

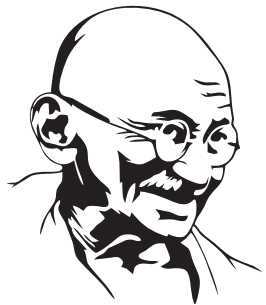
# CMA Final Strategic Cost Management

Volume 1

SJC Institute

*"Live as if you were to die tomorrow. Learn as if you were to live forever."*

Mahatma Gandhi



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# Decision Making Techniques

Unit 1

Decision Making Techniques (Theory)

Unit 2

Relevant Costing

Unit 3

CVP Analysis

Unit 4

Key Factor

Unit 5

Make or Buy Decision

Unit 6

Sub Contracting

Unit 7

Service Costing

# Decision Making Techniques (Theory)

**The cost of a product or process can be ascertained using different elements of cost using any of the following two techniques viz.,**

1. Absorption Costing
2. Marginal Costing

## 1. ABSORPTION COSTING

Under this method, the cost of the product is determined after considering the total cost i.e., both fixed and variable costs. Thus this technique is also called **traditional or total costing**. The variable costs are directly charged to the products where as the fixed costs are apportioned over different products on a suitable basis, manufactured during a period. Thus under absorption costing, all costs are identified with the manufactured products. **However, this technique suffers from the following limitations:**

## 2. LIMITATIONS OF ABSORPTION COSTING

1. **Being dependent on levels of output** which vary from period to period, costs are vitiated due to the existence of fixed overhead. This renders them useless for purposes of comparison and control. (If, however, overhead recovery rate is based on normal capacity, this situation will not arise).
2. **Carryover of a portion of fixed costs**, i.e., period costs to subsequent accounting periods as part of the cost of inventory is a unsound practice because costs pertaining to a period should not be allowed to be vitiated by the inclusion of costs pertaining to the previous period.
3. **Profits and losses in the accounts** are related not only to sales but also to production, including the production which is unsold. This is contrary to the principle that profits are made not at the stage when products are manufactured but only when they are sold.
4. **There is no uniformity in the methods** of application of overhead in absorption costing. These problems have, no doubt, to be faced in the case of marginal costing also but to a less extent because of the exclusion of fixed costs, as different assumptions made in the matter of application of fixed overhead will not arise in the case of marginal costing.
5. Absorption costing is **not always suitable for decision making** solutions to various types of problems of management decision making, where the absorption cost method would be practically ineffective, such as selection of production volume and optimum capacity utilisation, selection of production mix, whether to buy or manufacture, choice

of alternatives and evaluation of performance can be had with the help of marginal cost analysis. Sometimes, the conclusion drawn from absorption cost data in this regard may be misleading and lead to losses.

### 3. MARGINAL COSTING

Marginal costing is **“the ascertainment of marginal costs and of the effect on profit of changes in volume or type of output by differentiating between fixed costs and variable costs.”** Several other terms in use like direct costing, contributory costing, variable costing, comparative costing, differential costing and incremental costing are used more or less synonymously with marginal costing.

It is a process whereby costs are classified into fixed and variable and with such a division so many managerial decisions are taken. The **essential feature of marginal costing is division of total costs into fixed and variable**, without which this could not have existed. Variable costs vary with volume of production or output, whereas fixed costs remains unchanged irrespective of changes in the volume of output. It is to be understood that **unit variable cost remains same at different levels of output and total variable cost changes in direct proportion with the number of units**. On the other hand, **total fixed cost remains same disregard of changes in units, while there is inverse relationship between the fixed cost per unit and the number of units**.

### 4. FEATURES OF MARGINAL COSTING

**The main features of Marginal Costing may be summed up as follows:**

1. Appropriate and accurate division of total cost into fixed and variable by picking out variable portion of semi variable costs also.
2. Valuation of stocks such as finished goods, work-in-progress is valued at variable cost only.
3. The fixed costs are written off soon after they are incurred and do not find place in product cost or inventories.
4. Prices are based on Marginal Cost and Marginal Contribution.
5. It combines the techniques of cost recording and cost reporting.

### 5. ADVANTAGES OR MERITS OR APPLICATIONS OF MARGINAL COSTING

1. Marginal costing system is **simple to operate than absorption costing because they do not involve the problems of overhead apportionment and recovery**.
2. Marginal costing **avoids, the difficulties of having to explain the purpose and basis of overhead absorption to management that accompany absorption costing**. Fluctua-

tions in profit are easier to explain because they result from cost volume interactions and not from changes in inventory valuation.

3. It is **easier to make decisions on** the basis of marginal cost presentations, e.g., marginal costing shows which products are making a contribution and which are failing to cover their avoidable (i.e., variable) costs. Under absorption costing the relevant information is difficult to gather, and there is the added danger that management may be misled by reliance on unit costs that contain an element of fixed cost.
4. Marginal costing is **essentially useful to management as a technique in cost analysis** and cost presentation. It enables the presentation of data in a manner useful to different levels of management for the purpose of controlling costs. Therefore, it is an important technique in cost control.
5. **Future profit planning** of the business enterprises can well be carried out by marginal costing. The contribution ratio and marginal cost ratios are very useful to ascertain the changes in selling price, variable cost etc. Thus, marginal costing is greatly helpful in profit planning.
6. When a business concern consists of several units and produces several products and evaluation of performance of such components can well be made with the help of marginal costing.
7. It is **helpful in forecasting**.
8. **When there are different products, the determination of number of units of each product, called Optimum Product Mix**, is made with the help of marginal costing.
9. Similarly, **optimum sales mix i.e., sales of each and every product to get maximum profit** can also be determined with the help of marginal costing.
10. Apart from the above, numerous managerial decisions can be taken with the help of **marginal costing, some of which, may be as follows:**
  - (a) Make or buy decisions,
  - (b) Exploring foreign markets,
  - (c) Accept an order or not,
  - (d) Determination of selling price in different conditions,
  - (e) Replace one product with some other product,
  - (f) Optimum utilisation of labour or machine hours,
  - (g) Evaluation of alternative choices,
  - (h) Subcontract some of the production processes or not,
  - (i) Expand the business or not,
  - (j) Diversification,
  - (k) Shutdown or continue,

## 6. LIMITATIONS OF MARGINAL COSTING

- (a) The **separation of costs** into fixed and variable present's technical difficulties and no variable cost is completely variable nor is a fixed cost completely fixed.
- (b) Under the marginal cost system, **stock of finished goods and work-in-progress are understated**. After all, fixed costs are incurred in order to manufacture products and as such, these should form a part of the cost of the products. It is, therefore, not correct to eliminate fixed costs from finished stock and work-in-progress.
- (c) **The exclusion of fixed overhead from the inventories affects the Profit and Loss Account and produces an unrealistic and conservative Balance Sheet**, unless adjustments are made in the financial accounts at the end of the period.
- (d) In marginal costing system, **marginal contribution and profits increase or decrease with changes in sales volume**. Where sales are seasonal, profits fluctuate from period to period. Monthly operating statements under the marginal costing system will not, therefore, be as realistic or useful as in absorption costing.
- (e) During the earlier stages of a period of recession, **the low profits or increase in losses, as revealed in a magnified way in the marginal costs statements**, may unduly create panic and compel the management to take action that may lead to further depression of the market.
- (f) Marginal costing **does not give full information**. For example, increased production and sales may be due to extensive use of existing equipments (by working overtime or in shifts), or by an expansion of the resources, or by the replacement of labour force by machines. The marginal contribution fails to reveal these.
- (g) Though for **short-term assessment of profitability marginal costs may be useful, long term profit is correctly determined on full costs basis only**.
- (h) Although marginal costing eliminates the difficulties involved in the apportionment and under and over- absorption of fixed overhead, the **problem still remains so far as the variable overhead is concerned**.
- (i) With **increased automation and technological developments, the impact on fixed costs on products is much more than that of variable costs**. A system which ignores fixed costs is therefore, less effective because a major portion of the cost, such as not taken care of.
- (j) Marginal costing **does not provide any standard for the evaluation of performance**. A system of budgetary control and standard costing provides more effective control than that obtained by marginal costing.

## 7. DIFFERENCES BETWEEN ABSORPTION COSTING AND MARGINAL COSTING

	Absorption Costing	Marginal Costing
1.	Both fixed and variable costs are considered for product costing and inventory valuation.	Only variable costs are considered for product costing and inventory valuation.
2.	<b>Fixed costs are charged to the cost of production.</b> Each product bears a reasonable share of fixed cost and thus the profitability of a product is influenced by the apportionment of fixed costs.	Fixed costs are regarded as period costs. The profitability of different products is judged by their P/V ratio.
3.	<b>Cost data are presented in conventional pattern.</b> Net profit of each product is determined after subtracting fixed cost along with their variable cost.	<b>Cost data are presented to highlight the total contribution of each product.</b>
4.	The difference in the magnitude of opening stock and closing stock affects the unit cost of production due to the impact of related fixed cost.	The difference in the magnitude of opening stock and closing stock does not affect the unit cost of production.
5.	In case of absorption costing the cost per unit reduces, as the production increases as it is fixed cost which reduces, whereas, the variable cost remains the same per unit.	In case of marginal costing the cost per unit remains the same, irrespective of the production as it is valued at variable cost.

## 8. DIFFERENCE IN PROFIT UNDER MARGINAL AND ABSORPTION COSTING

- (i) **No opening and closing stock:** In this case, profit/loss under absorption and marginal costing will be equal.
- (ii) **When opening stock is equal to closing stock:** In this case, profit/loss under two approaches will be equal provided the fixed cost element in both the stocks is same amount.
- (iii) **When closing stock is more than opening stock:** In other words, when production during a period is more than sales, then profit as per absorption approach will be more than that by marginal approach. The reason behind this difference is that a part of fixed overhead included in closing stock value is carried forward to next accounting period.
- (iv) **When opening stock is more than the closing stock:** In other words when production is less than the sales, profit shown by marginal costing will be more than that shown by absorption costing. This is because a part of fixed cost from the preceding period is added to the current year's cost of goods sold in the form of opening stock.

## 9. DIFFERENTIAL COST ANALYSIS

**Differential Cost** is the change in the costs which results from the adoption of an alternative course of action. The alternative actions may arise due to change in sales volume, price, product mix (by increasing, reducing or stopping the production of certain items), or methods of production, sales, or sales promotion, or they may be due to '**make or buy**' or '**take or refuse**' decisions. When the change in costs occurs due to change in the activity from one level to another, differential cost is referred to as incremental cost or decremental cost, if a decrease in output is being considered, i.e. total increase in cost divided by the total increase in output. However, accountants generally do not distinguish between differential cost and incremental cost and the two terms are used to mean one and the same thing.

**The essential features of differential costs are as follows:**

1. The basis data used for differential cost analysis are costs, revenue and the investment factors which are relevant in the problem for which the analysis is undertaken.
2. Total differential costs rather than the costs per unit are considered.
3. Differential cost analysis is made outside the accounting records.
4. 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 alternatives under consideration, are ignored.
5. The differentials are measured from a common base point or position.
6. The stage at which the difference between the revenue and the cost is the highest, measured from the common base point, determines the choice from amongst a number of alternative actions.
7. In computing differential costs, historical or standard costs may be used but they should be adjusted to the requirements of future conditions.
8. The elements and items of cost to be considered in differential cost analysis will depend upon the nature of the problem and the alternatives being considered.

## 10. DIFFERENTIAL COSTS ANALYSIS AND MARGINAL COSTING

Although the techniques of **differential costs analysis are similar to those of marginal costing, the two should not be confused**. The points of similarity and difference between differential costs analysis and marginal costing are summarized below:

**Similarity:**

- (a) Both the techniques of cost analysis and cost presentation.
- (b) Both are made use of by the management in decision making and in formulating policies.
- (c) The concepts of differential costs and marginal costs mainly arise out of the difference in the behaviour of fixed and variable costs.

- (d) Differential costs 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.

**Difference:**

- (a) Differential cost analysis can be made in the case of both absorption costing as well as marginal costing.
- (b) While marginal costing excludes the entire fixed costs, some of the fixed costs may be taken into account as being relevant for the purpose of differential cost analysis.
- (c) Marginal costs may be embodied in the accounting system whereas differential costs are worked out separately as analysis statements.
- (d) In marginal costing, margin of contribution and contribution ratio are the main yardsticks for performance evaluation and for decision making. In differential cost analysis, differential costs are compared with the incremental or decremental revenues, as the case may be.

## 11. PRACTICAL APPLICATION OF DIFFERENTIAL COSTS

They are useful in managerial decisions, which are enumerated below:

- (i) Determination of **most profitable levels** of production and price.
- (ii) **Acceptance of offer** at a lower price or offering a quotation at lower selling price in order to increase capacity.
- (iii) It is used to decide whether it will be more profitable to **sell a product as it is or to process it further** into a different product to be sold at an increased price.
- (iv) Determining the suitable price at which **raw material** may be **purchased**.
- (v) Decision of **adding a new product** or business segment.
- (vi) **Discontinuing** a product or business segment in order to avoid or reduce the present loss or increase profit.
- (vii) Changing the **product mix**.
- (viii) **Make or buy** decisions.
- (ix) Decision regarding **alternative capital investment** and plant **replacement**.
- (x) Decision regarding **change in method of production**.

## 12. TOOLS AND TECHNIQUES OF MARGINAL COSTING

### 1. Contribution:

In common parlance, contribution is the reward for the efforts of the entrepreneur or owner of a business concern. From this, one can get in his mind that contribution means profit. But it is not so. Technically or in Costing terminology, contribution means not only

profit but also fixed cost. That is why; it is defined as the amount recovered towards fixed cost and profit.

Contribution is helpful in determination of profitability of the products and/or priorities for profitabilities 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	Amount (₹)		
	A	B	C
Selling price	100	150	200
Variable cost	50	70	100
Contribution	50	80	100

In the above example, one can say that the product 'C' is more profitable because, it has more contribution. This proposition of product having more contribution is more profitable is valid, as long as, there are no limitations on any factor of production. In this context, factors of production means, the factors that are responsible for producing the products such as material, labour, machine hours, demand for sales etc..

## 2. Limiting Factor (or) Key Factor:

In the above example, we find that product having more contribution is more profitable. However, when there is a limitation on any input factor, the profitability of the product cannot simply be determined by finding out the contribution of the unit, but it can be found out by ascertaining the contribution per unit of that factor of production which is limited in the given situation. Such factor of production which is limited in the question is called key factor or limiting factor.

Continuing the above example, it may be explained as follows:

The three products take same raw material. A takes 1 kg, B requires 2 kgs, C requires 5 kgs and the raw material is not abundant.

**Then profitability of the above products is determined as follows:**

$$\text{Profitability} = \left( \frac{\text{Contribution}}{\text{Key Factor}} \right)$$

A	B	C
50 / 1 = ₹ 50	80 / 2 = ₹ 40	100 / 5 = ₹ 20

Now, product A is more profitable because it has more contribution per kg of material.

The key factor can also be called as scarce factor or Governing factor or Limiting factor or Constraining factor etc., whatever may be the name, it indicates the limitation on the particular factor of production.

From the above, it is essentially understandable that contribution is helpful in determination of profitability of the products, priorities for profitability of the products and in particular, profitabilities when there are limitation on any factor.

## 2. Profit Volume Ratio (P/V Ratio) or Contribution Ratio:

First of all, a ratio is a statistical or mathematical tool with the help of which a relationship can be established between the variables of the same kind. Further, it may be expressed in different forms such as fractional form, quotient, percentage, decimal form, and proportional form.

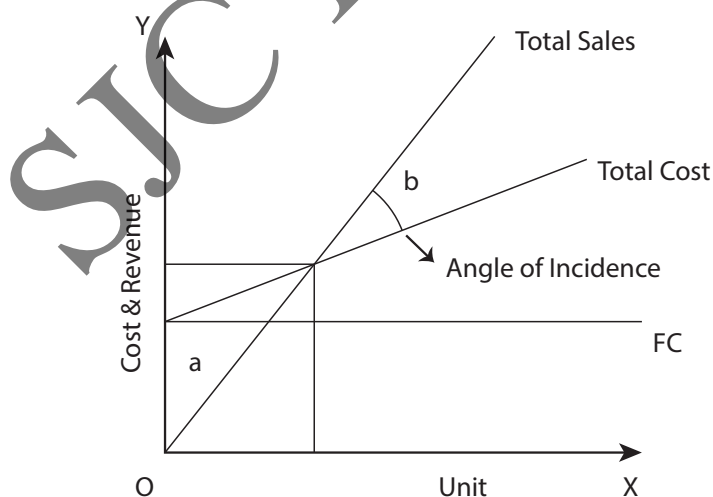
**For example:**

**Gross profit ratio:** It may be expressed as follows:

- Gross profit is  $\frac{1}{4}$ th of sales
- Sales is 4 times that of gross profit
- Gross profit ratio is 25%
- Gross profit is 0.25 of sales and lastly
- Gross profit and sales are in the ratio of 1: 4

## 3. Break Even Point:

When someone asks a layman about his business he may reply that it is alright. But a technical man may reply that it is break even. So, **Break Even** means the volume of production or sales where there is no profit or loss. In other words, **Break Even Point** is the volume of production or sales where total costs are equal to revenue. It helps in finding out the relationship of costs and revenues to output. In understanding the breakeven point, cost, volume and profit are always used. The break even analysis is used to answer many questions of the management in day to day business. The formal break even chart is as follows:



a = Losses      b = Profits

When no. of units are expressed on X-axis and costs and revenues are expressed on Y-axis, three lines are drawn i.e., fixed cost line, total cost line and total sales line. In the above graph we find there is an intersection point of the total sales line and total cost line and from that intersection point if a perpendicular is drawn to X-axis, we find break even units. Similarly, from the same intersection point a parallel line is drawn to X-axis so that it cuts

Y-axis, where we find Break Even point in terms of value. This is how, the formal pictorial representation of the Break Even chart.

At the intersection point of the total cost line and total sales line, an angle is formed called Angle of Incidence, which is explained as follows:

4. **Angle of Incidence:**

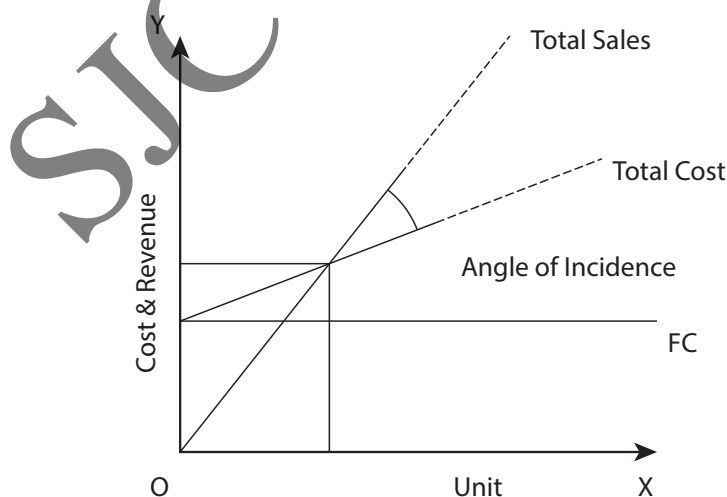
Angle of Incidence is an angle formed at the intersection point of total sales line and total cost line in a formal break even chart. If the angle is larger, the rate of growth of profit is higher and if the angle is lower, the rate of growth of profit is lower. So, growth of profit or profitability rate is depicted by Angle of Incidence.

5. **Break Even Analysis (or) Cost-Volume-Profit Analysis (CVP analysis):**

From the breakeven charts breakeven point and profits at a glance can be found out. Besides, management makes profit planning with the help of breakeven charts. It can clearly be understood by way of charts to know the changes in profit due to changes in costs and output. Such profit planning is made with the variables mainly cost, profit and volume, such an analysis is called **breakeven analysis**. Throughout the charts relationship is established among the cost, volume and profit, it is also called **Cost-Volume-Profit Analysis (CVP analysis)**. That is why it is popularly said by S.C.Kuchal in his book "**Financial Management - An Analytical and Conceptual Approach**", that Cost-volume-profit analysis, break even analysis and profit graphs are interchangeable words. The analysis is further explained as follows:

The change in profit can be studied through Break even charts in different situations in the following manner:

(i) **Increase in No. of Units**

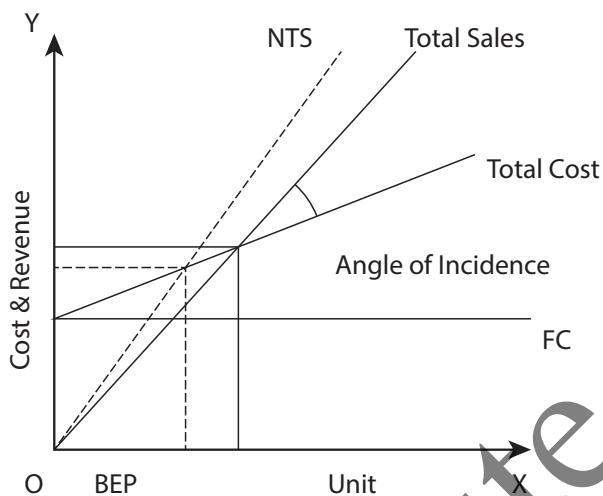


'.....' line indicates increase in total cost and total sales.

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 No. of units.

(ii) **Increase in Sales due to increase in selling price.**

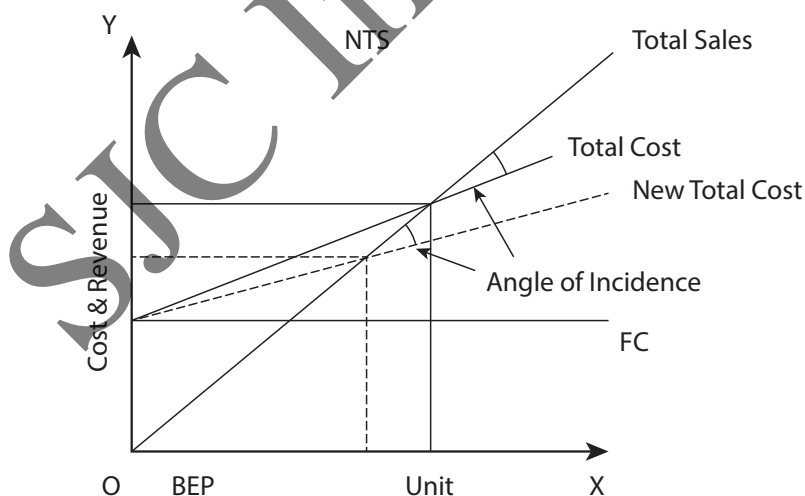
NTS = New Total Sales line



'.....' line indicates changes in break even point and changes in sales.

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.

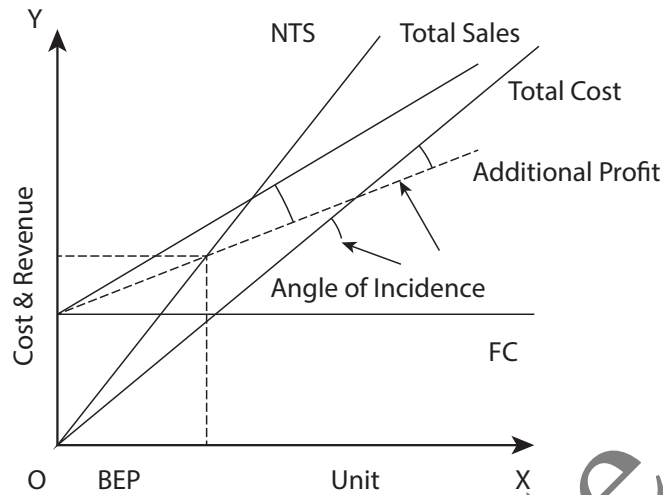
(iii) **Decrease in variable cost:**



'.....' line indicates decrease in total cost and decrease in B.E.P

From the above chart, we observe that when variable costs are decreased, no doubt, profit is increased. If there is change in variable cost then BEP also changes. If variable cost is decreased then BEP also decreases. If variable cost is increased then BEP also increases. Thus there is direct relationship between variable cost and BEP.

(iv) **Change in fixed cost:**

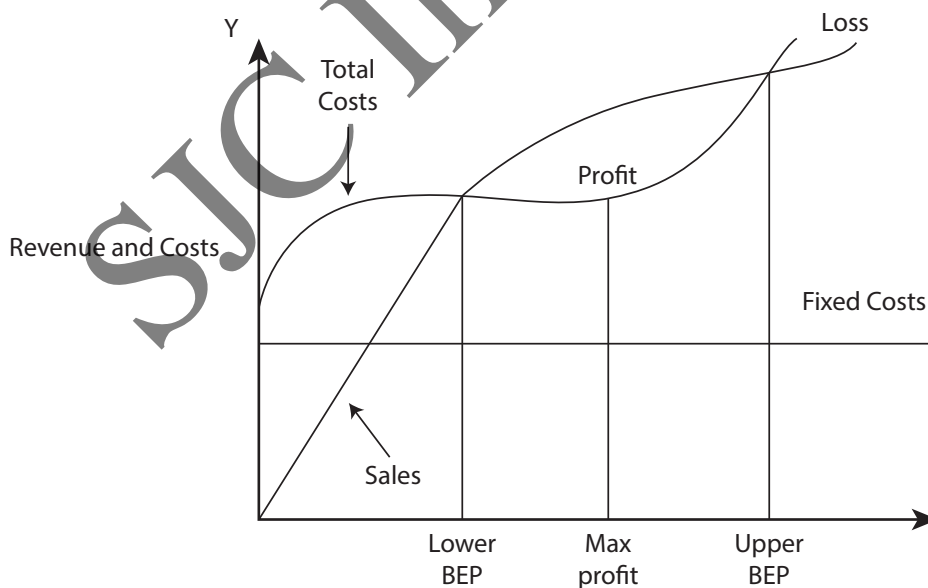


'.....' line indicates decrease in fixed cost and total cost and also decrease in BEP. NTC = New Total Cost Line

**NFC = New Fixed Cost Line**

From the above chart also we find that there is increase in profit due to decrease in fixed cost. If fixed cost is increased then BEP also increases. If fixed cost is decreased then BEP also decreases. Thus there is a direct relationship between fixed cost and BEP.

6. **Non linear Break Even Chart:**



In some cases on account of non-linear behaviour of cost and sales there may 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 above chart.

**7. Cash Break-Even Point:**

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

$$\text{Cash break even point} = \text{Cash fixed costs} / \text{Contribution per unit.}$$

**8. Profit Volume Chart:**

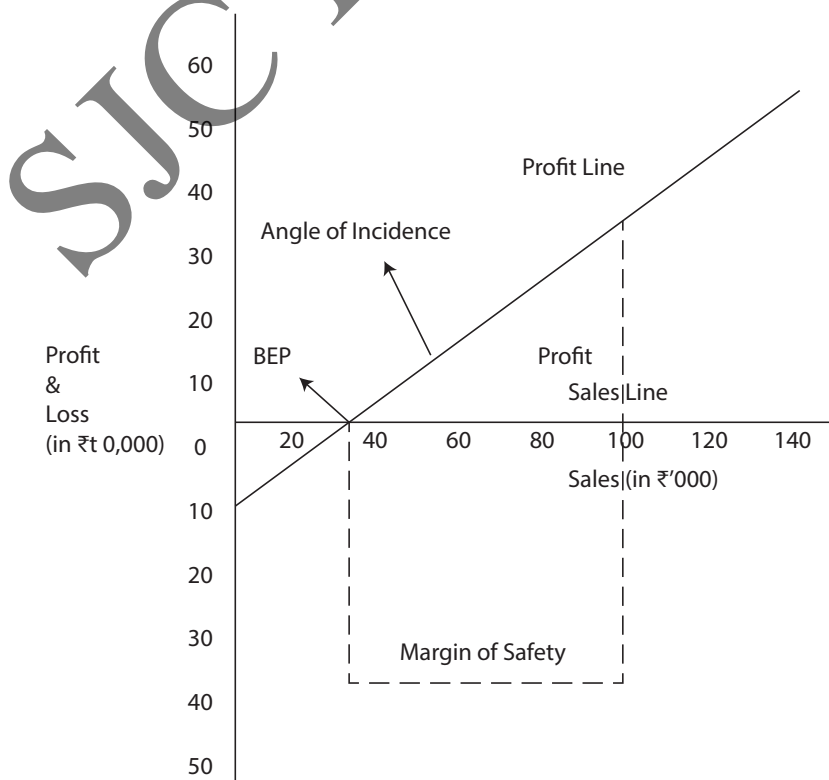
Profit-volume chart prominently exhibits the relationship between profit and sales volume. The normal break-even charts suffer from one limitation. Profit cannot be read directly from the chart. It is essential to deduct total cost from sale to know the profit figure. The profit graph overcomes the difficulty by plotting profit directly against an activity. These charts are easy to understand and their preparation involves drawing sales curve and profit curve. The point at which profit line cuts the sales line is called break-even point. Taking the methods and objects under consideration, the profit-volume chart can be further divided into following categories i.e.,

**a. Simple Profit-Volume Chart:**

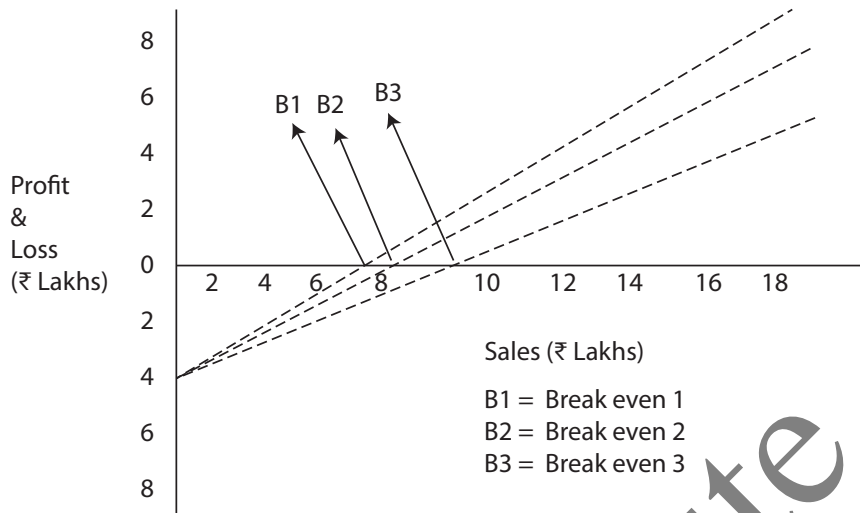
Its preparation involves the following steps:

- (i) Finding out profit at any two levels of activity.
- (ii) Drawing sales line.
- (iii) Drawing profit line.

Simple Profit-Volume chart is shown below:



- b. Profit volume chart showing different breakeven point at different price levels is shown below:



### 9. Uses and applications of Break even Analysis (Or) Profit Charts (Or) Cost Volume Profit Analysis:

The important uses to which cost-volume profit analysis or break-even analysis or profit charts may be put to use are:

- Forecasting costs and profits as a result of change in Volume determination of costs, revenue and variable cost per unit at various levels of output.
- Fixation of sales Volume level to earn or cover given revenue, return on capital employed, or rate of dividend.
- Determination of effect of change in Volume due to plant expansion or acceptance of order, with or without increase in costs or in other words, determination of the quantum of profit to be obtained with increased or decreased volume of sales.
- Determination of comparative profitability of each product line, project or profit plan.
- Suggestion for shift in sales mix.
- Determination of optimum sales volume.
- Evaluating the effect of reduction or increase in price, or price differentiation in different markets.
- Highlighting the impact of increase or decrease in fixed and variable costs on profit.
- Studying the effect of costs having a high proportion of fixed costs and low variable costs and vice-versa.
- Inter-firm comparison of profitability.
- Determination of sale price which would give a desired profit for break-even.
- Determination of the cash requirements as a desired volume of output, with the help of cash break-even charts.

- (m) Break-even analysis emphasizes the importance of capacity utilization for achieving economy.
- (n) During severe recession, the comparative effects of a shutdown or continued operation at a loss are indicated.
- (o) The effect on total cost of a change in the fixed overhead is more clearly demonstrated through break-even charts.

#### 10. **Limitations of Break-even Analysis:**

- (a) That Costs are either fixed or variable and all costs are clearly segregated into their fixed and variable elements. This cannot possibly be done accurately and the difficulties and complications involved in such segregation make the break-even point inaccurate.
- (b) That the behaviour of both costs and revenue is not entirely related to changes in volume.
- (c) That costs and revenue patterns are linear over levels of output being considered. In practice, this is not always so and the linear relationship is true only within a short run relevant range.
- (d) That fixed costs remain constant and variable costs vary in proportion to the volume. Fixed costs are constant only within a limited range and are liable to change at varying levels of activity and also over a long period, particularly when additional plants and equipments are introduced.
- (e) That sales mix is constant or only one product is manufactured. A combined analysis taking all the products of the mix does not reflect the correct position regarding individual products.
- (f) That production and sales figures are identical or the change in opening and closing stocks of the finished product is not significant.
- (g) That the units of production on the various product range are identical. Otherwise, it is difficult to find a homogeneous factor to represent volume.
- (h) That the activities and productivity of the concern remain unchanged during the period of study.
- (i) As output is continuously varied within a limited range, the contribution margin remains relatively constant.

This is possible mainly where the output is more or less homogeneous as in the case of process industries.

#### 11. **Margin of Safety:**

It is the sales point beyond the breakeven point. Margin of safety can be obtained by subtracting break even sales from Total sales. It is useful to determine financial soundness of business enterprise. If margin of safety is high, then the financial position of the enterprise is sound.

Unit 2  
**Relevant Costing**



**Learning  
Objective**

**BASICS**

1. MOST IMPORTANT ROLE OF TOP MANAGEMENT
2. THE DECISION MAKING PROCESS AND IMPORTANCE OF CONSIDERING ALTERNATIVES
3. DIFFERENT MEANING OF TERM "COST"
  - (a) Accounting Meaning
  - (b) Management Accounting Meaning
4. TYPES OF DECISIONS AND DECISION MAKING TECHNIQUES
  - (a) Short Term Decisions
    - (i) Non Regular Decisions
    - (ii) Regular Decisions
  - (b) Long Term Decisions
5. DIFFERENT APPROACHES OF TAKING A SHORT TERM NON REGULAR DECISION
  - (a) Total Cost Approach
  - (b) Incremental or Differential Cost Approach
  - (c) Relevant Cost Approach or Opportunity Cost Approach
6. MEANING OF RELEVANT COST
  - (a) Future Variable Cost
  - (b) Avoidable Fixed Cost
  - (c) Opportunity Cost
7. MEANING OF IRRELEVANT COST
  - (a) Sunk Cost
  - (b) Committed Fixed Costs
8. USES OF RELEVANT COSTING
  - (a) Evaluation of Offers
  - (b) Minimum Selling Price
9. DEMERITS OF RELEVANT COSTING



# Learning Objective

## PRACTICALS

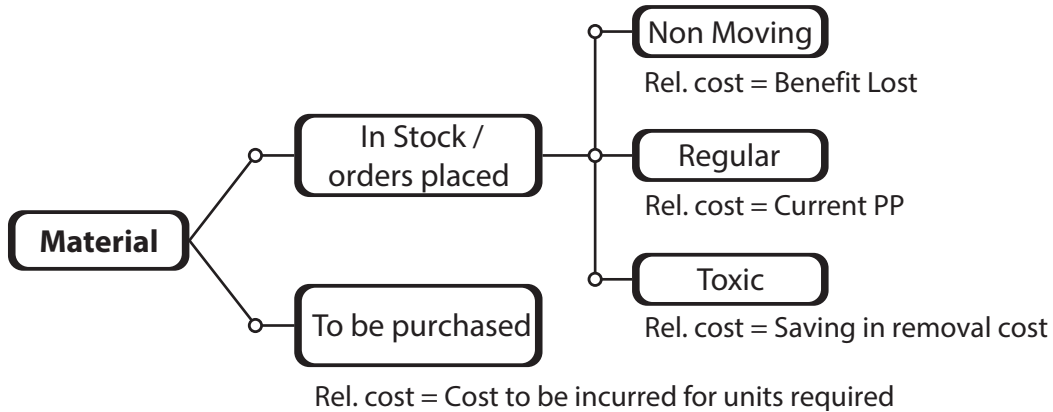
### PART A

1. OPPORTUNITY COST
  - (a) Meaning
  - (b) Why it is Important
  - (c) Evaluation Using Opportunity Cost
2. SHADOW PRICE OF RESOURCES
3. OPPORTUNITY GAIN AND ITS EFFECT
4. MINIMUM PRICE
5. MAXIMUM PRICE

### PART B

6. RELEVANT COST OF MATERIAL
7. RELEVANT COST OF LABOUR
8. RELEVANT COST OF OVERHEAD
9. RELEVANT COST OF DEPRECIATION
10. EVALUATION OF ALTERNATIVES / OFFER
11. CONTINUE OR DISCONTINUE DECISION USING RELEVANT COSTING

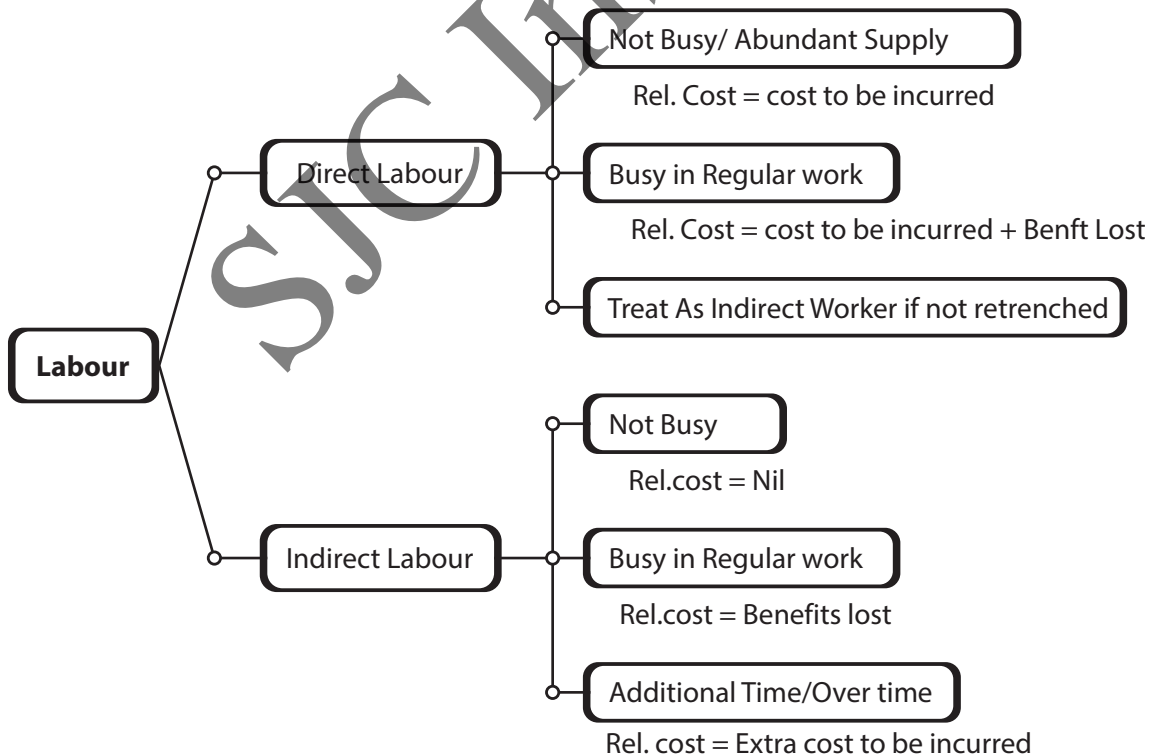
## RELEVANT COST OF MATERIALS



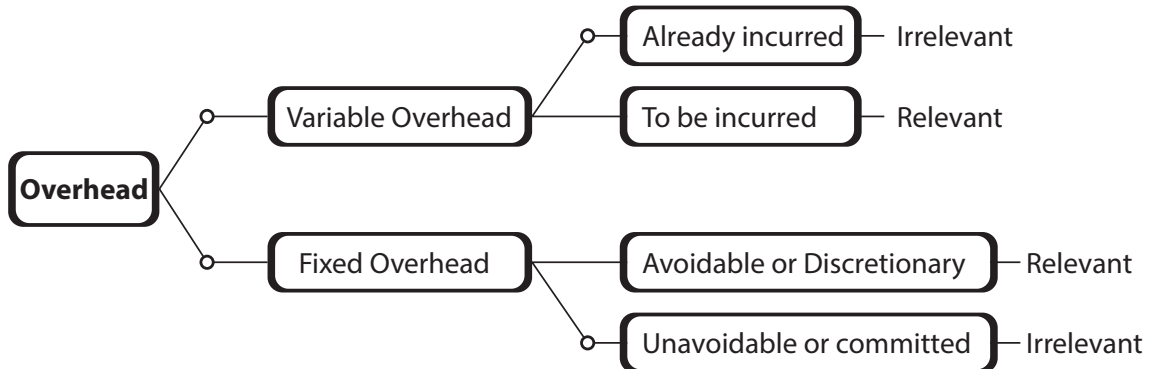
# If materials are to be purchased in lots then

- (a) **No use of extra materials** - Rel Cost = Cost to be incurred for the lot purchased- Scrap value of extra quantity.
- (b) **Regular use of extra materials** - Rel Cost = Cost to be incurred for the quantity required for the offer.

## RELEVANT COST OF LABOUR



## RELEVANT COST OF OVERHEADS



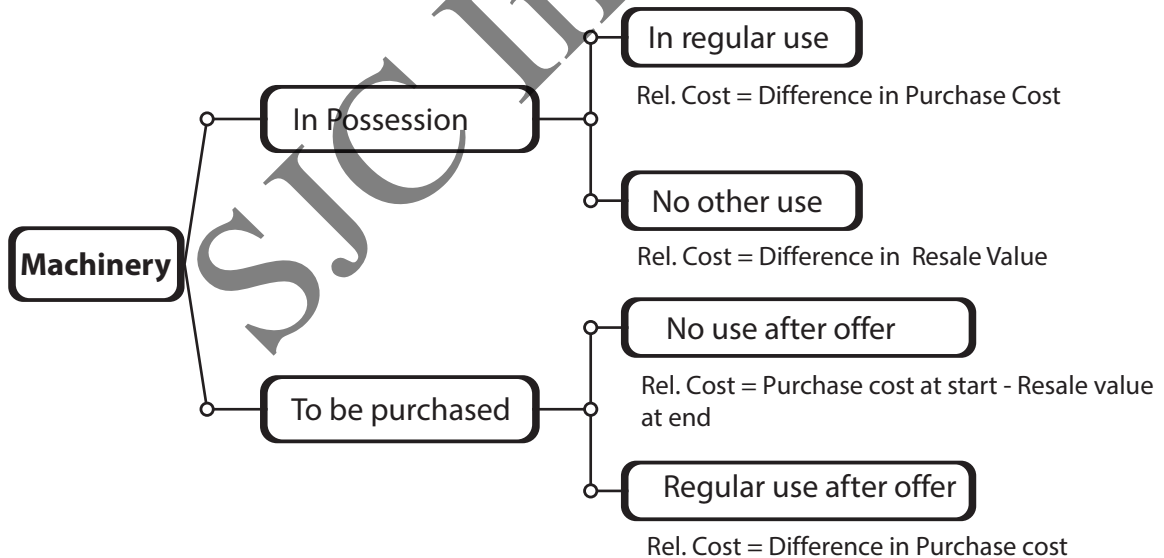
### #1. VOH Varying with LHrs or Labour Cost

Apply the given rate on actual labour hours or actual labour cost & not on the relevant labour cost.

### #2. Keywords to identify the Committed Fixed OH

Charged, Added, Recovered, Applied, Absorbed, Apportioned or Given as a Rate in % form or Rate per unit or Rate per LHR.

## RELEVANT COST OF DEPRECIATION



## 1. RELEVANT COST [MTP JUN'19]

**Relevant Costs** are costs appropriate to aiding the making of specific management decisions (CIMA). They are estimated future costs that differ among alternatives. Similarly, relevant revenues and expected future revenues differ among alternatives. The two key aspects of relevance are:

- (i) The costs and revenues must occur in future, and
- (ii) They must differ among alternatives. In decision making process, the decision maker must be aware of some pitfalls on account of various costs.

**Examples are:**

- (i) **Sunk costs** - be ignored as not relevant.
- (ii) **Fixed Costs** - if they change for the decision at hand, the changed portion only becomes relevant.
- (iii) **Opportunity costs** - They need not be overlooked (e.g., to outsource an activity when there is no idle capacity). An opportunity cost is the cost of an opportunity foregone by not using a limited resource in its next best alternative use.

## 2. OPPORTUNITY COST

- (i) **It is cost of opportunity foregone.** Mr. Ahmed Shah left a bank job which was paying him ₹ 15,000 per month and got admission in a University. Monthly fee-charge in the university is ₹ 10,000 per month. For Ahmed Shah, this would be ₹ 25,000 per month (₹ 10,000 + ₹ 15,000).
- (ii) Farhana is a fresh graduate from a business university. She got two offers, one of ₹ 25,000 from an investment bank and another of ₹ 15,000 for a teaching-assistant in a university. Another of her class-fellow, Shabana got the same offer from the same university. While Shabana would be happy to join the university, Faraha would not be as she would lose an opportunity to serve at the bank for ₹ 25,000.
- (iii) Whenever an organization is deciding to go for a particular project, it should not ignore opportunities for other projects. It should consider (i) **what alternative opportunities are there?** (ii) **Which is the best of these alternative opportunities?**

## 3. IMPUTED COSTS

These are Notional Costs appearing in the Cost Accounts only e.g. notional rent charges, interest on capital for which no interest has actually been paid. These are relevant costs for decision-making. Where alternative capital investment projects are being evaluated, it is necessary to consider the imputed interest on capital before a decision is arrived at as to which is the most profitable project.

## 4. AVOIDABLE COSTS

These are costs that can be eliminated in whole or in part by choosing one alternative over another. Avoidable costs are relevant costs.

**Replacement Cost:** It is the cost at which there could be purchase of an asset or material identical to that which is being replaced or revalued. It is the cost of replacement at current market price and is relevant for decision-making.

## 5. OUT-OF-POCKET COST [MTP JUN'22]

These are costs that entail current or near future cash outlays for the decision at hand. Such costs are relevant for decision - making, as these will occur in near future. This cost concept is a short-run concept and is used in decisions on fixing Selling Price in recession, Make or Buy, etc. **Out-of-Pocket** costs can be avoided or saved if a particular proposal under consideration is not accepted.

## 6. SPECIAL DECISIONS WHERE RELEVANT COST ARE REQUIRED

There are special decisions where relevant costs and benefits are to identified before proceeding further. Such decisions are:

- (i) Accept or reject an order when there is excess capacity
- (ii) Accept or reject an order when there is no excess capacity
- (iii) Outsource a product or service
- (iv) Add, drop a product, service or department
- (v) Sell or process further
- (vi) Optimization of limited resources or working under constraint.

## 7. IRRELEVANT COSTS

**Sunk costs** are costs that were incurred in the past. **Committed costs** are costs that will occur in the future, but that cannot be changed. As a practical matter, sunk costs and committed costs are equivalent with respect to their decision-relevance; neither is relevant with respect to any decision, because neither can be changed. Sometimes, accountants use the term "sunk costs" to encompass committed costs as well.

Experiments have been conducted that identify situations in which individuals, including professional managers, incorporate sunk costs in their decisions. One common example from business is that a manager will often continue to support a project that the manager initiated, long after any objective examination of the project seems to indicate that the best course of action is to abandon it. A possible explanation for why managers exhibit this behavior is

that there may be negative repercussions to poor decisions, and the manager might prefer to attempt to make the project look successful, than to admit to a mistake.

Here is an **example**, Consider a student who is between her junior and senior year in college, deciding whether to complete her degree. From a financial point of view (ignoring non-financial factors) her situation is as follows. She has paid for three years of tuition. She can pay for one more year of tuition and earn her degree, or she can drop out of school. If her market value is greater with the degree than without the degree, then her decision should depend on the cost of tuition for next year and the opportunity cost of lost earnings related to one more year of school, on the one hand; and the increased earnings throughout her career that are made possible by having a college degree, on the other hand. In making this comparison, **the tuition paid for her first three years is a sunk cost**, and it is entirely irrelevant to her decision. In fact, consider three individuals who all face this same decision, but one paid ₹ 24,000 for three years of in-state tuition, one paid ₹ 48,000 for out-of-state tuition, and one paid nothing because she had a scholarship for three years. Now assume that the student who paid out-of-state tuition qualifies for in-state tuition for her last year, and the student who had the three-year scholarship now must pay in-state tuition for her last year. Although these three students have paid significantly different amounts for three years of college (₹ 0, ₹ 24,000 and ₹ 48,000), all of those expenditures are sunk and irrelevant, and they all face exactly the same decision with respect to whether to attend one more year to complete their degrees. It would be wrong to reason that the student who paid ₹ 48,000 should be more likely to stay and finish, than the student who had the scholarship.

## 8. COMMITTED COST

A **committed cost** is an investment that a business entity has already made and cannot recover by any means, as well as obligations already made that the business cannot get out of.

**For example**, if a company buys a machine for ₹40,000 and also issues a purchase order to pay for a **maintenance contract** for ₹2,000 in each of the next three years, all ₹46,000 is a committed cost, because the company has already bought the machine, and has a legal obligation to pay for the maintenance. A **multi-year property lease agreement** is also a committed cost for the full term of the lease, since it is extremely difficult to terminate a lease agreement.

## 9. ABSORBED COST

The indirect costs that are associated with manufacturing. Absorbed costs include such expenses as insurance, or property taxes for the building in which the manufacturing process occurs. When the total manufacturing costs are determined, the implicit absorbed costs are not considered, but will be included in a separate account.

**Absorbed Fixed Cost:** Fixed Costs which do not change due to increase or decrease in activity is irrelevant to decision-making. Although Fixed Costs are absorbed in cost of production on a normal rate, they are irrelevant for managerial decision-making. However if Fixed Costs are specific, they become relevant for decision-making.

**Fixed Costs** are unrelated to output and are generally irrelevant for decision-making purpose. However, in the following circumstances, Fixed Costs become relevant for decision-making -

1. When Fixed Costs are specifically incurred for any contract,
2. When Fixed Costs are incremental in nature.
3. When the fixed portion of Semi-Variable Cost increases due to change in level of activity consequent to acceptance of a contract.
4. When Fixed Costs are avoidable or discretionary,
5. When Fixed Costs are such that one cost is incurred in lieu of another (the difference in costs will be relevant for decision-making.)

SJC Institute

**Q1**

Ex. Book No. Pg. No.

**Pick out** from each of the following items, costs that can be classified under committed fixed costs or discretionary fixed costs.

- Annual increase of salary and wages of administrative staff by 5% as per agreement.
- New advertisement for existing products is recommended by the Marketing Department for achieving sales quantities that were budgeted for at the beginning of the year.
- Rents paid for the factory premises for the past 6 months and the rents payable for the next six months. Production is going on in the factory.
- Research costs on a product that has reached maturity phase in its life cycle and the research costs which may be needed on introducing a cheaper substitute into the market for facing competition.
- Legal consultancy fees payable for patent rights on a new product. Patent rights have been applied for.

Reference	What's New
<b>Committed and Discretionary Fixed Cost</b>	

**Answer**

Part (a)	Committed FC	- Agreement
Part (b)	Discretionary FC	- Recommended
Part (c)	Committed FC	- Production is going on
Part (d)	Discretionary FC	- May be needed
Part (e)	Committed FC	- Have been applied for

**Q2**

Ex. Book No. Pg. No.

**MTP Dec'17; MTP Jun'22**

A company can produce any of its 4 products, A, B, C and D. Only one product can be produced in a production period and this has to be determined at the beginning of the production run. The production Capacity is 1,000 hours. Whatever is produced has to be sold and there is no Inventory build-up to be considered beyond the production period. The following information is given:

Particulars	A	B	C	D
Selling Price (₹ Per unit)	40	50	60	70
Variable Cost (₹ Per unit)	30	20	20	30
No. of units that can be sold	1,000	600	900	600

No. of production hours required per unit of product	1 hour	1 hour and 15 minutes	1 hour and 15 minutes	2 hours
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**What are the Opportunity Costs of A, B, C and D?**

<b>Reference</b>	<b>What's New</b>
<b>Opportunity cost</b>	<b>In terms of lost sales</b>

**Answer**

Particulars	A	B	C	D
1. Contribution per unit = SP p.u. – VC p.u.	40 – 30 = ₹10	50 – 20 = ₹30	60 – 20 = ₹40	70 – 30 = ₹40
2. Time Required	1 hour	1.25 hours	1.25 hours	2 hours
3. Possible Production Point Quantity = (1,000 ÷ 2)	1,000 units	800 units	800 units	500 units
4. Possible Sale Quantity	1,000 units	600 units	900 units	600 units
5. Sales Quantity lost due to Production Constraint = 4 – 3, if 4 > 3.	Nil	NA	100 units	100 units
6. Opportunity Costs = (5 × 1)	Nil	Nil	₹4,000	₹4,000

**Q 3**

Ex. Book No.  Pg. No.

**CMA Mat; MTP Jun'17**

X Ltd. has been approached by a customer who would like a special job to be done for him and is willing to pay ₹22,000 for it. The job would require the following materials:

Materials	Total units required	Units already in stock	Book Value of units in stock ₹/unit	Realisable Value ₹/unit	Replacement Cost ₹/unit
A	1,000	0	—	—	6
B	1,000	600	2	2.5	5
C	1,000	700	3	2.5	4
D	200	200	4	6	9

(i) Material B is used regularly by X Ltd. and if stocks were required for this job, they would need to be replaced to meet other production demand.

- (ii) Materials C and D are in stock as the result of previous excess purchase and they have a restricted use. No other use could be found for material C but material D could be used in another job as substitute for 300 units of material which currently cost ₹5 per unit (of which the company has no units in stock at the moment.)

**What** are the relevant costs of material, in deciding whether or not to accept the contract? Assume all other expenses on this contract to be specially incurred besides the relevant cost of material is ₹550.

<p>Reference</p> <p><b>Relevant cost of Material</b></p>	<p>What's <b>New</b></p>
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### Answer

#### Computation of relevant cost of the job

		Amount (₹)
A	(1,000 × 6)	6,000.00
B	(1,000 × 5)	5,000.00
C	[(700 × 2.5) + (300 × 4)]	2,950.00
D	(300 × 5)	1,500.00
		15,450.00
Add : Other expenses		550.00
		16,000.00

As the revenue from the order, which is more than the relevant cost of ₹16,000 the order should be accepted

**Q4** Ex. Book No. Pg. No.

For an offer, **find** the relevant cost of material from the following data:

Material	Units Required	Units in Stock	Book Value per unit	Realisable Value per unit	Replacement Value per unit
A	1,200	700	35	40	60
B	1,350	1,600	25	22	45
C	800	700	30	25	40
D	200	160	14	6	19
E	400	500	17	--	28
F	360	300	39	--	67

1. Material A & B is used regularly by X Ltd. and if stocks are required for this job, they would need to be replaced to meet other production.
2. Materials C and D are in stock as a result of over purchase. C has no other use but D could be used in another job as substitute demand for 350 units of material P, which currently cost ₹ 4.5 per unit (of which the company has no units in stock at the moment).
3. Material E & F are toxic materials & was purchased for a separate contract (not accepted). It should be disposed off at a cost of ₹ 3,500 & 8,000 respectively, if not used in this contract.

<b>Reference</b>	<b>What's New</b>
<b>Relevant Cost of Materials</b>	

**Answer**

**Statement showing Relevant Cost of Material for the offer**

Material	Qty. Required	Nature	Rel. Cost of Material in Stock	Rel. Cost of Material in Purchased	Total
(A)	1,200	Regular use	–	$(1,200 \times 60) = 72,000$	72,000
(B)	1,350	Regular	–	$(1,350 \times 45) = 60,750$	60,750
(C)	800	No use	$(700 \times 25) = 17,500$	$(1,000 \times 40) = 4,000$	21,500
(D)	200	No use	<b>Higher of:</b> Resale $160 \times 6 = 960$ Substitute use $= 350 \times 4.5 = 1,575$ 1,575	$(40 \times 19) = 760$	2,335
(E)	400	Toxic	Benefit Achieved $= \frac{3,500}{500} \times 400$ $= (2,800)$	–	(2,800)
(F)	360	Toxic	Benefit Achieved $= (8,000)$	$(60 \times 67) = 4,020$	(3,980)
					1,49,805

**Q 5** Ex. Book No. | Pg. No.

**CMA Mat; MTP Jun'17**

A machine which originally cost ₹12,000 has an estimated life of 10 years and it depreciated at the rate of ₹1,200 per year. It has been unused for some time, however, as expected production orders did not materialise.

A special order has now been received which would require the use of the machine for two months.

The current net realisable value of the machine is ₹8,000. If it is used for the job, its value is expected to fall to ₹7,500. The net book value of the machine is ₹8,400. Routine maintenance of the machine currently costs ₹40 per month. With use, the cost of maintenance and repairs would increase to ₹60 per month.

**What** would be the relevant cost of using the machine for the order so that it can be charged as the minimum price for the order?

<p>Reference</p> <p><b>Relevant cost of use of Machine</b></p>	<p>What's <b>New</b></p>
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**Answer**

**Computation of relevant cost of using the machine for the order**

		Amount (₹)
Fall in sale value, if used	(8,000 – 7,500)	500.00
Incremental maintenance cost	[(60 - 40) × 2]	40.00
		540.00

Q 6

Ex. Book No.	Pg. No.

**CMA Mat**

Tiptop Textiles manufactures a wide range of fashion fabrics. The company is considering whether to add a further product 'Superb' to the range. A market research survey recently undertaken at a cost of ₹50,000 suggests that demand of the 'Superb' will last for only one year, during which 50,000 units could be sold at ₹18 per unit. Production and sale of 'Superb' would take place evenly throughout the year. The following information is available regarding the cost of manufacturing 'Superb'.

**Raw Materials:** Each 'Superb' would require 3 types of raw materials Posh, Flash and Splash. Quantities required, current stock levels and cost of each raw material are shown below. Posh is used regularly by the company and stocks are replaced as they are used. The current stock of Flash is the result of over buying for an earlier contract. The material is not used regularly by Tiptop Textiles and any stock that was not used to manufacture 'Superb' would be sold. The Company does not carry a stock of splash and the units required would be specially purchased.

Raw	Quantity reqd. per unit of superb (Meters)	Current stock (meters)	Costs per metre of raw material		
			Original Cost	Current replacement cost	Current resale cost
			₹	₹	₹
Posh	1.00	1,00,000	2.10	2.50	1.80
Flash	2.00	60,000	3.30	2.80	1.10
Splash	0.50	0	5.50	5.00	5.00

**Labour:** Production of each 'Superb' would require a quarter of an hour of skilled labour and two hours of unskilled labour and ₹2 per hour for unskilled labour. In addition, one foreman would be required to devote all his working time for one year in supervision of the production of superb. He is currently paid an annual salary of ₹15,000. Tiptop Textiles is currently finding it very difficult to get skilled labour. The skilled workers needed to manufacture 'Superb' would be transferred from another job on which they are earning a contribution surplus of ₹1.50 per labour hour, comprising sales revenue of ₹10.00 less skilled labour wages of ₹3.00 and other variable costs of ₹5.50. It should not be possible to employ additional skilled labour during the coming year. If 'Superb' are not manufactured, the company expects to have available 2,00,000 surplus unskilled labour hours during the coming year. Because the company intends to expand in the future, it has decided not to terminate the services of any unskilled worker in the foreseeable future. The foreman is due to retire immediately on an annual pension payable by the company of ₹6,000. He has been prevailed upon to stay on for a further year and to defer his pension for one year in return for his annual salary.

**Machinery:** Two Machines would be required to manufacture 'Superb' MT 4 and MT 7. Details of each machine are as under:

		Start of the year ₹	End of the year ₹
MT 4	Replacement cost	80,000	65,000
MT 7	Resale Value	60,000	47,000
	Replacement cost	13,000	9,000
	Resale Value	11,000	8,000

Straight-line depreciation has been charged on each machine for each year of its life. Tiptop Textiles owns a number of MT 4 machines, which are used regularly for various products. Each MT 4 is replaced as soon it reaches the end of its useful life. MT 7 machines are no longer used and the one which would be used for 'Superb' is the only one the company now has. If it were not used to produce 'Superb' it would be sold immediately.

**Overheads:** A predetermined rate of recovery for overheads is in operation and the fixed overheads are recovered fully from the regular production at ₹3.50 per labour hour. Variable overhead costs for Superb are estimated at ₹ 1.20 per unit produced.

For decision-making, incremental costs based on relevant costs and opportunity costs are usually computed.

You are **required to compute** such a cost sheet for 'Superb' with all details of material, labour overhead etc., substantiating the figures with necessary explanations.

<p><b>Reference</b></p> <p><b>Evaluation of offer</b></p>	<p>What's <b>New</b></p> <p><b>Relevant cost of Material, Labour, Machinery, Overhead</b></p>
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### Answer

For each of the element the relevant cost will be as follows for preparing cost sheet

(i) **Market survey cost is a sunk cost and not relevant for decision making**

(ii) **Raw materials**

(a) Raw material 'posh', is used regularly and stocks are replenished and hence current replacement cost is relevant i.e.  $(50,000 \times 1 \times 2.5) = ₹ 1,25,000.00$

(b) Current stock of 'flash' is a result of over buying and will not be used for other than 'superb' and hence relevant cost is net releasable value

Material required  $(50,000 \times 2) = 1,00,000$  units

$(60,000 \times 1.1)$	₹ 66,000.00	
$(40,000 \times 2.8)$	₹ 1,12,000	₹ 1,78,000.00

(c) Material 'splash' has no stock and has to be bought and relevant cost is hence not relevant in decision making

$(50,000 \times 0.5 \times 5) = ₹ 1,25,000.00$

(iii) **Labour:**

(a) Due to unskilled labour, no work has been suffered and so no extra cost and hence not relevant in decision making

(b) Skilled labour is scarce therefore not only the cost, but also the contribution forgone, being opportunity cost, should be considered for decision making

$(50,000 \times 0.25 \times 4.5) = ₹ 56,250.00$

(c) Effective cost of pension  $(15,000 - 6,000) = ₹ 9,000.00$

(iv) **Machinery:**

(a) MT-4 are regularly used and therefore the difference between replacement cost at the start and at the end of the year is relevant  $(80,000 - 65,000) = ₹ 15,000.00$

(b) MT-7 is not used regularly and the difference between resale value at the start and at the end of the year should be taken  $(11,000 - 8,000) = ₹ 3,000.00$

(v) **Variable overheads are relevant  $(50,000 \times 1.2) = ₹ 60,000.00$**

(vi) **Fixed overheads are not relevant because it is recorded fully at regular production**

**Cost sheet of 50,000 units of superb**

	Amount (₹)	Amount (₹)
<b>Raw material:</b>		
Posh	1,25,000.00	
Flash	1,78,000.00	
Splash	1,25,000.00	4,28,000.00
<b>Labour:</b>		
Skilled	56,250.00	
Pension	9,000.00	65,250.00
<b>Machinery:</b>		
MT-4	15,000.00	
MT-7	3,000.00	18,000.00
<b>Variable overheads</b>		60,000.00
		5,71,250.00
Profit (b/f)		3,28,750.00
<b>Sales (50,000 × 18)</b>		9,00,000.00

Q7

Ex. Book No.	Pg. No.

B Ltd. is a company that has, in stock materials of type XY that cost ₹ 75,000, but they are now obsolete and have a scrap value of only ₹ 21,000. Other than selling the materials for scrap, there are only two alternative uses for them.

**Alternative I:**

Converting the obsolete materials into a specialised product, which would require the following additional work and materials:

Material A	600 units
Material B	1,000 units
Direct Labour	5,000 hours unskilled
	5,000 hours semi – skilled
	5,000 hours highly skilled
Extra selling and delivery expenses	₹ 27,000
Extra advertising	₹ 18,000

The conversion would produce 900 units of saleable product and these could be sold for ₹ 300 per unit.

Material A is already in stock and is widely used within the firm. Although present stocks, together with orders already planned, will be sufficient to facilitate normal activity and extra material used by adopting this alternative will necessitate such materials being replaced immediately. Material B is also in stock, but it is unlikely that any additional supplies can be obtained for some

considerable time, because of an industrial dispute. At the present time, Material B is normally used in the production of Product Z which sells at ₹ 390 per unit and incurs total variable cost (excluding Material B) of ₹ 210 per unit. Each unit of Product Z uses four units of Material B. The details of Materials A and B are as follows:

	Material A	Material B
Acquisition Cost at the time of purchase	₹ 100 per unit	₹ 10 per unit
Net Realisable Value	₹ 85 per unit	₹ 18 per unit
Replacement Cost	₹ 90 per unit	--

### Alternative II:

Adopting the obsolete materials for use as a substitute for a sub – assembly that is regularly used within the firm. Details of the extra work and materials required are as follows:

Material C	1,000 units
Direct Labour:	4,000 hours unskilled
	1,000 hours semi – skilled
	4,000 hours highly – skilled

1,200 units of sub assembly are regularly used per quarter at a cost of ₹ 900 per unit. The adaptation of material XY would reduce the quantity of the sub assembly purchased from outside the firm to 900 units for the next quarter only. However, since the volume purchased would be reduced, some discount would be lost and the price of those purchased from outside would increase to ₹ 1,050 per unit for that quarter.

