are easier to use than LIFO, FIFO and weighted average costs.
8. Standard times simplify the process of production scheduling.
9. Standard performance levels might provide an incentive for individuals to achieve targets for themselves at work.

Types of Standard

A standard is a norm against which the actual performance can be measured. The objective of setting standards is to measure efficiency and to monitor costs by assigning responsibility for deviations from the standards. Also, a standard can motivate employees by providing a goal for achievement, but the moot question that often arises is, "What is the proper standard to use?" A company can estimate materials, labour, and factory overheads usage and

costs, but what about the unforeseen costs, such as spoilage, lost time, and equipment breakdowns? Should these items be considered in determining the standard cost to manufacture a product? This issue is attempted to be solved if the types of standards are discussed. As such two specific type of standard may be set which depends on the top management. The two basic type of standards are:

- ◉ Ideal standard
- ◉ Attainable standard

Ideal standard

Some companies set their standards at the maximum degree of efficiency. Using such an ideal standard, they determine costs by considering estimated materials, labour, and overheads costs; the condition of the factory and machinery; and time for rest periods, holidays, and vacations—but make no allowances for inefficient conditions such as lost time, waste, or spoilage. This ideal standard can be achieved only under the most efficient operating conditions; therefore, it is practically unattainable, generally giving rise to unfavourable variances. Companies using this type of standard feel that it provides a maximum objective for which to strive in the attempt to improve efficiency. There is, however, a psychological disadvantage—factory personnel may become discouraged and lose their incentive to meet standards that are usually impossible to attain except under perfect operating conditions.

Attainable standards

From the potential problems of the ideal standard as discussed in the previous paragraph most companies set attainable standards that include such factors as lost time and normal waste and spoilage. These companies realize that some inefficiencies cannot be completely eliminated, so they design standards that can be met or even bettered in efficient production situations. The primary concern of the manufacturer should be to set standards that are high enough to provide motivation and promote efficiency, yet not so high that they are unattainable and, thus, bad for worker morale.

Some authors prefer the following categorization:

Ideal standards are based on the most favourable operating conditions, with no wastage, no inefficiencies, no idle time and no breakdowns. These standards are likely to have an unfavourable motivational impact, because employees will often feel that the goals are unattainable and not work so hard.

Attainable standards are based on efficient (but not perfect) operating conditions. Some allowance is made for wastage, inefficiencies, machine breakdowns and fatigue. If well-set they provide a useful psychological incentive, and for this reason they should be introduced whenever possible. The consent and co-operation of employees involved in improving the standard are required.

Current standards are standards based on current working conditions (current wastage, current inefficiencies). The disadvantage of current standards is that they do not attempt to improve on current levels of efficiency, which may be poor and capable of significant improvement.

Basic standards are standards which are kept unaltered over a long period of time, and may be out-of-date. They are used to show changes in efficiency or performance over an extended time period. Basic standards are perhaps the least useful and least common type of standard in use.

Criticisms of standard costing

Critics of standard costing have argued that standard costing is not appropriate in the modern business environment².

² <https://www.ukessays.com/essays/accounting/is-standard-costing-relevant-in-a-modern-business-environment.php#:~:text=Even%20though%20accountants%20believed%20that%20standard%20costing%20is,modern%20businesses%20%28Fleischman%20and%20Tyson%202008%2C%20pp.%20342%29.>

They have put forward various reasons in favour their argument, some of those are listed in the next few lines:

- a. The use of standard costing relies on the existence of repetitive operations and relatively homogeneous output. Nowadays many organisations are forced continually to respond to customers' changing requirements, with the result that output and operations are not so repetitive.
- b. Standard costing systems were developed when the business environment was more stable and less prone to change. The current business environment is more dynamic and it is not possible to assume stable conditions.
- c. Standard costing systems assume that performance to standard is acceptable. Today's business environment is more focused on continuous improvement.
- d. Standard costing was developed in an environment of predominantly mass production and repetitive assembly work. It is not particularly useful in today's growing service sector of the economy.

Use of Standard Costing

Standard costing is a cost accounting method widely used in various industries, including the Indian industry, for several practical purposes. It is employed to project the profit level of the business at any production level, aid in effective management functions such as planning and cost control, analyze the impact of cost changes on sales volume, measure production efficiency, evaluate segment performance, identify and measure variances between standards and actuals, and design performance measurement systems to encourage employee participation. For example, in the automobile industry, standard costing is used to determine the cost of production of a car by assigning overheads costs to the products. Similarly, in the pharmaceutical industry, it is used to determine the cost of production of a drug by assigning overheads costs to the products.

Standard Costing and budgetary control

Budgetary control and standard costing have the common objective of cost control by establishing pre-determined targets. These two techniques are similar in certain respects but differ in respect of other points. Budgetary control is a system of planning and controlling costs. It involves the establishment of budgets, measurement of actual performance, comparison of actual performance with budgeted performance to develop the deviations and the analysis of the causes of variations for taking appropriate remedial steps.

A contrast between standard costing and budgetary control is presented below:

Aspect	Standard Costing	Budgetary Control
Definition	Standard costing is a technique used to set predetermined costs for various elements of production, such as materials, labour, and overheads, to establish benchmarks for comparison with actual costs.	Budgetary control involves the establishment of budgets (financial plans) for various functions or activities within an organization and comparing actual performance against these budgets to monitor and control financial activities.
Focus	Focuses on setting predetermined costs for individual cost elements involved in the production process.	Focuses on setting financial targets for overall performance, including revenues, expenses, and profits, across different functions or departments within the organization.
Time Horizon	Typically short-term in nature, focusing on costs incurred during the production process.	Can be short-term or long-term, depending on the budget period set by the organization, but often covers a fiscal year.

Purpose	Primarily aimed at cost control and performance evaluation by comparing actual costs with standard costs to identify variances and take corrective actions.	Aimed at planning, coordinating, and controlling overall financial activities by setting targets, allocating resources, and evaluating performance against budgeted figures.
Scope	Primarily used in manufacturing industries where production costs are a significant component of overall expenses.	Applicable to various types of organizations across different sectors, including manufacturing, service, and non-profit organizations.
Flexibility	Less flexible compared to budgetary control as it focuses on predetermined costs based on historical data or industry standards.	More flexible as it allows for adjustments to budgets based on changing circumstances, such as economic conditions or business priorities.
Control Mechanism	Focuses on controlling costs through variance analysis and corrective actions to ensure that actual costs align with predetermined standards.	Focuses on controlling overall financial performance by monitoring actual performance against budgeted targets and taking corrective actions to address any deviations.
Performance Evaluation	Evaluates performance based on cost variances between actual and standard costs, focusing on efficiency and cost-effectiveness in production.	Evaluates performance based on variances between actual and budgeted figures across different financial categories, providing insights into overall financial health and performance.

6.2.3 Computation and Analysis of Variances (Material and Labour Costs only)

Variance Analysis

Once the standards are set, the next step is to compare the set standard with the actual results of a reporting period (week, month, quarter, year). The actual results achieved by an organisation during a reporting period will, in all likelihood, be different from the expected results (costs and revenues).

The top management spends considerable time and trouble setting standards. If the actual results turn out to be different from the standards, the top management is interested to investigate into the variances between the actual and the standard for control purpose, but prior to any investigation of the variances or fixation of responsibility the wise manager will consider the differences that have occurred and use the results of these considerations to assist in attempts to attain the standards.

Variances measure the difference between actual results and expected results. The process by which the total difference between standard and actual results is analyzed is known as variance analysis. The first step after finding out the deviations is to calculate the deviations which are either variances in sales revenue or variances in costs.

CIMA Official Terminology¹ defines Variance as the difference between a planned, budgeted, or standard cost and the actual cost incurred. The same comparisons may be made for revenues.

CIMA Official Terminology¹ defines Variance analysis as the evaluation of performance by means of variances, whose timely reporting should maximize the opportunity for managerial action.

Explanation to the definition of standard cost in para 4.32 of CAS 1 (Classification of Cost) states that Standard costs are used as scale of reference to compare the actual cost with the standard cost with a view to determine the variances, if any, and analyse the causes of variances and take proper measure to control them.

Thus, the main purpose of standard costs is comparison with actual costs and their analysis of causes of variance.

This enable the management to take proper measure to control the variances.

It is obvious that variances must be measured before they are analysed and managed³.

In the following chart a comprehensive classification of variances is considered.

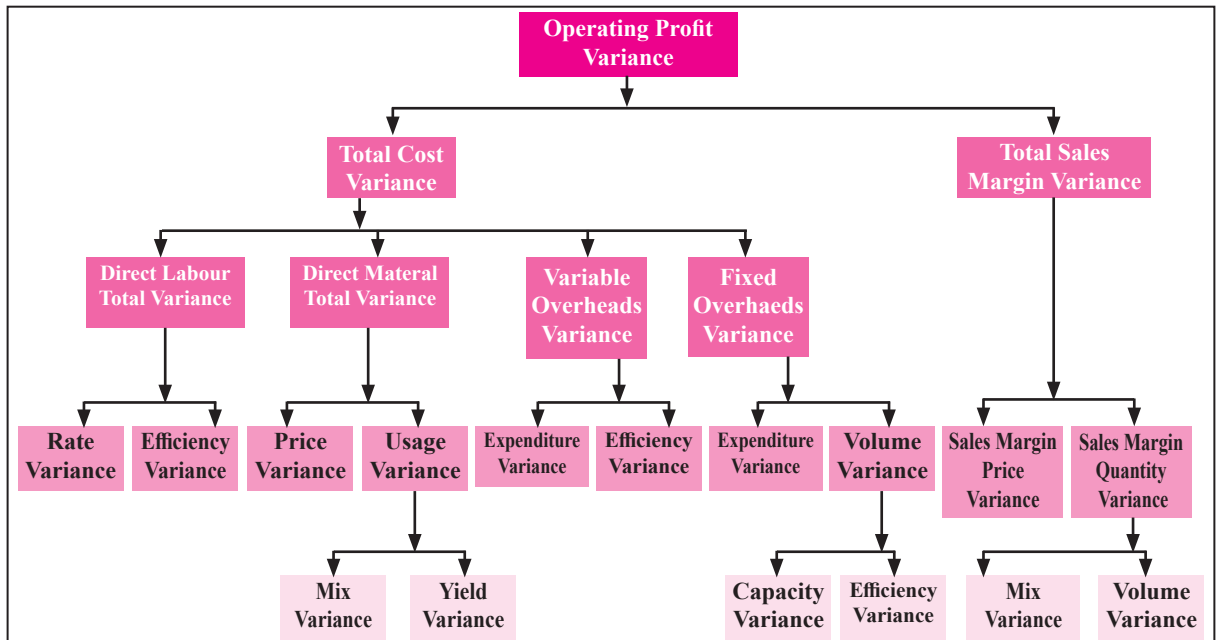


Figure 6.9: Chart of common variances [adapted from Lucey, T. (1996). Costing, 5th ed.]

Variances are, as such, are either:

- ⊙ **Favourable** - A favourable variance is achieved when the actual performance is better than the expected results.
- ⊙ **Adverse** - An adverse variance is achieved when the actual performance is worse than the expected results.

In terms of cost, when the actual cost is less than the standard cost it is advantageous to the management and is thus termed favourable variance. On the other, when actual cost is more than standard cost it is disadvantageous to the management and is referred as adverse variance.

Computation of Variances

After setting the standards and standard costs for various elements of cost, the next important step is to compute variances for each element of cost. Variance is the difference between the standard cost and the actual cost. In other words, it is the difference between what the cost should have been and what is the actual cost. These are either favourable or adverse. Element wise computation of variances⁴ is taken up for discussion in the following lines:

³ A conceptual understanding of variance analysis is available at <https://corporatefinanceinstitute.com/resources/knowledge/accounting/variance-analysis/>

⁴ It is important to note that the variance analysis is being introduced in this module and as such only direct material cost variances and direct labour cost variances are covered up in this module. Variable overheads variances, fixed overheads variances, sales variances and other advanced topics in variance analysis would be covered up in Paper 12 and Paper 16.

Material Cost Variance

The main objective is to find out the difference between the standard cost of material used for actual production and actual cost of material used. Thus, the main variance in this category is the material cost variance, which is thereafter categorised into other variances.

CIMA Official Terminology⁵ defines the direct material total variance as the measurement of the difference between the standard material cost of the output produced and the actual material cost incurred.

The formula for calculating material cost variance is given as under:

Material cost variance = (standard material cost of output produced – actual cost of material purchased)⁶

The direct material total variance (the difference between what the output actually cost and what it should have cost, in terms of material) can be divided into the following:

- **Direct Material Price Variance** - this variance arises due to changes in prices of direct materials and as such, due to the external factors and may be referred as uncontrollable variance.
- **Direct Material Usage Variance** – this variance arises due to internal factors of using materials more than what is stipulated for the purpose. This is, as such, a controllable variance. For investigating into the reason for such internal deviations of usage of direct material, this variance is subdivided into the following two:
 - ⊙ **Mix variance** – this variance arises as the actual mix of materials used (given that two or more materials is used) is different from the standard mix of materials recommended.
 - ⊙ **Yield variance** - in any manufacturing process, some unavoidable loss always takes place. The normal loss is always anticipated and taken into consideration while determining the standard quantity. Yield variance arises when the actual loss is more or less than the normal loss.

Following is a pictorial representation of direct material cost variance and its classifications:

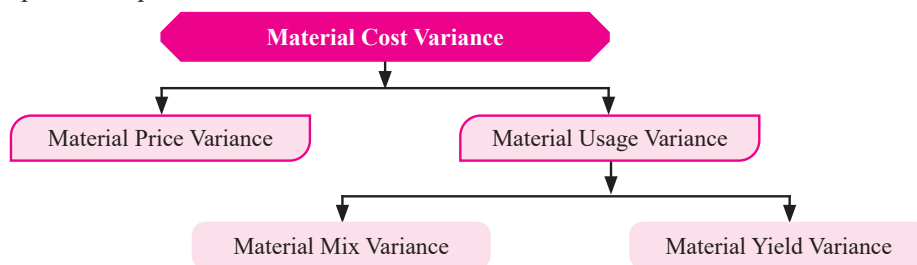


Figure 6.10: Classification of Material Cost Variance

Material Price Variance

One of the reasons for difference between the standard material cost and actual material cost is the difference between the standard price and actual price. Material price variance measures the difference between the standard price and actual price with reference to the actual quantity consumed.

CIMA Official Terminology⁵ defines the direct material total variance as the measurement of the difference between the standard material cost of the output produced and the actual material cost incurred.

The formula for calculating the material price variance is given as under:

⁵ CIMA Official Terminology, 2005, The Chartered Institute of Management Accountants (CIMA Publishing, an imprint of Elsevier).

⁶ This may be derived into AQAP (actual quantity × actual price) – standard cost of actual yield.

Material price variance

$$\begin{aligned} &= \{(\text{actual quantity of material purchased} \times \text{standard price}) - \text{actual cost of material purchased}\} \\ &= \text{Actual Quantity (Standard Price – Actual Price)}^7 \end{aligned}$$

It is important to note that there might be a situation where the quantities of material purchased and used are different, then as per the guidelines of CIMA Official Terminology¹, the total variance should be calculated as the sum of the usage and price variances.

Material Usage Variance

This is the difference between the standard quantity of materials that should have been used for the number of units actually produced, and the actual quantity of materials used, valued at the standard cost per unit of material. In other words, it is the difference between how much material should have been used and how much material was used, valued at standard cost.

CIMA Official Terminology¹ defines the direct material total variance as the measurement of efficiency in the use of material, by comparing standard material usage for actual production with actual material used, the difference is valued at standard cost.

The formula for calculating material usage variance is given as under:

Material usage variance

$$\begin{aligned} &= ((\text{actual production} \times \text{standard material per unit} - \text{actual material usage}) \times \text{standard cost per kg, litre, other}) \\ &= \text{Standard Price [Standard Quantity – Actual Quantity]}^8 \end{aligned}$$

The direct material usage variance may be divided into mix and yield variances if several materials are mixed in standard proportions which are taken up for discussion in a later paragraph.

Solved Case 1

In a particular situation, ASA Ltd., furnishes the following information:

Standard quantity of materials for producing 1 unit of finished product 'P' is 5 kg. The standard price is ₹6 per kg. During a particular period, 500 units of 'P' were produced. Actual material consumed was 2700 kg at a cost of ₹16,200. The owner, Subbuji requests his son, Nikhil, to calculate the direct material cost variances from the above data.

Solution:

Nikhil, Subbuji's son, who is a Cost Accountant uses the usual formulae for calculating the direct material cost variances as follows:

$$\begin{aligned} \text{Material cost variance} &= (\text{standard material cost of output produced} - \text{actual cost of material purchased}) \\ &= (500 \text{ units} \times 5 \text{ kg} \times ₹6) - 16200 \\ &= 15000 - 16200 \\ &= 1200 \text{ (A)}^9 \end{aligned}$$

7 This may be derived into AQAP (actual quantity × actual price) – AQSP (actual quantity × standard price)

8 This may be derived into AQAP (actual quantity × actual price) – standard cost of actual yield.

9 It is an adverse variance as the actual cost (₹16,200) is more than the standard cost (₹15,000), the cost that was stipulated for the production of 500 units.

Material price variance

$$= \text{Actual Quantity (Standard Price – Actual Price)}^{10} = 2700 \times (6 - 6) = \text{nil}$$

Material usage variance

$$= \text{Standard Price [Standard Quantity – Actual Quantity]} = 6 (2500 - 2700) = 1200 \text{ (A)}$$

The results put forward by Nikkhil, perplexed Subbuji who requested his son to present a layman's understanding on the variances calculated and presented. As a response, Nikkhil presented the following to his father:

The direct material total variance

This is the difference between what 500 units should have cost and what they did cost.

	(₹)
500 units should have cost (500 units × 5kg × ₹6 per kg)	15,000
But did cost (actual cost of actual yield)	16,200
Difference (Variance)	1,200

The variance is adverse because the yield costs more than what they should have cost.

The direct material total variance into its two constituent parts:

- The direct material price variance (since prices may have gone up or down)
- The direct material usage variance (internal issues of using more/less than what is stipulated).

The direct material price variance

This is the difference between what 2700 kgs should have cost and what 2700 kgs did cost.

	(₹)
2700 kg should have cost @ ₹ 6 per kg	16,200
But did cost (actual cost of material used)	16,200
Difference (Variance)	nil

The direct material usage variance

This is the difference between how many kilograms of material should have been used to produce 500 units of P and how many kilograms were used, valued at the standard cost per kilogram.

	(₹)
500 units should have used (500 units × 5kg)	2,500 kgs
But actual usage is	2,700 kgs
Excess usage	200 kgs
Excess usage valued at standard cost of ₹ 6 per kg (200 × 6)	1200 (A)

¹⁰ The actual price per kg is ₹ 6 (2700 kg of material is purchased at ₹16,200).

Excess usage valued at standard price results in disadvantageous and is adverse¹¹.

Summary,

Direct material cost variance = 1200 (A)

This comprise of

- ⊙ Direct material price variance = nil
- ⊙ Direct material usage variance = 1200 (A)

Further classification of direct material usage variance

It is noted in an earlier line that the direct material usage variance may be divided into:

- ⊙ Direct material mix variance
- ⊙ Direct material yield variance.

Direct material mix variance

The direct material mix variance may arise when two or more types of raw materials are mixed to produce the final product. In such cases, standard proportion of mixture is pre-determined. For example, in manufacturing one unit of product 'Q', material X and Y may have to be mixed in a standard proportion of 3:2. This is called as the standard mix.

However, when the actual production ensues, it is found that the actual mix may have to be changed due to several reasons like non-availability of a particular material etc. In such cases material mix variance arises.

CIMA Official Terminology¹ notes that the direct material mix variance is a subdivision of the material usage variance. If different materials can be substituted, the mix variance measures the cost of any variation from the standard mix of material.

Direct material mix variance

= {(quantity of material based on total material quantity split in standard proportions – actual quantity of material) × standard cost per kg, litre, other}},

This may be simplified and represented as

= **Standard Cost of Standard Mix – Standard Cost of Actual Mix**¹²

Material Yield Variance

In any manufacturing process, some unavoidable loss always takes place. Thus, if the input is 100, output may be 96, four units is the normal loss which is unavoidable in nature. The normal loss is always anticipated and taken into consideration while determining the standard quantity. Yield variance arises when the actual loss is more or less than the normal loss.

CIMA Official Terminology¹ makes the following observation:

Direct material yield variance is subdivision of the material usage variance. It measures the effect on cost of any difference between the actual usage of material and that justified by the output produced. It is recommended that the variance be calculated in total and not for individual material inputs.

11 Under the given circumstances, the total direct material cost variance is due to the excess usage and is attributable to the direct material usage variance as the direct material price variance is nil.

12 This is also written as [AQSP (actual quantity × standard price) – RSQSP (revised standard quantity × standard price)]

Material yield variance

$$= \{(\text{standard material quantity required for actual output} - \text{actual material quantities used in standard proportions}) \times \text{standard cost per kg, litre, other}\}$$

It is also written as,

$$\text{Material Yield Variance} = \text{SYR} [\text{Actual Yield} - \text{Standard Yield}]^{13}$$

SYR = Standard Yield Rate, i.e. standard cost per unit of standard output.

It follows that:

Direct material usage variance

$$= \text{direct material mix variance} + \text{direct material yield Variance}$$

Solved Case 2

Suppose that the Mr Arun Singji, the owner of Lotus Ltd. is worried about the variances in the direct material cost in his fountain pen manufacturing unit, Lotus Ltd. In the manufacturing unit he has adopted standard costing system and for a particular month he extracts following information:

Standard:	Material for 70 kg finished products	100 kg.
	Price of material	₹ 1 per kg
Actual:	Output	2,10,000 kg.
	Material used	2,80,000 kg.
	Cost of Materials	₹ 2,52,000

Mr Arun asks his Cost Accountant to calculate the direct material variances and reports the same to him.

Solution:¹⁴

- A. Actual Quantity [AQ] × Actual Price [AP] or AQAP = ₹2,52,000 (given)
 - B. Actual Quantity [AQ] × Standard Price [SP] or AQSP = 2,80,000 Kgs (material used) × ₹1 = ₹ 2,80,000
 - C. NIL (as only one material is used in production)
 - D. Standard Material Cost for Actual yield¹⁵ = [(100 kgs × ₹1) ÷ 70 kgs] × 210000 kgs = ₹ 3,00,000
- Material Cost Variance = D – A = ₹48,000 (Favourable¹⁶)
- Material Price Variance = B – A = ₹28,000 (Favourable¹⁷)
- Material Usage Variance = D – B = ₹20,000 (Favourable¹⁷)

Note:

Students need to be careful in calculating D i.e., Standard Material Cost for Actual Yield.

For every 100 kgs of input only 70 kgs is the output or actual yield.

¹³ This is also written as [RSQSP (revised standard quantity × standard price) – standard material cost of actual yield]

¹⁴ It is very important to note that the formulae for calculation has been recommended by CIMA official terminology (mentioned in note 6). The format for working is the author's way of representation and is for illustrative purpose only. Students are advised to refer to the working note format for understanding purpose only.

¹⁵ This is also referred as Standard Cost of Standard Material (SQSP).

¹⁶ Actual Material Cost is lower than what has been stipulated (Standard) for the actual production. Thus, favourable variance, implying efficiency regarding Material Cost.

Thus, standard cost for one kg of actual yield = $\frac{(100\text{kg} \times ₹ 1)}{70\text{kg}} = ₹ 1.42857$

for total actual yield (210000 kgs) standard cost of actual yield = $2,10,000 \text{ kgs} \times ₹ 1.42857 = ₹ 3,00,000$

Alternatively, students may use traditional formulae to calculate the variances. This is given as under:

Material Usage Variance = $(\text{SQ} - \text{AQ}) \times \text{SP}$

Material Price Variance = $(\text{SP} - \text{AP}) \times \text{AQ}$

Material Cost Variance = $(\text{SQ} \times \text{SP}) - (\text{AQ} \times \text{AP})$

Before proceeding the following working is required.

Standard Quantity of input for actual output (SQ) = $2,10,000 \text{ kg} \times \frac{100 \text{ kg}}{70 \text{ kg}} = 3,00,000 \text{ kg}$.

Actual Price (AP) = $\frac{₹ 2,52,000}{2,80,000 \text{ kg}} = ₹ 0.9 \text{ per kg}$

And the calculations would be

Material Cost Variance = $(300000 \times ₹ 1) - (280000 \times ₹ 0.90) = 48000 \text{ (F)}$

Material Price Variance = $(₹ 1 - ₹ 0.90) \times 280000 = 28000 \text{ (F)}$

Material Usage Variance = $(300000 - 280000) \times ₹ 1 = 20000 \text{ (F)}$

Reconciliation

Material Cost Variance = Material Price Variance + Material Usage Variance

$48000 \text{ (F)} = 28000 \text{ (F)} + 20000 \text{ (F)}$

Solved Case 3

Suppose that in a particular production process two material, material A and material B, are used to produce a chemical mixture called 'P'.

The standard cost of the chemical mixture 'P' is as follows:

40% material A at ₹20 per kg.

60% material B at ₹30 per kg.

A standard loss of 10% of input is expected in production.

The cost records for a period showed the following usage:

90 kg material A at a cost of ₹18 per kg.

110 kg material B at a cost of ₹34 per kg.

In a particular month the quantity produced of product 'P' was 182 kg.

The owner asks the cost accountant of the company to calculate the material variances.

Solution:**Working**

A. AQAP {Actual Quantity [AQ]× Actual Price [AP]}

$$(\text{Material A: } [90 \times ₹ 18] = 1620 + \text{Material B: } [110 \times 34] = 3740) = 5360$$

B. AQSP {Actual Quantity [AQ]× Standard Price [SP]}

$$(\text{Material A: } [90 \times 20] = 1800 + \text{Material B: } [110 \times 30] = 3300) = 5100$$

C. RSQSP {Actual Quantity in Standard Mix × Standard Price [SP]}

$$(\text{Material A: } [200 \text{ kg} \times 40\% \times 20] = 1600 + \text{Material B } [200 \text{ kg} \times 60\% \times 30 = 3,600]) = 5,200$$

D. Standard material cost for actual yield

$$= \frac{₹ 200 \text{ kg} \times 40\% \times 20 + 200 \text{ kg} \times 60\% \times 30}{180 \text{ kg}} \times 182 \text{ kg} = \frac{5200}{180} \times 182 = \mathbf{5257.78}$$

$$\text{Material cost variance} = \text{AQAP} - \text{standard material cost for actual yield} = (\text{A} - \text{D}) = 102.22 \quad (\text{A})$$

$$\text{Material price variance} = \text{AQAP} - \text{AQSP} = (\text{A} - \text{B}) = 260 \quad (\text{A})$$

$$\text{Material usage variance} = \text{AQSP} - \text{standard material cost for actual yield} = (\text{B} - \text{D}) = 157.78 \quad (\text{F})$$

$$\text{Material mix variance} = \text{AQSP} - \text{RSQSP} = (\text{B} - \text{C}) = 100 \quad (\text{F})$$

$$\text{Material yield variance} = \text{RSQSP} - \text{standard material cost for actual yield} = (\text{C} - \text{D}) = 57.78 \quad (\text{F})$$

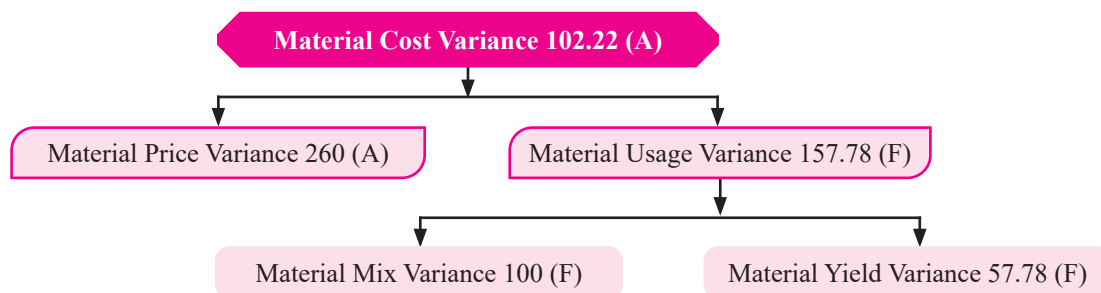
Reconciliation

Figure 6.11: Reconciliation of Material Cost Variance

Solved Case 4

Suppose that in a factory, Chemical A, B and C are mixed to manufacture Chemical D. After elaborate discussion with various stakeholders the following standards for material cost was designed.

The standard material cost for 100 kg of output, Chemical D, is made up of:

Chemical A 30 kg. @ ₹4 per kg

Chemical B 40 kg. @ ₹5 per kg

Chemical C 80 kg. @ ₹6 per kg

For a particular period 500 kg. of Chemical D was produced from a mix of:

Chemical A 140 kg. @ ₹588

Chemical B 220 kg. @ ₹1,056

Chemical C 440 kg. @ ₹2,860

How do yield mix and price of factors contribute to the variance in the actual cost per 100 kg. of chemical D over the standard cost?

Solution:

Working note 1

It is given in the problem that 500 kg. of chemical D were produced from a mix of:

Chemical A 140 kg. @ ₹588

Chemical B 220 kg. @ ₹1,056

Chemical C 440 kg. @ ₹2,860

Thus, for 100 kg (as required in the problem)

$$\text{Chemical A} = \frac{140}{500} \times 100 = 28 \text{ kg}$$

$$\text{Chemical B} = \frac{220}{500} \times 100 = 44 \text{ kg}$$

$$\text{Chemical C} = \frac{440}{500} \times 100 = \frac{88 \text{ kg}}{160 \text{ kg}}$$

and

Actual price of Chemical A = 4.2 (588 ÷ 140),

Actual price of Chemical B = 4.8 (1056 ÷ 220) and

Actual price of Chemical C = 6.5 (2860 ÷ 440).

Working note 2

$$\text{Total actual Qty (input)} = \frac{800 \text{ kg } (140 + 220 + 440)}{5} = 160 \text{ kg (for 100 kg of Chemical D, output)}$$

Revised Actual Qty (in Standard Mix)

$$\text{Chemical A} = 160 \times \frac{30}{150} = 32 \text{ kg}$$

$$\text{Chemical B} = 160 \times \frac{40}{150} = 42.67 \text{ kg}$$

$$\text{Chemical C} = 160 \times \frac{80}{150} = 85.33 \text{ kg}$$

A. Actual Quantity [AQ] × Actual Price [AP] or **AQAP**

$$(\text{Material A: } [28 \times 4.2] = 117.6 + \text{Material B: } [44 \times 4.8] = 211.2 + \text{Material C: } [88 \times 6.5] = 572) = 900.80$$

B. Actual Quantity [AQ] × Standard Price [SP] or AQSP

(Material A: $[28 \times 4] = 112$ + Material B: $[44 \times 5] = 220$ + Material C: $[88 \times 6] = 528$) = 860

C. Actual Quantity in Standard Mix × Standard Price [SP] or RSQSP

(Material A: $[32 \times 4] = 128$ + Material B: $[42.67 \times 5] = 213.33$ + Material C: $[85.33 \times 6] = 512$) = 853.33

D. Standard material cost for actual yield

$$\frac{(30 \times 4 + 40 \times 5 + 80 \times 6)}{100 \text{ kg}} \times 100 \text{ kg} = (120 + 200 + 480) = 800$$

Material Cost Variance = D – A = ₹ 100.80 (A)

Material Price Variance = B – A = ₹ 40.80 (A)

Material Mix Variance = C – B = ₹ 6.67 (A)

Material Usage Variance = D – B = ₹ 60 (A)

Material Yield Variance = D – C = ₹ 53.33 (A)

Materials variances and opening / closing inventory

Suppose that a company uses raw material P in production, and that this raw material has a standard price of ₹3 per metre. During one month 6,000 metres are bought for ₹18,600, and 5,000 metres are used in production. At the end of the month, inventory will have been increased by 1000 metres. In other words, there would be a closing inventory of 1000 meters.

In variance analysis, the problem is to decide on the calculation of the material price variance. Should it be calculated on the basis of materials purchased (6,000 metres) or on the basis of materials used (5,000 metres)?

The Solution to this problem depends on how closing inventories of the raw materials will be valued, as follows:

- If closing inventories of raw materials are valued at standard cost, (1,000 units at ₹3 per unit) the price variance is calculated on material purchases in the period.
- If closing inventories of raw materials are valued at actual cost (FIFO) (1,000 units at ₹3.10 per unit) the price variance is calculated on materials used in production in the period.

Since material inventories are usually valued at standard cost in a standard costing system, direct material price variances are usually calculated at the time of receipt of the materials, rather than at the time of usage.

A full standard costing system is usually in operation and therefore the price variance is usually calculated on purchases in the period. The variance on the full 6,000 metres will be written off to the costing profit and loss account, even though only 5,000 metres are included in the cost of production.

There are two main advantages in extracting the material price variance at the time of receipt, as follows:

- If variances are extracted at the time of receipt they will be brought to the attention of managers earlier than if they are extracted as the material is used. If it is necessary to correct any variances, then management action can be more timely.
- Since variances are extracted at the time of receipt, all inventories will be valued at standard price. This is administratively easier and it means that all issues from inventories can be made at standard price. If inventories are held at actual cost it is necessary to calculate a separate price variance on each batch as it is issued.

Cost Accounting

The price variance would be calculated (at the point of purchase) as follows:

	(₹)
6,000 metres of material P purchased should cost (×₹3)	18,000
but did cost	18,600
Price variance	600(A)

Solved Case 5

The following data is extracted from the cost records of FOSFER LLP which maintains a standard costing system. From the data given below, the Cost Accountant of the company is requested to calculate Material Price Variances for the two materials X and Y assuming that price variances are calculated at the time of purchase. Also calculate material usage variances the two material X and Y.

Particulars	Material X		Material Y	
	Qty (Kg)	Value (₹)	Qty (Kg)	Value (₹)
Raw material purchased	2000	4000	5000	6250
Issues to Works	2150	-	3950	-
Works stocks of Material				
Opening	300	-	1000	-
Closing	200	-	1250	-

The standard price of material and the standard usage are given as below:

Standard Price: Material X: ₹1.9 per Kg

Material Y: ₹1.30 per Kg

Standard usage:	Material X	Material Y
Product A	1 Kg	1 Kg
Product B	0.5 Kg	1 Kg

Actual Yield

Product A : 1130 units

Product B : 2550 units

Solution:

Material Price Variance is to be calculated at the point of purchase¹⁷

A. Actual Quantity (purchase) × Actual Price

X: $2000 \times 2 = 4000$

Y: $5000 \times 1.25 = 6250$ 10250

B (i). Actual Quantity (purchase) × Standard Price

X: $2000 \times 1.9 = 3800$

Y: $5000 \times 1.30 = 6500$ 10300.00

Material Price Variance = $10300 - 10250 = 50 \text{ (F)}$

¹⁷ Material Price variance is calculated at the point of purchase as it is specifically required. The material price variance can also be calculated on the basis of material used. If the organisation follows a standard costing system, the closing inventory is also to be calculated on the basis of standard cost and therefore it is recommended that the material price variance is calculated at the point of purchase. (this is discussed in detail in discussion leading to the Solved Case 5)

Material Usage Variance

(ii). Actual Quantity (Material Consumed ^{w/n1}) × Standard Price

$$X: 2250 \times 1.90 = 4275.00$$

$$Y: 3700 \times 1.30 = 4810.00 \quad \boxed{9085.00}$$

C. (There is no need to calculate C as Mix variance is not required to be calculated)

D. Standard Material Cost for actual yield ^{w/n 2}

$$\text{Product A: } 1130 \text{ units} \times 3.20 = 3616.00$$

$$\text{Product B: } 2550 \text{ units} \times 2.25 = 5737.50 \quad \boxed{9353.50}$$

$$\text{Material Usage Variance} = 9353.50 - 9085 = \mathbf{268.5 (F)}$$

[D can also be calculated in terms of Material used in which case, D would be:

$$\text{Material X} = [1130 \times 1 \text{ kg} + 2550 \times 0.5 \text{ kg}] \times 1.9 = 4569.5$$

$$\text{Material Y} = [1130 \times 1 \text{ kg} + 2550 \times 1 \text{ kg}] \times 1.30 = 4784.0 \quad \boxed{9353.50}$$

Working Notes:

w/n 1: Material Consumed = Material issued + opening stock – closing stock

$$\text{Material X} = 2150 + 300 - 200 = 2250$$

$$\text{Material Y} = 3950 + 1000 - 1250 = 3700$$

w/n 2: Standard material cost for 1 unit of Product A and Product B

	Material X		Material Y		Total
	<u>Usage</u>	<u>Rate</u>	<u>Usage</u>	<u>Rate</u>	
Product A	1kg	1.90	1 kg	1.30	3.20 = (1.90 + 1.30)
Product B	0.50 kg	1.90	1 kg	1.30	2.25 = (0.95 + 1.30)

Direct Labour Variances

The calculation of direct labour variances are similar to the calculation of materials variances as discussed in the previous paragraphs, except the terms hours and rate are used in place of the terms quantity and price. The production department is responsible for both the prices paid for labour services and the quantity of labour services used. Therefore, the production department must explain why any labour variances occur.

Total direct labour cost variance

It is the difference between the standard cost of labour allowed (as per standard laid down) for the actual output achieved and the actual cost of labour employed. In other words, it indicates the difference between the standard direct labour cost of the output which has been produced and the actual direct labour cost incurred.

standard direct labour cost of the output which has been produced and the actual direct labour cost incurred.

CIMA Official Terminology¹ gives the formula for calculating the variance as:

Total direct labour cost variance

$$= (\text{standard hours produced} \times \text{standard direct labour rate per hour}) - (\text{actual hours paid} \times \text{actual direct labour rate per hour})$$

If standard hours produced = SH for actual yield,

standard direct labour rate per hour = SR

actual hours paid = AH and

actual direct labour rate per hour = AR

then the above formula reduces to

$$= (\text{SH for actual yield} \times \text{SR}) - (\text{AH} \times \text{AR})$$

The direct labour total variance, discussed above, is divided into the direct labour rate variance and the direct labour efficiency variance.

Labour Rate Variance

It is that portion of the labour cost variance which arises due to the difference between the standard rate specified and the actual rate paid. This is more or less a variance arising out of external reason of labour charges which might be induced by external (to the management) factors. This is similar to the direct material price variance. It is the difference between the standard cost and the actual cost for the actual number of hours paid for. In other words, it is the difference between what the labour did cost and what it should have cost.

CIMA Official Terminology¹ states that labour rate variance indicates the actual cost of any change from the standard labour rate of remuneration. It gives the formula for calculating the variance as:

$$(\text{actual hours paid} \times \text{standard direct labour rate per hour}) - (\text{actual hours paid} \times \text{actual direct labour rate per hour})$$

It follows that:

Direct labour rate variance = (AH × SR) – (AH × AR) the connotation of AH, SR and AR is as discussed above.

Labour Efficiency Variance

It is of paramount importance that efficiency of labour is measured. For doing this, the actual time taken by the workers should be compared with the standard time allowed for the job. The standard time allowed for a particular job is decided with the help of time and motion study. This is similar to the direct material usage variance. It is the difference between the hours that should have been worked for the number of units actually produced, and the actual number of hours worked, valued at the standard rate per hour. In other words, it is the difference between how many hours should have been worked and how many hours were worked, valued at the standard rate per hour.

CIMA Official Terminology¹ states that the direct labour efficiency variance is the 'standard labour cost of any change from the standard level of labour efficiency' and gives the formula of labour efficiency variance as:

$$(\text{actual production in standard hours} - \text{actual hours worked}^{18}) \times \text{standard direct labour rate per hour}$$

Solved Case 6

Mr Lakhsman Rao, the owner of Guider Ltd. provides the following information regarding the production process of a particular fountain pen called the Zimbo.

The standard direct labour cost of Zimbo is as follows:

¹⁸ This is same as standard hours for actual production as stated in the formula for total labour cost variance.

2 hours of grade Z labour at ₹ 5 per hour = ₹ 10 per unit of Zimbo.

During the month of January 2022, 1,000 units of Zimbo were made, and the direct labour cost of grade Z labour was ₹ 8,900 for 2,300 hours of work.

Mr Lakhsman Rao asks his friend Mr Shiva who is a Cost Accountant to calculate for him the Labour Variances if any and also state to him whether they favourably or adversely impacts his cost structure.

Solution:

Mr Shiva calculates the following and presents them to Mr Lakhsman Rao:

- A. Actual hours worked $\times$ Actual rate = $2,300 \times \frac{8,900}{2,300} = \mathbf{8,900}$
- B. Actual hours worked $\times$ Standard rate = $(2300 \times ₹ 5 \text{ per hour}) = \mathbf{11,500}$
- C. Not applicable (as there is no idle time in the case)
- D. Not applicable (as there is single type of worker)
- E. Standard labour cost for actual yield = $(1000 \text{ units} \times ₹ 10 \text{ per unit}) = \mathbf{10,000}$

Labour cost variance = (Actual hours worked $\times$ Actual rate) – Standard labour cost for actual yield
 = A – E
 = **1100 (F)**

Labour rate variance = (Actual hours worked $\times$ Actual rate) – (Actual hours worked $\times$ Standard rate)
 = A – B
 = **2600 (F)**

Labour efficiency variance = (Actual hours worked $\times$ Standard rate) – Standard labour cost for actual yield
 = B – E
 = **1500 (A)**

Reconciliation



Figure 6.12: Reconciliation of Labour Cost Variance

Mr Lakhsman Rao, the owner of Guider Ltd. is not happy with the presentation of Mr Shiva since the calculations involve various technical terms and asks him to explain the matter in layman's terms. Mr Shiva as a response submits the following:

Direct labour total variance

This is the difference between what 1,000 units should have cost and what they did cost.

	(₹)
1,000 units should have cost ($\times ₹10$)	10,000
But did cost	8,900
Direct labour total variance	1,100 (F)

The variance is favourable because the units cost less than they should have done. This variance is analysed into two constituent parts: (a) Labour rate variance and (b) Labour efficiency variance.

Direct labour rate variance

This is the difference between what 2,300 hours should have cost and what 2,300 hours did cost.

	(₹)
2300 hours of work units should have cost ($\times ₹ 5$ per hour)	11,500
But did cost	8,900
Direct labour rate variance	2,600 (F)

The variance is favourable because the labour cost less than it should have cost.

Direct labour efficiency variance

1000 units of Zimbo should have ($\times 2$ hours)	2000 hours
But actually took	2300 hours
Excess hours taken	300 hours
The Excess hours valued at standard rate per hours (@ ₹ 5)	₹ 1,500 (A)

The variance is adverse because more hours were worked than should have been worked.

Reconciliation

Direct labour total variance [(1100(F))]
 = Direct labour rate variance [(2600 (F))]
 + Direct labour efficiency variance [(1500 (A))]

Idle time variance

This variance indicates the loss caused due to abnormal idle time. While fixing the standard time, normal idle time is taken into consideration. However, if the actual idle time is more than the standard/normal idle time, it is called as abnormal idle time. This variance always badly affects the efficiency of the worker and is thus always an adverse variance. As such it is a part of the efficiency variance but is shown separately. CIMA study text¹ points that if idle time arises, it is usual to calculate a separate idle time variance, and to base the calculation of the efficiency variance on active hours (when labour actually worked) only. It is always an adverse variance.

A company may operate a costing system in which any idle time is recorded. Idle time may be caused by machine breakdowns or insufficient flow of work to employees (because of bottlenecks in production or a shortage of orders from customers). When idle time occurs, the labour force is still paid wages for time at work, but no actual work is done. Time paid for without any work being done is unproductive and therefore inefficient. In variance analysis,

idle time is always an adverse efficiency variance. When idle time is recorded separately, it is helpful to provide information, for the purpose of control, which identifies the cost of idle time separately. Thus, in labour variance analysis, it is judicious to show an idle time variance as a separate part of the total labour efficiency variance. The remaining efficiency variance will then relate only to the productivity of the labour force during the hours spent actively working, and in such case, calculation of the efficiency variance would be based active hours (when labour actually worked) only.

From the above discussion an analysis of labour variances in the nature shown in the following chart is better suited¹⁹:

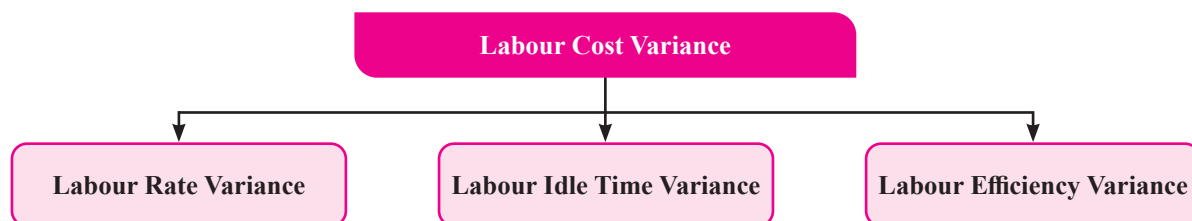


Figure 6.13: Classification of Labour Cost Variance

CIMA office terminology¹ gives the following explanation regarding labour idle time variance as ‘occurs when the hours paid exceed the hours worked and there is an extra cost caused by this idle time. Its computation increases the accuracy of the labour efficiency variance’.

The document gives the following formula for its computation:

Labour idle time variance = [(hours paid – hours worked) × standard direct labour rate per hour]

Solved Case 7

Mr Lakhsman Rao, the owner of Guider Ltd. provides the following information regarding the production process of a particular fountain pen called the Zimbo.

The standard direct labour cost of Zimbo is as follows:

2 hours of grade Z labour at ₹ 5 per hour = ₹ 10 per unit of Zimbo.

During the month of February 2022, 1,500 units of Zimbo were made, and the direct labour cost of grade Z labour was ₹ 17,500 for 3080 hours of work. It is also noted that during the period, however, there was a shortage of customer orders and 100 hours were recorded as idle time.

Mr Lakhsman Rao asks his friend Mr Shiva who is a Cost Accountant to calculate for him the Labour Variances if any and also state to him whether they favourably or adversely impacts his cost structure.

Solution:¹⁵

Mr Shiva calculates the following and presents them to Mr Lakhsman Rao:

- A. Actual hours worked × Actual rate = $3,080 \times \frac{17,500}{3,080} = 17,500$
- B. Actual hours worked × Standard rate = $(3080 \times ₹ 5 \text{ per hour}) = 15,400$

¹⁹ In some books, idle time variance is shown as a part of labour efficiency variance. This will not reflect the true efficiency (productivity) variance of the labour force as idle time may be caused by forces beyond the control of the labour like machine break down

Cost Accounting

C. Not applicable (as there is single type of worker)

D. Actual hours paid $\times$ Standard rate = $(2980 \times ₹ 5 \text{ per hour}) = \mathbf{14,900}$

E. Standard labour cost for actual yield = $(1500 \text{ units} \times ₹ 10 \text{ per unit}) = \mathbf{15,000}$
and

Labour cost variance = $(\text{Actual hours worked} \times \text{Actual rate}) - \text{Standard labour cost for actual yield}$
= $A - E$
= $\mathbf{2500 (A)}$

Labour rate variance = $(\text{Actual hours worked} \times \text{Actual rate}) - \text{Actual hours worked} \times \text{Standard rate}$
= $A - B$
= $\mathbf{2100 (A)}$

Labour idle time variance = $(\text{Hours paid} - \text{Hours worked}) \times \text{Standard direct labour rate per hour}$
= $D - B$
= $\mathbf{500 (A)}$

Labour efficiency variance = $(\text{Actual hours worked} \times \text{Standard rate}) - \text{Standard labour cost for actual yield}$
= $D - E$
= $\mathbf{100 (F)}$

Reconciliaton

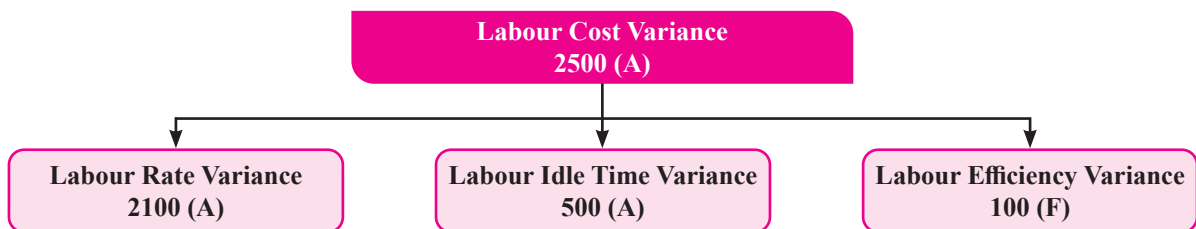


Figure 6.14: Reconciliation of Labour Cost Variance

Mr Lakhsman Rao, the owner of Guider Ltd. is not happy with the presentation of Mr Shiva since the calculations involve various technical terms and asks him to explain the matter in layman's terms. Mr Shiva as a response submits the following:

The direct labour total variance

	(₹)
1,500 units should have cost ($\times ₹10$)	15,000
But did cost	17,500
Direct labour total variance	<u>2,500 (A)</u>

The variance is adverse because the actual labour cost is more than what it should have cost.

This variance is analysed three constituent parts: (a) Labour rate variance and (b) Labour idle time variance and (c) Labour efficiency variance

The direct labour rate variance

The rate variance is a comparison of what the hours paid should have cost and what it actually cost.

	(₹)
3080 hours of grade Z labour should have cost ($\times ₹ 5$)	15,400
But did cost	17,500
Direct labour total variance	<u>2,100 (A)</u>

This is adverse variance as the actual cost is more than the standard labour cost.

The idle time variance

The idle time variance is the idle time hours, valued at the standard rate per hour.

Idle time variance = 100 hours $\times ₹ 5 = ₹ 500$ (A)

Idle time is always an adverse variance.

The direct labour efficiency variance

The efficiency variance considers the hours actively worked (the difference between hours paid for and idle time hours).

In the given case, 2,980 (3,080 – 100) hours is the actively worked hours. The variance is calculated by taking the amount of output produced (1,500 units of product Zimbo) and comparing the time it should have taken to make them. The variance in hours is valued at the standard rate per labour hour.

1500 units of Zimbo should take ($\times 2$ hrs)	3000 hrs
But did take (3080 – 100) ²⁰	<u>2980 hrs</u>
Direct labour efficiency variance in hrs	20 hrs (F)
$\times$ Standard rate per hour	<u>$\times ₹ 5$ per hour</u>
Direct Labour efficiency variance	<u>₹ 100 (F)</u>

Reconciliation

Direct labour rate variance 2,100 (A)

+ Idle time variance 500 (A)

+ Direct labour efficiency variance 100 (F)

= Direct labour total variance 2,500 (A)

It is noted in an earlier line that labour efficiency variance comprises of (a) labour mix variance and (b) labour yield variance.

Labour Mix Variance

Labour mix variance is the part of labour efficiency variance and its computation is similar to that of material mix variance. In a factory or an any workplace, there are various grades of worker. Workers may be skilled, semi-skilled and unskilled and thus they are paid differently. For any particular purpose, the actual composition of various

²⁰ It is important to note that if idle time is recorded and the variance is calculated separately (not as a part of the efficiency variance) the actual hours used in the efficiency variance calculation are the active hours worked and not the hours paid for.

grades of labour would be different from what is supposed to be (as mentioned in the standard). For example, the standard hours of skilled workers may be stipulated as 40 hrs, but during a month there is a shortfall in supply of actual labour of skilled labourers and only 30 hrs can be employed. This is met by employing semi-skilled workers. Thus, the actual composition varies from the standard composition and thus labour mix variance arises.

CIMA official terminology¹ classifies labour mix variance as a subdivision of the direct labour efficiency variance. And notes that if grades of labour can be substituted the mix variance measures the cost of any variation from the standard mix of grade. The formula for labour mix variance is given as:

Labour mix variance = (actual hours for grade – hours for grade based on total labour hours split in standard proportions) × (weighted average cost per hour – standard cost per hour)

This may be simply stated as

= Standard Cost of Standard Mix of Labourers – Standard Cost of Actual Mix of Labourer

Labour yield variance²¹

Labour yield variance is defined as the portion of direct labour efficiency variance that is attributable to the difference between the standard yield specified and the actual yield obtained.

CIMA official terminology¹ classifies labour yield variance as a subdivision of the direct labour efficiency variance. And notes that labour yield variance measures the effect on cost of any difference between the actual usage of labour and that justified by the output produced. The formula for labour yield variance is given as:

Labour yield variance = (standard labour hours allowed for actual output – actual labour hours input) × standard weighted average cost per direct labour hour

This may be simply stated as,

Labour yield variance = (Actual yield or output – Standard yield or output for actual input) × Standard cost per unit

Solved Case 8

Mr Lakhsman Rao, the owner of Guider Ltd. provides the following information regarding the production process of a particular fountain pen called the Zimbo. After careful consideration he has noted that a group of workers usually consists of 10 skilled, 5 semi-skilled and 5 unskilled workers, paid at standard hourly rates of ₹ 5.00, ₹ 3.20 and ₹ 2.80 respectively. In a normal working week of 40 hours, the group is expected to produce 1,000 units of Zimbo.

During March 2022, adjustments were to be made to the actual composition of the group, due to non-availability of labour and actually consisted of 13 skilled, 4 semi-skilled and 3 unskilled employees; actual wages paid were ₹ 4.80, ₹ 3.40 and ₹ 2.60 respectively.

Two hours were lost due to abnormal idle time and 960 units of Zimbo were produced.

Mr Lakhsman Rao is worried about the variances in labour cost and asks his friend Mr Shiva, who is a Cost Accountant to submit the analysis of the labour cost variances.

Solution

Mr Shiva makes the following calculation and presents to Mr Lakhsman Rao which covers the analysis of the variances calculated.

²¹ This is also referred as labour sub-efficiency variance.