Material C is not available externally though 1,000 units required would be available from stocks, it would be produced as extra production. The **standard cost** per unit of Material C would be as follows:

Raw Materials		13.00
Direct Labour	6 hours of unskilled labour	18.00
Variable OH	6 hours at ₹ 1	6.00
Fixed OH	6 hours at ₹ 3	18.00
Total		55.00

The wage rates and overhead recovery rates for B ltd are:

Variable Overhead	₹ 1 per direct labour hour
Fixed Overhead	₹ 3 per direct labour hour
Unskilled Labour	₹ 3 per direct labour hour
Semi – skilled Labour	₹ 4 per direct labour hour
Highly skilled labour	₹ 5 per direct labour hour

The unskilled labour is employed on a casual basis and sufficient labour can be acquired to exactly meet the production requirements. Semi – skilled labour is part of the permanent labour force, but the company has temporary excess supply of this type of labour at the present time. Highly skilled labour is in short supply and cannot be increased significantly in the short – term,

this labour is presently engaged in meeting the demand for product L, which requires 4 hours of highly skilled labour and yields a contribution of ₹ 24 per unit.

Given the above information, you are **required** to **present** cost information advising whether the stocks of Material XY should be sold, converted into a specialised product (Alternative I) or adopted for use as a substitute for a sub-assembly (Alternative II).

	<b>Reference</b>	<b>What's New</b>
	<b>Evaluation of offer</b>	

### Answer

#### Statement Showing Evaluation of Best Use of Material XY (in stock and obsolete)

Particulars	Workings	Amount (₹)	Amount (₹)	Amount (₹)
<b>OPTION 1 :</b>				
Scrap realisation	Scrap value			21,000
<b>OPTION 2 :</b>				
Conversion into specialised product				
Sales Revenue	(300 × 900)		2,70,000	
Less:				
Material A	In stock-regular use-replacement cost (600 × 90)		54,000	
Material B	In stock – cannot be purchased further - but in regular use of Z			
	Cost to be incurred - already in stock	Nil		
	Contribution lost from Product Z			
	Selling Price	390		
	Less – Variable Cost (Excl Material)	210		
	Less – Material B – already in stock	Nil		
	Contribution per unit of Z	180		
	Units of Material B used in one unit of Z	4 uts		
	Contribution per unit of B used in Z	45		
	Contribution lost from 1,000 units of B		45,000	

Particulars	Workings	Amount (₹)	Amount (₹)	Amount (₹)
Extra Selling and Delivery Expenses			27,000	
Extra advertisement			18,000	
Direct Labour	Unskilled - Casual Hiring – Cost to be incurred	15,000		
	Semi-Skilled – committed	Nil		
	Highly Skilled – $(5 + 24/4) = ₹ 11/hr$	55,000		
			70,000	
Variable overhead	$1 \times (5,000 + 5,000 + 5,000)$		15,000	
Net benefit				41,000
<b>OPTION 3:</b>				
Substitute Use				
Savings in Purchase cost of subassembly	Purchase cost of sub assembly without substitution $(1200 \times 900)$	10,80,000		
	Purchase cost of sub assembly after substitution $(900 \times 1050)$	9,45,000		
			1,35,000	
Less:				
Material C	To be produced in house – relevant production cost			
	Material	13		
	Direct labour	18		
	Variable overhead	6		
	Variable cost per unit	37		
	Variable cost for 1,000 units		37,000	
Direct Labour	Unskilled – Casual Hiring – $(4,000 \times 3)$	12,000		
	Semi skilled – permanent -	Nil		
	Highly skilled – $(5 + 24/4) = ₹ 11/hr$	44,000		
			56,000	
Variable overhead	$1 \times (4,000 + 1,000 + 4,000)$		9,000	
Net benefit				33,000

The best use of Material XY is to convert the obsolete materials into a specialised product for a maximum benefit of ₹ 41,000.

Q 8

Ex. Book No.	Pg. No.

**MTP Jun'18**

Company A can manufacture 1,000 units bicycles in a month for a fixed cost of ₹3,00,000. The variable cost is ₹500 per unit. Its current dem and is 600 units which it sales at ₹1,000 per unit. It is approached by Company Z for an order of 200 units of ₹700 per unit.

**Should** the Company A accept the order? **Give** your views as a CMA.

[6]



Reference

What's New

**Acceptance or Rejection of Order**

**Answer**

The CMA will go ahead with the order because in his opinion the special order will yield ₹200 per unit. He knows that the fixed cost ₹3,00,000 is irrelevant because it is going to be incurred regardless of whether the order is accepted or not. Effectively, the additional cost which Company A would have to incur is the variable cost of ₹500 per unit. Hence, the **order will yield ₹ 200 per unit (i.e. ₹ 700 – ₹500 of variable cost).**

Q 9

Ex. Book No.	Pg. No.

**CMA Mat**

Forward and Foundry Ltd. is feeling the effects of a general recession in the industry. Its budget for the coming half year is based on an output of only 500 tones of casting a month which is less than half of its capacity. The prices of casting vary with the composition of the metal and the shape of the mould, but they average ₹ 175 a tone. The following details are from the Monthly Production Cost Budget at 500 tone levels:

	Core making	Melting and Pouring	Moulding	Cleaning and Grinding
	₹	₹	₹	₹
Labour	10,000	16,000	6,000	4,500
Variable overhead	3,000	1,000	1,000	1,000
Fixed overhead	5,000	9,000	2,000	1,000
	18,000	26,000	9,000	6,500
Labour and O.H. rate per direct labour hour	9.00	6.50	6.00	5.2

Operation at this level has brought the company to the brink of break-even. It is feared that if the lack of work continues, the company may have to lay off some of the most highly skilled workers whom it would be difficult to get back when the volume picks up later on. No wonder, the work's Manager at this Juncture, welcomes an order for 90,000 casting, each weighing about 40 lbs., to be delivered on a regular schedule during the next six months. As the immediate

concern of the Works Manager is to keep his work force occupied, he does not want to lose the order and is ready to recommended a quotation on a no-profit and no-loss basis.

Materials required would cost ₹ 1 per casting after deducting scrap credits. The direct labour hour per casting required for each department would be:

Core Making	0.09
Melting and pouring	0.15
Moulding	0.06
Cleaning and grinding	0.06

Variable overheads would bear a normal relationship to labour cost in the melting and pouring department and in the moulding department. In core making, cleaning and grinding however, the extra labour requirements would not be accompanied by proportionate increases in variable overhead. Variable overhead would increase by ₹1.20 for every additional labour hour in core making and by 30 paise for every additional labour hour in cleaning and grinding. Standard wage rates are in operation in each department and no labour variances are anticipated.

To handle an order as large as this, certain increases in factory overheads would be necessary amounting to ₹ 1,000 a month for all departments put together. Production for this order would be spread evenly over the six months period.

You are **required** to:

- Prepare** a revised monthly labour and overhead cost budget, reflecting the addition of this order.
- Determine** the lowest price at which quotation can be given for 90,000 castings without incurring a loss.

<p><b>Reference</b></p> <p><b>Lowest price computation</b></p>	<p>What's <b>New</b></p> <p><b>Revised Labour &amp; Overhead Budget</b></p>
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## Answer

### Computation of Labour and Overhead Rate

	Core making	Melting & pouring	Moulding	Cleaning & grinding
Labour & overheads (₹)	18,000.00	26,000.00	9,000.00	6,500.00
Labour & overheads per hour (₹)	9.00	6.50	6.00	5.20
No. of hours	2,000.00	4,000.00	1,500.00	1,250.00
Variable overhead per hour (₹)	1.50	0.25	0.67	0.80
Labour rate per hour (₹)	5.00	4.00	4.00	3.60
Hours required for new order	1,350.00	2,250.00	900.00	900.00

Labour cost required for order (₹)	6,750.00	9,000.00	3,600.00	3,240.00
Variable overhead cost for order (₹)	1,620.00	563.00	600.00	270.00

**Revised monthly labour and overheads cost budget reflecting the additions of the order**

	Core Making ₹	Melting & Pouring ₹	Moulding ₹	Cleaning & Grinding ₹	Total ₹
Labour	10,000.00	16,000.00	6,000.00	4,500.00	
Labour for the order	6,750.00	9,000.00	3,600.00	3,240.00	
	16,750.00	25,000.00	9,600.00	7,740.00	
Variable overheads	3,000.00	1,000.00	1,000.00	1,000.00	
Variable overheads for the order	1,620.00	563.00	600.00	270.00	
	4,620.00	1,563.00	1,600.00	1,270.00	
Fixed cost	5,000.00	9,000.00	2,000.00	1,000.00	
Total	26,370.00	35,563.00	13,200.00	10,010.00	85,143.00
Add : additional fixed cost					1,000.00
				Total:	86,143.00

**Computation of total price for the order**

		₹
Material	(15,000 × 1)	15,000.00
Labour & overheads	(86,143 – 59,500)	26,643.00
		41,643.00
Total price for the order	(41,643 × 6)	2,49,858



Q10

RTP Jun'18

Sri Company Ltd. manufactures and sells in a year 20,000 units of a particular product to definite customers at a price of ₹100 per unit. The Firm has a capacity to produce 25,000 units of the product per annum. To produce beyond 25,000 units per annum, it will have to install a New Equipment at a cost of ₹15 Lakhs. The Equipment will have a life span of 10 years and will have no residual value. There is an offer from a Client to purchase 10,000 units of the product regularly at a price of ₹90 per unit. The order, if accepted, will have to be over and above the existing level of production of 20,000 units.

The Cost Structure of the Product (per unit basis) is Direct Materials - ₹30, Direct Labour- ₹20, Variable Overhead - ₹10 and Profit - ₹20. The present total Fixed Overheads is ₹ 4,00,000.

During the coming year, it has been estimated that the cost of Direct Material, as compared to the current year will increase by 10%. Because of certain wage agreement Direct Labour Cost will increase by 25%. Fixed OH will increase by 10%. If the new order for 10,000 units is accepted, Fixed Overheads will increase further by ₹ 60,000 due to increased administrative charges.

You are **required** to **analyse** whether the concern should accept the order or instead of that try to secure order for the balance unused capacity, as available now, through some Sales Promotion Expenses which will be ₹50,000 per annum. Ignore financial charges for the new investment.

<p><b>Reference</b></p> <p><b>Evaluation of Offer</b></p>	<p><b>What's New</b></p>
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## Answer

### 1. Present and Revised Cost and Profit Structure

Particulars	Present	Revised
(a) Sale Price p.u.	Given = ₹100	
(b) Direct Material Cost p.u.	Given = ₹30	₹30 + 10% = ₹33
(c) Direct Labour Cost p.u.	Given = ₹20	₹20 + 25% = ₹25
(d) VOH p.u.	Given = ₹10	No Change = ₹10
(e) Variable Cost pu (b + c + d)	₹60	₹68
(f) Fixed OH (Total)	Given = ₹4,00,000	₹4,00,000 + 10% = ₹4,40,000

### 2. Options available to the company

Option	Description
I	Continue at present level of 20,000 units
II	Incur Additional SOH and sell upto full capacity = 20,000 + 5,000 = 25,000 units
III	Buy New Equipments, accept special offer of 10,000 units at ₹90 p.u. = 20,000 + 10,000 = 30,000 units
IV	Accept both Options II and III, and sell 20,000 + 5,000 + 10,000 = 35,000 units

The profits from these options are analysed below.

### 3. Profit Analysis under different options

Particulars	Option I	Option II	Option III	Option IV
(a) Sale Quantity	20,000 units	25,000 units	30,000 units	35,000 units
(b) Sale Price p.u.	₹100	₹100	20,000 units at ₹100 & 10,000 units at ₹90	25,000 units at ₹100 & 10,000 units at ₹90
(c) Sale Revenue	₹20,00,000	₹25,00,000	₹29,00,000	₹34,00,000
(a × b)				

(d) VC at ₹68 p.u. (WN 1)	₹13,60,000	₹17,00,000	₹20,40,000	₹23,80,000
(e) Contribution (c – d)	₹6,40,000	₹8,00,000	₹8,60,000	₹10,20,000
(f) Fixed Costs				
Given (WN 1f)	₹4,40,000	₹4,40,000	₹4,40,000	₹4,40,000
Additional SOH	-	₹50,000	-	₹50,000
Additional AOH	-	-	₹60,000	₹60,000
Department on New Equipment	-	-	₹1,50,000	₹1,50,000
Total Fixed Costs	₹4,40,000	₹4,90,000	₹6,50,000	₹7,00,000
(g) Profit (e – f)	₹2,00,000	₹3,10,000	₹2,10,000	₹3,20,000
(h) Rank I Priority	(iv)	(ii)	(iii)	(i)

**Note:** Depreciation on New Equipments = ₹15,00,000/10 years = ₹1,50,000.

**Decision:** Option IV is preferable, due to maximum profits. If it is not possible, the Firm may choose Option II.

Q11

Ex. Book No.	Pg. No.

RTP Dec'18

Sportech Ceramics Ltd. is about to replace its rapidly deteriorating boiler equipment. Three types of boiler system are being considered as a suitable replacement: (A) Coal-fired, (B) Gas-fired, and (C) Oil-fired. The associated costs are as follows:

Boiler system	A (₹)	B (₹)	C (₹)
Cost of boiler (including installation and commissioning)	55,000	74,000	67,000
Annual fuel cost	27,000	23,000	25,000
Annual operating labour costs	8,000	---	---
Annual maintenance costs	4,000	3,000	3,000
Annual electricity costs	1,000	1,000	1,000
Total annual operating costs	40,000	27,000	29,000

The new boiler system is expected to last at least ten years. The company has an opportunity cost of finance of 15% per year. **Which** system should be chosen?

Reference	What's New
Evaluation of best option	

**Answer**

If the decision is taken on the basis of initial cost only, then the Coal-fired boiler system would be selected. However, over its life time (at least ten years) the annual operating costs are much higher than for the Gas-fired and Oil-fired systems. The life cycle costs for ten years are as follows:

Boiler system	A (₹)	B (₹)	C (₹)
Cost of boiler	55,000	74,000	67,000
Operating Costs (Annual Costs × 10 years)	4,00,000	2,70,000	2,90,000
Total costs	4,55,000	3,44,000	3,57,000

However, we need to discount the annual costs at a 15% discount rate to arrive at the present value cost of each system. The discount factor for year 1 -10 at 15% is 5.019.

The present value of each system then is:

Boiler system	A (₹)	B (₹)	C (₹)
Cost of boiler	55,000	74,000	67,000
Operating Costs (Annual Costs × 5.019)	2,01,000	1,36,000	1,46,000
Present value of Total costs	2,56,000	2,10,000	2,13,000

On the basis of financial considerations only, the Gas-fired system is the most economical. Unless there are other important considerations the Gas-fired system should be chosen. A more intricate analysis might attempt to forecast the likely changes in each of the annual operating costs (e.g., fuel costs, maintenance costs, etc.). It might be useful, to see how much each of the three fuel costs would need to change to alter the decision. In addition to looking at the importance of fuel costs to the decision, we can also check the sensitivity of the expected system life. For instance, if the expected life is reduced to five years, the Oil-fired system (C) becomes the most economics, as follows:

Boiler system	A (₹)	B (₹)	C (₹)
Cost of boiler	55,000	74,000	67,000
Operating Costs (Annual Costs × 3.353)	1,34,000	91,000	97,000
Present value of Total costs	1,89,000	1,65,000	1,64,000

If the expected life is reckoned to be six years or more, the decision is in favour of the GAS – fired system.

**Q12** Ex. Book No. | Pg. No.

**CMA Mat**

S.G Ltd produces four products in its factory. The volume of production and sales achieved is considerably lower than normal and so there has been substantial under recovery of overheads. The sales and cost particulars are as under:

(₹ In lakhs)					
	Products				Total
	A	B	C	D	
Sales	160	200	80	40	480
Costs:					
Direct Material	24	32	16	3	75
Direct Wages	40	48	32	8	128
Factory Overheads	48	64	40	8	160
Selling & Admn. (15% Sales)	24	30	12	6	72
Total	136	174	100	25	435
Profit / Loss	24	26	(20)	15	45
Under recovery of overheads					24
Profit before tax					21

40% of factory overheads are variable at normal volume and the selling and administration overheads are variable to the extent of 5% of sales. 20% of sales of product C are done in connection with Product A in as much as the discontinuance of Product C will bring down the sale of Product A by 10%. Alternatively, the sale of product C can be reduced to 20% of the present level to maintain the sales of product A.

In view of the loss reported for Product C the management has for consideration three proposals, viz;

- Discontinue product C. In that event the co. can save a sum of ₹8 lakhs p.a. in fixed expenses.
- Maintain the sales of product C to the extent of 20% of the present sales as sales service to product A. In that event the reduction of fixed expenses will be ₹ 3 lakhs p.a.
- Discontinue product C totally and increase the sales of product D for which demand is available to the extent of another ₹40 lakhs. This can be done without any change in fixed expenses.

**Draft** a report to the management bringing out the financial implications of the aforesaid three proposals as compared with the annual operating results generating a profit before tax of ₹21 lakhs. Suggest a source of action to be followed by the S.G Ltd.

Reference	What's New
<b>Discontinue Decision</b>	

**Answer**

**Computation of Variable Factory Overheads**

₹ In lakhs

	A ₹	B ₹	C ₹	D ₹	Total ₹
Factory Overheads recovered	48	64	40	8	160
(+) Under recovery (6:8:5:1)	7.2	9.6	6	1.2	24
Overheads at normal value	55.2	73.6	46	9.2	184
40% Overheads Variable	22.08	29.44	18.4	3.68	73.6
Fixed Overhead	33.12	44.16	27.6	5.52	110.4

**Presentation of data in 'Contribution' format**

₹ In lakhs

	A ₹	B ₹	C ₹	D ₹	Total ₹
I. Sales	160	200	80	40	480
II. Variable Cost					
Direct Material	24	32	16	3	75
Direct Wages	40	48	32	8	128
Variable Overheads	22.08	29.44	18.4	3.68	73.6
Variable Selling & Distribution Overheads.	8	10	4	2	24
	94.08	119.44	70.4	16.68	300.6
III. Contribution	65.92	80.56	9.6	23.32	179.4
IV Fixed Cost					
Fixed Factory Overheads	33.12	44.16	27.6	5.52	110.4
Fixed Selling & Distribution Overheads	16	20	8	4	48
	49.12	64.16	35.6	9.52	158.4
V. Profit/Loss	16.8	16.4	(26)	13.8	20.56

(a) **Computation of Profit at course of Action**

₹ In lakhs

	A	B	D	Total
I. Contribution (65.92 – 10%)	59.328	80.56	23.32	163.208
II. Fixed Cost				150.400
III. Profit				12.808

(b)

₹ In lakhs

		A	B	C	D	Total
I.	Contribution	65.92	80.56	1.92	23.32	171.72
II.	Fixed Cost					155.40
III.	Profit					16.32

(c)

₹ In lakhs

		A	B	D	Total
I.	Contribution	59.328	80.56	46.64	186.528
II.	Fixed Cost				158.400
III.	Profit				28.128

From the above computation, it was found that profit is more in the course of action C i.e., discontinuing in Product C completely & increasing the sales of Product D at 100%, it is the best course of action to be suggested.

**Q13**

Ex. Book No. Pg. No.

Aves Airlines Ltd. operates its services under the brand 'Yellow Bird'. The 'Yellow Bird' route network spans prominent business metropolis as well as key leisure destinations across the Indian subcontinent. 'Yellow Bird', a low-fare carrier launched with the objective of commoditizing air travel, offers airline seats at marginal premium to train fares across India.

Profits of the 'Yellow Bird' have been decreasing for several years. In an effort to improve the company's performance, consideration is being given to dropping several flights that appear to be unprofitable.

**Income statement for one such flight from 'New Delhi' to 'Kullu' (Y-09) is given below (per flight):**

	₹	₹
Ticket Revenue		
(175 seats × 80% Occupancy × ₹ 7,000 ticket price)		9,80,000
Less: Variable Expenses (₹ 1,400 per person)		1,96,000
Contribution Margin		7,84,000
Less: Flight Expenses:		
Salaries, Flight Crew	2,05,000	
Salaries, Flight Assistants	45,500	
Baggage Loading and Flight Preparation	72,000	
Overnight Costs for Flight Crew and Assistants at destination	18,000	

Fuel for Aircraft	2,55,000	
Depreciation on Aircraft	51,000*	
Liability Insurance	1,53,000	
Flight Promotion	35,000	
Hanger Parking Fee for Aircraft at destination	15,000	8,49,500
Net Gain / (Loss)		(65,500)

\* Based on obsolescence

**The following additional information is available about flight Y-09.**

- Members of the flight crew are paid fixed annual salaries, whereas the flight assistants are paid by the flight.
- The baggage loading and flight preparation expense is an allocation of ground crew's salaries and depreciation of ground equipment.
- One third of the liability insurance is a special charge assessed against flight Y-09 because in the opinion of insurance company, the destination of the flight is in a "high-risk" area.
- The hanger parking fee is a standard fee charged for aircraft at all airports.
- If flight Y-09 is dropped, Aves Airlines has no authorization at present to replace it with another flight.

**Required**

**Prepare** an analysis showing what impact dropping flight Y-09 would have on the airline's profit.

<p><b>Reference</b> <b>Discontinue Decision</b></p>	<p><b>What's New</b> <b>Airlines Discontinue Decision</b></p>
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**Answer**

**Statement showing Net Benefit per flight - Y-09**

Particulars	Workings	Amount
Ticket Revenue	Given	9,80,000
Less : Relevant Cost of Operating the flight		
Variable Cost		1,96,000
Salaries of Flight Crew	- Committed, irrelevant	Nil
Salaries of Flight Assistants	- Paid by the Flight - Relevant	45,500
Overnight Cost of Crew	- To be paid if flight is operated - Relevant	18,000

Fuel for Aircraft	- To be incurred if flight is operated	2,55,000
Liability Insurance	$\frac{1}{3}$ is specific = avoidable = $\frac{1}{3} \times 1,53,000$	51,000
	$\frac{2}{3}$ assumed to be committed	
Flight Promotion	- Assumed avoidable	35,000
Hanger Parking Fee	- will be same at all airport - committed	Nil
Depreciation of Aircraft	- amortisation of Sunk Cost	Nil
Baggage loading and flight preparation	- allocated - committed	Nil
Net Profit		3,79,500

If the flight Y-09 is dropped, the Ave Airlines will loose ₹ 3,79,500 per flight

Hence, it is advisable to continue the operation of this flight

SJC Institute

Unit 3  
**CVP Analysis**



**Learning  
Objective**

1. TECHNIQUES OF COSTING
  - a. Absorption Costing
  - b. Marginal Costing
2. USES OF MARGINAL COSTING
  - a. Pricing - in Competition
  - b. CVP Analysis
  - c. Management Decision Making
3. COMPARATIVE INCOME STATEMENT
  - a. Under Marginal Costing and Absorption Costing
4. CVP ANALYSIS CALCULATIONS
  - a. Basics
    - i) Contribution
    - ii) Break up of Total Cost
    - iii) Profit Volume Ratio
  - b. Break Even Analysis
    - i) Break Even Point and Cash Break Even Point
    - ii) Margin of Safety
    - iii) Break Even Point and Profit Volume Chart
    - iv) Jugalbandi Jodi
    - v) Break Even Point of Multiple Products
    - vi) BEP with Probability
    - vii) Break Even Point with Step Fixed Costs or Multiple BEP
  - c. Indifference Analysis
    - i) Indifferent Point Analysis
    - ii) Shutdown Point Analysis
5. EVALUATION OF ALTERNATIVES

## BREAKUP OF TOTAL COST

$$VC / ut \text{ or } MC = \frac{\Delta TC}{\Delta uts}$$

(assume no change in FC) Since,  $\Delta FC = 0$ ,  $MC = \text{Incremental cost} = \Delta TC$

## CONTRIBUTION

$$\text{Sales} - VC = FC + \text{Profit}$$

$$\text{Total Contribution} = \text{Quantity sold} \times \text{Contribution /unit}$$

## PROFIT-VOLUME RATIO OR CONTRIBUTION SALES RATIO

$$\frac{\text{Contribution / ut}}{SP / ut} = \frac{\text{Total Contribution}}{\text{Total Sales}} = \frac{\Delta \text{Profit}}{\Delta \text{Sales}}$$

$$\text{or, Sales} = \frac{\text{TFC} + \text{Profit (before tax)}}{\text{PV ratio}}$$

## IMPORTANT ASSUMPTIONS

- TFC remains constant.
- VC/unit remains constant.
- SP/ unit remains constant.

If any of the assumption do not hold good, do not use formulas. Follow these steps :

- (a) Contribution earned from initial volume
- (b) Desired contribution
- (c) Shortfall from desired contribution
- (d) Additional volume to be sold to recover the shortfall contribution as per new cost or price

## BEP

$$\text{BEP(uts)} = \frac{FC}{\text{Contribution pu}} \quad \& \quad \text{BEP(₹)} = \frac{FC}{\text{PVR}}$$

At BEP,

- Total Contribution = Total Fixed Cost
- No profit, No loss

## CASH BEP

$$\text{Cash in BEP(uts)} = \frac{\text{Cash FC}}{\text{Contribution pu}} \quad \& \quad \text{Cash BEP(₹)} = \frac{\text{Cash FC}}{\text{PVR}}$$

At Cash BEP,

- Total Contribution = Total Cash FC
- Total Cash FC = TFC – Non Cash exp (depreciation)

BEP ≥ Cash BEP

## MARGIN OF SAFETY

- Excess of sales over BES
- $\text{MOS (units)} = \text{Total Sales (uts)} - \text{BES (units)} = \frac{\text{Profit}}{\text{Contribution pu}}$
- $\text{MOS (₹)} = \text{MOS (Units)} \times \text{SP/Unit} = \frac{\text{Profit}}{\text{PV Ratio}}$

## JUGALBANDI JODIS

(a) BES Ratio + MOS Ratio = 1

$$\text{BES Ratio} = \frac{\text{FC}}{\text{Contribution}}$$

$$\text{MOS Ratio} = \frac{\text{Profit}}{\text{Contribution}}$$

(b) VC Ratio + Contribution Ratio = 1

## BEP WITH MULTIPLE PRODUCTS

### Total Contribution

- **Contribution / unit × Unit sold** – sales mix is in units  
Solve using x Method

### Total Contribution

- **(Sales – TVC) or (Sales × PVR)** – sales mix is in Value  
Solve using Weighted Average Method

$$\text{Overall BEP} = \frac{\text{TFC}}{\text{Weighted Average Contribution/ut or Weighted Average PVR}}$$

## BEP WITH STEP FC

- Before real BEP - No profits
- BEP exists in real terms when the calculated BEP units lies within the range of its FC
- After 1st BEP - Company starts making profit.
- When real BEP is on the upper limit of its slab, there has to be a 2nd Real BEP in the immediate next slab.
- Solve using algebraic equation or columnar approach

### C. ALGEBRIC EQUATION :

When slab range are equal

**Step 1 :** Find the slab number for 1st Real BEP

**Step 2 :** Find the first Real BEP

**Step 3 :** Find the 2nd Real BEP, if applicable.

### D. COLUMNAR APPROACH :

When slab range are unequal

**Step 1:** Make columns for each slab

**Step 2:** Find BEP in each slab

**Step 3:** Comment whether it is real or imaginary.

## INDIFFERENCE POINT

**Indifference Point** = To choose between two mutually exclusive options

$$= \frac{TFC}{\Delta VC / ut} \text{ or } \frac{TFC}{\Delta \text{Contribution} / ut} \text{ (when SP constant)}$$

Expected Level	Recommendation
> Indifference point	High FC option
< Indifference point	Low FC option
= Indifference point	Any option

## SHUTDOWN POINT

To choose between **Temporary Shutdown or Continue the operations** (during business distress or off season)

- **Non-financial factors** : Labour availability, Relation with suppliers, Accumulated inventory, Goodwill, Customer loyalty, Security , Competition pressure, Reopening hassles, Difficulty in regularisation.

- **Shutdown point** = 
$$\frac{TFC_{\text{continue}} - TFC_{\text{shutdown}}}{\text{Contribution / ut}_{\text{Continue}} - \text{Contribution / ut}_{\text{Shutdown}}}$$
  
= 
$$\frac{\text{Avoidable FC} - \text{Extra Shut Down Cost}}{\text{Contribution / ut}}$$

Expected Sales	Recommendations
> Shutdown point	Continue
< Shutdown point	Shut down
= Shutdown point	Any option

## BE WITH PROBABILITY EFFECT

- Probability of BE or of sales to earn a **profit** = Sum of Probability of Sales  $\geq$  Computed Sales
- Probability of Sales to make a **loss** = Sum of Probability of Sales  $\leq$  Computed Sales

## MINIMUM UNITS FOR BE

- Sell the product with the highest contribution per unit first.
- If batch size is applicable, plan to produce only 1 batch and see the BEP. [E.g. ABC – BEP Sum]

## BE WITH OPTIMUM MIX UNDER KEY FACTOR

- Key factor exists
- Optimum product mix has been obtained
- Use optimum mix ratio as the sales mix to find BEP
- **Combined PVR** = 
$$\frac{\text{Total contribution as per optimum mix}}{\text{Total sales as per optimum mix}}$$
- **Overall BEP** = 
$$\frac{TFC}{\text{Combined PVR}}$$

## 1. SENSITIVITY ANALYSIS [RTP DEC'18; RTP JUN'18]

**CVP based Sensitivity Analysis help Managers to cope with uncertainty.**

1. Sensitivity Analysis refers to analysis of the **change in one factor on the other related factors**. For example, what will be the effect of a 10% increase in Selling Price, on Sales Volume and Profits?
2. Sensitivity Analysis focusses on **how a result will be changed if the original estimates of the underlying assumptions change**.
3. CVP-based Sensitivity analysis will help top Management **to get answers to questions like** - What will be the Total Profit if the Sales Mix is changed to include more of Product L and less of Product M? or What will be the Profit if Fixed Costs increase by 30% and Variable Costs decline by 5%?, etc.
4. CVP-based Sensitivity analysis can be performed in a **Spreadsheet package**, i.e. computerized CVP Models. Computers will quickly show changes both graphically and numerically based on data keyed in.
5. Managers can study **various combinations** of changes in Selling Prices, Fixed Costs, Variable Costs and Product Mix, and can react quickly without waiting for formal MIS Reports from the Financial Officer.
6. Therefore, use of CVP-based Sensitivity analysis, helps Managers to **cope up with uncertainty**.

## 2. MARGIN OF SAFETY - SIGNIFICANCE IN THE CONTEXT OF BUSINESS [DEC'19; JUN'19]

The expression **Margin of Safety (MOS)** signifies the difference between actual sales and break even sales. In other words, all sales revenue above the break-even point represents the margin of safety. For **example**, if actual sales for the month of December 2015 are ₹ 50,00,000 and the break-even sales are ₹ 37,00,000, the difference of ₹ 12,50,000 is margin of safety. It can be expressed in percentage also.

Margin of safety is an important figure for any business because it tells management how much reduction in revenue will result in break-even. A higher MOS reduces the risk of business losses. Generally, the higher the margin of safety, the better the strength of business.

Q1

Ex. Book No. Pg. No.

**CMA Mat**

Details about the single product marketed by a company are as under

Per Unit	Amount (₹)
Selling Price	100
Direct Material	60
Direct Labour	10
Variable Overheads	10

No. of units sold in the year 5,035. Pursuant to an agreement reached with the Employee's union, there would be next year a 10% increase in wages across the board for all those directly engaged in production.

**Work out:**

- How many** more units have to be sold next year to maintain the same quantum of profit?
- Or else, by **what** percentage the Selling Price has to be raised to maintain the same P/V ratio.

Reference

What's **New**

**Units to be sold for same profit, % increase in SP**

**Answer**

**Current year details:**

		Amount (₹)
Sales	5,035 x 100	5,03,500
Variable Cost	80 x 5,035	4,02,800
Contribution		1,00,700
P/V Ratio	$\frac{C}{S} \times 100 = \frac{20}{100} \times 100 =$	20%

**Details of next year:**

		Amount (₹)
SP		100
VC: DM	60	
DL – 10 x 110%	11	
VOH	10	81
Contbn.		19

(i) **No. of units to maintain same profit** =  $\frac{\text{Desired Contribution}}{\text{Contbn. per unit}} = \frac{1,00,700}{19} = 5,300$

(ii) **Let S be the new SP**

$$\text{P/V Ratio} = \frac{S - V}{S} \times 100$$

$$\text{or, } 0.2 = \frac{S - 81}{S}$$

$$\text{or, } S = ₹ 101.25$$

∴ SP has to be increased by 1.25%.

**Q) 2**

Ex. Book No.

Pg. No.

Dec'17

The following data are obtained from the records of a company:

	Year 1 (₹)	Year 2 (₹)
Sales	80,000	1,00,000
Profit	10,000	15,000

**Required:**

- Calculate Break-even Point
- Profit or Loss when sales amount to ₹ 60,000, and
- Required sales for level of profit of ₹ 20,000.

[4 + 2 + 2 = 8]



Reference

**BEP; Profit or loss Amount; Required sales**

What's New

**Answer**

$$\text{P/V Ratio} = \frac{\text{Change in profit}}{\text{Change in sales}} = \frac{5,000}{20,000} = \frac{1}{4} \text{th or } 25\%$$

$$C = F + P$$

$$\begin{aligned} \text{or, } F &= C - P = 25\% \text{ of } 8,000 - 10,000 \\ &= ₹ 10,000 \end{aligned}$$

$$[\text{or, } 25\% \text{ of } 1,00,000 - 15,000 = ₹ 10,000]$$

$$(i) \therefore \text{BEP} = \frac{\text{FC}}{\text{P/V Ratio}} = \frac{\text{₹ } 10,000}{.25} = \text{₹ } 40,000$$

$$(ii) \text{ Sales} = \text{₹ } 60,000$$

$$\text{Profit} = C - F = 25\% \text{ of } 60,000 - 10,000 = \text{₹ } 5,000$$

$$\therefore \text{Profit} = \text{₹ } 5,000$$

$$(iii) \text{ Required Sales for (P)} = \text{₹ } 20,000$$

$$C = F + P = \text{₹ } 10,000 + 20,000 = \text{₹ } 30,000$$

$$\therefore \text{ Required Sales} = \frac{\text{₹ } 30,000}{0.25} = \text{₹ } 1,20,000$$

**Q3**

Ex. Book No.

Pg. No.

**Dec'21**

Manton Moulders is operating at 70% capacity and presents the following information:

BEP= ₹200 lakhs, PV Ratio= 40% and Margin of Safety= ₹50 lakhs

The management has decided to increase production to 95% capacity level with the following changes:

Selling price will be reduced by 8%

Variable cost will be reduced by 5% on sales

Fixed cost will increase by ₹20 lakhs, including depreciation on additions but excluding interest on additional capital.

Additional capital of ₹50 lakhs will be needed for capital expenditure and working capital

- (i) **Calculate** the present profit at 70% capacity [3]
- (ii) **Calculate** the sales that will be required to earn ₹10 lakhs over and above the present profit and also meet 20% interest on the additional capital. [3]
- (iii) **What** will be the revised Break Even Point? [2]
- (iv) **What** will be the new Margin of Safety? [1]



**Reference**

**Profit, Sales, BES, MOS**

**What's New**

**Answer**

(i) **Computation of present profit at 70% capacity:**

= ₹ 20 lakhs

(ii) **Sales required to earn target profit:**

= ₹ 311.12 lakhs

(iii) **New BEP** = ₹ 244.45 lakhs.

(iv) **New MOS** = ₹ 66.67 lakhs

**Q4** Ex. Book No. | Pg. No.

**CMA Mat; MTP Jun'17; RTP Jun'19**

Accelerate Co. Ltd., manufactures and sells four types of products under the brand names of A, B, C and D. The sales mix in value comprises 33 1/3%, 41 2/3%, 16 2/3% and 8 1/3% of products A, B, C and D respectively. The total budgeted sales (100%) are ₹ 60,000 p.m. Operating Costs are: 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 and
- (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%)

<p><b>Reference</b></p> <p><b>Multiple Product BEP</b></p>	<p><b>What's New</b></p> <p><b>Weighted Average PVR</b></p>
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**Answer**

(a) **Statement showing computation of break even point on overall basis:** Amount (₹)

	A	B	C	D	TOTAL
(a) Sales	20,000	25,000	10,000	5,000	60,000
(b) Variable cost	12,000	17,000	8,000	2,000	39,000
(c) Contribution	8,000	8,000	2,000	3,000	21,000
(d) Fixed cost					14,700
(e) Profit					6,300
(f) P/V ratio	40%	32%	20%	60%	35%
(g) Break even sales			14,700/35% =		42,000

(b) **Statement showing computation of break even point if the sales mix is changed:**

Amount (₹)

	A	B	C	D	TOTAL
Sales	15,000	24,000	18,000	3,000	60,000
Variable cost	9,000	16,320	14,400	1,200	40,920
Contribution	6,000	7,680	3,600	1,800	19,080
Fixed cost					14,700
P/V ratio	40%	32%	20%	60%	$(19,080/60,000) \times 100 = 31.8\%$
Break even sales					$14,700/31.8\% = 46,266$

**Q5** Ex. Book No. Pg. No.

**CMA Mat**

Evenkeel Ltd. manufactures and sells a single product X whose price is ₹40 per unit and the variable cost is ₹16 per unit.

- (a) If the fixed costs for this year are ₹4,80,000 and the annual sales are at 60% margin of safety, **calculate** the rate of net return on sales, assuming an income tax level of 40%.
- (b) For the next year, it is proposed to add another product line Y whose selling price would be ₹50 per unit and the variable cost ₹10 per unit. The total fixed costs are estimated at ₹6,66,600. The sales mix of X:Y would be 7:3. At **what** level of sales next year, would Evenkeel Ltd. break even? **Give** separately for both X and Y the break even sales in rupees and quantities.

Reference	What's New
<b>Multiple Product BEP</b>	

**Answer**

(a) **Statement showing computation of profit on X:**

	Amount (₹)
SP	= 40
VC	= 16
C	= 24

$$P/V \text{ Ratio} = \frac{C}{S} \times 100 = \frac{24}{40} \times 100 = 60\%$$

$$BES = \frac{FC}{PV \text{ Ratio}} = \frac{4,80,000}{60\%} = ₹ 8,00,000$$

Given that margin of safety = 60%, Let x be the total sales

$$0.6x = x - 8,00,000$$

$$\Rightarrow x = 20,00,000$$

$$\Rightarrow \text{No. of units} = \frac{x}{40} = \frac{20,00,000}{40} = 50,000 \text{ units}$$

		Amount (₹)
(I)	Sales (50,000 x 40)	= 20,00,000
(II)	Variable Cost	= 8,00,000
(III)	Contribution	= 12,00,000
(IV)	Fixed Cost	= 4,80,000
(V)	Profit	= 7,20,000
(VI)	Tax (7,20,000 x 40%)	= 2,88,000
(VII)	Net Profit	= 4,32,000
(VIII)	ROR on sales	= $\frac{4,32,000}{20,00,000} \times 100 = 21.60\%$

(b) Let the break-even units of products X & Y be 7a & 3a respectively.

In order to break even the contribution must be equal to FC

$$(7a \times 24) + (3a \times 40) = ₹ 6,66,600$$

$$a = 2,314.58$$

$$\text{BES of X} = 7a = 16,202 \text{ units and sales} = ₹ 6,48,080$$

$$\text{Y} = 3a = 6,944 \text{ units and sales} = ₹ 3,47,200.$$

Q 6

Ex. Book No.	Pg. No.

Jun'19

SRM Ltd. manufactures and sells a single product X whose selling price is ₹ 80 per unit and the variable cost is ₹ 32 per unit.

- Assume that for first year fixed costs are ₹ 9,60,000 and the annual sales are at 60% margin of safety.
- For second year, it is proposed to add another product line Y whose selling price would be ₹ 100 per unit and the variable cost ₹ 20 per unit. The total fixed costs are estimated at ₹ 13,33,200. The sales mix of X : Y would be 7 : 3 based on value.

**Required:**

- For the first year, calculate the rate of net return on sales, assuming an income tax level of 30%.
- For second year, at what level of sales would SRM Ltd. break even? Give separately for both X and Y the break even sales in rupees and quantities.

<p><b>Reference</b></p> <p><b>Multiple Product BEP</b></p>	<p><b>What's New</b></p>
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**Answer**

(i) **Contribution per unit** = SP-VC = ₹(80 – 32) = ₹48

Break-even Point = 960,000/48 = 20,000 units

Percentage Margin of Safety = (Actual Sales – Break-even Sales)/Actual Sales

Or, 60%

= (Actual Sales – 20,000 units)/Actual Sales

**Actual Sales** = 50,000 units

	₹
Sales value (50,000 units x ₹80)	40,00,000
Less: Variable costs (50,000 units x ₹32)	16,00,000
Contribution	24,00,000
Less: Fixed cost	9,60,000
Profit	14,40,000
Less: Income Tax @30%	4,32,000
Net Return	10,08,000

**Rate of net return on sales** = (10,08,000/40,00,000) × 100 = 25.2%

(ii)

	X (₹)	Y (₹)
Selling price per unit	80	100
Variable cost per unit	32	20
Contribution per unit	48	80 -
Individual products contribution margin	60% (48/80) × 100	80% (80/100) × 100

Contribution margin (X and Y)

60% × 7/10 + 80% × 3/10 = 66%

Break even sales = ₹ 20,20,000 (₹13,33,200/66%)

**Break even sales mix**

X - 70% of 20,20,000 = ₹14,14,000 i.e. 17,675 units

Y - 30% of 20,20,000 = ₹6,06,000 i.e. 6,060 units

Q7

Ex. Book No.

Pg. No.

**CMA Mat**

Ever Forward Ltd is manufacturing and selling two products: Splash and Flash, at selling prices of ₹3 and ₹4 respectively. The following sales strategy has been outlined for the year 2015.

- (i) Sales planned for year will be ₹7.20 lakhs in the case of Splash and ₹ 3.50 lakhs in the case of Flash.
- (ii) Break-even is planned at 60% of-the total sales of each product.
- (iii) Profit for the year to be achieved is planned at ₹69,120 in the case of Splash and ₹17,500 in the case of Flash. This would be possible by launching a cost reduction programme and reducing the present annual fixed expenses of ₹1,35,000 allocated as ₹1,08,000 to Splash and ₹27,000 to Flash.

The selling price of Splash and Flash will be reduced by 20% and 12.5% respectively to meet the competition.

You are **required** to **present** the proposal in financial terms giving clearly the following information.

- (a) Number of units to be sold of Splash and Flash to break-even as well as the total number of units of Splash and Flash to be sold during the year.
- (b) Reduction in fixed expenses product-wise that is envisaged by the cost Reduction Program.



Reference

**Multiple Product BEP**

What's New

**Reduction in fixed expense**

**Answer**

**S. S. Computation of Breakeven, total no of units to be sold & reduction in costs**

		Splash	Flash	Total
I	Sales (₹)	7,20,000	3,50,000	10,70,000
II	SP (₹)	2.4	3.5	
III	No. of units to be sold $\left(\frac{7,20,000}{2.4}\right)$	3,00,000	1,00,000	4,00,000
IV	Break even units 60%	1,80,000	60,000	
V	Break even sales (₹)	4,32,000	2,10,000	6,42,000
VI	M/s (₹)	2,88,000	1,40,000	4,28,000
VII	Project Planned	69,120	17,500	86,620
VIII	P/V Ratio	24%	12.5%	

IX	FC (Break even sales × P/V Ratio) (₹)	1,03,680	26,250	1,29,930
X	Previous FC (₹)	1,08,000	27,000	1,35,000
XI	Reduction in FC (X – IX) (₹)	4320	750	5070



## CMA Mat; MTP Dec'17

Study Horse Ltd., a cycle manufacturing company, has drawn up a programme for the manufacture of a new product for the purpose of fuller utilisation of its capacity. The scheme envisages the manufacture of baby tricycle fitted with a bell. The company estimates the sales of tricycles at 10,000 during the first year and expects that from the second year onwards the sales estimates will stabilise at 20,000 tricycles. Since the company has no provision for the manufacture of the small bells. It is initially proposed to be met by way of purchase from the market, at ₹ 8 each.

However, if the company desires to manufacture the bell in its factory by installation of new equipment, it has two alternative proposals as under:

	Installation of Super-X Machine	Installation of Janta Machine
Initial cost of machine	₹ 3,00,000	₹ 2,00,000
Life	10 years	10 years
Fixed overheads other than depreciation on machines (per annum)	₹ 54,000	₹ 28,000
Variable expenses per bell	₹ 4.00	₹ 5.00

Depreciation on machine should be charged on straight line basis.

### Required:

- (i) For each of the two levels of output namely, 10,000 and 20,000 bells state with suitable workings whether the company should purchase the bells from market or install new equipment for manufacture of bells. If your decision is in favour of the installation of new equipment, which of the two new machines should be installed?
- (ii) What would be your decision in case the forecast of requirement from the second year onwards is estimated at 40,000 bells instead of 20,000 bells.
- (iii) At what volume of bells will the installation of the two machines break even.

<p><b>Reference</b></p> <p><b>Indifference point</b></p>	<p><b>What's New</b></p> <p><b>2 machines &amp; BEP</b></p>
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**Answer**

(i) and (ii)

**Statement showing comparative costs at the 3 levels of output at the 3 alternatives**

Amount (₹)

Particulars	10,000 Units			20,000 Units			40,000 Units		
	Market	SPX	Janta	Market	SPX	Janta	Market	SPX	Janta
<b>Fixed Cost:</b>									
Depreciation		30,000	20,000		30,000	20,000		30,000	20,000
FOH other than depn.		54,000	28,000		54,000	28,000		54,000	28,000
Variable Cost		84,000	48,000		84,000	48,000		84,000	48,000
	80,000	40,000	50,000	1,60,000	80,000	1,00,000	3,20,000	1,60,000	2,00,000
<b>Total Cost</b>	<b>80,000</b>	<b>1,24,000</b>	<b>98,000</b>	<b>1,60,000</b>	<b>1,64,000</b>	<b>1,48,000</b>	<b>3,20,000</b>	<b>2,44,000</b>	<b>2,48,000</b>

From the above computations it is evident that,

At level of out put 10,000 - buying from market

20,000 - Installation of Janta

40,000 - Installation of Super - X are beneficial.

(iii) **Volume of bells at which the two machines will break even** =  $\frac{\text{Difference in FC}}{\text{Difference in VC per unit}}$

$$\frac{84,000 - 48,000}{5 - 4} = 36,000$$

Q9

Ex. Book No.	Pg. No.

**Dec'17**

Your company wants to buy one machine. Two alternative models are available – A and B. The following information are available with respect to them:

	Model A	Model B
Output p.a.	10,000	10,000
Fixed costs p.a. (₹)	30,000	16,000
Profit at 100% capacity (₹)	30,000	24,000

Both the machines will produce identical products. The annual market demand for the product is 10,000 units @ ₹ 10 per unit.

**Required:**

(i) The level of sales at which both are equally profitable;

(ii) The range of sales at which one is more profitable than the other.

[4 + 4 = 8]

<p><b>Reference</b></p> <p><b>Indifference Point</b></p>	<p><b>What's New</b></p>
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**Answer**

$[C = F + P]$

	A ₹	B ₹
Sales @ ₹ 10	1,00,000	1,00,000
Contribution	60,000	40,000
P/V ratio	60%	40%
Contribution/unit	6	4
Variable cost/unit	4	6
BEP	5,000 units	4,000 units

(i) For A :  $4x + 30,000$

B :  $6x + 16,000$

$\therefore 4x + 30,000 = 6x + 16,000$  ; Solving  $X = 7,000$  units

(ii) At 7,000 units both are equally profitable. BEP of A and B being 5,000 units and 4,000 units, Machine B is more profitable below 7,000 units, and A will be more profitable above 7,000 units.

A : Range of production 7,000 to 10,000 units

B : Range of production 4,000 to 6,999 units

**Q10** Ex. Book No.  Pg. No.

**RTP Dec'18**

A product can be manufactured at 50 units per hour in a semi-automatic machine and 100 units in an automatic machine. Manufacture is undertaken on job basis according to customer's order.

The cost of setting-up per order: ₹ 200 in semi-automatic line and ₹ 1,000 in automatic line. Daily cost of labour: Semi-automatic method ₹ 400; automatic method ₹ 200. Cost of power semi-automatic ₹ 50 and automatic ₹ 300 per day. In case of semi-automatic machines fixed overhead would be ₹ 500 per day.

Variable overheads may be taken at 40 per cent of wages in case of automatic machine and 10 per cent of wages in semi-automatic machine. Fixed overheads will increase by ₹ 2,50,000 p.a. in case of automatic machine apart from depreciation and interest. Cost of automatic machine is ₹ 2,00,000 higher than that of semiautomatic machine. Semi-automatic machine can be purchased at ₹ 3,00,000.

Market or material is not a limiting factor.

10 per cent depreciation and 15 per cent interest on capital per annum are to be taken into consideration.

Daily working hours are 8, and on average 25 working days are available per month. 20 per cent of the net working time is lost in both the cases for setting up, change of jigs, rest etc. The factory is booked in advance for a few years.

**Which** method will be preferable, if the average order size is?

(i) 1,000 units (ii) 10,000 units

**Determine** the order size at which we may be indifferent as to whether we should have automatic or semiautomatic machine.

Reference

Indifference point

What's New

**Full Capacity of Machines  
Calculation; Fixed Cost treated  
on Cost per Unit Basis**

### Answer

Market is not the key factor. It means whatever is produced, that will be sold. It means any machine that will install will work only at full capacity.

#### Workings:

##### Full Capacity

Full capacity	= Available Hours	(120) 8 × 25 × 12	= 2,400
	Less : Hours Lost	(20)	= 400
	Net Effective Hours	(100)	= 2,000

##### Semi Automatic

$(2,000 \times 500) = 1,00,000$  Units

##### Automatic

$(2,000 \times 100) = 2,00,000$  Units

**Statement showing cost per unit (other than the setting up cost) under each of two machines**

Costs	Semi Automatic 1,00,000	Automatic 2,00,000
Labour	$400 \times 25 \times 12 = 1,20,000$	$200 \times 25 \times 12 = 60,000$
Power	$50 \times 25 \times 12 = 15,000$	$300 \times 25 \times 12 = 90,000$
Variable overhead	$120,000 \times 0.10 = 12,000$	$60,000 \times 0.40 = 24,000$
Fixed overhead	$500 \times 25 \times 12 = 1,50,000$	4,00,000

Depreciation + interest	25% of 3,00,000 = 75000	25% of 5,00,000 = 125000
Total cost	3,72,000	6,99,000
Cost per unit (exclusive of setting up cost)	3.72	3.495

Order size 1,000 units

**Statement showing total cost for 1,000 units made from each of the two machines**

Setting cost	200	1,000
Other costs	3,720	3,495
Total cost	3,920	4,495

**Recommendation:** Semi-automatic machine is recommended if the expected order size is 1,000 units.

Order size 10,000 units

**Statement showing total cost for 10,000 units made from each of the two machines**

Setting cost	200	1,000
Other costs	37,200	34,950
Total cost	37,400	35,950

**Recommendation:** Automatic machine is recommended if the expected order size is 10,000 units.

Let indifference point is y units order size.

$$200 + 3.72y = 1,000 + 3.495y$$

$$y = 3,555.55 \text{ units.}$$

If the order size is up to 3,555 units, semi-automatic may be preferred. For order size of 3,556 or more, automatic is recommended.

**Q11** Ex. Book No.  Pg. No.

**CMA Mat**

Y Company has just been incorporated and planned to produce a product that will sell for ₹ 10 per unit. Preliminary market surveys show that demand will be around 10,000 units per year. The company has the choice of buying one of the two machines 'A' would have fixed costs of ₹30,000 per year and would yield a profit of ₹30,000 per year on the sale of 10,000 units. Variable costs behave linearly for both machines. Machine B would have Fixed Cost of ₹ 18,000 p.a. and would yield a profit of ₹22,000 p.a. on the sale of 10,000 units.

**Required to:**

- (a) Break-even sales for each machine
- (b) Sales level where both machines are equally profitable
- (c) Range of sales where one machine is more profitable than the other.

<b>Reference</b>	<b>What's New</b>
<b>BEP and Indifference point</b>	

**Answer**

- (a) **Statement Showing Computation of Break even of each machine, Calculation of indifference point & range of sales where each machine is profitable.**

		Amount (₹)	
	Particulars	A	B
I.	Selling Price	10	10
II.	No. of units	10,000	10,000
III.	Sales	1,00,000	1,00,000
IV.	Fixed Cost	30,000	18,000
V.	Profit	30,000	22,000
VI.	Contribution	60,000	40,000
VII.	Contribution Per unit	6	4
VIII.	Variable Cost Per Unit	4	6
	Break Even Sales	50,000	45,000
	Break Even units	5,000	4,500

- (b) **Sales Level where both machines are equally profitable**

$$= \frac{\text{Difference in Fixed Cost}}{\text{Difference in Variable Cost Per Unit}} = \frac{12,000}{2} = 6,000 \text{ units}$$

- (c) For the units  $\geq 6,000$  units machine A is more profitable because Variable Cost Per unit is less. For sales level below 6,000 units Machine B is more Profitable because its Variable Cost Per Unit is more.

**Q12**

Ex. Book No. | Pg. No.

**Dec'17**

The management of W Ltd., which is now operating at 50% capacity, expects that the volume of sales will drop below the present level of 5,000 units per month. The operating statement prepared for monthly sales shows:

	₹	₹
Sales (5,000 units at ₹ 3 per unit)		15,000
Less: Variable Costs at ₹ 2 per unit	10,000	
Fixed Overheads	5,000	15,000
Net Profit		Nil

It is proposed that the company should suspend production until market conditions improve. The General Manager estimated that a minimum of fixed cost (shut down costs) amounting to ₹ 2,000 would be necessary in any event.

**Required:**

- (i) **Advise** Management at what level of sales it could think of suspending production.
- (ii) If the sales price is ₹ 2.80, **what** should be the level of sales for shut down decision?

[3 + 3 = 6]

<p><b>Reference</b></p> <p><b>Shutdown Decision</b></p>	<p><b>What's New</b></p>
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**Answer**

- (i) **If selling price is ₹ 3 per unit**

$$\begin{aligned} \text{Shutdown Point} &= \frac{\text{Fixed Cost} - \text{Shut down cost}}{\text{Contribution pu.}} \times \text{SP} \\ &= \frac{5,000 - 2,000}{(\text{₹ } 3 - \text{₹ } 2)} \times \text{₹ } 3 \\ &= 3,000 \times 3 = \text{₹ } 9,000 \\ &\text{or, 3,000 units} \end{aligned}$$

**Verification of the above is as under:**

	₹
Sales 3,000 units @ ₹ 3	9,000
Less: Variable Cost 3,000 units @ ₹ 2	6,000
Contribution	3,000
Less: Fixed Cost	5,000
Operating Loss	2,000

Operating Loss = Loss at Shutdown Point

- (ii) **If selling price is reduced to ₹ 2.80**

$$\begin{aligned} \text{Shutdown Point} &= \left( \frac{5,000 - 2,000}{2.80 - 2.00} \right) \times \text{₹ } 2.80 \\ &= \text{₹ } 10,500 \\ &\text{or 3,750 units} \end{aligned}$$

Q13

Ex. Book No. Pg. No.

Jun'18

A regional audit firm offers audit, tax and consulting services. The segmented profit and loss position for the next year shows the following position:

	Audit (₹)	Tax (₹)	Consulting (₹)
1. Revenues	60,000	1,00,000	1,20,000
2. Costs:			
Service-level	50,000	60,000	70,000
Facility-level (apportioned)	10,000	12,000	16,000
Total	60,000	72,000	86,000
3. Operating Profit (1-2)	Nil	28,000	34,000

Partners are concerned about the profitability of their audit business and contemplate to close it down. In the event of closure of audit service, it might do more tax work. If audit service is discontinued, 50 per cent of the facility costs associated with auditing would be saved. More tax work would increase tax revenues by 45 per cent, but tax service-level costs would also increase by 45 per cent.

**Required:**

- (a) **Determine** whether the firm should drop auditing service and the impact on its closure on profit. Assume that audit centre facility level costs can be allocated to two other centres based on revenues. Compare Profitability of Tax and Consulting Services before and after closure of Audit Centre.
- (b) **What** other considerations are important to drop auditing service? [12 + 4 = 16]

Reference	What's New
<b>Discontinue Decision</b>	<b>Other Considerations</b>

**Answer**

- (a) **Whether to drop auditing service and the impact on profits:**

Item of Cost/ Revenue	Incremental impact
Revenue loss from Audit	- 60000
Savings in facility level costs	+ 5,000
Decrease in Service Level cost (Audit), considered avoidable	+ 50,000
Increase in Tax Service Revenue by 45%	+ 45000
Increase in service level cost for Tax Service	- 27000
Cumulative Impact	+ 13000

**Decision:** Close the Audit function and improve Tax Service.

	Tax		Consulting	
	Before	After	Before	After
Revenue	100000	145000	120000	120000
<b>Costs:</b>				
Service-level	60,000	87,000	70,000	70,000
Facility-level	12,000	14,736	16,000	18,264
Total Costs	72,000	1,01,736	86,000	88,264
Operating Profits	28,000	43,264	34,000	31,736

Total operating profits before dropping:  $28,000 + 34,000 = 62,000$

Total operating profits after dropping Audit function:  $43,264 + 31,736 = 75,000$

Impact = 13,000

(b) **Other important considerations for dropping Audit function:**

- (i) The Audit function is not unprofitable or with Nil profit as shown in the question. Its revenues less its service level costs and avoidable facility level costs are  $60,000 - 50,000 - 5,000 = 5,000$ . Hence, it is only due to allocated overhead that Audit function appears to be a non contributor.
- (ii) While the release of Audit function strengthens the Tax Service, the overall impact being ₹ 13,000 increase in profits, it is a major risk that the firm will be taking, since it is an audit firm.
- (iii) In the medium to long term, it could lose other potential clients who may go elsewhere to have more diversified services.
- (iv) The firm should try to improve its costs and increase its fees to have more comfortable profits.

**Q14**

Ex. Book No.	Pg. No.

**CMA Mat**

PH Ltd., has a productive capacity of 2,00,000 units of product BXE per annum. The company estimated its normal capacity utilisation at 90% for the current year. The variable costs are ₹22 per unit and the fixed factory overheads were budgeted at ₹7,20,000 per annum. The variable selling overheads amounted to ₹6 per unit and the fixed selling expenses were budgeted at ₹5,04,000. The operating data for year are as under:

Production	1,60,000 units
Sales @ ₹40 per unit	1,50,000 units
Opening stock of finished goods	10,000 units

The cost analysis revealed an excess spending of variable factory overheads to the extent of ₹80,000. There are no variances in respect of other items of cost.

**Required:**

- (i) **Determine** the budgeted break-even point for the year
- (ii) **What** increase in price would have been necessary to achieve the budgeted profit?
- (iii) **Present** statements of profitability for the year using:
  - (a) Marginal costing basis.
  - (b) Absorption costing basis.

<p><b>Reference</b></p> <p><b>BEP, SP Increase, Marginal vs Absorption</b></p>	<p><b>What's New</b></p> <p><b>Under Recovery Added to COP</b></p>
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**Answer**

(i) **Fixed cost** = Fixed overheads + Selling expenses = 7,20,000 + 5,04,000 = 12,24,000

	Amount (₹)
I Selling price	40.00
II Variable cost	28.00
III Contribution	12.00

Break even at budget =  $(12,24,000/12) = 1,02,000$  units

(ii) **Contribution at budget** =  $[(2,00,000 \times 90\%) \times 12]$  21,60,000

	Amount (₹)
Contribution per unit $(21,60,000/1,50,000)$	14.40
Add : Variable cost	28.00
Selling Price	42.40
∴ Increase in price $(42.40 - 40)$	2.40
Standard variable production cost	22.00
Add: Standard fixed cost $(7,20,000/2,00,000 \times 90\%)$	4.00
	26.00

(iii) **Profit under Absorption Costing**

**Working Note:**

		Units	Amount (₹)	Amount (₹)
Standard Variable cost	$(1,60,000 \times 22)$			35,20,000.00
Add : Variance				80,000.00
				36,00,000.00

Add : Fixed production cost absorbed	(1,60,000 x 4)		6,40,000.00	
Add : Under recovery	(7,20,000 – 6,40,000)		80,000.00	720,000.00
		1,60,000.00		43,20,000.00
Add : Opening stock		10,000.00		2,60,000.00
				45,80,000.00
Less : Closing stock		20,000.00	(43.2 x 0.2/1.6)	5,40,000.00
				40,40,000.00
Add : selling & dis. Cost				
Variable	(1,50,000 x 6)		9,00,000.00	
Fixed			5,04,000.00	1,404,000.00
Total cost				54,44,000.00
Profit (b/f)				5,56,000.00
Sales	(1,50,000 x 40)			60,00,000.00
Profit under marginal costing				
(i) Sales				60,00,000.00
(ii) Variable cost				
Production			36,00,000.00	
Add : opening	(10,000 x 22)		2,20,000.00	
			38,20,000.00	
Less : closing	20,000 x 36,00,000 / 1,60,000)		4,50,000.00	33,70,000.00
Selling & distribution				9,00,000.00
				42,70,000.00
(iii) Contribution				17,30,000.00
(iv) Fixed cost				12,24,000.00
(v) Profit				5,06,000.00

**Q15**

Ex. Book No.	Pg. No.

**CMA Mat**

ABC Ltd. manufactures only one product.

The following information relates to April and May 2022:

(i) Budgeted costs and selling prices:

Particulars	April	May
Variable manufacturing cost per unit	₹ 2.00	₹2.20
Total fixed manufacturing cost		

(based on budgeted sales of 25,000 units per month) (₹)	40,000	44,000
Total fixed marketing cost (based on budgeted sales of 25,000 units per month) (₹)	14,000	15,400
Selling price per unit (₹)	5.00	5.50

(ii) **Actual production and sales achieved:**

Particulars	April (units)	May (units)
Production	24,000	24,000
Sales	21,000	26,500

(iii) There was no stock of finished goods at the beginning of April 2022. There was no wastage or loss of finished goods during either April or May 2022.

(iv) Actual costs incurred corresponded to those budgeted for each month.

**Required:**

**Calculate** the relative effects on the monthly operating profits of applying the following methods:

- (i) Absorption costing and
- (ii) Marginal costing.

<p><b>Reference</b></p> <p><b>Marginal vs Absorption Costing</b></p>	<p><b>What's New</b></p> <p><b>Under recovery added to COS</b></p>
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**Answer**

(i) **Profit under Absorption Costing**

	April ₹	May ₹
Variable Manufacturing cost	48,000	52,800
Fixed Manufacturing cost	38,400	42,240
	(40,000/25,000 x 24,000)	(44,000/25,000 x 24,000)
Total production cost	86,400	95,040
(+) Op. Stock	--	10,800
	86,400	1,05,840
(-) Cl. Stock	10,800	1,980
	(86,400 x 3/24)	(95,040 x 5/24)
Production cost of goods sold	75,600	1,03,860

(+) Under recovery (40,000 – 38,400)	1,600	1,760
	(40,000 – 38,400)	(44,000 – 42,240)
	77,200	1,05,620
(+) Marketing costs	14,000	15,400
	91,200	1,21,020
Profit	13,800	24,730
Sales	1,05,000	1,45,750

(ii) **Profit under Marginal Costing**

		Units	April ₹	Units	May ₹
I	Sales		1,05,000		1,45,750
II	Variable Cost				
	Manufacturing	48,000		52,800	
	(+) Op. Stock			6,000	
		48,000		58,800	
	(-) Cl. Stock	6,000	42,000	1,100	57,700
III	Contribution		63,000		88,050
IV	Fixed Cost		54,000		59,400
V	<b>Profit</b>		9,000		28,650

Q16

Ex. Book No. Pg. No.

Jun'19; MTP Jun'22

X Ltd. manufactures and sells a special component. It follows a Standard Marginal Costing system. For the year ended 31.03.2019, it produced 1,500 components against a budgeted capacity of 2000 components. Out of the production 100 components were scrapped. Due to a computer virus most of the financials could not be retrieved.

However, the Chief Cost Accountant gave the following information:

Particulars	(₹)
Selling Price per component	213
Direct materials total cost	84,000
Direct labour cost per component (Actual efficiency 80%)	?
Variable Manufacturing overhead per component	15
Variable Selling overhead per component	8
Fixed Selling and Administration overheads	48,000
Fixed overhead manufacturing absorption rate per component (on the basis of budgeted capacity)	30
Closing stock (200 units) (Valued at prime cost for financial purpose)	18,000

**Required:**

- (i) **Prepare** the Profitability statements as per Marginal Costing, Absorption Costing and the actual Profit & Loss Account.
- (ii) **Reconcile** the actual profit with that of the Break-even profit under Marginal Costing.