Working note¹⁵

A. Actual hours worked (in actual mix) × Actual rate

Skilled – 13 workers × 40 hrs × ₹ 4.80 per hour	=	2496
Semi-skilled - 4 workers × 40 hrs × 3.40 per hour	=	544
Unskilled – 3 workers × 40 hrs × 2.60 per hour	=	312
		3352

B. Actual hours worked (in actual mix) × Standard rate

Skilled – 13 workers × 40 hrs × ₹ 5.00 per hour	=	2600
Semi-skilled - 4 workers × 40 hrs × 3.20 per hour	=	512
Unskilled – 3 workers × 40 hrs × 2.80 per hour	=	336
		3448

C. Actual hours worked (in standard mix) × Standard rate

Skilled – 10 workers × 40 hrs × ₹ 5.00 per hour	=	2000
Semi-skilled - 5 workers × 40 hrs × 3.20 per hour	=	640
Unskilled – 5 workers × 40 hrs × 2.80 per hour	=	560
		3200

D. Actual hours paid (in actual mix) × Standard rate

Skilled – 10 workers × 38 hrs × ₹ 5.00 per hour	=	1900
Semi-skilled – 5 workers × 38 hrs × 3.20 per hour	=	608
Unskilled – 5 workers × 38 hrs × 2.80 per hour	=	532
		3040

E. Standard labour cost for actual yield

$$= \frac{40 \text{ hrs} \times (10 \times 5.00 \text{ per hr} + 5 \times 3.20 \text{ per hr} + 5 \times 2.80 \text{ per hr})}{1,000 \text{ units}} \times 960 \text{ units} = \mathbf{3,072}$$

and

Labour cost variance = (Actual hours worked × Actual rate) – Standard labour cost for actual yield

$$= A - E$$

$$= \mathbf{280 \text{ (A)}}$$

Labour rate variance = (Actual hours worked × Actual rate) – Actual hours worked × Standard rate

$$= A - B$$

$$= \mathbf{96 \text{ (F)}}$$

Cost Accounting

$$\begin{aligned}\text{Labour idle time variance} &= (\text{Hours paid} - \text{Hours worked}) \times \text{Standard direct labour rate per hour} \\ &= C - D \\ &= \mathbf{160 (A)}\end{aligned}$$

$$\begin{aligned}\text{Labour efficiency variance} &= (\text{Actual hours worked} \times \text{Standard rate}) - \text{Standard labour cost for actual yield} \\ &= B - E \\ &= \mathbf{376 (A)}\end{aligned}$$

but idle time variance is to be calculated separately which is recommended.

$$\text{Thus, labour efficiency variance adjusted for idle time variance} = 376(A) - 160(A) = \mathbf{216 (A)}^{22}$$

Labour mix variance = (actual hours for grade – hours for grade based on total labour hours split in standard proportions) × (weighted average cost per hour – standard cost per hour) = Standard Cost of Standard Mix of Labourers - Standard Cost of Actual Mix of Labourer

$$= B - C = \mathbf{248 (A)}$$

$$\begin{aligned}\text{Labour yield variance} &= (\text{Actual yield or output} - \text{Standard yield or output for actual input}) \times \text{Standard cost per unit} \\ &= D - E = \mathbf{32 (F)}\end{aligned}$$

Reconciliation

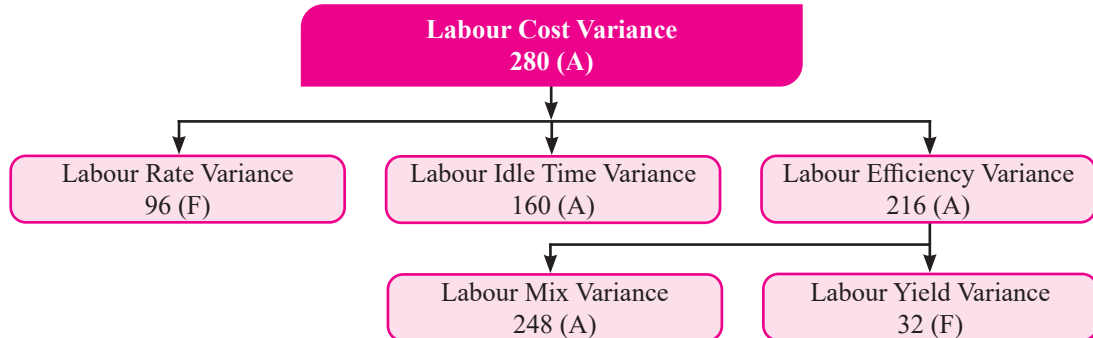


Figure 6.15: Reconciliation of Labour Cost Variance

Illustration 16

The standard cost of a certain chemical mixture is as under:

40% of Material A at ₹ 20 per kg. 60% of Material B at ₹ 30 per kg. A standard loss of 10% is expected in production. The following actual cost data is given for the period:

180 kg material A at a cost of ₹ 18 per kg

220 kg material B at a cost of ₹ 34 per kg

The weight produced is 360 kg.

²² Labour idle time variance is shown separately from efficiency variance as discussed in previous section.

Calculate and present:

- i. Material Cost Variance
- ii. Material Price Variance
- iii. Material Usage Variance
- iv. Material Mix Variance
- v. Material Yield Variance

Solution:

Assume 100 kg of Standard Input is used in the ratio of 40% and 60% for Material A and Material B respectively. So, the information can be presented as follows:

	Standard		Actual	
	Quantity	Rate	Quantity	Rate
	Kg	(₹)	Kg	(₹)
Material A	40	20	180	18
Material B	60	30	220	34
Total	100		400	
Less: Loss	10		40 (Bal. fig.)	
Output	90		360	

When there are more than one input then five parameters are to be calculated as follows:

1. SQ – Standard Quantity for Actual Output

$$\text{Material A} = \frac{40}{90} \times 360 = 160 \text{ kg}$$

$$\text{Material B} = \frac{60}{90} \times 360 = 240 \text{ kg}$$

2. SP – Standard Price per unit

$$\text{Material A} = ₹ 20, \quad \text{Material B} = ₹ 30$$

3. AQ – Actual Quantity

$$\text{Material A} = 180 \text{ kg}, \text{Material B} = 220 \text{ kg}$$

4. AP – Actual Price per unit

$$\text{Material A} = ₹ 18, \quad \text{Material B} = ₹ 34$$

5. RSQ – Revised Standard Quantity for Actual Input

$$\text{Material A} = \frac{40}{100} \times 400 = 160 \text{ kg}$$

$$\text{Material B} = \frac{60}{100} \times 400 = 240 \text{ kg}$$

Cost Accounting

6. Material Cost Variance = $SQ \times SP - AQ \times AP$
Material A = $160 \times 20 - 180 \times 18 = 3,200 - 3,240$ = ₹ 40 (A)
Material B = $240 \times 30 - 220 \times 34 = 7,200 - 7,480$ = ₹ 280 (A)
= ₹ 320 (A)
7. Material Price Variance = $(SP - AP) \times AQ$
Material A = $(20 - 18) \times 180$ = ₹ 360 (F)
Material B = $(30 - 34) \times 220$ = ₹ 880 (A)
= ₹ 520 (A)
8. Material Usage Variance = $(SQ - AQ) \times SP$
Material A = $(160 - 180) \times 20$ = ₹ 400 (A)
Material B = $(240 - 220) \times 30$ = ₹ 600 (F)
= ₹ 200 (F)
9. Material Mix Variance = $(RSQ - AQ) \times SP$
Material A = $(160 - 180) \times 20$ = ₹ 400 (A)
Material B = $(240 - 220) \times 30$ = ₹ 600 (F)
= ₹ 200 (F)
10. Material Yield Variance = $(SQ - RSQ) \times SP$
Material A = $(160 - 160) \times 20$ = Nil
Material B = $(240 - 240) \times 30$ = Nil

Illustration 17

From the following you are required to calculate:

- (a) Material Cost Variance
(b) Material Price Variance
(c) Material Usage Variance

Quantity of material purchased	3,000 units
Value of material purchased	₹ 9,000
Standard quantity of material required:	
for one tonne of finished product	25 units
Standard rate of material	₹ 2 per unit
Opening stock of material	NIL
Closing stock of material	500 units
Finished production during the period	80 tonnes

Solution:

SQ = Standard Quantity for Actual Output = $80 \times 25 = 2,000$ units

SP = Standard Price = ₹ 2 per unit

AQ = Actual Quantity Used for Production = $3,000 - 500 = 2,500$ units

AP = Actual Price per unit = $\frac{₹ 9,000}{3,000 \text{ units}} = ₹ 3 \text{ per unit}$

- (a) Material Cost Variance $= SQ \times SP - AQ \times AP$
 $= (2,000 \times 2) - (2,500 \times 3)$
 $= 4,000 - 7,500 = ₹ 3,500 \text{ (A)}$
- (b) Material Price Variance $= (SP - AP) \times AQ$
 $= (2 - 3) \times 2,500 = ₹ 2,500 \text{ (A)}$
- (c) Material Usage Variance $= (SQ - AQ) \times SP$
 $= (2,000 - 2,500) \times 2 = ₹ 1,000 \text{ (A)}$

Illustration 18

The standard cost of one of the products of the company shows the following standards:

Materials	Quantity (kg)	Price (₹)
A	40	76
B	10	50
C	50	20

The standard input mix is 100 kg and the standard output of the finished product is 90 kg

The actual results for the period are:

Materials	Quantity (kg)	Price (₹)
A	1,95,000	80
B	42,500	52
C	2,25,000	21

Actual output of the finished product is 4,18,500 kg

You are required to calculate the material variances.

Solution:

SQ = Standard Quantity for Actual Output

Material A = $\frac{40}{90} \times 4,18,500 = 1,86,000 \text{ kg}$

Material B = $\frac{10}{90} \times 4,18,500 = 46,500 \text{ kg}$

Material C = $\frac{50}{90} \times 4,18,500 = 2,32,500 \text{ kg}$

SP = Standard Price per unit

Material A = ₹ 76

Material B = ₹ 50

Material C = ₹ 20

Cost Accounting

AQ = Actual Quantity used

Material A = 1,95,000 kg Material B = 42,500 kg Material C = 2,25,000 kg

AP = Actual Price per unit

Material A = ₹ 80 Material B = ₹ 52 Material C = ₹ 21

RSQ = Revised Standard Quantity for Actual Input

$$\text{Material A} = \frac{40}{100} \times (1,95,000 + 42,500 + 2,25,000) = \frac{40}{100} \times 4,62,500 = 1,85,000 \text{ kg}$$

$$\text{Material B} = \frac{10}{100} \times 4,62,500 = 46,250 \text{ kg}$$

$$\text{Material C} = \frac{50}{100} \times 4,62,500 = 2,31,250 \text{ kg}$$

i. Material Cost Variance = SQ × SP – AQ × AP

$$\text{Material A} = (1,86,000 \times 76) - (1,95,000 \times 80) = ₹ \quad 14,64,000 \text{ (A)}$$

$$\text{Material B} = (46,500 \times 50) - (42,500 \times 52) = ₹ \quad 1,15,000 \text{ (F)}$$

$$\text{Material C} = (2,32,500 \times 20) - (2,25,000 \times 21) = ₹ \quad 75,000 \text{ (A)}$$

$$= ₹ \quad \underline{\underline{14,24,000 \text{ (A)}}}$$

ii. Material Price Variance = (SP – AP) × AQ

$$\text{Material A} = (76 - 80) \times 1,95,000 = ₹ \quad 7,80,000 \text{ (A)}$$

$$\text{Material B} = (50 - 52) \times 42,500 = ₹ \quad 85,000 \text{ (A)}$$

$$\text{Material C} = (20 - 21) \times 2,25,000 = ₹ \quad 2,25,000 \text{ (A)}$$

$$= ₹ \quad \underline{\underline{10,90,000 \text{ (A)}}}$$

iii. Material Usage Variance = (SQ – AQ) × SP

$$\text{Material A} = (1,86,000 - 1,95,000) \times 76 = ₹ \quad 6,84,000 \text{ (A)}$$

$$\text{Material B} = (46,500 - 42,500) \times 50 = ₹ \quad 2,00,000 \text{ (F)}$$

$$\text{Material C} = (2,32,500 - 2,25,000) \times 20 = ₹ \quad 1,50,000 \text{ (F)}$$

$$= ₹ \quad \underline{\underline{3,34,000 \text{ (A)}}}$$

iv. Material Mix Variance = (RSQ – AQ) × SP

$$\text{Material A} = (1,85,000 - 1,95,000) \times 76 = ₹ \quad 7,60,000 \text{ (A)}$$

$$\text{Material B} = (46,250 - 42,500) \times 50 = ₹ \quad 1,87,500 \text{ (F)}$$

$$\text{Material C} = (2,31,250 - 2,25,000) \times 20 = ₹ \quad 1,25,000 \text{ (F)}$$

$$= ₹ \quad \underline{\underline{4,47,500 \text{ (A)}}}$$

v. Material Yield Variance = (SQ – RSQ) × SP

$$\text{Material A} = (1,86,000 - 1,85,000) \times 76 = ₹ \quad 76,000 \text{ (F)}$$

$$\text{Material B} = (46,500 - 46,250) \times 50 = ₹ \quad 12,500 \text{ (F)}$$

$$\text{Material C} = (2,32,500 - 2,31,250) \times 20 = ₹ \quad 25,000 \text{ (F)}$$

$$= ₹ \quad \underline{\underline{1,13,500 \text{ (F)}}}$$

Illustration 19

Material	Standard Quantity (kg)	Price (₹)	Total (₹)
A	500	6.00	3,000
B	400	3.75	1,500
C	300	3.00	900
	1,200		5,400
Less : 10% Normal loss	120		
	1,080		5,400

Material	Actual Quantity (kg)	Price (₹)	Total (₹)
A	400	6.00	2,400
B	500	3.60	1,800
C	400	2.80	1,120
	1,300		5,320
Less : Actual loss	120		
	1,180		5,320

Calculate:

- Material Cost Variance
- Material Price Variance
- Material Usage Variance
- Material Mix Variance
- Material Yield Variance

Solution:**SQ – Standard Quantity for Actual Output**

$$\text{Material A} = \frac{500}{1,080} \times 1,180 = 546.29 \text{ kg}$$

$$\text{Material B} = \frac{400}{1,080} \times 1,180 = 437 \text{ kg}$$

$$\text{Material C} = \frac{300}{1,080} \times 1,180 = 327.78 \text{ kg}$$

SP – Standard Price per unit

Material A = ₹ 6 per kg

Material B = ₹ 3.75 per kg

Material C = ₹ 3 per kg

AQ – Actual Quantity

Material A = 400 kg

Material B = 500 kg

Material C = 400 kg

AP = Actual Price per unit

Material A = ₹ 6 per kg

Material B = ₹ 3.60 per kg

Material C = ₹ 2.80 per kg

RSQ – Revised Standard Quantity for Actual Input

$$\text{Material A} = \frac{500}{1,200} \times 1,300 = 541.67 \text{ kg}$$

$$\text{Material B} = \frac{400}{1,200} \times 1,300 = 433.33 \text{ kg}$$

$$\text{Material C} = \frac{300}{1,200} \times 1,300 = 325 \text{ kg}$$

- i. Material Cost Variance = $SQ \times SP - AQ \times AP$

$$\text{Material A} = (546.29 \times 6) - (400 \times 6) = ₹ 877.74 \text{ (F)}$$

$$\text{Material B} = (437 \times 3.75) - (500 \times 3.60) = ₹ 161.25 \text{ (A)}$$

$$\text{Material C} = (327.78 \times 3) - (400 \times 2.80) = ₹ 136.66 \text{ (A)}$$

$$\underline{\hspace{10em}} = ₹ 579.83 \text{ (F)}$$

- ii. Material Price Variance = $(SP - AP) \times AQ$

$$\text{Material A} = (6 - 6) \times 400 = \text{Nil}$$

$$\text{Material B} = (3.75 - 3.60) \times 500 = ₹ 75 \text{ (F)}$$

$$\text{Material C} = (3 - 2.80) \times 400 = ₹ 80 \text{ (F)}$$

$$\underline{\hspace{10em}} = ₹ 155 \text{ (F)}$$

- iii. Material Usage Variance = $(SQ - AQ) \times SP$

$$\text{Material A} = (546.29 - 400) \times 6 = ₹ 877.74 \text{ (F)}$$

$$\text{Material B} = (437 - 500) \times 3.75 = ₹ 236.25 \text{ (A)}$$

$$\text{Material C} = (327.78 - 400) \times 3 = ₹ 216.66 \text{ (A)}$$

$$\underline{\hspace{10em}} = ₹ 424.83 \text{ (F)}$$

- iv. Material Mix Variance = $(RSQ - AQ) \times SP$

$$\text{Material A} = (541.67 - 400) \times 6 = ₹ 850.02 \text{ (F)}$$

$$\text{Material B} = (433.33 - 500) \times 3.75 = ₹ 250.01 \text{ (A)}$$

$$\text{Material C} = (325 - 400) \times 3 = ₹ 225 \text{ (A)}$$

$$\underline{\hspace{10em}} = ₹ 375.01 \text{ (F)}$$

- v. Material Yield Variance = $(SQ - RSQ) \times SP$

$$\text{Material A} = (546.29 - 541.67) \times 6 = ₹ 27.72 \text{ (F)}$$

$$\text{Material B} = (437 - 433.33) \times 3.75 = ₹ 13.76 \text{ (F)}$$

$$\text{Material C} = (327.78 - 325) \times 3 = ₹ 8.34 \text{ (F)}$$

$$\underline{\hspace{10em}} = ₹ 49.82 \text{ (F)}$$

Illustration 20

The standard set for material consumption was 100 kg. @ ₹ 2.25 per kg.

In a cost period:

Opening stock was 100 kg. @ ₹2.25 per kg.

Purchases made 500 kg. @ ₹ 2.15 per kg. Consumption 110 kg.

Calculate: (a) Usage (b) Price variance

- (1) When variance is calculated at point of purchase
- (2) When variance is calculated at point of issue on FIFO basis
- (3) When variance is calculated at point of issue on LIFO basis

Solution:

SQ – Standard Quantity for Actual Output = 100 kg

SP – Standard Price per unit = ₹ 2.25 per kg

AQ – Actual Quantity used = 110 kg

- (a) Material Usage Variance $= (SQ - AQ) \times SP$
 $= (100 - 110) \times 2.25 = ₹ 22.50 (A)$
- (b) Computation of Price Variance $= (SP - AP) \times AQ = SP \times AQ - AP \times AQ$

1. When variance is calculated at point of purchase:

AP – Actual Price at the point of purchase is ₹ 2.15

Price Variance $= (2.25 \times 110) - (2.15 \times 110) = ₹ 11(F)$

2. When variance is calculated at point of issue on FIFO basis:

Price Variance $= (2.25 \times 110) - [2.25 \times 100 + 2.15 \times 10] = ₹ 1 (F)$

3. When variance is calculated at point of issue on LIFO basis:

Price Variance $= (2.25 \times 110) - (2.15 \times 110) = ₹ 11 (F)$

Illustration 21

Using the following information calculate each of three labour variance for each department:

	Department X	Department Y
Gross wages direct	₹ 28,080	₹ 19,370
Standard hours produced	8,640	6,015
Standard rate per hour	₹ 3	₹ 3.40
Actual hours worked	8,200	6,395

Solution:**Department X**

SH – Standard Hours for Actual Output = 8,640 hours

SR – Standard Rate per hour = ₹ 3 per hour

AH – Actual Hours Paid for = 8,200

AR – Actual Rate per hour = $\frac{₹ 28,080}{8,200 \text{ hours}}$

- i. Labour Cost Variance = $SH \times SR - AH \times AR$
 $= ₹ 8,640 \times 3 - 8,200 \times \frac{28,080}{8,200}$
 $= ₹ 25,920 - 28,080 = ₹ 2,160 \text{ (A)}$
- ii. Labour Rate Variance = $(SR - AR) \times AH = SR \times AH - AR \times AH$
 $= (3 \times 8,200) - \left(\frac{28,080}{8,200} \times 8,200 \right)$
 $= ₹ 24,600 - ₹ 28,080 = ₹ 3,480 \text{ (A)}$
- iii. Labour Efficiency Variance = $(SH - AH) \times SR$
 $= (8,640 - 8,200) \times 3$
 $= ₹ 1,320 \text{ (F)}$

Department Y

SH = 6,015 hours

SR = ₹ 3.40 per hour

AH = 6,395 hours

AR = $\frac{₹ 19,370}{6,395 \text{ hours}}$

- i. Labour Cost Variance = $SH \times SR - AH \times AR$
 $= (6,015 \times ₹ 3.40) - \left(6,395 \times \frac{19,370}{6,395} \right) = ₹ 1,081 \text{ (F)}$
- ii. Labour Rate Variance = $(SR - AR) \times AH = SR \times AH - AR \times AH$
 $= (₹ 3.40 \times 6,395) - \left(\frac{19,370}{6,395} \times 6,395 \right) = ₹ 2,373 \text{ (F)}$
- iii. Labour Efficiency Variance = $(SH - AH) \times SR$
 $= (6,015 - 6,395) \times ₹ 3.40 = ₹ 1,292 \text{ (A)}$

Illustration 22

Calculate variances from the following:

Standard				Actual			
Input (kg)	Material	₹ / kg	Total ₹	₹ Input (kg)	Material	₹ / kg	Total ₹
400	A	@ 50	20,000	420	A	@ 45	18,900
200	B	@ 20	4,000	240	B	@ 25	6,000
100	C	@ 15	1,500	90	C	@ 15	1,350
700			25,500	750			26,250

Labour hours				Labour hours			
		₹ / hour	Total			₹ / hour	Total
	Men 100 hours	@ 2	200		Men 120 hours	@ 2.50	300
	Women 200 hours	@ 1.50	300		Women 240 hours	@ 1.60	684
25	Normal Loss		500	75	Actual Loss		
675			26,000	675			26,934

Solution**Material Variances**

SQ – Standard Quantity for Actual Output

$$\text{Material A} = \frac{400}{675 (\text{Standard Output})} \times 675 (\text{Actual Output}) = 400 \text{ kg}$$

$$\text{Material B} = \frac{200}{675} \times 675 = 200 \text{ kg}$$

$$\text{Material C} = \frac{100}{675} \times 675 = 100 \text{ kg}$$

SP – Standard price per unit

$$\text{Material A} = ₹ 50 \text{ per kg} \quad \text{Material B} = ₹ 20 \text{ per kg} \quad \text{Material C} = ₹ 15 \text{ per kg}$$

AQ – Actual Quantity used

$$\text{Material A} = 420 \text{ kg} \quad \text{Material B} = 240 \text{ kg} \quad \text{Material C} = 90 \text{ kg}$$

AP – Actual Price per unit

$$\text{Material A} = ₹ 45 \text{ per kg} \quad \text{Material B} = ₹ 25 \text{ per kg} \quad \text{Material C} = ₹ 15 \text{ per kg}$$

RSQ – Revised Standard Quantity for Actual Input

$$\text{Material A} = \frac{400}{700} \times 750 = 428.57 \text{ kg}$$

$$\text{Material B} = \frac{200}{700} \times 750 = 214.29 \text{ kg}$$

$$\text{Material C} = \frac{100}{700} \times 750 = 107.14 \text{ kg}$$

- i. $\text{Material Cost Variance} = \text{SQ} \times \text{SP} - \text{AQ} \times \text{AP}$
 $\text{Material A} = 400 \times 50 - 420 \times 45 = ₹ 1,100 \text{ (F)}$
 $\text{Material B} = 200 \times 20 - 240 \times 25 = ₹ 2,000 \text{ (A)}$
 $\text{Material C} = 100 \times 15 - 90 \times 15 = ₹ 150 \text{ (F)}$
 $= ₹ 750 \text{ (A)}$
- ii. $\text{Material Price Variance} = (\text{SP} - \text{AP}) \times \text{AQ}$
 $\text{Material A} = (50 - 45) \times 420 = ₹ 2,100 \text{ (F)}$
 $\text{Material B} = (20 - 25) \times 240 = ₹ 1,200 \text{ (A)}$
 $\text{Material C} = (15 - 15) \times 90 = \text{Nil}$
 $= ₹ 900 \text{ (F)}$
- iii. $\text{Material Usage Variance} = (\text{SQ} - \text{AQ}) \times \text{SP}$
 $\text{Material A} = (400 - 420) \times 50 = ₹ 1,000 \text{ (A)}$
 $\text{Material B} = (200 - 240) \times 20 = ₹ 800 \text{ (A)}$
 $\text{Material C} = (100 - 90) \times 15 = ₹ 150 \text{ (F)}$
 $= ₹ 1,650 \text{ (A)}$
- iv. $\text{Material Mix Variance} = (\text{RSQ} - \text{AQ}) \times \text{SP}$
 $\text{Material A} = (428.57 - 420) \times 50 = ₹ 428.50 \text{ (F)}$
 $\text{Material B} = (214.29 - 240) \times 20 = ₹ 514.20 \text{ (A)}$
 $\text{Material C} = (107.14 - 90) \times 15 = ₹ 257.10 \text{ (F)}$
 $= ₹ 171.40 \text{ (F)}$
- v. $\text{Material Yield Variance} = (\text{SQ} - \text{RSQ}) \times \text{SP}$
 $\text{Material A} = (400 - 428.57) \times 50 = ₹ 1,428.50 \text{ (A)}$
 $\text{Material B} = (200 - 214.29) \times 20 = ₹ 285.80 \text{ (A)}$
 $\text{Material C} = (100 - 107.14) \times 15 = ₹ 107.10 \text{ (A)}$
 $= ₹ 1,821.40 \text{ (A)}$

Labour Variances

SH – Standard Hours for Actual Output

$$\text{Men} = \frac{100}{675 \text{ (Standard Output)}} \times 675 \text{ (Actual Output)} = 100 \text{ hours}$$

$$\text{Women} = \frac{200}{675} \times 675 = 200 \text{ hours}$$

SR – Standard Rate per hour

Men = ₹ 2 per hour

Women = ₹ 1.50 per hour

AH – Actual Hours Paid

Men = 120 hours

Women = 240 hours

AR – Actual rate per hour

Men = ₹ 2.50 per hour

Women = ₹ 1.60 per hour

RSH – Revised Standard Hours for actual input

$$\text{Men} = \frac{100}{700} \times 750 = 107.14 \text{ hours}$$

$$\text{Women} = \frac{200}{700} \times 750 = 214.28 \text{ hours}$$

i. Labour Cost Variance = SH × SR – AH × AR

$$\text{Men} = 100 \times 2 - 120 \times 2.50 = ₹ 100 \text{ (A)}$$

$$\begin{aligned} \text{Women} &= 200 \times 1.50 - 240 \times 1.60 = ₹ 84 \text{ (A)} \\ &= ₹ 184 \text{ (A)} \end{aligned}$$

ii. Labour Rate Variance = (SR – AR) × AH

$$\text{Men} = (2 - 2.50) \times 120 = ₹ 60 \text{ (A)}$$

$$\begin{aligned} \text{Women} &= (1.50 - 1.60) \times 240 = ₹ 24 \text{ (A)} \\ &= ₹ 84 \text{ (A)} \end{aligned}$$

iii. Labour Efficiency Variance = (SH – AH) × SR

$$\text{Men} = (100 - 120) \times 2 = ₹ 40 \text{ (A)}$$

$$\begin{aligned} \text{Women} &= (200 - 240) \times 1.50 = ₹ 60 \text{ (A)} \\ &= ₹ 100 \text{ (A)} \end{aligned}$$

iv. Labour Mix Variance = (RSH – AH) × SR

$$\text{Men} = (107.14 - 120) \times 2 = ₹ 25.72 \text{ (A)}$$

$$\begin{aligned} \text{Women} &= (214.28 - 240) \times 1.50 = ₹ 38.58 \text{ (A)} \\ &= ₹ 64.30 \text{ (A)} \end{aligned}$$

v. Labour Yield Variance = (SH – RSH) × SR

$$\text{Men} = (100 - 107.14) \times 2 = ₹ 14.28 \text{ (A)}$$

$$\begin{aligned} \text{Women} &= (200 - 214.28) \times 1.50 = ₹ 21.42 \text{ (A)} \\ &= ₹ 35.70 \text{ (A)} \end{aligned}$$

Illustration 23

The standard labour component and the actual labour component engaged in a week for a job are as under:

	Skilled workers	Semi-skilled workers	Unskilled workers
Standard no. of workers in the gang	32	12	6
Standard wage rate per hour (₹)	3	2	1

Actual no. of workers employed in the gang during the week	28	18	4
Actual wage rate per hour (₹)	4	3	2

During the 40 hour working week the gang produced 1,800 standard labour hours of work.