<p>Reference</p> <p><b>Marginal vs Absorption Costing</b></p>	<p>What's New</p>
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**Answer**

(1) <b>Fixed Manufacturing Overheads</b>	= 60,000
Budgeted Capacity × Absorption Rate (2000×30)	
Fixed administrative Overheads	= 48,000
<b>Total Fixed cost</b>	<b>= 108,000</b>
(2) <b>Contribution per Unit</b>	
Selling Price	213
Prime Cost (Material + Labour)(18,000/200)	90
Variable Manufacturing Overhead	15
Variable Selling Overhead	8
<b>Contribution/Unit (213 – 90 – 15 – 8)</b>	<b>100</b>
(3) <b>Break Even volume (108,000/100 Units)</b>	<b>= 1,080 Units</b>
(4) <b>Total Absorption Cost / Unit</b> (Materials + Labour + Variable Manufacturing OH)	<b>= 105</b>

(i) **Profit under Marginal Costing:**

Particulars	(₹)
Contribution (1,200 × 100)	= 1,20,000
Less: Fixed Cost	1,08,000
<b>Profit under Marginal Costing</b>	<b>12,000</b>

**Profit under Absorption Costing and the Actual P/L A/C**

Particulars	Profit under Absorption Costing	Actual P&L A/c
Sales (1,200 Units × ₹213)	2,55,600	2,55,600
Cost of Goods Manufactured		
Production (1,500 Units × ₹135)	2,02,500	2,02,500

Additional Labour cost (34 × 20/80 × 1,500)	-	12,750
Less: Closing Stock(200 units x 135 p.u.) (18,000 given in the question)	27,000	18,000
Less: Scrap (100 units x 135)	13,500	
Add: Under absorption of OH (500 × 30)	15,000	15,000
Add: Manufacturing Fixed OH	-	-
Total Cost of Manufacture	1,77,000	2,12,250
Gross Profit	78,600	43,350
Less: Fixed Administrative OH	48,000	48,000
Less: Variable Selling OH	9,600	9,600
Profit/(Loss)	21,000	(14,250)

(ii) **Reconciliation (actual P&L with Marginal Costing)**

Profit at Break Even point	0
Contribution from Margin of Safety (1,200 – 1,080) × 100	+12,000
Stock Valuation (Working Note)	-3,000
Less: Scrap (variable mfg cost 105 × 100) =	-10,500
Less: Labour	- 12,750
Actual Profit	-14,250

**Working Note 1 :**

**Stock Valuation :**

(at variable cost under Marginal Costing (105 × 200 = ₹ 21,000) and at ₹ 90 as per actual P&L given = 18,000)

∴ ₹ 3,000 still remains in the cost which is not shown in BE P/L

We needed to further reduce BE P/L by that amount

**Working Note 2 :**

The scrap cost is included in 1,500 units in Actual P/L. Hence, that has reduced its profit.

∴ It has to be reduced in BE P/L also.

**Q17**

Ex. Book No.	Pg. No.

**RTP Dec'18**

A company uses absorption costing system based on standard costs. The total variable manufacturing cost is ₹ 6 per unit. The standard production rate is 10 units per machine hour. Total budgeted and actual fixed production overhead costs are ₹ 8,40,000 p.a. Fixed production overhead is allocated at ₹ 14 per machine hour. Selling price is ₹ 10 per unit.

Variable selling overheads are ₹ 2 per unit and fixed selling costs are ₹ 2,40,000 p.a. Opening inventory was 30,000 units and the closing inventory was 40,000 units.

- (i) **Compute** the breakeven point under absorption costing system assuming that under/over recovery of fixed overheads are charged against cost of goods sold.
- (ii) **Compute** Breakeven point under marginal costing.
- (iii) Assuming that sales were at break-even level computed under (ii) above, and that under recovery or over recovery of fixed overheads is written off against cost of goods sold, **find** the profit under absorption costing system.



Reference

**Marginal VS Absorption Costing**

What's New

**BE under Absorption Costing**

**Answer**

- (i) **Reconciliation of profit under variable costing approach to that under absorption costing approach**

Profit/Loss under absorption costing approach (Profit/Loss in case of Breakeven point is zero)	Nil	
- Higher value of closing stock under absorption costing approach		56,000 (40,000 units @ ₹ 1.40)
- Higher value of opening stock under absorption costing approach	42,000 (30,000 units @ ₹ 1.40)	
Total	42,000	56,000
Loss under variable costing approach		₹ 14,000

Sales for ₹ 14,000 Loss (under variable costing approach)

$$= \frac{\text{Fixed Cost} - \text{Loss}}{\text{Contribution per unit}} = \frac{10,80,000}{10 - 6 - 2} = 5,33,000 \text{ units}$$

Break-even point under absorption costing = sale of 5,33,000 units (Production: 5,43,000 units)

- (ii) **BEP (under marginal costing approach)**

$$= \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{10,80,000 - 14,000}{10 - 6 - 2} = 5,40,000 \text{ units}$$

BEP (under marginal costing approach) = sale of 5,40,000 units (Production: 5,50,000 units)

**Working Notes:**

Total fixed overheads ₹ 8,40,000

Fixed overheads per machine hour = ₹ 14

Production rate per machine hour = 10

Fixed overhead per unit = ₹ 1.40

**Value of stock under variable costing** = Variable production cost = ₹ 6 per unit

**Value of stock under absorption costing**

= Variable production cost + fixed production cost  
= ₹ 6 per unit + ₹ 1.40 per unit  
= ₹ 7.40 per unit

(iii) **Calculation of profit under absorption costing approach if the sales being 5,40,000 units**

Variable costing profit at 5,40,000 units sales : Nil

Under absorption costing profit will be higher by ₹ 14,000 on account of higher values of opening and closing stock.

Hence, profit under absorption costing = ₹ 14,000.

**Q18**

Ex. Book No.	Pg. No.

**CMA Mat, MTP Jun'18**

Bathing care Ltd. manufactures and sells soaps under the brand name - Elite, Lovely, Fresh and Janata. The Janata soap is very popular as it is of good quality and at the same time reasonably priced. The company produces and sells per annum on an average 50,000 cakes of Elite, 1,00,000 cakes of Lovely, 75,000 cakes of fresh and 2,00,000 cakes of Janata at a unit selling price of ₹3.50, ₹3.00, ₹2.50 and ₹1.5 respectively.

At this level of production and sales the unit cost of a cake of each brand of soap is as follows:

(Expressed in Paise)

	Elite	Lovely	Fresh	Janata
Direct Material	50	40	35	45
Direct Labour	20	20	15	10
<b>Production Expenses:</b>				
Variable	10	10	5	5
Fixed	20	25	20	20
<b>Administrative Expenses:</b>				
Fixed	30	40	25	30
Variable	15	5	10	5
<b>Selling &amp; Distribution Expenses:</b>				
Fixed	80	60	45	10
Variable	45	20	25	5
<b>Total Cost</b>	<b>270</b>	<b>220</b>	<b>180</b>	<b>130</b>

The co. has lot of unutilised capacity and there is ample scope for improving production and sales volumes.

Bathing Care Ltd. has built a name for its products in the market and with proper sales effort it should be possible to sell whatever is produced by the co., the production manager sees no problems. The sales manager puts up a bold scheme for almost quadrupling the present profits of the company.

1. An exclusive advertising campaign has to be undertaken to produce and sell Janata Soaps and it is estimated at ₹4,85,000.
2. At the same time the selling price of Janata Soap should be reduced to ₹ 1. By adopting this sales strategy the sales manager is confident that he is able to double the present sales volume of Janata Soap and with each 1 lakh increase of Janata Soap, he would be able to push 30,000 cakes of Elite, 70,000 of Lovely, 50,000 of Fresh in the market.

You are **required** to **find out** the profit at present and profit if the sales managers scheme is implemented.



Reference

What's New

**Evaluation of proposal by sales Manager**

**Answer**

**Statement showing computation of profit at the current Mix:**

	Elite (₹)	Levels (₹)	Fresh (₹)	Janata (₹)	Total (₹)
(I) Selling Price	3.50	3.00	2.50	1.50	
(II) Variable Cost :					
Direct Material	0.50	0.40	0.35	0.45	
Direct Labour	0.20	0.20	0.15	0.10	
Production Expenses	0.10	0.10	0.50	0.50	
Administrative Overhead	0.15	0.05	0.10	0.05	
Selling Overhead	0.45	0.20	0.25	0.05	
	1.40	0.95	0.90	0.70	
(III) Contribution	2.10	2.05	1.60	0.80	
(IV) Total Contribution	1,05,000	2,05,000	1,20,000	1,60,000	5,90,000
(V) Fixed Cost:					
Production Expenses	0.20	0.25	0.20	0.20	
Advertisement Expenses	0.30	0.40	0.25	0.30	
Selling & Distribution Expenses	0.80	0.60	0.45	0.10	
	1.30	1.25	0.90	0.60	
(VI) Total Fixed Cost	65,000	1,25,000	67,500	1,20,000	3,77,500
(VII) Profit	40,000	80,000	52,000	40,000	2,12,500

**Statement showing computation of profit by adopting Sales Manager's scheme:**

	Elite	Levels	Fresh	Janata	Total
No. of Units	1,10,000	2,40,000	1,75,000	4,00,000	
Contribution per unit (₹)	2.10	2.05	1.60	(0.8 – 0.5) 0.30	
Total Contribution (₹)	2,31,000	4,92,000	2,80,000	1,20,000	11,23,000
Fixed Cost (₹)					8,62,500
Profit (₹)					2,60,500

**Q19** Ex. Book No. Pg. No.

**CMA Mat; MTP Jun'18**

The profit for the year of Push On Ltd. work out to 12.5% of the capital employed and the relevant figures are as under:

	Amount (₹)
Sales	5,00,000
Direct Material	2,50,000
Direct labour	1,00,000
Variable overheads	40,000
Capital employed	4,00,000

The new sales manager who has joined the company recently estimates for the next year a profit of about 23% on the capital employed provided the volume of sales is increased by 10% and simultaneously there is an increase in Selling Price of 4% and an overall cost reduction in all the elements of cost by 2%.

**Find out** by computing in detail the cost and profit for next year, whether the proposal of sales manager can be adopted.

Reference	What's New
<b>Acceptance or Rejection of Proposal</b>	<b>Fixed Overheads</b>

**Answer**

**Computation of Fixed Cost:**

	Amount (₹)
Sales	5,00,000
(-) Profit	4,00,000 x 12.5%
<b>Total Cost</b>	<b>4,50,000</b>
(-) VC: DM	2,50,000

DL	1,00,000	
VOH	40,000	3,90,000
Fixed Cost		60,000

**Statement showing computation of profit obtained on adopting the sales manager's proposal:**

		Amount (₹)	
(I)	Sales	$5,00,000 \times \frac{110}{100} \times \frac{104}{100}$	5,72,000
(II)	Variable Cost	$3,90,000 \times \frac{110}{100} \times \frac{98}{100}$	4,20,420
(III)	Contribution		1,51,580
(IV)	Fixed Cost	$60,000 \times 98\%$	58,800
(V)	Profit		92,780

$$\% \text{ of profit on capital employed} = \frac{92,780}{4,00,000} \times 100 = 23.195 > 23\%$$

∴ **Proposal is adoptable.**

**Q 20**

Ex. Book No.	Pg. No.

**CMA Mat**

Nice and Warm, Ltd. manufactures and markets hot plates. During the first five years of operations, the company has experienced a gradual increase in sales volume, and the current annual growth in sales of 5% is expected to continue in the foreseeable future. The plant is now producing at its full capacity of one lakh hot plates.

At the monthly Management Advisory committee meeting, amongst other things, the plan of action for next year was discussed.

Managing Director proposed two alternatives. **First**, operations could be continued at full capacity and with the existing facilities, an output of one lakh hot plates at a selling price of ₹100 per plate per unit could be maintained. **Secondly**, production and sales could be increased by 5% to take advantage of the rate of expansion in demand for the product. But this could increase cost, as to achieve the output, the company will have to resort to weekend and over time workings. However, a policy of steady growth was preferable to maintaining status quo.

In view of the company's competitors having a substantial share of the market, the Works Director was of the view that it was not enough for the company to maintain merely the present share of the total market. A large share of the total market should be obtained. For that, the company should increase production by 10% through a modest expansion of the plant capacity. In order to sell the output of 1,10,000 units the selling price could be reduced to ₹95 per unit.

Thinking on the same lines, the Marketing Director put forth a more radical proposal. The strategy should be to seize the competitive leadership in the market with regard to both price

and volume. With this end in view, he suggested that the company should straightaway embark on an expensive modernisation programme, which will initially increase volume by 20%. The entire output of 1,20,000 hot plates could be easily sold at a price of ₹ 90 per unit.

At this juncture, the Managing Director expressed concern about the probable behavior of the company's competitors. They might also expand in order to produce more and sell at lower prices. Suppose this happened, he wanted also the financial effects of the proposals of the Works Director and Marketing Director, if in these proposals, the expected increase in sales were to be only half of that predicted.

As a Cost Accountant of the company, you are required to critically evaluate the six alternatives along with your recommendations and circulate the same to the Directors. In this connection, you have gathered the following details:

- (i) If next year's production was maintained at the current year's level, variable cost would remain at ₹ 50 per unit. Fixed cost would remain unchanged at ₹ 30 lakhs.
- (ii) The week-end and overtime working would increase with the variable and fixed costs. Variable cost would rise to ₹ 55 per unit while fixed cost would increase to ₹ 30,25,000
- (iii) In the proposal of the Works Director, the ratio of variable costs to sales would continue to be 50%. Fixed costs would rise to ₹ 32,25,000.
- (iv) In the proposal of Marketing Director, as a result of increased production, efficiency and some savings from purchase of materials, it is estimated that the ratio of variable cost of sales would decrease to 48% and the fixed costs would increase by ₹ 5,16,000.

Your answer **should** contain:

- (a) A tabular statement of comparative figures pertaining to total turnover, total contribution, Percentage of Profit to Sales and Breakeven units as regard to each of the six proposals.
- (b) Comments on the relative risk involved.
- (c) Consideration of the short-term and long-term implications of the Managing Director's proposals.
- (d) Comment on the price elasticity of demand for the company's products and your suggestions on the pricing policy and cost structure
- (e) Comment on financial implications of the expansion scheme.

<p><b>Reference</b></p> <p><b>Evaluation of Six proposals Profitability</b></p>	<p><b>What's New</b></p> <p><b>Low Risk = Low BES</b> <b>Higher MOS,</b> <b>Higher % of Profit to Sales</b></p>
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**Answer**

(a) **Statement showing contribution, profit at six alternatives**

	Managing director		Works director		Marketing director	
	I	II	I	II	I	II
(i) No. of units	100,000.00	105,000.00	110,000.00	105,000.00	120,000.00	110,000.00
(ii) Selling price per unit (₹)	100.00	100.00	95.00	95.00	90.00	90.00
(iii) Sales turnover (₹ Lakhs)	100.00	105.00	104.50	99.75	108.00	99.00
(iv) Variable cost per unit (₹)	50.00	55.00	47.50	47.50	43.20	43.20
(v) Contribution per unit (ii-iv) (₹)	50.00	45.00	47.50	47.50	46.80	46.80
(vi) Total contribution (₹ Lakhs)	50.00	47.25	52.25	49.88	56.16	51.48
(vii) Fixed cost (₹ Lakhs)	30.00	30.25	32.25	32.25	35.16	35.16
(viii) Profit (₹ Lakhs) (vi-vii)	20.00	17.00	20.00	17.63	21.00	16.32
(ix) % of profit on sales (%)	20.00	16.19	19.14	17.67	19.44	16.48
(x) Break even units (vii/v)(units)	60,000.00	67,222.00	67,895.00	67,895.00	75,128.00	75,128.00
(xi) Margin of safety units	40,000.00	37,778.00	42,105.00	37,105.00	44,872.00	34,872.00
(xii) P.V ratio	0.50	0.45	0.50	0.50	0.52	0.52

- (b) Managing Director's first proposal seems to be more favorable from the risk point of view because it has low break even and high margin of safety coupled with higher percentage of profit to sales.
- (c) From the short run point of view, Managing director's second proposal, i.e steady growth of 5% a year would be better, even by resorting to weekend over time working. However, from the long term view point, the above proposal is not advisable because when they have steady growth, they can go for expansion of business rather than resorting to overtime working. If it is not possible to go for expansion, a steady status quo is the best solution.
- (d) It was given that , annual growth of sales of 5% is expected to continue in foreseeable future. It is not clear, why the second proposal of the works director and marketing director should suggest, reduction in price for 5% and 10% respectively.

It seems no serious study has been made on the price elasticity of demand of the product. If there is demand for the product and increased production, they may reduce the price by adapting discriminate price policy

- (e) If the company desires to expand the production, it is necessary to find out the sources of financing of expansion scheme by relative profitability of different funds.

**Q 21**

Ex. Book No.	Pg. No.

**CMA Mat**

The Management Accountant of X Ltd., has prepared the following estimates of working results for the year ending 31st December, 2016 for the purpose of preparing the budgets for the year ending 31st December, 2017.

**Year ending 31/12/2016**

Direct material	₹/unit	16.00
Direct wages	"	40.00
Variable overheads	"	12.00
Selling price	"	125.00
Fixed expenses	₹	6,75,000 p.a.
Sales	₹	25,00,000 p.a.

During the year 2017, it is expected that the material prices and variable overheads will go up by 10% and 5% respectively. As a result of re-organisation of production methods the overall direct labour efficiency will increase by 12% but the wage rate will go up by 5%. The fixed overheads are also expected to increase by ₹1,25,000. The technical director states that the same level of output as obtained in 2016 should be maintained in 2017 also and efforts should be made to maintain the same level of profit by suitably increasing the selling price. The marketing director states that the market will not absorb any increase in the selling price. On the other hand he proposes that publicity involving advertisement expenses in the proportions will increase the quantity of sales as under:

Advertisement expenses (₹)	80,000	1,94,000	3,20,000	4,60,000
Additional units of sales	2,000	4,000	6,000	8,000

**Required:**

- (i) **Present** an income statement for the year 2017.
- (ii) **Find** the revised price and the percentage of increase in the price for 2017 if the Technical Directors' views are accepted.
- (iii) **Evaluate** the four alternative proposals put forth by the Marketing Director, determine the best output level to be budgeted and prepare an overall income statement for 2017 at that level of output.

 <p><b>Reference</b> <b>Evaluation of Alternatives</b></p>	<p><b>What's New</b></p>

**Answer**

**I. Statement of profit at budget**

	Amount (₹)
(i) Selling price	125.00
(ii) Variable cost	
a. Direct material	16.00
b. Direct wages	40.00
c. Variable overheads	12.00
	68.00
(iii) Contribution (i-ii)	57.00
(iv) No. of units (25,00,000/125)	20,000.00
(v) Total contribution	1,140,000.00
(vi) Less: Fixed cost	675,000.00
(vii) Profit (v-vi)	465,000.00

**II. Computation of selling price, if the technical director views are implemented**

Variable cost		Amount (₹)
Direct material	(16 x 110%)	17.60
Direct wages	[(40 x 105%) x (100/112)]	37.50
Variable overheads	(12 x 105%)	12.60
		67.70

In order to get the same profit contribution to be recovered is as follows:

	Amount (₹)
Existing fixed overheads	675,000.00
<b>Add : Expected increase</b>	125,000.00
	800,000.00
<b>Add : Desired profit</b>	465,000.00
	1,265,000.00
Therefore Contribution per unit (12,65,000/20,000)	₹ 63.25
Required selling price = Variable cost + Contribution = 67.7 + 63.25	₹ 130.95
% increase in sale price = [(130.95 - 125)/125] x 100]	4.76%

**III. Computation of additional profit at four alternatives proposed by marketing director**

Additional Units	2,000	4,000	6,000	8,000
	Amount (₹)			
a. Contribution per unit (125-67.7)	57.30	57.30	57.30	57.30
b. Total Contribution	114,600.00	229,200.00	343,800.00	458,400.00

c. Additional fixed cost	80,000.00	194,000.00	320,000.00	460,000.00
d. Profit/(loss)	34,600.00	35,200.00	23,800.00	(1,600.00)

**Statement showing overall income for the year 2017**

a. No. of units	24,000.00
<b>Amount (₹)</b>	
b. Contribution per unit	57.30
c. Total contribution	1,375,200.00
d. Fixed cost (8,00,000 + 1,94,000)	994,000.00
e. Profit	381,200.00

**Q 22**

Ex. Book No.	Pg. No.

**CMA Mat, MTP Jun'19**

SV Ltd engaged in the manufacture of four products has prepared the following budget for 2022.

Product	A	B	C	D
Production Units	20,000	5,000	25,000	15,000
Selling price ₹/unit	21.75	36.75	44.25	64.00
Direct Materials ₹/unit	6.00	13.50	10.50	24.00
Direct Wages ₹/unit	4.75	9.00	18.00	24.00
Variable Overheads ₹/unit	5.00	6.00	6.00	6.50
Fixed Overheads ₹/annum	75,000	25,000	2,25,000	1,80,000

When the budget was discussed, it was proposed that the production of 'C' should be increased by 10,000 units for which capacity existed in 2022.

It was also decided that for the next year i.e. 2023, the production capacity should be further increased by 25,000 units over and above the increase of 10,000 units envisaged as above for 2022. The additional production capacity of 25,000 units should be used for the manufacture of product 'B' for which new production facilities were to be created at an annual fixed overhead cost of ₹35,000. The direct material costs of all the four products were expected to increase by 10% in 2023 while the other costs and selling prices would remain the same.

**Required:**

- Find** the profit of 2022 on the assumption that the existing capacity of 10,000 units is utilised to maximize the profit.
- Prepare** a statement of profit for 2023.
- Assuming that the increase in the output of product 'B' may not fully materialise in the year 2023, **find** the number of units of product B to be sold in 2023 to earn the same overall profit as in 2022.

<b>Reference</b>	<b>What's New</b>
<b>Evaluation of Proposal</b>	

**Answer**

(a) **Statement showing computation of profit for the year 2022**

			A	B	C	D	Total
I.	Selling Price	₹	21.75	36.75	44.25	64.0	
II.	Variable Cost	₹	15.75	28.50	34.50	54.5	
III.	Contribution	₹	6.0	8.25	9.75	9.5	
IV.	No. of units		20,000	5,000	35,000	15,000	
V.	Total Contribution	₹	1,20,000	41,250	3,41,250	1,42,500	6,45,000
VI.	Fixed Cost	₹	75,000	25,000	2,25,000	1,80,000	5,05,000
VII.	Profit	₹					1,40,000

(b) **Profit for the year 2023**

		A	B	C	D	Total
I.	No. of Units	20,000	30,000	35,000	15,000	
		₹	₹	₹	₹	₹
II.	Contribution Per Unit	5.4	6.9	8.7	7.1	
III.	Total Contribution	1,08,000	2,07,000	3,04,500	1,06,500	7,26,000
IV.	Fixed Cost (5,05,000 + 35,000)					5,40,000
V.	Profit					1,86,000

(c) **In order to get the profit of 2022, the 'Contribution' to be recovered as follows:**

	Amount (₹)
Profit for the year 2022	1,40,000
Existing Fixed Cost	5,05,000
Additional Fixed Cost	35,000
	6,80,000
(-) 'Contribution' Recovered from A,C,D	5,19,000
To be recovered from 'B'	1,61,000

No. of units of B required =  $161000 / 6.9 = 23,333$  units

Additional units over minimum required =  $23,333 - 5000 = 18,333$  units

**Q 23**

Ex. Book No.	Pg. No.

**CMA Mat**

Z Ltd., makes a range of five products to which the following standards apply:

	₹ / Unit				
	A	B	C	D	E
Sales price	50	60	70	80	90
Direct materials	9	10	17	12	21
Direct Wages	16	20	24	28	32
Variable production overheads	8	10	12	14	16
Variable selling and distribution overheads	5	6	7	8	9
Fixed overheads	4	5	6	7	8
	42	51	66	69	86

The direct labour wage rate is ₹4 per hour. Fixed overheads have been allocated on the basis of direct labour hours. The company has commitments to produce a minimum of 400 units of each product per month. Direct hours cannot exceed 13,000 per month due to restriction of space. The Board is now considering an offer of a new three-year contract to produce an additional 400 units of product B per month at a selling price of ₹58 per unit. The contract would involve an outlay of ₹1,00,000 on the lease of additional factory premises and purchase of new plant and equipment. There would be residual value at the end of the contract. Variable production costs would be in accordance with existing standards, variable selling and distribution costs would be one-half of the existing rate and cash outflows on fixed costs would be ₹20,000 per annum. There would be no change to existing production arrangements. An outside supplier has offered to supply 400 units of product B per month at a price of ₹48 per unit. If purchased externally cash flows on additional fixed costs will be ₹ 25,000 per annum.

**Required:**

- Give** recommendations, supported by calculations, to show how direct labour hours in the existing factory should be utilised in order to maximize profits.
- Show** the budgeted trading results on the basis of your recommendations in (a)
- Give** calculations to show whether or not the proposed contract for product B should be accepted and, if so, whether it should be purchased externally or manufactured in the new premises. The company's cost of capital is 10% (the present value of an annuity of ₹1 for three years at 10% is ₹2.49). Ignore taxation and inflation.

<p><b>Reference</b></p> <p><b>Optimum Mix and Evaluation of Offer - Subcontract</b></p>	<p><b>What's New</b></p>
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**Answer**

**A. Statement showing contribution per labour hour and determination of priority for profitability** Amount (₹)

	A	B	C	D	E
(i) Selling price	50.00	60.00	70.00	80.00	90.00
(ii) Variable cost					
a. Direct material	9.00	10.00	17.00	12.00	21.00
b. Labour	16.00	20.00	24.00	28.00	32.00
c. Variable overheads	8.00	10.00	12.00	14.00	16.00
d. Variable selling & dis. Overheads	5.00	6.00	7.00	8.00	9.00
	38.00	46.00	60.00	62.00	78.00
(iii) Contribution	12.00	14.00	10.00	18.00	12.00
(iv) Contribution per labour hour	3.00	2.80	1.66	2.57	1.50
(v) Priority	I	II	IV	III	V

**B. Statement showing optimum mix under given conditions and computation of profit at that mix.**

	A	B	C	D	E	Total
Minimum no. of units	4,800.00	4,800.00	4,800.00	4,800.00	4,800.00	
Units in remain hours (w/n)	3,000.00					
No. of units	7,800.00	4,800.00	4,800.00	4,800.00	4,800.00	
Contribution per Unit (₹)	12.00	14.00	10.00	18.00	12.00	
Total contribution (₹)	93,600.00	67,200.00	48,000.00	86,400.00	57,600.00	352,800.00
Fixed cost (1,56,000 hoursx1) (₹)						156,000.00
Profit (₹)						196,800.00

**Working notes:**

Available hours	1,56,000.00 hrs.
Hours utilised for minimum $\{(4 + 5 + 6 + 7 + 8) \times 4,800\}$	1,44,000.00 hrs.
Remaining hours	12,000.00 hrs.
Therefore units of a to be produced (12,000/4)	3,000 units

**C. Option I**

	Amount (₹)
Selling price offered	58.00
Less: Variable cost (46-(6/2))	43.00
Contribution	15.00
No. of units	4,800.00

Total contribution	72,000.00
Less: Fixed cost	20,000.00
Profit	52,000.00

**Present value of profit for three years contract**

	Amount (₹)
i.e Inflow (52,000 x 2.49)	129,480.00
Less : outflow	100,000.00
Net present value	29,480.00

**Option II**

	Amount (₹)	
Contract value (4,800 x 48)	230,400.00	
Add : Fixed cost	25,000.00	
	255,400.00	
Present value for three years	(2,55,400 x 2.49)	(₹) (635,946.00)
Present value of inflows	(4,800 x 58 x 2.49)	(₹) 693,216.00
Net present value		(₹) 57,270.00

It is better to accept the order for product-b and to supply them by sub-contracting the order.

**Q 24**

Ex. Book No.	Pg. No.

**CMA Mat**

Shri Kiran manufactures lighters. He sells his product at ₹20 each, and makes profit of ₹5 on each lighter. He worked 50 per cent of his machinery capacity at 50,000 lighters. The cost of each lighter is as

	₹
Direct material	6
Wages	2
Works overhead	5 (50 per cent fixed)
Sales expenses	2 (25 per cent variable)

His anticipation for the next year is that the cost will go up as under:

Fixed cost	10%
Direct wages	20%
Material	5%

There will not be any change in selling price. There is an additional order for 20,000 lighters in the next year. **What** is the lowest rate he can quote so that he can earn the same profit as the current year?

<p><b>Reference</b></p> <p><b>Price Quotation to achieve the desired profit</b></p>	<p><b>What's New</b></p>
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**Answer**

Present profit	= 50,000 x 5	= ₹ 250000
Present Fixed cost	= 50,000 (2.5 + 1.5)	= ₹ 200000

**Computation of Profit after increase in prices:**

Particulars		Amount (₹)	Amount (₹)
I.	Selling Price		20.00
II.	Variable Cost		
	Material [6 x 105/100]	6.30	
	Wages [2 x 120 / 100]	2.40	
	Works Overhead	2.50	
	Sales Expenses	0.50	11.70
III	Contribution		8.30
IV	Total Contribution [50,000 x 8.30]		4,15,000
V	Fixed Cost [2,00,000 x 110/100]		2,20,000
VI	Profit		1,95,000

**Computation of Selling Price of the order:**

Contribution of profit required for unit 55,000/20,000	=	₹ 2.75
(+) Variable cost per unit	=	₹ 11.70
Therefore, Required Selling Price	=	₹ 14.45

**Q 25** Ex. Book No. | Pg. No.

**MTP Jun'19**

Seema Ltd., has prepared the following budget for the year:

Particulars	Activity Level	
	60%	80%
Raw Materials (₹)	30,00,000	40,00,000
Direct Wages (₹)	18,00,000	24,00,000
Factory Overheads (₹)	32,00,000	36,00,000
Total (₹)	80,00,000	1,00,00,000

The policy of the company is to charge 25% on variable costs to cover profit. Raw material is in short supply and the company wants to utilize its available supply of raw materials in an optimum manner. Planned operating capacity is 80%.

The company has to execute a job, as per details given below:

Raw Materials ( ₹ ) : 40,000

Direct Wages ( ₹ ) : 30,000

You are **required to quote** the price of the job, in accordance with the policy of the company.

[10]

Reference	What's <b>New</b>
<b>Price Quotation</b>	<b>Ratio of Contribution to Material = Desired Contribution</b>

**Answer**

**Segregation of Factory Overheads into Fixed and Variables:**

Activity Level	Factory Overheads ( ₹ )
80%	36,00,000
60%	32,00,000
Difference of 20%	4,00,000
Variability for 1%	20,000(V)

At 80% of the activity, the variable factory overheads would have been  $80 \times 20,000 = ₹ 16,00,000$   
Total Factory Overheads at this level are ₹ 36,00,000.

Hence, the Fixed Overheads would be ₹ 36,00,000 – ₹ 16,00,000 i.e., ₹ 20,00,000.

**Variable Overheads as % of Direct Wages** =  $16,00,000 / 24,00,000 \times 100 = 66.67\%$ .

Variable Costs at 80% of the Activity

Raw Materials	₹ 40,00,000
Direct Wages	₹ 24,00,000
Variable Overheads	₹ 16,00,000
<b>Total Variable Cost</b>	<b>₹ 80,00,000</b>

At 80% of the activity, Profit = 25% of VC = 25% of 80,00,000 = ₹ 20,00,000

**Contribution** = Fixed Costs + Profit = 20,00,000 + 20,00,000 = ₹ 40,00,000.

Raw Materials are in short supply and hence are the constraint.

**Ratio of Contribution to Raw Material** =  $40,00,000 \div 40,00,000 = 100\%$ .

### Price Quotation

	(₹)
Raw Materials	40,000
Direct Wages	30,000
Variable Overheads @ 66.67% of Direct Wages	20,000
Contribution @ 100% of Raw Materials	40,000
Total	1,30,000

**Q 26** Ex. Book No. | Pg. No.

### CMA Mat; MTP Jun'18

Look Ahead Ltd. wants to fix proper selling prices for their products 'A' and 'B' which they are newly introducing in the market. Both these products will be manufactured in Department D, which is considered as a Profit Centre.

The estimated data are as under:

	A	B
Annual Production (unit)	1,00,000	2,00,000
	₹	₹
Direct Materials per unit	15.00	14.00
Direct Labour per unit	9.00	6.00
(Direct Labour Hour Rate = ₹ 3)		

The proportion of overheads other than interest, chargeable to the two products are as under: Factory overheads (50% fixed) 100% of Direct Wages. Administration overheads (100% fixed) 10% of factory costs. Selling and Distribution overheads (50% variable) ₹ 3 and ₹ 4 respectively per unit of products A and B.

The fixed capital investment in the Department is ₹50 lakhs. The working capital requirement is equivalent to 6 months stock of cost of sales of both the product. For this project a term loan amounting to ₹40 lakhs has been obtained from Financial Institutions on a interest rate of 14% per annum. 50% of the working capital needs are met by bank borrowing carrying interest at 18% per annum. The Department is expected to give a return of 20% on capital employed.

You are **required** to:

- Fix** the selling price of products A and B such that the contribution per direct labour hour is the same for both the products.
- Prepare** a statement showing in details the overall profit that would be made by the Department.



Reference

**Price Quotation**

What's New

**ROCE = EBIT/Capital Employed**

**Answer**

**Statement of Cost**

Material	A Amount (₹)	B Amount (₹)
Direct Material	15	14
Direct Labour	9	6
Price Cost	24	20
Factory Overhead (100% Direct Labour)	9	6
Factory Cost	33	26
Administration Overhead (10% of Factory Cost)	3.30	2.6
Cost of production	36.30	28.6
Selling and Distribution	3	4
Cost of Sales (or) Unit Cost	39.30	32.60

**Variable Cost:**

	A Amount (₹)	B Amount (₹)
Prime Cost	24	20
Factory Overhead (Variable) (9 x 50%) (6 x 50%)	4.5	3
Selling (Variable)	1.5	2
Total	30	25

**Computation of Total capital Employed:**

	Amount (₹)
Fixed Capital	50,00,000
Working Capital:	
A = 1,00,000 x 39.3	39,30,000
B = 2,00,000 x 32.6	65,20,000
	52,25,000
	1,04,50,000 x 6/12
Total Capital employed	1,02,25,000
Required Return @ 20% on Total Capital employed	20,45,000
Total Cost	1,04,50,000
Add: EBIT	20,45,000
Sales Value	1,24,95,000
Less: Variable Cost	1,00,000 x 30 + 2,00,000 x 25 80,00,000

Contribution		44,95,000
Contribution per hour	$44,95,000/7,00,000$	6.4214
Contribution for unit of 'A'	$3 \times 6.4214$	19.2643
Contribution for unit of 'B'	$2 \times 6.4214$	12.8429

**Computation of Selling Price:**

	A Amount (₹)	B Amount (₹)
Variable cost	30	25
Add: Required Contribution	19.2643	12.8429
Selling Price	49.2643	37.8429

(b)

	Amount (₹)
I Sales	1,24,95,000
II Cost	1,04,50,000
III EBIT (Profit)	20,45,000
IV Interest on term loan (40,00,000 x 14%)	(5,60,000)
V Interest on bank borrowing $52,25,000 \times \frac{1}{2} \times \frac{18}{100}$	(4,70,250)
VI Profit	10,14,750

Q27

Ex. Book No. Pg. No.

**CMA Mat**

S.V. Ltd budgets to make 1,00,000 units of product P. The variable cost per unit is ₹ 10. Fixed costs are ₹6,00,000.

The finance Director suggested that the cost-plus approach should be used with a profit mark-up of 25%.

However, the Marketing Director disagreed and has supplied the following information:

Price per unit (₹)	Demand (Unit)
18	84,000
20	76,000
22	70,000
24	64,000
26	54,000

As Management Accountant of the Company **analyse** the above proposals and comment.

<p><b>Reference</b></p> <p><b>Price Quotation</b></p>	<p>What's <b>New</b></p>
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**Answer**

**Calculation of selling price as per Finance Director's approach**

	Amount (₹)
Variable Cost	10
Fixed Cost (6,00,000/1,00,000)	6
Total Cost	16
Add: Profit mark up 25%	4
Selling Price	20

**Evaluation of marketing Director's Proposal:**

Selling Price	Contribution per unit	No. of units	Total contribution	Fixed Cost	Profit
₹	₹		₹	₹	₹
18	8	84,000	6,72,000	6,00,000	72,000
20	10	76,000	7,60,000	6,00,000	1,60,000
22	12	70,000	8,40,000	6,00,000	2,40,000
24	14	64,000	8,96,000	6,00,000	2,96,000
26	16	54,000	8,64,000	6,00,000	2,64,000

At the selling price of ₹ 24 per unit, the profit is maximum and hence that price must be fixed for the product.

What is a **Key Factor**?

Ways to deal with **Key Factor**

1. Traditional Approach
2. Modern Approach

Different situations to deal with <b>Key Factor</b>		
No. of Products	No. of Key Factors	How to deal with it
ONE	Multiple	Theory of Bottleneck
Multiple	ONE	Utilise the available for best products <b>Step 1:</b> Ranking of Products based on Contribution per unit of Key Factor <b>Step 2:</b> Allocation Based on Rank
Multiple	Multiple	<ul style="list-style-type: none"> <li>• Use Combinations</li> <li>• Use Simultaneous Equations</li> <li>• Use Linear Programming</li> <li>• Use Throughput Accounting</li> </ul>

### Special Effects

1. Different basis of Ranking
2. Tie between two ranks
3. Fractional Allocation Reasoning
4. Minimum or Specific Commitment

## 1. PRINCIPLES OF KEY FACTOR [RTP JUN'18; DEC'18]

1. If **Availability** < **Requirement**, that Resource is called a Key Factor or Key Resource.
2. If **Availability** > **Requirement**, that Resource is called as an Idle Resource.
3. Key Resource and Idle Resource are **mutually** exclusive terms, i.e. they do not refer to the same resource as such.
4. Key Resource should not be kept **idle**, and an Idle Resource will always have spare capacity.
5. Key Resource has **Opportunity Costs**, while Idle Resources have no Opportunity Costs.
6. A Key Resource, if kept idle, will **erode/ reduce** Contribution.
7. For identifying Key Resource, **Availability = Normal Resource Availability at Normal Costs**. Any additional resource availability at higher cost (e.g. additional labour hours due to Overtime Work and Premium) will not be considered.
8. For identifying Key Resource, **Requirement = Requirement at 100% capacity Levels**, i.e. Maximum Output.
9. In case of minimum production condition, minimum resource requirements should be allocated **independent** of the Key factor Ranking priority. Additional Resource requirements only should be allocated based on Key Factor Ranking.
10. In case of Multiple Products and Multiple Key Factors with difference in ranking priority, Linear Programming (**LPP**) **Techniques** may be applied for Resource Allocation decision.
11. Application of Key Factor Principles is subject to - (a) **feasibility**, and (b) **Company policy**.

**Q1**

**Dec'18; MTP Dec'19**

A company is producing and selling three products. **How** would you determine relative profitability of products in each of the following independent situation ?

- (i) Total sales potential in unit is limited,
- (ii) Total sales potential in value is limited,
- (iii) Raw materials are in short supply,
- (iv) Production capacity (machine hours) is limited.

[1 + 1 + 1 + 1 = 4]

<p><b>Reference</b></p> <p><b>Relative profitability</b></p>	<p><b>What's New</b></p> <p><b>Basic Ranking</b></p>
--	--

**Answer**

The Selection process will be based on optimization of contribution in relation to constraint.

- (i) Unit contribution
- (ii) P/V or C/S ratio
- (iii) Contribution per Kg of RM
- (iv) Contribution per machine hour.

**Q2**

**Dec'18; MTP Dec'19**

XYZ Ltd. produces three products. The cost data are as under :

Particulars		X	Y	Z
Direct Materials		₹64	₹152	₹117
Direct Labour :				
Dept.	Rate per hour (₹)	Hrs.	Hrs.	Hrs.
1	5	18	10	20
2	6	5	4	6.5
3	4	10	5	20
Variable overheads		₹16	₹9	₹24

Fixed overheads ₹ 4,00,000 per annum

The budget was prepared at a time, when market was sluggish. The budgeted quantities and selling prices are as under :

Product	Budgeted Quantity	Selling price (₹) unit
X	9750	270
Y	7800	280
Z	7800	400

Later the market improved and the sale quantities could be increased by 20% for product X and 25% each for products Y and Z. The Sales Manager confirmed that the increased quantities could be achieved at the prices originally budgeted. The Production Manager has stated that the output cannot be increased beyond the budgeted level due to limitation of direct labour hours in Department 2.

**Required :**

- (i) **Set** optimal product mix.
- (ii) **State** profit under optimal product mix. [6 + 6 = 12]

**Reference**

**Optimum Mix**

**What's New**

**Profit Calculation**

**Answer**

Products :		X	Y	Z
Budgeted Quantity (units) :		9,750	7,800	7,800
Selling price (p.u.):	(i)	270	280	400
Variable cost (p.u.):				
Direct materials		64	152	117
Direct labour		160	94	219
Variable overheads		16	9	24
Total variable cost (p.u.)	(ii)	240	255	360
Contribution (p.u) (₹)	(i) – (ii)	30	25	40

(i) **Statement of optimal product mix and profit.**

Products :		X	Y	Z	Total
Contribution (p.u) : (₹)	(a)	30	25	40	
Direct labour hours in Dept. 2	(b)	5	4	6.5	
Contribution per hr:	(a)/(b)	6	6.25	6.15	
Ranking		III	I	II	
Optimal product mix units	(c)	5,655	9,750	9,750	
		(28,275 hrs.)	(39,000 hrs)	(63,375 hrs)	

Total contribution (₹)	(a) x (c)	1,69,650	2,43,750	3,90,000	8,03,400
Less : Fixed cost (₹)					4,00,000
<b>Optimal profit</b>					<b>4,03,400</b>

**Working Notes**

(1) **Total hours available in Department 2**

Products (a)	Units (b)	Hrs.(p.u.) (c)	Total hrs. (d) = (b) x (c)
X	9,750	5	48,750
Y	7,800	4	31,200
Z	7,800	6.5	50,700
Total available hrs. for budgeted production			1,30,650

(2) **Maximum Sales Quantities of Products (under improved market conditions)**

Products	Units	Increase in percentage	Total number of units
X	9,750	20	11,700
Y	7,800	25	9,750 x 4 = 39,000
Z	7,800	25	9,750 x 6.5 = 63,375
Required hours for Y + Z			1,02,375
Hours available for X : 1,30,650 – 1,02,375			= 28,275
Production for X 28,275 ÷ 5			= 5655 units

**Q3**

**CMA Mat**

Novelties Ltd. seeks your advice on production mix in respect of the three products Super, Bright and Fine. You have the following information: Data for Standard Costs per Unit:

	Super	Bright	Fine	
Direct Materials	₹320	₹ 240	₹160	
Variable overhead	16	40	24	
Direct Labour:				
Department:	<b>Rate per Hour (₹)</b>	<b>Hours</b>	<b>Hours</b>	<b>Hours</b>
A	8.00	6	10	5
B	16.00	6	15	11

From current budget, you have further details as below:

	Super	Bright	Fine
Annual production (No.s)	5,000	6,000	10,000
Selling price per unit (₹)	624	800	480

Fixed Overhead: ₹16,00,000			
Sales department's estimate of maximum possible sales in the coming year (No.s)	6,000	8,000	12,000

You are also to note that there is a constraint on supply of labour in Department A and its manpower cannot be increased beyond its present level.

**Suggest** the best production and sales mix from the standpoint of maximum profitability. **Prepare** statements setting out the profits resulting from the budgeted production and the best alternative suggested by you.

<p>Reference</p> <p><b>Optimum Mix</b></p>	<p>What's <b>New</b></p> <p><b>Labour Hour is a Key Factor</b></p>
--	--

**Answer**

**Statement showing computation of Contribution per hour in Dept-A & determination of priority for profitability.**

		Super ₹	Bright ₹	Fine ₹
I	Selling Price	624	800	480
II	Variable Cost			
	Direct Material	320	240	160
	Variable Overhead	16	40	24
	Direct Labour			
	<b>Dept – A</b>	48	80	40
	<b>Dept – B</b>	96	240	176
		480	600	400
III	Contribution	144	200	80
IV	Contribution per labour hour in Dept. A	24	20	16
V	<b>Priority</b>	I	II	III

**Statement showing computation of profit at current budgeted production:**

		Super	Bright	Fine	Total
I	No. of units	5,000	6,000	10,000	
II	Contribution	144	200	80	
III	Total Contribution (₹)	7,20,000	12,00,000	8,00,000	27,20,000
IV	Fixed Cost (₹)				16,00,000
V	Profit (₹)				11,20,000

**No. of hours in Department A at budget** = 6 × 5,000 + 10 × 6,000 + 5 × 10,000 = 1,40,000.

**Statement showing optimum mix under the given condition & computation of profit at that mix:**

		Super	Bright	Fine	Total
I	No. of units	6,000	8,000	4,800	
II	Contribution Per unit	144	200	80	
III	Total Contribution (₹)	8,64,000	16,00,000	3,84,000	28,48,000
IV	Fixed Cost (₹)				16,00,000
V	Profit (₹)				12,48,000

Available hours	1,40,000
(-) used for Super (6000 x 6)	36,000
	1,04,000
(-) used for Bright (8000 x 10)	80,000
	24,000

No. of units of Fine =  $24,000/5 = 4,800$  Units

## Q4

## CMA Mat

Something More Ltd. is considering adding to its product line. After a lot of deliberations between the sales and production personnel, it is decided that products P, Q and R would be the most desirable additions to be company's product range on account of the technical competency, marketing potential and production flexibility as regards these products. In fact P, Q and R can all be made on the same kind of plant as that already in use and therefore as regards production, all products can be readily interchanged. However, it is considered necessary to build further plant facilities to cater for additional production. In this connection the following data are relevant:

Products (Per Unit)	Amount (₹)		
	P	Q	R
Direct Materials	100	120	90
Direct Labour	50	70	90
Variable Overheads	50	130	100
Selling Price	350	420	370
Demand in units per cost period (on the basis of the above selling price)	200	125	750
Machine Hours required per units of production	15	5	3

It is felt that initially extra plant facilities can be built to operate at the following five different levels of activity, viz., 1,800; 2,300; 2,800; 3,300 and 3,800 machine hours per cost period. The fixed overhead costs for a cost period relevant to these five different levels of activity are estimated at ₹ 15,000; ₹20,000; ₹ 26,000; ₹33,000 and 39,000 respectively.

You are **required to advise**, with supporting figures, the product or products to be manufactured and in what quantities at each of the five contemplated levels of activity in order to maximize the profits at each level and also indicate the level of activity that would seem most desirable to be pursued for such maximization of profits.

<p><b>Reference</b></p> <p><b>Optimum Mix</b></p>	<p>What's <b>New</b></p> <p><b>5 times for each level of Activities</b></p>
---	---

**Answer**

Statement showing contribution per machine hour and determination of priority for profitability

	Amount (₹)					
	P		Q		R	
Selling Price	-	350		420		370
Variable Cost:						
Direct Material	100		120		90	
Direct Labour	50		70		90	
Variable Overheads	50	200	130	320	100	280
Contribution Per unit		150		100		90
Contribution per machine hour		10		20		30
		III		II		I

Statement Showing optimum mix and profit of the 5 levels and determination of capacity to be pursued for maximization of profit:

Level of Activity	P			Q			R			Total Contrib. ₹	Fixed Cost ₹	Profit ₹
	Hours	Units	Contrib. ₹	H	U	C	H	U	C			
1,800	-	-	-	-	-	-	1,800	600	54,000	54,000	15,000	39,000
2,300	-	-	-	50	10	1,000	2,250	750	67,500	68,500	20,000	48,500
2,800	-	-	-	550	110	11,000	2,250	750	67,500	78,500	26,000	52,500
3,300	425	28.33	4,250	625	125	12,500	2,250	750	67,500	84,250	33,000	51,250
3,800	925	61.67	9,250	625	125	12,500	2,250	750	67,500	89,250	39,000	50,250

From the above computation it is evident that 2,800 hour capacity level of activity is to be pursued to maximize profit.

**Q5**

**CMA Mat**

The operating results of B.N. Ltd., for the year 2022 were as under:

The Company sells 4 products - 'A', 'B', 'C' & 'D' in 4:1:3:2 & P.V. Ratio 20%, 6%, 12% & 10% respectively.

Total sales value of all the products was ₹80 lacs. Total fixed overheads amounted to ₹ 10 lacs. Raw material contents of each product represented 50% of the respective variable cost. The forecast for the year 2023 is as under:

- (i) The raw material costs will go up by 10%
- (ii) The company has been able to obtain export quota of raw material of the value of ₹ 35 lacs.
- (iii) The maximum sale potential of any of the above four products is 40% of the 2022 sale value.
- (iv) The Company expects to secure an increase of 5% in the selling prices of all the products uniformly.

**Required:**

- (a) **Prepare** a statement showing the profitability of 2022.
- (b) **Set** a Product mix to maximise profit in 2023.
- (c) **Prepare** a statement showing the profitability of 2023.

Reference

**Optimum Mix**

What's New

**Raw Material Quota**

**Answer**

**Statement showing profit for 2022, computation of contribution per rupee of material and determination of priority for profitability** Amount (₹)

	A	B	C	D	Total
Sales	3,200,000.00	800,000.00	2,400,000.00	1,600,000.00	8,000,000.00
Contribution	640,000.00	48,000.00	288,000.00	160,000.00	1,136,000.00
Fixed cost					1,000,000.00
Profit					136,000.00

Amount (₹)

Variable cost	2,560,000.00	752,000.00	2,112,000.00	1,440,000.00
Raw material cost	1,280,000.00	376,000.00	1,056,000.00	720,000.00

Contribution per rupee of Raw Material Cost	0.50	0.13	0.27	0.22
Priority	I	IV	II	III

**Statement showing optimum mix under given conditions and computation of profit at that mix**

Amount (₹)

	A	C	D	Total
(i) Sales	3,360,000.00 (80 x 40% x 105%)	3,360,000.00 (80 x 40% x 110%)	1,152,242.00 (w/n)	7,872,242.00
(ii) Variable cost				
a. Raw material	1,408,000.00 [32x(12.8/32) x 110%]	1,548,800.00	543,200.00 (b/f)	35,00,000
b. Other variable cost	1,280,000.00	1,408,000.00	493,818.00	
	2,688,000.00	2,956,800.00	1,037,018.00	6,681,818.00
(iii) Contribution	672,000.00	403,200.00	115,224.00	1,190,424.00
(iv) Fixed cost				1,000,000.00
(v) Profit				190,424.00

**Working notes:**

	Amount (₹)
Available material	3,500,000.00
Less : Utilised for	
A {(33.6) x (12.8 x 1.1)/(32 x 1.05)}	1,408,000.00
C {(33.6) x (10.56 x 1.1)/(24 x 1.05)}	1,548,800.00
	543,200.00

**Sales of D to be produced**

Let X be sales

$$[(X \times 7.2 \times 1.1)/16 \times 1.05] = 5,43,200 \quad X = ₹ 11,52,242$$

**Q6**

**CMA Mat**

V Ltd. produces two products P and Q. The draft budget for the next month is as under:

Budgeted production and sale (units)	40,000	80,000
Selling price ₹/unit	25	50
Total costs ₹/unit	20	40
Machine hours/unit	2	1
Max. sale potential (units)	60,000	1,00,000

The fixed expenses are estimated at ₹9,60,000 per month. The co. absorbs fixed Oh's on the basis of machine hours which are fully utilised by the budgeted production and cannot be further increased.

When the budget was discussed, the managing director states that the product mix should be altered to yield optimum profit. The marketing director suggests that he could introduce a new product C each unit of which take 1.5 machine hours. However a processing vat involving a capital outlay of ₹2,00,000 is to be installed for processing product C. The additional fixed overheads relating to the processing vat was estimated at ₹60,000 per month. The variable costs of product C was estimated at ₹21 per unit.

**Required:**

- (i) **Calculate** the profit as per draft budget for the next month.
- (ii) **Revise** the product mix based on data given P and Q to yield optimum profit.
- (iii) The company decides to discontinue either product P or Q whichever is giving lower profit and proposes to substitute product C instead. **Fix** the selling price of C in such a way to yield 15% return on additional capital employed besides maintaining the same overall profit as envisaged in (ii) above.

<p>Reference</p> <p><b>Optimum Mix and Computation of Selling price</b></p>	<p>What's New</p> <p><b>Discontinue with less profitable product</b></p>
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**Answer**

(i) **Computation of profit as per draft budget:** Amount (₹)

	P	Q	Total
Selling Price	25	50	
Total Cost	20	40	
Profit	5	10	
Budgeted Units	40,000	80,000	
Profit	2,00,000	8,00,000	10,00,000

(ii) **Statement of Pricing**

	P	Q	Total
Total Cost	8,00,000	32,00,000	40,00,000
(-) Fixed Cost			9,60,000
Variable Cost			30,40,000
Fixed Cost P.u.	12	6	
Variable Cost P.u.	8	34	
Contribution P.u.	17	16	

Contribution Per machine hour	8.5	16
	II	I

**Statement showing optimum mix and relevant profit:**

Amount (₹)

	P	Q	Total
No. of units	30,000	1,00,000	
Contribution P. u.	17	16	
Total Contbn.	5,10,000	16,00,000	21,10,000
Fixed Cost			9,60,000
Profit			11,50,000

**Working Notes:**

Available hours = (40,000 x 2) + (80,000 x 1) =	₹ 1,60,000
(-) Utilised for Q	₹ 1,00,000
	₹ 60,000

$$\text{No. of units of P} = \frac{60,000}{2} = 30,000 \text{ units}$$

**Computation of SP of product C:**

Out of products P & Q, P is less profitable and hence can be replaced by C.

Variable Cost = ₹ 21

Fixed Cost = ₹ 60,000

Machine hours released = 60,000 hrs.

$$\text{No. of units of C} = \frac{60,000}{1.5} = 40,000 \text{ units}$$

**In order to get the profit as above, the contribution to be recovered is as follows:**

	Amount (₹)
Total Contribution	21,10,000
(+) Fixed Cost (addnl.)	60,000
(+) Return on capital employed	30,000
	22,00,000
(-) Recovered from Q	16,00,000
	6,00,000

Contribution per unit = $\frac{60,000}{40,000}$	= ₹15
(+) VC	₹21
Selling Price	₹ 36

**Q7**

**CMA Mat; MTP Dec'21**

AB Ltd. manufactures three products. The standard selling prices and costs have been estimated for 1985 as follows:

	Per Unit		
	X (₹)	Y (₹)	Z (₹)
Selling Price	28	60	125
Direct materials	8	15	20
Direct wages	10	20	50
Variable overheads	5	10	25

Direct wages are paid at the rate of ₹2 per hour in each case. Fixed overheads are budgeted at ₹25,000 for the coming year.

In short run, the company cannot increase its direct labour strength and as a result, only 35,000 direct labour hours will be available in the coming year. The company has commitments to produce 500 units of each product.

It has been suggested that after meeting the minimum requirements for X, Y and Z, the balance of available direct labour hours should be used to produce the product Z.

You are **required** to:

- To **prepare** an income statement showing the expected results if the proposal is adopted
- Comment** on the statement you have produced in (a) and prepare an income statement for any alternative policy which you consider would be more profitable.
- Basing your calculations on your suggestion in (b), **show** the company's BEP in terms of units and sales value.
- Show** the sales value which is required to produce an after tax return of 10% on capital employed of ₹1,00,000 assuming tax rate of 50%.



**Reference**

**Optimum Mix BES and Desired Sales**

**What's New**

**With Minimum Commitment, BES - Sell minimum units of all first and then sell additional units of others**

**Answer**

- Statement showing computation of Contribution per hour & determination of priority for profitability:**

		X (₹)	Y (₹)	Z (₹)
I.	Selling Price	28	60	125
II.	Variable Cost	23	45	95

III.	Contribution	5	15	30
IV.	Contribution Per hour	1	1.5	1.25
	Priority	III	I	II

**Computation of Profit at the proposal**

		X	Y	Z	Total (₹)
	Minimum Units to be produced	500	500	500	
	Units in Remaining time	--	--	600	
I.	No. of Units	500	500	1,100	
II.	Contribution Per Unit	₹ 5	15	30	
III.	Total Contribution	₹ 2,500	7,500	33,000	43,000
IV.	Fixed Cost	₹			25,000
V.	Profit	₹			18,000

**Working Notes:**

Available Hours	=	35,000
(-) Hours for Minimum units	=	20,000
		15,000
Units of Z	=	15,000 / 25 = 600 units.

(b) **Computation of profit at Optimum Mix**

		X	Y	Z	Total (₹)
	Minimum Units to be produced	500	500	500	
	Units in Remaining time	--	1,500	--	
I.	No. of Units	500	2,000	500	
II.	Contribution Per Unit	₹ 5	15	30	
III.	Total Contribution	₹ 2,500	30,000	15,000	47,500
IV.	Fixed Cost	₹			25,000
V.	Profit	₹			22,500

Units of Y = 15,000 / 10 = 1,500 units

- (c) In order to break even 'C' must be equal to Fixed Cost 'Contribution' recovered from minimum units of each product.

X	= 500 x 5	=	2,500
Y	= 500 x 15	=	7,500
Z	= 500 x 30	=	15,000
	Fixed Cost	=	25,000

**Break Even Units & Value**

	Units	Value (₹)
X	500	14,000
Y	500	30,000
Z	500	62,500
	1,500	106,500

(d)

Required Return before tax	= 1,00,000 x 10% / 0.5	= ₹ 20,000
Sales of Y required to get this profit	= 20,000 / 15 x 60 = ₹80,000	
Total sales required	= 1,06,500 + 80,000	= ₹ 1,86,500

**Q8**

**CMA Mat**

S. U Ltd. produces three products namely A, B and C. The budgeted production, costs and selling prices for the next year are as under:

Product	A	B	C
Direct materials (₹/unit)	24	16	12
Direct wages:			
	Hr / Unit		
<b>Dept. Rate/Hour:</b>			
1. ₹ 4 / Hr	3	5	2.5
2. ₹ 2 / Hr	3	8	6
Budgeted Production (units)	10,000	12,000	20,000
Max. possible sales (units)	12,000	16,000	24,000
Selling price (₹/unit)	75	105	60

Variable overheads:

**Dept.1** Recovered at 100% of direct wages.

**Dept.2** Recovered at 50% of direct wages.

Fixed overheads ₹ 5,00,000 per annum.

The direct labour hour in Dept1 is in short supply and the budgeted volume of output envisages full utilisation of the available direct labour hours. In Dept 2, the co. has committed to engage the workers to the extent of the direct labour hours required for the budgeted volume of production. Should a change in the product mix be desired, the co. can engage additional direct labour hours required in dept 2 at normal rates; but any portion of the direct labour hours of dept 2 rendered surplus by reasons of a change in the present product mix have to be paid by the co. as idle wages in view of the commitment already made.

**Required:**

- (i) **Present** a statement showing the budgeted profitability.
- (ii) **Set** optimal product mix and work out the optimum profit after taking into consideration the idle time wages, if any, payable in dept 2.
- (iii) If the co. desires to subcontract the surplus direct labour hours, if any, in dept 2, **what** minimum charges should be quoted per direct labour hour.

Reference	What's <b>New</b>
<b>Optimum Mix</b>	<b>Cost of Idle wages</b>
	<b>Minimum charges to be quoted to subcontract</b>

**Answer**

- (i) **Statement showing computation of budgeted profit and contribution per labour hour in dept. 1:**

	A ₹	B ₹	C ₹	Total ₹
Selling Price	75	105	60	
Variable Cost:				
Direct Material	24	16	12	
Direct Wages : Dept 1	12	20	10	
Dept 2	6	16	12	
VOH	15	28	16	
	57	80	50	
Contribution	18	25	10	
Contr. Per lab hour	6	5	4	
In Dept. I				
	I	II	III	
Budgeted units	10,000	12,000	20,000	
Total contribution	1,80,000	3,00,000	2,00,000	6,80,000
Fixed Cost				5,00,000
Profit				1,80,000

- (ii) **Statement showing optimum mix and profit at that mix:** Amount (₹)

No. of Units	A	B	C	Total
No. of Units	12,000	16,000	9,600	
C P.U	18	25	10	
Total Contribution	2,16,000	4,00,000	96,000	7,12,000

FC			5,00,000
Profit			2,12,000
(-) Cost of idle wages in dept 2		24,400 x 2	48,800
Profit after idle wages			1,63,200

**Working Notes:**

No. of hours in **dept 1** = (10,000 x 3) + (12,000 x 5) + (20,000 x 2.5) = 1,40,000

No. of hours in **dept 2** = (10,000 x 3) + (12,000 x 8) + (20,000 x 6) = 2,46,000

	Dept I hrs	Dept II hrs
Available Hours	1,40,000	2,46,000
(-) Utilized for A	36,000	36,000
	1,04,000	2,10,000
(-) for B	80,000	1,28,000
	24,000	82,000
No. of Units of C = $\frac{24,000}{2.5} = 9,600$	24,000	9,600 x 6 = 57,600
Idle Hours	-	24,400

(iii) **Hire charges** = Labour Cost + Var. O.H = 2 + 2 x 50% = ₹ 3 per hour

**Q9**

**CMA Mat**

Akshara combines manufactures 3 components X, Y and Z which are made up from 3 parts A, B and C in the following proportions:

X	1A and 1B
Y	2A, 2B and 1C
Z	3A, 1B and 2C

These parts are made on the premises. Further information as follows:

	A (₹)	B (₹)	C (₹)
Selling price	6	14	24
Direct materials	2	2	5
Time cost	2	9	12

Time cost which covers the cost of direct labour and overheads is valued at ₹6 per hour. All parts can be sold individually at the above selling prices, but the market demand, which it is hoped, will be satisfied from the expansion for the components. The further expansion would provide an additional 58,000 hours and the additional market demand for the components would be 5,000 units each. Additional fixed expenses related to the expansion are expected to be ₹15,000.

**Prepare** a statement showing how the additional capacity available should be used to generate maximum additional profit.

**Reference**  
**Optimum Mix**

**What's New**  
**Combining parts to make a product**

**Answer**

**Statement showing computation of 'Contribution' per hour & determination of priority for profitability:**

		X ₹	Y ₹	Z ₹
I.	Selling Price	20 (6 + 14)	64 (12 + 28 + 24)	80 (18 + 14 + 48)
II.	Variable Cost			
	Direct Material	4	13	18
	Time Cost	11	34	39
		15	47	57
III.	Contribution	5	17	23
IV.	Contribution Per Hour	2.73 $\frac{5}{11/6}$	3.00 $\frac{17}{34/6}$	3.54 $\frac{23}{39/6}$
V.	Priority	III	II	I

**Statement showing optimum mix under the given conditions & computation of profit at that mix:**

		X	Y	Z	Total
I.	No. of Units		4,500	5,000	
			₹		
II.	Contribution Per Unit		17	23	
III.	Total Contribution	₹	76,500	1,15,000	1,91,500
IV.	Fixed Cost	₹			15,000
V.	Profit	₹			1,76,500

Available hours	=	58,000
(-) hours used for Z (5,000 x 39/6)	=	32,500
		25,500

No. of units produced by Y =  $25,500 \div \frac{34}{6} = 4,500$  units

**Q10**

**CMA Mat**

Domestic political trouble in the country of an overseas supplier is causing concern in your company because it is not known when further supplies of raw material 'x' will be received. The current stock held of this particular raw material is 17,000 kilograms, which costs ₹ 1,36,000. Based on raw material 'x', your company makes five different products and the expected demand for each of these, for the next three months, is given below together with other relevant information:

Product code	Kilogram of raw material 'x' per unit of finished product	Direct labour hours per unit of finished product	Selling price per unit	Expected demand over three months
	Kg.	Hours	₹	Units
701	0.7	1.0	26	8,000
702	0.5	0.8	28	7,200
821	1.4	1.5	34	9,000
822	1.3	1.1	38	12,000
937	1.5	1.4	40	10,000

The direct wages rate per hour is ₹5 and production overhead is based on direct wages cost - The variable overhead absorption rate being 40% and the fixed overhead absorption rate being 60% Variable selling costs, including sales commission, are 15% of selling price.

Budgeted fixed selling and administration costs are ₹ 3,00,000 per annum. Assume that the fixed production overhead incurred will equal the absorbed figure.

You are **required** to:

- Show what quantity of the raw material on hand ought to be allocated to which products in order to maximize profits for the forthcoming three months.
- Present a brief statement showing contribution and profit for the forthcoming three months, if your suggestion in (a) **is adopted**;
- Comment briefly on the analysis you used to aid the decision making process in (a) and give three other examples of business problems where this type of analysis can be useful.



Reference

**Optimum Mix**

What's New

**Ranking and Allocation**

**Answer**

**Statement showing computation of contribution per koilogram of material and determination of priority for profitability** Amount (₹)

	701	702	821	822	937
(i) Selling price	26.00	28.00	34.00	38.00	40.00
(ii) <b>Variable cost</b>					
a. Direct material	5.60	4.00	11.20	10.40	12.00
b. labour	5.00	4.00	7.50	5.50	7.00
c. Production overheads	2.00	1.60	3.00	2.20	2.80
d. selling expenses	3.90	4.20	5.10	5.70	6.00
	16.50	13.80	26.80	23.80	27.80
(iii) Contribution	9.50	14.20	7.20	14.20	12.20
(iv) Contribution per kilogram of material	13.57	28.40	5.14	10.90	8.13
(v) <b>Priority</b>	2	1	5	3	4

**Statement showing optimum mix under given conditions and computation of profit at that mix**

	701	702	821	822	937	Total
No. of units	8,000.00	7,200.00		6,000.00		
Contribution per Unit (₹)	9.50	14.20		14.20		
Total contribution (₹)	76,000.00	1,02,240.00		85,200.00		2,63,440.00
Fixed cost (₹)						1,36,080.00
Profit (₹)						1,27,360.00

**Working Notes:**

**Computation of material apportion on the basis of priority**

	Kgs (₹)
Available material	17,000.00
Less : used for 702 (7,200 x 0.5)	3,600.00
	13,400.00
701 (8,000 x 0.7)	5,600.00
	7,800.00

Therefore no. of units of 822 to be produced from remaining material (7,800/1.3) = 6,000 Units

**Fixed Cost**

	Amount (₹)
Selling and Administrative Overheads [(3,00,000/12) x 3]	75,000.00
Factory overheads [(8,000 x 5 x 60%) + (7,200 x 4 x 60%) + (6,000 x 5.5 x 60%)]	61,080.00
	1,36,080.00

**Q11**

**RTP Jun'18**

VCPL Co. produces and sells 4 types of dolls for children. It also produces and sells a set of dress kit for the dolls. The company has worked out the following estimates for the next year -

Doll	Estimated Demand(Units)	Standard Material Cost	Standard Labour Cost	Estimated Sales per unit
A	50,000	₹20	₹15	₹60
B	40,000	₹25	₹15	₹80
C	35,000	₹32	₹18	₹100
D	30,000	₹50	₹20	₹120
Dress Kit	2,00,000	₹15	₹5	₹50

To encourage the sale of Dress Kits, a discount of 20% in its price is offered if it were to be purchased along with the doll. It is expected that all the customers buying dolls will also buy the Dress Kit.

The Company's Factory has effective capacity of 2,00,000 Labour Hours per annum on a single shift basis and it produces all the products on that basis. The Labour Hour Rate is ₹15. Overtime of Labour has to be paid at double the normal rate.

Variable Cost works out to 40% of Direct Labour Cost. Fixed Costs are ₹30 Lakhs per annum.

There will be no inventory at the end of the year. **Prepare** a conservative estimate of the year's profitability.

<p><b>Reference</b> <b>Optimum Mix</b></p>	<p><b>What's New</b> <b>With Overtime and Without Overtime</b></p>
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**Answer**

1. **Computation of Labour Overtime premium**

Particulars	Doll A	Doll B	Doll C	Doll D	Dress Kit
(a) Direct Labour Cost per hour	₹15	₹15	₹18	₹20	₹5
(b) Labour Rate per hour (given)	₹15	₹15	₹15	₹15	₹15
(c) Hours required per unit (a ÷ b)	1 hour	1 hour	1.2 hours	1.33 hours	0.33 hours
(d) Sales Demand (units)	50,000	40,000	35,000	30,000	2,00,000
(e) Total Hours required ( c x d)	50,000	40,000	42,000	40,000	66,667

Total Hours required for all the dolls and dress kits is 2,38,667 hours. Since only 2,00,000 hours are available, the balance of 38,667 hours will be from Overtime work.

**Premium Amount** = 38,667 hrs × ₹15 = ₹5,80,000

2. **Computation of Discount offered**

(a) Total Sale of all Dolls = 50,000 + 40,000 + 35,000 + 30,000 =	1,55,000 units
(b) Hence, Dress Kits sold separately (i.e. without discount) = 2,00,000 - 1,55,000 =	45,000 units
(c) Total Discount offered = 1,55,000 Dress Kits × ₹50 × 20% =	₹15,50,000

This discount is subtracted from the Gross Continuation of Dress Kits, in the statement of profitability.

3. **Computation of Contribution and Profits (in ₹)**

Particulars	Doll A	Doll B	Doll C	Doll D	Dress Kit
(a) Selling Price p.u	60.00	80.00	100.00	120.00	50.00
(b) Variable Costs p.u					
Materials	20.00	25.00	32.00	50.00	15.00
Labour	15.00	15.00	18.00	20.00	5.00
VOH(40% of Lab.)	6.00	6.00	7.20	8.00	2.00
<b>Total Variable Costs</b>	41.00	46.00	57.20	78.00	22.00
(c) Contribution p.u (a - b)	19.00	34.00	42.80	42.00	28.00
(d) Sales Demand (units)	50,000	40,000	35,000	30,000	2,00,000
(e) Total Contribution (c x d)	9,50,000	13,60,000	14,98,000	12,60,000	56,00,000
(f) Discount					(15,50,000)
(g) <b>Net Contribution</b> (e - f)	9,50,000	13,60,000	14,98,000	12,60,000	40,50,000
Total Net Contribution from all Dolls and Dress Kits from above					₹91,18,000
Less: Fixed Costs (₹30,00,000 + OT Premium ₹5,80,000)					₹35,80,000
Estimated Net Profit for the Sales Demand					₹55,38,000

**Q12**

**CMA Mat**

Allplay Ltd., are specialists in the manufacture of dolls for children. They manufacture and market four types of dolls patented the names, Dolly, Molly, Jolly, Polly and a doll dress sewing kit. They require your assistance as a Cost Accountant for determining the appropriate sales and product-mix of their products for the coming year. From the production standards established market forecasts and pricing policies, you get the following data:

Doll's name	Estimated demand for next year Unit	Standard material cost per unit ₹	Standard labour cost per unit. ₹	Estimated net price per unit. ₹
Dolly	50,000	1.40	0.80	5.20
Molly	42,000	0.70	0.50	2.40

Jolly	35,000	2.70	1.40	8.50
Polly	40,000	1.00	1.00	4.00
Sewing kit	3,25,000	0.60	0.40	3.00

- (i) To promote sales of the sewing kit, there is a 15% discount offered in the established price of a kit, purchased at the same time along with a doll and it is expected that all the customers will avail this benefit.
- (ii) The labour rate of ₹2.00 per hour is expected to continue without change in the next year. The plant has an effective capacity of 1,30,000 labour hours on a single shift basis. Present equipment can produce all of the products. Overtime worked is paid at double the normal rate.
- (iii) Next year's fixed cost is estimated at ₹30,000 in the factory, ₹20,000 in administration and ₹ 50,250 in selling and distribution.
- (iv) Variable costs will be equivalent to 50% of standard Direct Labour cost.
- (v) The company has a very small inventory of its products that can be ignored.
- (a) You are **required** to **draw** a conservative estimate for the next year of the total contribution that would be made by each product line and the net income that would be earned by the company.
- (b) The company is at present having some industrial relations problem and if this continues in the next year, it would not then be possible to arrange for overtime work. Anticipating that eventuality, you are **required** to **suggest** a product-mix that would absolutely minimize the drop in the income already envisaged. With that product-mix, work out product-wise contribution and the new net income that would be earned as a result.

<p><b>Reference</b></p> <p><b>Optimum Mix</b></p>	<p><b>What's New</b></p> <p><b>With Overtime and Without Overtime</b></p>
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**Answer**

- (a) **Conservative Estimate**

Amount (₹)

	Dolly	Molly	Jolly	Polly	Sewing kit		Total
					Discount	No Discount	
Selling price	5.20	2.40	8.50	4.00	2.55	3.00	
Variable cost							
a. Direct material	1.40	0.70	2.70	1.00	0.60	0.60	

b. Direct wages	0.80	0.50	1.40	1.00	0.40	0.40	
c. Variable overheads	0.40	0.25	0.70	0.50	0.20	0.20	
	2.60	1.45	4.80	2.50	1.20	1.20	
Contribution	2.60	0.95	3.70	1.50	1.35	1.80	
Hours per unit	0.40	0.25	0.70	0.50	0.20	0.20	
Contribution per hour	6.50	3.80	5.29	3.00	6.75	9.00	
No. of units	50,000.00	42,000.00	35,000.00	40,000.00	167,000.00	158,000.00	
Total contribution	130,000.00	39,900.00	129,500.00	60,000.00	225,450.00	284,400.00	869,250.00
Fixed cost							100,250.00
Profit before considering o.t							769,000.00
Less : Overtime premium (w/n)							20,000.00
Profit at conservative estimate							749,000.00

- (b) **Statement showing computation of contribution per hour, determination of priority and profit at conservative estimate.**

**Computation of over time premium**

		Hours
Available hours		130,000.00
Less : Utilised for		
Dolly	(50,000 x .4)	20,000.00
Molly	(42,000 x 0.25)	10,500.00
Jolly	(35,000 x .7)	24,500.00
Polly	(40,000 x .5)	20,000.00
Sewing kit (discount)	(1,67,000 x .2)	33,400.00
Sewing kit (no discount)	(1,58,000 x 0.2)	31,600.00
O. T. Hours		10,000.00

Therefore, overtime premium (10,000 x 2) = ₹ 20,000

**Computation of profit when no over time is available**

	Dolly	Molly	Jolly	Polly	Sewing kit		Total
					Discount	No Discount	
a. No. of units	50,000.00	42,000.00	35,000.00	20,000.00	147,000.00	178,000.00	
	₹	₹	₹	₹	₹	₹	₹
b. Contribution per unit	2.60	0.95	3.70	1.50	1.35	1.80	
c. Total contribution	130,000.00	39,900.00	129,500.00	30,000.00	198,450.00	320,400.00	848,250
d. Fixed cost							100,250
e. Profit							748,000

**Q13**

**CMA Mat**

- (a) A firm produces 5 different products from a single raw material. Raw material is available in abundance at ₹6 per kg. The labour rate is ₹8 per hour for all products. The plant capacity is 21,000 labour hours for the budget period. Production facilities can produce the products. The factory overhead rate is ₹8 per hour, comprising ₹5.60 per hour fixed overhead and ₹2.40 per hour as variable overhead. The selling commission is 10% of the product price. Given the following information, you are to suggest a suitable sales mix which will maximise the company's profits. **Determine** the profits that will be earned at the selected sales mix.

Product	Market Demands (Units)	Selling Price (₹)	Labour Hours Per (Unit)	Raw Material Required Per Unit (in gms)
A	4,000	32.00	1.00	700
B	3,600	30.00	0.80	500
C	4,500	48.00	1.50	1,500
D	6,000	36.00	1.10	1,300
E	5,000	44.00	1.40	1,500

- (b) Assume, in above situation, 3,500 hours of over time working is possible. It will result in additional fixed overheads of ₹20,000; a doubling of labour rates and a 50% increase in variable overheads. Do your **recommend** to overtime working?

<p><b>Reference</b></p> <p><b>Optimum Mix</b></p>	<p><b>What's New</b></p> <p><b>Evaluation of Overtime work</b></p>
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**Answer**

(a) **Statement showing contribution per labour hour and ranking:**

		A	B	C	D	E
		₹	₹	₹	₹	₹
I.	Selling Price	32	30	48	36	44
II.	Variable Cost					
	Raw Materials	4.2	3	9	7.8	9
	Labour	8	6.4	12	8.8	11.2
	Variable Overhead	2.4	1.92	3.6	2.64	3.36
	Selling Commission	3.2	3.00	4.8	3.6	4.4
	Total	17.8	14.32	29.4	22.84	27.96
III.	Contribution	14.2	15.68	18.6	13.16	16.04
IV.	Contribution per hour	14.2	19.6	12.4	11.96	11.45
		II	I	III	IV	V

**Working Notes:**

	hrs.
Available hours	21,000
(-) Utilized for B 3,600 x 0.8	2,880
	18,120
(-) for A	4,000
	14,120
(-) for C	6,750
	7,370
(-) for D	6,600
	770

No. of units of E =  $770 / 1.4 = 550$  units

**Statement showing optimum mix under the given conditions and computation of profit at that mix.**

		A	B	C	D	E	Total
		₹	₹	₹	₹	₹	₹
I.	No. of Units	4,000	3,600	4,500	6,000	550	
II.	Contribution Per Unit	14.2	15.68	18.6	13.16	16.04	
III.	Total Contribution	56,800	56,448	83,700	78,960	8,822	2,84,730
IV.	Fixed Cost	22,400	16,128	37,800	36,960	4,312	1,17,600
V.	Profit	34,400	40,320	45,900	42,000	4,510	1,67,130

(b) **If overtime is used for Product E,**

	Amount (₹)	
Contribution obtained = $11.45 \times 3,500$		40,075
Less: Additional Fixed Cost	20,000	
Overtime Labour Cost $3,500 \times 8$	28,000	
Addl. Variable Cost $3,500 \times 1.2$	4,200	52,200
	Loss	12,125

Hence overtime working is not recommended.

## Q14

## CMA Mat

A farmer owns an orchard which has an area of 300 acres on which he grows apples, apricots, Cherrie and plums. Of the total area, 200 acres of land are suitable for growing apricots and cherries and in the remaining acres of land any of the four fruits can be grown.

The marketing policy requires that in each season all the four types of fruits must be produced and the quantity of any one of the four fruits should not be less than 12,000 boxes.

It is essential that the area devoted to any one should be in terms of complete acres and not in fractions of an acre. There are no physical or marketing limitations and there is an adequate supply of all types of labour

The details regarding the selling price, production and cost are given below:

	Apples	Apricots	Cherries	Plums
Selling price per box ₹	10	10	20	30
Acreage at each present devoted to each line	120	70	80	30
Seasons yield in boxes per acre	500	150	100	200
Weight per box kg	30	30	40	20
Costs (₹):				
Direct: Material per acre	180	70	60	100
Labour:				
Growing per acre	200	150	100	130
Harvesting & Picking per box	1	1	2	3
Transport per box	2	2	1	3

Fixed overhead incurred each season:

	₹	Basis of apportionment to produce
Cultivation and growing	27,840	Direct labour cost incurred
Harvesting	20,900	Direct labour cost incurred
Administration	42,250	No. of boxes produced

Transport	5,110	Weight produced
Land revenue	9,000	No. of acres cultivated

Using above information, you are **required** to:

- Calculate** profit and loss per box of each type of fruit that the farmer will obtain from operating the orchard on the present basis.
- Advise** the farmer on the area to be allocated to each item in order to earn the maximum total profit.

<p><b>Reference</b></p> <p><b>Optimum Mix with Minimum Commitment</b></p>	<p><b>What's New</b></p>
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**Answer**

- Statement showing computation of profit per box of each crop if the Orchard is maintained on the present basis.**

	Particulars	Apples	Apricots	Cherries	Plums	Total
I.	Selling Price (₹)	10	10	20	30	
II.	No. of boxes	60,000	10,500	8,000	6,000	84,500
III.	Total Weight in kgs (No. of boxes x Weight per box)	18,00,000	3,15,000	3,20,000	1,20,000	25,55,000
IV.	Sales (₹)	6,00,000	1,05,000	1,60,000	1,80,000	1,045,000
V.	Variable Cost (₹)					
	Direct Material	21,600	4,900	4,800	3,000	34,300
	Growing	24,000	10,500	8,000	3,900	46,400
	Harvesting	60,000	10,500	16,000	18,000	1,04,500
	Transport	1,20,000	21,000	8,000	18,000	1,67,000
	Total Variable Cost (₹)	2,25,600	46,900	36,800	42,900	3,52,200
VI.	Contribution (Sales - Variable Cost) (₹)	3,74,400	58,100	1,23,200	1,37,100	6,92,800
VII.	Fixed Cost (₹)					
	Cultivation & Growing	14,400	6,300	4,800	2,340	27,840
	Harvesting	12,000	2,100	3,200	3,600	20,900
	Administration	30,000	5,250	4,000	3,000	42,250
	Transport	3,600	630	640	240	5,110
	Land Revenue	3,600	2,100	2,400	900	9,000
	Total Fixed Cost (₹)	63,600	16,380	15,040	10,080	1,05,100

VIII.	Profit (₹)	3,10,800	41,720	1,08,160	1,27,020	5,87,700
IX.	Profit Per box (₹)	5.18	3.97	13.52	21.17	6.95
X.	Contribution per acre (₹)	3,120	830	1,540	4,570	
	Priority	II	IV	III	I	

(b) **Statement showing optimum mix under the given conditions:**

Particulars	Apples	Apricots	Cherries	Plums	Total
Minimum boxes to produce	12,000	12,000	12,000	12,000	
Area required for this minimum (acres)	24	80	120	60	284
Remaining Area (acres)	—	—	—	16	16
No. of acres	24	80	120	76	300

**Q15**

**Dec'19**

An agro-based farm is planning its production for next year. The following is relating to the current year:

Products/Crops	M	N	O	P
Area occupied (acres)	125	100	150	125
Yield per acre (ton)	50	40	45	60
Selling price per ton (₹)	100	125	150	135
Variable cost per acre (₹):				
Seeds	150	125	225	200
Pesticides	75	100	150	125
Fertilizers	62.50	37.50	50	62.50
Cultivations	62.50	37.50	50	62.50
Direct wages	2,000	2,250	2,500	2,850

Fixed overhead per annum ₹ 13,44,000.

The land that is being used for the production of O and P can be used for either crop. But not for M and N. the land that is being used for the production of M and N can be used for either crop, but not for O and P. In order to provide adequate market service, the company must produce each year at least 1,000 tons of each of M and N and 900 tons each of O and P.

**Required:**

- Determine** the profit for the production mix fulfilling market commitment.
- Assuming the land could be cultivated to produce any of the four products and there was no market commitment, **calculate** the profit amount of most profitable crop and break-even point of most profitable crop in terms of acres and sales value. [5 + 3 = 8]

<p>Reference</p> <p><b>Optimum Mix</b></p>	<p>What's <b>New</b></p> <p><b>Break Even Sales</b></p>
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**Answer**

(i) **Profit Statement of Recommended mix:**

Product	M	N	O	P
Yield per acre (tons)	50	40	45	60
Selling price per ton	100	125	150	135
Sales revenue per acre	5,000	5,000	6,750	8,100
Variable cost per acre	2,350	2,550	2,975	3,300
Contribution per acre	2,650	2,450	3,775	4,800
Rank	1	2	2	1
Minimum sales requirement in acre		25	20	
		(1,000/40)	(900/45)	
Recommended mix in acre	200	25	20	255
Total Contribution	5,30,000	61,250	75,500	12,24,000
Less – Fixed cost				13,44,000
Profit				5,46,750

(ii) Most profitable crop. Production should be concentrated on P which gives highest contribution per acre of ₹ 4,800.

Overall contribution if complete land is used for P =  $(500 \times 4,800) = ₹ 24,00,000$

Less: Fixed cost = ₹ 13,44,000

Profit = ₹ 10,56,000

Break-even point in acres for P =  $13,44,000 / 4,800 = 280$  acres

Break-even point in sales value =  $280 \times 135 \times 60 = ₹ 22,68,000$

**Q16**

**CMA Mat**

As a part of its rural upliftment programme, the Government has put under cultivation a farm of 96 hectares to grow tomatoes of four varieties: Royal Red, Golden Yellow, Juicy Crimson and Sunny Scarlet. Of the total, 68 hectares are suitable for all four varieties, but the remaining 28 hectares are suitable for growing only Golden Yellow and Juicy Crimson. Labour is available for all kinds of farm work and there is no constraint. The market requirement is that all four varieties of tomato must be produced with a minimum of 1,000 boxes of any one variety.

The farmers engaged have decided that the area devoted to any crop should be in terms of complete hectares and not in fractions of a hectare. The other limitation is that not more than 22,750 boxes of any one variety should be produced. The following data are relevant.

Annual Yield	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
<b>Boxes per hectore</b>	350	100	70	180
<b>Costs</b>	₹	₹	₹	₹
Direct:				
Material per hectore	476	216	196	312
Labour:				
Growing per hectore	896	608	371	528
Harvesting and packing per box	3.60	3.28	4.40	5.20
Transport per box	5.20	5.20	4.00	9.60
Market price per box	15.38	15.87	18.38	22.27
Fixed overheads per annum				
Growing	₹ 11,200			
Harvesting	₹ 7,400			
Transport	₹ 7,200			
General Administration	₹ 10,200			

**Find out:**

- (i) Within the given constraints, the area to be cultivated with each variety of tomatoes, if the largest total profit has to be achieved.
- (ii) The amount of such profit in rupees.
- (iii) A nationalized bank has come forward to help in the improvement programme of the 28 hectares in which only Golden Yellow and Juicy Crimson will grow, with a loan of ₹ 5,000 at a very nominal interest of 6% per annum. When this improvement is carried out, there will be a saving of ₹ 1.25 per box in the harvesting cost of Golden Yellow and the 28 hectares will become suitable for growing Royal Red in addition to the existing Golden Yellow and Juicy Crimson varieties. Assuming that other constraints continue, **find** the maximum total profit that would be achieved when the improvement programme is carried out.

<p><b>Reference</b></p> <p><b>Optimum Mix Farm Development</b></p>	<p><b>What's New</b></p>
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**Answer**

**Statement showing contribution per hectare and determination of priority for profitability**

Amount (₹)

	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
(i) Sales realised per hectare	5,383	1,587	1,286.6	4,008.6
(ii) <b>Variable cost:</b>				
a. direct material	476	216	196	312
b. growing cost per hectare	896	608	371	528
c. harvesting and packing	1,260	328	308	936
d. transport	1,820	520	280	1,728
	4,452	1,672	1,155	3,504
(iii) Contribution per hectare	931	(-85)	133.60	504.6
(iv) <b>Priority</b>	1	4	3	2

**Statement showing optimum product mix under the given conditions and computation of profit at that mix**

	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
Minimum boxes to be produced (Units)	1,000.00	1,000.00	1,000.00	1,000.00	
Area required for this minimum (hectars)	3.00	10.00	14.00	6.00	33.00
Remaining land Apportioned on the basis of given data according to priority (hectars)	59.00		4.00		63.00
(i) No. of hectares	62.00	10.00	18.00	6.00	96.00
(ii) Contribution per hectare (₹)	931.00	(85.00)	133.60	504.60	
(iii) Total contribution (₹)	57,722.00	(850.00)	2,404.80	3,027.60	62,304.40
(iv) Fixed cost (₹)					36,000.00
(v) <b>Profit (₹)</b>					26,304.40

**Statement showing optimum mix after the improvement programme and computation of profit**

	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet	Total
Area required for the minimum (hectars)	3.00	10.00	14.00	6.00	33.00

Remaining land Apportioned on the basis of given data according to priority (hectares)	62.00			1.00	63.00
(i) No. of hectares	65.00	10.00	14.00	7.00	96.00
(ii) Contribution per hectare (₹)	931.00	40.00	133.60	504.60	
(iii) Total contribution (₹)	60,515.00	400.00	2,404.80	3,532.20	66,852.00
(iv) Fixed cost (₹)					36,300.00
(v) <b>Profit (₹)</b>					30,552.00

## Q17

## CMA Mat

A small-scale manufacturing unit has employed skilled persons for doing pressing and welding operations on various products. The welders produce two different products, W1 and W2. The press operators also produce two products, p1 and p2. Due to specific skill requirements, the press operators can't do welding job and vice-versa. The labour hours and cost data in respect of the above 4 products are as under.

	W1	W2	P1	P2
Hours per unit	4	4	5	2
Price per unit (₹)	50	50	80	65
Direct Material per unit (₹)	18	22	35	45
Direct Labour Rate per hour (₹)	4	4	4	4
Variable Overheads per unit (₹)	2	2	3	3

The unit incurs ₹50,000 per annum on fixed costs for producing the above products. The available labour hours for welding are 20,000 and for pressing 16,000.

The unit has also observed that the market can absorb minimum 2,000 units of W1, 2,500 units of W2, 1,800 units of P1 and 2,200 units of P2. The demand keeps on fluctuating. The manager of the shop has, therefore, suggested that the workers should be trained to do either of welding or pressing job so that any excess demand can be fulfilled. It is estimated that this decision will increase the burden of fixed costs by ₹5,000 p.a.

### Required:

- Present** the figures of optimum product mix assuming that the minimum marketable quantity is produced before the workers are trained and after they are trained.
- Prepare** profitability statement for optimum product mix under both the above conditions and recommend whether it is advisable to train employees.

<p><b>Reference</b></p> <p><b>Optimum Mix</b></p>	<p><b>What's New</b></p> <p><b>Training Cost</b></p>
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**Answer**

(a) **Statement showing computation per hour and determination of priority**

	W1 ₹	W2 ₹	P1 ₹	P2 ₹
(i) Selling price	50.00	50.00	80.00	65.00
(ii) Variable cost				
a. direct material	18.00	22.00	35.00	45.00
b. direct wages	16.00	16.00	20.00	8.00
c. variable overheads	2.00	2.00	3.00	3.00
	36.00	40.00	58.00	56.00
(iii) Contribution	14.00	10.00	22.00	9.00
(iv) Contribution per hour	3.50	2.50	4.40	4.50
(v) Priority	III	IV	II	I

**Statement showing calculation of profit before workers are trained**

	W1	W2	P1	P2	Total
Minimum units	2,000.00	2,500.00	1,800.00	2,200.00	
Units in remaining time	500.00			1,300.00	
(i) Total units	2,500.00	2,500.00	1,800.00	3,500.00	
(ii) Contribution per unit (₹)	14.00	10.00	22.00	9.00	
(iii) Total contribution (₹)	35,000.00	25,000.00	39,600.00	31,500.00	1,31,100.00
(iv) Fixed cost (₹)					50,000.00
(v) Profit (₹)					81,100.00

**Working Notes:**

	W1 hours	P2 hours
Available hours	20,000.00	16,000.00
Less : used for minimum	18,000.00	13,400.00
	2,000.00	2,600.00
units	500.00	1,300.00

(b) **Statement showing calculation of profit after training**

	W1	W2	P1	P2	
Minimum units	2,000.00	2,500.00	1,800.00	2,200.00	
Units in remaining time				2,300.00	
(i) Total units	2,000.00	2,500.00	1,800.00	4,500.00	
(ii) Contribution per unit (₹)	14.00	10.00	22.00	9.00	
(iii) Total contribution (₹)	28,000.00	25,000.00	39,600.00	40,500.00	1,33,100.00
(iv) Fixed cost (₹)					55,000.00
(v) Profit (₹)					78,100.00

From the above, it is not advisable to train the workers.

**Q18**

**CMA Mat: MTP Jun'17**

A firm has two machines, namely, machine 'P' and machine 'Q'. Machine 'P' can be used for the production of either product 'A' or product 'B' or both. Machine 'Q' can be used for the production of either product 'X' or product 'Y' or both. In order to maintain customer relations a minimum quantity of 1,500 units each of 'A' and 'B' and 1,200 units each of 'X' and 'Y' should be produced by the firm.

The production and cost data for 2022 are as under:

Machine hours available P - 4500 hours; Q - 5100 hours

	PRODUCTS			
	A	B	X	Y
Machine used	P	P	Q	Q
Machine hours required per unit of out put	1.0	1.25	1.25	0.8
Selling price per unit	₹ 200	₹ 250	₹ 300	₹ 256
Direct material per unit	80	100	100	80
Direct labour per machine hour	90	80	100	125
Variable overhead per machine hour	12	12	20	20

Fixed overheads are ₹ 4 lacs per annum. An additional expenditure involving a fixed overhead of ₹25,000 per annum will convert the machine P and Q into a versatile centre such that any four of the products can be manufactured on these two machines. The rate of output on these machines and direct wage rate will, however, remain the same.

**Required:**

- (i) **Set** an optimal product mix subject to minimum market commitments both before and after the conversion of the machines into a versatile centre.
- (ii) **Evaluate** the profitability under the two sets or product mixes.
- (iii) **Advise** the management whether the conversion of machine should be undertaken or not.

<p>Reference</p> <p><b>Optimum Mix</b></p>	<p>What's New</p> <p><b>Versatile Machine</b></p>
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**Answer**

- (i) **Statement showing computation of Contribution per machine hour & determination of priority for profitability:**

		A (₹)	B (₹)	X (₹)	Y (₹)
I	Selling Price	200	250	300	256
II	Variable Cost				
	Direct Material	80	100	100	80
	Direct Labour	90	100	125	100
	Variable Overhead	12	15	25	16
		182	215	250	196
III	Contribution	18	35	50	60
IV	Contribution per hour	18	28	40	75
V	Priority	IV	III	II	I

- (ii) **Statement showing optimum product mix under the given condition & computation of profit before conversion of machines into Versatile:**

	A	B	X	Y	Total
Minimum units to be produced	1,500	1,500	1,200	1,200	
Units in remaining hours	--	900	--	3,300	
I No. of units	1,500	2,400	1,200	4,500	
II Contribution per unit (₹)	18	35	50	60	
III Total contribution (₹)	27,000	84,000	60,000	270,000	4,41,000
IV Fixed Cost (₹)					4,00,000
V Profit (₹)					41,000

**Working Notes**

	P	Q
Available Hours	4,500	5,100
- Minimum Production		
A 1,500 x 1	X 1,200 x 1.25	
B 1,500 x 1.25	Y 1,200 x 0.8	2,460
	1,125	2,640
No. of Units of B = 1,125/1.25	900	No. of Units Y = 2,640/0.8
		3,300

**Statement showing optimum mix under the given condition & computation of profit at that mix after conversion of machines into Versatile:**

	A	B	X	Y	Total
Minimum units to be produced	1,500	1,500	1,200	1,200	
Units in remaining hours	--	--	--	4,706.25	
I No. of units	1,500	1,500	1,200	5,906.25	
II Contribution per unit (₹)	18	35	50	60	
III Total contribution (₹)	27,000	52,500	60,000	3,54,375	4,93,875
IV Fixed Cost (₹)					4,25,000
V Profit (₹)					68,875

**Working Notes:**

Total No. of hours	=	9,600
Hours utilized (3,375 + 2,460)	=	5,835
		3,765
Units of Y = 3,765 / 0.8	=	4,706 Units

- (iii) As the profit is increased **by 27,875/-** it is advised to convert the machines into versatile centers.

**Q19**

**CMA Mat**

A company produces four products A,B,C, and D which are marketed in cartons. Of the total of 20 machines installed, 8 are suitable for manufacturing all the four products and the remaining 12 machines are not suitable for the manufacture of products A and D.

Each machine is in production for 300 days per year and each is used on a given product in terms of full days and not in fractions of days. The company however has no problem in obtaining adequate supplies of labour and raw materials.

The marketing policy is that all four products should be sold and the minimum annual production should be 3,000 cartons for each product. Fixed costs budgeted amount to ₹50 lacs. Production cost and price data are as under:-

	A	B	C	D
Production/day/machine (cartons)	14	4	3	6
Selling price/carton Cost: Process I	₹810	790	845	1,290
Direct Materials/day. Machine	₹140	52	45	84
Direct Labour/day/Machine Process II	224	148	90	132
Direct Material/Carton	₹ 30	30	30	30

Direct Labour/Carton	₹240	216	300	360
Variable Overheads/Carton	₹390	390	300	720

With a view to meeting the increasing demand for products A and D, the company is contemplating to convert such number of machines, as may be necessary, out of the 12 machines which at present are unsuitable to produce products A and D into all purpose machines. The cost of conversion of these machines is ₹2,10,000 per machines. The expenditure is to be amortized over a period of three years. The company expects 12.5% return on this expenditure.

Market research indicates that the company's sales products A and D can be increased to 37,500 cartons and 5,400 cartons respectively.

**Required:**

- Calculate** the optimum profit of the company if the existing machines were worked on most profitable basis before conversion.
- Recommend** the maximum number of machines to be converted into all purpose machines giving supporting calculations.
- Calculate** for the first year the optimum profit of the company after conversion of the required number of machines into all-purpose machines.

<p>Reference</p> <p><b>Optimum Mix</b></p>	<p>What's <b>New</b></p> <p><b>Maximum number of Machines to be converted</b></p>
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**Answer**

**Statement showing Computation of Contribution per machine days determination of priority for profitability.**

		A	B	C	D
		₹	₹	₹	₹
I	Selling price per carton	810	790	845	1,290
II	Variable Cost				
	<b>Process 1</b>				
	Direct Material	10	13	15	14
	Direct Labour	16	37	30	22
	<b>Process 2</b>				
	Direct Material	30	30	30	30
	Direct Labour	240	216	300	360
	Variable Overheads	390	390	300	720
		686	686	675	1,146

III	Contribution per carton	124	104	170	144
IV	Contribution per machine day	1,736	416	510	864
V	Priority	I	IV	III	II

**Statement showing optimum mix under the given conditions & Computation of profit at that mix.**

	A	B	C	D	Total
Minimum no. of cartons to be produced	3,000	3,000	3,000	3,000	
Cartons in the remaining machine days	23,590 (1,685 x 14)		5,550 (1,850 x 3)		
I No. of Cartons	26,590	3,000	8,550	3,000	
II Contribution per Carton (₹)	124	104	170	144	
III Total Contribution (₹)	32,97,160	3,12,000	14,53,500	4,32,000	54,94,660
IV Fixed Cost (₹)					50,00,000
V Profit (₹)					4,94,660

Available Machine days	(300 x 8)			(300 x 12)
	2,400			3,600
A = 3,000/14		215	B = 3,000/4	750
D = 3,000/6		500	C = 3,000/3	1,000
Machine Days		1,685		1,850

(b) **Computation of No. of machines to be converted**

	A	D
Maximum Production	37,500	5,400
No. of machine days required	2,679	900
	(37,500/14)	(5,400/6)

Total machine days required to meet the demand = 2,679 + 900	=	3,579
(-) Machine days already available	=	2,400
No. of machine days further required	=	1,179
No. of machines required to be converted = 1,179/300 = 3.93 (say) 4		

(c) **Computation of Optimum Mix after conversion & Profit.**

	A	B	C	D	Total
I No. of cartons	37,500	3,000	5,014	5,400	
	₹	₹	₹	₹	₹
II Contribution per carton	124	104	170	144	
III Total Contribution	46,50,000	3,12,000	8,52,380	7,77,600	65,91,980

IV	Fixed Cost				52,80,000
V	Profit				13,11,980
	(-) Capital cost @ 12.5% on 8,40,000				1,05,000
					12,06,980

Total No. of Machine days (20 x 300)			= 6,000.00	
A -	37,500/14		= 2,678.57	
B -	3,000/4		= 750.00	
D -	5,400/6		= 900.00	4,328.57
Machine days available to 'C'			= 1,671.43	
No. of Cartons produced by 'C'			= 1,671.43 x 3 = 5,014	

**Note: Fixed Cost** = ₹ [50,00,000 + (2,10,000 × 4)/3] = ₹ 52,80,000

**Q) 20**

**MTP Dec'17**

Bloom Ltd makes 3 products , A, B and C. The following information is available:

(figures in ₹ Per unit)

Particulars	A	B	C
Selling Price (peak-season)	550	630	690
Selling Price (off-season)	550	604	690
Material Cost	230	260	290
Labour (peak-season)	110	120	150
Labour (off-season)	100	99	149
Variable Production Overhead	100	120	130
Variable Selling Overhead (only for peak-season)	10	20	15
Labour hours required for one unit of production (in hours)	8	11	7

Material Cost and Variable Production Overheads are the same for the peak-season and off-season. Variable Selling Overheads are not incurred in the off-season. Fixed Costs amount to ₹26,780 for each season, of which ₹2,000 is towards Salary for Special Technician, incurred only for product B, and ₹1,780 is the amount that will be incurred on after-sales warranty and free maintenance of only product C, to match competition.

Labour force can be inter-changeable used for all the products. During peak-season, there is labour shortage and the maximum labour hours available are 1,617 hours. During off-season, labour is freely available, but demand is limited to 100 units of A, 115 units of B and 135 units of C, with production facility being limited to 215 units for A, B and C put together.

You are **required** to:

1. **Advise** the Company about the best product mix during the peak-season for maximum profit.
2. **What** will be the maximum profit for the off-season?

<p><b>Reference</b></p> <p><b>Optimum Mix</b></p>	<p><b>What's New</b></p> <p><b>Specific Fixed Cost</b></p>
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### Answer

1. **Product Decision and Profits during Peak Season (Figure in ₹)**

Product	A	B	C
(a) Selling Price per unit	550	630	690
(b) Variable Costs per unit:			
Direct Material	230	260	290
Direct Labour	110	120	150
Variable Overhead - Production	100	120	130
Variable Overhead - Selling	10	20	15
Sub-Total variable Cost	450	520	585
(c) Contribution per unit (a – b)	100	110	105
(d) Direct Labour Hours required per unit	8	11	7
	hours	hours	hours
(e) Contribution per Labour hour (c ÷ d)	12.5	10	15
(f) Ranking	II	III	I
(g) Possible Production with DLH of 1,617 hours (1,617 ÷ d)	202	147	231
	units	units	units
(h) Specific Fixed Overhead (given)	Nil	2,000	4,780
(i) Other General Fixed Overhead (Total 26,780 less h)	20,000	20,000	20,000
(j) Total Fixed OH if the product is produced individually	20,000	22,000	24,780
(h + i)			
(k) BEQ (j ÷ c)	200	200	236
	units	units	units

**Observation:** Comparing (g) and (k) above, it is observed that only Product A should be produced, since B and C will not be able to recover the Fixed Costs. Hence, the Company should produce 202 units of Product A, resulting in a Contribution of (₹202 x 100) = ₹20,200 – Fixed Cost ₹20,000 = ₹200.

Note Even if Product C has the maximum ranking with respect to Key Factor, it is not profitable to produce. Hence, the next best profitable product, i.e. Product A should be preferred.

2. **Computation of Contribution per unit during Off-Season (Figures in ₹)**

Product	A	B	C
(a) Selling Price per unit	550	604	690
(b) Variable Cost per unit:			
Direct Material	230	260	290
Direct Labour	100	99	149
Variable Overhead – Production	100	120	130
Sub – Total Variable Cost	Product	A	B
(c) Contribution per unit (a – b)	120	125	130
(d) Ranking based on Contribution per unit	III	II	I
(e) Maximum Demand	100 units	115 units	135 units

Since Overall Total Possible production is only 215 units and there are specific fixed Costs for B and C, the following options are available for analysis –

Item	Contribution p.u.	Option 1		Option 2		Option 3	
		Units	Contribution	Units	Contribution	Units	Contribution
Product A	120	Nil	Nil	100	₹12,000	80	₹9,600
Product B	125	115	₹14,375	115	₹14,375	Nil	Nil
Product C	121	100	₹12,100	Nil	Nil	135	₹16,335
Total		215	₹26,475	215	₹26,375	215	₹25,935
Less: Fixed Cost			₹26,780		₹22,000		₹24,780
Profit / (Loss)			₹(305)		₹4,375		₹1,155

Best option is to produce 100 units of Product A and 115 units of Product B during off-season. Maximum Profit = ₹4,375

**Q21**

**MTP Dec'22**

Cosmetics dealing with eye, facial, and lip makeup category are the most prosperous industry in a country. While the cosmetics industry could be relatively strong as compared to other categories of consumers, the year 2020-21 has been very poor in terms of sales, almost all segments of this industry have witnessed a similar kind of downfall in terms of sales during COVID-19 because of closing of the offline stores at different locations throughout. Cosmetics are designed to enhance one's appearance (makeup), to conceal blemishes, enhance one's natural features (such as the eyebrows and eyelashes), add color to a person's face and, can be used to change the appearance of the face entirely to resemble a different person, creature or object. The cruelty-free (no animal testing), vegetarian (no byproducts of animal slaughter),

and vegan (no animal ingredients at all) beauty market has exploded in recent years globally and has been finding its space in this country's market too. Moreover, with the advancement of vegan products in the country, Country consumers are paying extra attention to not only a particular shade of lipstick that suits them but also about how the lipstick is made. Furthermore, the increasing adoption of the vegan lifestyle and the growing health concerns about the negative impact of petroleum-based ingredients are driving the demand for vegan cosmetics. With the increasing internet penetration, the online market for the purchase of consumer goods has seen rapid growth in the last 3-4 years in Country.

With the rise in the adoption of western culture, the colour cosmetics market is one of the fastest-growing markets in Country. As the aesthetic appeal in the young generation is rising, the penetration of colour cosmetics products in the Country market is increasing. Country is estimated as one of the fastest-growing countries, in terms of color cosmetics, in the Asian region. Country companies are venturing into organic colour cosmetics, due to its increasing demand, among the more affluent sections of the society. Furthermore, the rising beauty consciousness among individuals, the influence of social media, and inflating income levels are increasing the preference for customized, organic, and premium product variants, which is offering lucrative growth opportunities to leading market players operating in the country. In addition, physical store retailers are adopting innovative strategies, such as housing beauty studios with personalized beauty advisors, to drive customer's engagement and improve their shopping experience.

Particulars	A	B	C	D
Variable cost of production per unit	₹130	₹100	₹90	₹85
Labour hour required per unit	3	4	2	3
Market price per unit	₹150	₹146	₹140	₹130

Anticipated growth in the market can be attributed to growing disposable income leading to increasing purchasing power of the people. Emergence of online retail and increasing inclination of youth towards skin care and other grooming products is another key factor which is expected to drive the cosmetics market during the forecast period. Moreover, rising consumer awareness and preference to buy advanced skin care products which not only make them look beautiful but also enhance their skin type is also leading to huge demand for cosmetics products. Leading companies are working on bring more innovative products which suits the demand of the consumers. The increasing focus on personal health and hygiene represents one of the major factors influencing the demand for beauty and personal care products in Country.

S Ltd. has three different divisions namely X, Y, Z. All the divisions are very unique in terms of their performance. Among all the divisions, Division Z is profit center which produces four products namely A, B, C and D. Each product is sold in the external market also. Few relevant information are extracted which are expressed below:

After market survey and present requirement it was revealed that product D amongst all the product of Division Z can be transferred to division Y but the maximum quantity that might be required for transfer is 2,500 units of D.

The maximum sales in the external market are 2,800 units for A; 2,500 units for B ; 2,300 units for C and 1,600 units for D.

As there is no internal agreement between the divisions and overall objective is to maximize the profit as well as wealth, Division Y can purchase the same product at a slightly cheaper rate of ₹125 per unit instead of receiving transfers of product D from division Z.

- (a) **Which** is the most preferred product and why? [2]
- (b) Imagine yourself that you are financial advisor of S Ltd. After detailed study, **show** the optimum product mix when total available hours in division Z is :
- (i) 20,000 hours and
- (ii) 30,000 hours [4]
- (c) In your opinion, **what** should be the transfer price for each unit for 2,500 units of D if total available hours is 20,000 hours? [4]
- (d) **Is** there any change in transfer price per unit of D for above mentioned units if available hours is 30,000 hours? [2]

Reference	What's New
	Case Study

### Answer

- (a) The product C is most preferred product as maximum contribution per hour (₹ 25) company can enjoy.

#### Rough Work

Product	A (₹)	B (₹)	C (₹)	D (₹)
Market price per unit	150	146	140	130
Less: Variable cost of Production per unit	130	100	90	85
Contribution per unit	20	46	50	45
Contribution per hour	6.66	11.50	25	15
Ranking	IV	III	I	II

From the above table, it is clear that product C is most preferred product as maximum contribution company can enjoy

- (b) **For 20,000 hrs.:**

Product C = 2,300 units produced and 4,600 hours used

Product D = 1,600 units produced and 4,800 hours used

Product B = 2,500 units produced and 10,000 hours used

Product A = 600 units produced and 600 hours used

**For 30,000 hrs.:**

Product C = 2,300 units produced and 4,600 hours used

Product D = 1,600 units produced and 4,800 hours used

Product B = 2,500 units produced and 10,000 hours used

Product A = 2,800 units produced and 8,400 hours used

**Rough Work**

Product	Max Demand (units)	Hrs./unit	For 20,000 hrs.			For 30,000 hrs.		
			Unit produced	Hour used	Balance hours	Unit produced	Hour used	Balance hours
C	2,300	2	2,300	4,600	15,400	2,300	4,600	25,400
D	1,600	3	1,600	4,800	10,600	1,600	4,800	20,600
B	2,500	4	2,500	10,000	600	2,500	10,000	10,600
A	2,800	3	200	600	NIL	2,800	8,400	2,200

**Working note:**

- (i) **When 20,000 hours are available:** Time required to meet the demand of 2,500 units of Product D for division Y is 7,500 hours. This requirement of time viz. 7,500 hours for providing 2,500 units of Product D for Division Y can be made by sacrificing the production of 1,725 units of product B (1,725 units x 4hours = 6,900 hours) and 200 units of product A (200 units x 3 hours = 600 hours)
- (ii) **When 30,000 hours are available:** The required time for producing 2,500 units of Product D for division Y is 7,500 hours. This requirement can be made to the extent of 2,200 hours out of the balance hours (as shown in the above table, last column). The remaining requirement of 5,300 hours can be made by sacrificing the output of 1,766.66 units of product A.

(c) **Transfer price of 2,500 units of product D = ₹2,95,850**

Transfer price of Per unit of product D = ₹ 118.34

**Rough Work**

**Statement showing of fixation of transfer price for each unit for 2,500 units of D when 20,000 hours are available**

Transfer price	2,500 units of product D	Per unit of product D
Variable cost (2,500 units × ₹85)	₹2,12,500	85
Opportunity cost of contribution foregone by not producing 200 units of A (200 units × ₹20)	₹4,000	1.6
Opportunity cost of contribution foregone by not producing 1,725 units of B (1,725 units × ₹46)	₹79,350	31.74
<b>Transfer Price</b>	<b>₹2,95,850</b>	<b>118.34</b>

- (d) **Transfer price of 2,500 units of product D** = ₹2,47,833.20 Transfer price of Per unit of product D = ₹ 99.13

**Rough Work**

Statement showing of fixation of transfer price for each unit for 2,500 units of D when 30,000 hours are available

Transfer price	2,500 units of product D (₹)	Per unit of product D (₹)
Variable cost (2,500 units × ₹85)	2,12,500	85
Opportunity cost of contribution foregone by not producing 1,766.66 units of A (1,766.66 units × ₹20)	35,333.20	14.13
Transfer Price	2,47,833.20	99.13

SJC Institute

# Make or Buy Decision



## Learning Objective

1. **APPLICABILITY**
  - a. On Raw Materials
  - b. On Components
2. **FACTORS INFLUENCING DECISIONS**
  - a. Cost Factors
  - b. Non Cost Factors
3. **NON COST FACTORS**
  - a. Quality and Secrecy
  - b. Quantity
  - c. Time
  - d. Peer Co-operation
  - e. Focus
  - f. Capacity
  - g. Investment
  - h. Skills

### COST FACTORS

1. **CAPACITY AVAILABLE FOR QUANTITY REQUIRED**

Step 1 : Relevant Cost of Manufacture  
Step 2 : Purchase Cost  
Step 3 : Compare and Decide
2. **CAPACITY REQUIRED IS MORE THAN CAPACITY AVAILABLE**

Step 1 : Compare Relevant Cost of Manufacture and Purchase and Decide  
Step 2 : For Components to be manufactured, Find savings in manufacturing per unit  
Step 3 : Find Hours / Unit of Manufacture  
Step 4 : Find Savings in Manufacturing per Hour  
Step 5 : Rank for Manufacture  
Step 6 : Allocate the available Capacity to manufacture  
Step 7 : Purchase what quantity could not be purchased
3. **BUY ONLY ONE COMPONENT WHEN CAPACITY IS NOT AVAILABLE**
3. **INDIFFERENCE POINT ANALYSIS**

## 1. MAKE/BUY DECISION [RTP JUN'18]

In case of Make or Buy decisions, i.e. whether to produce a component / product internally, or buy it from outside, Marginal Costing and Opportunity Costing approaches are adopted in decision -making. The following are the relevant considerations in Make or Buy decisions -

<b>Relating to Suppliers</b>	<ol style="list-style-type: none"> <li>1. Quality of goods supplied by Supplier.</li> <li>2. Reasonable certainty of the Supplier meeting the delivery dates, i.e. Timeliness.</li> <li>3. Availability of more than one Supplier to reduce the risk involved in buying.</li> <li>4. Lead Time involved in receiving the materials versus time involved in own production.</li> <li>5. Supplier Stability, i.e. whether the Supplier will support the Firm in the long-run also.</li> </ol>
<b>Relating to Labour</b>	<ol style="list-style-type: none"> <li>6. Availability of skilled labour, technical know-how and capability to make the product / component.</li> <li>7. Labour relations - any adverse effect on labour relations if it is decided to buy instead of making.</li> <li>8. Cost of labour redundancies, if any.</li> </ol>
<b>Relating to Capacity</b>	<ol style="list-style-type: none"> <li>9. Cost of Special Machineries to be installed in making the component.</li> <li>10. Possible use of released capacity and facility as a result of buying instead of making.</li> <li>11. Possibility of expanding the existing capacity or creating extra capacity (e.g. Overtime Work, Second Shift)</li> <li>12. Process of making - whether confidential or patented or a general process.</li> <li>13. Technical obsolescence associated with the component - whether investment in machinery is risky or not.</li> </ol>
<b>Other Factors</b>	<ol style="list-style-type: none"> <li>14. Seasonal demand of Components, leading to costs of inventory holding.</li> <li>15. Price Stability and possibility of escalations in the Price of Components purchased.</li> <li>16. Possibility of adverse Foreign Exchange Rate Fluctuations in respect of Imported Components.</li> <li>17. Availability of transport and other infrastructure facilities for procuring the component from outside.</li> <li>18. Behavior of cost of make and cost of buy in the long run.</li> </ol>

### Cost Comparison

Cost of Make	Cost of Buy
Variable Costs	Direct Purchase Costs
+ Specific Fixed Cost (if any)	+ Purchase Related Costs like Buying Commission, Transportation, etc.
+ Opportunity Cost (in case of full capacity operations)	+ Opportunity Cost if any (e.g. Purchase of different quality Raw Material, leading to reduction in Selling Price of Finished Product).

#### Decision will be as under -

- **If Cost of Make < Cost of Buy**, then MAKE.
- **If Cost of Make = Cost of Buy**, the Firm is indifferent. (Non-cost factors to be considered)
- **If Cost of Make > Cost of Buy**, then BUY.

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**Q1**

**RTP Jun'18**

MNC Company assembles bicycles. This year's expected production is 10,000 units. MNC makes the Chains for Its bicycles. Its Accountant reports the following costs for making 10,000 Bicycle Chains -

Particulars	Costs per unit	Total for 10,000 units
Direct Materials	₹4.00	₹40,000
Direct Manufacturing Labour	₹2.00	₹20,000
Power and Utilities (variable)	₹1.50	₹15,000
Inspection, Set-Up and Materials Handling		₹2,000
Machine Rent		₹3,000
Allocated Fixed Costs of Plant Administration, Insurance, etc.		₹30,000
<b>Total Costs</b>		<b>₹1,10,000</b>

MNC received an offer from an outside vendor for the supply of any number of chains at ₹8.20 per Chain. The following additional information is available on MNC's operations -

- Inspection, Set-up and Materials Handling Costs vary with the number of batches in which the Chains are produced. MNC currently produces the Chains in batches of 1,000 units. It estimates that 10 batches are required for meeting the expected production requirements.
- MNC rents the machine used to make the Chains. If it chooses to outsource the Chains, machine rent can be avoided.

**Required:**

1. Should MNC accept the Vendor's offer for 10,000 units? What is the net gain / (loss)? **What** is the maximum price payable to the Vendor?
2. Suppose the Chains were purchased outside, the facilities where the Chains are currently made will be used to upgrade the bicycles by adding Mud Flaps and Reflectors. As a result, the Selling Price of the Bicycles can be increased marginally by ₹20. The Variable Costs of the upgrade would be 18 and additional Tooling Costs of ₹16,000 would be incurred. **Should** MNC make or buy the Chains, at the anticipated production level of 10,000 units? **What** is the maximum price payable to the Vendor in this situation?
3. MNC's Sales Manager is concerned that the estimate of 10,000 units may be high and believes that only 6,200 units can be sold. Production will be cut back, freeing up work facilities and space. This space can be used to add the Mud Flaps and Reflectors whether MNC outsources the Chains or makes them in-house. At this lower output, MNC will produce the chains in 8 batches of 775 units each. **Should** MNC purchase the Chains from the Outside Vendor?

<b>Reference</b>	<b>What's New</b>
<b>Evaluation of Make or Buy</b>	<b>Maximum Price</b>

## Answer

### 1. Computation of Relevant Costs of own production

Particulars	Nature and Computation	₹
Direct Materials	Variable and Relevant = ₹4 x 10,000 units	40,000
Direct Manufacturing labour	Variable and Relevant = 2 x 10,000 units	20,000
Power and Utilities	Variable and Relevant = 1.50 x 10,000 units	15,000
Inspection, Set up etc.	Batch Related Production Costs= Specific and Relevant (given)	2,000
Machine Rent	Specifically incurred = relevant	3,000
Fixed Costs	Allocated and Irrelevant	Nil
	<b>Total Relevant Costs for own production</b>	<b>80,000</b>

Average Relevant Cost per unit for own production = ( ₹ 80,000/10,000)= ₹ 8 per unit

Since Cost of Buying ₹ 8.20 p.u. is higher than Average Relevant Cost ₹ 8, own production is preferable. Hence, the Company should not accept the Vendor's offer.

Maximum Price Payable = Relevant Cost = ₹ 8.00 per unit.

### 2. Effect of Alternative use of facilities:

Additional Benefit from upgradation = 10,000 units x ( ₹20 - 18)	=	₹20,000
Less: Fixed Costs incurred specifically	=	₹16,000
Net Additional Benefit	=	₹4,000

Since this benefit will be foregone due to own production of Chains, the relevant cost of own production will then be 80,000 (as per WN 1) + ₹ 4,000 (Opportunity Cost)= ₹84,000.

Average Relevant Cost per unit for own production= ₹84,000/10,000 units= ₹8.40 per unit

Since Cost of Buying ₹ 8.20 p.u. is less than Average Relevant Cost ₹8.40, buying the chains is preferable now.

Maximum Price Payable = Relevant Cost = ₹ 8.40 per unit.

### 3. Computation of Relevant Costs of Own Production, with Revision in Production Estimates

Particulars	Nature and Computation	₹
Direct Materials	Variable and Relevant = ₹4 x 6,200 units	24,800
Direct Manufacturing labour	Variable and Relevant = ₹2 x 6,200 units	12,400

Power and Utilities	Variable and Relevant = ₹1.50 × 6,200 units	9,300
Inspection, Set up etc.	Batch Related Costs = (2,000 + 10 batches) × 8 batches	1,600
Machine Rent	Specifically incurred = relevant	3,000
Fixed Costs	Allocated and Irrelevant	Nil
	<b>Total Relevant Costs for own production</b>	<b>₹51,100</b>

- Average Cost per unit for own production = (₹51,100/6,200 units) = ₹8.24 per unit
- Since Cost of Buying ₹ 8.20 p.u. is less than Average Relevant Cost ₹8.24, buying the chains is preferable.
- Maximum Price Payable = Relevant Cost = ₹ 8.24 per unit

**Q2**

**Dec'19**

Company XYZ produces two components (M and N) and is planning the allocation of its available resources for the next period.

75 units of component M and 60 units of component N are required to be produced but machine hour capacity is restricted to a total of 300 hours. Any deficit of components produced in-house can be made up by the purchase of any quantity of either component from an outside supplier.

The objective of company XYZ is to satisfy the requirement for components at minimum total cost. The following information is available concerning each component.

Cost (₹ per unit)	M	N
Direct materials	6.20	8.70
Direct Labour	5.10	7.50
Variable production overheads	1.20	1.30
Fixed production overheads	4.80	6.40
<b>Total</b>	<b>17.30</b>	<b>23.90</b>
Machine hours (per unit)	2.00	3.00
Price from outside supplier (₹ per unit)	18.50	25.90

**Required:**

For the next period:

- Calculate** the variable costs of producing each component in-house.
- Calculate** the extra costs of buying-in each component
- Determine** which component should have production priority. **Show** workings clearly and **justify** your conclusion.
- Calculate** the number of units of each component that should be manufactured by company XYZ. [2 + 2 + 2 + 2 = 8]

<p><b>Reference</b></p> <p><b>Make/Buy Decision</b></p>	<p><b>What's New</b></p> <p><b>VC /component, Extra cost/ component, Priority of component production, Unit should manufacture</b></p>
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**Answer**

(i) **Calculation for variable cost of producing in-house**

Products	M (₹)	N (₹)
<b>Variable Cost:</b>		
Direct material	6.20	8.70
Direct labour	5.10	7.50
Variable production cost in-house	1.20	1.30
<b>Total</b>	<b>12.50</b>	<b>17.50</b>

(ii) **Calculation of Extra Cost of Buying-in each component**

Products	M	N
Price to be charged by outside Supplier	18.50	25.90
Variable cost of producing in-house [as per (a)]	12.50	17.50
Extra cost of buying – in	6.00	8.40

(iii) **Machine hour cost per unit**

Products	M	N
Machine Hours per unit	2.00	3.00
Extra cost of buying – in per unit (₹)	6.00	8.40
Extra cost of buying (per machine hour) (₹)	3.00	2.80

Priority should be given to the In-house production of component M in order to minimize the extra cost of buying-in.

(iv) **Components to be manufactured by XYZ**

M = 75 units (75 units × 2 hours) = 150 machine hours

N = 50 units [(300 – 150 machine hours)/ 3]

**Q) 3**

**MTP Dec'18**

Excel Electronics manufacturing electronic equipments is currently procuring component A from a local supplier at a cost of ₹60 each. The company is presently considering the proposal for installing a machine for the manufacture of the component. It has two alternative proposals as under:

- (A) Installation of semi-automatic machine involving an annual fixed expenditure of ₹36 lakhs and a variable cost of ₹24 per component manufactured.
- (B) Installing an automatic machine involving an annual fixed expenditure of ₹ 60 lakhs and a variable cost of ₹ 20 per component manufactured.

You are **required** to:

- (i) **Find** the annual requirement of components to justify a switch-over from procurement of components to manufacture of the same by installing (I) semiautomatic machine and (II) automatic machine.
- (ii) **Advise** the company on the machine to be installed if the annual requirement of the components is 5,00,000 units.
- (iii) **Advise** the company at what annual volume it should select automatic machine instead of semi-automatic machine. [3 + 3 + 2 = 8]

<p><b>Reference</b></p> <p><b>Indifference Point</b></p>	<p><b>What's New</b></p> <p><b>Annual requirement calculation</b></p>
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**Answer**

- (i) **Components required to be produced to justify the installation of the machine**

	Semi-Automatic machine (₹)	Automatic Machine (₹)
Purchase price of the component		
Variable Cost	60	60
Saving	24	20
	36	40
Fixed Cost	36,00,000	60,00,000
Components required to be produced to justify the installation of the machine	$36,00,000/36 = 1,00,000$	$60,00,000/40 = 1,50,000$

- (ii) **If the annual requirement is 5,00,000 units:**

Variable Cost	1,20,00,000	1,00,00,000
Fixed Cost	36,00,000	60,00,000
Total cost	1,56,00,000	1,60,00,000

**Recommendation:** Install semi-automatic machine.

(iii)

Fixed costs for Automatic machine	₹ 60,00,000
(-) Fixed costs for Semi-Automatic machine	₹ 36,00,000
Difference	₹ 24,00,000

**Volume required to justify Automatic machine = 24,00,000 / 4 = 6,00,000 components.**

## Q4

## CMA Mat

AB Ltd manufactures a picnic table which has three components, X,Y,Z one of each being required for each table. The company is working to its full machine capacity of 28,000 hours per period and the machinery used is capable of making all the components.

The tables are made in batches of 20 and data relating to current production are:

Components	Per batch of 20			
	Machine Hours	Variable Costs ₹	Fixed Costs ₹	Total Costs ₹
X	6	15	6	21
Y	10	18	7	25
Z	12	18	13	31
Assembly	28	32	13	45
		83	44	127
		Profit		23
		Selling price		150

Over the next budget period the machine capacity cannot be increased although the assembly capacity can be increased as required. The budget for the next period is being prepared. Because of the expected increase in sales, purchase of one of the components is being considered and the following quotation has been received:

### Batches of 20

Component	Price (₹)
X	22
Y	28
Z	32

The company has decided that only one component will be bought outside in any one period. The sales director thinks that he could sell at least 50% more tables than at present and probably 75% more provided that the production capacity was available.

You are **required** to:

- (a) **Recommend** which component should be bought outside if production is increased by 50% and how many components should be bought;

(b) **Recommend** which component should be bought outside if production is increased by 75% and how many components should be bought.

<p><b>Reference</b></p> <p><b>Buy any one component to match the increased demand</b></p>	<p><b>What's New</b></p>
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**Answer**

No. of units being produced at present =  $28,000/28 = 1000$

**Statement showing Contribution (or) buying cost per machine hour.**

Particulars		X	Y	Z
I	Price quoted (₹)	22	28	32
II	Variable cost (₹)	15	18	18
III	Contribution (₹)	7	10	14
IV	Contribution (or) Buying cost per Machine hour (₹)	1.17 (7/6)	1.00 (10/10)	1.17 (14/12)

Since, the buying cost per machine hour is less in case of Y it should be bought from outside.  
No. of units that may be bought from outside.

(a) **If 50% capacity is increased:**

Hours utilized for X = $1,500 \times 6$	=	9,000 hours
(1,000 x 150%) Z = $1,500 \times 12$	=	18,000 hours
		27,000 hours

Remaining hours =  $28,000 - 27,000 = 1,000$  hours

No. of units that can be manufactured by Y =  $1,000/10 = 100$  units

No. of units to be bought from outside =  $1,500 - 100 = 1,400$  units

(b) **If 75% capacity is increased:**

Hours utilized for X = $1,750 \times 6$	=	10,500 hours
Z = $1,750 \times 12$	=	21,000 hours

This is not possible because if Y is bought from outside, the available hours are not sufficient to manufacture X & Z and it is also given that only one component should be bought from outside. We have to buy from outside either X (or) Z and it will not matter if we buy any one of these because the buying cost per machine hour is same.

In that event, we shall try to purchase from outside which takes more machine hours, at present i.e. Z. On calculation no. of units of Z to be bought from outside is as follows:

Hours utilized for making X = 1,750 x 6 =	10,500 hours
Y = 1,750 x 10 =	17,500 hours
	28,000 hours

No. of units of Z to be bought from outside = 1,750 units.

**Q5**

**CMA Mat; MTP Dec'21**

Household Equipments Ltd. is producing kitchen equipment from five components three of which are made using general purpose machines and two by manual labour. The data for the manufacture of the equipment is as follows:

Components	A	B	C	D	E	Total
Machines hours reqd. per unit	10	14	12			36 hrs
Labour hours reqd. per unit				2	1	3hrs
Variable cost per unit (in ₹)	32	54	58	12	4	160
Fixed cost per unit (apporioned) ₹	48	102	116	24	36	316
Total component cost ₹	80	156	174	36	30	476
Assembly cost/unit (all variable)						₹40
Selling price/unit						₹600

The marketing department of the company anticipates 50% increase in demand during the next period. General purpose machinery used to manufacture. A, B and C is already working to the maximum capacity of 4752 hours and there is no possibility of increasing this capacity during the next period. But labour is available for making components D and E and also for assembly according to demand. The management is considering the purchase of one of the components A, B or C from the market to meet the increase in demand. These components are available in the market at the following prices:

Components A	₹ 80
Components B	₹ 160
Components C	₹ 125

**Required:**

- Profit made by the company from current operations.
- If the company buys any one of the components A,B or C, what is the extent of additional capacity that can be created?
- Assuming 50% increase in demand during the next period, which component should the company buy from the market?
- The increase in profit, if any, if the component suggested in (c) is purchased from the market.

<p><b>Reference</b></p> <p><b>Buy any one component to match the increased demand</b></p>	<p><b>What's New</b></p>
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**Answer**

(a) **Statement showing profit at current operations:**

		Amount (₹)
SP		600
Variable Cost	(160 + 40)	200
Contribution		400
No. of units	4752/36	Units 132
Total Contribution		52,800
Fixed Cost		41,712
Profit		11,088

Amount (₹)

	A	B	C
Buying cost	80	160	125
Variable Cost	32	54	58
Extra buying Cost	48	106	67
Excess buying cost per hour	4.8	7.571	5.583

It is better to buy component A from the market because excess buying cost per machine hour is less.

**Computation of additional capacity created if components are bought from outside:**

<b>If A is bought:</b>		
No. of units that can be manufactured	(4752/26)	182.76 units
Increase in capacity	(182.76 – 132/132 × 100)	38.46 %
<b>If B is bought:</b>		
No. of units	(4752/22)	216
Increase in capacity	(182.76 – 132/132 × 100)	63.64%
<b>If C is bought:</b>		
No. of units	(4752/24)	198
Increase in capacity	(198 – 132/132 × 100)	50%

(c) **A is cheaper to buy.** But the increase in capacity will not be sufficient to meet the expected demand for next year. Therefore, we shall try to buy the next cheaper component. i.e.,

C and by buying it the increase in capacity will be exactly equal to the demand for our product during the next year. **Hence, component 'C' should be bought from the market.**

(d) **Statement showing computation of profit by buying C from outside:**

(I) No. of Units	(4,752/24)	Units 198
(II) Selling Price		₹ 600
(III) Variable Cost	(200 – 58 + 125)	₹ 267
(IV) Contribution		₹ 333
(V) Total Contribution		₹ 65,934
(VI) Fixed Cost		₹ 41,712
(VII) Profit		₹ 24,222
Less: Existing Profit		₹ 11,088
Increase in profit		₹ 13,134

**Q6**

**MTP Jun'22**

Demand for two-wheelers has gained pace since the easing of Covid-induced curbs by state governments and the momentum is expected to continue well into the festive season, said a top executive at one of the largest automobile manufacturers in the country. In the country, two-wheelers primarily include motorcycles, mopeds, scooters and electric two wheelers. Some of the key factors driving the demand of two wheelers in India include its ease of maneuvering through congested roads, lower carbon emissions, higher fuel efficiency, and providing an economical mode of transportation in comparison to three or four wheeled vehicles. Furthermore, rising urbanization, improving road infrastructure, and increasing number of women consumers are also catalyzing the demand of two wheelers in India. The market, however, faces some challenges as well. Increasing work from home practice, which does not require people to commute to work may negatively impact demand over the next few years. Furthermore, increasing petrol prices in the country may also act as a constraint for market growth, particularly, in the entry level price sensitive category. Overall, it is expected that the two-wheeler market is to revive from 2021 onwards and exhibit moderate growth during 2021-2026. Vehicle's exhaust system is designed to take care of toxic emissions automobiles produces. It will direct harmful hydrocarbons away from the driver and passengers, and reduce the air pollutants automobiles releases into the environment, helping keep the air clean. An additional benefit is that the exhaust system significantly reduces the amount of noise automobiles produce. An exhaust system in working order will keep automobiles sounding pleasant as it runs and will reduce noxious gases. Motorcycle exhaust system also known as muffler is made to route exhaust gases away from the engine. As fuel burn inside the engine gases and fumes are produced, so this gases and fumes need to be taken out from the engine. The exhaust system does the work. The muffler also captures some of the harmful toxins in the gases before they are released into the atmosphere. It also helps regulating engine noise. Some are made to create specific sounds to certain motorcycles. Silencer has to muffle the vibrations of the exhaust gases, reduce their velocity and thus reduce the amount of noise emitted from the engines. The pulsating low from each cylinder's exhaust process of an automobile petrol or diesel engine sets up pressure

waves in the exhaust system-the exhaust port and the manifold having average pressure levels higher than the atmospheric. This varies with the engine speed and load. At higher speeds and loads the exhaust manifold is at pressures substantially above atmospheric pressure. These pressure waves propagate at speed of the sound relative to the moving exhaust gas, which escapes with a high velocity producing an objectionable exhaust boom or noise. A suitably designed exhaust silencer accomplishes the muffling of this exhaust noise. Which means that the exhaust gases from an internal-combustion engine are passed to attenuate (reduce) the airborne noise of the engine.