Calculate labour variances.

Solution:

Analysis of the Given data

Workers	Standard		Actuals	
Skilled	$32 \times 40 = 1,280$ hours	@ ₹ 3 per hour	$28 \times 40 = 1,120$ hours	@ ₹ 4 per hour
Semi-Skilled	$12 \times 40 = 480$ hours	@ ₹ 2 per hour	$18 \times 40 = 720$ hours	@ ₹ 3 per hour
Unskilled	$6 \times 40 = 240$ hours	@ ₹ 1 per hour	$4 \times 40 = 160$ hours	@ ₹ 2 per hour
Input	2,000 hours		2,000 hours	
Output	2,000 hours		1,800 hours	

SH – Standard Labour Hours for Actual output

$$\text{Skilled} = \frac{1,280}{2,000} \times 1,800 = 1,152 \text{ hours}$$

$$\text{Semi – Skilled} = \frac{480}{2,000} \times 1,800 = 432 \text{ hours}$$

$$\text{Unskilled} = \frac{240}{2,000} \times 1,800 = 216 \text{ hours}$$

SR – Standard Rate per hour

Skilled = ₹ 3 per hour

Semi-Skilled = ₹ 2 per hour

Unskilled = ₹ 1 per hour

AH – Actual Hours Paid

Skilled = 1,120 hours

Semi-Skilled = ₹ 720 hours

Unskilled = ₹ 160 hours

AR – Actual Rate

Skilled = ₹ 4 per hour

Semi-Skilled = ₹ 3 per hour

Unskilled = ₹ 2 per hour

RSH – Revised Standard Hours for Actual Input

$$\text{Skilled} = \frac{1,280}{2,000} \times 2,000 = 1,280 \text{ hours}$$

$$\text{Semi-Skilled} = \frac{480}{2,000} \times 2,000 = 480 \text{ hours}$$

$$\text{Unskilled} = \frac{240}{2,000} \times 2,000 = 240 \text{ hours}$$

i. Labour Cost Variance = SH × SR – AH × AR

$$\text{Skilled} = (1,152 \times 3) - (1,120 \times 4) = ₹ 1,024 \text{ (A)}$$

$$\text{Semi-Skilled} = (432 \times 2) - (720 \times 3) = ₹ 1,296 \text{ (A)}$$

$$\text{Unskilled} = (216 \times 1) - (160 \times 2) = ₹ 104 \text{ (A)}$$

$$\underline{\underline{= ₹ 2,424 \text{ (A)}}}$$

ii. Labour Rate Variance = $(SR - AR) \times AH$

$$\text{Skilled} = (3 - 4) \times 1,120 = ₹ 1,120 \text{ (A)}$$

$$\text{Semi-Skilled} = (2 - 3) \times 720 = ₹ 720 \text{ (A)}$$

$$\text{Unskilled} = (1 - 2) \times 160 = ₹ 160 \text{ (A)}$$

$$\underline{\underline{= ₹ 2,000 \text{ (A)}}}$$

iii. Labour Efficiency Variance = $(SH - AH) \times SR$

$$\text{Skilled} = (1,152 - 1,120) \times 3 = ₹ 96 \text{ (F)}$$

$$\text{Semi-Skilled} = (432 - 720) \times 2 = ₹ 576 \text{ (A)}$$

$$\text{Unskilled} = (216 - 160) \times 1 = ₹ 56 \text{ (F)}$$

$$\underline{\underline{= ₹ 424 \text{ (A)}}}$$

iv. Labour Mix Variance = $(RSH - AH) \times SR$

$$\text{Skilled} = (1,280 - 1,120) \times 3 = ₹ 480 \text{ (F)}$$

$$\text{Semi-Skilled} = (480 - 720) \times 2 = ₹ 480 \text{ (A)}$$

$$\text{Unskilled} = (240 - 160) \times 1 = ₹ 80 \text{ (F)}$$

$$\underline{\underline{= ₹ 80 \text{ (F)}}}$$

v. Labour Yield Variance = $(SH - RSH) \times SR$

$$\text{Skilled} = (1,152 - 1,280) \times 3 = ₹ 384 \text{ (A)}$$

$$\text{Semi-Skilled} = (432 - 480) \times 2 = ₹ 96 \text{ (A)}$$

$$\text{Unskilled} = (216 - 240) \times 1 = ₹ 24 \text{ (A)}$$

$$\underline{\underline{= ₹ 504 \text{ (A)}}}$$

Illustration 24

A chemical company gives you the following standard and actual data of its Chemical No. 1456. You are required to calculate variances.

Standard Data		
450 kg	Material A @ ₹ 20 per kg	₹ 9,000
360 kg	Material B @ ₹ 10 per kg	₹ 3,600
810 kg		₹ 12,600
90 kg	Normal Loss	

720 kg		₹ 18,600
	2,400 Skilled hours @ ₹ 2 per hour	₹ 4,800
	1,200 Unskilled hours @ ₹ 1 per hour	₹ 1,200
		₹ 6,000

Actual Data		
450 kg	Material A @ ₹ 19 per kg	₹ 8,550
360 kg	Material B @ ₹ 11 per kg	₹ 3,960
810 kg		₹ 12,510
50 kg	Actual Loss	
760 kg		₹ 19,410
	2,400 Skilled hours @ ₹ 2.25 per hour	₹ 5,400
	1,200 Unskilled hours @ ₹ 1.25 per hour	₹ 1,500
		₹ 6,900

Solution:

Material Variances

SQ – Standard Quantity for Actual Output

$$\text{Material A} = \frac{450}{720} \times 760 = 475 \text{ kg}$$

$$\text{Material B} = \frac{360}{720} \times 760 = 380 \text{ kg}$$

SP – Standard Price per unit

$$\text{Material A} = ₹ 20 \text{ per kg}$$

$$\text{Material B} = ₹ 10 \text{ per kg}$$

AQ – Actual Quantity used

$$\text{Material A} = 450 \text{ kg}$$

$$\text{Material B} = 360 \text{ kg}$$

AP – Actual Price per unit

$$\text{Material A} = ₹ 19 \text{ per kg}$$

$$\text{Material B} = 11 \text{ per kg}$$

RSQ – Revised Standard Quantity for Actual Input

$$\text{Material A} = \frac{450}{810} \times 810 = 450 \text{ kg}$$

$$\text{Material B} = \frac{360}{810} \times 810 = 360 \text{ kg}$$

i. Material Cost Variance = $SQ \times SP - AQ \times AP$

Material A = $(475 \times 20) - (450 \times 19) = ₹ 950 \text{ (F)}$

Material B = $(380 \times 10) - (360 \times 11) = ₹ 160 \text{ (A)}$

= ₹ 790 (F)

ii. Material Price Variance = $(SP - AP) \times AQ$

Material A = $(20 - 19) \times 450 = ₹ 450 \text{ (F)}$

Material B = $(10 - 11) \times 360 = ₹ 360 \text{ (A)}$

= ₹ 90 (F)

iii. Material Usage Variance = $(SQ - AQ) \times SP$

Material A = $(475 - 450) \times 20 = ₹ 500 \text{ (F)}$

Material B = $(380 - 360) \times 10 = ₹ 200 \text{ (F)}$

= ₹ 700 (F)

iv. Material Mix Variance = $(RSQ - AQ) \times SP$

Material A = $(450 - 450) \times 20 = \text{Nil}$

Material B = $(360 - 360) \times 10 = \text{Nil}$

= Nil

v. Material Yield Variance = $(SQ - RSQ) \times SP$

Material A = $(475 - 450) \times 20 = ₹ 500 \text{ (F)}$

Material B = $(380 - 360) \times 10 = ₹ 200 \text{ (F)}$

= ₹ 700 (F)

Labour Variances

SH – Standard Hours for Actual Output

Skilled = $\frac{2,400}{3,600} \times 3,600 = 2,533.33 \text{ hours}$

Unskilled = $\frac{1,200}{3,600} \times 3,600 = 1,266.67 \text{ hours}$

SR – Standard Rate per hour

Skilled = ₹ 2 per hour

Semi-skilled = ₹ 1 per hour

AH – Actual Hours

Skilled = 2,400 hours

Semi-skilled = 1,200 hour

AR – Actual Rate

Skilled = ₹ 2.25 per hour

Semi-skilled = ₹ 1.25 per hour

Cost Accounting

RSH – Revised Standard Hour for Actual Input

$$\text{Skilled} = \frac{2,400}{3,600} \times 3,600 = 2,400 \text{ hours}$$

$$\text{Unskilled} = \frac{1,200}{3,600} \times 3,600 = 1,200 \text{ hours}$$

i. Labour Cost Variances = SH × SR – AH × AR

$$\text{Skilled} = (2,533.33 \times 2) - (2,400 \times 2.25) = ₹ 333.34 \text{ (A)}$$

$$\text{Unskilled} = (1,266.67 \times 1) - (1,200 \times 1.25) = ₹ 233.33 \text{ (A)}$$

$$= ₹ 566.67 \text{ (A)}$$

ii. Labour Rate Variances = (SR – AR) × AH

$$\text{Skilled} = (2 - 2.25) \times 2,400 = ₹ 600 \text{ (A)}$$

$$\text{Unskilled} = (1 - 1.25) \times 1,200 = ₹ 300 \text{ (A)}$$

$$= ₹ 900 \text{ (A)}$$

iii. Labour Efficiency Variances = (SH – AH) × SR

$$\text{Skilled} = (2,533.33 - 2,400) \times 2 = ₹ 266.66 \text{ (F)}$$

$$\text{Unskilled} = (1,266.67 - 1,200) \times 1 = ₹ 66.67 \text{ (F)}$$

$$= ₹ 333.33 \text{ (F)}$$

iv. Labour Mix Variances = (RSH – AH) × SR

$$\text{Skilled} = (2,400 - 2,400) \times 2 = \text{Nil}$$

$$\text{Unskilled} = (1,200 - 1,200) \times 1 = \text{Nil}$$

$$= \text{Nil}$$

v. Labour Yield Variances = (SH – RSH) × SR

$$\text{Skilled} = (2,533.33 - 2,400) \times 2 = ₹ 266.66 \text{ (F)}$$

$$\text{Unskilled} = (1,266.67 - 1,200) \times 1 = ₹ 66.67 \text{ (F)}$$

$$= ₹ 333.33 \text{ (F)}$$

Illustration 25

The standard output of Production ‘ABY’ is 25 units per hour in manufacturing department of STR Ltd employing 100 workers. The standard wages rate per labour hour is ₹ 30.

In a 42 hour week of September 2021, the department produced 1,040 units of ABY despite 5% of the time paid was lost due to an abnormal reason. The hourly wage rate actually paid were ₹ 31, ₹ 30 and ₹ 28.50 respectively to 10, 30 and 60 of the workers.

Based on the above information calculate labour variances.

Solution:

1. SH – Standard Hours for Actual Production

$$= \text{Standard hour per worker} \times \text{Number of workers}$$

$$= \frac{\text{Actual Production}}{\text{Standard output per hour per labour}} \times \text{Number of workers}$$

$$= \frac{1,040 \text{ units}}{25 \text{ units per hour}} \times 100 \text{ workers}$$

$$= 4,160 \text{ hours}$$

2. SR – Standard Rate = ₹ 30 per hour

3. AH – Actual Hours paid =
- $42 \times 100 = 4,200$
- hours

4. AR – Actual Rate per hour

Worker Type I - ₹ 31 per hour (Number of Type I worker = 10)

Worker Type II - ₹ 30 per hour (Number of Type II worker = 30)

Worker Type III - ₹ 28.50 per hour (Number of Type III worker = 60)

5. AHW – Actual Hours worked =
- $4,200 \text{ hours} \times 95\% = 3,990$
- hours

6. Idle time =
- $\text{AH} - \text{AHW} = 4,200 - 3,990 = 210$
- hours or
- $4,200 \times 5\% = 210$
- hours

- i. Labour Cost Variance =
- $\text{SH} \times \text{SR} - \text{AH} \times \text{AR}$

$$= 4,160 \times 30 - (42 \times 10 \times 31 + 42 \times 30 \times 30 + 42 \times 60 \times 28.50)$$

$$= 1,24,800 - (13,020 + 37,800 + 71,820) = \text{₹ } 2,160 \text{ (F)}$$

- ii. Labour Rate Variance =
- $(\text{SR} - \text{AR}) \times \text{AH}$

$$\text{For Type I workers} = (30 - 31) \times 42 \times 10 = \text{₹ } 420 \text{ (A)}$$

$$\text{For Type II workers} = (30 - 30) \times 42 \times 30 = \text{Nil}$$

$$\text{For Type III workers} = (30 - 28.50) \times 42 \times 60 = \text{₹ } 3,780 \text{ (F)}$$

$$= \text{₹ } 3,360 \text{ (F)}$$

- iii. Labour Efficiency Variance =
- $(\text{SH} - \text{AHW}) \times \text{SR}$

$$= (4,160 - 3,990) \times \text{₹ } 30 = \text{₹ } 5,100 \text{ (F)}$$

- iv. Labour Idle time Variance =
- $(\text{AHW} - \text{AH}) \times \text{SR}$

$$= (3,990 - 4,200) \times \text{₹ } 30 = \text{₹ } 6,300 \text{ (A)}$$

Budget and Budgetary Control

6.3

6.3.1 Concepts, Types of Budget

Introduction

Budgeting is a fundamental process in cost and management accounting that involves the formulation of a comprehensive plan for allocating resources and achieving organizational goals within a specified period. It serves as a financial roadmap, outlining expected revenues, expenses, and cash flows, while also providing a framework for decision-making, performance evaluation, and resource allocation. It plays a crucial role in organizational management by providing a structured approach to financial planning and control. It enables businesses to set clear financial objectives, allocate resources effectively, and measure performance against predefined benchmarks.

Budgetary control, on the other hand, is the systematic process of planning, coordinating, and monitoring financial activities to ensure that actual performance aligns with budgeted targets. It facilitates the implementation of strategic initiatives, fosters accountability among stakeholders, and enhances transparency in financial management practices.

What 'budget' means?

CIMA Official Terminology¹ defines a budget as a quantitative expression of a plan for a defined period of time. It may include planned sales volumes and revenues; resource quantities, costs and expenses; assets, liabilities and cash flows.

A budget, since it has different purposes, might mean different things to different people. A budget is either considered as a forecast, a means of allocating resources, a yardstick or a target. The details of each of them are mentioned in the below mentioned lines.

Forecast

A budget typically includes forecasts of expected revenues, expenses, and other financial aspects for a specific period, such as a fiscal year.

It helps managers to plan for the future. Given uncertainty about the future, however, it is quite likely that a budget will become outdated as events occur and so the budget will cease to be a realistic forecast. New forecasts might be prepared that differ from the budget. While a forecast is what is likely to happen; a budget is what an organisation wants to happen.

There is significant difference between the two concepts. The differences are categorised below:

Both budgets and forecasts refer to the anticipated actions and events, but still there are wide differences between budgets and forecasts as given below :

¹ CIMA Official Terminology, 2005, The Chartered Institute of Management Accountants (CIMA Publishing, an imprint of Elsevier).

Forecasts	Budgets
• Forecasts is mainly concerned with anticipated or probable events.	• Budget is related to planned events.
• Forecasts may cover for longer period (often in excess of a year).	• Budget is planned or prepared for a shorter period.
• Forecast is only a tentative estimate.	• Budget is a target fixed for a period.
• Forecast results in planning.	• Result of planning is budgeting.
• The function of forecast ends with the forecast of likely events.	• The process of budget starts where forecast ends and converts it into a budget.
• Forecast usually covers a specific business function.	• Budget is prepared for the business as a whole.
• Forecasting does not act as a tool of controlling measurement.	• Purpose of budget is not merely a planning device but also a controlling tool.

Essentials of a Budget

An analysis of the above issues reveals the following essentials of a budget:

1. It is prepared for a definite future period.
2. It is a statement prepared prior to a defined period of time.
3. The Budget is monetary or quantitative statement of policy.
4. The Budget is a predetermined statement and its purpose is to attain a given objective.

A budget, therefore, be taken as a document which is closely related to both the managerial as well as accounting functions of an organisation.

Objectives of Budgeting

The objectives of budgeting revolve around strategic planning, resource optimization, performance management, and organizational effectiveness. By fulfilling these objectives, budgeting contributes to the achievement of long-term sustainability and growth.

The specific objectives are discussed below;

- **Planning:** Budgeting facilitates the formulation of comprehensive financial plans that outline the allocation of resources to achieve organizational goals. It helps in setting specific targets for revenues, expenses, and investments, thereby providing a roadmap for future actions.
- **Coordination:** Budgeting promotes coordination among different departments and functions within an organization by aligning their activities with overall strategic objectives. It ensures that various departments work towards common goals and avoid conflicts in resource allocation.
- **Control:** Budgeting serves as a tool for monitoring and controlling financial activities by comparing actual performance against budgeted targets. It helps in identifying variances, analyzing their causes, and taking corrective actions to ensure that resources are used efficiently and effectively.
- **Evaluation:** Budgeting facilitates the evaluation of organizational performance by providing benchmarks for measuring progress and success. It enables management to assess the effectiveness of strategies, identify areas for improvement, and make informed decisions to enhance future performance.

- **Communication:** Budgeting enhances communication and transparency within the organization by clearly articulating financial goals, priorities, and expectations. It ensures that all stakeholders understand their roles and responsibilities in achieving budgeted targets, fostering accountability and collaboration.

Benefits of Budgeting

Budgeting plays an important role in planning and controlling. It helps in directing the scarce resources to the most productive use and thus ensures overall efficiency in the organisation. The benefits derived by an organisation from an effective system of budgeting can be summarized as given below:

- i. Budgeting facilitates planning of various activities and ensures that the working of the organisation is systematic and smooth.
- ii. Budgeting is a coordinated exercise and hence combines the ideas of different levels of management in preparation of the same.
- iii. Any budget cannot be prepared in isolation and therefore coordination among various departments is facilitated automatically.
- iv. Budgeting helps planning and controlling income and expenditure so as to achieve higher profitability and also act as a guide for various management decisions.
- v. Budgeting is an effective means for planning and thus ensures sufficient availability of working capital and other resources.
- vi. It is extremely necessary to evaluate the actual performance with predetermined parameters. Budgeting ensures that there are well-defined parameters and thus the performance is evaluated against these parameters.
- vii. As the resources are directed to the most productive use, budgeting helps in reducing the wastages and losses.

The Budget Framework

In this section, some important aspects of the budget and the framework under which the budget is prepared are taken up for discussion. The following are considered as important aspect of the budget framework.

Budget committee - The budget committee is the coordinating body in the preparation and administration of budgets. It is usually headed up by the managing director as chairman of the committee and is assisted by a budget officer who is usually a Cost Accountant. Every part of the organisation should be represented on the committee, so there should be a representative from sales, production, marketing and so on.

The Budget Period² - The conventional approach is that once per year the manager of each budget centre prepares a detailed budget for one year. The budget is divided into either twelve monthly for control purposes. The preparation of budgets on an annual basis has been strongly criticized on the grounds of rigidity as it entails a commitment for a period of 12 months. This is risky as the budget is based on uncertain forecasts. An alternative approach is for the annual budget to be broken down by months (quarterly basis). This may also result in a rolling budget which is also referred as a continuous budget that is updated regularly when the earlier budget expires, or we can say it is an extension of the current budget. A rolling budget is also known as a budget rollover.

CIMA Official Terminology¹ defines the budget period as a period for which a budget is prepared and used, which may then be subdivided into control periods.

The Budget Manual - A budget manual is prepared by the Cost Accountant. It describes the objectives and procedures involved in the budgeting process and provides a useful reference source for managers responsible for budget preparation. The manual may include a timetable specifying the order in which the budgets should be

2 Except for capital expenditure budgets, the budget period is usually the accounting year (sub-divided control periods).

prepared and the dates when they should be presented to the budget committee. The manual should be circulated to all individuals who are responsible for preparing budgets.

CIMA Official Terminology¹ defines the budget manual as a detailed set of guidelines and information about the budget process typically including a calendar of budgetary events, specimen budget forms, a statement of budgetary objectives and desired results, listing of budgetary activities and budget assumptions regarding, for example, inflation and interest rates.

A budget manual generally contains the following:

- a. An explanation of the objectives of the budgetary process
- b. Organisational structures consisting of the organisational chart.
- c. An outline of the principal budgets and the relationship between them.
- d. Administrative details of budget preparation.
- e. Procedural matters.

Responsibility for budgets – The person with whom the responsibility for budget lies is also known as the Budget holder. The manager responsible for preparing each budget should ideally be the manager responsible for carrying out the budget. For example, the preparation of particular budgets might be allocated as follows:

- a. The sales manager should draft the sales budget and the selling overheads cost centre budgets.
- b. The purchasing manager should draft the material purchases budget.
- c. The production manager should draft the direct production cost budgets.

Budgetary Control

Before detailing the computational issues of budgets, in this section, aspects of budgetary control is being discussed. Budgetary Control is the systematic process where management uses the budgets prepared at the beginning of the accounting period to compare and analyse the actual results at the end of the accounting period and to set improvement measures for the next accounting year. Thus, the whole gamut of preparation of budget and using the same for control purpose is being considered in the budgetary control. It is applied to a system of management and accounting control by which all operations and output are forecasted as far ahead as possible and actual results when known are compared with budget estimates. Budgetary control is defined as the establishment of the budgets relating to the responsibilities of executives to the requirements of a policy and the continuous comparison of actual with budgeted result either to secure by individual action the objectives of that policy or to provide a firm basis for its revision. The following steps are involved in budgetary control:

- ⊙ Establishments of budgets for each function and section of the organisation.
- ⊙ Continuous comparison of the actual performance with that of the budget so as to know the variation from budget and placing the responsibility of executives for failure to achieve the desired results as given in the budget.
- ⊙ Taking suitable remedial action to achieve the desired objective if there is a variation of the actual performance from the budgeted performance.
- ⊙ Revision of budgets in the light of changed circumstances.

Objectives of Budgetary Control

Budgetary Control is planned to assist the management for policy formulation, planning, controlling and co-ordinating the general objectives of budgetary control and can be stated in the following ways:

- ⊙ **Planning:** A budget is a plan of action. Budgeting ensures a detailed plan of action for a business over a period of time.

- ◉ Co-ordination: Budgetary control co-ordinates the various activities of the entity or organisation and secure co-operation of all concerned towards the common goal.
- ◉ Control: Control is necessary to ensure that plans and objectives are being achieved. Control follows planning and co-ordination. No control performance is possible without predetermined standards. Thus, budgetary control makes control possible by continuous measures against predetermined targets. If there is any variation between the budgeted performance and the actual performance, the same is subject to analysis and corrective action.

6.3.2 Budgetary Control vs Standard Costing

Details	Standard Costing	Budgetary Control
Meaning	It is a system of accounting where predetermined costs are used for analysis of variance and control of the entire organisation.	It is planning exercise made by the management in setting budget for the forthcoming period and analysis of actual with budgeted figure.
Expressed	It may be expressed both in terms of quantitative and monetary measure.	It is expressed in monetary terms only.
Objective	It is ascertained and control of cost.	It is concerned with the overall profitability and financial position of the concern.
Emphasis	It emphasizes on what should be the cost.	It emphasizes on the level of cost not to be exceeded.
Projection	It is projection of cost accounts.	It is projection of financial accounts.
Used by	Standards are usually limited to manufacturing activities only.	Budgets are used by all departments.

6.3.3 Advantages and Limitations

Advantages of Budgetary Control

The advantages of budgetary control may be summarized as follows:

1. Budgetary control facilitates reduction of cost.
2. Top management uses budgetary control in planning and formulation of policies.
3. Budgetary control facilitates effective co-ordination of activities of the various departments and functions by setting their limits and goals.
4. Budgetary control ensures maximization of profits through cost control
5. Budgetary control evaluates the performance of different budget centers on a continuous basis.
6. Budgetary control facilitates adoption of standard costing.

Limitations of Budgetary Control

It is clear that budgetary control is an effective tool for management regarding the control aspect. However, it has certain important limitations which are identified below:

1. Budgets are based on estimates and forecasting. There are various limitations of forecasting as it cannot be considered as an exact science. Thus budgets are tentatively defined plan of action.

2. Budget may prove short or excess of actual requirement. This is more noticeable in a VUCA world where uncertainty in business environment has become the order of the day.
3. Effective implementation of budgetary control depends upon willingness, co-operation and understanding among people.
4. Budgeting is a time consuming process which often becomes less cost effective when changes in business environment occur rapidly.

6.3.4 Preparation of Budgets

The Budgeting Process

Types of budgeting process

This budgeting process involves preparing the budget by the company's senior management based on the company's objectives. The departmental managers are assigned the responsibility for its successful implementation. Every department can opt to create its own budget based on the company's broader budget allocation and goals. The following are the four budgeting processes which are classified on the basis of the participation of the budget holders³.

- ⊙ Bottom-Up Budgeting – this is the budgeting process where all budget holders have the opportunity to participate in setting their own budgets.
- ⊙ Imposed/Top-Down Budgeting – this is the budgeting process where budget allowances are set without permitting ultimate budget holders the opportunity to participate in the process.
- ⊙ Negotiated Budget – this is the budgeting process in which budget allowances are set largely on the basis of negotiations between budget holders and those to whom they report.
- ⊙ Participative Budgeting – Participative budgeting involves employees from lower levels who give their input about the cost allocation. It allows lower-level employees to feel a sense of ownership and belonging to the organisation, as they feel that they are an important part of the budgeting process. Thus, it is often referred as bottom – up budgeting.

Stages in the budgeting process

The important stages of the budgeting process are as follows:

1. communicating details of budget policy and guidelines to those people responsible for the preparation of budgets;
2. determining the factor that restricts output;
3. the order of preparation of budget;
4. negotiation of budgets with superiors;
5. final acceptance of budgets;
6. ongoing review of budgets.

Step One - Communicating details of the budget policy

The annual budget is only an implementation part of the long-range plan. Top management must communicate the

³ The person who is ultimately responsible for ensuring that the budget is followed is known as the Budget Holder. Budget holders are usually the managers and operational directors of companies who are tasked by the owners/shareholders or the board of directors to ensure that the company follows whatever budget is laid out for them. [<https://corporatefinanceinstitute.com/resources/careers/jobs/budget-holder/>].

policy effects of the long-term plan to those responsible for preparing the current year's budgets. Policy effects includes planned changes in sales mix, or the expansion or contraction of certain activities. Thus, preparation of the sales budget is the starting point.

Step Two - Determining the factor that restricts performance

In every organisation there are factors that restricts performance for a given period. In the majority of organisations this factor is sales demand. These factors that restrict performance are referred as principal budget factor. CIMA Official Terminology¹ defines the principal budget factor as factors that limits the activities of an undertaking. The document states that identification of the principal budget factor is often the starting point in the budget setting process. Often the principal budget factor will be sales demand but it could be production capacity or material supply. The principal budget factor may also be machine capacity, distribution and selling resources, the availability of key raw materials or the availability of cash. Once this factor is defined then the remainder of the budgets can be prepared. For example, if sales are the principal budget factor then the production manager can only prepare his budget after the sales budget is complete.

Step Three - The order of budget preparation

Assuming that the principal budget factor has been identified as being sales, the order of budget preparation is summarised as follows:

- a. The sales budget is prepared in units of product and sales value. Along with this the finished goods inventory budget should have to be prepared simultaneously.
- b. With the information from the sales and inventory budgets, the production budget is to be prepared. The production budget will be stated in terms of units.
- c. This leads on logically to budgeting the resources for production. This involves preparing a materials usage budget, machine usage budget and a labour budget.
- d. Sequentially, a materials inventory budget will have to be prepared, to decide the planned increase or decrease in the level of inventory held. Once the raw materials usage requirements and the raw materials inventory budget are known, the purchasing department can prepare the raw material purchases budget.
- e. During the preparation of the sales and production budgets, the managers of the cost centres of the organisation will prepare their draft the department overheads costs budgets. Such overheads will include maintenance, stores, administration, selling and research and development.
- f. From the above information a budgeted income statement has to be prepared.
- g. For the preparation of budgeted statement of financial position, the capital expenditure budget (for non-current assets), the working capital budget (for budgeted increases or decreases in the level of receivables and accounts payable as well as inventories), and a cash budget have to be prepared.

Step Four - Negotiation of budgets

To implement a participative approach to budgeting, the budget should be originated at the lowest level of management and the managers at this level should submit their budget to their superiors for approval.

Step Five - Final acceptance of the budgets

When all the budgets are in harmony with each other, they are summarized into a master budget consisting of a budgeted profit and loss account, a balance sheet and a cash flow statement. Only when the master budget is accepted by the top management and is in consonance with all the other budgets, the top management is nods its final acceptance. This is possible only after sufficient negotiation has taken place over the budgets between the budget holder and the superiors.

Step Six - Budget review

The budget process should not stop when the budgets have been agreed. Periodically, the actual results should be compared with the budgeted results. This is a continuous process and is like the feedback loop.

It can be concluded that the most important aspect of the process is the identification of the principal budget factor or key budget factor. If it is not stated specifically then sales are considered as the principal budget factor. On the basis of this, the preparation stage of the process ensues with the preparation of the sales budget and ends with the preparation of the master budget.

Types of Budget

Budgets can be classified based on various criteria including the following;

1. **Functional Classification** - Budgets can be classified according to the function or purpose they serve within an organization.
2. **Time Period Classification:** Budgets can be classified based on the time period they cover.
3. **Static vs. Flexible Classification:** This is based on the capacity for which the budget is developed. On the basis of capacity, budgets can be classified based on their flexibility to adjust to changing circumstances

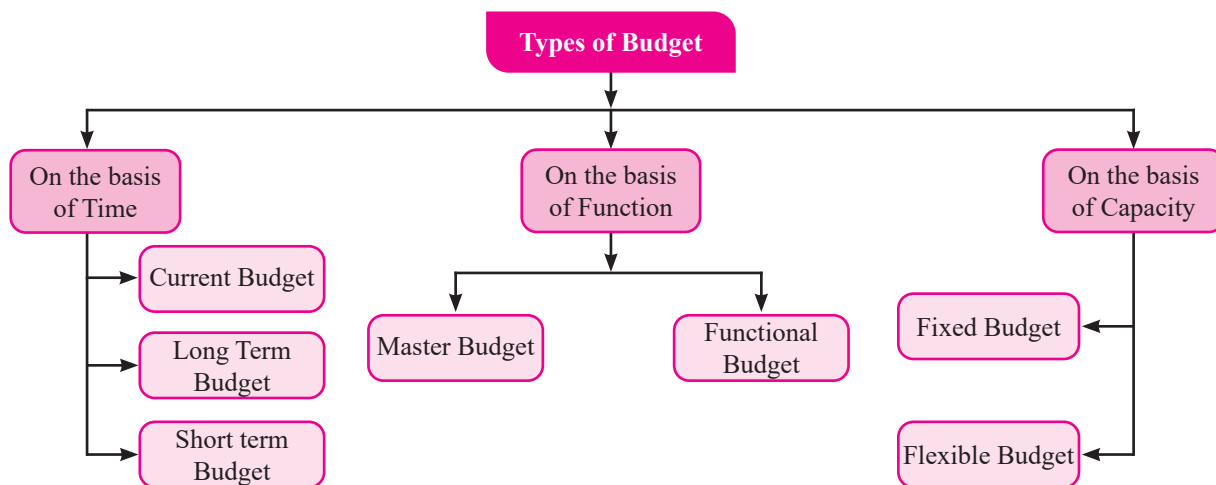


Figure 6.16: Classification of Various of Budgets

Classification on the basis of Time

- Long-Term budgets – These budgets are prepared for a longer period (more than one year). It is usually developed by the top level management. These budgets summarise the general plan of operations and its expected consequences. Long-Term Budgets are prepared for important activities like composition of its capital expenditure, new product development and research, long-term finance etc.
- Short-Term Budgets – These budgets are usually prepared for a period of one year. Sometimes they may be prepared for shorter period as for quarterly or half yearly.
- Current Budgets – These budgets are prepared for the current operations of the business. The planning period of a budget generally in months or weeks.

Classification on the basis of Function

Functional Budget : The functional budget, also referred as a departmental budget, is one which relates to any of the functions of an organisation. The number of functional budgets depend upon the size and nature of business. The following are the commonly used:

- ⊙ Sales Budget
- ⊙ Purchase Budget
- ⊙ Production Budget
- ⊙ Selling and Distribution Cost Budget
- ⊙ Labour Cost Budget
- ⊙ Cash Budget
- ⊙ Capital Expenditure Budget

CIMA Official Terminology¹ defines a functional budget is a budget of income and/or expenditure applicable to a particular function frequently including sales budget, production cost budget (based on budgeted production, efficiency and utilisation), purchasing budget, human resources budget, marketing budget and research and development budget.

Master Budget: The master budget provides a consolidation of all the subsidiary budgets and normally consists of:

- ⊙ a budgeted income statement
- ⊙ budgeted statement of financial position
- ⊙ a cash budget.

Master Budget may be defined as a summary budget incorporating all the functional budgets, which has been finally approved and adopted.

Classification on the Basis of Capacity

- ⊙ Fixed Budget : A fixed budget is designed to remain unchanged irrespective of the level of activity actually attained.
- ⊙ Flexible Budget : A flexible budget is a budget which is designed to change in accordance with the various level of activity actually attained. The flexible budget also called as Variable Budget or Sliding Scale Budget, takes both fixed, variable and semi fixed manufacturing costs into account.

Functional Budget

The functional budgets are prepared for each function of the organisation. These budgets are normally prepared for a period of one year and then broken down to each month. The CIMA definition and the categorisation of the functional budget are discussed in the previous section. Some illustration on preparation of functional budget are given in the next section.

Illustration 26

The Barker Company manufactures two models of adding machines, A and B. The following production and sales data for the month of June 2022 are given below :

Particulars	A	B
Estimated inventory (units) June 1	4500	2250
Desired inventory (units) June 30	4000	2500
Expected Sales Volume (units)	7500	5000
Unit sale price (₹)	75	120

Prepare a sales budget and a production budget for June 2022.

Solution:

Barker Company
(Sales Budget for June 2022)

Product	Sales Volume (Unit)	Unit Selling Price (₹)	Total Sales Price (₹)
A	7,500	75	5,62,500
B	5,000	120	6,00,000
			11,62,500

Barker Company
(Production Budget for June 2022)

Particulars	Products A (units)	Product B (units)
Expected Sales	7,500	5,000
Ending inventory, desired	4,000	2,500
Total	11,500	7,500
Less : Beginning inventory	4,500	2,250
Total production (In units)	7,000	5,250

Illustration 27

Prepare a Production Budget for three months ending March 31, 2022 for a factory producing four products, on the basis of the following information:

Type of Product	Estimated Stock on January 1, 2022	Estimated Sales during January to March 2022	Desired Stock on March 31, 2022
A	2,000	10,000	3,000
B	3,000	15,000	5,000
C	4,000	13,000	3,000
D	3,000	12,000	2,000

Cost Accounting

Solution :

Opening Stock + Production = Sales + Closing Stock

or, Production = Sales + Closing Stock – Opening Stock

Particulars	Product A	Product B	Product C	Product D
Sales	10,000	15,000	13,000	12,000
Add: Closing Stock	3,000	5,000	3,000	2,000
	13,000	20,000	16,000	14,000
Less: Opening Stock	2,000	3,000	4,000	3,000
Production (units)	11,000	17,000	12,000	11,000

Illustration 28

Budgeted production and production costs for the year ending 31st December are as follows:

	Product X	Product Y
Production (units)	2,20,000	2,40,000
Direct material / unit	₹12.50	₹ 19.00
Direct wages / unit	₹ 4.50	₹ 7.00
Total factory overheads for each type of product (variable)	₹ 6,60,000	₹ 9,60,000

A company is manufacturing two products X and Y. A forecast about the number of units to be sold in the first seven months is given below :

Month	January	February	March	April	May	June	July
Product X	10,000	12,000	16,000	20,000	24,000	24,000	20,000
Product Y	28,000	28,000	24,000	20,000	16,000	16,000	18,000

It is anticipated that:

- There will be no work-in-progress at the end of any month.
- Finished units equal to half the sales for the next month will be in stock at the end of each month (including December of previous year).

Prepare for 6 months ending 30th June, a Production Budget and a summarized cost of production budget.

Solution:

Production Budget for 6 months ending 30th June - Product X

Particulars	January	February	March	April	May	June
Sales	10,000	12,000	16,000	20,000	24,000	24,000
Add: Closing Stock	6,000	8,000	10,000	12,000	12,000	10,000
	16,000	20,000	26,000	32,000	36,000	34,000
Less: Opening Stock	5,000	6,000	8,000	10,000	12,000	12,000
Product (units)	11,000	14,000	18,000	22,000	24,000	22,000

Closing Stock of December = Opening Stock of January = $\frac{50}{100} \times \text{Sales of February}$

and Closing Stock of January = $\frac{50}{100} \times \text{Sales of February}$

Total Production of Product X for 6 months = 11,000 + 14,000 + 18,000 + 22,000 + 24,000 + 22,000
= 1,11,000 units

Production Budget for 6 months ending 30th June - Product Y

Particulars	January	February	March	April	May	June
Sales	28,000	28,000	24,000	20,000	16,000	16,000
Add: Closing Stock	14,000	12,000	10,000	8,000	8,000	9,000
	42,000	40,000	34,000	28,000	24,000	25,000
Less: Opening Stock	14,000	14,000	12,000	10,000	8,000	8,000
Product (units)	28,000	26,000	22,000	18,000	16,000	17,000

Total Production of Product Y for 6 months = 28,000 + 26,000 + 22,000 + 18,000 + 16,000 + 17,000 = 1,27,000 units

Summarized Cost of Production Budget for 6 month ending 30th June

Particulars	Product X (1,11,000 units) (₹)	Product Y (1,27,000 units) (₹)	Total (₹)
Materials	@ ₹ 12.50 = 13,87,500	@ ₹ 19 = 24,13,000	38,00,500
Direct Wages	@ ₹ 4.50 = 4,99,500	@ ₹ 7 = 8,89,000	13,88,500
Variable Overheads [WN]	@ ₹ 3 = 3,33,000	@ ₹ 4 = 5,08,000	8,41,000
Cost of Production	22,20,000	38,10,000	60,30,000

Working Notes:

Computation of Variable Factory Overheads Rate per unit

$$\text{Product X} = \frac{\text{₹ } 6,60,000}{2,20,000 \text{ units}} = \text{₹ } 3$$

$$\text{Product Y} = \frac{\text{₹ } 9,60,000}{2,40,000 \text{ units}} = \text{₹ } 4$$

Illustration 29

From the following figures prepare the raw material purchase budget for January 2022:

	Materials					
	A	B	C	D	E	F
Estimated Stock on 1st Jan	16,000	6,000	24,000	2,000	14,000	28,000
Estimated Stock on 31st Jan	20,000	8,000	28,000	4,000	16,000	32,000
Estimated Consumption	1,20,000	44,000	1,32,000	36,000	88,000	1,72,000
Standard Price per unit	25 paise	5 paise	15 paise	10 paise	20 paise	30 paise

Solution :

Opening Stock + Purchase = Consumption + Closing Stock

or, Purchase = Consumption + Closing Stock – Opening Stock

Raw Materials Purchase Budget for January 2022

Particulars	A	B	C	D	E	F
Budgeted Consumption (units)	1,20,000	44,000	1,32,000	36,000	88,000	1,72,000
Add: Estimated Stock on 31st Jan (units)	20,000	8,000	28,000	4,000	16,000	32,000
	1,40,000	52,000	1,60,000	40,000	1,04,000	2,04,000
Less: Estimated Stock on 1st Jan (units)	16,000	6,000	24,000	2,000	14,000	28,000
Budgeted Purchase (units)	1,24,000	46,000	1,36,000	38,000	90,000	1,76,000
Standard Price per unit	25 paise	5 paise	15 paise	10 paise	20 paise	30 paise
Budgeted Purchase Cost (₹)	31,000	2,300	20,400	3,800	18,000	52,800

Illustration 30

The following data on production, materials required for products X and Y, and Inventory pertain to the budget of LMN Company:

Particulars	Product X	Product Y
Production (Units)	2000	3000
Material (Units)		
A	3.0	1.0
B	4.0	6.5

Particulars	Beginning	Desired Ending	Price / unit (₹)
Material Inventory :			
A	2000	3000	2
B	6000	6000	1.2

- Determine the number of material units needed to produce products X and Y
- Calculated the cost of materials used for production.
- Determine the number of materials units to be purchased.
- Calculate the cost of materials to be purchased.

Solution:

- (a) Number of material units needed to produce products X and Y

Particulars	Material A	Material B
Number of Product X to be produced (a)	2000	2000
Number of material units needed per product X (b)	3.0	4.0
Material required (a × b)	6000	8000

Particulars	Material A	Material B
Number of Product Y to be produced (a)	3000	3000
Number of material units needed per product Y (b)	1.0	6.5
Material required (a × b)	3000	19500

Particulars	Material A	Material B
Total number of material units needed for Production of Product X and Product Y (6000 + 3000)	9000	
(8000 + 19500)		27500

(b) Cost of materials used for production

Particulars	Material A	Material B
Total number of material units	9,000	27,500
Unit Price (₹)	2	1.20
Cost of materials used for production (₹)	18,000	33,000

(c) Number of materials units to be purchased

Particulars	Material A	Material B
Total number of material units required for production	9000	27500
Add : Desire ending inventory	3000	6000
	12000	33500
Less : Beginning inventory	2000	6000
Material to be purchased	10000	27500

(d) Cost of materials units to be purchased

Particulars	Material A	Material B
Materials to be purchased	10000	27500
Unit Price (₹)	2.00	1.20
Material to be purchased (₹)	20,000	33,000

Illustration 31

Long Beach Tools Corporation has the following direct labour requirements for the production of a machine tool set:

Direct Labour	Required Time (Hours)	Hourly Rate (₹)
Machining	6	10
Assembly	10	8

Cost Accounting

Forecasted sales of for June, July, August and September are 6000, 5000, 8000, 7000 units respectively. On June 1, beginning Inventory of the tool set was 1500. The Closing inventory (desired) each month is one-half of the forecasted sales for the following month.

- Prepare a production budget for the months of June, July and August.
- Develop a direct labour budget for the months of June, July and August and for each type of direct labour.

Solution :

Long Beach Tool Corporation Production Budget

Particulars	June (units)	July (units)	August (units)
Forecasted Sales	6000	5000	8000
Add : Closing Inventory (Desired)	2500	4000	3500
Total Requirement	8500	9000	11500
Less : Opening Inventory	1500	2500	4000
Number of Units to be produced	7000	6500	7500

Long Beach Tool Corporation Direct Labour Budget

Particulars	June (units)	July (units)	August (units)
Machining:			
a. Budgeted Production	7000 units	6500 units	7500 units
b. Direct Labour Hours per unit	6 hours	6 hours	6 hours
c. Total direct Labour hours required (a × b = c)	42000 hrs.	39000 hrs.	45000 hrs.
d. Direct Labour Cost [c × ₹ 10]	₹ 4,20,000	₹ 3,90,000	₹ 4,50,000

Particulars	June (units)	July (units)	August (units)
Assembly :			
Budgeted Production	7000 units	6500 units	7500 units
Direct Labour Hours per unit	10 hours	10 hours	10 hours
Total direct Labour hours required (a × b = c)	70000 hrs.	65000 hrs.	75000 hrs.
Direct Labour Cost [c (as calculated) × ₹ 8]	₹ 5,60,000	₹ 5,20,000	₹ 6,00,000

Illustration 32

You are required to prepare a Selling Overheads Budget from the estimates given below:

	Amount (₹)
Advertisement (Fixed)	1,000
Salaries of the Sales Department (Fixed)	1,000
Expenses of the Sales Department (Fixed)	750
Salesmen's Remuneration (Fixed)	3,000

Salesmen's Commission @ 1% on sales excluding Agent's Sales

Carriage Outwards: Estimated @ 5% on sales

Agent's Commission: 7½ % on Agent's sales

The sales during the period were estimated as follows:

- ⊙ ₹ 80,000 including Agent's Sales ₹ 8,000
- ⊙ ₹ 90,000 including Agent's Sales ₹ 10,000
- ⊙ ₹ 1,00,000 including Agent's Sales ₹ 10,500

Solution :

Selling Overheads Budget

Particulars	₹	₹	₹
Sales	80,000	90,000	1,00,000
A. Fixed Overheads			
Advertisement	1,000	1,000	1,000
Salaries of Sales Dept.	1,000	1,000	1,000
Expenses of Sales Dept.	750	750	750
Salesmen Remuneration	3,000	3,000	3,000
Total (A)	5,750	5,750	5,750
B. Variable Overheads			
Salesmen Commission	720 [(80,000 – 8,000) × 1%]	800 [(90,000 – 10,000) × 1%]	895 [(1,00,000 – 10,500) × 1%]
Carriage Outward	4,000 [80,000 × 5%]	4,500 [90,000 × 5%]	5,000 [1,00,000 × 5%]
Agent's Commission	600 [8,000 × 7.5%]	750 [10,000 × 7.5%]	788 [10,500 × 7.5%]
Total (B)	5,320	6,050	6,683
Grand Total (A + B)	11,070	11,800	12,433

Cash Budget

A cash budget is a statement in which estimated future cash receipts and payments are tabulated in such a way as to show the forecast cash balance of a business at defined intervals. It is an estimate of cash receipts and cash payments prepared for each month. In this budget all expected payments, revenue as well as capital and all receipts, revenue and capital are taken into consideration. The main purpose of cash budget is to predict the receipts and payments in cash so that the firm will be able to find out the cash balance at the end of the budget period. This will help the firm to know whether there will be surplus cash or deficit at the end of the budget period. It will help them to plan for either investing the surplus or raise necessary amount to finance the deficit. Cash Budget is prepared in various ways, but the most popular form of the same is by the method of Receipt and Payment method.

CIMA Official Terminology¹ defines a cash budget as a detailed budget of estimated cash inflows and outflows incorporating both revenue and capital items. The following illustrates the preparation of a cash budget.

The usefulness of cash budgets

The cash budget is a very important planning tool that an organisation can use. It acts as a cash summary and shows the cash effect of all plans made within the budgetary process. Preparing a cash budget is an essential aspect of financial planning and control, offering valuable insights into the organization's cash flow dynamics and enabling proactive management of liquidity, budgetary performance, and financial risks. The cash position and the appropriate action for each are classified below:

- i. Short term surplus – in case this is projected by the cash budget, the management may take the following actions:
 - ⊙ make short term investments
 - ⊙ make early payments to the suppliers to obtain discount
 - ⊙ invest in receivables and inventories to increase sales.
- ii. Short-term shortfall - in case this is projected by the cash budget, the management may take the following actions:
 - ⊙ arrange for overdraft if the situation demands
 - ⊙ take necessary arrangements to reduce receivables
 - ⊙ delay payments of accounts payable to the extent possible without incurring additional costs like forgoing of discount.
- iii. Long-term surplus - in case this is projected by the cash budget, the management may be said to be in suitable position and should take up the following actions:
 - ⊙ make strategic plans to expand and diversify
 - ⊙ the firm should make arrangements to make long term investments
 - ⊙ Acquisition of fixed assets can also be considered.
- iv. Long-term shortfall – in case this is projected by the cash budget, the management may be said to be in suitable position and should take up the following actions:
 - ⊙ Raise long term finance by issue of equity and other long term source
 - ⊙ Consider shut down of operations or divestment
 - ⊙ Consider other retrenchment strategies.

Illustration on Cash Budget

Illustration 33

The following sales budget is given for Van Dyke Sales Company for the second quarter of 2022 :

Particulars	April	May	June	Total
Sales Budget (₹)	45000	50000	60000	155000

Credit sales are collected as follows:

70 percent in month of sale, 20 percent in month following sale, 8 percent in second month following sale, and 2 percent uncollectible. The accounts receivable balance at the beginning of the second quarter is ₹ 18,000, ₹ 3,600 of which represents uncollected February sales, and ₹ 14,400 uncollected March sales.

1. Calculate the total sales for February and March.
2. Compute the budgeted cash collections from sales for each month. (Without prejudice to the answer to part 1, assume that February sales equal ₹ 40,000 and March sales equal ₹ 50,000.)

Solution

1. February Sales $\Rightarrow (1 - 0.7 - 0.2) = ₹ 3600 \Rightarrow 3600 \div (1 - 0.9) = ₹ 36000$
 March Sales $\Rightarrow (1 - 0.7) = ₹ 14400 \Rightarrow ₹ 14400 \div 0.3 = ₹ 48000$

2. **Budgeted Cash Collections from Sales**

Details	April	May	June
Cash collection			
February : 40000 (8%)	3200		
March : 50000 (20%)	10,000		
50000 (8%)		4000	
April : 45000 (70%)	31500		
45000 (20%)		9000	
45000 (8%)			3600
May : 50000 (70%)		35000	
50000 (20%)			10000
June : 60000 (70%)			42000
	44700	48000	55600

Illustration 34

ABC Ltd a newly started company wishes to prepare Cash Budget from January. Prepare a cash budget for the first six months from the following estimated revenue and expenses.

Month	Total Sales (₹)	Materials (₹)	Wages (₹)	Overheads	
				Production (₹)	Selling & Distribution (₹)
January	20,000	20,000	4,000	3,200	800
February	22,000	14,000	4,400	3,300	900
March	28,000	14,000	4,600	3,400	900
April	36,000	22,000	4,600	3,500	1,000
May	30,000	20,000	4,000	3,200	900
June	40,000	25,000	5,000	3,600	1,200

Cash balance on 1st January was ₹ 10,000. A new machinery is to be installed at ₹ 20,000 on credit, to be repaid by two equal installments in March and April, sales commission @ 5% on total sales is to be paid within a month following actual sales.

₹ 10,000 being the amount of 2nd call may be received in March. Share premium amounting to ₹ 2,000 is also obtained with the 2nd call may be received in March. Period of credit allowed by suppliers – 2 months; period of credit allowed to customers – 1 month, delay in payment of overheads 1 month. Delay in payment of wages ½ month. Assume cash sales to be 50% of total sales.

Solution :

Cash Budget for the period January to June (for first 6 month)

(in ₹)

Particulars	January	February	March	April	May	June
Opening Balance (A)	10,000	18,000	29,800	27,000	24,700	33,100
Add: Receipts (B)						
Cash Sales [WN 1]	10,000	11,000	14,000	18,000	15,000	20,000
Collection from Debtors [WN 1]	-	10,000	11,000	14,000	18,000	15,000
Share Call Money	-	-	10,000	-	-	-
Share Premium	-	-	2,000	-	-	-
Total (A + B)	20,000	39,000	66,800	59,000	57,700	68,100
Payments (C)						
Creditors for Materials	-	-	20,000	14,000	14,000	22,000
Wages [WN 2]	2,000	4,200	4,500	4,600	4,300	4,500
Production O/H	-	3,200	3,300	3,400	3,500	3,200
Selling & Distribution	-	800	900	900	1,000	900
Sales Commission	-	1,000	1,100	1,400	1,800	1,500
Installment of Machinery	-	-	10,000	10,000	-	-
Total (C)	2,000	9,200	39,800	34,300	24,600	32,100
Closing Balance (A + B – C)	18,000	29,800	27,000	24,700	33,100	36,000

Working Notes :

1. Calculation of Cash Sales and Collection from Debtors

Month	Total Sales (₹)	Cash Sales (50%) (₹)	Credit Sales (50%) (₹)	Collection Month
January	20,000	10,000	10,000	February
February	22,000	11,000	11,000	March
March	28,000	14,000	14,000	April
April	36,000	18,000	18,000	May
May	30,000	15,000	15,000	June
June	40,000	20,000	20,000	July

2. Calculation of Payment of Wages (in ₹)

Month	Wages	Payment Month					
		January	February	March	April	May	June
January	4,000	2,000	2,000	-	-	-	-
February	4,400	-	2,200	2,200	-	-	-
March	4,600	-	-	2,300	2,300	-	-
April	4,600	-	-	-	2,300	2,300	-
May	4,000	-	-	-	-	2,000	2,000
June	5,000	-	-	-	-	-	2,500
		2,000	4,200	4,500	4,600	4,300	4,500

Fixed and Flexible Budget

It has been discussed previously that on the basis of capacity, budgets can also be classified as fixed or flexible.