To be efficient as a sound reducer, a muffler must decrease the velocity of the exhaust gases and either absorbs sound waves or cancel them by interference with reflected waves coming from the same source. A typical sound absorbing material used in a muffler is a thick layer of fine fibers, the fibers are caused to vibrate by the sound waves, thus converting the sound energy into heat. Mufflers that attenuate sound waves by interference are known as reactive mufflers. These devices generally separate the waves into two components that follow different paths and then come together again out of phase (out of step), thus cancelling each other out and reducing the sound.

The trends for the two-wheeler segment in India:

Particulars	Costs per unit	Total for 10,000 units
Direct Materials	4.00	40,000
Direct Manufacturing Labour	2.00	20,000
Power and Utilities (variable)	1.50	15,000
Inspection, Set-Up and Materials Handling		2,000
Machine Rent		3,000
Allocated Fixed Costs of Plant Administration, Insurance, etc.		30,000
Total Costs		1,10,000

MNC received an offer from an outside vendor for the supply of any number of mufflers at ₹ 8.20 per Muffler. The following additional information is available on MNC's operations –

- Inspection, Set-up and Materials Handling Costs vary with the number of batches in which the Mufflers are produced. MNC currently produces the Mufflers in batches of 1,000 units. It estimates that 10 batches are required for meeting the expected production requirements.
- MNC rents the machine used to make the Mufflers. If it chooses to outsource the Mufflers, machine rent can be avoided.

**Required:**

- Should** MNC accept the Vendor's offer for 10,000 units? What is the maximum price payable to the Vendor? [3]
- Suppose the Mufflers were purchased from outside, the facilities where the Mufflers are currently made will be used to upgrade the bicycles by adding Mud Flaps and Reflectors. As a result, the Selling Price of the Bicycles can be increased marginally by ₹ 20. The Variable costs of the upgrade would be 18 and additional Tooling Costs of ₹ 16,000 would

be incurred. **Should** MNC make or buy the Mufflers, at the anticipated production level of 10,000 units and why? [3]

- c. **What** is the maximum price payable to the Vendor in the situation of (b)? [2]
- d. MNC's Sales Manager is concerned that the estimate of 10,000 units may be high and believes that only 6,200 units can be sold. Production will be cut back, freeing up work facilities and space. This space can be used to add the Mud Flaps and Reflectors whether MNC outsources the Mufflers or makes them in-house. At this lower output, MNC will produce the mufflers in 8 batches of 775 units each. **Should** MNC purchase the Mufflers from the Outside Vendor? [4]

Reference

**Make or buy decision**

What's New

**Maximum Price Payable**

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## Learning Objective

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### 1. APPLICABILITY

On Finished Goods or a part of Finished Goods Production

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### 2. FACTORS INFLUENCING DECISIONS

- a. Cost Factors
- b. Non Cost Factors

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### 2. NON COST FACTORS

- a. Quality and Secrecy
- b. Quantity
- c. Time
- d. Peer Co-operation
- e. Focus
- f. Capacity
- g. Investment
- h. Skills

## COST FACTORS

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### 1. CAPACITY AVAILABLE FOR QUANTITY REQUIRED

Step 1 : Relevant Cost of Manufacture

Step 2 : Purchase Cost

Step 3 : Compare and Decide

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### 2. CAPACITY REQUIRED IS MORE THAN CAPACITY AVAILABLE

Step 1 : Compare Relevant Cost of Manufacture and Purchase and Decide

Step 2 : For Components to be manufactured, Find savings in manufacturing per unit

Step 3 : Find Hours / Unit of Manufacture

Step 4 : Find Savings in Manufacturing per Hour

Step 5 : Rank for Manufacture

Step 6 : Allocate the available Capacity to manufacture

Step 7 : Purchase what quantity could not be produced



## Learning Objective

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### 3. DIFFERENCE BETWEEN KEY FACTOR & SUBCONTRACTING APPROACH

- a. Key Factor - First Produce & Purchase remaining
- b. Subcontracting - Compare Produce and Purchase and then decide

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**Q1**

**CMA Mat**

T.T.D Ltd., manufacturing a single product has normal working capacity of 8,000 units per annum. The sales manager has projected a sale of 10,000 units for the year 2015 - 16 at a price of ₹250 per unit.

The operating budget for 2015-16 as under:

	₹ in lakhs	₹ in lakhs
Sales: 8,000 units @ ₹250 each		20.00
Cost of production		
Raw material	12.00	
Direct wages	3.00	
Works overhead (50% Fixed)	1.40	
Admn. overhead (all fixed)	0.60	
Selling & Distribution OH (80% fixed)	1.00	18.00
Profit		2.00

In order to increase production to meet the sales demand, two proposals have been put forward as under:

- (1) Subcontracting the production of 2,000 units at ₹225 per unit.
- (2) Installing additional machine which will entail the following expenses :
  - (a) Cost of machine ₹2,00,000; Life 20 years
  - (b) Recruitment of 10 workers including direct workers to operate the machine at a wage rate of ₹500 each per month. Add 25% towards fringe benefits. (None of the existing workers will be utilised for this purpose).
  - (c) Interest on capital required for the purchase of machine 15% p.a.

The following additional fixed expenses will be required in respect of both alternatives. Administration expenses - ₹10,000 per year.

Selling & Distribution expenses - ₹20,000 per year.

You are **required to prepare**

- (1) A statement showing respective profitability of the two methods of increasing the production.
- (2) Comment upon the choice of one of the two proposals.

<p><b>Reference</b> <b>Make/Subcontract</b></p>	<p><b>What's New</b> <b>Wage cost in 2nd option</b></p>
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**Answer**

**Statement Showing Computation of Profit at Proposed alternatives as well as present position:**

		Present Position (8,000) ₹ In lakhs	Sub Contract (10,000) ₹ In lakhs	Own Expansion (10,000) ₹ In lakhs
I.	Sales	20	25	25
II.	Variable Cost			
	Raw Materials	12	12	15
	Direct Wages	3	3	3
	Works Overhead	0.7	0.7	0.875
	Selling & Distribution Overhead	0.2	0.2	0.25
	Sub Contract Cost		4.5	
	Add Workers			0.75
		15.9	20.4	19.875
III.	Contribution	4.1	4.6	5.125
IV.	Fixed Cost	2.1	2.4	2.8
V.	Profit	2.0	2.2	2.325

The best proposal is to produce by their own to meet the additional demand by installing a new machine because it has highest profit.

Fixed Cost includes interest & depreciation.

**Q2**

**CMA Mat**

A Modern Packing Corporation specialises in the manufacture of one-liter plastic bottles. The firm's customers include dairy processors, fruit juice manufacturers and manufacturers of edible oils. The bottles are produced by a process called blow moulding. A machine heats plastic to the melting point. A bubble of molten plastic is formed inside a mould, and a jet of hot air is forced into the bubble. This blows the plastic into the shape of the mould. The machine releases the moulded bottle, an employee trims off any flashing (excess plastic around the edge), and the bottle is complete.

The Firm has four moulding machines, each capable of producing 100 bottles per hour. The firm estimates that the variable cost of producing a plastic bottle is 20 paise. The bottles are sold for 50 paise each.

Management has been approached by a local toy company that would like the firm to produce a moulded plastic toy for them. The toy company is willing to pay ₹ 3.00 per unit for the toy. The variable cost of manufacture of the toy will be ₹2.40. In addition, Modern Packing Corporation would have to incur a cost of ₹20,000 to construct the needed mould exclusively for this order. Because the toy uses more plastic and is of a more intricate shape than a bottle, a moulding machine can produce only 40 units per hour. The customer wants 1,00,000 units. Assume that

Modern Packing Corporation has the total capacity of 10,000 machine hours available during the period in which the toy company wants the delivery of toys. The firm's fixed costs, excluding the costs to construct the toy mould, during the same period will be ₹2,00,000.

**Required:**

- (a) If the management predicts that the demand for its bottles will require the use of 7,500 machine hours or less during the period, **should** the special order be accepted? **Give** the reasons.
- (b) If the management predicted that the demand for its bottles would be higher than its ability to produce bottles, **should** the order be accepted? **Why?**
- (c) The management has located a firm that has just entered the moulded plastic business. The firm has considerable excess capacity and more efficient moulding machines and is willing to subcontract the toy job, or any portion of it for ₹ 2.80 per unit. It will construct its own toy mould. **Determine** Modern Packing Corporation's minimum expected excess machine hour capacity needed to justify producing any portion of the order itself rather than subcontracting it entirely.
- (d) The management predicted that it would have 1,600 hours of excess machine hour capacity available during the period. Consequently, it accepted the toy order and subcontracted 36,000 units to the other plastic company. In fact demand for bottles turned out to be 9,00,000 units for the period. The firm was able to produce only 8,40,000 units because it had to produce the toys. **What** was the cost of the prediction error failure to predict demand correctly?

<p><b>Reference</b></p> <p><b>Evaluation of offer</b></p>	<p><b>What's New</b></p> <p><b>Indifference Point</b></p>
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**Answer**

Contribution From M bottle per hour	[100(0.5 - .2)]	₹30
Contribution from toy per hour	[40(3 - 2.4)]	₹24

- (a) When the demand for the bottles is 7,500 or less hours, it is better to accept, toy order because it gives additional profit of ₹40,000
- (b) When the capacity for bottles is more than 7,500 hours, the toy order should not be accepted because the contribution of bottle ₹30, is more than the contribution per hour of toy ₹24
- (c) The level at which it is necessary to sub contract the toy order is  $[20,000 / (2.8 - 2.4)] = 50,000$  units

(d) **Computation of cost of prediction error.**

(i) **Statement showing computation of profit if 36,000 toys are given for sub contract**

	Bottles	Toy Manufacture	Toy Sub contract	Total
i. No. of units	8,40,000.00	64,000.00	36,000.00	
ii. Contribution per unit (₹)	0.30	0.60	0.20	
iii. Total contribution (₹)	2,52,000.00	38,400.00	7,200.00	2,97,600.00
iv. Fixed cost (₹)	2,00,000.00	20,000.00		2,20,000.00
v. Profit (₹)	52,000.00	18,400.00	7,200.00	77,600.00

(ii) **Computation of profit at actual position**

	Bottles	Toys	Total
i. No. of units	9,00,000.00	1,00,000.00	
ii. Contribution per unit (₹)	0.30	0.20	
iii. Total contribution (₹)	2,70,000.00	20,000.00	2,90,000.00
iv. Fixed cost (₹)	2,00,000.00		2,00,000.00
v. Profit (₹)	70,000.00	20,000.00	90,000.00
Therefore cost of prediction error	(90,000 – 77,600)		₹12,400

### Q3

The following data is given for four products:

	A	B	C	D
Selling Price per unit (₹)	150	80	105	90
Variable cost per unit (₹)	100	50	60	70
Purchase price per unit (₹)	120	60	100	50
Hours required per unit	2	5	10	1
Maximum demand (units)	1,000	1,000	1,000	1,000

Hours available are 14,500 hours

**State** which of the product should be manufactured or purchased under:

- (a) Key Factor Approach
- (b) Sub Contracting Approach

<p><b>Reference</b></p> <p><b>Key Factor VS Sub Contracting</b></p>	<p><b>What's New</b></p>
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**Answer**

(a) **Key Factor Approach**

**Statement of Ranking**

Particulars	A	B	C	D
Selling Price	150	80	105	90
(-) Variable Cost	100	50	60	70
Contribution per unit	50	30	45	20
Hour required per unit	2	5	10	1
Contribution per Hour	25	6	4.5	20
Rank	I	III	IV	II

**Statement of Optimum Mix**

Product	Hour Allotted	Units Produced	Contribution
A (I)	2,000	1,000	1,000 × 50 = 50,000
D (II)	1,000	1,000	1,000 × 20 = 20,000
B (III)	5,000	1,000	1,000 × 30 = 30,000
C (IV)	6,500	$\frac{6,500}{10} = 650$	650 × 45 = 29,250
	14,500		
C Purchased	-	350	350 × (105 - 100) = 1,750
Total Contribution			1,31,000

(b) **Sub Contracting Approach**

**Statement of Ranking**

Particulars	A	B	C	D
Relevant Cost of Manufacturing				
Variable Cost	100	50	60	70
Purchase Price	120	60	100	50
Decision	Make	Make	Make	Buy or Sub Contract
Savings in Manufacturing per unit	20	10	40	-
Hour per unit	2	5	10	-
Savings in Manufacturing per hour	10	2	4	-
Rank	I	III	II	

**Statement showing Optimum Mix and Contribution**

Product	Hour Allotted	Units Produced	Contribution
<b>Make</b>			
A (I)	2,000	1,000	1,000 × 50 = 50,000
C (II)	10,000	1,000	1,000 × 45 = 45,000
B (III)	2,500	500	500 × 30 = 15,000
	14,500		
<b>Sub Contract</b>			
B	–	500	500 × (80 – 60) = 10,000
D	–	1,000	1,000 × (90 – 50) = 40,000
<b>Total Contribution</b>			<b>1,60,000</b>

**Q4**

**RTP Jun'18**

AUES manufactures two products P and Q. Both the products pass through the Company's two Departments, A and B. The market demand for a month is 2,500 units of P and 2,000 units of Q. The Company has a normal capacity of 600 hours in Department A and 520 hours in Department B per month. Overtime is acceptable upto 50% of normal hours in each department. Details relating to the products and departments are –

Product	P	Q	Department	A	B
Direct Material Cost	₹ 10 p.u.	₹ 5 p.u.	Direct Labour time required –		
			P (minutes per unit)	6	12
			Q (minutes per unit)	18	12
Fixed OH per month	₹ 18,000	₹ 6,400	Direct Wage Rate per hour –		
			Normal Time	₹10	₹12
			Overtime	₹15	₹18

If the Company is not able to fulfill the demand for want of capacity, the balance quantity of products can be sold by buying from a sub - contractor, who has agreed to supply Product P at ₹18 and Product Q at ₹12 per unit.

- Calculate** the quantity of each product to be manufactured and / or to be sub - contracted in a most economical way of fulfilling the market demand.
- Present** a statement showing the Total Costs involved in your solution above.

<p><b>Reference</b></p> <p><b>Make/ Sub contract</b></p>	<p><b>What's New</b></p>
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**Answer**

1. **Identification of Key Factor**

Particulars		Department A	Department B
(a) Normal Time Available	Given	600 hours	520 hours
(b) Possible Overtime at 50%	50% of (a)	300 hours	260 hours
(c) Total Time Available	(a+ b)	900 hours	780 hours
(d) Time Read for P Production	P (2,500 units)	$2,500 \times 6/60 = 250$ hours	$2,500 \times 12/60 = 500$ hours
(e) Time Read for Q Production	Q (2,000 units)	$2,000 \times 18/60 = 600$ hours	$2,000 \times 12/60 = 400$ hours
(f) Total Time required	(d + e)	850 hours	900 hours
(g) Whether Key Factor		(See Note) Yes	Yes

Note: A Resource is considered as a Key Factor when its normal availability is less than its requirement. For this purpose, only the Normal Time as per (a) is compared with Total Requirement as per (f). Overtime is not considered here because - (a) Overtime is only a possibility, not compulsory, and (b) Costs undergo an increase during overtime.

2. **Computation of Contribution per unit of product:** (Production during Normal Time)

Particulars	Product P	Product Q
(a) Cost of Buying per unit	₹ 18.00	₹12.00
(b) Variable Cost of Make: Materials	₹10.00	₹5.00
Labour - Department A	$₹10 \times 6/60 = ₹1.00$	$₹10 \times 18/60 = ₹3.00$
Labour - Department B	$₹12 \times 12/60 = ₹2.40$	$₹12 \times 12/60 = ₹2.40$
Total Costs of own make	₹13.40	₹10.40
(c) Savings per unit, if made in Normal Time	₹ 4.60	₹1.60

**Observation:** Since there is a savings per unit if made during normal time, the company should first prefer own production of both products and if limited by capacity, may sub-contract (buy) the balance quantity.

3. **Effect of overtime work on Contribution per unit of the Products**

Particulars	Product P	Product Q
(a) Savings per unit, if made during Normal Time	₹ 4.60	₹ 1.60
(b) Effect of Overtime premium: 50% of Normal Costs		
Labour - Department A	$5 \times 6/60 = ₹0.50$	$₹5 \times 18/60 = ₹1.50$
Labour - Department B	$6 \times 12/60 = ₹1.20$	$₹6 \times 12/60 = ₹1.20$
(c) Savings per unit, if made in Overtime	₹2.90	(₹1.10)

**Note:** Since the Normal Time Labour Cost has already been considered in the computation of Savings per unit, the Overtime Premium is the only incremental cost and is hence relevant.

**Observation based on effect of Overtime Work:**

- (i) **Normal Time Work:** Both products P and Q can be produced during normal time as cost of make is less than cost of buy. There is a saving of ₹4.60 and ₹1.60 per unit, on own production.
- (ii) **Overtime Work:** The effect of overtime work differs for the products as under -
  - Product P can be produced during Overtime Work, either in Department A or Department B or in both. There will be a saving of ₹2.90 p.u., due to own production, even if Overtime Work is involved in both Departments A and B.
  - Product Q can be produced during Overtime Work, either in Department A only (saving of ₹0.10) or in Department B only (saving of ₹0.40), but not in both. If Overtime Work is required in both departments for Product Q, it is better to sub-contract the same.

4. **Computation of Ranking Priority (Savings per Labour Hour in Departments A and B)**

Particulars	Product P	Product Q
(a) Savings per unit, if made during normal time	₹4.60	₹1.60
(b) Hours required in Department A	6/60 hours	18/60 hours
(c) Savings per hour in Department A = (a ÷ b)	₹46 per hour	₹5.33 per hour
(d) Ranking for production in Department A	I	II
(e) Hours required in Department B	12/60 hours	12/60 hours
(f) Savings per hour in Department B = (a ÷ e)	₹23 per hour	₹8.00 per hour
(g) Ranking for production in Department B	I	II

**Note:** Since ranking priorities on the Key Factors are the same, the solution can be obtained as given below. In case of different priorities on Multiple Key Factors, Linear Programming Techniques may be used for resource allocation.

5. **Key Factor Allocation and Production Decision**

Particulars		Department A	Department B
(a) Normal Time Available		600 hours	520 hours
(b) Possible Overtime at 50%		300 hours	260 hours
(c) Total Time Available	(a + b)	900 hours	780 hours
Time Allocation: (see Table below)		Hours Utilised	Hours Utilised
<b>Stage 1: Make - Normal Time</b>	P = 2,500 units	$2,500 \times 6/60 = 250$ hours	$2,500 \times 12/60 = 500$ hours
<b>Stage 2: Make - Normal Time</b>	Q = 100 units	$100 \times 18/60 = 30$ hours	(bal .fig.)=20hours

<b>Stage 3: Make - Overtime in B</b>	Q = 1,067 units	(bal. fig.) = 320 hours	$1,067 \times 12/60 = 213$ hours
<b>Stage 4: Sub-contract</b>	Q = 833 units	No further production possible since OT is involved in both Depts. A and B which is not economical.	

Stage	Explanation
1	Product P has maximum preference for own production. Hence it will be produced first. Time utilised therefore = 250 hours and 500 hours of Normal Time in A and B. Balance time left will be 350 hours in Department A and 20 hours in Department B.
2	Least Normal Time available is 20 hours in Department B. This will be utilised in production of Q, equivalent to $20 \div 12/60$ hours = 100 units. This will utilise $100 \text{ units} \times 18/60 = 30$ hours in Department A.
3	Balance Normal Time is 320 hours in Department A. This will be utilised in production of Q, equal to $320 \div 18/60$ hours = 1,067 units. This will utilise $1,067 \times 12/60 = 213$ hours (in Overtime) in Dept B. Since this is within the permissible overtime limit of 260 hours, this production is feasible. [Note: If available overtime is less than 213 hours, production of Q will be restricted to that level.]
4	Now both Departments require overtime operation for Product Q. Since this is costlier when compared to sub-contracting, the Firm should purchase the balance requirements of Product Q.

6. **Statement of Contract Costs**

Particulars	Decision	Quantity	Cost per unit	Total Cost
Product P	Make in Normal Time	2,500 units	(WN 2b) ₹13.40	₹33,500.00
Product Q	Make in Normal Time	100 units	(WN 2b) ₹10.40	₹1,040.00
Product Q	Make - Overtime in B	1,067 units	(Note) ₹11.60	₹12,377.20
Product Q	Sub-Contract	833 units	(WN 2a) ₹12.00	₹9,996.00
Fixed Costs	Given = ₹18,000 + ₹6,400			₹24,400.00
				₹81,313.20

**Note:** Cost of making Q by working Overtime in Department B = Normal Time Cost + Overtime Premium of Product Q in Department B = ₹10.40 + ₹1.20 (WN 3b) = ₹11.60 per unit.

Unit 7  
**Service Costing**



**Learning  
Objective**

1. NATURE OF SERVICE COSTING
2. SIGNIFICANCE OF SERVICE COSTING
3. PRICING SERVICE SECTOR
4. PASSENGER TRANSPORT
5. HOTEL INDUSTRY
6. HOSPITAL INDUSTRY

SJC Institute

## 1. OPERATING OR SERVICE COSTING

Cost Accounting has been traditionally associated with manufacturing companies. However in the modern competitive market, cost accounting has been increasingly applied in service industries like banks, insurance companies, transportation organizations, electricity generating companies, hospitals, passenger transport and railways, hotels, road maintenance, educational institutions, road lighting, canteens, port trusts and several other service organizations. The costing method applied in these industries is known as 'Operating Costing'.

According to CIMA [London] operating costing is, **'that form of operating costing which applies where standardized services are provided either by an undertaking or by a service cost center within an undertaking'**.

## 2. NATURE OF OPERATING COSTING

The main **objective of operating costing is to compute the cost of the services offered by the organization**. For doing this, it is necessary to decide the unit of cost in such cases. The cost units vary from industry to industry. **For example**, in goods transport industry, cost per ton kilometer is to be ascertained while in case of passenger transport, cost per passenger kilometer is to be computed. Cost units used in different service units are explained in detail later in chapter. The next step is to collect and identify various costs under different headings.

**The headings used are,**

- (a) Fixed or standing charges
- (b) Semi-fixed or maintenance charges
- (c) Variable or running charges.

One of the **important features of operating costing is that mostly such costs are fixed in nature**. For **example**, in case of passenger transport organization, most of the costs are fixed while few costs like diesel and oil are variable and dependent on the kilometers run.

Because of the diverse nature of activities carried out in service undertakings, the cost system used is obviously different from that of manufacturing concern. Let us discuss the method of computing costs in various service organisations .

**Transport Organisation:** Costing in a transport industry consists of determining the operating cost of each vehicle and applying this cost to find out the cost per unit of service rendered by a vehicle. The cost unit is selected with proper care keeping in view the needs of each concern, the weight, bulk, volume and type of goods carried and distance covered in each trip. Transport undertakings include goods transport organizations as well as passenger transport organizations. The cost unit is either ton kilometer or passenger kilometer. The meaning is cost of carrying one ton over a distance of one kilometer or cost of carrying one passenger for a distance of one kilometer.

**Collection of Costs :** A log book is maintained for each vehicle to record details of trips made by the vehicle during a specified period of time. Log book is maintained usually on a daily basis. The details shown in the log book enables the management to make suitable allocation of vehicles,

to avoid the duplicate trips, or to avoid idle running capacity. The log book also provides the information relating to the fuel consumed, distance travelled, no of hours travelled, chargeable kilo meters. The log book provide the data for proper allocation of cost and in this respect these may be compared with the production details available in a manufacturing concern

### Classification of Costs:

The costs of a transport organisation can be classified and accumulated under the following heads:-

- (a) **Fixed or stand-by costs:** These costs which include garage charges, insurance, taxes, license, depreciation, wages of drivers, cleaner's salary, establishment cost of workshop and office. Out of the above some of the costs are directly identifiable for each vehicle such as license fee and some are apportioned such as office expenses
- (b) **Maintenance Charges:** These costs are in the nature of semi-variable nature includes expenditure on maintenance, repairs, tyres, tubes and other charges.
- (c) **Operating and Running costs:** These costs are variable in nature, includes fuel, lubricating oil, wages of drivers/ cleaners (if paid on per trip / kilometer). These costs can be easily identifiable with each of the vehicle.

## 3. SIGNIFICANCE OF OPERATING OR RUNNING COSTS

- (i) Control of operating and running cost and avoidance of waste of fuel and other consumable material.
- (ii) Cost of running own vehicles may compared with the hired or other forms of transport.
- (iii) Facilitates quotation of hiring rates to outside parties who ask for the transport service.
- (iv) If transport service is treated as a separate department or service cost center, the costs to be charged to the requesting department may be easily determined.
- (v) Suitable information is obtained for efficient routing of vehicles.
- (vi) Cost of idle vehicles and lost running time is easily obtained.

## 4. PRICING SERVICE SECTOR [DEC'21]

- Supply and labour billing.
- Pure labour billing Cost plus pricing
- Service overhead based billing

**Q1**

**MTP Dec'19**

A practicing Cost and Management Accountant now spends ₹0.90 per K.m on taxi fares for his client's work. He is considering two other alternatives the purchase of a new small car or an old bigger car.

Item	New Small Car (₹)	Old Bigger Car (₹)
Purchase Price	35,000	20,000
Sale price after 5 years	19,000	12,000
Repairs and Servicing p.a	1,000	1,200
Taxes and insurance p.a	1,700	700
Petrol consumption per liter (k.m)	10	7
Petrol price per liter	3.5	3.5

He estimates that he does 10,000 Km annually. **Which** of the three alternatives will be cheaper? If his practice expands he has to do 19,000 Km p.a. **where** will the cost of the two cars break even and **why**? Ignore interest and Income-tax. [6]

Reference: **Passenger Transport**

What's **New**

**Answer**

Statement Showing computation of break even point for three alternatives

	Taxi Amount (₹)	New Smaller Car Amount(₹)	Old Bigger Car Amount(₹)
Fixed Cost:			
Depreciation		16,000/5 = 3,200	8,000/5 = 1,600
Repairs		1,000	1,200
Taxes and Insurance		1,700	700
Total Fixed Cost (A)		5,900	3,500
Variable Cost Per KM (B)	0.9	0.35	0.5
Total Variable Cost for 10,000 KM (C)	9,000	3,500	5,000
Total Variable Cost for 19,000 KM (D)	17,100	6,650	9,500
Total Cost For 10,000 KM (A+C)	9,000	9,400	8,500
Total Cost For 19,000 KM (A+D)	17,100	12,550	13,000

- (a) At 10,000 KMS old bigger car is cheaper than the other two alternatives.
- (b) At 19,000 KMS it is better and cheaper to purchase the new smaller car.

**Indifference point** = (difference in fixed cost / difference in variable cost per unit) = (2,400/0.15)  
= 16,000 kms

## Q2

## MTP Dec'19; Dec'18

A local Government authority owns and operates a leisure centre with numerous sporting facilities, residential accommodation, a cafeteria and a sports shop. The summer season lasts for 20 weeks including a peak period of 6 weeks corresponding to the school holidays. The following budgets have been prepared for the next summer season:

<b>Accommodation:</b>
60 single rooms let on a daily basis.
35 double rooms let on a daily basis at 160% of the single room rate.
<b>Room rate:</b>
Fixed costs ₹29,900.
Variable costs ₹ 4 per single room per day and ₹6.40 per double room per day
<b>Sports centre:</b>
Residential guests each pay ₹ 2 per day and casual visitors ₹ 3 per day for the use of facilities.
Fixed costs ₹15,500.
<b>Sports Shop:</b>
Estimated contribution ₹1 per person per day.
Fixed costs ₹ 8,250.
<b>Cafeteria:</b>
Estimated contribution ₹ 1.50 per person per day.
Fixed costs ₹12,750.

During the summer season the centre is open 7 day a week and the following activity levels are anticipated.

Double rooms fully booked for the whole season.

Single rooms fully booked for the peak period but at only 80% of

Capacity during the rest of the season.

30 casual visitors per day on average.

You are **required** to:

- Calculate** the charges for single and double rooms assuming that the authority wishes to make a ₹ 10,000 profit on accommodation.
- Calculate** the anticipated total profit for the leisure centre as a whole for the season.
- Advise** the authority whether an offer of ₹2,50,000 from a private leisure company to operate the centre for five years is worth while, assuming that the authority uses a 10% cost of capital and operations continue as outlined above.

<b>Reference</b>  <b>Hotel Industry</b>	<b>What's New</b>
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**Answer**

(a) **Computation of usage of room days**

		₹
<b>Single room</b>		
(60 × 7 × 6)	2,520.00	
(60 × 7 × 14 × 80%)	4,704.00	
		7,224.00
<b>Double room (35 × 7 × 20)</b>		4,900.00
(i) Total sale value of accommodation		
Variable cost		
Single room (7,224 × 4)	28,896.00	
Double room (4,900 × 6.4)	31,360.00	60,256.00
Fixed cost		29,900.00
Required profit		10,000.00
		1,00,156.00

Let 'S' be the room rent of single room and 1.6'S' is the rent of double room Therefore,

$$7,224S + 4,900(1.6S) = 1,00,516$$

$$7,224S + 7,840S = 1,00,516 = S = 6.65$$

$$\text{Double room rent} = (6.65 \times 1.6) = 10.64$$

(b) **Statement showing computation of total profit to leisure centre**

			₹
a. <b>Accommodation</b>			10,000.00
b. <b>Sports centre:</b>			
Total	[(7224 × 2) + (4900 × 2 × 2) + (30 × 7 × 20 × 3)]	46,648.00	
Less : fixed		15,500.00	31,148.00
c. <b>Sports Shop:</b>			
Contribution	[(7224 × 1) + (4900 × 2 × 1) + (30 × 7 × 20 × 1)]	21,224.00	
Less : fixed		8,250.00	12,974.00

<b>d. Cafeteria</b>			
Contribution	$[(7224 \times 1.5) + (4900 \times 2 \times 1.5) + (30 \times 7 \times 20 \times 1.5)]$	31,836.00	
Less : fixed		12,750.00	19,086.00
			73,208.00

(c) **Present values**

Present value compound factor @ 10% for 5 years	3.79
P.V. of profit for 5 years $(73208 \times 3.7906)$	₹ 2,77,500.00

As the present value of profit for 5 years is ₹ 2,77,500, which is more than the lease rent of ₹ 2,50,000, it is not worthwhile to give leisure centre for lease

**Q3**

**RTP Jun'18; RTP Dec'18**

MN Agarwal owns a Gift -shop, a Restaurant and a Lodge in Shillong. Typically, he operates these only during the season period of 4 months in a year. For the past season the occupancy rate in the Lodge was 90% and level of activity in case of Gift Shop and Restaurant at 80%. The relevant data for the past season were as under -

(Amounts in ₹)

	Gift-Shop		Restaurant		Lodge	
	Amount	%	Amount	%	Amount	%
1. Receipts / Sales	48,000	100	64,000	100	1,80,000	100
2. Expenditure:						
Cost of Sales	26,400	55	35,200	55	-	-
Supplies	2,400	5	6,400	10	14,400	8
Insurance & Taxes	1,920	4	6,400	10	36,000	20
Depreciation	2,880	6	8,000	12(1/2)	39,600	22
Salaries	4,800	10	4,800	7(1/2)	25,200	14
Electricity Charges	960	2	3,200	5	13,500	7(1/2)
Total	39,360	82	64,000	100	1,28,700	71(1/2)
3. Profit	8,640	18	-	-	51,300	28(1/2)

**Additional information:**

- Cost of Sales and Supplies vary directly with the occupancy rate In case of Lodge and level of activity In case of Gift Shop and Restaurant.
- Insurances and Taxes and Depreciation are for the entire period of twelve months.
- Salaries paid are for the season period except a Chowkidar for the Lodge who is paid for the full year at ₹ 400 per month.

- (d) Electricity Charges include Fixed Charges of ₹640, ₹1,920 and ₹9,900 for Gift-Shop, Restaurant and Lodge respectively.

The balance amount varies directly with occupancy rate in case of Lodge and level of activity in case of Gift -Shop and Restaurant. Fixed Electric Charges are for the season except in case of Lodge where ₹6,900 is for the season and ₹3,000 for the entire period of twelve months.

Agarwal is interested in increasing his Net Income. The following options are under his consideration -

- (a) To continue the operations during the season period only by inserting advertisement in newspapers thereby occupancy rate to reach 100% in case of Lodge and 90% level of activity in respect of Gift- Shop and Restaurant. The costs of advertisement are estimated at ₹12,000).
- (b) To continue operations throughout the entire period of twelve months comprising season period of four months and off - season period of eight months. The occupancy rate is expected at 90% and 40% during season period and off -season period respectively in case of the Lodge. The room rents are bound to be reduced to 50% of the original rates during off - season period. The level of activity of Gift - Shop and Restaurant is expected at 80% and 30% during season and off - season period respectively but 5% discount on the original rates will have to be offered during off-season period.

**Which** option is profitable? As a Cost Accountant would you like to suggest him any other alternative based upon the above figures, **which** can be adopted to earn more net profit? (Use Incremental Revenue and Cost Approach.)

Reference	What's New
<b>Hotel Industry</b>	

### Answer

#### 1. Additional Revenues and Costs under Option 1: Operate during Season only (₹)

Particulars	Gift Shop	Restaurant	Lodge	Total
1. Additional Revenue	Given = 48,000 at 80%.	Given = 64,000 at 80%.	Given = 1,80,000 at 90%.	34,000
	So, for extra 10% = 48,000 (10/80) = 6,000	So, for extra 10% = 64,000 x (10/80) = 8,000	So, for extra 10% = 1,80,000 x (10/90) = 20,000	
2. Additional Costs				
(a) Cost of Sales	6,000 × 55% = 3,300	8,000 × 55% = 4,400	Nil	7,700

(b) Supplies	$6,000 \times 5\% = 300$	$8,000 \times 10\% = 800$	$20,000 \times 8\% = 1,600$	2,700
(c) Electricity Charges	$(960 - 640) \times (10/80) = 40$	$(3,200 - 1,920) \times (10/80) = 160$	$(13,500 - 9,900) \times (10/90) = 400$	600
(d) Advertisement				12,000
Sub Total				23,000
3. Additional Profit				11,000

2. **Additional Revenues and Costs under Option 2: Operate during all 12 months**

(amounts in ₹)

Particulars	Gift Shop	Restaurant	Lodge	Total
1. Additional Revenue	$48,000 \times 2 \times (30\%/80\%) \times 95\% = 34,200$	$64,000 \times 2 \times (30\%/80\%) \times 95\% = 45,600$	$1,80,000 \times 2 \times (40\%/90\%) \times 50\% = 80,000$	1,59,800
2. Additional Cost				
(a) Cost of Sales	$36,000 \times 55\% = 19,800$	$48,000 \times 55\% = 26,400$	Nil	46,200
(b) Supplies	$36,000 \times 5\% = 1,800$	$48,000 \times 10\% = 4,800$	$1,60,000 \times 8\% = 12,800$	19,400
(c) Salaries	$4,800 \times 2 = 9,600$	$4,800 \times 2 = 9,600$	$(25,200 - 4,800) \times 2 = 40,800$	60,000
(d) Electricity - Fixed	$640 \times 2 = 1,280$	$1,920 \times 2 = 3,840$	$6,900 \times 2 = 13,800$	18,920
(e) Electricity - Variable	$(960 - 640) \times 2 \times (30\%/80\%) = 240$	$(3,200 - 1,920) \times 2 \times (30\%/80\%) = 960$	$(13,500 - 9,900) \times 2 \times (40\%/90\%) = 3,200$	4,400
Sub Total				1,48,920
3. Additional Profit				10,880

3. **Decision:** Both options are desirable since there is an Additional Net Income. **Option 1** is slightly better than **Option 2** by ₹120. However, it is suggested that the Firm should adopt a combination of both options in which case, the Total Additional Profit will be ₹11,000 + ₹10,880 = ₹21,880.

**Q4**

**Dec'19**

Following is the operating results of Premier hospital for the year ended 31st march 2019:

Particulars	₹
Revenue	1,13,88,000
Cost: Variable	26,28,000
Bed capacity cost (fixed) but varies with number of beds	45,30,000

Staff cost	35,10,000
Profit	7,20,000

The hospital charged each patient an average of ₹ 650 per day, had a capacity of 60 beds operated 24 hours per day for 365 days. The hospital has minimum departmental personnel requirements based on totals annual patient days and following table gives the Salary to be paid.

Annual patient days	Salary (₹ in 000s)
10,000 – 14,000	32,00
14,001 – 17,000	33,80
17,001 – 23,725	35,10

**Required:**

- (i) **Compute** the Break even patient days for the year ended 31st March, 2019.
- (ii) **Compute** the Break even patient days for the year ended 31st March, 2020 if the hospital capacity is raised to 80 beds. Patient demand is unknown but assume that revenue per patient and cost per patient day, cost per bed, and employee salary will remain the same as for the year ended 31st March, 2019. [6 + 4 = 10]

<p><b>Reference</b></p> <p><b>Hospital Industry</b></p>	<p><b>What's New</b></p> <p><b>Break even Patient days, Step Fixed Cost</b></p>
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**Answer**

- (i) **Computation of Break even patient days for the year ended 21st March, 2019**

No of patient days operated	1,13,88,000/650	17,520
Variable Cost per patient day	26,28,000/17520	150
Contribution per patient day	650 – 150	500
<b>Fixed Cost</b>		
Bed Capacity cost	45,30,000	
Staff Cost – Salary	35,10,000	80,40,000
<b>Break Even Patient days</b>	80,40,000 / 500	16,080
Since it falls in the previous range revised fixed cost will be :		
<b>Revised Fixed Cost</b>		
Bed Capacity cost	45,30,000	
Staff Cost – Salary	33,80,000	79,10,000
<b>Break Even Patient days</b>	79,10,000/500	15,820

(ii) **Computation of Break even patient days for the year ended 31st March, 2020**

Expected patient demand with 80 beds	$80 \times 365 \times 17,520 / (365 \times 60)$	23,360
Existing Staff salary will return unchanged		
Fixed Cost		
Bed Capacity cost ( $80/60 \times 45,30,000$ )	60,40,000	
Staff Cost – Salary	35,10,000	95,50,000
<b>Break Even Patient days</b>	$9,550,000/500$	19,100

Since, it is in the same range there is no change in the breakeven.

**Q5**

**Dec'21**

Getwell Hospitals is a recently constructed multi speciality hospital and has been operating for the last three years quite successfully. A group of doctors who were founders of this hospital could not use the entire facility by itself to recover costs and make profits. They rented out the hospital facilities to different expert groups like pediatrics, cardiology etc. and collected amounts consisting of two elements-the variable portion relating to the number of patient days and a fixed portion irrespective of the number of beds occupied. Apart from common facilities, the respective expert groups had to engage its own nurses, aides and supervisory nurses on a full time basis. This is being done carefully after assessing the ability to attend on the requirements of patients.

During COVID, the number of patients who came for regular check-ups and undertook consequent preventive medical treatments dwindled drastically and therefore the whole hospital saw the necessity and opportunity to function as a COVID Care hospital. Now the facilities were rented to Covid treatment groups and all groups had a hundred per cent occupancy.

One such group called Covid Sure Cure (CSC) that rented this facility had the following figures for the past year: It had taken up 60 beds for 365 days. It was charged by Getwell a sum of ₹ 9,31,80,000 as the fixed charge and ₹ 9000 per patient day as the variable charge. CSC in turn charged its patients ₹ 15000 per bed per day.

The range of requirements beginning from the minimum relating to nursing staff is given below:

Annual Patient Days	Aides (A)	Nurses (N)	Supervising Nurses (SN)
10,000 – 14,000	20	10	3
14,001 – 17,000	21	11	3
17,001 – 20,000	21	12	3
20,001 – 23,000	22	13	4
23,001 – 25,000	23	14	5
25,001 – 27,000	24	15	7

Salaries that had to be paid annually to each person under these categories was the following

25,001 – 27,000	₹ 3,60,000	₹ 4,80,000	₹ 5,40,000
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CSC was comfortable during the pandemic as all the beds were occupied all the time and there was a growing demand for more. But in the coming year, as the number of patients has come down and some beds are now being given for post-covid complication care patients, CSC wants to look at its cost structure to be able to negotiate a different pricing with Getwell.

- (i) Under the given conditions of outflows to salaries and to Getwell, **how many** patient days will be required by CSC for the earliest break-even?
- (ii) **How many** beds does this figure translate to, on an average?
- (iii) **Will** it be substantially worthwhile for CSC to consider trimming its requirement on the number of nursing staff?
- (iv) If CSC expects an 80 % level of occupancy during the current period, **what** should be the amount to be paid to Getwell with a 25 % margin of safety? It feels it cannot increase the charge to patients. [4 + 2 + 2 + 4 = 12]

<p>Reference <b>Hospital Industry</b></p>	<p>What's <b>New</b> <b>Break even Patient days, Step Fixed Cost</b></p>
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### Answer

- (i) BEP patient days = 18020.
- (ii) This translates to about 49.36, say 50 beds occupancy. (18020 ÷ 365)
- (iii) The staffing cost is very low considering the huge bulk of fixed cost to Getwell. As seen above, one level of pruning will only save 230 patient days, which is not even one bed occupancy. Hence it is not worthwhile for CSC to trim its staff. Another aspect is that trimmed workforce may be stressed and may not render adequate quality. Further, it is stated that the staffing is already done carefully. Hence there is no likelihood of a substantial reduction in nursing staff cost.
- (iv) Amount to be paid to Getwell towards fixed and variable component = ₹ 18,21,60,000.



## Learning Objective

### BASICS

1. TRANSFER PRICE : INTERNAL TRANSFER PERSPECTIVES
  - a. Accounting or Reporting Perspective
  - b. Management Accounting Perspective
  - c. Direct Tax Perspective
2. TRANSFER VS SALE
3. PARTIES TO A TRANSFER
4. MANAGEMENT ACCOUNTING PERSPECTIVE

### PRACTICALS

1. DIVISIONAL PERFORMANCE MEASURES
  - a. Return on Investment (ROI)
  - b. Residual Income (RI)
2. DIVISIONAL PROFITABILITY STATEMENTS
3. COMPUTATION OF TRANSFER PRICE UNDER
  - a. As instructed
  - b. Return on Investment Pricing Method
  - c. Shared Profit Method
4. THE GOAL CONGRUENCY CONCEPT
  - a. Minimum and Maximum Price
  - b. Evaluation of Transfer from Group's view point

## 1. INTRODUCTION AND MEANING

In the modern days, production is on the mass scale due to technological advancement and upgradation. Organisations grow in course of time and for such growing organisations, decentralization becomes absolutely necessary. It becomes inevitable for such organisations to establish separate divisions and departments to ensure smooth working. Transfer pricing has become necessary in highly decentralized companies where number of divisions/departments are created as a part and parcel of the decentralized organisation. Transfer pricing is one of the tools in the hands of management for measuring the performance of divisions or departments.

A '**Transfer Price**' is that notional value at which goods and services are transferred between divisions in a decentralized organisation. Transfer prices are normally set for intermediate products, which are goods, and services that are supplied by the selling division to the buying division. In large organisations, each division is treated as a 'profit center' as a part and parcel of decentralization. Their profitability is measured by fixation of 'transfer price' for inter divisional transfers.

The transfer price can have impact on the division's performance and hence lot of care is to be taken in fixation of the same. The following **factors should be taken into consideration before fixing the transfer prices**.

1. Transfer price should help in the accurate measurement of divisional performance.
2. It should motivate the divisional managers to maximize the profitability of their divisions.
3. Autonomy and authority of a division should be ensured.
4. Transfer Price should allow 'Goal Congruence' which means that the objectives of divisional managers match with those of the organisation.

## 2. OBJECTIVES OF INTER COMPANY TRANSFER PRICING

The following are the main objectives of intercompany transfer pricing scheme:

1. **To evaluate the current performance and profitability of each individual unit :** This is necessary in order to determine whether a particular unit is competitive and can stand on its working. When the goods are transferred from one department to another, the revenue of one department becomes the cost of another and such inter transfer price affects the reported profits.
2. **To improve the profit position :** Intercompany transfer price will make the unit competitive so that it may maximize its profits and contribute to the overall profits of the organisation.
3. **To assist in decision making :** Correct intercompany transfer price will make the costs of both the units realistic in order to take decisions relating to such problems as make or buy, sell or process further, choice between alternative methods of production.
4. **For accurate estimation of earnings on proposed investment decisions :** When finance is scarce and it is required to determine the allocation of scarce resources between various divisions of the concern taking into consideration their competing claims, then this technique is useful.

### 3. METHODS OF TRANSFER PRICING [JUN'17]

There are several methods of fixation of 'Transfer Price'. They are discussed below.

1. Pricing based on cost.
    - (a) Actual cost
    - (b) Cost plus
    - (c) Standard cost
    - (d) Marginal cost
  2. Market price as transfer price.
  3. Negotiated pricing.
  4. Pricing based on Opportunity cost.
1. **Pricing based on cost:** In these methods, 'cost' is the base and the following methods fall under this category.
    - (a) **Actual Cost:** Under this method the actual cost of production is taken as transfer price for inter divisional transfers. Such actual cost may consist of variable cost or sometimes total costs including fixed costs.
    - (b) **Cost Plus:** Under this method, transfer price is fixed by adding a reasonable return on capital employed to the total cost. Thereby the measurement of profit becomes easy.
    - (c) **Standard Cost:** Under this method, transfer price is fixed on the basis of standard cost. The difference between the standard cost and the actual cost being variance is absorbed by transferring division. This method is simple and easy to follow, but the constant revision of standards is necessary at regular intervals.
    - (d) **Marginal Cost:** Under this method, the transfer price is determined on the basis of marginal cost. The reason being fixed cost is in any case unavoidable and hence should not be charged to the buying division. That is why only marginal cost will be taken as transfer price
  2. **Market price as transfer price:** Under this method, the transfer price will be determined according to the market price prevailing in the market. It acts as a good incentive for efficient production to the selling division and any inefficiency in production and abnormal costs will not be borne by the buying division. The logic used in this method is that if the buying division would have purchased the goods/services from the open market, they would have paid the market price and hence the same price should be paid to the selling division. One of the variation of this method is that from the market price, selling and distribution overheads should be deducted and price thus arrived should be charged as transfer price. The reason behind this is that no selling efforts are required to sale the goods/services to the buying division and therefore these costs should not be charged to the buying division. Market price based transfer price has the following **advantages** :
    1. Actual costs are fluctuating and hence **difficult to ascertain**. On the other hand market prices can be **easily ascertained**.

2. Profits resulting from market price based transfer prices are good parameters for **performance evaluation** of selling and buying divisions.
3. It **avoids extensive arbitration** system in fixing the transfer prices between the divisions.

However, the market price based transfer pricing has the following **limitations** :

1. There may be **resistance** from the buying division. They may question buying from the selling division if in any way they have to pay the market prices.
  2. Like cost based prices, market prices may also be **fluctuating** and hence there may be difficulties in fixation of these prices.
  3. Market price is a rather **vague** term as such prices may be ex-factory price, wholesale price, retail price etc.
  4. Market prices may not be available for **intermediate products**, as these products may not have any market.
  5. This method may be difficult to operate if the **intermediate product** is for **captive consumption**.
  6. Market price may **change frequently**.
  7. Market prices **may not be ascertained easily**.
3. **Negotiated Pricing:** Under this method, the transfer prices may be fixed through negotiations between the selling and the buying division. Sometimes it may happen that the **concerned product may be available in the market at a cheaper price than charged by the selling division**. In this situation the buying division may be tempted to purchase the product from outside sellers rather than the selling division. Alternatively the **selling division may notice that in the outside market, the product is sold at a higher price but the buying division is not ready to pay the market price**. Here, the selling division may be reluctant to sell the product to the buying division at a price, which is less than the market price. In all these conflicts, the overall profitability of the firm may be affected adversely. Therefore it becomes beneficial for both the divisions to negotiate the prices and arrive at a price, which is mutually beneficial to both the divisions. Such prices are called as '**Negotiated Prices**'. In order to make these prices effective care should be taken that both, the buyers and sellers should have access to the available data including about the alternatives available if any. Similarly buyers and sellers should be free to deal outside the company, but care should be taken that the overall interest of the organisation is not affected.
- The main **limitation** of this method is that **lot of time** is spent by both the negotiating parties in fixation of the negotiated prices.
  - **Negotiating skills** are required for the managers for arriving at a mutually acceptable price, otherwise there is a possibility of **conflicts** between the divisions.
4. **Pricing based on opportunity cost:** This pricing recognizes the **minimum price** that the selling division is ready to accept and the **maximum price** that the buying division is ready to pay. The final transfer price may be based on these minimum expectations of both

the divisions. The most ideal situation will be when the minimum price expected by the selling division is less than the maximum price accepted by the buying division. However in practice, it may happen very rarely and there is possibility of conflicts over the opportunity cost.

It is very clear that **fixation** of transfer prices is a very **delicate** decision. There might be **clash** of interests between the selling and buying division and hence while fixing the transfer price, overall interests of the organisation should be taken into consideration and overall '**Goal Congruence**' should be given utmost importance rather than interests of the selling or buying division.

#### 4. DUAL RATE TRANSFER PRICING METHOD : [RTP JUN'18; DEC'18]

1. **Dual-Rate Transfer Pricing** uses two separate Transfer Prices to price each inter-divisional transaction, as under-

##### Dual Rate Transfer Pricing Method

<b>Debit Cost in Recipient Division</b> = Relevant Costs, i.e. Variable Cost + Opportunity Cost, if any	<b>Cost</b> = <b>Credit Income in Transferring Division</b> = Market Price, or Full Cost plus mark-up (whether or not Intermediate Product is marketable)
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Under this method, **Company Profits** = Total of Divisional Profits Less Inter – Divisional Mark -up,

2. **Advantages:**
  - (a) **Incentive to Transferring Division:** The Transferring Division Manager is motivated to transfer the Intermediate Product internally, since each unit transferred generates a profit (due to mark-up).
  - (b) **No Unjust Enrichment:** If the Transfer Price is set at the Transferring Division's Marginal Cost for the Intermediate Product, that division will not have any contribution from internal transfers. All the total contribution from inter -divisional trading will be assigned to the Recipient Division. Such unjust enrichment is avoided through the use of mark-up.
  - (c) **Optimal Decisions:** Since Relevant Cost is used as the second Transfer Price, (for debiting Cost in Recipient Division) the Transfer Pricing system automatically promotes goal congruence by leading to optimal decisions.
3. **Disadvantages:**
  - (a) **Confusing:** Use of different Transfer Prices causes confusion, particularly when more than two divisions are involved.
  - (b) **Artificial:** Dual Transfer Prices are considered to be artificial.

- (c) **No incentive:** Fixed Price with mark -up protects Transferring Divisions from competition. It gives them little incentive to improve their productivity.
- (d) **Misleading:** Dual Transfer Prices can result in misleading information and create a false impression of divisional profits. There is a possibility of double-counting of profits. At the extreme, all divisions may report profits, when the Company as a whole is losing money.

SJC Institute

**Q1**

**CMA Mat; Jun'17**

A Company with two manufacturing divisions is organised on profit centre basis. Division 'A' is the only source for the supply of a component that is used in Division B in the manufacture of a product KLIM. One such part is used in each unit of the product KLIM. As the demand for the product is not steady. Division B can obtain orders for increased quantities only by spending more on sales promotion and by reducing the selling prices. The Manager of Division B has accordingly prepared the following forecast of sales quantities and selling prices.

Sales units per day	Average Selling price per unit of KLIM ₹
1,000	5.25
2,000	3.98
3,000	3.30
4,000	2.78
5,000	2.40
6,000	2.01

The manufacturing cost of KLIM in Division B is ₹3,750 for first 1,000 units and ₹750 per 1,000 units in excess of 1,000 units.

Division A incurs a total cost of ₹1,500 per day for an output to 1,000 components and the total costs will increase by ₹900 per day for every additional 1,000 components manufactured. The Manager of Division A states that the operating results of his Division will be optimised if the transfer price of the component is set at ₹1.20 per unit and he has accordingly set the aforesaid transfer price for his supplies of the component to Division A.

You are **required**:

- (a) Prepare a schedule showing the profitability at each level of output for Division A and Division B.
- (b) Find the profitability of the company as a whole at the output level which
  - (i) Division A's net profit is maximum.
  - (ii) Division B's net profit is maximum.
- (c) If the Company is not organised on profit centre basis, what level of output will be chosen to yield the maximum profit.

<p><b>Reference</b></p> <p><b>Divisional and Overall Profitability</b></p>	<p><b>What's New</b></p>
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**Answer**

 (i) **Statement showing profit of division A:**

Sale per day (units)	Sale value	Cost	Profit/(loss)
	₹	₹	₹
1,000	1,200	1,500	(300)
2,000	2,400	2,400	-
3,000	3,600	3,300	300
4,000	4,800	4,200	600
5,000	6,000	5,100	900
6,000	7,200	6,000	1,200

**Profit of division B:**

No of units	Sales	Transfer price	Other manufacturing cost	Total cost	Profit/(loss)
	₹	₹	₹	₹	₹
1,000	5,250	1,200	3,750	4,950	300
2,000	7,960	2,400	4,500	6,900	1,060
3,000	9,900	3,600	5,250	8,850	1,050
4,000	11,120	4,800	6,000	10,800	320
5,000	12,000	6,000	6,750	12,750	(750)
6,000	12,060	7,200	7,500	14,700	(2,640)

 (ii) **Profitability of the company at the output level where division A's net profit is maximum :**

	₹
Profit of division A at 6,000 units	1,200
Profit of division B at 6,000 units	(2,640)
Profit /(loss)	(1,440)
<b>Division B's net profit is maximum:</b>	
Profit of division A at 2,000 units	-
Profit of division B at 2,000 units	1,060
	1,060

 (c) **When the company is not organized on profit centre basis**
**Profit at different levels of output**

Units	Division A	Division B	Total
	₹	₹	₹
1,000	(300)	300	—
2,000	—	1,060	1,060
3,000	300	1,050	1,350

4,000	600	320	920
5,000	900	(750)	150
6,000	1,200	(2,640)	(1,440)

Best output level is **3,000 units**

**Q2**

**CMA Mat**

Your company fixes the inter-divisional transfer prices for its products on the basis of cost, plus a return on investment in the division. The Budget for Division A for 1981-82 appears as under:

Fixed Assets	5,00,000
Current assets	3,00,000
Debtors	2,00,000
Annual Fixed Cost of the Division	8,00,000
Variable Cost per unit of Product	10
Budgeted Volume	4,00,000 units per year
Desired ROI	28%

**Determine** the transfer Price for Division A.

<b>Reference</b>	<b>What's New</b>
<b>Transfer Price Based on ROI</b>	

**Answer**

Particulars		₹
Variable Cost		10.00
Fixed Cost per unit	$8,00,000 \div 4,00,000$	2.00
Required Return	$\frac{10,00,000 \times 28\%}{4,00,000}$	0.70
Total cost or Transfer price		12.70

**Q3**

**CMA Mat; MTP Jun'20**

Transferor Ltd. has two processes Preparing and Finishing. The normal output per week is 7,500 units (Completed) at a capacity of 75%

Transferee Ltd. had production problems in preparing and requires 2,000 units per week of prepared material for their finishing processes.

The existing cost structure of one prepared unit of Transferor Ltd. at existing capacity

Material	₹ 2.00 (variable 100%)
Labour	₹ 2.00 (Variable 50%)
Overhead	₹ 4.00 (variable 25%)

The sale price of a completed unit of Transferor Ltd is ₹16 with a profit of ₹4 per unit.

**Construct** the effect on the profits Transferor Ltd., for six months (25 weeks) of supplying units to Transferee Ltd. with the following alternative transfer prices per unit:

- Marginal Cost
- Marginal Cost + 25%
- Marginal Cost + 15% Return on capital (assume capital employed ₹20 lakhs)
- Existing Cost
- Existing Cost + a portion of profit on the basis of  $(\text{preparing cost} / \text{Total Cost}) \times \text{Unit Profit}$
- At an agreed market price of ₹8.50 Assume no increase in fixed cost.

<b>Reference</b>	<b>What's New</b>
<b>Transfer Price - Different Methods</b>	

### Answer

Transferred units	$25 \times 2,000 =$	50,000
Existing profit	$7,500 \times 25 \times 4 =$	₹ 7,50,000

Effect on profit if transfer price is

(i) **Marginal cost**

	₹
Material	2.00
Labour	1.00
OHs	1.00
	4.00

At this transfer price there is no effect on profit of transferor ltd.

(ii) **Profit** = 50,000

(iii) **Price per unit** =  $4 + \{(20,00,000 \times 15\% \times 0.5) / 50,000\} = 7$

Under this method profit of transferor ltd is increases by 1,50,000 i.e.,  $50,000 \times (7-4)$

(iv) Profit increases by  $50,000 \times (8 - 4) = 2,00,000$

(v) **Transfer price:**

	₹
{8 + (8/12)4}	= 10.67
Marginal Cost	= 4.00
Profit	= 6.67

Profit increases by  $50,000 \times 6.67 = ₹ 3,33,500/-$

(vi) **Transfer price** = 8.50

Profit increase by  $4.5 \times 50,000 = ₹ 2,25,000$

## Q4

MTP Dec'19

XYZ Ltd which has a system of assessment of Divisional Performance on the basis of residual income has two Divisions, Alfa and Beta. Alfa has annual capacity to manufacture 15,00,000 numbers of a special component that it sells to outside customers, but has idle capacity. The budgeted residual income of Beta is ₹ 1,20,00,000 while that of Alfa is ₹ 1,00,00,000. Other relevant details extracted from the budget of Alfa for the current year were as follows

Particulars	
Sale (Outside Customer)	12,00,000 @ ₹ 180
Variable cost p.u	160
Divisional fixed cost	₹ 80,00,000
Capital employed	9,00,00,000
Cost of Capital	10%

Beta has just received a special order for which it requires components similar to the ones made by Alfa. Fully aware of the idle capacity of Alfa, Beta has asked Alfa to quote for manufacture and supply of 3,00,000 numbers of the components with a slight modification during final processing. Alfa and Beta agree that this will involve an extra variable cost of ₹ 6 per unit.

You are **required** to

**Calculate** the transfer price which Alfa should quote to Beta to achieve its budgeted residual income. [8]

<p><b>Reference</b></p> <p><b>Transfer Price - Residual Income</b></p>	<p><b>What's New</b></p>
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### Answer

Fixed Cost	80,00,000
Return on 9,00,00,000 × 10%	90,00,000
Residual Income	1,00,00,000

Total Contribution Required 2,70,00,000

Contribution derived from existing units = 12,00,000 × 20 = ₹2,40,00,000

Contribution required on 3,00,000 units = 2,70,00,000 - 2,40,00,000 = ₹30,00,000

Contribution per unit = 30,00,000 / 3,00,000 = ₹10

Increase in Variable cost = ₹ 6

$$\begin{aligned}
 \therefore \text{Transfer price} &= \text{V.C} + \text{Desired Residual Income} + \text{Increase in VC} \\
 &= 160 + 10 + 6 \\
 &= ₹176
 \end{aligned}$$

### Q5

### CMA Mat

SV Ltd. Manufactures a product which is obtained basically from a series of mixing operations. The finished product is packaged in the company made glass bottles and packed in attractive cartons.

The company is organized into two independent divisions viz. one for the manufacture of the end product and the other for the manufacture of glass bottles. The Product manufacturing division can buy all the bottle requirements from the bottle manufacturing division.

The General Manager of the bottle manufacturing division has obtained the following quotations from the outside manufacturers for the empty bottles.

Volume	Purchase Value
Empty bottles	Total (₹)
8,00,000	14,00,000
12,00,000	20,00,000

A cost analysis of the bottle manufacturing division for the manufacture of empty bottles reveals the following production costs:

Volume	Purchase value
Empty bottles	Total Cost (₹)
8,00,000	₹10,40,000
12,00,000	14,40,000

The production cost and sales value of the end product marketed by the product manufacturing division are as under.

Volume (Bottle of end product)	Total cost of end product*	Sales Value (Packed in bottles)
8,00,000	₹64,80,000	₹ 91,20,000
12,00,000	₹96,80,000	₹1,27,80,000

There has been considerable discussion at the corporate level as to the use of proper price for transfer of empty bottles from the bottle manufacturing division to product manufacturing division. This interest is heightened because a significant portion of the Divisional General Manager's salary is in incentive bonus based on profit centre results.

As the corporate management accountant responsible for defining the proper transfer prices for the supply of empty bottles by the bottle manufacturing division to the product manufacturing division, you are **required to show** for the two levels of volume of 8,00,000 and 12,00,000 bottles, the profitability by using (i) market price and (ii) shared profit relative to the cost involved basis for the determination of transfer prices. The profitability position should be furnished separately for the two divisions and the company as a whole under each method. **Discuss** also the effect of these methods on the profitability of the two divisions.

\* (Excluding cost of empty bottles)



Reference

What's New

**Transfer Price Shared Profit Method**

## Answer

Statement showing Computation of transfer price on the basis of profit shared on cost basis:

	Output (8,00,000) Amount (₹)	Output (12,00,000) Amount (₹)
Sales	91,20,000	127,80,000
<b>Costs:</b>		
Product manufacturing division	64,80,000	96,80,000
Bottle manufacturing division	10,40,000	14,40,000
	75,20,000	1,11,20,000
<b>Profit</b>	16,00,000	16,60,000
Share of bottle manufacturing division	2,21,276	2,14,964
Product manufacturing division	13,78,724	14,45,036
Transfer price	12,61,276	16,54,964
Transfer price per bottle	1.5777	1.379

**Profitability on the basis of market price:**

	Output (8,00,000)	Output (12,00,000)
	Amount (₹)	Amount (₹)
<b>Bottle manufacturing division</b>		
Sale value	14,00,000	20,00,000
(-)cost	10,40,000	14,40,000
Profit	3,60,000	5,60,000
<b>Product manufacturing division</b>		
Sale value	91,20,000	127,80,000
(-)cost of product	64,80,000	96,80,000
Cost of bottle	14,00,000	20,00,000
	78,80,000	1,16,80,000
Profit	12,40,000	11,00,000
Total profit	16,00,000	16,60,000
<b>Transfer price</b>	1.75	1.67

**Q6**
**CMA Mat; MTP Jun'17**

Division A is a profit centre which produces three products X, Y and Z. Each product has an external market.

	X	Y	Z
External market price per unit	₹ 48	₹ 46	₹ 40
Variable cost of production in division A	₹ 33	₹ 24	₹ 28
Labour hours required per unit in division A	3	4	2

Product Y can be transferred to Division B, but the maximum quantity that might be required for transfer is 300 units of Y.

	X	Y	Z
The maximum external sales are :	800 units	500 units	300 units

Instead of receiving transfers of Product Y from Division A, Division B could buy similar product in the open market at a slightly cheaper price of ₹45 per unit.

**What** should the transfer price be for each unit for 300 units of Y, if the total labour hours available in Division A are?

- (a) 3,800 hours
- (b) 5,600 hours.

<p><b>Reference</b></p> <p><b>Maximum Transfer Price</b></p>	<p><b>What's New</b></p> <p><b>With Key Factor</b></p>
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**Answer**

**Computation of contribution per labour hour from external sales:**

	X	Y	Z
Market price (₹)	48	46	40
Variable cost (₹)	33	24	28
Contribution (₹)	15	22	12
Labour hours required	3	4	2
Contribution per labour hour (₹)	5	5.50	6
<b>Priority</b>	III	II	I

**Computation of transfer price when**

(a) **The capacity is 3,800 hours:**

Hours required for Z = 300 × 2	600
Y = 500 × 4	2,000
	2,600
X = 800 × 3	2,400
	5,000

The existing capacity is not sufficient to produce the units to meet the external sales. In order to transfer 300 units of Y, 1,200 hours are required in which division A will give up the production of X to this extent.

	₹
Variable Cost of Y	24
(+) contribution lost by giving up production of X to the extent of 1,200 hours = 1,200 × 5 = 6,000	20
∴ Opportunity cost per unit = (6,000/300)	
Required transfer price	44

(b) **If the capacity is 5,600 hours:**

	₹
Variable cost	24
Contribution cost of giving up X to the extent of 600hours = 600 × 5 = 3,000	
Opportunity Cost Per unit = (3,000/300)	10
Required transfer price	34

## Q7

## CMA Mat; MTP Dec'19

P.H. Ltd. has two manufacturing departments organised into separate profit centres known as the Basic unit and Processing unit. The Basic unit has a production capacity of 4,000 tonnes per month of Chemvax but at present its sales are limited ₹ 2,000 tonnes to outside market and 1,200 tonnes to the Processing unit.