When a budget is prepared by assuming a fixed percentage of capacity utilization, it is called as a fixed budget. For example, a firm may decide to operate at 80% of its total capacity and prepare a budget showing the projected profit or loss at that capacity, then it prepares a fixed budget.

CIMA official terminology¹ defines a fixed budget as a budget set prior to the control period and not subsequently changed in response to changes in activity, costs or revenues. It may serve as a benchmark in performance evaluation.

For preparation of the fixed budget, sales forecast will have to be prepared along with the cost estimates. Cost estimates can be prepared by segregating the costs according to their behavior i.e. fixed and variable. Cost predictions should be made element wise and the projected profit or loss can be worked out by deducting the costs from the sales revenue.

A fixed budget is a budget which is set for a single activity level. While a flexible budget is a budget which recognises different cost behaviour patterns and is designed to change as volume of activity changes. It is important to note that Master budgets are based on planned volumes of production and sales but do not include any provision for the event that actual volumes may differ from the budget. In this sense they may be described as fixed budgets.

As such preparation of flexible budgets are significantly different from what has been discussed so far. The functional budgets which has been discussed so far are all based on a single level of activity and, as such, are fixed budgets.

Advantages of Flexible Budget

Flexible budget, as such, is preferred way of budgeting as it gives a projection of profit at various activity levels. The following is a list of various advantages of the flexible budget.:

1. In flexible budget, all possible volume of output or level of activity can be covered.
2. Overheads costs are analysed into fixed variable and semi-variable costs.
3. Expenditure can be forecasted at different levels of activity.
4. It facilitates comparison of related activities which are essential for intelligent decision making.
5. A flexible budget can be prepared with standard costing or without standard costing.
6. Flexible budget facilitates ascertainment of costs at different levels of activity. Thus, fixation of price, placing tenders and acceptance of quotations can be based on flexible budgets.

Preparation of flexible budgets⁴

There are basically two steps in preparing the flexible budget which are stated below:

Step 1

The first step in the preparation of a flexible budget is the determination of cost behaviour patterns, which means deciding whether costs are fixed, variable or semi-variable.

- ⊙ Fixed costs remain constant over various activity levels.
- ⊙ For non-fixed costs, divide each cost figure by the related activity level. If the cost is a variable cost, the cost per unit will remain constant. If the cost is a semi-variable cost, the unit rate will reduce as activity levels increase.

⁴ For preparation of flexible budget, students are advised to:

1. Observe the various costs given and classify them as fixed or variable.
2. If the costs are semi variable, then students would have to segregate the cost into its variable element and its fixed element. (the methods of segregation is specified in previous modules)

Step 2

The second step in the preparation of a flexible budget is to calculate the budget cost allowance for each cost item.

Budget cost allowance = budgeted fixed cost* + (number of units × variable cost per unit)**

* nil if the cost is variable in nature.

** nil for fixed cost

It is very important to note that semi-variable costs need to be segregated into their fixed and variable components so that the budget cost allowance can be calculated.

Illustration 35

A company manufactures a single product and has produced the following flexible budget for the year

Particulars	Level of activity		
	70% (₹)	80% (₹)	90% (₹)
Turnover	2,10,000	2,40,000	2,70,000
Direct Material	17,780	20,320	22,860
Direct labour	44,800	51,200	57,600
Production overheads	30,500	32,000	33,500
Administrative Overheads	17,000	17,000	17,000
Total Cost	1,10,080	1,20,520	1,30,960
Profit	99,920	1,19,480	1,39,040

Calculate the (a) Direct material Cost, (b) Direct labour cost, and (c) Production overheads, if the budget is fixed at 45% level of activity.

Solution:

(a) Direct materials cost is variable cost.

Check :**Cost per %**

$$70\% : \frac{17,780}{70} = 254$$

$$80\% : \frac{20,320}{80} = 254$$

$$90\% : \frac{22,860}{90} = 254$$

So, Direct materials at 45% level of activity = $254 \times 45 = ₹ 11,430$

- (b) Direct labour is a variable cost.

Check :

Cost per %

$$70\% : \frac{44,800}{70} = 640$$

$$80\% : \frac{51,200}{80} = 640$$

$$90\% : \frac{57,600}{90} = 640$$

So, Direct labour at 45% level of activity = $640 \times 45 = ₹ 28,800$

- (c) Production overheads is a semi-variable cost.

Check :

Cost per %

$$70\% : \frac{30,500}{70} = 436$$

$$80\% : \frac{32,000}{80} = 400$$

$$90\% : \frac{33,500}{90} = 372$$

Variable cost of (90% – 70%) activity = $(33,500 - 30,500)$

Or, Variable cost portion in Production overheads of 20% = ₹ 3,000

Or, Variable cost of 1% change in activity = $3,000/20 = ₹ 150$

Now, Fixed cost portion in Production overheads = $33,500 - (90 \times 150) = ₹ 20,000$

Therefore, Total Production overheads cost at 45% level of activity = $20,000 + (45 \times 150) = ₹ 26,750$

Illustration 36

The monthly budgets for manufacturing overheads of a concern for two levels of activity were as follows :

Capacity	60%	100%
Budgeted Production (units)	600	1,000
	(₹)	(₹)
Wages	1,200	2,000
Consumable stores	900	1,500
Maintenance	1,100	1,500
Power and fuel	1,600	2,000
Depreciation	4,000	4,000
Insurance	1,000	1,000
Total Cost	9,800	12,000

Cost Accounting

You are required to:

- Indicate which of the items are fixed, variable and semi-variable.
- Prepare a budget for 80% capacity, and
- Find the total cost, both fixed and variable per unit of output at 60%, 80% and 100% capacity.

Solution:

(i) Statement showing segregation of the items in Fixed, Variable and Semi-Variable

Items of Cost	Nature of Cost	Variable Cost p.u	Fixed
Wages	Variable	$\frac{1,200}{600} = ₹ 2. \text{ p.u.}$	
Consumable stores	Variable	$\frac{900}{600} = ₹ 1.50 \text{ p.u.}$	
Maintenance	Semi-Variable	$= \frac{\text{Change in total Cost}}{\text{Change in Output}}$ $= \frac{1,500 - 1,100}{1,000 - 600}$ $= \frac{400}{400} = ₹ 1. \text{ p.u.}$	Total Cost – Variable Cost $= 1,100 - (600 \times 1)$ $= ₹ 500$
Power and fuel	Semi-Variable	$= \frac{\text{Change in total Cost}}{\text{Change in Output}}$ $= \frac{2,000 - 1,600}{1,000 - 600}$ $= \frac{400}{400} = ₹ 1. \text{ p.u.}$	Total Cost – Variable Cost $= 1,600 - (600 \times 1)$ $= ₹ 1,000$
Depreciation	Fixed		₹ 4,000
Insurance	Fixed		₹ 1,000

(ii) Budget at 80% Capacity

Production	1,000 × 80% = 800 units (₹)
Wages	$800 \times 2 = 1,600$
Consumable stores	$800 \times 1.50 = 1,200$
Maintenance	$800 \times 1 + 500 = 1,300$
Power and fuel	$800 \times 1 + 1,000 = 1,800$
Depreciation	4,000
Insurance	1,000
Total Cost	10,900

(iii)

Capacity	60%		80%		100%	
Production	600 units		800 units		1000 units	
	p.u. (₹)	Total (₹)	p.u. (₹)	Total (₹)	p.u. (₹)	Total (₹)
Variable Costs						
Wages	2.00	1,200	2.00	1,600	2.00	2,000
Consumable stores	1.50	900	1.50	1,200	1.50	1,500
Maintenance	1.00	600	1.00	800	1.00	1,000
Power and Fuel	1.00	600	1.00	800	1.00	1,000
Total Variable Costs	5.50	3,300	5.50	4,400	5.50	5,500
Fixed Costs						
Maintenance		500		500		500
Power and Fuel		1,000		1,000		1,000
Depreciation		4,000		4,000		4,000
Insurance		1,000		1,000		1,000
Total Fixed Costs	$\frac{6,500}{600}$ = 10.83	6,500	$\frac{6,500}{800}$ = 8.125	6,500	$\frac{6,500}{1,000}$ = 6.50	6,500
Total Costs	16.33	9,800	13.625	10,900	12.00	12,000

Illustration 37

A factory engaged in manufacturing plastic toys is working at 40% capacity and produces 10,000 toys per month. The present cost break up for one toy is as under:

Material : ₹ 10

Labour : ₹ 3

Overheads : ₹ 5 [60% fixed]

The selling price is ₹ 20 per toy.

If it is decided to work the factory at 50% capacity, the selling price falls by 3%, at 90% capacity, the selling price falls by 5% accompanied by a similar fall in the price of material. You are required to prepare a statement showing the profits/losses at 40%, 50% and 90% capacity utilizations.

Solution:

**Flexible Budget
At 40%, 50% and 90% Capacity Utilization**

Particulars	40% Capacity Utilization	50% Capacity Utilization	90% Capacity Utilization
Production - Units	10,000	12,500	22,500
Selling Price Per Unit	₹ 20	₹ 19.40	₹ 19
Sales Value [units × selling price]	₹ 2,00,000	₹ 2,42,500	₹ 4,27,500
Variable Costs :			
Material ₹ 10 per unit	₹ 1,00,000	₹ 1,21,250*	₹ 2,13,750**
Labour ₹ 3 per unit	₹ 30,000	₹ 37,500	₹ 67,500
Overheads ₹ 2 per unit (₹ 5 × 40%)	₹ 20,000	₹ 25,000	₹ 45,000
Total Variable Costs	₹ 1,50,000	₹ 1,83,750	₹ 3,26,250
Fixed Costs (₹ 5 × 60% × 10,000)	₹ 30,000	₹ 30,000	₹ 30,000
Total Costs [Variable Cost + Fixed Cost]	₹ 1,80,000	₹ 2,13,750	₹ 3,56,250
Profit/Loss [Sales – Total Costs]	₹ 20,000	₹ 28,750	₹ 71,250

* 12,500 units × ₹ 9.70 per unit = ₹ 1,21,500

** 22,500 units × ₹ 9.50 per unit = ₹ 2,13,750

Zero Base Budgeting (ZBB)

Zero Base Budgeting (ZBB) is method of budgeting whereby all activities are reevaluated each time budget is formulated and every item of expenditure in the budget is fully justified. Thus, the ZBB involves from scratch or zero. ZBB (also known as priority based budgeting) actually emerged in the late 1960s as an attempt to overcome the limitations of incremental budgeting. This approach requires that all activities are justified and prioritized before decisions are taken relating to the amount of resources allocated to each activity. In incremental budgeting or traditional budgeting, previous year's figures are taken as base and based on the same the budgeted figures for the next year are worked out. Thus, the previous year is taken as the base for preparation of the budget. However, the main limitation of this system of budgeting is that an activity is continued in the future only because it is being continued in the past. Hence in ZBB, the beginning is made from scratch and each activity and function is reviewed thoroughly before sanctioning the same and all expenditures are analyzed and sanctioned only if they are justified. Besides adopting a 'Zero Based' approach, the ZBB also focuses on programs or activities instead of functional departments based on line items, which is a feature of traditional budgeting. It is an extension of program budgeting. In program budgeting, programs are identified and goals are developed for the organisation for the particular program. By inserting decision packages in the system and ranking the packages, the analysis is strengthened and priorities are determined.

Applications of Zero Based Budgeting: The following stages/steps are involved in the application of ZBB:

- Each separate activity of the organisation is identified and is called as a decision package. Decision package is actually nothing but a document that identifies and describes an activity in such a manner that it can be evaluated by the management and rank against other activities competing for limited resources and decide whether to sanction the same or not.

- ⊙ It should be ensured that each decision package is justified in the sense it should be ascertained whether the package is consistent with the goal of the organisation or not.
- ⊙ If the package is consistent with the overall objectives of the organisation, the cost of minimum efforts required to sustain the decision should be determined.
- ⊙ Alternatives for each decision package are considered in order to select better and cheaper options.
- ⊙ Based on the cost and benefit analysis a particular decision package/s should be selected and resources are allocated to the selected package.

Benefits from Zero Based Budgeting :

ZBB was first introduced by Peter A. Pyhrr, a staff control manager at Texas Instruments Corporation, U.S.A. He developed this technique and implemented it for the first time during the year 1969-70 in Texas in the private sector and popularized its wider use. He wrote an article on ZBB in Harvard Business Review and later wrote a book on the same. The ZBB concept was first applied in the State of Georgia, U.S.A. when Mr. Jimmy Carter was the Governor of the State. Later after becoming the President of U.S.A, Mr. Carter introduced and implemented the ZBB in the country in the year 1987. ZBB has a wide application not only in the Government Departments but also in the private sector in a variety of business. In India, the ZBB was applied in the State of Maharashtra in 80s and early 90s. Benefits from ZBB can be summarized in the following manner:

- ⊙ ZBB facilitates review of various activities right from the scratch and a detailed cost benefit study is conducted for each activity. Thus an activity is continued only if the cost benefit study is favourable. This ensures that an activity will not be continued merely because it was conducted in the previous year.
- ⊙ A detailed cost benefit analysis results in efficient allocation of resources and consequently wastages and obsolescence is eliminated.
- ⊙ A lot of brainstorming is required for evaluating cost and benefits arising from an activity and this results into generation of new ideas and also a sense of involvement of the staff.
- ⊙ ZBB facilitates improvement in communication and co-ordination amongst the staff.
- ⊙ Awareness amongst the managers about the input costs is created which helps the organisation to become cost conscious.
- ⊙ An exhaustive documentation is necessary for the implementation of this system and it automatically leads to record building.

Limitations of Zero Based Budgeting :

The following are the limitations of Zero Based Budgeting:

- ⊙ It is a very detailed procedure and naturally if time consuming and lot of paper work is involved in the same.
- ⊙ Cost involved in preparation and implementation of this system is very high.
- ⊙ Morale of staff may be very low as they might feel threatened if a particular activity is discontinued.
- ⊙ Ranking of activities and decision-making may become subjective at times.
- ⊙ It may not advisable to apply this method when there are non-financial considerations, such as ethical and social responsibility because this will dictate rejecting a budget claim on low ranking projects.

Performance Budgeting

It is budgetary system where the input costs are related to the performance i.e. the end results. This budgeting is used extensively in the Government and Public Sector Undertakings. It is essentially a projection of the Government activities and expenditure thereon for the budget period. This budgeting starts with the broad classification of expenditure according to functions such as education, health, irrigation, social welfare etc. Each of the functions is then classified into programs sub classified into activities or projects. The main features of performance budgeting are as follows:

- ◉ Classification into functions, programs or activities
- ◉ Specification of objectives for each program
- ◉ Establishing suitable methods for measurement of work as far as possible
- ◉ Fixation of work targets for each program.

Objectives of each program are ascertained clearly and then the resources are applied after specifying them clearly. The results expected from such activities are also laid down. Annual, quarterly and monthly targets are determined for the entire organisation. These targets are broken down for each activity centre. The next step is to set up various productivity or performance ratios and finally target for each program activity is fixed. The targets are compared with the actual results achieved. Thus, the procedure for the performance budgets include allocation of resources, execution of the budget and periodic reporting at regular intervals.

The budgets are initially compiled by the various agencies such as Government Department, public undertakings etc. Thereafter these budgets move on to the authorities responsible for reviewing the performance budgets. Once the higher authorities decide about the funds, the amount sanctioned are communicated and the work is started. It is the duty of these agencies to start the work in time, to ensure the regular flow of expenditure, against the physical targets, prevent over runs under spending and furnish report to the higher authorities regarding the physical progress achieved.

In the final phase of performance budgetary process, progress reports are to be submitted periodically to higher authorities to indicate broadly, the physical performance to be achieved, the expenditure incurred and the variances together with explanations for the variances.

Further Illustrations

Illustration 38

Draw a Material Procurement Budget (Quantitative) from the following information:

Estimated sales of a Product 40,000 units. Each unit of the Product requires 3 units of Material A and 5 units of Material B.

Estimated opening balances at the commencement of the next year:

Finished product = 5,000 units

Material A = 12,000 units

Material B = 20,000 units

Opening stock of Material on order:

Material A = 7,000 units

Material B = 11,000 units

The desirable closing balance at the end of the next year:

Finished product = 7,000 units

Material A = 15,000 units

Material B = 25,000 units

Material on order:

Material A = 8,000 units

Material B = 10,000 units

Solution:

Production = Sales + Closing Stock – Opening Stock
 = 40,000 + 7,000 – 5,000 = 42,000 units

Raw Materials Purchase Budget

Particulars	Product A units	Product B units
Materials Required	$42,000 \times 3 = 1,26,000$	$42,000 \times 5 = 2,10,000$
Add: Closing Stock	15,000	25,000
Add: Closing Stock of Material on Order	8,000	10,000
	1,49,000	2,45,000
Less: Opening Stock	12,000	20,000
Less: Opening Stock of Material on Order	7,000	11,000
Raw Material Purchase	1,30,000	2,14,000

Illustration 39

A company manufactures Product A and Product B during the year 31st December, 2021, it is expected to sell 15,000 kg of Product A and 75,000 kg of Product B at ₹ 30 and ₹ 16 per kg respectively. The direct materials P, Q and R are mixed in the proportion of 3 : 5 : 2 in the manufacture of Product A, and Materials Q and R are mixed in the proportion of 1 : 2 in the manufacture of Product B. The actual and budgeted inventories for the year are given below:

	Opening Stock	Estimated Closing Stock	Anticipated cost per kg
	(kg)	(kg)	(₹)
Material P	4,000	3,000	12
Material Q	3,000	4,000	10
Material R	30,000	9,000	8
Product A	3,000	1,500	—
Product B	4,000	4,500	—

Prepare the Production Budget and Materials Budget showing the expenditure on purchase of materials for the year ending 31st December, 2021.

Solution:

Production Budget for Product A and Product B

Particulars	Product A units	Product B units
Sales	15,000	75,000
Add: Closing Stock	1,500	4,500
	16,500	79,500
Less: Opening Stock	3,000	4,000
Production	13,500	75,500

Material Purchase Budget for the year ending December 31st, 2021

Particulars	P	Q	R	Total
Materials required for Product A in the ratio of 3 : 5 : 2	4,050	6,750	2,700	13,500
Materials required for Product B in the ratio of 1 : 2	—	25,167	50,333	75,500
Total requirement	4,050	31,917	53,033	89,000
Add: Closing Stock	3,000	4,000	9,000	16,000
	7,050	35,917	62,033	1,05,000
Less: Opening Stock	4,000	3,000	30,000	37,000
Purchases (in units)	3,050	32,917	32,033	68,000
Cost per kg	12	10	8	
Total Purchase Cost (₹)	36,600	3,29,170	2,56,264	6,22,034

Illustration 40

The following details apply to an annual budget for a manufacturing company:

Quarter	1 st	2 nd	3 rd	4 th
Working Days	65	60	55	60
Production (units per working day)	100	110	120	105
Raw material purchases (% by weight of annual total)	30%	50%	20%	—
Budgeted purchase price / kg (₹)	1	1.05	1.125	—

Quantity of raw material per unit of production 2 kg. Budgeted closing stock of raw material 2,000 kg. Budgeted opening stock of raw material 4,000 kg (Cost ₹ 4,000).

Issues are priced on FIFO Basis. Calculate the following budgeted figures:

- Quarterly and annual purchase of raw material by weight and value.
- Closing quarterly stocks by weight and value.

Solution:

(a) Quarterly and annual purchase of raw material by weight and value

Quarter	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Production (units)	$65 \times 100 = 6,500$	$60 \times 110 = 6,600$	$55 \times 120 = 6,600$	$60 \times 105 = 6,300$	26,000
Material Required (kg) (Production $\times$ 2 kg p.u) Add: Closing Stock (kg)	13,000	13,200	13,200	12,600	52,000 2,000
Less: Opening Stock (kg)					54,000 4,000
Annual Purchase by weight (kg)					50,000
Quarterly Purchase by weight (kg)	$30\% \times 50,000 = 15,000$	$50\% \times 50,000 = 25,000$	$20\% \times 50,000 = 10,000$	—	
Budgeted Purchase Price per kg (₹)	1	1.05	1.125		
Quarterly and Annual Purchase by Value (₹)	$15,000 \times 1 = 15,000$	$25,000 \times 1.05 = 26,250$	$10,000 \times 1.125 = 11,250$		52,500

(b) Closing quarterly stock by weight and value

Store Ledger (FIFO)

Quarter	Receipt			Issue			Balance (Closing Stock)		
	Quantity (kg)	Rate	Amount (₹)	Quantity (kg)	Rate	Amount (₹)	Quantity (kg)	Rate	Amount (₹)
Opening							4,000	1	4,000
1	15,000	1	15,000	13,000	1	13,000	6,000	1	6,000
2	25,000	1.05	26,250	13,200 (6,000) (7,200)	$\left(\begin{smallmatrix} 1 \\ 1.05 \end{smallmatrix} \right)$ (6,000) (7,560)	13,560 (6,000) (7,560)	17,800	1.05	18,690
3	10,000	1.125	11,250	13,200	1.05	13,860	14,600 (4,600) (10,000)	$\left(\begin{smallmatrix} 1.05 \\ 1.125 \end{smallmatrix} \right)$ (4,830) (11,250)	16,080 (4,830) (11,250)
4	—	—	—	12,600 (4,600) (8,000)	$\left(\begin{smallmatrix} 1.05 \\ 1.125 \end{smallmatrix} \right)$ (4,830) (9,000)	13,830 (4,830) (9,000)	2,000	1.125	2,250

Illustration 41

Prepare a Cash Budget for the three months ending 30th June, 2022 from the information given below:

(a)

Month	Sales (₹)	Materials (₹)	Wages (₹)	Overheads (₹)
February	14,000	9,600	3,000	1,700
March	15,000	9,000	3,000	1,900
April	16,000	9,200	3,200	2,000
May	17,000	10,000	3,600	2,200
June	18,000	10,400	4,000	2,300

(b) Credit terms are:

Sales / Debtors: 10% sales are on cash, 50% of the credit sales are collected next month and the balance in the following month.

Creditors: Materials after 2 month

Wages : $\frac{1}{4}$ in next month

Overheads: $\frac{1}{2}$ in next month

(c) Cash and bank balance on 1st April, 2022 is expected to be ₹ 6,000.

(d) Other relevant information are:

- Plant and machinery will be installed in February, 2022 at a cost of ₹ 96,000. The monthly installment of ₹ 2,000 is payable from April onwards.
- Dividend @ 5% on preference share capital of ₹ 2,00,000 will be paid on 1st June.
- Advance to be received for sale of vehicles ₹ 9,000 in June.
- Dividends from investments amounting to ₹ 1,000 are expected to be received in June.

Solution:

Cash Budget for the 3 months ending 30th June, 2022

Particulars	April (₹)	May (₹)	June (₹)
Opening Balance (A)	6,000	3,950	3,000
Add: Receipts (B)			
Cash Sales [WN 1]	1,600	1,700	1,800
Collection from Debtors [WN 1]	13,050	13,950	14,850
Advance from Sale of Vehicles	—	—	9,000
Dividend	—	—	1,000
Total (A + B)	20,650	19,600	29,650
Payments (C)			
Creditors for			
Materials	9,600	9,000	9,200
Wages [WN 2]	3,150	3,500	3,900
Overheads [WN 3]	1,950	2,100	2,250
Installment of Plant and Machinery	2,000	2,000	2,000
Preference Dividend	—	—	10,000

Particulars	April (₹)	May (₹)	June (₹)
Total (C)	16,700	16,600	27,350
Closing Balance (A + B – C)	3,950	3,000	2,300

Working Notes:

1. Calculation of Cash Sales and Collection from Debtors

Amount (₹)

Month	Total Sales	Cash Sales	Credit Sales	Collection			
				March	April	May	June
February	14,000	1,400	12,600	6,300	6,300	–	–
March	15,000	1,500	13,500	–	6,750	6,750	–
April	16,000	1,600	14,400	–	–	7,200	7,200
May	17,000	1,700	15,300	–	–	–	7,650
June	18,000	1,800	16,200	–	–	–	–
					13,050	13,950	14,850

2. Calculation of Payment of Wages

(Amount in ₹)

Month	Wages (₹)	March (₹)	April (₹)	May (₹)	June (₹)
March	3,000	2,250	750	–	–
April	3,200	–	2,400	800	–
May	3,600	–	–	2,700	900
June	4,000	–	–	–	3,000
			3,150	3,500	3,900

3. Calculation of Payment of Overheads

Month	Overheads (₹)	Overheads			
		March (₹)	April (₹)	May (₹)	June (₹)
March	1,900	950	950	1,000	1,100
April	2,000		1,000	1,100	1,150
May	2,200				
June	2,300				
			1,950	2,100	2,250

Illustration 42

For production of 10,000 units the following are budgeted expenses:

	Cost Per unit (₹)
Direct Materials	48
Direct Labour	24
Variable Overheads	20
Fixed Overheads (₹ 1,20,000)	12
Variable Expenses (Direct)	4
Selling Expenses (10% Fixed)	12
Administration Expenses (₹ 40,000 Fixed)	4
Distribution Expenses (20% Fixed)	4
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Prepare a budget for production of 7,000 units and 9,000 units.

Solution:

Flexible Budget at Different Capacities and Determination of Overheads Rates

Particulars	10,000 units		7,000 units		9,000 units	
	Cost p.u. (₹)	Total (₹)	Cost p.u. (₹)	Total (₹)	Cost p.u. (₹)	Total (₹)
Variable Cost						
Direct Materials	48	4,80,000	48	3,36,000	48	4,32,000
Direct Labour	24	2,40,000	24	1,68,000	24	2,16,000
Variable Overheads	20	2,00,000	20	1,40,000	20	1,80,000
Variable Expenses	4	40,000	4	28,000	4	36,000
Selling Expenses (90% × 12)	10.80	1,08,000	10.80	75,600	10.80	97,200
Distribution Expenses (80% × 4)	3.20	32,000	3.20	22,400	3.20	28,800
Total Variable Cost (A)	110	11,00,000	110	7,70,000	110	9,90,000
Fixed Cost						
Fixed Overheads	12	1,20,000		1,20,000		1,20,000
Selling Expenses (10% × 12)	1.20	12,000		12,000		12,000
Administration Expenses	4	40,000		40,000		40,000
Distribution Expenses (20% × 4)	0.80	8,000		8,000		8,000
Total Fixed Cost (B)	18	1,80,000		1,80,000		1,80,000
Total Cost (A + B)	128	12,80,000		9,50,000		11,70,000

Illustration 43

Draw up a flexible budget for overheads expenses on the basis of the following data and determine the overheads rates at 70%, 80% and 90%

Plant Capacity	at 80% capacity
Variable Overheads:	₹
Indirect Labour	12,000
Stores including spares	4,000
Semi-Variable:	
Power (30% - Fixed, 70% - Variable)	20,000
Repairs (60% - Fixed, 40% - Variable)	2,000
Fixed overheads:	
Depreciation	11,000
Insurance	3,000
Salaries	10,000
Total Overheads	62,000
Estimated Direct Labour Hours	1,24,000

Solution:**Flexible Budget at Different Capacities and Determination of Overheads Rates**

Plant Capacity	80% (₹)	70% (₹)	90% (₹)
Variable Overheads:			
Indirect Labour	12,000	$\frac{12,000}{80\%} \times 70\% = 10,500$	$\frac{12,000}{80\%} \times 90\% = 13,500$
Stores including spares	4,000	$\frac{4,000}{80\%} \times 70\% = 3,500$	$\frac{4,000}{80\%} \times 90\% = 4,500$
Total Variable Overheads (A)	16,000	14,000	18,000
Semi Variable: [WN 1]			
Power	20,000	18,250	21,750
Repairs	2,000	1,900	2,100
Total Semi Variable (B)	22,000	20,150	23,850

Cost Accounting

Plant Capacity	80% (₹)	70% (₹)	90% (₹)
Fixed:			
Depreciation	11,000	11,000	11,000
Insurance	3,000	3,000	3,000
Salaries	10,000	10,000	10,000
Total Fixed (C)	24,000	24,000	24,000
Total (A + B + C)	62,000	58,150	65,850
Labour Hours	1,24,000	$\frac{1,24,000}{80\%} \times 70\% = 1,08,500$	$\frac{1,24,000}{80\%} \times 90\% = 1,39,500$
Labour Hour Rate (₹ / hour)	0.50 $\left(\frac{62,000}{1,24,000 \text{ hr}} \right)$	0.536 $\left(\frac{58,150}{1,08,500 \text{ hr}} \right)$	0.472 $\left(\frac{65,850}{1,39,500 \text{ hr}} \right)$

Working Notes:

1. Calculation of Semi Variable Costs

Plant Capacity	80% (₹)	70% (₹)	90% (₹)
Semi Variable:			
a. Power –			
Variable 70%	14,000	$\frac{14,000}{80\%} \times 70\% = 12,250$	$\frac{14,000}{80\%} \times 90\% = 15,750$
Fixed 30%	6,000	6,000	6,000
	20,000	18,250	21,750
b. Repairs –			
Variable 40%	800	$\frac{800}{80\%} \times 70\% = 700$	$\frac{800}{80\%} \times 90\% = 900$
Fixed 60%	1,200	1,200	1,200
	2,000	1,900	2,100

Illustration 44

From the following information relating to 2021 and conditions expected to prevail in 2022, prepare a budget for 2022.

2021 Actual:	Amount (₹)
Sales (40,000 units)	1,00,000
Raw materials	53,000
Wages	11,000
Variable Overheads	16,000
Fixed Overheads	10,000
2022 Prospects:	
Sales (60,000 units)	1,50,000
Raw materials	5% increase in price
Wages	10% increase in wage rate
	5% increase in productivity
Additional Plant:	
One Lathe	25,000
One Drill	12,000
10% Depreciation to be considered	

Solution:

Budget showing Costs and Profits for the year 2022

	Amount (₹)
i. Sales	1,50,000
ii. Costs	
Raw Materials $[53,000 \times \frac{60,000}{40,000} \times \frac{105}{100}]$	83,475
Wages $[11,000 \times \frac{60,000}{40,000} \times \frac{110}{100} \times \frac{105}{100}]$	19,058
Variable Overheads $[16,000 \times \frac{60,000}{40,000} \times \frac{105}{100}]$	24,000
Fixed Overheads $[10,000 + (25,000 + 12,000) \times \frac{10}{100}]$	13,700
Total Cost	1,40,233
iii. Profit (i. – ii.)	9,767

Illustration 45

Production costs of a factory for a year are as follows:

	Amount (₹)
Direct Wages	80,000
Direct Materials	1,20,000
Production Overheads: Fixed	40,000
Variable	60,000

During the forthcoming year it is anticipated that:

- The average rate for direct labour remuneration will fall from ₹ 0.80 per hour to ₹ 0.75 per hour.
- Production efficiency is currently at 5% less than the whole capacity, in the forth coming year it will be at full capacity.
- Price per unit of direct material and of other materials and services which comprise overheads will remain unchanged.
- Production in the coming year will increase by $33\frac{1}{3}\%$. Draw up a production cost budget.

Solution:

Production Cost Budget for the forthcoming year

Particulars	₹
i. Wages $[80,000 \times 133\frac{1}{3}\% \times \frac{0.75}{0.80} \times \frac{100}{95}]$	1,05,263
ii. Materials $[1,20,000 \times 133\frac{1}{3}\%]$	1,60,000
iii. Variable Overheads $[60,000 \times 133\frac{1}{3}\%]$	80,000
iv. Fixed Overheads	40,000
Production Cost (i + ii + iii)	3,85,263

Illustration 46

A company manufactures two products A and B and the budgeted data for the year are as follows:

	Product A (₹)	Product B (₹)
Sales price per unit	100	75
Direct materials per unit	20	10
Direct wages per unit	5	4
Total works overheads	10,105	9,009
Total marketing overheads	1,200	1,100

The sales manager forecasts the sales in units as follows:

	Product A	Product B
January	28	10
February	28	12
March	24	16
April	20	20
May	16	24
June	16	24
July to January (next year) per month	18	20

It is assumed that (i) there will be no work in progress at the end of any month, and (ii) finished units is equal to half the sales for the following month will be kept in stock.

Prepare (a) A Production Budget for each month and (b) A Summarized Profit and Loss Statement for the year ending in December.

Solution:

(a) Production Budget (in units)

Particulars	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Product A													
Sales	28	28	24	20	16	16	18	18	18	18	18	18	240
Add: Cl. Stock	14	12	10	8	8	9	9	9	9	9	9	9	
	42	40	34	28	24	25	27	27	27	27	27	27	
Less: Op. Stock	14	14	12	10	8	8	9	9	9	9	9	9	
	28	26	22	18	16	17	18	18	18	18	18	18	235
Product B													
Sales	10	12	16	20	24	24	20	20	20	20	20	20	226
Add: Cl. Stock	6	8	10	12	12	10	10	10	10	10	10	10	
	16	20	26	32	36	34	30	30	30	30	30	30	
Less: Op. Stock	5	6	8	10	12	12	10	10	10	10	10	10	
	11	14	18	22	24	22	20	20	20	20	20	20	231

$$\text{Closing Stock of January} = \frac{1}{2} \times \text{Sales of February}$$

$$\text{and, Opening Stock of January} = \text{Closing Stock of December} = \frac{1}{2} \times \text{Sales of January}$$

$$\text{or, Opening Stock of January} = \frac{1}{2} \times \text{Sales of January}$$

(b)

Summarised Production Cost Budget

Particulars	Product A	Product B	Total
Production	235 units	231 units	
	(₹)	(₹)	(₹)
Direct Material:	235 @ ₹ 20 = 4,700	231 @ ₹ 10 = 2,310	7,010
Direct Labour	235 @ ₹ 5 = 1,175	231 @ ₹ 4 = 924	2,099
Works Overheads	10,105	9,009	19,114
Total Production Cost	15,980	12,243	28,223
Production Cost p.u.	$\frac{15,980}{235 \text{ units}} = ₹ 68 \text{ p.u.}$	$\frac{12,243}{231 \text{ units}} = ₹ 53 \text{ p.u.}$	

Summarised Profit and Loss Statement for the year

Particulars	Product A (₹)	Product B (₹)	Total (₹)
Sales	240 × 100 = 24,000	226 × 75 = 16,950	40,950
Less: Cost of Goods Sold	240 × 68 = 16,320	226 × 53 = 11,978	28,298
Marketing Overheads	1,200	1,100	2,300
Profit	6,480	3,872	10,352

Illustration 47

Three Articles X, Y and Z are produced in a factory. They pass through two cost centers A and B. From the data furnished compile a statement for budgeted machine utilization in both the centers.

(a) Sales budget for the year

Product	Annual Budgeted Sales (units)	Opening Stock of finished products (units)	Closing Stock
X	4,800	600	Equivalent to 2 months sales
Y	2,400	300	-do-
Z	2,400	800	-do-

(b) Machine hours per unit of product

Product	Cost Centers	
	A	B
X	30	70
Y	200	100
Z	30	20

(c) Total number of machines

Cost Centre	
A	284
B	256
Total	540

(d) Total working hours during the year: Estimated 2,500 hours per machine.

Solution:

Calculation of units of Production of Different Products

(in units)

Particulars	Product X	Product Y	Product Z
Sales	4,800	2,400	2,400
Add: Closing Stock	$\frac{4,800}{12 \text{ months}} \times 2 \text{ months} = 800$	$\frac{2,400}{12 \text{ months}} \times 2 \text{ months} = 400$	$\frac{2,400}{12 \text{ months}} \times 2 \text{ months} = 400$
Less: Opening Stock	600	300	800
Production	5,000	2,500	2,000

Machine Hours Utilisation Budget

Particulars	Cost Centers							
	A				B			
	X	Y	Z	Total	X	Y	Z	Total
Production (units)	5,000	2,500	2,000		5,000	2,500	2,000	
Hours required p.u.	30	200	30		70	100	20	
Total Machine hours required	1,50,000	5,00,000	60,000	7,10,000	3,50,000	2,50,000	40,000	6,40,000
Number of Machines required [WN]	60	200	24	284	140	100	16	256

Working Notes:

Number of Machines required:

Cost Centre A :	Product X	$= \frac{284}{7,10,000} \times 1,50,000 = 60 \text{ machines}$
	Product Y	$= \frac{284}{7,10,000} \times 5,00,000 = 200 \text{ machines}$
	Product Z	$= \frac{284}{7,10,000} \times 60,000 = 24 \text{ machines}$
Cost Centre B :	Product X	$= \frac{256}{6,40,000} \times 3,50,000 = 140 \text{ machines}$
	Product Y	$= \frac{256}{6,40,000} \times 2,50,000 = 100 \text{ machines}$
	Product Z	$= \frac{256}{6,40,000} \times 40,000 = 16 \text{ machines}$

Illustration 48

Prepare a Production Budget for three months ending March 31, 2022 for a factory producing four products, on the basis of the following information.

Type of Product	Estimated Stock on January 1, 2022	Estimated Sales during January to March 2022	Desired Stock on March 31, 2022
A	2,000	10,000	3,000
B	3,000	15,000	5,000
C	4,000	13,000	3,000
D	3,000	12,000	2,000

Solution:

Opening Stock + Production = Sales + Closing Stock

or, Production = Sales + Closing Stock – Opening Stock

Particulars	Product A	Product B	Product C	Product D
Sales	10,000	15,000	13,000	12,000
Add: Closing Stock	3,000	5,000	3,000	2,000
	13,000	20,000	16,000	14,000
Less: Opening Stock	2,000	3,000	4,000	3,000
Production (units)	11,000	17,000	12,000	11,000

Illustration 49

Budgeted production and production costs for the year ending 31st December are as follows:

	Product X	Product Y
Production (units)	2,20,000	2,40,000
Direct material / unit	₹12.50	₹ 19.00
Direct wages / unit	₹ 4.50	₹ 7.00
Total factory overheads for each type of product (variable)	₹ 6,60,000	₹ 9,60,000

A company is manufacturing two products X and Y. A forecast about the number of units to be sold in the first seven months is given below:

Month	January	February	March	April	May	June	July
Product X	10,000	12,000	16,000	20,000	24,000	24,000	20,000
Product Y	28,000	28,000	24,000	20,000	16,000	16,000	18,000

It is anticipated that:

- There will be no work-in-progress at the end of any month.
- Finished units equal to half the sales for the next month will be in stock at the end of each month (including December of previous year).

Prepare for 6 months ending 30th June a Production Budget and a summarised cost of production budget.

Solution

Production Budget for 6 months ending 30th June - Product X

Particulars	January	February	March	April	May	June
Sales	10,000	12,000	16,000	20,000	24,000	24,000
Add: Closing Stock	6,000	8,000	10,000	12,000	12,000	10,000
	16,000	20,000	26,000	32,000	36,000	34,000
Less: Opening Stock	5,000	6,000	8,000	10,000	12,000	12,000
Product (units)	11,000	14,000	18,000	22,000	24,000	22,000

Closing Stock of December = Opening Stock of January = $\frac{50}{100} \times \text{Sales of January}$

and Closing Stock of January = $\frac{50}{100} \times \text{Sales of February}$

Total Production of Product X for 6 months = 11,000+14,000+18,000+22,000+24,000+22,000 = 1,11,000 units

Production Budget for 6 months ending 30th June - Product Y

Particulars	January	February	March	April	May	June
Sales	28,000	28,000	24,000	20,000	16,000	16,000
Add: Closing Stock	14,000	12,000	10,000	8,000	8,000	9,000
	42,000	40,000	34,000	28,000	24,000	25,000
Less: Opening Stock	14,000	14,000	12,000	10,000	8,000	8,000
Product (units)	28,000	26,000	22,000	18,000	16,000	17,000

Total Production of Product Y for 6 months = 28,000+26,000+22,000+18,000+16,000+17,000 = 1,27,000 units

Summarised Cost of Production Budget for 6 month ending 30th June

Particulars	Product X (1,11,000 units) (₹)	Product Y (1,27,000 units) (₹)	Total (₹)
Materials	@ ₹ 12.50 = 13,87,500	@ ₹ 19 = 24,13,000	38,00,500
Direct Wages	@ ₹ 4.50 = 4,99,500	@ ₹ 7 = 8,89,000	13,88,500
Variable Overheads	@ ₹ 3 = 3,33,000	@ ₹ 4 = 5,08,000	8,41,000
Cost of Production	22,20,000	38,10,000	60,30,000

Working Notes:

- Computation of Variable Factory Overhead Rate per unit

$$\text{Product X} = \frac{\text{₹ 6,60,000}}{2,20,000 \text{ units}} = \text{₹ 3}$$

$$\text{Product Y} = \frac{\text{₹ 9,60,000}}{2,40,000 \text{ units}} = \text{₹ 4}$$

Illustration 50

Draw a Material Procurement Budget (Quantitative) from the following information:

Estimated sales of a Product 40,000 units. Each unit of the Product requires 3 units of Material A and 5 units of Material B.

Cost Accounting

Estimated opening balances at the commencement of the next year:

Finished product = 5,000 units

Material A = 12,000 units

Material B = 20,000 units

Material on order:

Material A = 7,000 units

Material B = 11,000 units

The desirable closing balance at the end of the next year:

Finished product = 7,000 units

Material A = 15,000 units

Material B = 25,000 units

Material on order:

Material A = 8,000 units

Material B = 10,000 units

Solution:

Production = Sales + Closing Stock – Opening Stock

= 40,000 + 7,000 – 5,000 = 42,000 units

Raw Materials Purchase Budget

Particulars	Product A (units)	Product B (units)
Materials Required	42,000 x 3 = 1,26,000	42,000 x 5 = 2,10,000
Add: Closing Stock	15,000	25,000
Add: Closing Stock on Order	8,000	10,000
	1,49,000	2,45,000
Less: Opening Stock	12,000	20,000
Less: Opening Stock on Order	7,000	11,000
Raw Material Purchase	1,30,000	2,14,000

Illustration 51

From the following figures prepare the raw material purchase budget for January 2022:

	Materials					
	A	B	C	D	E	F
Estimated Stock on 1 st Jan	16,000	6,000	24,000	2,000	14,000	28,000
Estimated Stock on 31 st Jan	20,000	8,000	28,000	4,000	16,000	32,000
Estimated Consumption	1,20,000	44,000	1,32,000	36,000	88,000	1,72,000
Standard Price per unit	25 p.	5 p.	15 p.	10 p.	20 p.	30 p.

Solution:

Opening Stock + Purchase = Consumption + Closing Stock

or, Purchase = Consumption + Closing Stock – Opening Stock

Raw Materials Purchase Budget for January 2022

Particulars	A	B	C	D	E	F	Total
Estimated Consumption (units)	1,20,000	44,000	1,32,000	36,000	88,000	1,72,000	
Add: Estimated Stock on 31 st Jan (units)	20,000	8,000	28,000	4,000	16,000	32,000	
	1,40,000	52,000	1,60,000	40,000	1,04,000	2,04,000	
Less: Estimated Stock on 1 st Jan (units)	16,000	6,000	24,000	2,000	14,000	28,000	
Estimated Purchase (units)	1,24,000	46,000	1,36,000	38,000	90,000	1,76,000	
Standard Price per unit	25 p.	5 p.	15 p.	10 p.	20 p.	30 p.	
Estimated Purchase Cost (₹)	31,000	2,300	20,400	3,800	18,000	52,800	1,28,300

Illustration 52

A company manufactures Product A and Product B during the year 31st December, 2021, it is expected to sell 15,000 kg of Product A and 75,000 kg of Product B at ₹ 30 and ₹ 16 per kg respectively. The direct materials P, Q and R are mixed in the proportion of 3 : 5 : 2 in the manufacture of Product A, and Materials Q and R are mixed in the proportion of 1 : 2 in the manufacture of Product B. The actual and budgeted inventories for the year are given below:

	Opening Stock	Estimated Closing Stock	Anticipated cost per kg
	kg	kg	₹
Material P	4,000	3,000	12
Material Q	3,000	6,000	10
Material R	30,000	9,000	8
Product A	3,000	1,500	-
Product B	4,000	4,500	-

Prepare the Production Budget and Materials Budget showing the expenditure on purchase of materials for the year ending 31st December, 2021.

Solution:

Production Budget for Product A and Product B

Particulars	Product A (units)	Product B (units)
Sales	15,000	75,000
Add: Closing Stock	1,500	4,500
	16,500	79,500
Less: Opening Stock	3,000	4,000
Production	13,500	75,500

Material Purchase Budget for the year ending December 31st, 2021

Particulars	P	Q	R	Total
Materials required for Product A in the ratio of 3 : 5 : 2	4,050	6,750	2,700	13,500
Materials required for Product B in the ratio of 1 : 2	-	25,167	50,333	75,500
Total requirement	4,050	31,917	53,033	
Add: Closing Stock	3,000	6,000	9,000	
	7,050	37,917	62,033	
Less: Opening Stock	4,000	3,000	30,000	
Purchases (in units)	3,050	34,917	32,033	
Cost per kg	12	10	8	
Total Purchase Cost (₹)	36,600	3,49,170	2,56,264	6,42,034

Illustration 53

The following details apply to an annual budget for a manufacturing company.

Quarter	1 st	2 nd	3 rd	4 th
Working Days	65	60	55	60
Production (units per working day)	100	110	120	105
Raw material purchases (% by weight of annual total)	30%	50%	20%	-
Budgeted purchase price / kg (₹)	1	1.05	1.125	-

Quantity of raw material per unit of production 2 kg. Budgeted closing stock of raw material 2,000 kg. Budgeted opening stock of raw material 4,000 kg (Cost ₹ 4,000).

Issues are priced on FIFO Basis. Calculate the following budgeted figures.

- Quarterly and annual purchase of raw material by weight and value.
- Closing quarterly stocks by weight and value.

Solution:

a) Quarterly and annual purchase of raw material by weight and value

Particulars	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Production (units)	65 x 100 = 6,500	60 x 110 = 6,600	55 x 120 = 6,600	60 x 105 = 6,300	26,000
Material Required (kg) (Production x 2 kg p.u)	13,000	13,200	13,200	12,600	52,000
Add: Closing Stock (kg)					2,000
					54,000
Less: Opening Stock (kg)					4,000
Annual Purchase by weight (kg)					50,000
Quarterly Purchase by weight (kg)	30% x 50,000 = 15,000	50% x 50,000 = 25,000	20% x 50,000 = 10,000	-	
Budgeted Purchase Price per kg	1	1.05	1.125		
Quarterly and Annual Purchase by Value (₹)	15,000 x 1 = 15,000	25,000 x 1.05 = 26,250	10,000 x 1.125 = 11,250		52,500

b) Closing quarterly stock by weight and value

Store Ledger (FIFO)

Quarter	Receipt			Issue			Balance (Closing Stock)		
	Quantity (kg)	Rate	Amount ₹	Quantity (kg)	Rate	Amount ₹	Quantity (kg)	Rate	Amount ₹
Opening							4,000	1	4,000
1	15,000	1	15,000	13,000	1	13,000	6,000	1	19,000
2	25,000	1.05	26,250	13,200		13,560	17,800	1.05	18,690
3	10,000	1.125	11,250	13,200	1.05	13,860	14,600		16,080
4	-	-	-	12,600		13,830	2,000	1.125	2,250

Illustration 54

You are required to prepare a Selling Overheads Budget from the estimates given below:

	Amount (₹)
Advertisement (Fixed)	1,000
Salaries of the Sales Department (Fixed)	1,000
Expenses of the Sales Department (Fixed)	750
Salesmen's Remuneration (Fixed)	3,000

Salesmen's Commission @ 1% on sales affected

Carriage Outwards: Estimated @ 5% on sales

Agent's Commission: 7 on sales

The sales during the period were estimated as follows:

- ₹ 80,000 including Agent's Sales ₹ 8,000
- ₹ 90,000 including Agent's Sales ₹ 10,000
- ₹ 1,00,000 including Agent's Sales ₹ 10,500

Solution:

Selling Overheads Budget

Particulars	₹	₹	₹
Sales	80,000	90,000	1,00,000
(A) Fixed Overheads			
Advertisement	1,000	1,000	1,000
Salaries of Sales Dept.	1,000	1,000	1,000
Expenses of Sales Dept.	750	750	750
Salesmen Remuneration	3,000	3,000	3,000
Total (A)	5,750	5,750	5,750

(B) Variable Overheads			
Salesmen Commission	720 [(80,000 – 8,000) x 1%]	800 [(90,000 – 10,000) x 1%]	895 [(1,00,000 – 10,500) x 1%]
Carriage Outward	4,000 [80,000 x 5%]	4,500 [9,00,000 x 5%]	5,000 [1,00,000 x 5%]
Agent's Commission	600 [8,000 x 7.5%]	750 [10,000 x 7.5%]	788 [10,500 x 7.5%]
Total (B)	5,320	6,050	6,683
Grand Total (A + B)	11,070	11,800	12,433

Illustration 55

Prepare a Cash Budget for the three months ending 30th June, 2022 from the information given below:

a)

Month	Sales (₹)	Materials (₹)	Wages (₹)	Overheads (₹)
February	14,000	9,600	3,000	1,700
March	15,000	9,000	3,000	1,900
April	16,000	9,200	3,200	2,000
May	17,000	10,000	3,600	2,200
June	18,000	10,400	4,000	2,300

Credit terms are:

Sales / Debtors: 10% sales are on cash, 50% of the credit sales are collected next month and the balance in the following month.

Creditors: Materials 2 month

Wages $\frac{1}{4}$ month

Overheads $\frac{1}{2}$ month

c) Cash and bank balance on 1st April, 2022 is expected to be ₹ 6,000.

d) Other relevant information are:

- Plant and machinery will be installed in February, 2022 at a cost of ₹ 96,000. The monthly installment of ₹ 2,000 is payable from April onwards.
- Dividend @ 5% on preference share capital of ₹ 2,00,000 will be paid on 1st June.
- Advance to be received for sale of vehicles ₹ 9,000 in June.
- Dividends from investments amounting to ₹ 1,000 are expected to be received in June.

Solution:**Cash Budget for the 3 months ending 30th June, 2022**

Particulars	April	May	June
	₹	₹	₹
Opening Balance (A)	6,000	3,950	3,000
Add: Receipts (B)			
Cash Sales	1,600	1,700	1,800
Collection from Debtors	13,050	13,950	14,850
Advance from Sale of Vehicles	-	-	9,000
Dividend	-	-	1,000
Total (A + B)	20,650	19,600	29,650
Payments (C)			
Creditors for			
Materials	9,600	9,000	9,200
Wages	3,150	3,500	3,900
Overheads	1,950	2,100	2,250
Installment of Plant and Machinery	2,000	2,000	2,000
Preference Dividend	-	-	10,000
Total (C)	16,700	16,600	27,350
Closing Balance (A + B – C)	3,950	3,000	2,300

Working Notes:**1. Calculation of Cash Sales and Collection from Debtors**

Amount (₹)

Month	Total Sales	Cash Sales	Credit Sales	Collection Month			
				March	April	May	June
February	14,000	1,400	12,600	6,300	6,300	-	-
March	15,000	1,500	13,500	-	6,750	6,750	-
April	16,000	1,600	14,400	-	-	7,200	7,200
May	17,000	1,700	15,300	-	-	-	7,650
June	18,000	1,800	16,200	-	-	-	-
					13,050	13,950	14,850

2. Calculation of Payment of Wages

Month	Wages ₹	Payment Month			
		March ₹	April ₹	May ₹	June ₹
March	3,000	2,250	750	-	-
April	3,200	-	2,400	800	-
May	3,600	-	-	2,700	900
June	4,000	-	-	-	3,000
			3,150	3,500	3,900

3. Calculation of Payment of Overheads

Month	Overheads ₹	Payment Month			
		March ₹	April ₹	May ₹	June ₹
March	1,900	950	950		
April	2,000		1,000	1,000	
May	2,200			1,100	1,100
June	2,300				1,150
			1,950	2,100	2,250

Illustration 56

For production of 10,000 units the following are budgeted expenses:

	Cost Per unit ₹
Direct Materials	48
Direct Labour	24
Variable Overheads	20
Fixed Overheads (₹ 1,20,000)	12
Variable Expenses (Direct)	4
Selling Expenses (10% Fixed Fixed)	12
Administration Expenses (₹ 40,000 fixed)	4
Distribution Expenses (20% fixed)	4
	128

Prepare a budget for production of 7,000 units and 9,000 units.