The transfer price for the year 2022 was agreed at ₹ 400 per tonne. This price has been fixed in line with the external wholesale trade price on 1st January 2022. However, due to heavy competition the Basic unit has been forced to reduce the wholesale trade price to ₹ 360 per tonne with effect from 1st June, 2022. This price however was not made applicable to the sales made to the Processing unit of the company. The Processing unit applied for revision of the price as applicable to the outside market buyers as from 1st June 2022 but the same was turned down by the basic unit.

The Processing unit refines Chemvax and packs the output known as Colour-X in drums of 50kgs each. The selling price of colour-X is ₹ 40 per drum. The Processing unit has a potential of selling a further quantity of 16,000 drums of colour-X provided the overall price is reduced to ₹32 per drum. In that event it can buy the additional 800 tonnes of Chemvax from the basic unit whose capacity can be fully utilised. The outside market will not however absorb more than the present quantity of 2,000 tonnes.

**The cost data relevant to the operations are:**

	Basic Unit ₹	Processing Unit ₹
Raw Materials/tonne	70	Transfer price
Variable Cost/tonne	140	170
Fixed Costs/month	₹ 3,00,000	1,20,000

You are **Required** :

- (i) Prepare statement showing the estimated profitability for June 2022 for each unit and the company as a whole on the following bases:
  - (a) At 80% and 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹400 per tonne.
  - (b) At 80% capacity utilisation of the basic unit at the market price of ₹360 per tonne and the transfer price to the Processing unit of ₹ 400 per tonne.
  - (c) At 100% capacity utilisation of the Basic unit at the market price and transfer price to the Processing unit of ₹ 360 per tonne.
- (ii) Comment on the effect of the company's transfer pricing policy on the profitability of the Processing Unit.

Reference

**Divisional and Overall Profitability**

What's New

**Under different capacity levels**

**Answer**

- (a) **Statement showing computation of profit at 80% capacity when transfer price is ₹ 400/- ton:**

		Basic unit	Processing unit	Total
(i) No. of units		3,200	$(1200 \times 1000)/50$	24,000
(ii) Contribution per unit	₹	$\{400 - (140 + 70)\} = 190$	$\{40 - (570/20)\}$	11.50
(iii) Total contribution	₹	6,08,000	2,76,000	8,84,000
(iv) Fixed cost	₹	3,00,000	1,20,000	4,20,000
(v) Profit	₹	3,08,000	1,56,000	4,64,000

**At 100% capacity:**

		Basic unit	Processing unit	Total
(i) No. of units		4,000	40,000	44,000
(ii) Contribution per unit	₹	190	3.50	
(iii) Total contribution	₹	7,60,000	1,40,000	9,00,000
(iv) Fixed cost	₹	3,00,000	1,20,000	4,20,000
(v) Profit	₹	4,60,000	20,000	4,80,000

- (b) **Computation of profit:**

		Basic unit		Processing unit	Total
		Out side sale	Internal transfer		
(i) No of units		2,000	1,200	24,000	
(ii) Contribution per unit	₹	150	190	11.50	
(iii) Total contribution	₹	3,00,000	2,28,000	2,76,000	
	₹	5,28,000		2,76,000	8,04,000
(iv) Fixed cost	₹	3,00,000		1,20,000	4,20,000
(v) Profit	₹	2,28,000		1,56,000	3,84,000

- (c) **Computation of profit:**

		Basic unit	Processing unit	Total
No of units		4,000	40,000	
Contribution per unit	₹	150	5.50	

Total contribution	₹	6,00,000	2,20,000	8,20,000
Fixed cost	₹	3,00,000	1,20,000	4,20,000
Profit	₹	3,00,000	1,00,000	4,00,000

Overall profit is more at 100% capacity of basic unit with a transfer price of ₹ 400/- per ton being the market price. If individual interests are not considered this may be adopted. However, from the view point of the processing unit, it will not be interested to buy more than 1200 tonnes from the basic unit, because its profit gets reduced when it takes additional units. Therefore, the present policy of the management is not at all attractive to the processing unit.

## Q8

## RTP Jun'18; Dec'18

A Company is organized on decentralized lines, with each manufacturing division operating as a separate profit centre. Each Division Manager has full authority to decide on sale of division's output to outsiders or to other divisions. Division A manufactures a single standardized product. Some output is sold externally and remaining is transferred to Division X where n is a sub-assembly in the manufacture of that Division's product. The unit cost of Division A and Division X is as follows:

Particulars	Division A	Division X
Transfer from Division A to X	-	₹ 42.00
Direct Material	₹6.00	₹ 35.00
Direct Labour	₹3.00	₹4.50
Direct Expenses	₹3.00	-
Variable Manufacturing Overheads	₹3.00	₹18.00
Fixed Manufacturing Overheads	₹6.00	₹18.00
Variable Selling & Packing Expenses	₹3.00	₹2.50
Total	₹24.00	₹120.00

Division A sold 40,000 units annually at the Standard Price of ₹45 in the external market. In addition to the external sales 10,000 units are transferred annually to Division X at an internal price of ₹42 per unit. Variable Selling and Packing Expenses are not incurred by the Supplying Division for the internal transfer of the product. Division X incorporates the transferred goods into a more advanced product. The Manager of Division X disagrees with the basis used to set the Transfer Price. He argues that Transfer Price should be made at Variable Cost, since he claims that his Division is taking output that Division A should be unable to sell at a price of ₹45.

He also submitted a report of the relationship between Selling Price and demand, to support of his disagreement.

The report of customer demand at various Selling Prices for Division A and for Division X is as follows –

Division A	Selling Price per unit	₹30	₹45	₹60
	Demand	60,000 units	40,000 units	20,000 units

Division X	Selling Price per unit	₹120	₹135	₹150
	Demand	15,000 units	10,000 units	5,000 units

The Company has sufficient capacity to meet demand at various Selling Prices. Internal transfer demanded units will be decided by X Division.

**Required:**

- To **calculate** Divisional Overall Profitability, if Division A transfers demanded units to X at a price of ₹42.
- To **calculate** Divisional and Overall Profitability, if Division A transfers demanded units to X at Variable Cost.
- In place of Internal Transfers, Division A can sell 10,000 units of its product in a new external market without affecting existing market, at a price of ₹ 32 per unit and X Division can purchase these units at the rate of ₹31 in the open market. **Calculate** Company's Profit by following the above strategies.

Reference	What's New
<b>Divisional and Overall Profitability</b>	<b>Best Value for Transfer</b>

**Answer**

1. **Computation of Variable Costs per unit in different cases**

Particulars	Dir Matl	Dir Lab	Dir Exps	Var POH	Var SOH	Total VC
(a) Divn A (for Ext Sale)	₹6.00	₹3.00	₹3.00	₹3.00	₹3.0	₹18.00
(b) Divn A (for Int Tfr)	₹6.00	₹3.00	₹3.00	₹3.00	-	₹15.00
(c) Divn X (Own VC)	₹35.00	₹4.50	-	₹18.00	₹2.50	₹60.00

Note: **Fixed Costs** of - (i) Divn A = (50,000 units × ₹6) = ₹3,00,000,  
(ii) Divn X = (10,000 units × ₹18) = ₹1,80,000.

2. **Determination of Internal Transfer quantity, i.e. Demand by X division**

When TP = ₹42						When TP = VC = ₹15 p.u					
Qty	SP p.u	Own VC	TP p.u	Cn p.u	Total Cn	Qty	SP p.u	Own VC	TP p.u	Cn p.u	Total Cn
5,000	₹150	₹60	₹42	₹48	₹2,40,000	5,000	₹150	₹60	₹15	₹75	₹3,75,000
10,000	₹135	₹60	₹42	₹33	₹3,30,000 (maximum)	10,000	₹135	₹60	₹15	₹60	₹6,00,000
15,000	₹120	₹60	₹42	₹18	₹2,70,000	15,000	₹120	₹60	₹15	₹45	₹6,75,000 (maximum)

So, Demanded Internal Transfer Qty =10,000 units	So, Demanded Internal Transfer Qty = 15,000 units
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### 3. Profit Statement at various Transfer Prices and Output levels

Particulars	Transfer from A to X at TP = ₹ 42 p.u			Transfer from A to X at TP = VC ₹15		
	Division A		Division X	Division A		Divn X
	Sale	Transfer	Sale	Sale	Transfer	Sale
(a) Qty (units)	40,000	10,000	10,000	40,000	15,000	15,000
(b) Sale Price p.u.	₹45	₹42	₹135	₹45	₹15	₹ 120
(c) VC p.u.: Own	₹18	₹15	₹60	₹18	₹15	₹ 60
Transfer in	-	-	₹42	-	-	₹ 15
Total VC pu	₹18	₹15	₹102	₹18	₹15	₹ 75
(d) Contribution pu	₹27	₹ 27	₹33	₹27	-	₹ 45
(e) Total Contribution (a × d)	₹ 10,80,000	₹ 2,70,000	₹ 3,30,000	₹ 10,80,000	-	₹ 6,75,000
		₹13,50,000	₹3,30,000	₹10,80,000		₹ 6,75,000
(f) Fixed Cost (WN1)		(₹ 3,00,000)	(₹ 1,80,000)		(₹3,00,000)	(₹1,80,000)
(g) Profit (e - f)		₹10,50,000	₹1,50,000		₹7,80,000	₹4,95,000
(h) Company Profit		(10,50,000 + 1,50,000) = ₹12,00,000			(7,80,000 + 4,95,000) = ₹12,75,000	

Note: Both Departments have enough capacity to meet Internal & external demands.

### 4. Profit Statement when Division X procures its materials from external market

Particulars	Division A		Division X
(a) Sale Quantity (units)	Given 40,000 units	New 10,000 units	10,000 units
(b) Selling Price p.u	₹45	₹32	₹135
(c) Variable Cost p.u	₹18	₹18	(60 + 31) = ₹91
(d) Contribution p.u	₹27	₹14	₹ 44
(e) Total Contribution (a × d)	₹10,80,000	₹1,40,000	₹4,40,000
	₹12,20,000		
(f) Fixed Cost (WN 1)		₹3,00,000	₹1,80,000
(g) Profit		₹9,20,000	₹2,60,000
(h) Company Profit	(9,20,000 + 2,60,000) = ₹11,80,000		

**Q9**

**RTP Jun'18; Dec'18**

HRO Cycles Ltd has 2 divisions, A and B which manufacture bicycle. Division A produces the bicycle frame and Division B assembles rest of the bicycle on the frame. There is a market for both the sub - assembly and the final product. Each division has been treated as a profit center. The Transfer Price for the sub - assembly has been set at the long run average market price. The following data are available to each division -

Estimated Selling Price for Final Product	₹3,000 p.u.
Long-run Average Market Price for sub - assembly	₹2,000 p.u.
Incremental Costs of completion sub - assembly in Division B	₹1,500 p.u.
Incremental Costs in Division A	₹1,200 p.u.

**Required:**

1. If Division A's maximum capacity is 1,000 units per month and sales to the intermediate market are now 800 units. **Should** 200 units be transferred to Division B at the long run average price basis?
2. **What** would be the Transfer Price, if the Manager of Division B should be kept motivated?
3. If outside market increases to 1,000 units, **should** Division A continue to transfer 200 units to Division B or sell entire production to outside market?

<p><b>Reference</b></p> <p><b>Evaluation of Transfer</b></p>	<p><b>What's New</b></p>
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**Answer**

1. **When External Sales = 800 units**
  - (a) Since **External Sales of Sub-Assembly** by Division A is only 800 units, there is a spare capacity of 200 units, which does not involve any Opportunity Costs.
  - (b) Cost of Final Product from Company angle = Variable Costs of A + Variable Costs of B = ₹1,200 + ₹1,500 = ₹2,700 p.u. Since Final Selling Price (3,000) is above cost ₹2,700, there is a Net Contribution of ₹300 p.u. of the Final product. Hence, 200 units may be transferred by Division A.
2. **Range of Transfer Prices will be as under -**
  - (a) **Minimum TP** (from Divn A viewpoint) = Variable Costs only = ₹ 1,200.
  - (b) **Maximum TP** (from Divn B viewpoint) = Least of - (i) Market Price of Sub-Assembly [or] (ii) Ability to pay = ₹ 2,000 [or] (₹3,000 – ₹1,500) = ₹1,500.
  - (c) A Transfer Price in the range of ₹1,200 to ₹1,500 will be agreeable to both Managers.

- (d) To keep the Manager of Division B motivated, the profit earned ₹ 300 per unit may be shared equally between the two Divisions. Hence, the appropriate Transfer Price for motivating Division B may be Variable Cost of Division A + 50% Share of Profit to be given to **Division A = ₹ 1,200 + ₹150 = ₹1,350.**

### 3. When External Sales = 1,000 units

- (a) If External Sales by Division A increases to 1,000 units, Internal Transfer would involve Opportunity Costs. Hence, Relevant Cost of Internal Transfer = Variable Costs ₹1,200 + Opportunity Costs ₹ 800 (being Contribution foregone on External Sales) = ₹ 2,000.
- (b) **Cost of Final Product from Company angle** = Relevant Costs of A + Relevant Costs of B = ₹2,000 + ₹1,500 = ₹3,500 p.u. Since Final Selling Price ( ₹3,000) is below Relevant Cost ( ₹3,500), there is a Net Loss of ₹500 p.u. of the Final Product. Hence, Internal Transfers are not worthwhile. Division A has to sell the entire output of 1,000 units to the outside market only.

## Q10

Jun'19

AB Ltd. has two manufacturing divisions, A and B, operating as profit centres. A has a production capacity of 3,500 units of product A per month, but presently, it produces 2,000 units for a special customer S, @ a selling price of ₹ 400 per unit (which will not accept partial supply) and 1,000 units for B. S has an agreement with AB that A shall not supply to the external market at any price lower than that to S, or it can supply to the market at any price after discontinuing supplies to S. Division B does some further work on A, incurs a variable processing cost of ₹220 per unit to produce its product B. The monthly fixed costs of Division A are ₹ 2,00,000. The monthly fixed costs of B are ₹ 1,50,000. Division A's raw material cost is ₹150 per unit and its variable manufacturing costs are ₹ 100 per unit. Variable selling overhead of ₹ 50 per unit of A and ₹ 70 per unit of B are incurred for sales other than transfers.

A had been selling to the outside market at a price of ₹460 per unit. Due to competition, it has to reduce its price to ₹380 per unit on the entire supplies if it has to sell any quantity above 2,000 units. At ₹380/unit, its entire output can be sold. B has an outside market price of ₹ 800 per unit and can sell up to 2,500 units. If A does not supply to B, a close substitute is available in the market for purchase by B at ₹ 380, on which some additional work costing ₹ 40 per unit has to be done to make it comparable to A. Assume that B will accept partial supply from A and that both divisions have complete autonomy in deciding their strategy and they have the knowledge of costs/revenues/supply conditions in each other's divisions.

### Required:

Using figures relevant for the following questions and calculations for the monthly period:

- (i) **Find out** the optimal strategy for A - how much to produce each month, how much to supply to external market and how much to supply to B and at what minimum cost to maximize its Divisional profits.
- (ii) **What** would be the range of transfer price per unit and the quantity that Manager of A will try to successfully negotiate with the Manager of B?

- (iii) **What** would be the range of transfer price that the Manager of B would consider to negotiate with A?
- (iv) As the top management person, **what** would you quote as the appropriate transfer price to be fair to A and B in their performance evaluation? [4 + 4 + 2 + 2] = 12

<p><b>Reference</b></p> <p><b>Best Strategy</b></p>	<p><b>What's New</b></p> <p><b>Range of Transfer Price</b></p>
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**Answer**

**Strategy for A:**

(i) **Strategy I:**

Sell 2,000 units to S at 400 ₹/u and 1,500 units outside @ 460 ₹/u

Contributions: $100 \times 2,000$	=	200,000
Contribution (outside) $160 \times 1,500$	=	240,000
Total Contribution for 3,500 units		440,000
Less: Fixed Cost	=	200,000
Profit		240,000

**Strategy II:**

Sell 1,500 units to B @ 380/unit and 2,000 units outside @ 460/u

Contribution B: $380 - 250$ excluding selling cost = $130 \times 1,500$	=	195,000
Contribution outside = $160 \times 2,000$	=	320,000
Total Contribution	=	515,000
Less: Fixed Cost	=	200,000
Profit		315,000

Selling all 3,500 units only to B or only outside are less profitable than the above two options and are rejected. Select Strategy II for A.

- (ii) B can get an equivalent product outside at ₹ 380, but has to incur additional costs up to ₹420. A can negotiate anything between ₹ 380 and ₹ 420
- (iii) The Manager of B knows that A will save on the external sales' variable selling overhead. What is ₹ 380 for A from outside selling price ( $380 - 300 = 80$ ) is equivalent of ₹ 330 from B (contribution =  $330 - 250 = 80$ ).

Manager of B will negotiate between ₹330 per unit to ₹420 per unit, beyond which B will not pay.

**Top Management:**

At 380 transfer price, A saves ₹ 50 on selling overhead. B saves ₹ 40 on reworking. Hence, at 375, A saves ₹ 45 and B also saves ₹ 45. Hence ₹ 375 will be a fair cost.

**Alternatively,** As top management, the price to be decided will be midway between 380 and 420, which is 400, equally fair to A and B.

**Q11****Dec'19**

XY Co. has Profit Centre Divisions X and Y, making products X and Y respectively. Each unit of Y requires one unit of X and Y can sell a maximum of 50,000 units in the external market at a selling price of ₹ 150 per unit. X has the capacity to produce 1,00,000 units of X. The variable cost per unit is 12. Fixed costs are ₹ 7,20,000. X can sell the following quantities in the external market:

Price per unit (₹)	Demand Units
18	84,000
20	76,000
22	70,000
24	64,000
26	54,000 or less

Assume no stock to build up for X or Y.

Y can purchase its requirement from the external market at ₹ 22 per unit, but has to incur a bulk transportation cost of ₹ 1,50,000 for any quantity, which will not be incurred on transfers from X.

**Required:**

- Assuming no demand from Y, **what** will be the best strategy for X?
- What** will be the minimum transfer price that X will agree to if X has to supply 50,000 units to Y? What price will Y offer as the maximum?
- If Y is acceptable to partial supplies, **what** will be X's best strategy under no compulsion to transfer, but with the option to transfer as many units that it wants to? **What** will be the quantity that X will agree to transfer and the corresponding price, assuming both divisions agree to share the benefits of transfer equally?
- What** is the best strategy of the company? Will the company's overall strategy differ from the individual divisions' strategy? **Compute** the benefits / disadvantages / indifference between the divisional best and company best strategies.

**Present** relevant calculations to substantiate all your answers.

[2 + 4 + 3 + 3 + 4] = 16

**Reference**  
**Best strategy**

What's **New**

**Min TP by seller, Max TP by buyer,  
Agreeable quantity to transfer,  
Companies overall strategy**

**Answer**

Variable cost is constant at ₹ 12. Hence the value that will give the maximum contribution will be relevant.

Price per unit	Demand Units	Contbn ₹/unit	Contbn Value
18	84,000	6	5,04,000
20	76,000	8	6,08,000
22	70,000	10	7,00,000
24	64,000	12	7,68,000
26	54,000	14	7,56,000

(i) The optimal strategy for X would be to manufacture 64,000 units for external demand in the absence of demand from Y.

(ii) If X has to supply 50,000 units to Y, then, it can supply only 50,000 units for external sales at ₹ 26. Contribution from external sales will be ₹  $14 \times 50,000 = 7,00,000$

Minimum contribution from Y will be 56,000 for 50,000 units. Hence, X will transfer at a minimum price of ₹  $12 + (56,000/50,000) = 13.12$  or ₹ 13 so that it is able to maintain the contribution from its optimal strategy.

However, if X is strong enough, it can demand a price of ₹ 22 which Y will be paying to outside suppliers.

Y will not pay anything more than  $22 + 1,50,000/50,000$ , i.e., 25 ₹ /unit.

(iii) If X can choose, X will supply 64,000 units for external demand and supply 36,000 units to Y. Y will have to incur transport even for the 14,000 units it purchases from outside. Hence it will not pay anything above ₹ 22. X will not accept anything below ₹ 13. Benefits to be shared equally between X and Y =  $22 - 13 = 9$  per unit. Hence Transfer price per unit will be ₹  $13 + 4.5 = ₹ 17.5$ , so that Y benefits by ₹ 4.5 and X also gets additional ₹ 4.5 contribution per unit transferred. Quantity transferred will be 36,000 units.

(iv) For the company as a whole, it is incurring a variable cost of ₹ 22 plus transport of ₹ 3 = ₹ 25 for every unit of Y purchased. Contribution of X as per best strategy = ₹ 13. Hence, for the company, best strategy will be to transfer 50,000 units to Y and sell 50,000 units to external sales.

Contribution lost by sub optimal strategy in Div X will be 68,000 =  $[7,68,000 - (50,000 \times 14)]$

**Gain by transfer**

= transport of 1,50,000 + savings in purchase cost  $(22 - 13) \times 50,000$

= ₹ 1,50,000 + 4,50,000. = ₹ 6,00,000.

**Net gain**

=  $(- 68,000) + 6,00,000 = 5,32, 000.$

## Q12

Dec'21

X Ltd is a diversified corporation with separate and distinct operating divisions. Each division's performance is evaluated on the basis of total profits and return on division investment. The Division A manufactures and sells table top air cooler units. Division A currently produces 15,000 units. Division A's manager believes that sales can be increased if the unit selling price of the table top air cooler is reduced. A market research study conducted by an independent firm at the request of the manager indicates that a 15% reduction in the selling price (₹60) would increase volume by 16% or 2,400 units, the reduced price applying to all the units. Division A has sufficient production capacity to manage this increased volume with no increase in fixed costs.

At present, Division A uses a filter in each of its units that it purchases from an outside supplier at a cost of ₹70 per filter. The manager of Division A has approached the manager of the Division B regarding the sale of a filter unit to Division A. The Division B currently manufactures and sells exclusively to outside firms a filter that is similar to the one used by Division A. The specifications of the Division A filter are slightly different which would reduce the Division B's direct material cost by ₹5 per unit. In addition, the Division B would not incur any variable selling costs in the units sold to Division A. The manager of Division A wants all of the filters it uses to come from one supplier, and has offered to pay B ₹50 for each filter unit. Division B has the capacity to produce 75,000 units and currently sells 64,000 units in the market.

Particulars	(₹)	
	Division A	Division B
Selling Price per unit	400	100
Manufacturing Costs:		
Filter	70	-
Variable Manufacturing Cost	112	30
Variable Marketing Cost	18	6

### Required:

- Should** Division A go for the increased volume of sales from a financial perspective? **Justify** your recommendation with appropriate figures. [2]
- If B should supply the entire requirement of A after considering (i) above, **what** is the minimum transfer price that B will agree to, given that a single transfer price applies to all units transferred to A? **Is** B likely to accept A's proposed transfer price? [3]
- In the interest of X Ltd. as a whole, **what** should be the best strategy in terms of sourcing and selling the filters? **Work out** a suitable transfer price for the management to convince A and B. Assume that X Ltd. is not constrained about avoiding partial supply. [3]

Reference	What's New
<b>Best Strategy</b>	

### Answer

(i) **Sales revenue for 15,000 units** =  $15,000 \times 400 = ₹ 60,00,000$

**Sales Revenue for 17,400 units** =  $17,400 \times 0.85 \times 400 = 17,400 \times 340 = ₹ 59,16,000$

A should not go for the increased sales at that discount since there is no incremental revenue or contribution.

Alternatively, Contribution per unit 200, for 15,000 units = ₹ 30,00,000

Contribution per unit 140, for 17,400 units = ₹ 24,36,000

The volume of 15,000 units of air coolers is more profitable for A.

(ii) B has spare capacity of  $75,000 - 64,000 = 11,000$  units. This can be supplied at variable cost less selling and material saving, i.e. 11,000 units at 25 ₹ per unit. = ₹ 2,75,000

4,000 units have to be supplied by diverting market sales at  $100 - 6 - 5 = 89 \times 4,000 = ₹ 3,56,000$

**Transfer price for 15,000 units** = ₹ 6,75,000

₹/unit =  $6,31,000/15,000 = 42.07$

A has offered ₹ 50. It will be in B's interest to accept the offer.

(iii) For every unit of B sold outside, the company earns a contribution of ₹ 64, whereas, if it transfers to A, the cost saved is just ₹ 70-25, which is ₹ 45 per unit.

For X Ltd's best strategy, B should supply 11,000 units to A out of its spare capacity and not divert from the market. X Ltd should convince A to accept partial supply from B. A also stands to gain since instead of paying ₹ 70 outside for the entire requirement of 15,000 units, A will incur only ₹ 50, which is also acceptable by B for its spare capacity. A should buy 4,000 units from the market at ₹ 70 and 11,000 units from B at ₹ 50 which it offered earlier. B will not sell below ₹ 25 per unit (its variable cost to A) even from its spare capacity.

# Variance Analysis (Standard Costing)

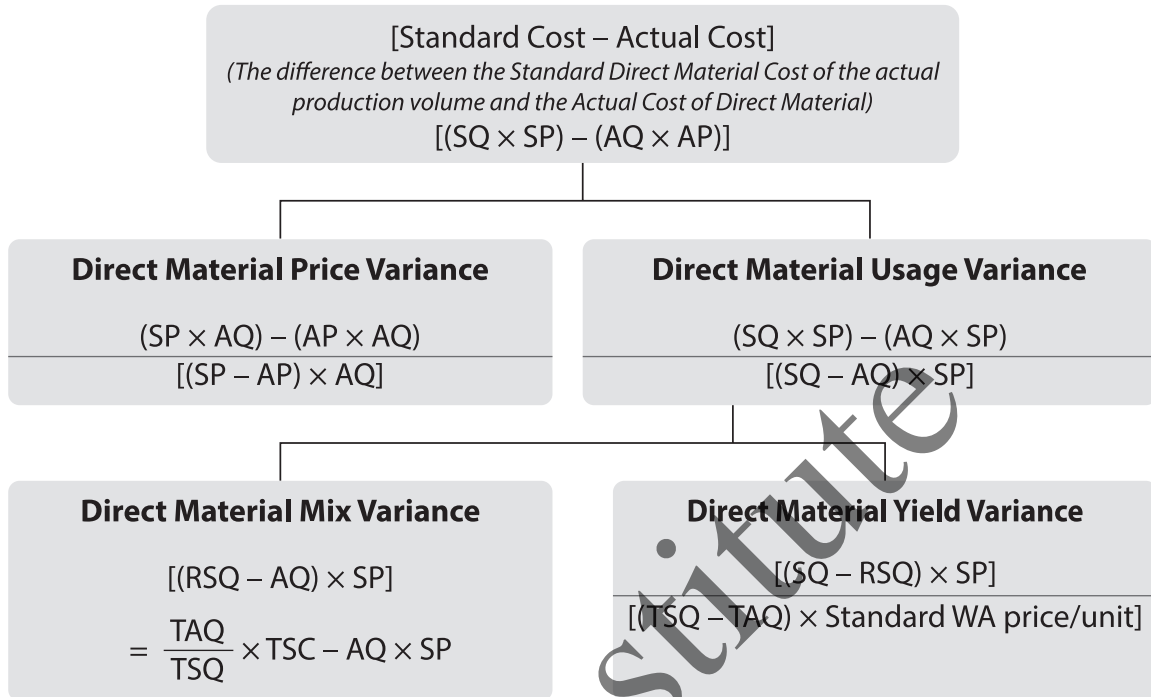


## Learning Objective

1. DIRECT MATERIAL VARIANCES
2. DIRECT LABOUR VARIANCES
3. VARIABLE PRODUCTION OVERHEAD VARIANCES
4. FIXED PRODUCTION OVERHEAD VARIANCES
5. TOTAL OVERHEAD VARIANCES
6. OVERHEAD VARIANCE UNDER ABC
7. EQUIVALENT PRODUCTION - WIP EFFECT ON COST VARIANCES
8. SALES VARIANCES (TURNOVER OR VALUE)
9. SALES MARGIN VARIANCES (ABSORPTION COSTING) & MATERIAL COSTING
10. PROFIT RECONCILIATION STATEMENT
11. PLANNING, OPERATING AND TRADITIONAL VARIANCES
12. RELEVANT COST APPROACH TO VARIANCE ANALYSIS

## DIRECT MATERIAL VARIANCES

### Direct Material Cost Variance



**Note :**

- SQ = Standard Quantity = Expected Consumption for Actual Output
- AQ = Actual Quantity of Material Consumed
- RSQ = Revised Standard Quantity = Actual Quantity Rewritten in Standard Proportion
- SP = Standard Price per Unit
- AP = Actual Price per Unit
- (\*) = Standard Cost refers to 'Standard Cost of Standard Quantity for Actual Output'
- (#) = Direct Material Total Variance (also known as material cost variance)

### Material Purchase Price Variance Single Plan

$$[(SP - AP) \times PQ]$$

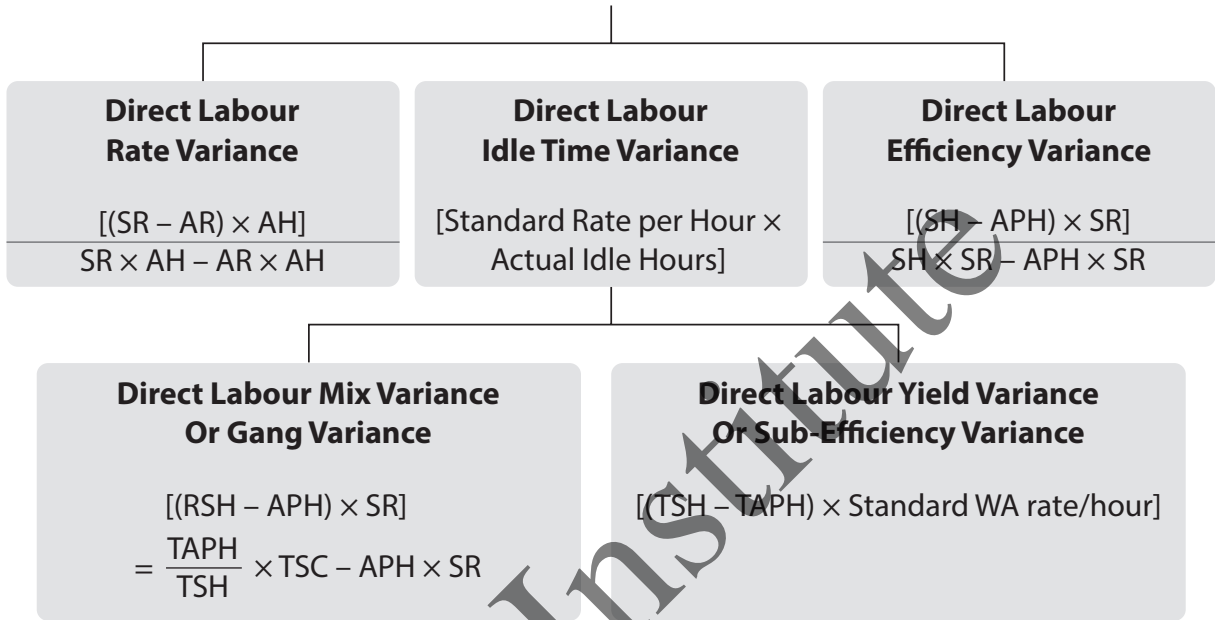
**Note :**

- PQ = Purchase Quantity
- SP = Standard Price
- AP = Actual Price

# DIRECT LABOUR VARIANCES

## Direct Labour Total Variance

$$\frac{[\text{Standard Cost} - \text{Actual Cost}]}{[(\text{SH} \times \text{SR}) - (\text{AH} \times \text{AR})]}$$



**Note :**

- SH = Standard Hours = Expected time (Time allowed) for Actual Output
- AH = Actual Hours
- APH = Actual Productive Hours
- RSH = Revised Standard Hours = Actual Hours (worked) rewritten in Standard Proportion
- SR = Standard Rate per Labour Hour
- AR = Actual Rate per Labour Hour Paid

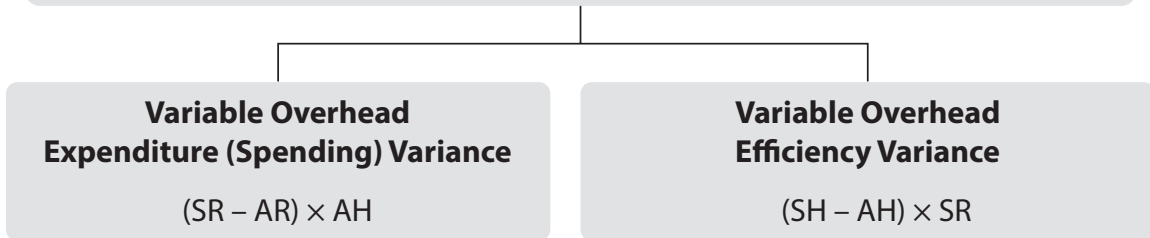
Idle Time is a period for which a workstation is available for production but is not used due to e.g. shortage of tooling, material or operators. During Idle Time, Direct Labour Wages are being paid but no output is being produced. The cost of this can be identified separately in an Idle Time Variance, so that it is not 'hidden' in an adverse Labour Efficiency Variance.

Some organizations face Idle Time on regular basis. In this situation the Standard Labour Rate may include an allowance for the cost of the expected idle time. Only the impact of any unexpected or abnormal Idle Time would be included in the Idle Time Variance.

## VARIABLE PRODUCTION OVERHEAD VARIANCES

### Variable Overhead Total Variance

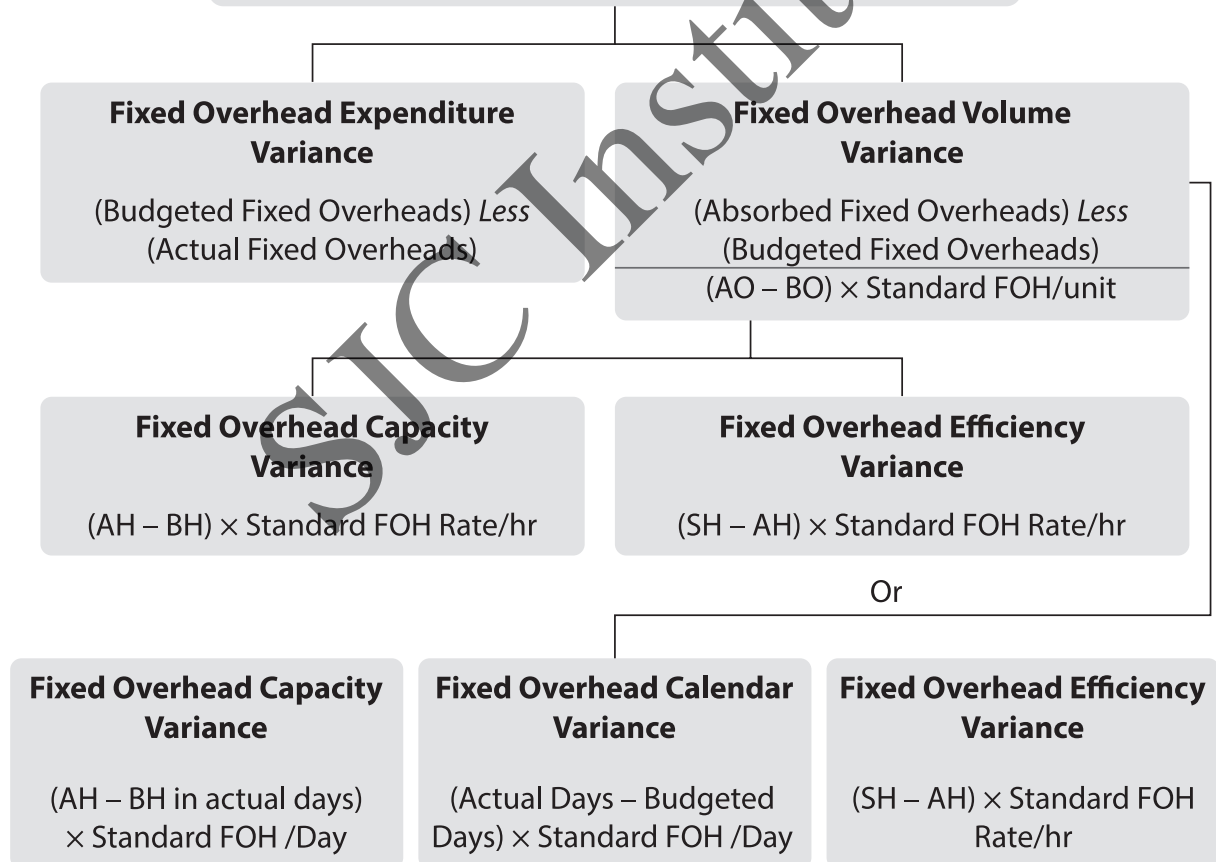
(Standard Variable Overheads for Actual Production – Actual Variable Overheads)



## FIXED PRODUCTION OVERHEAD VARIANCES

### Fixed Overhead Total Variance

(Standard FOH/unit × AO) – (Actual Fixed Overheads)



**Note**

**Fixed Overheads Ratios :**

1. Volume Ratio or Activity Ratio =  $\frac{AQ}{BQ} = \frac{SH}{BH}$
2. Capacity Ratio =  $\frac{AH}{BH}$
3. Efficiency Ratio =  $\frac{SH}{AH}$
4. Volume Ratio = Capacity Ratio × Efficiency Ratio

**SALES VARIANCES (TURNOVER OR VALUE)**



**Note :**

BO = Budgeted Sales Output

AO = Actual Sales Output

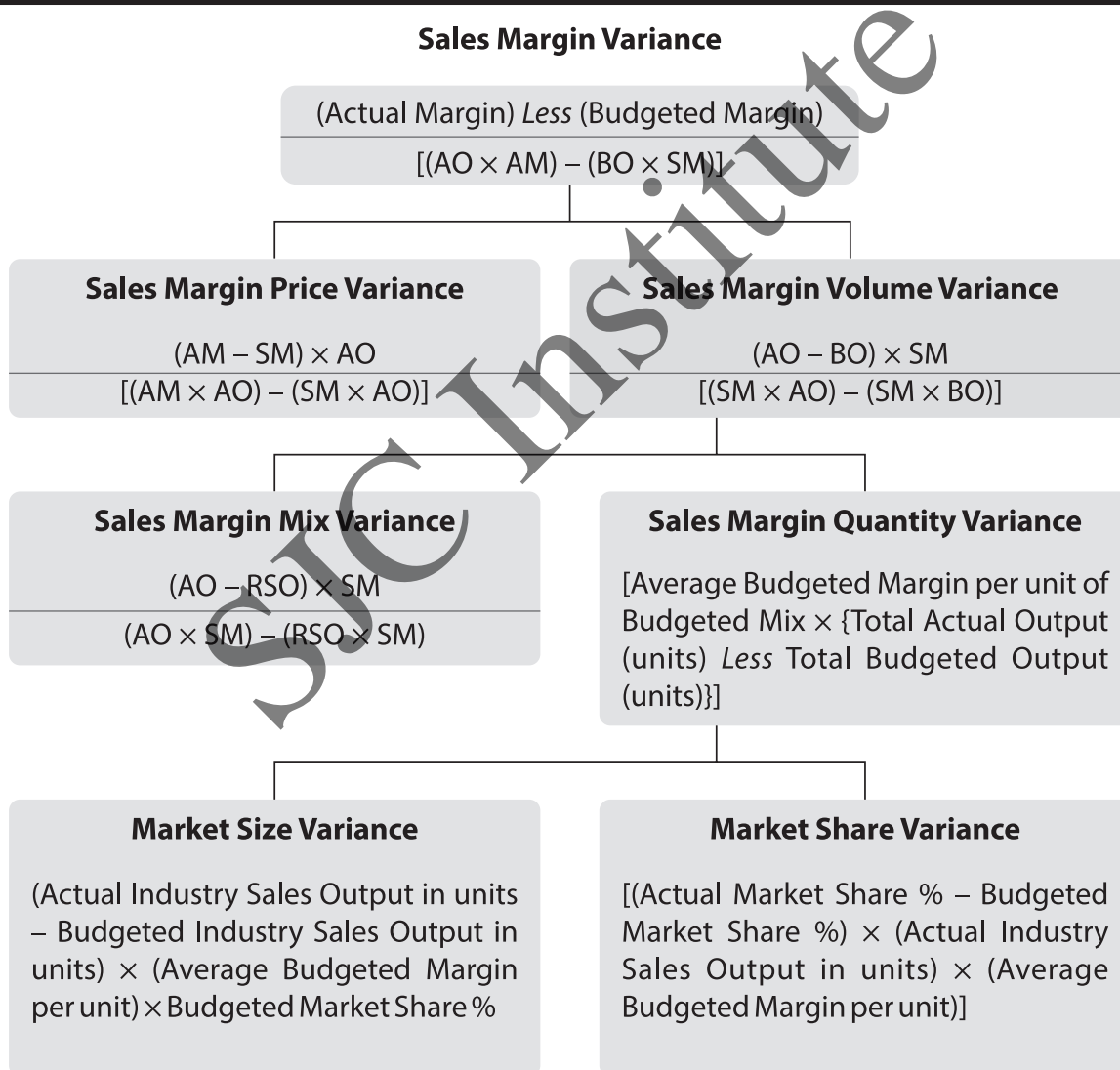
RSO = Revised Standard Sales Output

= Actual Output Sold Rewritten in Budgeted Proportion

SP = Standard Selling Price per Unit

AP = Actual Selling Price per Unit

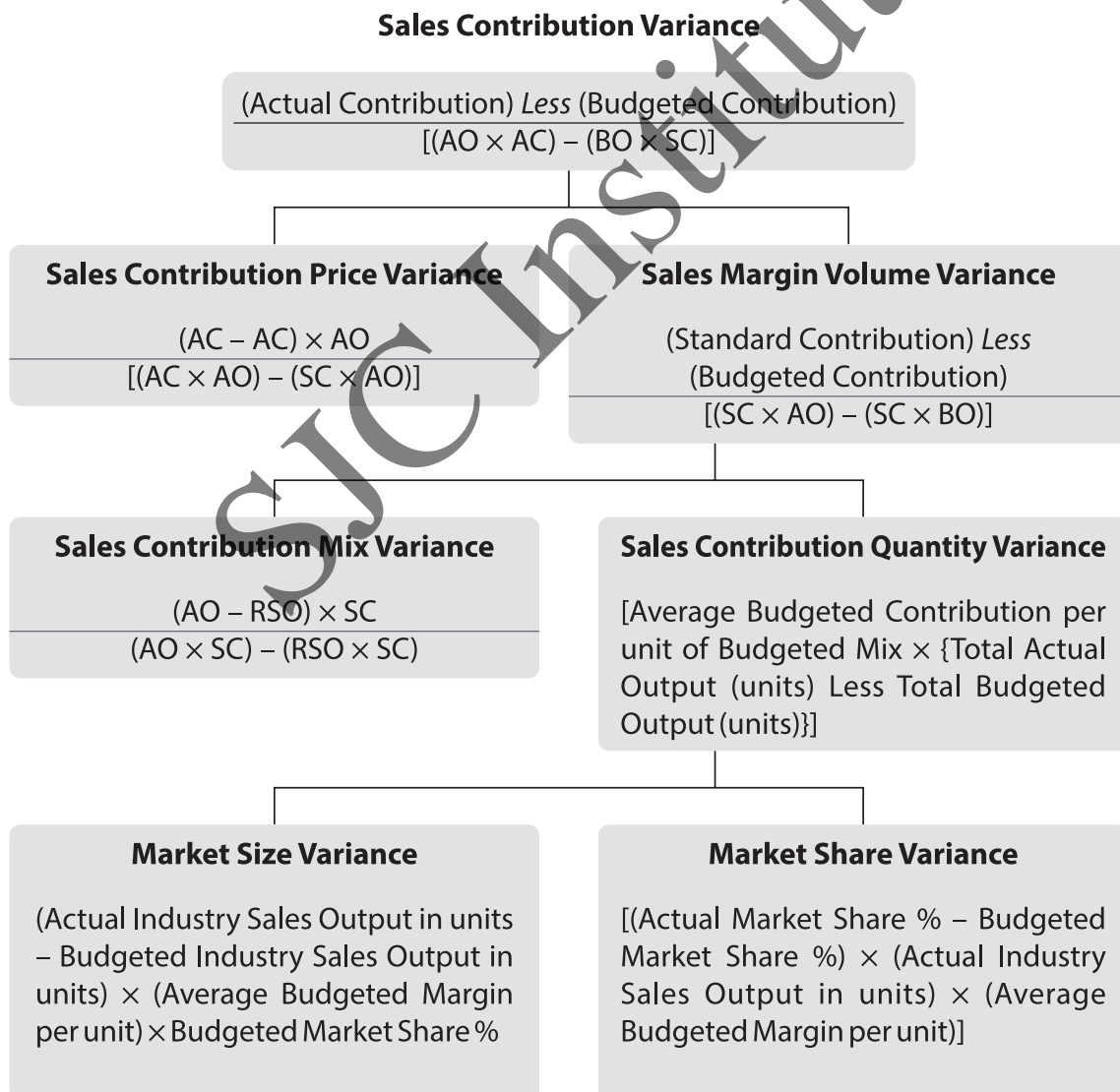
**SALES MARGIN VARIANCES (ABSORPTION COSTING)**



**Note :**

- BO = Budgeted Sales Output
- AO = Actual Sales Output
- RSO = Revised Standard Sales Output  
= Actual Output Sold Rewritten in Budgeted Proportion
- SM = Standard Margin / Ut  
= Standard Price per Unit – Standard Cost per Unit
- AM = Actual Margin / Ut  
= Actual Sales Price per Unit – Standard Cost per Unit

**SALES CONTRIBUTION VARIANCES (MARGINAL COSTING)**



**Note :**

- BO = Budgeted Sales Output
- AO = Actual Sales Output
- RSO = Revised Standard Sales Output  
= Actual Output Sold Rewritten in Budgeted Proportion
- SC = Standard Contribution / ut  
= Standard Price per Unit – Standard Cost (variable) per Unit
- AC = Actual Contribution / ut  
= Actual Sales Price per Unit – Standard Cost (variable) per Unit

- **Sales Price Variance is equal to Sales Margin/ Contribution Price Variance.** This is because, for the actual quantity sold, standard cost remaining constant, change in selling price will have equal impact on turnover and profit/ contribution.
- **Sales Margin Volume Variance** = (Sales Volume Variance × Budgeted Net Profit Ratio)
- **Sales Contribution Volume Variance** = (Sales Volume Variance × Budgeted PV Ratio)

**A Relation: Sales Margin Volume Variance in terms of Profit & Contribution**

Sales Margin (Profit) Volume Variance	Standard Margin Per Unit × (Actual Output – Budgeted Output)
	= [Standard Contribution Per Unit – Standard Fixed Overheads Per Unit] × (Actual Output – Budgeted Output)
	= [Standard Contribution Per Unit × (Actual Output – Budgeted Output)] – [Standard Fixed Overheads Per Unit × (Actual Output – Budgeted Output)]
	= Sales Contribution Volume Variance – Fixed Overhead Volume Variance Or
Sales Contribution Volume Variance	Sales Margin Volume Variance + Fixed Overhead Volume Variance

Note: Production units equals to Sales units for both actual & budget.

## 1. INTRODUCTION

During the first stages of development of cost accounting, historical costing was the only method available for ascertaining and presenting costs. Historical costs have, however, the following **limitations**:

- (a) Historical cost is valid **only for one accounting period**, during which the particular manufacturing operation took place.
- (b) Data is obtained **too late** for price quotations and production planning.
- (c) Historical cost relating to one batch or lot of production is not a **true guide for fixing price**.
- (d) **Past actual are affected** by the level of working efficiencies.
- (e) Historical costing is comparatively **expensive** as it involves the maintenance of a large volume of records and forms.

The limitations and disadvantages attached to historical costing system led to further thinking on the subject and resulted in the emergence of standard costing which makes use of scientifically pre-determined standard costs under each element.

### Definition:

Standard Costing is defined as "the preparation and use of standard cost, their comparison with actual costs and the measurement and analysis of variances to their causes and points of incidence."

## 2. GENERAL PRINCIPLES OF STANDARD COSTING

1. **Predetermination of technical data** related to production. i.e., details of materials and labour operations required for each product, the quantum of inevitable losses, efficiencies expected, level of activity, etc.
2. **Predetermination of standard costs** in full details under each element of cost, viz., labour, material and overhead.
3. **Comparison of the actual performance and costs with the standards** and working out the variances, i.e., the differences between the actuals and the standards.
4. **Analysis of the variances** in order to determine the reasons for deviations of actuals from the standards.
5. **Presentation of information** to the appropriate **level** of management to enable suitable action (remedial measures or revision of the standards) being taken.

### 3. DIFFERENCE BETWEEN STANDARD COSTING AND BUDGETARY CONTROL [MTP DEC'19]

Like Budgetary Control, Standard Costing **assume that costs are controllable along definite lines of supervision and responsibility** and it aims at managerial control by comparison of actual performances with suitable predetermined yardsticks. The **basic principles of cost control**, viz., setting up of targets or standards, measurement of performance, comparison of actual with the targets and analysis and reporting of variances **are common** to both standard costing and budgetary control systems. Both techniques are of importance in their respective fields are **complementary to each other**. Thus, conceptually there is not much of a difference between standard costs and budgeted and the terms budgeted performance and standard performance mean, for many concerns one and the same thing.

Budgets are usually based on past costs adjusted for anticipated future changes but **standard costs are of help in the preparation of production costs budgets**. In fact, standards are often indispensable in the establishment of budgets. On the other hand, **while setting standard overhead rates of standard costing purposes**, the **budgets framed for the overhead costs may be made use of with modifications**, if necessary. Thus, standard costs and budgets are interrelated but not inter-dependent.

Despite the **similarity** in the basic principles of Standard Costing and Budgetary Control, the two systems vary in scope and in the matter of detailed techniques. The **difference** may be summarized as follows:

1. **A system of Budgetary Control may be operated even if no Standard Costing system is in use in the concern.**
2. While **standard is an unit** concept, **budget is a total** concept.
3. **Budgets are the ceilings or limits of expenses** above which the actual expenditure should not normally rise; if it does, the planned profits will be reduced. **Standards are minimum targets** to be attained by actual performance at specified efficiency.
4. **Budgets are complete in** as much as they are framed for all the activities and functions of a concern such as production, purchase, selling and distribution, research and development, capital utilisation, etc. **Standard Costing relates mainly to the function of production** and the related manufacturing costs.
5. A more searching analysis of the variances from standards is necessary than in the case of **variations from the budget**.
6. Budgets are **indices**, adherence to which keeps a business out of difficulties. Standards are **pointers** to further possible improvements.

### 4. ADVANTAGES OF STANDARD COSTING [MTP JUN'19]

**The advantages derived from a system of standard costing are tabulated below:**

1. Standard Costing system **establishes yard-sticks** against which the **efficiency** of actual performances is measured.

2. The standards provide **incentive** and **motivation** to work with greater effort and vigilance for achieving the standard. This increase efficiency and productivity all round.
3. At the very stage of setting the standards, **simplification and standardisation** of products, methods, and operations are effected and waste of time and materials is eliminated. This assists in managerial planning for efficient operation and benefits all the divisions of the concern.
4. Costing procedure is **simplified**. There is a reduction in paper work in accounting and less number of forms and records are required.
5. Cost are available with **promptitude for various purposes like fixation of selling prices**, pricing of inter-departmental transfers, ascertaining the value of costing stocks of work-in-progress and finished stock and determining idle capacity.
6. Standard Costing is an **exercise in planning** - it can be very easily fitted into and used for budgetary planning.
7. Standard Costing system facilities **delegation of authority** and **fixation of responsibility** for each department or individual. This also tones up the general organisation of the concern.
8. Variance analysis and reporting is based on the principles of **management by exception**. The top management may not be interested in details of actual performance but only in the variances from the standards, so that corrective measures may be taken in time.
9. When constantly reviewed, the standards provide means for achieving **cost reduction**.
10. Standard costs assist in **performance analysis** by providing **ready means for preparation of information**.
11. **Production and pricing policies** may be formulated in advance before production starts. This helps in prompt decision-making.
12. Standard costing facilitates the **integration of accounts** so that reconciliation between cost accounts and financial accounts may be eliminated.
13. Standard Costing **optimizes the use of plant capacities, current assets and working capital**.

## 5. LIMITATIONS OF STANDARD COSTING

1. Establishment of standard costs is **difficult** in practice.
2. In course of time, sometimes even in a short period the standards become **rigid**.
3. **Inaccurate, unreliable** and **out of date** standards do more harm than benefit.
4. Sometimes, standards create **adverse psychological effects**. If the standard is set at high level, its non achievement would result in **frustration** and build-up of **resistance**.
5. Due to the play of random factors, variances **cannot sometimes be properly explained**, and it is difficult to **distinguish between controllable and non-controllable expenses**.

6. Standard costing may **not sometimes be suitable for some small concerns**. Where production cannot be carefully scheduled, frequent changes in production conditions result in variances. Detailed analysis of all of which would be meaningless, superfluous and costly.
7. Standard costing **may not, sometimes**, be suitable and **costly** in the case of industries dealing with **non-standardized** products and for repair jobs which keep on changing in accordance with customer's specifications.
8. **Lack of interest in standard costing on the part of the management** makes the system practically ineffective. This limitation, of course, applies equally in the case of any other system which the management does not accept wholeheartedly.

## 6. STANDARD COST

Standard Cost is defined as **"the predetermined cost that is calculated at the management's standards of efficient operations and the relevant necessary expenditure"**.

From this, we understand that **it is the cost calculated when all the people working in the organisation to their utmost, the expenditure incurred for producing the product can be taken as standard cost**. The optimum efficiency can not at all time exists. Therefore, optimum efficiency is assumed and that is why standard cost is called assumed cost. Further, all the inputs of cost scientifically analysed using so many industrial engineering techniques such as work measurement, method study, time and motion study, merit rating, job evaluation and other scientific techniques, it can also be called as Scientific Cost.

## 7. STANDARD COSTS AND ESTIMATED COSTS

The **distinction** between Standard Costs and Estimated Costs should be clearly understood. While both Standard Costs and Estimated Costs are predetermined costs, their objectives are different. The main **differences** between the two types of costs are:

1. Estimated Costs are intended to determine **what the costs 'will' be**. Standard Costs aim at what costs 'should' be.
2. **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.
3. 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.

## 8. SETTING OF STANDARD COSTS

**While setting production costs standards, the following preliminaries should be considered:**

- (a) **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.
- (b) **Review of the existing costing system** and the cost records and forms in use.
- (c) **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 organization, and whether the **standards will be merged** in the accounting system or kept outside the accounts as statistical data.
- (d) **Proper classification of the accounts** so that variances may be determined in the manner desired.
- (e) **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.

## 9. STOCK VALUATION

The function of a Balance Sheet is to give a true and fair view of the state of affairs of a company on a particular date. A true and fair view also implies the consistent application of generally accepted principles. Stocks valued at **standard costs are required to be adjusted at actual costs** in the following circumstances:

- (a) **As per Accounting Standards** – 2, closing stock to be valued either at cost price or at net realisable value (NRV) whichever is less.
- (b) The standard costing system introduced is **still in an experimental stage** and the variances merely represent deviations from poorly set standards.
- (c) Occurrence of certain variances which are **beyond the control** of the management. (Unless the stocks are adjusted for uncontrollable factors, the values are not correctly stated).

## 10. MAINTENANCE OF RAW MATERIAL STOCK AT STANDARD COST

In the single plan, the inventory in the stores ledger may be carried either at standard costs or at actual. Although both the methods are in use, the consensus is in favour of standard costs. **The advantages of adopting standard costs for inventory valuation are as follows:**

- (a) **Stores ledger may be maintained in quantities only** and **the standard price noted at the top** in the ledger sheets. This **economises the use of forms** as well as reduces clerical costs as no columns for rates need be maintained.
- (b) **Pricing of materials requisitions is simplified** as only one standard price for each item of material is required to be used.
- (c) **Price variance is promptly revealed at the time of purchase** of material.

**The disadvantages are:**

- (a) The stores ledger **does not reveal the current prices**.
- (b) If the material stock is **shown in the Balance Sheet at standard costs**, the variances have the effect of **distorting the profit or loss**. Standard cost of the closing inventory is required to be adjusted to actual cost based on price variance to comply with the statutory requirement of the Companies Act, 2013.
- (c) **A revision of the standard** necessitates **revision of the cost of the inventory**.

## 11. DEFINE ACTIVITY RATIO [JUN'19]

It is the number of standard hours equivalent to the work produced, expressed as a percentage of the budgeted standard hours.

$$\text{Activity Ratio} = \frac{\text{Standard Hours for Actual Work}}{\text{Budgeted Standard hours}} \times 100$$

Activity ratios gauge an organization's operational efficiency and profitability. These ratios are most useful when compared to a competitor or industry to establish whether an entity's processes are favourable or unfavourable. Activity ratios can form a basis of comparison across multiple reporting periods to determine changes over time.

## 12. TREATMENT OF VARIANCES IN COST ACCOUNTS

In Standard Cost Accounting Systems, which contain both actual and standard costs in the accounting records and financial statements, the question of adjustment of the cost variances at the end of the accounting period arises.

Three methods of disposal of variances and the advantages and disadvantages of each are discussed below:

1. Transfer to Profit and Loss Account.
2. Allocation of Variances to Finished Stock, Work-in-Progress and Cost of Sales Account.
3. Transfer of Variances to the Reserve Account.

Under the method Allocation of Variances to Finished Stock, Work-in-Progress and Cost of Sales Account, the variances are distributed over stocks of finished and partly finished products and to the cost of sales. The distribution of each variance is made to the three accounts on a percentage basis according to the closing balance (value) of each account.

**Q1**

**CMA Mat**

S.V. Ltd. Manufacturers by mixing three raw materials. For every batch of 100Kg. of BXE, 125 Kg. of raw Materials are used. In April, 1988, 60 batches were prepared to produce an output of 5,600 Kg. of BXE. The standard and actual particulars for April, 1988 are as under:

Raw material	Mix %	Price per kg	Mix %	Price per kg	Quantity of raw materials purchased kg
A	50	20	60	21	5,000
B	30	10	20	8	2,000
C	20	5	20	6	1,200

Calculate all variances.

**Reference**

**Material variances**

What's **New**

**Processing Loss**

**Answer**

	Standard data			actual data		
	Q	P	V	Q	P	V
A	3,750	20	75,000	4,500	21	94,500
B	2,250	10	22,500	1,500	8	12,000
C	1,500	5	7,500	1,500	6	9,000
	60 × 125 = 7,500		1,05,000	7,500		1,15,500
(-) Standard Loss	60 × 25 = 1,500			1,900		
	6,000		1,05,000	5,600		1,15,500

	SQSP	RSQSP	AQSP	AQAP
A	3,500 × 20		4,500 × 20	
B	2,100 × 10		1,500 × 10	
C	1,400 × 5		1,500 × 5	

A	70,000		90,000	
B	21,000		15,000	
C	7,000		75,000	
Total	₹ 98,000	₹ 105,000	₹ 1,12,500	₹ 1,15,500

SQ FOR A =  $5,600/6,000 \times 3,750$ , B =  $5,600/6,000 \times 2,250$ , C =  $5,600/6,000 \times 1,500$

- **Material price variance** = ₹ 3,000(A)
- **Material mix variance** = ₹ 7,500(A)
- **Material yield variance** = ₹ 7,000(A)
- **Material cost variance** = ₹ 17,500(A)

## Q2

## CMA Mat; MTP Dec'19

A company manufacturing a special type of fencing tile  $12'' \times 8'' \times 1\frac{1}{2}''$  used a system of standard costing. The standard mix of the compound used for making the tiles is:

1,200 kg.	of Material A @	₹ 0.30 per kg.
500 kg.	of Material B @	₹ 0.60 per kg.
800 kg.	of Material C @	₹ 0.70 per kg.

The compound should produce 12,000 square feet of tiles of  $1\frac{1}{2}''$  thickness. During a period in which 1,00,000 tiles of the standard size were produced, the material usage was:-

Kg		₹
7,000	Material A @ ₹0.32 per kg.	2,240
3,000	Material B @ ₹0.65 per kg.	1,950
5,000	Material C @ ₹0.75 per kg.	3,750
15,000		7,940

**Present** the cost figures for the period showing Material price, Mixture, Sub-usage Variance.

Reference	What's New
<b>Material Variances</b>	<b>No. of tiles Calculations</b>

### Answer

Area of tile =  $12 \times 8 / 12 \times 12 = 2/3$  sq ft

No of tiles that can be laid in 12,000 sq ft is  $12,000 / (2/3) = 18,000$

	Standard data			Actual data		
	Q	P	V	Q	P	V
A	6,666.67	0.3	2,000	7,000		2,240
B	2,777.77	0.6	16,666.67	3,000		1,950
C	4,444.44	0.7	3,111.11	5,000		3,750
	13,888.89		6,778	15,000		7,940

Q for A =  $18,000 / 1,00,000 \times 1,200 = 6,666.67$

Q for B =  $18,000/1000,00,500 = 2,777.77$

Q for C =  $18,000/1,00,000 \times 800 = 4,444.44$

	SQSP	RSQSP	AQSP	AQAP
A		$7,200 \times 0.3$	$7,000 \times 0.3$	
B		$3,000 \times 0.6$	$3,000 \times 0.6$	
C		$4,800 \times 0.7$	$5,000 \times 0.7$	
A		2,160	2,100	
B		1,800	1,800	
C		3,360	3,500	
	₹ 6,778	₹ 7,320	₹ 7,400	₹ 7,940

RSQ for A =  $(15,000/13,888.89) \times 6,66,667$

- Material sub usage variance = ₹ 542(A)
- Material mix variance = ₹ 80(A)
- Material usage variance = ₹ 622(A)
- Material price variance = ₹ 540(A)
- Material cost variance = ₹ 1,162(A)

**Q3**

**CMA Mat; MTP Dec'19**

A brass foundry making castings which are transferred to the machine shop of the company at standards in regard to material stocks which are kept at standard price are as follows:-

Standard Mixture	70% Copper : 30% Zinc	
Standard Price	Copper ₹2,400 per ton	Zinc ₹ 650 per ton

Standard loss in melting 5% of input

Figures in respect of a costing period are as follows:

<b>Commencing stocks</b>	Copper	100 tons	
	Zinc	60 tons	
<b>Finishing stocks</b>	Copper	110 tons	
	Zinc	50 tons	
<b>Purchases</b>	Copper	300 tons	Cost ₹ 7,32,500
	Zinc	100 tons	Cost ₹ 62,500
Metal melted	400 tons		
Casting produced	375 tons		

Present figures showing: Material Price, Mixture and yield Variance.

<p>Reference</p> <p><b>Material Variance</b></p>	<p>What's New</p> <p><b>Single Plan &amp; Partial Plan</b></p>
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**Answer**

	Copper		Zinc	
	Q	V	Q	V
Opening stock	100	2,40,000	60	39,000
(+) Purchases	300	7,32,500	100	62,500
	400	9,72,500	160	1,01,500
(-) Closing stock	110	2,64,000	50	32,500
	290	7,08,500	110	69,000

	Standard			Actual		
	Q	P	V	Q	P	V
Copper	280	2,400	6,72,000	290		7,08,500
Zinc	120	650	78,000	110		69,000
	400		7,50,000	400		7,77,500
(-) Standard loss @ 5%	20			25		
	380		7,50,000	375		7,77,500

	SQSP	RSQSP	AQSP	AQAP
Copper	$276.315 \times 2,400$		$290 \times 2,400$	
Zinc	$118.42 \times 650$		$110 \times 650$	
Copper	6,63,157		6,96,000	
Zinc	76,975		71,500	
Total	7,40,132	7,50,000	7,67,500	7,77,500

**Material yield variance = 9,868(A)**

- Material price variance = 10,000(A)
- Material mix variance = 17,500(A)

**Q4 CMA Mat; Dec'18; MTP Jun'18; MTP Dec'18**

One kilogram of product 'K' requires two chemicals A and B. The following were the details of product 'K' for the month of June, 2015:

- (a) Standard mix Chemical 'A' 50% and Chemical 'B' 50%
- (b) Standard price per kilogram of Chemical 'A' ₹12 and Chemical 'B' ₹15
- (c) Actual input of Chemical 'B' 70 kilograms.
- (d) Actual price per kilogram of Chemical 'A' ₹15
- (e) Standard normal loss 10% of total input.
- (f) Materials Cost variance total ₹650 adverse.
- (g) Materials Yield variance total ₹135 adverse.