Solution:

Flexible Budget

Particulars	10,000 units		7,000 units		9,000 units	
	Cost p.u. ₹	Total ₹	Cost p.u. ₹	Total ₹	Cost p.u. ₹	Total ₹
Variable Cost						
Direct Materials	48	4,80,000	48	3,36,000	48	4,32,000
Direct Labour	24	2,40,000	24	1,68,000	24	2,16,000
Variable Overheads	20	2,00,000	20	1,40,000	20	1,80,000
Variable Expenses	4	40,000	4	28,000	4	36,000
Selling Expenses (90% x 12)	10.80	1,08,000	10.80	75,600	10.80	97,200
Distribution Expenses (80% x 4)	3.20	32,000	3.20	22,400	3.20	28,800
Total Variable Cost (A)	110	11,00,000	110	7,70,000	110	9,90,000
Fixed Cost						
Fixed Overheads	12	1,20,000		1,20,000		1,20,000
Selling Expenses (10% x 12)	1.20	12,000		12,000		12,000
Administration Expenses	4	40,000		40,000		40,000
Distribution Expenses (20% x 4)	0.80	8,000		8,000		8,000
Total Fixed Cost (B)	18	1,80,000		1,80,000		1,80,000
Total Cost (A + B)	128	12,80,000		9,50,000		11,70,000

Illustration 57

Draw up a flexible budget for overhead expenses on the basis of the following data and determine the overhead rates at 70%, 80% and 90%

Plant Capacity	at 80% capacity
Variable Overheads:	₹
Indirect Labour	12,000
Stores including spares	4,000
Semi-Variable:	
Power (30% - Fixed: 70% - Variable)	20,000
Repairs (60% - Fixed: 40% - Variable)	2,000
Fixed overheads:	
Depreciation	11,000
Insurance	3,000
Salaries	10,000
Total Overheads	62,000
Estimated Direct Labour Hours	1,24,000

Solution:

Flexible Budget at Different Capacities and Determination of Overhead Rates

Plant Capacity	80% ₹	70% ₹	90% ₹
Variable Overheads:			
Indirect Labour	12,000	$\frac{12,000}{80\%} \times 70\% = 10,500$	$\frac{12,000}{80\%} \times 90\% = 13,500$
Stores including spares	4,000	$\frac{4,000}{80\%} \times 70\% = 3,500$	$\frac{4,000}{80\%} \times 90\% = 4,500$
Total Variable Overheads (A)	16,000	14,000	18,000
Semi Variable:			
Power	20,000	18,250	21,750
Repairs	2,000	1,900	2,100
Total Semi Variable (B)	22,000	20,150	23,850
Fixed:			
Depreciation	11,000	11,000	11,000
Insurance	3,000	3,000	3,000
Salaries	10,000	10,000	10,000
Total Fixed (C)	24,000	24,000	24,000
Total (A + B + C)	62,000	58,150	65,850
Labour Hours	1,24,000	$\frac{1,24,000}{80\%} \times 70\% = 1,08,500$	$\frac{1,24,000}{80\%} \times 90\% = 1,39,500$
Labour Hour Rate (₹ / hour)	0.50 $\left[\frac{₹62,000}{1,24,000 \text{ hr}} \right]$	0.536 $\left[\frac{₹58,150}{1,08,500 \text{ hr}} \right]$	0.472 $\left[\frac{₹65,850}{1,39,500 \text{ hr}} \right]$

Working Notes:

1. Calculation of Semi Variable Costs

Plant Capacity	80% (₹)	70% (₹)	90% (₹)
Semi Variable:			
Power			
Variable 70%	14,000	$\frac{14,000}{80\%} \times 70\% = 12,250$	$\frac{14,000}{80\%} \times 90\% = 15,750$
Fixed 30%	6,000	6,000	6,000
	20,000	18,250	21,750
Repairs			
Variable 40%	800	$\frac{800}{80\%} \times 70\% = 700$	$\frac{800}{80\%} \times 90\% = 900$
Fixed	1,200	1,200	1,200
	2,000	1,900	2,100

Illustration 58

From the following information relating to 2021 and conditions expected to prevail in 2022, prepare a budget for 2022.

2021 Actual:	Amount (₹)
Sales (40,000 units)	1,00,000
Raw materials	53,000
Wages	11,000
Variable Overheads	16,000
Fixed Overhead	10,000
2022 Prospects:	
Sales (60,000 units)	1,50,000
Raw materials	5% increase in price
Wages	10% increase in wage rate
	5% increase in productivity
Additional Plant:	
One Lathe	25,000
One Drill	12,000
10% Depreciation to be considered	

Solution:**Budget showing Costs and Profits for the year 2022**

	₹
i. Sales	1,50,000
ii. Costs	
Raw Materials $[53,000 \times \frac{60,000}{40,000} \times \frac{105}{100}]$	83,475
Wages $[11,000 \times \frac{60,000}{40,000} \times \frac{110}{100} \times \frac{100}{105}]$	17,285
Variable Overheads $[16,000 \times \frac{60,000}{40,000}]$	24,000
Fixed Overheads $[10,000 + (25,000 + 12,000) \times \frac{10}{100}]$	13,700
Total Cost	1,38,460
iii. Profit (i. – ii.)	11,540

Illustration 59

Production costs of a factory for a year are as follows:

	Amount (₹)
Direct Wages	80,000
Direct Materials	1,20,000
Production Overheads: Fixed	40,000
Variable	60,000

During the forthcoming year it is anticipated that:

- The average rate for direct labour remuneration will fall from ₹ 0.80 per hour to ₹ 0.75 per hour.
- Production efficiency will be reduced by 5%.
- Price per unit of direct material and of other materials and services which comprise overheads will remain unchanged, and
- Production in the coming year will increase by $33\frac{1}{3}\%$ Draw up a production cost budget.

Solution:

Production Cost Budget for the forthcoming year

Particulars	₹
i. Wages $(80,000 \times 133\frac{1}{3}\% \times \frac{0.75}{0.80} \times \frac{100}{95})$	1,05,263
ii. Materials $(1,20,000 \times 133\frac{1}{3}\%)$	1,60,000
iii. Variable Overhead $(60,000 \times 133\frac{1}{3}\%)$	80,000
iv. Fixed Overhead	40,000
Production Cost	3,85,263

Illustration 60

A company manufactures two products A and B and the budgeted data for the year are as follows:

	Product A ₹	Product B ₹
Sales price per unit	100	75
Direct materials per unit	20	10
Direct wages per unit	5	4
Total works overheads	10,105	9,009
Total marketing overheads	1,200	1,100

The sales manager forecasts the sales in units as follows:

	Product A	Product B
January	28	10
February	28	12
March	24	16
April	20	20
May	16	24
June	16	24
July to January (next year) per month	18	20

It is assumed that (i) there will be no work in progress at the end of any month, and (ii) finished units equal to half the sales for the following month will be kept in stock.

Prepare (a) A Production Budget for each month and (b) A Summarized Profit and Loss Statement for the year.

Solution:

(a) Production Budget (in units)

Particulars	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Product A													
Sales	28	28	24	20	16	16	18	18	18	18	18	18	240
Add: Cl. Stock	14	12	10	8	8	9	9	9	9	9	9	9	
	42	40	34	28	24	25	27	27	27	27	27	27	
Less: Op. Stock	14	14	12	10	8	8	9	9	9	9	9	9	
	28	26	22	18	16	17	18	18	18	18	18	18	235
Product B													
Sales	10	12	16	20	24	24	20	20	20	20	20	20	226
Add: Cl. Stock	6	8	10	12	12	10	10	10	10	10	10	10	
	16	20	26	32	36	34	30	30	30	30	30	30	
Less: Op. Stock	5	6	8	10	12	12	10	10	10	10	10	10	
	11	14	18	22	24	22	20	20	20	20	20	20	231

Closing Stock of January = $\frac{1}{2} \times$ Sales of February

And, Opening Stock of January = Closing Stock of December = $\frac{1}{2} \times$ Sales of January

or, Opening Stock of January = $\frac{1}{2} \times$ Sales of January

(b) Summarised Production Cost Budget

Particulars	Product A	Product B	Total
Production	235 units	231 units	
	₹	₹	₹
Direct Material:	235 @ ₹ 20 = 4,700	231 @ ₹ 10 = 2,310	7,010
Direct Labour	235 @ ₹ 5 = 1,175	231 @ ₹ 4 = 924	2,099
Works Overheads	10,105	9,009	19,114
Total Production Cost	15,980	12,243	28,223
Production Cost p.u.	$\frac{₹15,980}{235 \text{ units}} = ₹ 68 \text{ p.u.}$	$\frac{₹12,243}{231 \text{ units}} = ₹ 53 \text{ p.u.}$	

Summarised Profit and Loss Statement for the year

Particulars	Product A (₹)	Product B (₹)	Total (₹)
Sales	240 × 100 = 24,000	226 × 75 = 16,950	40,950
Less: Cost of Goods Sold	240 × 68 = 16,320	226 × 53 = 11,978	28,298
Marketing Overheads	1,200	1,100	2,300
Profit	6,480	3,872	10,352

Illustration 61

Three Articles X, Y and Z are produced in a factory. They pass through two cost centers A and B. From the data furnished compile a statement for budgeted machine utilization in both the centers.

(a) Sales budget for the year

Product	Annual Budgeted Sales (units)	Opening Stock of finished products (units)	Closing Stock
X	4,800	600	Equivalent to 2 months sales
Y	2,400	300	-do-
Z	2,400	800	-do-

(b) Machine hours per unit of product

Product	Cost Centers	
	A	B
X	30	70
Y	200	100
Z	30	20

(c) Total number of machines

Cost Centre	
A	284
B	256
Total	540

(d) Total working hours during the year: Estimated 2,500 hours per machine.

Solution:

Calculation of units of Production of Different Products

Particulars	Product X (Units)	Product Y (Units)	Product Z (Units)
Sales	4,800	2,400	2,400
Add: Closing Stock	$\frac{4,800}{12} \times 2 = 800$	$\frac{2,400}{12} \times 2 = 400$	$\frac{2,400}{12} \times 2 = 400$
Less: Opening Stock	600	300	800
Production	5,000	2,500	2,000

Machine Hours Utilisation Budget

Particulars	Cost Centers							
	A				B			
	X	Y	Z	Total	X	Y	Z	Total
Production (units)	5,000	2,500	2,000		5,000	2,500	2,000	
Hours required p.u.	30	200	30		70	100	20	
Total Machine hours required	1,50,000	5,00,000	60,000	7,10,000	3,50,000	2,50,000	40,000	6,40,000
Number of Machines required	60	200	24	284	140	100	16	256

Working Notes:

Cost Centre A	Product X	$= \frac{284}{7,10,000} \times 1,50,000 = 60$ machines
	Product Y	$= \frac{284}{7,10,000} \times 5,00,000 = 200$ machines
	Product Z	$= \frac{284}{7,10,000} \times 60,000 = 24$ machines
Cost Centre B	Product X	$= \frac{256}{6,40,000} \times 3,50,000 = 140$ machines
	Product Y	$= \frac{256}{6,40,000} \times 2,50,000 = 100$ machines
	Product Z	$= \frac{256}{6,40,000} \times 40,000 = 16$ machines

Exercise

A. Theoretical Questions:

⊙ Multiple Choice Questions

1. The cost of a product under marginal costing system includes
 - a. Prime cost plus variable overheads
 - b. Prime cost plus fixed overheads
 - c. Prime cost plus factory overheads
 - d. Only prime cost
2. The difference between absorption costing and marginal costing is in regard to the treatment of
 - a. Direct materials
 - b. Fixed overheads
 - c. Prime cost
 - d. Variable overheads
3. Fixed costs are treated as
 - a. Overheads costs
 - b. Prime costs
 - c. Period costs
 - d. Conversion costs
4. When sales and production (in units) are same then profits under
 - a. Marginal costing is lower than that of absorption costing
 - b. Marginal costing is higher than that of absorption costing
 - c. Marginal costing is equal to that of absorption costing
 - d. None of the above
5. When sales exceed production (in units) then profit under
 - a. Marginal costing is higher than that of absorption costing
 - b. Marginal costing is equal to that of absorption costing
 - c. Marginal costing is lower than that of absorption costing
 - d. None of the above

6. Which of the following factors responsible for change in the break-even point?
 - a. Change in selling price
 - b. Change in variable cost
 - c. Change in fixed cost
 - d. All of the above
7. Variable cost
 - a. Remains fixed in total
 - b. Remains fixed per unit
 - c. Varies per unit
 - d. Nor increase or decrease
8. Marginal Costing technique follows the following basic of classification
 - a. Element wise
 - b. Function Wise
 - c. Behaviour wise
 - d. Identifiability wise
9. P/V ratio will increase if the
 - a. There is a decrease in fixed cost
 - b. There is an increase in fixed cost
 - c. There is a decrease in selling price per unit.
 - d. There is a decrease in variable cost per unit.
10. The technique of differential cost is adopted when
 - a. To ascertain P/V ratio
 - b. To ascertain marginal cost
 - c. To ascertain cost per unit
 - d. To make choice between two or more alternative courses of action
11. Which of the following would not be used to estimate standard direct material prices?
 - a. The availability of bulk purchase discounts
 - b. Purchase contracts already agreed
 - c. The forecast movement of prices in the market
 - d. Performance standards in operation
12. What is an attainable standard?

- a. A standard which includes no allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under perfect operating conditions
 - b. A standard which includes some allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under efficient operating conditions
 - c. A standard which is based on currently attainable operating conditions
 - d. A standard which is kept unchanged, to show the trend in costs
13. Budgets are shown in-Terms
- a. Qualitative
 - b. Quantitative
 - c. Materialistic
 - d. both (b) and (c)
14. Which of the following is not an element of master budget?
- a. Capital Expenditure Budget
 - b. Production Schedule
 - c. Operating Expenses Budget
 - d. All above
15. Which of the following is not a potential benefit of using a budget?
- a. Enhanced coordination of firm activities
 - b. More motivated managers
 - c. Improved inter-departmental communication
 - d. More accurate external financial statements
16. Which of the following is a long-term budget?
- a. Master Budget
 - b. Flexible Budget
 - c. Cash Budget
 - d. Capital Budget
17. Materials become key factor, if
- a. quota restrictions exist
 - b. insufficient advertisement prevails
 - c. there is low demand
 - d. there is no problem with supplies of materials
18. The difference between fixed cost and variable cost assumes significance in the preparation of the

following budget

- a. Master Budget
- b. Flexible Budget
- c. Cash Budget
- d. Capital Budget

19. The budget that is prepared first of all is _____.

- a. Master budget
- b. Sales budget assuming that it is the key factor
- c. Cash Budget
- d. Capital expenditure budget

20. Sales budget is a _____.

- a. expenditure budget
- b. functional budget
- c. master budget
- d. None of these

21. When a company wants to prepare a factory overheads budget in which the estimated costs are directly derived from the estimates of activity levels, which of the following budget should be prepared by the company?

- a. Flexible budget
- b. Fixed budget
- c. Master budget
- d.. R & D budget

22. Which of the following budgets facilitates classification of fixed and variable costs:

- a. Capital expenditure budget
- b. Flexible budget
- c. Cash budget
- d. Raw materials budget

23. The entire budget organisation is controlled and headed by a senior executive known as:

- a. General Manager
- b. Accountant
- c. Budget Controller
- d. None of the above

24. Which of the following is generally a long term budget:
- Cash budget
 - Sales budget
 - Research and Development budget
 - Capital expenditure budget
25. A flexible budget requires a careful study of
- Fixed, semi-fixed and variable expenses
 - Past and current expenses
 - Overheads, selling and administrative expenses.
 - None of these.
26. The basic difference between a fixed budget and flexible budget is that a fixed budget _____
- is concerned with a single level of activity, while flexible budget is prepared for different levels of activity
 - Is concerned with fixed costs, while flexible budget is concerned with variable costs.
 - is fixed while flexible budget changes
 - None of these.

Answer:

1	A	2	B	3	C	4	C	5	A	6	D	7	B	8	C
9	D	10	D	11	D	12	B	13	D	14	B	15	D	16	D
17	A	18	B	19	B	20	B	21	A	22	B	23	C	24	D
25	A	26	A												

⊙ **State True or False**

- Excess of Actual cost over Standards Cost is treated as unfavourable variance.
- Variances are calculated for both material and labour.
- While fixing standards, normal losses and wastages are taken into account.
- Standard costing is an ideal name given to the estimate making.
- Pre-determined standards provide a yardstick for the measurement of efficiency.
- Material cost variance and labour cost variance are always equal.
- Fixing standards is the work of industrial engineer or the production people and not of cost accountant.

8. Standards costing are more profitability employed in job order industries than in process type industries.
9. Budget is a means and budgetary control is the end result.
10. To achieve the anticipated targets, Planning, Co-ordination and Control are the important main tasks of management, achieved through budgeting and budgetary control.
11. A key factor or principal factor does not influence the preparation of all other budgets.
12. Budgetary control does not facilitate introduction of 'Management by Exception'.
13. Generally, budgets are prepared to coincide with the financial year so that comparison of the actual performance with budgeted estimates would facilitate better interpretation and understanding.
14. A flexible budget is one, which changes from year to year.
15. A flexible budget recognises the difference between fixed, semi-fixed and variable cost and is designed to change in relation to the change in level of activity.
16. Sales budget, normally, is the most important budget among all budgets.
17. The principal factor is the starting point for the preparation of various budgets.
18. A budget manual is the summary of all functional budgets.

Answer:

1	T	2	T	3	T	4	F	5	T	6	F	7	F	8	F
9	T	10	T	11	F	12	F	13	T	14	F	15	T	16	T
17	T	18	F												

⊙ **Fill in the Blanks**

1. _____ are not assigned to the product but are recognized as expenses in the period incurred. All nonmanufacturing costs are period costs
2. Only difference between variable costing and absorption costing is the classification of _____
3. Under marginal costing the difference in the magnitude of _____ does not affect the unit cost of production.
4. _____ compare favourably with the economist's definition of marginal cost, viz. that marginal cost is the amount which at any given volume of output is changed if output is increased or decreased by one unit.
5. Historical costing uses post period costs while standards costing uses _____ costs.
6. Three types of standards are _____, _____, _____.
7. The _____ is usually the co-ordinator of the standards committee.

Cost Accounting

8. Basically there are two types of standards viz; _____ and _____.
9. When actual cost is less than the standards cost, it is known as _____ variance.
10. A flexible budget is geared toward _____ rather than a single level of activity.
11. _____ is a system for reporting revenue and cost information to the individual responsible for the revenue-causing and/or cost-incurring function.
12. Budgets are useful for _____ the operating activities and _____ of a business enterprise.
13. The _____ is the starting point in preparing the master budget (given that sales are the principal budget factor).
14. Responsibility Accounting is a system of accounting that recognizes various _____ throughout the organisation.

Answer:

1	Period Cost	2	fixed factory overheads
3	opening stock and closing stock	4	Differential Costs
5	Predetermined	6	Basic Ideal and Current
7	Cost Accountants	8	ideal standard attainable standard
9	Favourable	10	A range of activity
11	Responsibility accounting	12	forecasting, financial position
13	Sales Budget	14	responsibility centres

◉ Essay Type Questions

1. Define 'variable cost' and 'fixed cost' with help of diagrams.
2. Contrast the economist's view of costs and revenues with that taken in management accounting.
3. What happens to the breakeven point when the sales price per unit falls?
4. What happens to the breakeven point when the variable cost per unit falls?
5. What happens to the breakeven point when fixed overheads increase?
6. Give three examples of applications of CVP analysis.
7. Explain how CVP analysis helps in the following decisions:
 - i. special orders;
 - ii. abandonment decisions;
 - iii. situations of limiting factors;
 - iv. a decision on buying in services.

8. Explain the situations where full cost pricing may be appropriate.
9. What are the limitations of full cost pricing?
10. Explain the situations where marginal cost pricing may be appropriate.
11. Describe the difference between budgeted and standard costs.
12. Describe the different purposes of a standard costing system.
13. State practical application of standard costing system.
14. What are the possible causes of (a) material price and (b) material usage variances?
15. Explain why it is preferable for the material price variance to be computed at the point of purchase rather than the point of issue.
16. What are the possible causes of (a) wage rate and (b) labour efficiency variances?
17. Explain the reason for excluding idle time variance from labour efficiency variance.
18. 'Idle time variance is always adverse' – Explain.
19. What is generally meant by the term budget? What are the essentials of a budget?
20. State the main differences between budgets and forecasts?
21. Explain budgetary control? What are the objectives of Budgetary Control?
22. Distinguish between Standard Costing and Budgetary control?
23. Write short notes on:
 - i. Budget Centre.
 - ii. Budget Officer.
 - iii. Budget Committee.
 - iv. Budget Manual.
 - v. Budget Period.
 - vi. Key Factor.
 - vii. Performance of Budgeting.
24. Briefly explain the different types of budgets with diagram for the classification.
25. What do you understand by Cash Budget? Discuss the procedure for preparing the cash budget.
26. What do you understand by Master Budget?
27. What do you understand by Fixed Budget and Flexible Budget? What are the advantages of Flexible Budget?

B. Numerical Questions:

⊙ **Numericals Multiple Choice Questions**

1. If sales are ₹ 90,000 and variable cost to sales is 75%, contribution is
 - a. ₹ 21,500
 - b. ₹ 22,500
 - c. ₹ 23,500
 - d. ₹ 67,500
2. If sales are ₹ 1,50,000 and variable cost are ₹ 50,000. Compute P/V ratio.
 - a. 66.66%
 - b. 100%
 - c. 133.33%
 - d. 65.66%
3. Contribution is ₹ 3,00,000 and sales is ₹ 15,00,000. Compute P/V ratio.
 - a. 15%
 - b. 20%
 - c. 22%
 - d. 17.5%
4. Variable cost to sales ratio is 40%. Compute P/V ratio.
 - a. 60%
 - b. 40%
 - c. 100%
 - d. None of the these
5. Fixed cost is ₹ 30,000 and P/V ratio is 20%. Compute breakeven point.
 - a. ₹ 1,60,000
 - b. ₹ 1,50,000
 - c. ₹ 1,55,000
 - d. ₹ 1,45,000

6. Standard price of material per kg ₹ 20, standards consumption per unit of production is 5 kg. Standard material cost for producing 100 units is
 - a. ₹ 20,000
 - b. ₹ 12,000
 - c. ₹ 8,000
 - d. ₹ 10,000
7. Standard cost of material for a given quantity of output is ₹ 15,000 while the actual cost of material used is ₹ 16,200. The material cost variance is:
 - a. ₹ 1,200 (A)
 - b. ₹ 16,200 (A)
 - c. ₹ 15,000 (F)
 - d. ₹ 31,200 (A)
8. Standard price of material per kg is ₹ 20, standard usage per unit of production is 5 kg. Actual usage of production 100 units is 520 kgs, all of which was purchase at the rate of ₹ 22 per kg. Material usage variance is
 - a. ₹ 400 (F)
 - b. ₹ 400 (A)
 - c. ₹ 1,040 (F)
 - d. ₹ 1,040 (A)
9. Standard price of material per kg is ₹ 20, standard usage per unit of production is 5 kg. Actual usage of production 100 units is 520 kgs, all of which was purchase at the rate of ₹ 22 per kg. Material cost variance is
 - a. ₹ 2,440 (A)
 - b. ₹ 1,440 (A)
 - c. ₹ 1,440 (F)
 - d. ₹ 2,300 (F)
10. Standard quantity of material for one unit of output is 10 kgs. @ ₹ 8 per kg. Actual output during a given period is 800 units. The standards quantity of raw material
 - a. 8,000 kgs
 - b. 6,400 kgs
 - c. 64,000 kgs
 - d. None of these

11. What is the labour rate variance if standard hours for 100 units of output are 400 @ ₹ 2 per hour and actual hours taken are 380 @ ₹ 2.25 per hour?
 - a. ₹ 120 (adverse)
 - b. ₹ 100 (adverse)
 - c. ₹ 95 (adverse)
 - d. ₹ 25 (favourable)
12. In a period, 11280 kilograms of material were used at a total standard cost of ₹ 46,248. The material usage variance was ₹ 492 adverse. What was the standard allowed weight of material for the period?
 - a. 11600 kg
 - b. 11160 kg
 - c. 12190 kg
 - d. 10590 kg
13. The operations to produce a unit of product L require 9 active hours. Budgeted idle time of 10% of total hours paid for is to be incorporated into the standard times for all products. The wage rate is ₹ 4 per hour. The standard labour cost of one unit of product L is:
 - a. ₹ 10.00
 - b. ₹ 36.00
 - c. ₹ 39.60
 - d. ₹ 40.00

Answer:

1	B	2	A	3	B	4	A	5	B	6	D	7	A	8	B
9	B	10	A	11	C	12	B	13	D						

Unsolved Case

1. Leisure Furniture Ltd produces furniture for hotels and public houses using specific designs prepared by firms of interior design consultants. Business is brisk and the market is highly competitive with a number of rival companies tendering for work. The company's pricing policy, based on marginal costing (variable costing) techniques, is generating high sales. The main activity of Home Furniture Ltd is the production of a limited range of standard lounge suites for household use. The company also offers a service constructing furniture to customers' designs. This work is undertaken to utilise any spare capacity. The main customers of the company are the major chains of furniture retailers. Due to recession, consumer spending on household durables has decreased recently and, as a result, the company is experiencing a significant reduction in orders for its standard lounge suites. The market is unlikely to improve within the next year. The company's pricing policy is to add a percentage mark-up to total cost.

Required

Explain why different pricing policies may be appropriate in different circumstances, illustrating your Solution: by reference to Leisure Furniture Ltd and Home Furniture Ltd.

- 2.¹ Decathlon LLP manufactures cricket bats using high quality wood and skilled labour using mainly traditional manual techniques. The manufacturing department is a cost centre within the business and operates a standard costing system based on marginal costs. At the beginning of April, the production director attempted to reduce the cost of the bats by sourcing wood from a new supplier and deskilling the process a little by using lower grade staff on parts of the production process. The standards were not adjusted to reflect these changes. The variance report for April is shown below (extract):

Variances	Adverse (₹)	Favourable (₹)
Material price		5100
Material usage	7500	
Labour rate		43600
Labour efficiency	48800	
Labour idle time	5400	

The production director pointed out in his April board report that the new grade of labour required significant training in April and this meant that productive time was lower than usual. He accepted that the workers were a little slow at the moment but expected that an improvement would be seen in May. He also mentioned that the new wood being used was proving difficult to cut cleanly resulting in increased waste levels.

Sales for April were down 10 per cent on budget and returns of faulty bats were up 20 per cent on the previous month. The sales director resigned after the board meeting stating that SW had always produced quality products but the new strategy was bound to upset customers and damage the brand of the business.

Required:

Assess the performance of the production director using all the information above taking into account both the decision to use a new supplier and the decision to deskill the process.

- 3.² Thorne Co. values, advertises and sells residential property on behalf of its customers. The company has been in business for only a short time and is preparing a cash budget for the first four months of 2022.

Year	2021	2022	2022	2022	2022
Month	December	January	February	March	April
Units Sold	10	10	15	25	30

The average price of each property is ₹ 1,80,000 and Thorne Co. charges a fee of 3 per cent of the value of each property sold. Thorne Co. receives 1 per cent in the month of sale and the remaining 2 per cent in the

1 Adopted from Management and Cost Accounting (10th edition) by Colin Drury.

2 Adopted from Management and Cost Accounting, eighth edition by Colin Drury

month after sale. The company has nine employees who are paid on a monthly basis. The average salary per employee is ₹ 35,000 per year. If more than 20 properties are sold in a given month, each employee is paid in that month a bonus of ₹ 140 for each additional property sold.

Variable expenses are incurred at the rate of 0.5 per cent of the value of each property sold and these expenses are paid in the month of sale. Fixed overheads of ₹ 4,300 per month are paid in the month in which they arise. Thorne Co. pays interest every three months on a loan of ₹ 200 000 at a rate of 6 per cent per year. The last interest payment in each year is paid in December. An outstanding tax liability of ₹ 95,800 is due to be paid in April. In the same month Thorne Co. intends to dispose of surplus vehicles, with a net book value of ₹ 15,000, for ₹ 20,000. The cash balance at the start of January 2022 is expected to be a deficit of ₹ 40,000.

Required :

Thorne company appoints you to

- a. Prepare a monthly cash budget for the period from January to April. The budget must clearly indicate each item of income and expenditure, and the opening and closing monthly cash balances.
- b. Discuss the factors to be considered by Thorne Co. when planning ways to invest any cash surplus forecast by its cash budgets.
- c. Discuss the advantages and disadvantages to Thorne Co. of using over draft finance to fund any cash shortages forecast by its cash budgets.