You are **required to calculate:**

1. Materials mix variance total
2. Materials usage Variance total
3. Materials price variance total
4. Actual loss of actual input
5. Actual input of chemical 'A'
6. Actual price per kilogram of Chemical 'B'

<p><b>Reference</b></p> <p><b>Material Variances</b></p>	<p><b>What's New</b></p> <p><b>Actual loss, Actual input, Actual price</b></p>
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**Answer**

Let, actual input of chemical A be 'a' kgs  
 Actual price per Kg of chemical B be ₹ b  
 Standard input be 100 Kgs  
 Actual output be 90 Kgs

	Standard			Actual		
	Q	P	V	Q	P	V
A	50	12	600	a	15	15a
B	50	15	750	70	b	70b
	100		1,350	70 + a		15a + 70b

(-) normal loss	10	—	—	a - 20	—	—
	90		1,350	90		15a + 70b

	(1)	(2)	(3)	(4)
	SQSP	RSQSP	AQSP	AQAP
A		$12 \times (70+a/100) \times 50$	$12 \times a$	
B		$15 \times (70+a/100)/50$	$15 \times 70$	
	1,350	$945 + 13.5a$	$1,050 + 12a$	$15a + 70b$

Given, Material cost variance = (1) - (4) = - 650  
 $= 15a + 70b = ₹ 2,000$

Material Yield variance = (1) - (2) = - 135  
 $\Rightarrow a = 40$   
 $\Rightarrow b = 20$

- (1) **SQSP** = ₹ 1,350
- (2) **RSQSP** =  $945 + (13.5 \times 40) = ₹ 1,485$
- (3) **AQSP** =  $1,050 + (12 \times 40) = ₹ 1,530$
- (4) **AQAP** =  $(15 \times 40) + (70 \times 20) = ₹ 2,000$ 
  - (a) Material mix variance = ₹ 45(A)
  - (b) Material usage variance = ₹ 180(A)
  - (c) Material price variance = ₹ 470(A)
  - (d) Actual loss of actual input = 20 Kgs
  - (e) Actual input of chemical A = 40 Kgs
  - (f) Actual price per Kgs of chemical B = ₹ 20

**Q5**

**Dec'18**

One kilogram of product 'K' requires two chemical A and B. The following were the details of product 'K' for the month of June 2018 :

- (i) Standard mix ratio is 1:1
- (ii) Standard price per kilogram of chemical 'A' ₹ 12 and chemical 'B' ₹ 15.
- (iii) Actual input of chemical 'B' 70 kilograms
- (iv) Actual price per kilogram of Chemical 'A' ₹ 15
- (v) Standard normal loss 10% of total input.

- (vi) Materials cost variance total ₹ 650 adverse and the same was fully attributable to Chemical 'B'.
- (vii) Materials yield variance total ₹ 135 adverse.

**Required :**

**Compute** all missing variances and complete the Variance Report.

[6 + 4 = 10]

<p><b>Reference</b></p> <p><b>Material Variances</b></p>	<p>What's <b>New</b></p> <p><b>Missing Figures</b></p>
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**Answer**

	SPSQ	SPRSQ	SPAQ	AQAP
A	12*?	12*?	12*?	?*15
B	15*?	15*?	15*70	70*?

- (1) Let the total actual input be X kgs. Therefore applying the Standard Mix Ratio, the Revised Standard Quantity of Chemicals A and B each would be 0.5 kgs.
- (2) Total YIELD VARIANCE of 135 adverse can be split according to the ratio of SPSQ. Since inputs are equal the ratio will be that of price i.e. 4:5. Hence, YIELD VARIANCE of A is 60 Adverse and B is ₹ 75 Adverse. Substituting yield variance we get SQ of A & B each as 50 kgs.

$$A = 12*(SQ - 0.5X) = -60$$

$$SQ - 0.5X = .5$$

$$SQ = 0.5X - 5$$

Similarly, for B  $SQ = 0.5X - 5$

- (3) Total actual input = X kgs. : Actual input of A = (X - 70)

- (4) Material Cost Variance of A = Nil (i.e. SPSQ - AQAP) = 0

$$\text{i.e., } 12*(0.5X - 5) - 15*(X - 70)$$

Solving this  $X = 110$

Therefore, Revised Standard Quantity of A and B each is 55 kg and

Standard Quantity of A and B each is 50 Kgs.

Material cost variance of B = ₹ 650 Adverse

$$\text{i.e. } (15*50) - 70*AP = -650$$

$$\therefore 750 - 70AP = -650, 70AP = 1,400, AP = 20$$

The final variance report is as follows

	SPSQ	SPRSQ	SPAQ	AQAP
A	600	660	480	600
B	750	825	1,050	1,400
Total	1,350	1,485	1,530	2,000

	Yield	Mix Variance	Usage Variance	Price Variance	Cost Variance
A	60A	180F	120F	120A	0
B	75A	225A	300A	350A	650A
Total	135A	45A	180A	470A	650A

**Q6**

MTP Jun'19

DM is a denim brand specializing in the manufacture and sale of hand-stitched jeans trousers. DM manufactured and sold 10,000 pairs of jeans during a period. Information relating to the direct labour cost and production time per unit is as follows:

	Actual Hours Per Unit	Standard Hours Per Unit	Actual Rate Per Hour	Standard Rate Per Hour
Direct Labour	0.65	0.60	₹ 120	₹ 100

**Note:** 0.65 hours per unit of actual time includes the idle time.

During the period, 800 hours of idle time was incurred. In order to motivate and retain experienced workers, DM has devised a policy of paying workers the full hourly rate in case of any idle time.

**Required:**

- (i) Idle time Variance  
 (ii) Labour Efficiency Variance [3 + 5 = 8]

<p><b>Reference</b></p> <p><b>Labour variances</b></p>	<p><b>What's New</b></p>
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**Answer**

<p>(i) Idle Time Variance: Idle time Variance</p>	<p>= number of idle hours × standard rate          = 800 hours × ₹ 100          = ₹ 80,000 (A)</p>
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(ii) Labour Efficiency Variance:	
Total Hours	= 10,000 units × 0.65 hours per unit = 6,500 hours.
Active Hours	= 6,500 hours – 800 idle hours = 5,700 hours.
Standard Cost of Active Hours	= Active Hours × Standard Rate = 5,700 hours × ₹ 100 per hour = ₹ 5, 70,000
Standard Hours	= 10,000 units × 0.60 hours per unit = 6,000 hours.
Standard Cost	= Standard Hours × Standard Rate = 6,000 hours × ₹ 100 per hour = ₹ 6, 00,000
Labour Efficiency Variance	= Standard Cost – Standard Cost of Active Hours = 6, 00,000 – 5, 70,000 = ₹ 30,000 (F)

### Q7

MTP Dec'18

A manufacturing company has the following production budget for November 2016:

Product A = 20,000 units and Product B = 40,000 units

A standard hour represents 10 units of A and 8 units of B.

Standard wage rate per hour is ₹ 0.50

During the month 7,500 hours were paid for @ ₹ 0.60 per hour, which included 350 unproductive hours due to unbudgeted holidays as also loss of production of 250 units of Product-A due to machine breakdown.

Actual production for the month was 24,000 units of A and 38,000 units of B.

**Calculate** the following:

- (i) Direct labour rate variance
- (ii) Direct labour idle time variance
- (iii) Direct labour efficiency variance.
- (iv) Direct labour total variance.

[2½ × 4 = 10]

<p><b>Reference</b></p> <p><b>Labour variances</b></p>	<p><b>What's New</b></p> <p><b>Loss of Production due to machine breakdown</b></p>
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**Answer**

Product	Production (Units)	Per standard hours (Units)	Standard hours
A	24,000	10	2,400
B	38,000	8	4,750
			7,150

- (i) **Direct labour rate variance:**  $(SR - AR) \times AT = ₹ (0.50 - 0.60) \times 7,500 = ₹ 750 (A)$
- (ii) **Direct labour idle time variance:**  $Abnormal\ idle\ time \times SR = 375 \times 0.50 = ₹ 187.50 (A)$
- (iii) **Direct labour efficiency variance:**  
 $(ST - AT\ excluding\ abnormal\ Idle\ Time) \times SR = (7,150 - 7,125) \times ₹ 0.50 = ₹ 12.50 (F)$
- (iv) **Direct labour total variance:**  
 Standard cost-7,150 hours @ ₹ 0.50 = ₹ 3,575  
 Actual cost-7,500 hours @ ₹ 0.60 = ₹ 4,500  
 Direct labour total variance ₹ 925 (A)

**Note:**

Abnormal idle time – Unbudgeted holidays	= 350 hours
Machine breakdown-(1/10) × 250	= 25 hours
	375 hours

**Q8**

**Jun'19**

Fifteen workers (10 Type I workers and 5 Type II workers) work in a production process during a month of 25 working days. Each Type I worker is expected to produce 8 units per day and Type II worker is expected to produce 12 units per day. They work on the regular shift from 9:00 a.m. to 5 p.m. and have a tea break between 10:30 to 10:45 a.m. and 3:00 to 3:15 p.m. and also have a lunch break from 1:00 to 1:30 p.m. The actual production was 1,800 units by Type I workers and 1,200 units by Type II workers. The standard wage rate per hour were ₹50 and ₹60 for Type I and Type II workers, respectively and corresponding actuals were 60 and 70, respectively. During the month, 16 hours were lost actually for both types of workers, which is also as per expectation for waiting for materials and inspection.

**Calculate** the following:

- (i) Standard labour cost for the month
- (ii) Labour cost variance
- (iii) Labour efficiency variance
- (iv) Idle time variance

Indicate (A) or (F) to denote whether the variances are adverse or favourable. [3+3+1+1 = 16]

<p><b>Reference</b></p> <p><b>Labour Variances</b></p>	<p><b>What's New</b></p> <p><b>Hours Available</b></p>
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**Answer**

	Type I	Type II	Total
Available/m (hrs)	10 workers × 25 days/m × 8 hrs/day (bet 9 to 5) = 2000hrs	5 workers × 25 days/m × 8hrs/day = 1000hrs	
Units per day per worker	8	12	
Hours/unit	8/8 = 1 hr/u	8 hrs/12 units = 2/3 = 0.67 hrs/unit	
Actual production (u)	1,800	1,200	
Std hrs for actual production	1,800 × 1 = 1,800	1200 × 2/3 = 800	
Standard rate/hr	50	60	
Std cost of production	1800 × 50 = 90,000	800 × 60 = 48,000	1,38,000
Actual hours paid	2,000 hours	1000hrs	
Actual rate	60	70	
Actual cost	1,20,000	70,000	1,90,000
Labour cost variance			52,000 (A)
Efficiency variance	(1,800 – 2,000) × 50 = 10,000(A)	(800 – 1,000) × 60 = 12,000(A)	22,000(A)
Idle time variance (Since normal waiting and break are included in standard labour hours)	Nil	Nil	

(Standard production hours per day = 8 (normal breaks and waiting time have to be include in the standard)

No. of days per month = 25.

Standard hours per month = 25 × 8 = 200 hours per worker × 10 workers = 2,000 hours.)

**Q9**

**CMA Mat**

The Standard labour complement and the actual labour complement engaged in a week for a job are as under:

	Skilled Workers	Semi-Skilled Workers	Unskilled Workers
(a) Standard No. of workers in the gang	32	12	6
(b) Standard wage rate per hour ₹	3	2	1
(c) Actual No. of workers employed in the gang during the week	28	18	4
(d) 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:**

- (1) Labour efficiency variance
- (2) Mix variance
- (3) Rate of wages variance
- (4) Labour cost variance

<p><b>Reference</b> <b>Labour Variances</b></p>	<p><b>What's New</b> <b>Standard Hours Produced</b></p>
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**Answer**

	Standard data			Actual data		
	H	R	V	H	R	V
Skilled	1,280	3	3,840	1,120	4	4,480
semi skilled	480	2	960	720	3	2,160
Unskilled	240	1	240	160	2	320
	2,000		5,040	2,000		6,960

	SRSH	SRRSH	SRAH	ARAH
Skilled	3 × 1,152		3 × 1,120	
Semi skilled	2 × 432		2 × 720	
Unskilled	1 × 216		1 × 160	
	₹ 4,536	₹ 5,040	₹ 4,960	₹ 6,960

SH for skilled workers =  $(1,800/2,000) \times 1,280 = 1,152$

SH for semi-skilled workers =  $(1,800/2,000) \times 480 = 452$

SH for unskilled workers =  $(1,800/2,000) \times 240 = 216$

SRSB = Standard cost of standard labour = ₹ 4,536

SRRSB = Revised standard cost of labour = ₹ 5,040

SRAH = Standard cost of actual labour = ₹ 4,960

ARAH = Actual cost labour = ₹ 6,960

- Labour sub efficiency variance = ₹ 504(A)
- Labour mix variance = ₹ 80(F)
- Labour efficiency variance = ₹ 424(A)
- Labour rate variance = ₹ 2,000(A)
- Labour cost variance = ₹ 2,424(A)

**Q10**

**CMA Mat**

Calculate variances from the following:

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

Labour Hours			Labour Hours		
	100 @ ₹ 2 Per hour	200		120 Hrs. @ ₹2.50	300
	200 Women @ ₹ 1.50	300	500	240 Women @ ₹ 1.60	384
25	Normal Loss		75	Actual Loss	
675		26,500	675		26,034

**Reference**

**Material & Labour variances**

**What's New**

**Answer**

Calculate of Material Variances:

	(1) SQSP	(2) RSQSP	(3) AQSP	(4) AQAP
A		$428.57 \times 50$	$420 \times 50$	
B		$214.29 \times 20$	$240 \times 20$	
C		$107.14 \times 15$	$90 \times 15$	
A		21,429		
B		4,289		
C		1,607		
	₹ 25,500	₹ 27,325	₹ 27,150	₹ 26,250

RSQ for

$$A = 400/700 \times 750$$

$$B = 200/700 \times 750$$

$$C = 100/700 \times 750$$

(1) SQSP = Standard Cost of Standard Material = ₹ 25,500

(2) RSQSP = Revised Standard Cost of Material = ₹ 27,325

(3) AQSP = Standard Cost of Actual Material = ₹ 27,150

(4) AQAP = Actual Cost of Material = ₹ 26,250

(a) Material yield variance (1 – 2) = ₹ 1,825 (A)

(b) Material mix variance (2 – 3) = ₹ 175 (F)

(c) Material usage Variance (1 – 3) = ₹ 1,650 (A)

(d) Material price Variance (3 – 4) = ₹ 900 (F)

(e) Material cost Variance (1 – 4) = ₹ 750 (A)

**Calculation of Labour Variances:**

	(1) SRSH	(2) SRRSH	(3) SRAH	(4) ARAH
Men		$2 \times 120$	$2 \times 120$	
Women		$1.50 \times 240$	$1.50 \times 240$	
Men		240	240	
Women		360	360	
	₹ 500	₹ 600	₹ 600	₹ 684

RSH for

$$\text{Men} = 100/300 \times 360$$

$$\text{Women} = 200/300 \times 360$$

- (1) SRSB = Standard Cost of Standard Labour = ₹ 500
- (2) SRRSB = Revised Standard Cost of Labour = ₹ 600
- (3) SRAH = Standard Cost of Actual Labour = ₹ 600
- (4) ARAH = Actual Cost of Labour = ₹ 684
- (a) Labour Yield Variance (1 – 2) = ₹ 600 (A)
- (b) Labour Mix variance (2 – 3) = Nil
- (c) Labour efficiency Variance (1 – 3) = ₹ 100 (A)
- (d) Labour Rate Variance (3 – 4) = ₹ 84 (A)
- (e) Labour Cost Variance (1 – 4) = ₹ 184 (A)

**Q11**

**CMA Mat**

Item	Budget	Actual
No.of working days	20	22
Output per man hour	1.0 Units	0.9 Units
Overhead cost	₹1,60,000	1,68,000
Man-hours per day	8,000	8,400

**Calculate** Overhead Variances.

<p><b>Reference</b></p> <p><b>Fixed Overhead Variances</b></p>	<p><b>What's New</b></p>
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**Answer**

(1)	(2)	(3)	(4)	(5)
SRSB	SRAH	SRRBH	SRBH	ARAH
1 × 1,66,320	1 × 1,84,800	1 × 1,76,000		
₹ 1,66,320	₹ 1,84,800	₹ 1,76,000	₹ 1,60,000	₹ 1,68,000

- $SR = \text{budgeted FOH} / \text{budgeted hours} = 1,60,000 / 1,60,000 = 1$
- $RBH = (22/20) \times 1,60,000 = 1,76,000$
- $AH = 22 \times 8,400 = 1,84,800$
- $AQ = 1,84,800 \times 0.9 = 1,66,320$
- $SH = 1,66,320 / 1 = 1,66,320$

- (1) SRSB = Standard Cost of Standard Fixed Overheads = ₹ 1,66,320
- (2) SRAH = Standard Cost of Actual Fixed Overheads (or)  
Fixed Overheads absorbed or recovered = ₹ 1,84,800
- (3) SRRBH = Revised budgeted Fixed overheads = ₹ 1,76,000
- (4) SRBH = Budgeted Fixed overheads = ₹ 1,60,000
- (5) ARAH = Actual Fixed Overheads = ₹ 1,68,000
  - (a) FOH efficiency variance = 1 – 2 = ₹ 18,480(A)
  - (b) FOH capacity variance = 2 – 3 = ₹ 8,800(F)
  - (c) FOH calendar variance = 3 – 4 = ₹ 16,000(F)
  - (d) FOH volume variance = 1 – 4 = ₹ 6,320(F)
  - (e) FOH budget variance = 4 – 5 = ₹ 8,000(A)
  - (f) FOH cost variance = 1 – 5 = ₹ 1,680(A)

### Q12

### CMA Mat

The following data have been obtained from the records of a machine shop for an average month:

	Budget
No. of working days	25
Working hours per day	8
No. of direct workers	16
Efficiency	One standard hour per clock hour
Down time	20%
Fixed	₹ 15,360
Variable	20,480

The actual data for the month of September 2022 are as under:

Overheads: Fixed	16,500
Variable	14,500
Net operator hours worked	1,920
Standard hours produced	2,112

There was a special holiday in September 2022.

**Required** to present reports to Departmental Manager:

- (i) Showing the three cost ratios you have chosen:
- (ii) Setting out the analysis of variances.

<p><b>Reference</b></p> <p><b>Variable Overhead &amp; Fixed Overhead Variances</b></p>	<p><b>What's New</b></p>
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**Answer**

(i) **Cost Ratios:**

- Efficiency ratio =  $(SH/AH) \times 100 = (2,112/1,920) \times 100 = 110\%$
- Activity ratio =  $(SH/BH) \times 100 = (2,112/2,560) \times 100 = 82.5\%$
- Capacity utilization ratio =  $(\text{actual hours}/\text{budgeted hours}) \times 100$   
 $= (1,920/2,560) \times 100 = 75\%$
- Capacity usage ratio =  $(\text{budgeted hours}/\text{maximum possible hours}) \times 100$   
 $= (2,560/3,200) \times 100 = 80\%$
- Idle capacity ratio =  $100\% - 80\% = 20\%$
- Calendar ratio =  $(\text{actual days}/\text{budgeted days}) \times 100$   
 $= (24/25) \times 100 = 96\%$

(ii) **Analysis of Variances Variable OHs:**

(1)	(2)	(3)
SRSH	SRAH	ARAH
$8 \times 2,112$	$8 \times 1,920$	
₹ 16,896	₹ 15,360	₹ 14,500

- VOH efficiency variance = ₹ 1,536(F)
- VOH budget variance = ₹ 860(F)
- VOH cost variance = ₹ 2,396(F)

Fixed OHs:

(1)	(2)	(3)	(4)	(5)
SRSH	SRAH	SRRBH	SRBH	ARAH
$6 \times 2,112$	$6 \times 1,920$	$6 \times 2,457.6$		
₹ 12,672	₹ 11,520	₹ 14,746	₹ 15,360	₹ 16,500

- (1) SRSH = Standard Cost of Standard Fixed Overheads = ₹ 12,672
- (2) SRAH = Standard Cost of Actual Fixed Overheads (or)  
 Fixed Overheads absorbed or recovered = ₹ 11,520
- (3) SRRBH = Revised budgeted Fixed overheads = ₹ 14,746

- (4) SRBH = Budgeted Fixed overheads = ₹ 15,360
- (5) ARAH = Actual Fixed Overheads = ₹ 16,500
- (a) FOH efficiency variance = 1 – 2 = ₹ 1,152(F)
- (b) FOH capacity variance = 2 – 3 = ₹ 3,226(A)
- (c) FOH calendar variance = 3 – 4 = ₹ 614(A)
- (d) FOH volume variance = 1 – 4 = ₹ 2,688(A)
- (e) FOH budget variance = 4 – 5 = ₹ 1,140(A)
- (f) FOH cost variance = 1 – 5 = ₹ 3,828(A)

**Q13**

**CMA Mat, MTP Jun'19**

A Company manufactures two products X and Y. Product X requires 8 hours to produce while Y requires 12 hours. In April, 2013, of 22 effective working days of 8 hours a day. 1,200 units of X and 800 units of Y were produced. The company employs 100 workers in production department to produce X and Y. The budgeted hours are 1,86,000 for the year.

**Calculate** Capacity, Activity and Efficiency ratios and establish their relationship.

<p><b>Reference</b></p> <p><b>Capacity, Activity, Efficiency Ratio</b></p>	<p><b>What's New</b></p>
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**Answer**

		(Hours)
Standard hours of production		
Product X	(1,200 units × 8 hrs.)	9,600
Product Y	(800 units × 12 hrs.)	9,600
Total standard hours		19,200
Actual hours worked	(100 workers × 8 hrs. × 22 days)	17,600
Budgeted hours per month	(1,86,000 hrs./ 12 months)	15,500

**Capacity Ratio** =  $\frac{\text{Actual hours worked}}{\text{Budgeted hours p.m.}} \times 100 = \frac{17,600}{15,500} \times 100 = 113.55\%$

**Efficiency Ratio** =  $\frac{\text{Standard hours of production}}{\text{Actual hours worked}} \times 100 = \frac{19,200}{17,600} \times 100 = 109.09\%$

**Activity Ratio** =  $\frac{\text{Standard hours of production}}{\text{Budgeted hour p.m.}} \times 100 = \frac{19,200}{15,500} \times 100 = 123.87\%$

**Relationship of Ratios**

$$\begin{aligned} \text{Activity ratio} &= \text{Efficiency Ratio} \times \text{Capacity Ratio} \\ 123.87 &= \frac{109.09 \times 113.55}{100} \end{aligned}$$

**Q14**

**CMA Mat**

The standard cost sheet per unit for the product produced by Modern Manufactures is worked out on this basis.

Direct materials 1.3 tons @ ₹4 per ton

Direct labour 2.9 hours @ 2.3 per hour

Factory overhead 2.9 hours @ ₹2 per hour

Normal capacity is 2,00,000 direct labour hours per month.

The factory overhead rate is arrived at on the basis of a fixed overhead of ₹1,00,000 per month and a variable overhead of ₹1.50 per direct labour hour.

In the month May, 50,000 units of the product was started and completed. An investigation of the raw material inventory account reveals that 78,000 tons of raw material were transferred into and used by the factory during May. These goods cost ₹4.20 per ton. 1,50,000 hours of direct labour were spent during May at cost of ₹2.50 per hour. Factory overhead for the month amounted to ₹3,40,000 of which 1,02,000 was fixed.

**Compute and identify** all variances under Material, Labour and Overhead as favourable or adverse. Also **identify** one or more departments in the Co. who might be held responsible for each variance.

<p>Reference</p> <p><b>Material, Labour and VOH, FOH</b></p>	<p>What's <b>New</b></p>
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**Answer**

**Calculation of Material Variance:**

(1) SQSP	(2) AQSP	(3) AQAP
65,000 × 4	78,000 × 4	78,000 × 4.20
2,60,000	3,12,000	3,27,600

SQ = 50,000 × 1.3 = 65,000 units

- (a) Material usage variance (1 – 2) = ₹ 52,000 (A)
- (b) Material Price Variance (2 – 3) = ₹ 15,600 (A)
- (c) Material Cost Variance (1 – 3) = ₹ 67,600 (A)

**Calculation of Labour Variances:**

(1) SRSH	(2) SRAH	(3) ARAH
$2.3 \times 1,45,000$	$2.3 \times 1,50,000$	$2.50 \times 1,50,000$
₹ 3,33,500	₹ 3,45,000	₹ 3,75,000

$SH = 50,000 \times 2.90 = 1,45,000$

50,000 = Actual Production

- (1) SRSH = Standard Cost of Standard Labour = ₹ 3,33,500
- (2) SRAH = Standard Cost of Actual Labour = ₹ 3,45,000
- (3) ARAH = Actual Cost of Labour = ₹ 3,75,000
  - (a) **Labour efficiency Variance** (1 – 2) = ₹11,500 (A)
  - (b) **Labour Rate Variance** (2 – 3) = ₹30,000 (A)
  - (c) **Labour Cost Variance** (1 – 3) = ₹41,500 (A)

**Calculation of Variable Overhead Variances:**

(1) SRSH	(2) SRAH	(3) ARAH
$1.5 \times 1,45,000$	$1.5 \times 1,50,000$	
₹ 2,17,500	₹ 2,25,000	₹ 2,38,000 (3,40,000 – 1,02,000)

- (a) Variable Overhead efficiency Variance (1 – 2) = ₹ 7,500 (A)
- (b) Variable Overhead Budget/exp. Variance (2 – 3) = ₹ 13,000 (A)
- (c) Variable Overhead Cost Variance (1 – 3) = ₹ 20,500 (A)

**Calculation of Fixed Overhead Variances:**

(1) SRSH	(2) SRAH	(3) SRBH	(4) ARAH
$0.5 \times 1,45,000$	$0.5 \times 1,50,000$		
₹ 72,500	₹ 75,000	₹ 1,00,000	₹ 1,02,000

- (a) Fixed Overhead efficiency Variance (1 – 2) = ₹ 2,500 (A)
- (b) Fixed Overhead Capacity Variance (2 – 3) = ₹ 25,000 (A)
- (c) Fixed Overhead Volume Variance (1 – 3) = ₹ 27,500 (A)
- (d) Fixed Overhead Budget/Exp Variance (3 – 4) = ₹ 2,000 (A)
- (e) Fixed Overhead Cost Variance (1 – 4) = ₹ 29,500 (A)

## Q15

Dec'21

ST Ltd. uses a standard costing system. The following data relating to a single product for the month of September has been furnished to you. The Standard cost per unit was:

Direct Material: Standard Price ₹10 per kg, Standard quantity 20 kgs per unit

Direct Labour : Standard Rate of pay ₹5.50 per hour, Standard Time 12 hours per unit

Production OH Costs, all classified as fixed, were budgeted at ₹9,00,000 p.a. The standard time for producing one unit is 12 machine hours and normal capacity is 60,000 machine hours p.a. Production OH is absorbed on machine hours. The costs incurred and other relevant information for the month is given below:

Direct Material used-1,00,000 kgs at a cost of ₹10,50,000 Direct Wages paid- ₹3,10,000 for 62,000 hours Production Overhead- ₹9,26,000

Machine capacity used-60,000 hours

Actual output-4,800 units. Assume no stocks of WIP or Finished Goods at the year end.

- (i) The standard product cost for one unit **is**
- (ii) Variance for Material (Usage and Price) **are**
- (iii) Variance for Labour (Rate and Efficiency) **are:**
- (iv) Variance for Fixed OH (Volume and Expenditure) **are**

Reference

**Material, Labour and Fixed Overhead Variances**

What's **New**

### Answer

- (i) Standard Product Cost for one unit = ₹ 446
- (ii) Material Usage Variance: = ₹ 40,000 (A) Material Price Variance: = ₹ 50,000 (A)
- (iii) Labour Efficiency Variance: = ₹ 24,200 (A) Labour Rate Variance: = ₹ 31,000(F)
- (iv) Fixed OH Volume Variance: = ₹ 36,000(A) Fixed OH Expenditure Variance: = ₹ 26,000(A)

## Q16

CMA Mat

F Manufacturing Ltd., uses the three variances method to analyse the manufacturing overhead variances. Manufacturing overhead variances for the fiscal year just ended were computed as follows:

Spending - ₹ 86,000 Adverse

Efficiency - ₹ 36,000 Favourable

Volume - ₹ 80,000 Favourable

The manufacturing overhead application rate for the year was ₹ 160 per machine hour of which ₹ 60 per machine hour was the variable component. The year end balance in the Manufacturing Overhead Control Account was ₹ 16,50,000 and the standard machine hours for the year were 11,300.

From the above data **Compute:**

- (i) Budgeted machine hours,
- (ii) Actual machine hours,
- (iii) Applied manufacturing overhead,
- (iv) Total amount of fixed overhead cost.

<p><b>Reference</b></p> <p><b>Total Overhead Variance</b></p>	<p><b>What's New</b></p> <p><b>Budgeted machine hours, Actual machine hours, Applied manufacturing overhead, Total amount of fixed o/h cost</b></p>
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**Answer**

(i) **Calculation of Budgeted Machine Hours**

Volume variance = ₹ 80,000 (F) given

Volume variance = Std. fixed overhead rate per hour (Std. machine hours for actual output – Budgeted machine hours for actual output)

$$\begin{aligned} ₹ 80,000(F) &= ₹ 100 (11,300 - x) \quad 800 = 11,300 - x \\ x &= 11,300 - 800 \\ x &= 10,500 \end{aligned}$$

∴ Budgeted Machine hours for actual output = 10,500 hours

(ii) **Actual Machine Hours**

Efficiency variance = ₹ 36,000 (F) (given)

Efficiency variance = Std. variable overhead rate per hour (Std. hours for actual output – Actual hours for actual output)

$$\begin{aligned} ₹ 36,000(F) &= ₹ 60 (11,300 \text{ hours} - x) \quad 600 = 11,300 - x \\ x &= 10,700 \end{aligned}$$

∴ Actual Machine hours = 10,700 hours

(iii) **Applied Manufacturing overhead**

= Actual overhead incurred + Total variance

= ₹ 16,50,000 + ₹ 30,000 = ₹ 16,80,000

**Working Notes**

$$\begin{aligned} \text{Total variance} &= \text{Spending variance} + \text{Efficiency variance} + \text{Volume variance} \\ &= ₹ 86,000 (A) + ₹ 36,000 (F) + ₹ 80,000 (F) = ₹ 30,000 (F) \end{aligned}$$

(iv) **Total amount of Fixed overhead cost**

Spending variance = Flexible budget for actual hours – Actual factory overhead incurred

$$₹ 86,000 (A) = (10,700 \text{ hours} \times ₹ 60 + \text{Total amount of fixed overhead} - ₹ 16,50,000)$$

$$₹ 86,000 (A) = ₹ 6,42,000 + \text{Total amount of fixed overhead (budgeted)} - ₹ 16,50,000$$

$$\text{Total amount of fixed overhead} = ₹ 10,08,000 - ₹ 86,000 = ₹ 9,22,000$$

**Q17**

**CMA Mat; MTP Jun'18; MTP Dec'18; MTP Jun'22**

X uses traditional standard costing system. The inspection and setup costs are actually ₹ 1,760 against a budget of ₹ 2,000.

ABC system is being implemented and accordingly, the number of batches is identified as the cost driver for inspection and setup costs. The budgeted production is 10,000 units in batches of 1,000 units, whereas actually, 8,800 units were produced in 11 batches.

- (i) **Find** the volume and total fixed overhead variance under the traditional standard costing system.
- (ii) **Find** total fixed overhead cost variance under the ABC system.

<p><b>Reference</b></p> <p><b>Variations under Absorption costing and ABC system</b></p>	<p><b>What's New</b></p> <p><b>Cost Drivers</b></p>
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**Answer**

(i) **Calculation of volume and total fixed overhead under Traditional Standard Costing System**

Budgeted overhead cost per unit	= ₹ 2,000/10,000 units	₹ 0.20
Actual overhead cost per unit	= ₹ 1,760/8,800 units	₹ 0.20
Total fixed overhead variance	= Absorbed budgeted overhead – Actual overhead	Nil
	= (₹ 0.20 × 8,800 units) – ₹ 1,760	

Fixed overhead expenditure variance	= Budgeted overhead – Actual overhead = 2,000 – 1,760	₹240 (F) ₹ 0.20 per unit
Standard absorption rate	= ₹ 2,000/10,000 units	
Fixed overhead volume variance	= Standard absorption rate × (Budgeted units – Actual units) = ₹ 0.20 (10,000 units – 8,800 units)	₹ 240 (A)
Verification: Total fixed overhead variance	= Expenditure variance + Volume variance = 240 (F) + 240 ((A)	Nil

(ii) **Calculation of fixed overhead cost variance under ABC System**

Particulars	Budget	Actual	ABC standard
Total cost (₹)	2,000	1,760	1,800
Production (units)	10,000	8,800	8,800
No. of batches	10	11	9
Batch size (units/batch)	1,000	800	1,000
Cost per batch	200	160	200

Under ABC 8,800 units should have been produced in standard batch size of 1,000 units/batch.

No. of batches	= 8,800/1,000	9 approx.
Standard cost under ABC	= Budgeted cost per batch × ABC standard number of batches = ₹ 200 × 9	1,800

Under ABC, variability is with respect to batches and not units

Absorbed overheads	= 9 batches × Standard rate per batch = 9 × ₹ 200	₹ 1,800
Actual overheads		₹ 1,760
Total overheads cost variance		₹ 40 (F)

## Q18

## Jun'18

An Engineering Co. manufactures a single product whose standard cost structure is as follows:

Direct materials: 2.40 kg at ₹ 30 per kg	72.00
Direct Labour : 6 hours at ₹ 4 per hour	24.00
Factory Overheads : 6 hours at ₹ 0.75 per hour	4.50
Total	100.50

The factory overheads are based on the following flexible budget:

Capacity	80%	90%	100%	100%
Production (units)	6,000	6,750	7,500	8,250
Overheads (₹)	29,250	31,500	33,750	36,000

Actual data for the month of January, 2018:

Budgeted production	7,500 units
Materials used	19,240 kg at ₹ 31 per kg
Direct labour	46,830 hours at ₹ 4.20 per hour
Actual factory overheads	₹ 36,340
Production completed	7,620 units

Details of Work-in-Progress:

**Opening :** 120 units, materials fully supplied, 50% converted. **Closing :** 100 units, materials fully supplied, 50% converted.

### Required:

- (i) Effective or Equivalent Production for each element of cost.
- (ii) **Calculate:**
  - (a) Material variances (cost, price and usage)
  - (b) Labour variances (cost, rate of pay and efficiency)
  - (c) Overhead variances (expenditure and volume variance, efficiency and capacity variance) [4 + 3 + 6 = 13]

**Reference**  
**Equivalent Production- Opening and Closing WIP**

**What's New**  
**Material, Labour and Overhead Variances**

**Answer**

(i) **Statement of Equivalent Production**

	Units	Material		Labour and Overheads	
		%	Units	%	Units
Opening Work-in-Progress	120	—	—	50	60
Completely processes during the month	7,500	100	7,500	100	7,500
Closing Work-in-Progress	100	100	100	50	50
	7,720		7,600		7,610

Some required data (computed)

**Material:**

Standard Quantity : 7,600 @ 2.40 kg = 18,240 kg

Standard Value : 18,240 kg @ ₹ 30 = ₹ 5,47,200

**Labour:**

Standard Hours : 7,610 @ 6 hours = 45,660 hours

Standard Wages : 45,660 @ ₹ 4 per hour = ₹ 1,82,640

Standard Production =  $\frac{\text{Actual Hours}}{\text{Standard Hours per Unit}} = \frac{46,830}{6} = 7,805$  units

Budgeted Production = 7,500 units

Standard rate per unit =  $\frac{\text{Budgeted Overheads}}{\text{Budgeted Production}} = \frac{₹ 33,750}{7,500} = ₹ 4.50$

**Standard Overheads (or overheads recovered)** = 7,610 @ ₹ 4.50 = ₹ 34,245

**Actual cost of materials:** 19,240 kg @ ₹ 31 = ₹ 5,96,440

**Actual Wages:** 46,830 hr @ ₹ 4.20 = ₹ 1,96,686

(ii) **Statement of Variances**

(a) **Material cost variance:** (SC – AC) = (₹ 5,47,200 – 5,96,440) = ₹ 49,240 (A) which can be analysed into:

(a) **Material price variance:** (SP – AP) AQ = (30 – 31) × 19,240 = ₹ 19,240 (A)

(b) **Material usage variance:** (SQ – AQ) SP = (18,240 – 19,240) × ₹ 30 = ₹ 30,000 (A)

(b) **Labour cost variance:** (SC – AC) = (₹ 1,82,640 – 1,96,686) = ₹ 14,046 (A) which can be further analysed as follows:

(a) **Rate variance:** (SR – AR) AT = (4.00 – 4.20) 46,830 = ₹ 9,366 (A)

(b) **Efficiency variance:** (AP – SP) SR = (7,610 – 7,805) × ₹ 24 = ₹ 4,680 (A)

(c) **Factory O.H. cost variance:** Std. O.H. – Actual O.H. = ₹ 34,245 – 36,340 = ₹ 2,095 (A) which can be analyzed as follows:

(a) **Expenditure or Budgeted variance:**

Budgeted O.H. – Actual O.H.

$$₹ 33,750 - 36,340 = ₹ 2,590 \text{ (A)}$$

However, the solution will be -

TOH Exp. Var based.

Here, they have assumed All OH as fixed which is not correct.

$$\text{TOH Exp.} = (3/6 \times 46,860 + 11,250) - 36,340 = 1,675 \text{ (A)}$$

(b) **Volume variance:**

$$\text{SR (AP - BP)} = ₹ 4.5 (7,610 - 7,500) = ₹ 495 \text{ (F)}$$

However, this should be

$$\text{Fixed OH Volume Variance} = (7,610 - 7,500) \times \frac{11,250}{7,500}$$

**Volume variance can be further divided as follows:**

1. Efficiency variance:  $\text{SR (AP - SP)} = ₹ 4.50 (7,610 - 7,805) = ₹ 877.50 \text{ (A)}$

2. Capacity variance:  $\text{SR (SP - BP)} = ₹ 4.50 (7,805 - 7,500) = ₹ 1,372.50 \text{ (F)}$

**Q19**

**CMA Mat**

Budgeted and actual sales for the month of December, 2005 of two products A and B of M/s. XY Ltd. were as follows:

Product	Budgeted Units	Sales Price/Unit	Actual Units	Sales Price / Unit (₹)
A	6,000	₹ 5	5,000	5.00
			1,500	4.75
B	10,000	₹ 2	7,500	2.00
			1,750	1.90

Budgeted costs for Products A and B were ₹4.00 and ₹ 1.50 unit respectively.

**Work out** from the above data the following variances.

Sales Volume Variance, Sales Value Variance, Sales Price Variance, Sales Sub Volume Variance, Sales Mix Variance.

<p><b>Reference</b></p> <p><b>Sales Variances</b></p>	<p><b>What's New</b></p>
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**Answer**

	SQSP	AQSP	RSQSP	AQAP
A	5,000 × 5.00	6,500 × 5	5,906.25 × 5	6,000 × 5
	1,500 × 4.75			
B	7,500 × 2.00			
	1,750 × 1.90	9,250 × 2	9,843.75 × 2	10,000 × 2
A	25,000	32,500	29,531.25	30,000
	7,125			
B	15,000			
	3,325	18,500	19,687.5	20,000
	₹50,450	₹51,000	₹49,219	₹50,000

Revised Standard Quantity for

A =  $6,000/16,000 \times 15,750 = 5,906.25$  units

B =  $10,000/16,000 \times 15,750 = 9,843.75$  units

- (1) AQAP = Actual Sales or Actual Quality Sold = ₹50,450
- (2) AQSP = Actual Quantity of Sales at Standard Price = ₹51,000
- (3) RSQSP = Revised Budgeted or standard Sales = ₹49,219
- (4) SQSP = Standard or Budgeted Sales = ₹50,000
  - (a) Sales Sub usage variance = 3 – 4 = ₹781 (A)
  - (b) Sales Mix Variance = 2 – 3 = ₹1,781 (F)
  - (c) Sales Volume Variance = 2 – 4 = ₹1,000 (F)
  - (d) Sales Price Variance = 1 – 2 = ₹550 (A)
  - (e) Sales Value Variance = 1 – 4 = ₹450 (F)

**Q20**

**CMA Mat**

**Compute** the missing data indicated by the Question marks from the following.

	Product 'R'	Product 'S'
Sales quantity		
Std. (units)	?	400
Actual (Units)	500	?
Price ( Unit )		
Standard	₹12	₹15
Actual	₹15	₹20
Sales price variance	?	?

Sales volume variance	₹ 1,200 F	?
Sales value variance	?	?

Sales mix variance for both the products together was ₹450 F, 'F' denotes Favourable.

**Reference**

**Sales Variances**

What's **New**

**Missing Figures**

**Answer**

Let the standard units of product R be r Actual units of product S be s

	Standard			Actual		
	Q	P	V	Q	P	V
R	R	12	12r	500	15	7,500
S	400	15	6,000	s	20	20s
	400 + r		6,000 + 12r	500 + s		7,500 + 20s

Given sales volume variance for R = ₹ 1,200(F)

⇒ AQSP – SQSP = ₹ 1,200

r = ₹ 400

Sales mix variance = AQSP – RSQSP = ₹ 450(F)

	AQSP	RSQSP
R	12 × 500	12 × {(500+s)/(400+r)} × 400
S	15 × s	12 × {(500+s)/(400+r)} × 400
	6,000 + 15s	6,750 + 13.5s

Then s = 800

- Standard units of product R, r = ₹ 400
- Actual units of product S, s = ₹ 800
- Sales price variance for R = AQ(AP – SP) = ₹ 1,500(F)  
S = 4,000(F)
- Sales volume variance for S = SP(AQ – SQ) = ₹ 6,000(F)
- Sales value variance for R = AQAP – SQSP = ₹ 2,700(F)  
For S = ₹ 10,000(F)

## Q21

MTP Jun'22

G Ltd. is engaged in marketing of wide range of consumer goods. A, B and C are the zonal sales officers for four zones. The company fixes annual sales target for them individually. You are furnished with the following:

The standard costs of sales target in respect of A, B and C are ₹ 5,00,000, ₹ 3,75,000, ₹ 4,00,000 respectively.

A, B and C respectively earned ₹ 29,900, ₹ 23,500, and ₹ 24,500 as commission at 5% on actual sales effected by them during the previous year.

The relevant variances as computed by a qualified Cost Accountant are as follows:

	A	B	C
Sales Price Variance	4,000(F)	6,000(A)	5,000(A)
Sales Volume Variance	6,000(A)	6,000(F)	15,000(F)

Adverse Variance (A) and Favourable Variance (F)

**What** is the amount of target sales and margin fixed in case of each of the zonal sales officers?

<p><b>Reference</b></p> <p><b>Sales &amp; Profit Variance</b></p>	<p><b>What's New</b></p> <p><b>Amount of Target sales and Margin Fixed</b></p>
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## Q22

CMA Mat

X Ltd. produces and sells a single product. Standard cost card per unit of the product is as follows: (₹)

Direct materials: A	(10 kg. @ ₹ 5 per kg.)	50
B	(5 kg. @ ₹ 6 per kg.)	30
Direct wages	(5 hours @ ₹ 5 per hour)	25
Variable production overheads	(5 hours @ ₹ 12 per hour)	60
Fixed production overheads		25
Total standard cost		190
Standard gross profit		35
Standard selling price		225

A fixed production overhead has been absorbed on the expected annual output of 25,200 units produced evenly throughout the year. During the month of December, 2013, the following were the actual results for an actual production of 2,000 units.

(₹)

Sales	(2,000 units @ ₹ 225)	4,50,000
Direct materials: A	18,900 kg.	99,225
B	10,750 kg.	61,275
Direct wages	10,500 hours (actually worked 10,300 hours)	50,400
Variable production overheads		1,15,000
Fixed production overheads		56,600
Total		3,82,500
Gross profit		67,500

The material price variance is extracted at the time of receipt of materials. Material purchase were a 20,000 kg. @ ₹ 5.25 per kg; B 11,500 kg. @ ₹ 5.70 per kg.

**Required:**

- (i) **Calculate** all variances.
- (ii) **Prepare** an operating statement showing standard gross profit, variances and actual gross profit.
- (iii) **Explain** the reason for the difference in actual gross profit given in the question and calculated in (ii) above.

<p><b>Reference</b></p> <p><b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b></p> <p><b>Single Plan Effect</b></p>
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**Answer**

(i) **Material Variances**

Standard quantity for actual output	A = 2,000 × 10	20,000 kg.
	B = 2,000 × 5	10,000 kg.
Revised standard quantity :	A = 20,000/30,000 × 29,650	19,766.67 kg.
	B = 10,000/30,000 × 29,650	9,883.33 kg.
Standard yield	= (2,100/31,500) × 29,650	1,976.67
(a) Material price variance	= (SP – AP) AQ	
	A = (5 – 5.25) × 20,000	5,000 (A)
	B = (6 – 5.7) × 11,500	3,450 (F)
		₹ 1,550 (A)

(b) Material usage variance	$= (SQ - AQ) SP$ $A = (20,000 - 18,900) \times 5$ $B = (10,000 - 10,750) \times 6$	 5,500 (F) 4,500 (A) ₹ 1,000 (F)
(c) Material mix variance	$= SP (RSQ - AQ)$ $A = (19,766.67 - 18,900) \times 5$ $B = (9,883.33 - 10,750) \times 6$	 4,333.33 (F) 5,200.00 (A) ₹ 866.67 (A)
(d) Material yield variance	$= SR (AY - SY)$ $= (2,000 - 1,976.67) \times 80$	 ₹ 1,866.67 (F)

### Labour Variances

(a) Labour rate variance	$= (SR - AR)AH$ $= (5 - 4.8) \times 10,500$	 ₹ 2,100 (F)
(b) Labour efficiency variance	$= SR (SH - AH)$ $= (10,000 - 10,300) \times 5$	 1,500 (A)
(c) Labour idle time variance	$= \text{Idle hours} \times SR$ $= 200 \times 5$	 1,000 (A)

### Variable Overhead Variances

(a) V. OH. cost variance	$= \text{Recovered overhead} - \text{Actual overhead}$ $= (2,000 \times 60 - 1,15,000)$	 ₹ 5,000 (F)
(b) V. OH. exp. variance	$= \text{Standard variable overhead} - \text{Actual variable overhead}$ $= (10,300 \times 12) - 1,15,000$	 8,600 (F)
(c) V. OH. efficiency variance	$= \text{Recovered variable overhead} - \text{Standard variable overhead}$ $= 1,20,000 - 1,23,600$	 ₹ 3,600 (A)

### Fixed Overhead Variances

(a) Fixed OH. cost variance	$= \text{Recovered overhead} - \text{Actual overhead}$ $= (2,000 \times 25) - 56,600$	 ₹ 6,600 (A)
(b) Fixed OH. exp. variance	$= \text{Budgeted overhead} - \text{Actual overhead}$ $= (25,200 \times 25) + 12 - 56,600$	 ₹ 4,100 (A)

(c) Fixed OH. volume variance	= Recovered overhead – Budgeted overhead = (50,000 – 52,500)	₹ 2,500 (A)
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(ii) **Reconciliation Statement (₹)**

Particular		Favourable	Adverse	
Standard profit (35 × 2,000)				70,000
Variances	Price			
Material		-	1,550.00	
	Mix	-	866.67	
	Yield	1,866.67	-	
Labour	Rate	2,100.00	-	
	Efficiency	-	1,500.00	
	Idle time		1,000.00	
Variable overheads	Expenditure	8,600.00	-	
	Efficiency	-	3,600.00	
Fixed overheads	Expenditure	-	4,100.00	
	Volume	-	2,500.00	
		12,566.67	15,116.67	2,550 (A)
Actual profit				67,450

(iii) Actual gross profit given in the question is 67,500 while calculated operating profit in statement is ₹67,450. The difference amount is due to material price variance that is calculated at the time of receipt of material instead of consumption of material.

Material price variance

A = 18,900 × (5 – 5.25)	= 4,725 (A)	
B = 10,750 × (6 – 5.70)	= 3,225 (F)	= ₹ 1,500 (A)

Over recovery in the operating statement is 50 (i.e. 1,550 – 1,500), should be added in actual profit ₹ 67,500. (i.e. 67,450 + 50).

**Q 23**

**CMA Mat**

In a company operating on a standard costing system for a given four week period budgeted for sales of 10,000 units. at ₹ 50 per unit, actual sales were 9,000 units at ₹51.25 per unit. Costs relating to that period were as follows:

	Standards (₹)	Actuals (₹)
Materials	₹ 2,50,000	2,57,400
Wages	75,000	70,875
Fixed Overhead	20,000	18,810

Variable Overhead	10,000	9,250
Semi-variable overhead	2,700	2,430
Standard hours	50,000	
Actual hours		40,500

- (1) The Standard material content of each unit is estimated at 25 kg. at ₹1 per kg. actual figures were 26 kg. at ₹1.10 per kg.
- (2) Semi-variable Overhead consists of FIVE - NINTHS fixed expenses and FOUR - NINTHS variable.
- (3) The Standard wages per unit are 5 hours at ₹1.50 per hour Unit actual wages were 4.5 hours at ₹1.75 per hour.
- (4) There were no opening stocks and the whole production for the period was sold.
- (5) The four week period was normal period.

You are **Required:**

- (a) To **compute** the variances in Sales, Materials, Labour and Over heads due to all possible causes; and
- (b) With the help of such a computation **draw** a statement reconciling the actual profit for the period with the standard profits.

**Reference**

**Profit Reconciliation Statement**

**What's New**

**Answer**

**Working notes:**

	Budget ₹	Actual ₹
Fixed overhead	20,000	18,810
Share in semi variable OHs (5/9)	1,500	1,350
	21,500	20,160
Variable OHs	10,000	9,250
Share in semi variable OHs(4/9)	1,200	1,080
	11,200	10,330

**Variances:**

**Sales:**

(1) AQAP	(2) AQSP	(3) SQSP
$51.25 \times 9,000$	$50 \times 9,000$	$50 \times 10,000$
₹ 4,61,250	₹ 4,50,000	₹ 5,00,000

AQAP = actual value of sales = 4,61,250

AQSP = actual sales at standard prices = 4,50,000

SQSP = standard value of sales = 5,00,000

- (a) Sales volume variance = (2) – (3) = 50,000(A)
- (b) Sales price variance = (1) – (2) = 11,250(F)
- (c) Sales value variance = (1) – (3) 38,750(A)

**Material:**

(1) SQSP	(2) AQSP	(3) AQAP
$1 \times 2,25,000$	$1 \times 2,34,000$	$1.1 \times 2,34,000$
2,25,000	2,34,000	2,57,400

AQ =  $9,000 \times 26 = ₹ 2,34,000$

SQ =  $9,000 \times 25 = ₹ 2,25,000$

- (1) Standard cost of standard material = ₹ 2,25,000
- (2) Standard cost of actual material = ₹ 2,34,000
- (3) Actual cost of material = ₹ 2,57,400
  - (a) Material usage variance = (1) – (2) = ₹ 9,000(A)
  - (b) Material price variance = (2) – (3) = ₹ 23,400(A)
  - (c) Material cost variance = (1) – (3) = ₹ 32,400(A)

**Labour:**

(1) SRSH	(2) SRAH	(3) ARAH
$1.5 \times 45,000$	$1.5 \times 40,500$	$1.75 \times 40,500$
₹ 67,500	₹ 60,750	₹ 70,875

SH =  $9,000 \times 5 = 45,000$

- (1) SRSH = Standard cost of standard labour = ₹ 67,500
- (2) SRAH = Standard cost of actual labour = ₹ 60,750
- (3) ARAH = Actual cost of labour = ₹ 70,875

- (a) Labour efficiency variance = (1) – (2) = ₹ 6,750(F)
- (b) Labour rate variance = (2) – (3) = ₹ 10,125(A)
- (c) Labour cost variance = (1) – (3) = ₹ 3,375(A)

**Variable OHs:**

(1) SRSH	(2) SRAH	(3) ARAH
0.224 × 45,000	0.224 × 40,500	10,330
₹ 10,080	₹ 9,072	₹ 10,330

SR = 11,200/50,000 = ₹ 0.224

- (1) SRSH = Standard cost of standard variable OHs = ₹ 10,080
- (2) SRAH = Standard cost of actual variable OHs = ₹ 9,072
- (3) ARAH = Actual cost of variable OHs = ₹ 10,330
- (a) Variable OHs efficiency variance = (1) – (2) = ₹ 1,008(F)
- (b) Variable OHs budget variance = (2) – (3) = ₹ 1,258(A)
- (c) Variable OH cost variance = (1) – (3) = ₹ 250(A)

**Fixed OHs:**

(1) SRSH	(2) SRAH	(3) SRBH	(4) ARAH
0.43 × 45,000	0.43 × 40,500	0.43 × 50,000	
₹ 19,350	₹ 17,415	₹ 21,500	₹ 20,160

SR = 21,500/50,000 = 0.43

- (1) SRSH = Standard cost of standard fixed OHs = ₹ 19,350
- (2) SRAH = Standard cost of actual fixed OHs = ₹ 17,415
- (3) SRBH = Budgeted fixed OHs = ₹ 21,500
- (4) ARAH = Actual fixed OHs = ₹ 20,160
- (a) Fixed OHs efficiency variance = (1) – (2) = ₹ 1,935(F)
- (b) Fixed OHs capacity variance = (2) – (3) = ₹ 4,085(A)
- (c) Fixed OHs volume variance = (1) – (3) = ₹ 2,150(A)
- (d) Fixed OHs budget variance = (3) – (4) = ₹ 1,340(F)
- (e) Fixed OH cost variance = (1) – (4) = ₹ 810(A)

**Statement showing Reconciliation of Actual & Standard profits:**

		₹
Budgeted sales		5,00,000
(+) Sales price variance	11,250	
(-) Sales volume variance	(50,000)	(38,750)
Actual sales		4,61,250
(-) Standard cost of sales		
Material {2,50,000 × (9/10)}	2,25,000	
Wages {75,000 × (9/10)}	67,500	
Fixed OHs {21,500 × (9/10)}	19,350	
Variable OHs {11,200 × (9/10)}	10,080	3,21,930
Standard Profit		1,39,320
Add: Favorable variances		
Labour efficiency variance	6,750	
Variable OH efficiency	1,008	
Fixed OH efficiency	1,935	
Fixed OH budget	1,340	11,033
		1,50,353
Less: Adverse variances		
Material usage variance	9,000	
Material price variance	23,400	
Labour rate variance	10,125	
Variable OH budget	1,258	
Fixed OH capacity variance	4,085	47,868
Actual profit		1,02,485

**Q 24****RTP Jun'18**

The standard cost sheet of XYZ Ltd. based on the normal output of 30,000 units for a quarter is as under -

Direct Materials	4 kg at ₹2 per kg	₹8
Direct Wages	6 hours at ₹4 per hour	₹24
Overheads	50% of Direct Wages	₹12
Standard Profit		₹6
Selling Price		₹50

The Budgeted Fixed OH is ₹ 1,44,000 per quarter and it is included in the Overhead Costs given above.

On the basis of the budgeted activity of 36,000 units, the Company estimated its Q -2 profit as under-

	₹
Direct Materials	2,88,000
Direct Wages	8,64,000
Overheads	4,32,000
Total Costs	15,84,000
Profit (balancing figure)	2,16,000
Sales	18,00,000

“The cost records revealed the following actual data for the second quarter of the year - Production was 25,000 units. Direct Materials consumed 96,000 kg at ₹ 2.25 per kg. Direct Wages paid 1,60,000 hours at ₹ 4.10 per hour, out of which 6,000 hours being idle time were not recorded on production. Overheads were ₹ 3,32,000 out of which ₹ 1,50,000 were fixed. 25,000 units were sold at an Average Price of ₹51.50 per unit.

**Required:**

1. **Prepare** a statement of Actual Profit/ Loss for Q-2.
2. **Analyse** the variances and present an Operating Statement reconciling the Budgeted Profit with Actual Profit.

<p><b>Reference</b></p> <p><b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b></p> <ul style="list-style-type: none"> <li>• BO = Normal Output</li> <li>• Profit on BO, Cost on Normal Output</li> <li>• VOH Idle Time Variance</li> </ul>
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**Answer**

1. **Statement of Actual Profit for Q - 2**

Particulars	Computation	₹	₹
Sales	25,000 units at 51.50 per unit		12,87,500
Less: Materials	96,000 kg at ₹2.25 per kg	2,16,000	
Labour	1,60,000 hours at ₹4.10 per hour	6,56,000	12,04,000
Variable OH	{3,32,000 – 1,50,000}	1,82,000	
Fixed OH	Given	1,50,000	
Actual profit			83,500

2. **Sales Variances (Total Approach)**

Col.(1):BQ × BP	Col.(2):AQ × BP	Col.(3):AQ × AP
36,000 uts × 50	25,000 uts × 50	25,000 uts × 51.50
= ₹18,00,000	= ₹12,50,000	= ₹12,87,500

Sales Volume Variance + Sales Price Variance	
=18,00,000 – 12,50,000 = 5,50,000(A)	= 12,50,000 – 12,87,500 = 37,500(F)
Total Sales Variance = 18,00,000 – 12,87,500 = ₹5,12,500(A)	

3. **Materials Variances (Total Approach)**

Col.(1):SQ × SP	Col.(2):AQ × SP	Col.(3):AQ × AP
(25,000 × 4) × 2 = ₹2,00,000	96,000 kg × 2 = ₹1,92,000	96,000 kg × 2.25 = ₹2,16,000
Usage Variance + Price Variance		
=2,00,000 – 1,92,000 = ₹8,000 (F)	=1,92,000 – 2,16,000 = ₹24,000 (A)	
Total Material Cost Variance = 2,00,000 – 2,16,000 = ₹16,000		

**Note:** Since there is a difference between Normal capacity and Budgeted Capacity, and absorption is based on the Normal Output, Reconciliation is done only under Absorption Costing.

Under Absorption Costing Approach, Effect on Profit due to Sales Volume = Net Profit foregone = (25,000 – 36,000) × 6 = ₹66,000 (A)

4. **Labour Variances**

Col.(1): SH × SR	Col.(2): Net AH × SR	Col.(3): Total AH × SR	Col.(4): AH × AR
(25,000 uts × 6 hrs) × 4 = 6,00,000	(1,60,000 – 6,000) hrs × 4 = 6,16,000	1,60,000 hrs × 4 = 6,40,000	1,60,000 hrs × 4.10 = 6,56,000
Labour Net Efficiency Variance	Labour Idle Time Variance	Labour Rate Variance	
6,00,000 – 6,16,000 = ₹16,000(A)	6,16,000 – 6,40,000 = ₹24,000(A)	6,40,000 – 6,56,000 = ₹16,000(A)	
Total Labour Cost Variance = 6,00,000 – 6,56,000 = ₹56,000(A)			

5. **Analysis of VOH and FOH**

Total OH = ₹12 × 30,000 units = 3,60,000. This is analysed for the following computations -

Particulars	Fixed OH	Variable OH
(a) Amount of OH	(given) 1,44,000	3,60,000 – 1,44,000 = 2,16,000
(b) Budgeted Output (Normal capacity)	30,000 units	30,000 units
(c) OH Rate per unit (a ÷ b)	₹4.80 per unit	₹7.20 per unit
(d) Budgeted Hours	30,000 units × 6 = 1,80,000 hours	30,000 units × 6 = 1,80,000 hrs
(e) OH Rate per hour (a ÷ d)	0.80 per hour	1.20 per hour

6. **VOH Variances**

Col.(1): SH × SR	Col.(2): Net AH × SR	Col.(3): Total AH × SR	Col.(4): AVOH
(25,000 uts x 6 hrs) x 1.20 = ₹1,80,000	(1,60,000 – 6,00) hrs x 1.20 = ₹1,84,800	1,60,000 hrs x 1.20 = ₹1,92,000	( Given) ₹1,82,000
VOH Net Efficiency Variance + VOH Idle Time Variance + VOH Expenditure Variance			
=1,80,000 – 1,84,000 = ₹4,800A	=1,84,800 – 1,92,000 = ₹7,200A	=1,92,000 – 1,82,000 = ₹10,000F	
Total VOH Cost Variance = 1,80,000 – 1,82,000 = ₹2,000A			

7. **FOH Variances**

Col. (1): AO × SR	Col. (2): Net AH × SR	Col. (3): Total AH × SR	Col. (4): BFOH	Col.(5): AFOH
25,000 uts × 4.80 = ₹1,20,000	(1,60,000 – 600) hrs × 0.80 = ₹1,23,200	1,60,000 hrs × 0.80 = ₹1,28,000	(given) ₹1,44,000	(given) ₹1,50,000
Net Efficiency Variance + Idle Time Variance + Capacity Variance + Expenditure Variance				
=1,20,000 – 1,23,200 = ₹ 3,200 (A)	=1,23,200 – 1,28,000 = ₹4,800 (A)	= 1,28,000 – 1,44,000 = ₹16,000 (A)	= 1,44,000 – 1,50,000 = ₹6,000 (A)	
Volume Variance = 1,20,000 – 1,44,000 = 24,000 A + Expenditure Variance b/fd as above = 6,000 (A)				

**Total FOH Cost Variance = 1,20,000 – 1,50,000 = ₹30,000 (A)**

8. **Operating Statement / Reconciliation Statement (in ₹):**

Particulars	Method 2: Absorption Costing Approach
Budgeted Profit	36,000 units × 6 = 2,16,000
Effect of Sales Variances	
+/- Sales Volume Variance Effect on Profit	(66,000)
Sales Price Variance	37,500
Effect of Cost Variances	
+/- Material Variances Usage	8,000
Price	(24,000)
Labour Variances Net Efficiency	(16,000)
Idle Time	(24,000)
Rate	(16,000)
VOH Variances Net Efficiency	(4,800)
Idle Time	(7,200)
Expenditure	10,000

FOH Variances	Net Efficiency	(3,200)
	Idle Time	(4,800)
	Capacity	(16,000)
	Expenditure	(6,000)
Actual Profit		83,500

**Note:** Budgeted Profit ± Sales Volume Variance impact on Profit, i.e. ₹2,16,000 – ₹66,000 Adv. = ₹1,50,000, is called Standard Profit on Actual Sales, i.e. 25,000 units at ₹ 6 per unit.

**Q) 25**

**CMA Mat**

The assistant management accountant of your company has been preparing the profit and loss account for the week ended 31st October. Unfortunately, he has had a traffic accident and is now in a hospital, so as senior cost analyst you have been asked to complete this statement. The uncompleted statement and relevant data are shown below.

Weekended 31st October

	₹	₹
Sales		50,000
<b>Standard Cost:</b>		
Direct materials		
Direct wages		
Overhead		
Standard profit	–	–
Variances		
	<b>Fav./(adv.)</b>	<b>Fav./(adv.)</b>
	₹	₹
Direct materials:		
Price	(400)	
Usage	(300)	
Total:		(700)
Direct Labour:		
Rate		
Efficiency		
Total		–
Overhead expenditure		
Volume		
Total	–	
Total variance		–
Actual Profit		–

### Standard Data

The standard price of direct material used is ₹600 per ton. From each tonne of material it is expected that 2,400 units will be produced. A forty hour week is operated. Standard labour rate per hour is ₹4. There are 60 employees working as direct labour.

The standard performance is that each employee should produce one unit of product in 3 minutes. There are 4 working weeks in October. The budgeted fixed overhead for October is ₹ 76,800.

### Actual data

Materials used during the week were 20 tonnes at ₹ 620 per tonne. During the week 4 employees were paid of ₹ 4.2 p.h and 6 were paid ₹ 3.8 p.h and Remaining were paid at Standard Rate Overheads incurred was ₹ 18,000.

You are **required** to **complete** the P & L Statement for the week ended 31st Oct.

<p><b>Reference</b></p> <p><b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b></p> <p><b>Completion of P&amp;L statement, Budget Output Computation</b></p>
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### Answer

Actual cost of material (620 × 20)		₹ 12,400
(-) Direct material:	400	
Price variance	300	(700)
Usage variance		11,700

For ₹ 600/- production = 2,400 units

For ₹ 11,700/- production = (2,400/600) × 11,700 = 46,800 units

### Labour variances

(1) SRSH	(2) SRAH	(3) ARAH
4 × 2,340	4 × (40 × 60)	[(4 × 4.20) + (6 × 3.80) + (50 × 4)] 40
₹ 9,360	₹ 9,600	₹ 9,584

Labour rate variance (2) – (3): 16(F)

Labour efficiency variance: (1) – (2): 240(A)

Overhead variances:

(1)	(2)	(3)	(4)
SRSB	SRAH	SRBH	ARAH
8 × 2,340	8 × 2,400		
₹ 18,720	₹ 19,200	₹ 19,200	₹ 18,000

OHs expenditure variance: (3) – (4): 1,200(F)

OHs volume variance: (1) – (3) : 480(A)

**P&L statement for the week ended 31st October:**

		₹	₹
Sales			50,000
Standard cost			
Direct material		11,700	
Direct wages		9,360	
Overheads		18,720	39,780
Standard profit			10,220
<b>Variences</b>	F/(A)	F/(A)	
Direct material: price			
Usage	(400)		
<b>Total</b>	(300)		
		(700)	
Direct labour:			
Rate	16		
Efficiency	(240)		
<b>Total</b>		(224)	
Overheads:			
Expenditure	1,200		
Volume	(480)		
<b>Total</b>		720	
Total variance			(204)
Actual profit			10,016

**Q26**

**CMA Mat**

You have been appointed as Management Accountant of S.M. Ltd. Given below is the Company's operating profit and loss Statement for the month of April, 2015.

	Standard and Variances	Actual
	₹	₹
Budgeted Sales	90,000	
Variances due to Volume of Orders	5,000	
Selling prices	2,000	97,000
Budgeted profit	19,000	
Profit Variance due to Sales Volume	1,200	
Profit variance due to Selling price	2,000	22,200
Production cost Variances:		
Materials		
Price	750	
Usage	(300)	450
Labour		
Rate	(1,250)	
Efficiency	(500)	(1,750)
Overheads Expenditure: Fixed		
Variable	(1,250)	
Efficiency	1,000	
Capacity	500	750
Operating Profit		21,650

The costing department provides you with the following information about sales and cost for the month of May, 2015.

Product	Standard Cost per unit ₹	Budgeted Sales		Actual Sales	
		Number of Units	Sales Value ₹	Number of Units	Sales Value ₹
A	31	1,250	50,000	1,400	54,000
B	25	1,000	30,000	950	27,500
C	15	750	15,000	900	17,500

	₹
<b>Materials:</b>	
Standard cost of materials actually used	26,150
Standard cost of materials allowed	26,650
Actual cost of materials used	27,150

<b>Labour:</b>	
Standard labour cost per hour	₹ 0.90
Actual clocked hours	22,000
Actual labour cost	₹ 21,300
Budgeted hours	20,000
Standard hours produced	22,500


**Overheads:**

Budgeted rates of overheads recovery per direct labour hour:

Variable ₹ 1.00; Fixed ₹ 0.50; Actual Overhead Costs.

Variable ₹ 21,500; Fixed ₹12,000

**Prepare** an operating profit and loss statement for May, 2015 in the same form as for April, 2015.

	<b>Reference</b>	<b>What's New</b> <ul style="list-style-type: none"> <li>• Multiple Finished Product</li> <li>• Follow the format given in question</li> </ul>
	<b>Profit Reconciliation Statement</b>	

**Answer**

	(1) AQAP	(2) AQSP	(3) SQSP
A	54,000	56,000	50,000
B	27,500	28,500	30,000
C	17,500	18,000	15,000
	₹99,000	₹1,02,500	₹95,000

- (1) AQAP = Actual Sales = ₹ 99,000
- (2) AQSP = ₹1,02,500
- (3) SQSP = Standard or Budgeted Sales = ₹ 95,000
  - (a) Sales Volume Variance = 2 – 3 = ₹ 7,500 (F)
  - (b) Sales Price Variance = 1 – 2 = ₹ 3,500 (A)

**Profit Variance:**

	(1) AQAR	(2) AQSR	(3) SQSR
A	1,400 × 7.5714	1,400 × 9	1,250 × 9
B	950 × 3.9473	950 × 5	1,000 × 5

C	$900 \times 4.4444$	$900 \times 5$	$750 \times 5$
A	10,600	12,600	11,250
B	3,750	4,750	5,000
C	4,000	4,500	3,750
	₹ 18,350	₹ 21,850	₹ 20,000

SR = Standard Selling Price – Standard Cost per unit

AR = Actual Selling Price – Standard Cost per unit

SR: A = 9; B = 5; and C = 5

AR:

A =  $(54,000/1,400) - 31 = ₹ 7.5,714$

B =  $(27,500/950) - 25 = ₹ 3.9,473$

B =  $(17,500/900) - 15 = ₹ 4.4444$

(1) AQAR = Actual Profit = ₹ 18.350

(2) AQSR = Actual Sales at Standard Rate of Profit = ₹ 21,850

(3) SQSR = Budgeted Profit = ₹ 20,000

(a) Profit Variance Due to Sales Volume =  $2 - 3 = ₹ 1,850$  (F)

(b) Profit Variance due to selling price =  $1 - 2 = ₹ 3,500$  (A)

### Material Variance:

(1)	(2)	(3)
SQSP	AQSP	AQAP
26,650	26,150	27,150

(1) SQSP = Standard Cost of Standard Material = ₹ 26,650

(2) AQSP = Standard Cost of Actual material = ₹ 26,150

(3) AQAP = Actual Cost of Material = ₹ 27,150

(a) Material Usage Variance =  $1 - 2 = ₹ 500$  (F)

(b) Material Price Variance =  $2 - 3 = ₹ 1,000$  (A)

### Labour Variances:

(1)	(2)	(3)
SRSH	SRAH	ARAH
$0.9 \times 22,500$	$0.9 \times 22,000$	
20,250	19,800	21,300

(1) SRSH = Standard Cost of Standard Labour = ₹ 20,250

(2) SRAH = Standard Cost of Actual labour = ₹ 26,150

- (3) ARAH = Actual Cost of Labour = ₹ 21,300
  - (a) Labour Efficiency Variance = 1 – 2 = ₹ 450 (F)
  - (b) Labour Rate Variance = 2 – 3 = ₹ 1,500 (A)

**Variable Overhead Variances:**

(1) SRSH	(2) SRAH	(3) ARAH
1 × 22,500	1 × 22,000	
₹ 22,500	₹ 22,000	₹ 21,500

- (1) SRSH = Standard Cost Standard Variable Overheads = ₹ 22,500
- (2) SRAH= Standard Cost of Actual Variable Overheads = ₹ 22,000
- (3) ARAH = Actual Variable Overheads = ₹ 21,500
  - (a) Variable Overheads Efficiency Variance = 1 – 2 = ₹ 500 (F)
  - (b) Variable Overheads Expenditure Variance = 2 – 3 = ₹ 500 (F)

**Fixed Overhead Variances:**

(1) SRSH	(2) SRAH	(3) SRBH	(4) ARAH
0.5 × 22,500	0.5 × 22,000	0.5 × 20,000	
₹11,250	₹11,000	₹10,000	₹12,000

- (1) SRSH = Standard Cost of Standard Fixed Overheads = ₹ 11,250
- (2) SRAH = Standard Cost of Actual Fixed Overheads = ₹ 11,000
- (3) SRBH = Budgeted Fixed Overheads = ₹ 10,000
- (4) ARSH = Actual Fixed Overheads = ₹ 12,000
  - (a) Fixed Overheads Efficiency Variance = 1 – 2 = ₹ 250 (F)
  - (b) Fixed Overheads Capacity variance = 2 – 3 = ₹ 1,000 (F)
  - (c) Fixed Overheads Expenditure variance = 3 – 4 = ₹ 2,000 (A)

**Operating Profit and Loss Statement for the month of May, 2009:**

	Standard & Variances ₹	Actual Variances ₹
Budgeted Sales	95,000	
Variances due to Volume	7,500	
Variances due to Selling prices	(3,500)	99,000
Budgeted Profit	20,000	
Variance due to sales Volume	1,850	

Variance due to Selling prices	(4,500)	17,350
<b>Production Cost Variances:</b>		
Material usage	500	
Material Price	(1,000)	(500)
Labour efficiency	450	
Labour Rate	(1,500)	(1,050)
<b>Overheads variance:</b>		
Expenditure: Variable	1,000	1,000
Expenditure: Fixed	(2,000)	
Fixed Overheads Efficiency	250	
Fixed Overheads Capacity	1,000	(750)
Operating Profit		17,050

**Q27**

**CMA Mat; MTP Jun 17**

The budgeted output of a single Product manufacturing company for 2014-15 was 5,000 units. The financial results in respect of the actual output of 4,800 units achieved during the year were as under:-

	₹
Direct Material	29,700
Direct wages	44,700
Variable Overheads	72,750
Fixed Overheads	39,000
Profit	36,600
Sales	2,22,750

The standard direct wage rate is ₹4.50 per hour and the standard variable overhead rate is ₹7.50 per hour.


The cost accounts recorded the following variances for the year.

Variances	Favourable	Adverse
	₹	₹
Material Price	-	300
Material Usage	-	600
Wage Rate	750	-
Labour Efficiency	-	2,250
Variable Overhead Expense	3,000	-
Variable Overhead Efficiency	-	3,750

Fixed Overhead Expenditure Variance	-	1,500
Selling Price	6,750	-

**Required:**

- Prepare** a statement showing the original budget.
- Prepare** the standard product cost sheet per unit.
- Prepare** a statement showing the reconciliation of originally budgeted profit and the actual profit.

 <b>Reference</b> <b>Profit Reconciliation Statement</b>	<b>What's New</b> <b>Original Budget</b>
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**Answer****Statement showing original budget and standard cost per unit:**

Element	Actual (₹)	Variance (₹)	Standard Cost 4,800 (₹)	Standard Cost Per unit (₹)	Original Budget 5,000 units (₹)
Material	29,700	900(A)	28,800	6.00	30,000
Direct Wages	44,700	1,500(A)	46,200	9.00	45,000
		2,250(A)			
Variable Overhead	72,750	750(A)	72,000	15.00	75,000
		3,750(A)			
Fixed Overhead	39,000	1,500(A)	37,500	7.50	37,500
	1,86,150	4,650(F)	1,81,500	37.50	1,87,500
Profit (b/f)	36,600	2,100(F)	34,500	7.50	37,500
Sales	2,22,750	6,750(F)	2,16,000	45.00	2,25,000

**Statement showing reconciliation of budgeted profit with Actual profit:**

	(₹)
Budgeted Profit	37,500
Add: All favourable variances	10,500
	48,000
Less All adverse variances	8,400
	39,600
Less: FOH Volume Variance $(4,800 - 5,000) \times 7.5$	(1,500)
Less: Profit Volume Variances $(4,800 - 5,000) \times 7.5$	(1,500)
Actual Profit	36,600

**Q28**

**CMA Mat**

ABC Ltd; adopts a standard costing system. The standard output for a period is 20,000 units and the standard cost and profit per unit is as under:

	₹
Direct Material (3 units @ ₹1.50)	4.50
Direct Labour (3 Hrs. @ ₹1.00 )	3.00
Direct Expenses	0.50
Factory Overheads : Variable	0.25
Fixed	0.30
Administration Overheads	0.30
Total Cost	8.85
Profit	1.15
Selling Price (Fixed by Government)	10.00

The actual production and sales for a period was 14,400 units. There has been no price revision by the Government during the period.

The following are the variances worked out at the end of the period.

		Favourable (₹)	Adverse (₹)
Direct Material			
	Price		4,250
	Usage	1,050	
Direct labour			
	Rate		4,000
	Efficiency	3,200	
Factory Overheads			
	Variable – Expenditure	400	
	Fixed – Expenditure	400	
	Fixed – Volume		1,680
Administration Overheads			
	Expenditure		400
	Volume		1,680

You are **required** to:

- (a) **Ascertain** the details of actual costs and prepare a Profit and Loss Statement for the period showing the actual Profit/Loss. Show working clearly.
- (b) **Reconcile** the actual Profit with standard profit.

Reference

What's New

**Profit Reconciliation Statement**
**Answer**

 (a) **Statement Showing the actual profit and loss statement:**

Particulars	Amount	Amount
	₹	₹
Standard Material Cost (14,400 × 4.50)	64,800	
Add: Price Variance	4,250	
Less: Usage Variance	(1,050)	68,000
Standard Labour Cost (14,400 × 3)	43,200	
Add: Rate Variance	4,000	
Less: Efficiency Variance	(3,200)	44,000
Direct Expenses (14,400 × 0.50)		7,200
Factory Overhead:		
Variable (14,400 × 0.25)	3,600	
Less: Expenditure Variance	(400)	3,200
Fixed (14,400 × 0.30)	4,320	
Add: Volume Variance	1,680	
Less: Expenditure Variance	(400)	5,600
Administration Overhead (14,400 × 0.3)	4,320	
Add: Volume Variance	1,680	
Add: Exp. Variance	400	6,400
Total Cost		1,34,400
Profit (B/F)		9,600
Sales		1,44,000

 (b) **Statement showing reconciliation of standard profit with actual profit**

Particulars	Amount	Amount
	₹	₹
Standard Profit (14,400 × 1.15)		16,560
Add: Material usage variance	1,050	
Labour efficiency Variance	3,200	
Variable Overhead expenditure variance	400	
Fixed Overhead expenditure variance	400	5,050

		21,610
Less: Material price variance	4,250	
Labour Rate Variance	4,000	
Fixed Overhead volume variance	1,680	
Administration Expenditure Variance	400	
Administration Volume Variance	1,680	12,010
<b>Actual Profit</b>		<b>9,600</b>

**Q29**

**CMA Mat**

Standard Cost card of a product is as under:

	₹
Direct Materials:	
A. 2 Kg. @ ₹ 3 per kg.	6.00
B. 1 Kg. @ ₹ 4 Per Kg.	4.00
Direct wages 5 Hours @ ₹4 per hour	20.00
Variable overheads 5 hours @ ₹1 per hour	5.00
Fixed overheads 5 hours @ ₹2 per hour	10.00
Total:	45.00
Standard profit	5.00
Standard selling price	50.00

The actual sales value was ₹ 3,05,000. Direct material consumed was Material A 14,850Kg valued at ₹ 43,065 and Material B 7,260 kg valued at ₹29,750. The total direct labour hours worked was 32,000 and the wages paid therefore amounted to ₹ 1,27,500. The direct labour hours actually booked on production was 31,800.

Overheads recorded were: Fixed ₹ 80,600 and variable ₹ 30,000. Closing work in progress 600 units in respect of which materials A and B were fully issued and labour and overheads were 50% complete. Actual production of finished goods was 6,000 units, Budgeted output 8,000 per month.

**Analyse** the variance and present an operating statement showing the reconciliation between budgeted and actual profit for the month in the following format:

**Operating Statement**

	₹
Budgeted Profit	
Sales Margin Variances	
Price	
Volume	
Total	

Cost Variances	
Direct Material	
Price	
Yield	
Mix	
Direct Wages	
Rate	
Efficiency	
Idle Time	
Variable overheads	
Expenses	
Efficiency	
Fixed Overheads	
Expenses	
Efficiency	
Idle time	
Capacity	
Total cost variance	
Actual Profit.	

**Reference**

**Profit Reconciliation Statement**

**What's New**

**Answer**

**Note 1 : Equivalent Production**

	Units	Material A & B		Labour & Overhead	
		DOC	Eq unit	DOC	Eq unit
Finished Goods	6,000	100%	6,000	100%	6,000
Closing WIP	600	100%	600	50%	300
			6,600		6,300

**Sales margin or profit variances:**

(1)	(2)	(3)
AQAR	AQSR	SQSR
6,000 × (50.83 – 45)	6,000 × 5	8,000 × 5
₹ 35,000	₹ 30,000	₹ 40,000

- (a) Profit variance due to selling price = (1) – (2) = ₹ 5,000(F)
- (b) Profit variance due to sales volume = (2) – (3) = ₹ 10,000(A)
- (c) Profit value variance = (1) – (3) = ₹ 5,000(A)

**Material variances:**

	Standard			Actual		
	Q	P	V	Q	P	V
A	13,200	3	39,600	14,850		43,065
B	6,600	4	26,400	7,260		29,750
	19,800		66,000	22,110		72,815

	SQSP	RSQSP	AQSP	AQAP
A		14,740 × 3	14,850 × 3	
B		7,370 × 4	7,260 × 4	
	66,000	73,700	73,590	72,815

- (a) Material yield variance: (1) – (2) = ₹ 7,700(A)
- (b) Material mix variance : (2) – (3) = 73,700 – 73,590 = ₹ 110(F)
- (c) Material price variance : (3) – (4) = 66,000 – 73,590 = ₹ 7,590(A)

**Labour variances:**

(1)	(2)	(3)
SRSH	SRAH	ARAH
4 × 31,500	4 × 32,000	
1,26,000	1,28,000	1,27,500

- (a) Labour idle time variance : 200 × 4 = 800 (A)
- (b) Labour rate variance: (2) – (3) = 1,28,000 – 1,27,500 = 500(F)
- (c) Labour efficiency variance: 1,26,000 – 1,28,000 = 2,000(A)

**Variable overheads variances:**

(1)	(2)	(3)
SRSH	SRAH	ARAH
1 × 31,500	1 × 31,800	
31,500	31,800	30,000

- (a) VOH efficiency variance: (1) – (2) = 31,500 – 31,800 = ₹ 300 (A)
- (b) VOH budget variance : (2) – (3) = 31,800 – 30,000 = ₹ 1,800 (F)

**Fixed overhead variance:**

(1) SRSH	(2) SRAH	(3) SRBH	(4) ARAH	(5) SR × APH
2 × 31,500	2 × 32,000			2 × (32,000 – 200)
63,000	64,000	80,000	80,600	63,600

- (a) FOH idle capacity variance:  $200 \times 2 = ₹ 400(A)$
- (b) FOH efficiency variance :  $63,000 - 63,600 = ₹ 600 (A)$
- (c) FOH capacity variance =  $64,000 - 80,000 = ₹ 16,000 (A)$
- (d) FOH budget variance:  $80,000 - 80,600 = ₹ 600 (A)$

**Note :** FOH Volume Variance =  $63,300 - 80,000 = 16,700 (A)$

**Operating statement showing reconciliation of budgeted and actual profit:**

		₹
Budgeted profit		40,000
Sales margin variance due to:		
Price	5,000(F)	
Volume	10,000(A)	(5,000)
		35,000
Cost variances		
Direct material variances:		
Price	705(F)	
Mix	110(F)	
Yield	7,700(A)	(6,885)
Direct wages variances:		
Rate	500(F)	
Efficiency	2,000(A)	
Idle time	800(A)	(2,300)
Variable OHs variances:		
Expenditure	1,800(F)	
Efficiency	300(A)	1,500
Fixed OHs variances:		
Efficiency	600(A)	
Expenditure	600(A)	
Idle time	400(A)	
Capacity	16,000(A)	(17,600)
<b>Actual profit</b>		<b>9,715</b>

**Q30**

**CMA Mat; MTP Dec'17**

The summarised results of a company for the two years ended 31st December 2014 and 2015 are given below: -

	2015 ₹ lacs	2014 ₹ lacs
Sales	770	600
Direct Materials	324	300
Direct Wages	137	120
Variable Overheads	69	60
Fixed Overheads	150	80
Profit	90	40

As a result of re-organisation of production methods and extensive advertisement campaign use, the company was able to secure an increase in the selling prices by 10% during the year 2015 as compared to the previous year.

In the year 2014, the company consumed 1,20,000 Kgs. of raw materials and used 24,00,000 hours of direct labour. In the year 2015, the corresponding figures were 1,35,000kgs. of raw materials and 26,00,000 hours of direct labour.

You are **required** to:

Use information given for the year 2014 as the base year information to analyse the results of the year 2015 and to **show** in a form suitable to the management the amount each factor has contributed by way of price, usage and volume to the change in profit in 2015.

<p><b>Reference</b></p> <p><b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b></p> <p><b>LY Vs CY</b></p>
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**Answer**

**A. Sales Variance**

- (1) Sales price variance =  $770 - \{770 \times (100/110)\} = ₹ 70(F)$
- (2) Sales volume variance =  $\{770 \times (100/110)\} - 600 = ₹ 100(F)$   
 % increase in volume =  $(100/600) \times 100 = ₹ 16.67\%$
- (3) Sales Value variance =  $770 - 600 = ₹ 170(F)$

**B. Material Variance**

Material price =  $(3,00,00,000)/1,20,000 = ₹ 250/-$   
 Material expected to be used =  $(1,20,000/600) \times 700 = 1,40,000$  Kgs

Standard Material Cost = 1,40,000 × ₹ 250 = ₹ 350 Lacs

- (4) Material cost variance = 350 – 324 = ₹ 26 (F)
- (5) Material volume variance = 300 × (1/6) = ₹ 50(A)
- (6) Material usage variance = 5,000 × 250 = ₹ 12.5 (F)
- (7) Material price variance = (250 – 240) × 1,35,000 = ₹ 13.5 (F)

**C. Labour Variance**

Labour hours expected to be used = (24,00,000/600) × 700 = 28,00,000

Labour rate = (120,00,000)/(24,00,000) = ₹ 5/-

Standard Labour Cost = 28,00,000 × ₹ 5 = ₹ 140 Lacs

- (8) Labour cost variance = ₹ 140 – ₹ 137 = ₹ 3 (F)
- (9) Labour volume variance = 120/6 = ₹ 20(A)
- (10) Labour efficiency variance = 2 × 5 = ₹ 10 (F)
- (11) Labour rate variance = 20 – 3 – 10 = ₹ 7 (A)

**D. Overhead Variance**

Standard variable overheads = ₹ 60 + (₹ 60 × 16.67%) = ₹ 70

Standard variable overheads rate per hour = ₹ 60 / 24 = ₹ 2.5

- (12) VOH cost variance = 70 – 69 = ₹ 1(F)
- (13) VOH volume variance = 60/6 = ₹ 10(A)
- (14) VOH efficiency variance = 2,00,000 × 2.5 = ₹ 5 (F)
- (15) VOH expenditure variance = 10 – 1 – 5 = ₹ 4(A)
- (16) FOH cost variance = ₹ 70(A)

**Profit reconciliation statement:**

		₹ in lakhs
Profit for 2014		40
(+) Sales variance:		
Price	70	
Volume	100	
Material variance:		
Usage	12.50	
Price	13.50	
Labour variance-efficiency	10	
VOH efficiency variance	5	211
		251
(-) Material volume variance	50	

Labour variance:		
Volume	20	
Rate	7	
VOH variances:		
Volume	10	
Expenditure	4	
FOH cost variance	70	161
Profit for 2015		90

### Q31

### CMA Mat; MTP Jun'17


Despite the increase in the sales price of its sole product to the extent of 20%, a company finds that it has incurred a loss during the year 2012-13 to the extent of ₹ 4 lakhs as against a profit of ₹ 5 lakhs made in 2011-12. This adverse situation is attributed mainly to the increase in prices of materials and overheads, the increase over the previous year being on the average, 15% and 10% respectively.

The following figures are extracted from the books of the company:

	(₹) 31-3-2012	(₹) 31-3-2013
Sales	1,20,00,000	1,29,60,000
Cost of sales:		
Material	80,00,000	91,10,000
Variable overhead	20,00,000	24,00,000
Fixed overhead	15,00,000	18,50,000

#### Required:

Analyse the variances over the year in order to bring out the reasons for the fall in profit.

 <p><b>Reference</b> <b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b> <b>LY Vs CY</b></p>
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## Answer

Statement of figures extracted from the books of the company:

(₹ lakhs)

Year	2011-12	2012-13 (based on 2011-12 prices)	Difference
(a)	(b)	(c)	(b) – (c)
Sales (W.N. 1)	120	*108.00	12
Cost of sales:			
Material (W.N. 2)	80	79.22	
Variable overhead (W.N. 3)	20	21.82	
Fixed overhead (W.N. 4)	15	16.82	

\*Decrease in sales = ₹ 120 – ₹ 108 = ₹ 12 lakhs or 10% of 2011-12 sales figure at 2012-13 rate

$$\begin{aligned} \text{Contribution to sales ratio during 2011-12} &= \frac{\text{Sales} - \text{Variable costs}}{\text{Sales}} \\ &= \frac{\text{₹ 120} - \text{₹ 100}}{\text{₹ 120}} \text{ or } (1/6) \text{ of per rupee sale} \end{aligned}$$

Loss of contribution during 2012-13 on the sale of 12 lakhs = ₹ 12 lakhs × 1/6 = ₹ 2 lakhs

### Computation of Variances

Sales Price Variance = Actual sales – Standard sales = ₹ 129.60 – ₹ 108	₹ 21.60 lakhs (F)
Material Price Variance = Standard cost of actual quantity – Actual cost = ₹ 79.22 – ₹ 91.10	₹ 11.88 lakhs (A)
Variable Overhead Expenditure Variance = Budgeted variable overhead for actual hours – Actual variable overhead = (₹ 21.82 – ₹ 24)	₹ 2.18 lakhs (A)
Variable Overhead Efficiency Variance = Std. variable overhead for standard hours – Std. variable overhead for actual hours = ₹ 18 – ₹ 21.82	₹ 3.82 lakhs (A)

\* Variable overhead in 2011-12 was ₹ 20 lakhs. Since there was a decrease in sales in 2012-13 to the extent of 10% of 2011-12 sales figure (based on 2011-12 prices). Therefore, the standard variable overhead for standard hours at this reduced sales in 2012-13 would be equal to (₹ 20 lakhs minus 10% of 20 lakhs) i.e. (₹ 20 lakhs – ₹ 2 lakhs) = ₹ 18 lakhs.

Fixed Overhead Expenditure Variance = Budgeted fixed overhead – Actual fixed overhead = ₹ 16.82 – ₹ 18.50	₹ 1.68 lakhs (A)
Fixed Overhead Volume Variance = Std. fixed overhead for actual output – Std. fixed overhead for budgeted output = (16.82 – 15)	₹ 1.82 lakhs (A)

### Reconciliation Statement

Particulars	(₹)
Profit during 2011-12	5,00,000
Add: Net increase in profit due to the sales of 2011-12	19,60,000
[after taking into account increase in sales price but decrease in contribution margin due to decrease in quantum (vol. of sales)] (Refer to working note 5)	24,60,000
Less: Usage/Efficiency variance	
Material	7,22,000
Variable overhead	3,82,000
Fixed overhead volume variance	1,82,000
	12,86,000
Less: Price variances	
Material price variance	11,88,000
Variable overhead expenditure variance	2,18,000
Fixed overhead expenditure variance	1,68,000
	15,74,000
Loss during 2012-13 (Difference figure)	(4,00,000)

**Conclusion:** The reasons for the decrease in the total profit figure of the year 2012-13 (in spite of the increase in sales price) are due to adverse - (i) Usage/efficiency variances to the extent of ₹ 12,86,000 and (ii) Price variances to the extent of ₹ 15,74,000.

### Working Notes:

(1) Sales during 2012-13 at 2010-11 price level	$\frac{129.60}{120} \times 100$	₹ 108 lakhs
(2) Material cost of 2012-13 at 2010-11 price level	$\frac{91.10}{115} \times 100$	₹ 79.22 lakhs
(3) Variable overhead of 2012-13 at 2010-11 price level	$\frac{24}{110} \times 100$	₹ 21.82 lakhs
(4) Fixed overhead of 2012-13 at 2010-11 price level	$\frac{18.50}{110} \times 100$	₹ 16.82 lakhs
(5) Net increase in profit due to rise of 20% of S.P. and reduction in contribution due to reduction in sales	129.6 – 108 – 2	₹ 19.6 lakhs

**Q 32**
**CMA Mat**

	₹ In lakhs	
	31-3-2014	31-3-2015
	₹	₹
Sales	120	129.6
Prime cost of sales	80	91.1
Variable Overheads	20	24.0
Fixed expenses	15	18.5
PROFIT	5	(4.0)

During 2014-15, average prices increased over these of the previous years

- (1) 20% in case of sales
- (2) 15% in case of prime cost
- (3) 10% in case of Overheads.

**Prepare** a profit variance statement from the above data.

Reference	What's New
<b>Profit Reconciliation Statement</b>	<b>Ratio Based</b>

**Answer**
**Calculation of variances:**

(1) Sales price Variance :	$129.60 - (129.60 \times 100/120)$	₹21.60 (F)
(2) Sales Volume Variance :	$(129.60 \times 100/120)$	₹ 12 (A)
(3) Sales Value Variance :	$129.60 - 120$	₹9.60 (F)
Decrease in volume	$\frac{12}{120} \times 100$	10%
(4) Prime Cost price Variance :	$(91.10 \times 100/115) - 91.10$	₹11.88 (A)
(5) Prime Cost Volume Variance	$80 \times 10/100$	₹8 (F)
(6) Prime Cost Usage or efficiency Variance	$(80 \times 90/100) - (91.10 \times 100/115)$	₹7.22 (A)
(7) Prime Cost Variance	$80 - 90.1$	₹11.1 (A)
(8) Variable Overhead Price Variance	$(24 \times 100/110) - 24$	₹2.18 (A)
(9) Variable Overhead Volume Variance	$20 \times 10/100$	₹2 (F)
(10) Variable Overhead Efficiency Variance	$(20 \times 90/100) - (24 \times 100/110)$	₹3.82 (A)
(11) Variable Overhead Cost Variance	$20 - 24$	₹4 (A)

(12) Fixed Overhead Price Variance	$(18.50 \times 100/110) - 18.50$	₹1.68 (A)
(13) Fixed Overhead Efficiency Variance	$15 - (18.50 \times 100/110)$	₹1.82 (A)
(14) Fixed Overhead Cost Variance	$15 - 18.50$	₹3.5 (A)

**Profit Variance Statement:**

		₹
Budgeted Profit		5.00
Add: Sales Price Variance	21.60	
Prime Cost Variance	8.00	
Variable Overhead Variance	2.00	31.60
		36.60
Less: Sales Volume Variance	12.00	
Price Cost Price Variance	11.88	
Price Cost usage Variance	7.22	
Variable Overhead Price Variance	2.18	
Variable Overhead Efficiency Variance	3.82	
Fixed Overhead Price Variance	1.68	
Fixed Overhead Efficiency Variance	1.82	40.60
<b>Actual Loss</b>		<b>4.00</b>

**Q33**

**RTP Jun'18; RTP Dec'18**

A Company following Standard Marginal Costing system has the following Interim Trading Statement for the quarter ending 30th June, which reveals a loss off ₹17,000, detailed below -

<b>Income</b>	₹	₹
Sales	4,99,200	
Closing Stock (at Prime Cost)	18,000	5,17,200
<b>Costs</b>	₹	₹
Direct Material	1,68,000	
Direct Labour	1,05,000	
Variable Overhead	42,000	3,15,000
Fixed Overhead	1,20,000	
Fixed Administration OH	40,000	
Variable Distribution OH	19,200	
Fixed Selling OH	40,000	2,19,200
Total Costs		5,34,200
Loss		17,000

Additional Information is as follows:

1. Sales for the quarter were 1,200 units. Production was 1,400 units, of which 100 units were scrapped after complete manufacture. The factory capacity is estimated at 2,000 units.
2. Because of low production, Labour Efficiency during the quarter is estimated to be 20% below normal level.

You are **required to analyse** the above and report to the Management, giving the reasons for the loss.

<p><b>Reference</b></p> <p><b>Profit Reconciliation Statement</b></p>	<p><b>What's New</b></p> <p><b>Effect of Scrap</b></p>
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**Answer**

**1. Analysis of the Profit and Loss Account to compute Standards**

Particulars	Total (₹)	Standards Per Unit
Sales	4,99,200	₹4,99,200/ 1,200 units = ₹416
Less: Cost of Production:		
Materials	1,68,000	1,68,000/1,400 units = ₹120
Labour Cost (at 20% below normal level)	1,05,000	(1,05,000 × 80%)/1,400 units = 60
VOH(at 20% below normal efficiency)	42,000	(42,000 × 80%)/1,400 units = 24
Less: Closing Stock (120 + 60) × 100 units	(18,000)	(see Note)
Gross Contribution	2,02,200	₹212
Less: Variable Distribution OH	19,200	19,200 / 1,200 units = ₹16
Net Contribution	1,83,000	₹196
Less: Fixed Costs (1,20,000 + 40,000 + 40,000)	2,00,000	
Loss	(17,000)	

**Note:** Production 1,400 units - Sales 1,200 units - Scrapped 100 units = 100 units

**2. Assumptions / Working Notes in analysing Variances**

(a) **Sales Variances:** Budgeted Capacity = 2,000 units is taken as Budgeted Sales Quantity. Also, it is assumed that

**Budgeted Sale Price** = Actual Sale Price = ₹ 416 per unit.

- Sales Price Variance = Nil.
- Sales Volume Variance (Effect on Contribution )  
= (2,000 units – 1,200 units) × 196 = ₹1,56,800A

(b) **Material Cost Variances:** In the absence of information, Material Cost Variances = Nil.

(c) **Labour Cost Variances:**

- Labour Rate Variance = Nil.
- Labour Efficiency Variance = 1,05,000 × 20% Efficiency Loss = ₹ 21,000A

(d) **Variable OH Cost Variances:**

- VOH Expenditure Variance = Nil.
- VOH Efficiency Variance = 42,000 × 20% Efficiency Loss = ₹ 8,400A.

(e) **FOH Cost Variances:** In the absence of information, FOH Cost Variances = Nil.

(f) **Effect of Abnormal Loss:** Variable Cost of Output scrapped after complete manufacture = (120 + 60 + 24) = 204 × 100 units = ₹20,400A.

(g) **Stock Valuation Effect:** Since Marginal Costing System in use, the inventories are to be carried at total variable cost. However, since the Company has valued its inventories on Prime Cost basis, i.e. excluding VOH, to that extent, profits will be under-stated. Hence, effect of VOH not included in Stock Valuation = 24 × 100 units = ₹2,400A.

3. **Explanation of factors causing Loss during the period**

Particulars	₹	₹
Budgeted Contribution for 2,000 units at ₹196	3,92,000	
Less: Budgeted Fixed Costs (1,20,000 + 40,000 + 40,000)	2,00,000	
Budgeted Profit		1,92,000
Less: Effect of Variances		
Sales Volume Variance	1,56,800(A)	
Labour Efficiency Variance	21,000(A)	
VOH Efficiency Variance	8,400(A)	
Abnormal / Loss / Scrap	20,400(A)	
Stock Valuation Difference	2,400(A)	(2,09,000)
Loss for the period		(17,000)

**Alternative treatment:** In the above calculations, Labour Efficiency has been taken to have an impact on VOH, i.e. time related OH also. If such impact is not considered in VOH, Standard Contribution; per unit will be ₹190 (instead of ₹196). All calculations will stand modified accordingly.

**Q34**

Trident Toys Ltd. manufactures a single product and the standard cost system is followed. Standard cost per unit is worked out as follows:

	₹
Materials (10 Kgs. @ ₹4 per Kg)	40
Labour (8 hours @ ₹8 per hour)	64

Variable overheads (8 hours @ ₹3 per hour)	24
Fixed overheads (8 hours @ ₹3 per hour)	24
Standard Profit	56

Overheads are allocated on the basis of direct labour hours. In the month of April 2018, there was no difference between the budgeted and actual selling price and there were no opening or closing stock during the period.

The other details for the month of April 2018 are as under

	Budgeted	Actual
Production and Sales	2,000 Units	1,800 Units
Direct Materials	20,000 Kgs. @ ₹4 per kg	20,000 Kgs. @ ₹4 per kg
Direct Labour	16,000 Hrs. @ ₹8 per Hr.	14,800 Hrs. @ ₹8 per Hr.
Variable Overheads	₹48,000	₹44,400
Fixed Overheads	₹48,000	₹48,000

### Required

- I. RECONCILE the budgeted and actual profit with the help of variances according to each of the following method:
  - (a) The conventional method
  - (b) The relevant cost method assuming that
    - (i) Materials are scarce and are restricted to supply of 20,000 Kgs. for the period.
    - (ii) Labour hours are limited and available hours are only 16,000 hours for the period.
    - (iii) There are no scarce inputs. [12]
- II. **COMMENT** on efficiency and responsibility of the Sales Manager for not using scarce resources. [8]

<b>Reference</b> <b>Relevant Cost Approach to Variance</b>	<b>What's New</b>
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### Answer

#### (i) COMPUTATION OF VARIANCES

$$\begin{aligned}
 \text{Material Usage Variance} &= \text{Standard Price} \times (\text{Standard Quantity} - \text{Actual Quantity}) \\
 &= ₹4.00 \times (18,000^* \text{ Kgs.} - 20,000 \text{ Kgs.}) \\
 &= ₹ 8,000 \text{ (A)}
 \end{aligned}$$

$$* \left( 1,800 \text{ units} \times \frac{20,000 \text{ Kgs.}}{2,000 \text{ units}} \right)$$

**Labour Efficiency Variance** = Standard Rate × (Standard Hours – Actual Hours)  
 = ₹ 8.00 × (14,400\* hrs. – 14,800 hrs.)  
 = ₹ 3,200 (A)

$$* \left( 1,800 \text{ units} \times \frac{16,000 \text{ Hrs.}}{2,000 \text{ units}} \right)$$

**Variable Overhead Efficiency Variance**

= Standard Variable Overheads for Production – Budgeted Variable Overheads for Actual hours  
 = (14,400 hrs. × ₹3.00) – (₹3.00 × 14,800 hrs.)  
 = ₹ 1,200 (A)

**Fixed Overhead Volume Variance**

= Absorbed Fixed Overheads – Budgeted Fixed Overheads  
 = (14,400 hrs. × ₹3.00) – (16,000 hrs. × ₹3.00)  
 = ₹4,800 (A)

**Sales Margin Volume Variance**

= Standard Margin – Budgeted Margin  
 = (1,800 units × ₹56.00) – (2,000 units × ₹56.00)  
 = ₹ 11,200 (A) Sales Contribution Volume Variance  
 = Standard Contribution – Budgeted Contribution  
 = (1,800 units × ₹80.00) – (2,000 units × ₹80.00)  
 = ₹ 16,000 (A)

**Statement Showing “Reconciliation Between Budgeted Profit & Actual Profit”**

Particulars	Conventional Method (₹)	Relevant Cost Method (₹)		
		Scarce Material	Scarce Labour	No Scarce Inputs
Budgeted Profit (2,000 units × ₹56)	1,12,000	1,12,000	1,12,000	1,12,000
Sales Volume Variance	11,200 (A)	NIL*	12,000\$ (A)	16,000 (A)
Material Usage Variance	8,000 (A)	24,000 (A)	8,000 (A)	8,000 (A)
Labour Efficiency Variance	3,200 (A)	3,200 (A)	7,200 (A)	3,200 (A)
Variable Overhead Efficiency Variance	1,200 (A)	1,200 (A)	1,200 (A)	1,200 (A)
Fixed Overhead Volume Variance	4,800 (A)	N.A.#	N.A. #	N.A. #
Actual Profit	83,600	83,600	83,600	83,600

## NOTES

### Scarce Material

Based on conventional method, direct material usage variance is ₹8,000 (A) i.e. 2,000 Kg.  $\times$  ₹4. In this situation material is scarce, and, therefore, material cost variance based on relevant cost method should also include contribution lost per unit of material. Excess usage of 2,000 Kg. leads to lost contribution of ₹ 16,000 i.e. 2,000 Kgs.  $\times$  ₹ 8. Total material usage variance based on relevant cost method, when material is scarce will be: ₹ 8,000 (A) + ₹ 16,000 (A) = ₹ 24,000 (A). Since labour is not scarce, labour variances are identical to conventional method.

Excess usage of 2,000 Kgs. leads to loss of contribution from 200 units i.e. ₹16,000 (200 units  $\times$  ₹ 80). It is not the function of the sales manager to use material efficiently. Hence, loss of contribution from 200 units should be excluded while computing sales contribution volume variance.

(\*)  $\rightarrow$

Therefore, sales contribution volume variance, when materials are scarce will be NIL i.e. ₹16,000 (A) – ₹16,000 (A).

### Scarce Labour

Material is no longer scarce, and, therefore, the direct material variances are same as in conventional method. In conventional method, excess labour hours used are: 14,400 hrs. – 14,800 hrs. = 400 hrs. Contribution lost per hour = ₹10. Therefore, total contribution lost, when labour is scarce will be: 400 hrs.  $\times$  ₹10 = ₹4,000. Therefore, total labour efficiency variance, when labour hours are scarce will be ₹7,200 (A) i.e. ₹3,200 (A) + ₹4,000 (A).

Excess usage of 400 hrs. leads to loss of contribution from 50 units i.e. ₹4,000 (50 units  $\times$  ₹80). It is not the function of the sales manager to use labour hours efficiently. Hence, loss of contribution from 50 units should be excluded while computing sales contribution volume Variance.

(\$)  $\rightarrow$

Therefore, sales contribution volume variance, when labour hours are Scarce will be ₹12,000 (A) i.e. ₹16,000 (A) - ₹4,000 (A). Fixed Overhead Volume Variance

(#)  $\rightarrow$

The fixed overhead volume variance does not arise in marginal costing system. In absorption costing system, it represents the value of the under or over absorbed fixed overheads due to change in production volume. When margin al costing is in use there is no overhead volume variance, because marginal costing does not absorb fixed overheads.

### (ii) Comment on Efficiency and Responsibility of the Sales Manager

The **sales manager is accountable** for prices, volume, and mix of the product, whereas the production manager must control the costs of materials, labour, factory overheads and quantities of production. The purchase manager must purchase materials at budgeted prices. **Sales manager is not responsible for contribution lost** due to excess usage or inefficient usage of resources in case of scarce resources. Hence, such contribution lost

must be **excluded from the sales contribution volume variance and it is to be borne by production manager.**

### Q35

Ski Slope had planned, when it originally designed its budget, to buy its artificial ice for ₹10/ per kg. However, due to subsequent innovations in technology, producers slashed their prices to ₹9.70 per kg. and this figure is now considered to be a general market price for the purpose of performance assessment for the budget period. The actual price paid was ₹9.50, as the Ski Slope procurement department negotiated strongly for a better price. The other information relating to that period were as follows:

Original Standards (ex-ante)		Revised Standards (ex-post)		Actual (5,500 units)	
5,500 units × 5 Kgs. × ₹10	₹ 2,75,000	5,500 units × 4.75 Kgs. × ₹9.70	₹ 2,53,412.50	27,225 Kgs. × ₹9.50	₹ 2,58,637.50

#### Required

- (i) CALCULATE the variances for 'Ice' by
  - (a) Traditional Variance Analysis; and
  - (b) An approach which distinguishes between Planning and Operational Variances.
- (ii) INTERPRET the result.

<p><b>Reference</b></p> <p><b>Operating and Traditional Variances</b></p>	<p><b>What's New</b></p>
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#### Answer

- (i) (a) **Traditional Variances**

$$\begin{aligned} \text{Usage Variance} &= (27,500 \text{ Kgs.} - 27,225 \text{ Kgs.}) \times ₹10 \\ &= ₹2,750 \text{ (F)} \end{aligned}$$

$$\begin{aligned} \text{Price Variance} &= (₹10 - ₹9.50) \times 27,225 \text{ Kgs.} \\ &= ₹13,612.50 \text{ (F)} \end{aligned}$$

$$\begin{aligned} \text{Total Variance} &= ₹2,750 \text{ (F)} + ₹13,612.50 \text{ (F)} \\ &= ₹16,362.50 \text{ (F)} \end{aligned}$$

- (b) **Operational Variances**

$$\text{Usage Variance} = (26,125 \text{ Kgs.} - 27,225 \text{ Kgs.}) \times ₹ 9.70$$

$$\begin{aligned}
 &= ₹10,670 \text{ (A)} \\
 \text{Price Variance} &= (₹9.70 - ₹9.50) \times 27,225 \text{ Kgs.} \\
 &= ₹5,445 \text{ (F)} \\
 \text{Total Variance} &= ₹10,670 \text{ (A)} + ₹5,445 \text{ (F)} \\
 &= ₹5,225 \text{ (A)}
 \end{aligned}$$

### Planning Variances

$$\begin{aligned}
 \text{Usage Variance} &= (27,500 \text{ Kgs.} - 26,125 \text{ Kgs.}) \times ₹10 \\
 &= ₹ 13,750 \text{ (F)} \\
 \text{Price Variance} &= (₹ 10 - ₹ 9.70) \times 26,125 \text{ Kgs.} \\
 &= ₹ 7,837.50 \text{ (F)} \\
 \text{Total Variance} &= ₹ 13,750 \text{ (F)} + ₹ 7,837.50 \text{ (F)} \\
 &= ₹ 21,587.50 \text{ (F)}
 \end{aligned}$$

### (ii) Interpretation

It is important to note that an **innovation in technology** is outside the control of Ski Slope and is, by nature, a planning 'error'. Equally, the better negotiation of a price should be recognised as an operational matter. **Operational variances** are self evidently under the control of operational management, so operational efficiency must be assessed with only these figures in mind. The material procurement department has clearly done well by negotiating a price reduction beyond the market dip. One might question the quality of the ice, as the **usage variance is adverse** (possibly the ice fails to cover the field and so more is required). Obviously, the favourable price variance is smaller than the adverse usage variance, thus, overall performance is quite poor. A supervisor **cannot assess variances in isolation from each other**.

SJC Institute

# Throughput Accounting



## Learning Objective

### THEORY

1. THEORY OF CONSTRAINTS
2. THROUGHPUT CONCEPTS
3. THROUGHPUT ACCOUNTING AND CONTRIBUTION APPROACH
4. THROUGHPUT COSTING AND ABSORPTION COSTING
5. STEPS TO INCREASE THROUGHPUT
6. PROBLEMS WITH THROUGHPUT ACCOUNTING
7. REPORTING UNDER THROUGHPUT ACCOUNTING
8. ACCEPTANCE OF THROUGHPUT ACCOUNTING

### PRACTICAL

9. RANKING AND ALLOCATION
10. THROUGHPUT ACCOUNTING RATIO
11. ELEVATION OF BOTTLENECK

## 1. CONCEPT AND AIM OF THEORY OF CONSTRAINTS [DEC'21; MTP JUN'19]

TOC analyses the Bottlenecks and constraints within the firm that restrict output and hinder speedy production. Throughput is related directly to the ability to cope with the constraint and to manage the bottleneck. This focus on throughput enables management to examine both constraints and bottlenecks in order to increase Throughput contribution.

## 2. THROUGHPUT ACCOUNTING

**Throughput Accounting** is a management accounting technique used as a performance measure in the theory of constraints. It is the business intelligence used for maximizing profits. It focuses importance on generating more throughput. It seeks to increase the velocity or speed of production of products and services keeping in view of constraints. It is based on the concept that a company must determine its overriding goal and then it should create a system that clearly defines the main capacity constraint that allows it to maximize that goal. The changes that this concept causes are startling.

**Throughput accounting is a system of performance measurement and costing which traces costs to throughput time.** It is claimed that it complements JIT principles and forces attention to the true determinants of profitability. Throughput accounting is defined as follows:

**“A management accounting system which focuses on ways by which the maximum return per unit of bottleneck activity can be achieved” – CIMA Terminology.**

## 3. THROUGHPUT CONCEPTS [MTP JUN'17; MTP JUN'19]

A few new terms are used in throughput accounting. They are explained as below:

### **Throughput:**

Throughput is the excess of sales value over the totally variable cost. That is nothing but contribution margin left after a product's price is reduced by the amount of its totally variable cost.

### **Totally Variable Cost:**

This cost is incurred only if a product is produced. In many cases only direct materials are considered as totally variable cost. Direct labour is not totally variable, unless piece rate wages are paid.

### **Capacity Constraints:**

It is a resource within a company, that limits its total output. For example, it can be a machine that can produce only a specified amount of a key component in a given time period, thereby keeping overall sales from expanding beyond the maximum capacity of that machine. There may be more than one capacity constraint in a company, but rarely more than one for a specified product or product line.

### Throughput (or Cycle) Time:

Throughput (or cycle) time is the average time required to convert raw materials into finished goods ready to be shipped to customer. It includes the time required for activities such as material handling, production processing, inspecting and packaging.

### Throughput Efficiency:

Throughput efficiency is the relation of throughput achieved to resources used.

$$\text{Throughput efficiency} = \frac{(\text{Throughput cost})}{(\text{Actual factory cost})}$$

### Throughput Time Ratio:

It is the ratio of time spent adding customer value to products and services divided by total cycle time. It is also known as the '**ratio of work content to lead time**'.

### Operating Expenses:

This is sum total of all company expenses including totally variable expenses. It should be noted that throughput accounting does not care, if a cost is semi-variable, fixed or allocated – all costs that are not totally variable is lumped together for throughput accounting purpose. This group of expenses is considered the price that a company pays to ensure that it maintains its current level of capacity.

### Investment:

This term is used here also, as it is used in common parlance, i.e. any application of funds, which is intended to provide a return by way of interest, dividend or capital appreciation. However, there is a particular emphasis on company's investment in working capital. This is discussed subsequently in discussion about throughput model.

### Total Factory Cost:

With the exception of material costs, in the short run, most factory costs (including direct labour) are fixed. These fixed costs can be grouped together and called total factory costs (TFC).

### Manufacturing Response Time:

With JIT, products should not be made, unless there is a customer waiting for them, because the ideal inventory level is zero. The effect of this will be that there will be idle capacity in some operations except the operation, which is bottleneck of the moment. Working on output just to increase WIP or Finished Goods stocks creates no profit and so would not be encouraged. This means that profit is inversely proportional to the level of inventory in the system. It can be expressed as follows:

$$\text{Profit} = f = \left[ \frac{1}{\text{MRT}} \right]$$

Where, MRT = Manufacturing Response Time

### Profitability:

This concept emphasizes that profitability is determined by how quickly goods can be produced to satisfy customer's orders. Production for stock does not create profits. Improving the throughput of bottleneck operations will increase the rate at which customer demand can be met and this will improve profitability. Contribution in its traditional form (**sales – variable costs**) is not a good guide or profitability because it ignores capacity factors and rate of production.

$$\text{Return per factory hour} = \left[ \frac{\text{Sales Prices} - \text{Material Cost}}{\text{Time on key resource i.e., the bottleneck}} \right]$$

### Product costs are measured thus:

$$\text{Cost per factory hour} = \left[ \frac{\text{Total factory costs (TFC)}}{\text{Total time available on the key resource}} \right]$$

The return and cost per factory hour are combined into the throughput accounting ratio as follows:

$$\text{TA} = \left[ \frac{\text{Return per factory hour (or minute)}}{\text{Cost per factory hour (or minute)}} \right]$$

**The TA ratio should be greater than 1.** If it is less than 1, the product will lose money for the company and the company should consider withdrawing it from the market.

Using TA, value is not created until products are sold. Thus items made for stock produce no return and depress the TA ratio. This should prompt managers to use their limited bottleneck resource to produce products for which customer demand exists. The TA ratio can be considered in total terms and compares the total return from the throughput to TFC, i.e.,

$$\text{Primary TA Ratio} = \left[ \frac{\text{Return from total throughput (i.e., Sales-Material Costs)}}{\text{TFC (i.e., all costs other than materials)}} \right]$$

## 4. THROUGHPUT ACCOUNTING AND CONTRIBUTION APPROACH

Throughput accounting has certain similarities with the traditional approach of maximizing contribution per unit of scarce resource. However, there are certain differences. In throughput accounting, return is defined as sales less material costs in contrast to contribution, which is sales less all variable costs, i.e., material, labour, overheads. The assumption (i.e., emphasis) in throughput accounting is that all costs except material are fixed in relation to throughput in short run. Eminent management accountants like Kaplan and Shank have criticized TA for its **short-term emphasis**. Besides, **TA does not appear to be useful in JIT environment**. Throughput helps to direct attention to bottlenecks and forces management to concentrate on the key elements in making profits and approach adopted to gain this objective is reduction in inventory and reducing response time to customer demand.

## 5. BASIC LOGIC OF THROUGHPUT COSTING AND COMPARISON WITH ABSORPTION COSTING:

Throughput costing assigns only unit level spending for direct costs as the cost of products or services. Advocates of throughput costing argue that adding any other indirect cost, past or committed cost, to product cost creates improper incentives to drive down the average cost per unit by making more products than can be used or sold. Since these are committed costs, making more units with the same level of spending arithmetically reduces the average cost per unit and makes the production process appear to be more efficient. Throughput accounting (costing) avoids this incentive because the cost per unit depends only on the unit level spending (i.e., cost of materials) not how many units are made. Using throughput accounting (costing) means that cost management analyst must distinguish between

- (a) Spending for resources caused by the decision to produce different levels of products and services, and
- (b) The use of resources that organisation has committed to supply regardless of level of products and services provided.

## 6. STEPS TO BE FOLLOWED TO INCREASE THE THROUGHPUT

The theory of constraints is applied within an organisation by following what are called '**the five focusing steps.**' These are a tool that Goldratt developed to help organisations deal with constraints, otherwise known as bottlenecks, within the system as a whole (rather than any discrete unit within the organisation.) **The steps are as follows:**

- (a) **Identify** the bottleneck in the system i.e., identification of the limiting factor of the production (or) process such as installing capacity or hours etc.
- (b) **Decide** how to exploit the systems bottleneck that means bottleneck resource should be actively and effectively used as much as possible to produce as many goods as possible.
- (c) **Subordinate** everything else to the decision made in step (b). The production capacity of the bottleneck resource should determined production schedule.
- (d) **Augment** the capacity of the bottleneck resource with the minimum capital input.
- (e) **Identify** the new bottlenecks in the process and repeat the same above steps to address the bottlenecks.

## 7. PROBLEMS WITH THROUGHPUT ACCOUNTING

1. When throughput accounting is the driving force behind all production scheduling, **a customer that has already placed an order for a product**, which will result in a sub-optimal profit level for the manufacturing, may find that its order is never filled.

2. The company's ability to create the highest level of profitability is now **dependent on the production scheduling staff**, who decides, what products are to be manufactured and in what order.
3. **Another issue is that all costs are totally variable in the long-run** since the management then, has the time to adjust them to long-range production volumes.

## 8. REPORTING UNDER THROUGHPUT ACCOUNTING

When the throughput model is used for financial reporting purposes, the format appears slightly different. The income statement includes only direct materials in the cost of goods sold, which results in a **'throughput contribution instead of gross margin. All other costs are jumped into an 'Operating Expenses' category** below the throughput contribution margin, yielding a net income figure at the bottom. All other financial reports stay the same. Though this single change appears relatively minor, it has significant impact. The primary change is that throughput accounting **does not charge any operating expenses to inventory** so that they can be expressed in future period. Instead, all operating expenses are realized during the current period. As a result, **any incentive for managers to over produce is completely eliminated because they cannot use the excess amount to shift expenses out of current period, thereby making their financial results look better than they would otherwise.** Though this is a desirable result, such a report can be used **only for internal reporting** because of the requirement of generally accepted accounting principles that some overheads should be charged to excess production.

## 9. SYSTEMATIC CHANGES REQUIRED FOR ACCEPTANCE OF THE THROUGHPUT ACCOUNTING

Throughput accounting does not have a logical linkage with the more traditional form of cost accounting. This makes it difficult for it to gain acceptance. The main problem is that this method does not use cost as the basis for the most optimal production decisions. This is entirely contrary to the teachings of any other type of accounting, which holds that the highest margin products should always be produced first. Now question is whether the enterprise should either use throughput or traditional costing exclusively or is there any way to merge the two. Following discussion relates to this issue:

### (a) **Inventory Valuation:**

Generally accepted accounting principles clearly state that cost of overhead must be apportioned to inventory. Throughput accounting states that **none of the overhead cost should be so assigned.** In this case, since the rules are so clear, it is apparent that throughput accounting loses. The existing system must continue to assign costs irrespective of how throughput principles are used for other decision making (short-range) activities.

(b) **Inventory Investment Analysis:**

There are fundamental differences between the two methodologies. Both hold that the objective is always to keep one's investment at a minimum. In the case of traditional cost accounting, this is because the return on investment is higher when the total amount of investment is forced to the lowest possible level. Throughput accounting, however, wants to **shrink the amount of investment because it includes work-in-progress inventory in this category**. It tries to **keep WIP levels down so that waste is reduced in the production system**. In short, first system advocates a small investment for financial reasons, while later system favours it because it makes more operational sense. Despite the differences in reasoning, the same conclusion is reached by both methodologies. However, throughput approach is still better, for it forces one to analyse all inventory reduction projects in light of how they together will impact the capacity constraint rather than individually.

(c) **Capital Investment Analysis:**

Traditional cost accounting only analyses each investment proposal on its own rather than considering its impact on the production processes as a whole. It tends to recommend **investments that will result in an incremental investment but no overall change in the level of corporate capacity**, which is driven by capacity constraint. Throughput accounting, however, has a **tight focus on investment only in areas that impact capacity constraint** – to other investment proposals are rejected. In this instance, it is best to reject the traditional system and conduct analysis based on throughput principles.

(d) **Product Costing:**

Under throughput accounting, **a product has only a totally variable cost, which may be far lower than the fully absorbed cost**, that would be assigned to it under more traditional costing system. **This totally variable cost is almost always direct materials**, which is an easily calculated figure. Full absorption costing, however, requires a large amount of calculation effort, before a detailed cost can be compiled for a product. **For companies selling to Government under cost-plus contracts, there are lengthy detailed requirements** as to what variable and overhead costs should be assigned to each product manufactured. These rules virtually require the use of absorption costing – throughput costing is not a viable solution. **For companies, that do not require detailed costing justifications while selling their products, it may be possible to use the much simpler throughput accounting approach.**

(e) **Production Scheduling:**

Traditional systems do not include any kind of throughput accounting, that tells production planners which orders should be produced first. These days with throughput accounting, it is possible to **customize existing systems** or to **upgrade packaged software** so that this option is available to planners. This would allow them to produce the items that result in the highest throughput per minute of the capacity constraint. Here it is difficult to fully support the throughput approach. Any company that has already received a customer has an obligation to fill it, even if the resulting sale will reduce its overall level of profit from the theoretical maximum that can be calculated with throughput accounting. **Maximising short-term profit by ignoring orders is tantamount to long-term suicide since**

**customers will leave in droves.** Consequently, production planners should be left alone to schedule production in the traditional manner rather than basing their decisions on short-term profit maximisation.

(f) **Long-term planning:**

This is the main application area of throughput accounting. The enterprise should estimate the approximate sales levels for each product for a long-time frame enter into a throughput model and determine what mix of prospective sales will result in the highest level of profitability. This method is much superior to use of throughput costing for short-term production decisions, since long-term planning sidesteps problems by avoiding existing customer orders that will result in low profits. **Long-term planning does not involve existing customer orders so that decisions to produce various types of products at different price points can be made before the sales force goes out to obtain orders.**

(g) **Price Setting:**

**Throughput accounting is favoured by the sales and marketing staff** because the margin on products is simple to obtain-just subtract totally variable costs from the price. This beats the **incomprehensible image of allocations** accompanying activity based costing. Price setting in throughput environment focuses more on what products can be inserted into the existing production mix at a price that will incrementally increase overall profitability, rather than the painful accumulation and allocation of costs to specific products. Throughput accounting is the clear choice here based on ease of understandability and the speed with which information can be accumulated.

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## Q1 CMA Mat; MTP Jun'18; MTP Dec'19; MTP Dec'19

H Ltd. manufactures three products. The material cost, selling price and bottleneck resource details per unit are as follows:

Particulars		Product X	Product Y	Product Z
Selling price	(₹)	66	75	90
Material and other variable cost	(₹)	24	30	40
Bottleneck resource time	(minutes)	15	15	20

Budgeted factory costs for the period are ₹ 2,21,600. The bottleneck resources time available is 75,120 minutes per period.

### Required:

- Company adopted throughput accounting and products are ranked according to 'product return per minute'.  
Select the highest rank product.
- Calculate throughput accounting ratio and comment on it.

Reference

What's New

Ranking & TAR

### Answer

- Calculation of Rank according to product return per minute (₹)

Particulars		X	Y	Z
Selling price		66	75	90
Less: Variable cost		24	30	40
Throughput contribution (a)		42	45	50
Minutes per unit (b)		15	15	20
Contribution per minute (a) ÷ (b)		2.8	3	2.5
Ranking		II	I	III

- Calculation of Throughput Accounting ratio

Particulars		X	Y	Z
Factory cost per minute (₹ 2,21,600/75,120 minutes) (₹)		2.95	2.95	2.95
TA ratio (Contribution per minute/Cost per minute)		0.95	1.02	0.85
Ranking based on TA ratio		II	I	III

**Analysis** - Product Y yields more contribution compared to average factory contribution per minute, whereas X and Z yield less.

**Q2**

**RTP Jun'18; RTP Dec'18**

K Mnf. Ltd produces three products, X, Y and Z. The capacity of K Mnf. Ltd's plant is restricted by process alpha. Process alpha is expected to be operational for eight hours per day and can produce 1,200 units of X per hour, 1,500 units of Y per hour, and 600 units of Z per hour.

Selling prices and material costs for each product are as follows.

Product	Selling price ₹ per unit	Material cost ₹ per unit	Throughput contribution ₹ per unit
X	150	80	70
Y	120	40	80
Z	300	100	200

Conversion costs are ₹ 720,000 per day.

**Required:**

- Calculate** the profit per day if daily output achieved is 6,000 units of X, 4,500 units of Y and 1,200 units of Z.
- Calculate** the TA ratio for each product.
- In the absence of demand restrictions for the three products, **Advise** K Mnf. Ltd's management on the optimal production plan.

**Reference**

**Throughput Accounting Ratio**

**What's New**

**Answer**

- Profit per day** = throughput contribution – conversion cost  

$$= [(\text{₹ } 70 \times 6,000) + (\text{₹ } 80 \times 4,500) + (\text{₹ } 200 \times 1,200)] - \text{₹ } 7,20,000$$

$$= \text{₹ } 3,00,000$$
- TA ratio** = throughput contribution per factory hour / conversion cost per factory hour  
 Conversion cost per factory hour = ₹ 720,000 / 8 = ₹ 90,000

Product	Throughput contribution per factory hour	Cost per factory hour	TA ratio
X	₹ 70 × 1,200 = ₹ 84,000	₹ 90,000	0.93
Y	₹ 80 × 1,500 = ₹ 120,000	₹ 90,000	1.33
Z	₹ 200 × 600 = ₹ 120,000	₹ 90,000	1.33

- An attempt should be made to remove the restriction on output caused by process alpha's capacity. This will probably result in another bottleneck emerging elsewhere. The extra

capacity required to remove the restriction could be obtained by working overtime, making process improvements or product specification changes. Until the volume of throughput can be increased, output should be concentrated upon products Y and Z (greatest TA ratios), unless there are good marketing reasons for continuing the current production mix.

Product X is losing money every time it is produced so, unless there are good reasons why it is being produced, for example it has only just been introduced and is expected to become more profitable, A Ltd should consider ceasing production of X.

### Q3

### CMA Mat

Modern Co produces 3 products, A, B and C, details of which are shown below:

Particulars	A	B	C
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Variable overhead (₹)	30	20	15
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck resource (hours per unit)	5	4	3

There are 3,20,000 bottleneck hours available each month.

#### Required:

Calculate the optimum product mix based on the throughput concept.

Reference	What's New
<b>Ranking &amp; Allocation</b>	

#### Answer

Particulars	A	B	C
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Throughput per unit (₹)	60	40	45
Time required on the bottleneck resource (hours per unit)	5	4	3
Return per factory hour (₹)	12	10	15
Ranking	2	3	1
Total Available hours		= 3,20,000	

(-) Hours used for C (40,000 x 3)	= 1,20,000	
(-) Hours used for A (30,000 x 5)	= 1,50,000	= 2,70,000
Balance hours available for B		= 50,000
No. of units that can be made in balance hours	= 50,000/4	= 12,500 units.

**Statement showing optimum mix:**

	A	B	C
No. of units	30,000	12,500	40,000

**Q4 CMA Mat; MTP Dec'17; Dec'19; MTP Dec'19**

A factory has a key resource (bottleneck) of Facility A which is available for 31,300 minutes per week. Budgeted factory costs and data on two products, X and Y, are shown below:

Product	Selling Price/Unit	Material Cost/Unit	Time in Facility A
X	₹ 35	₹ 20.00	5 minute
Y	₹ 35	₹ 17.50	10 minutes

Budgeted factory costs per week:

	₹
Direct labour	25,000
Indirect labour	12,500
Power	1,750
Depreciation	22,500
Space costs	8,000
Engineering	3,500
Administration	5,000

Actual production during the last week is 4,750 units of product X and 650 units of product Y. Actual factory cost was ₹ 78,250.

**Calculate:**

- (i) Total factory costs (TFC)
- (ii) Cost per Factory Minute
- (iii) Return per Factory Minute for both products
- (iv) TA ratios for both products.
- (v) Throughput cost per week.
- (vi) Efficiency ratio

Reference	What's New
<b>Total factory cost, Cost per factory minute, Return per factory minute, TAR, Throughput Cost, Efficiency Ratio</b>	

### Answer

- (i) **Total Factory Costs** = Total of all costs except materials.  
 $= ₹ 25,000 + ₹ 12,500 + ₹ 1,750 + ₹ 22,500 + ₹ 8,000 + ₹ 3,500 + ₹ 5,000.$   
 $= ₹ 78,250$
- (ii) **Cost per Factory Minute** = Total Factory Cost ÷ Minutes available  
 $= ₹ 78,250 ÷ 31,300 = ₹ 2.50$
- (iii) **Return per Factory Minute for both products**
- (a) **Return per bottleneck minute for Product X** =  $\frac{\text{Selling Price} - \text{Material Cost}}{\text{Minutes in bottleneck}}$   
 $= (35 - 20) / 5 = ₹ 3$
- (b) **Return per bottleneck minute for Product Y** =  $\frac{\text{Selling Price} - \text{Material Cost}}{\text{Minutes in bottleneck}}$   
 $= (35 - 17.5) / 10 = ₹ 1.75$
- (iv) **Throughput Accounting (TA) Ratio for Product X** =  $\frac{\text{Return per Minute}}{\text{Cost per Minute}}$   
 $= (3 / 2.5) = 1.2$
- Throughput Accounting (TA) Ratio for Product Y** =  $\frac{\text{Return per Minute}}{\text{Cost per Minute}}$   
 $= (1.75 / 2.5) = 0.7$
- Based on the review of the TA ratios relating to two products, it is apparent that if we only made Product Y, the enterprise would suffer a loss, as its TA ratio is less than 1. Advantage will be achieved, when product X is made.
- (v) **Standard minutes of throughput for the week:**  
 $= [4,750 \times 5] + [650 \times 10] = 23,750 + 6,500 = 30,250 \text{ minutes}$
- Throughput cost per week:**  
 $= 30,250 \times ₹ 2.5 \text{ per minutes}$   
 $= ₹ 75,625$

(vi) **Efficiency %** = (Throughput cost / Actual TFC) %  
 = (₹ 75,625 / ₹ 78,250) x 100  
 = 96.6%

The bottleneck resource of Facility A is available for 31,300 minutes per week but produced only 30,250 standard minutes. This could be due to:

- (a) the process of a 'wandering' bottleneck causing facility A to be underutilized.
- (b) inefficiency in facility A.

**Q5**

**CMA Mat**

Cat Co makes a product using three machines – X, Y and Z. The product has to pass through all the three machines.

The capacity of each machine is as follows:

	X	Y	Z
Machine capacity per week (in units)	800	600	500

The demand for the product is 1,000 units per week. For every additional unit sold per week, profit increases by ₹ 50,000. Cat Co is considering the following possible purchases (they are not mutually exclusive):

**Purchase 1** Replace machine X with a newer model. This will increase capacity to 1,100 units per week and costs ₹ 60 Lakhs.

**Purchase 2** Invest in a second machine Y, increasing capacity by 550 units per week. The cost of this machine would be ₹ 68 Lakhs.

**Purchase 3** Upgrade machine Z at a cost of ₹ 75 Lakhs, thereby increasing capacity to 1,050 units.

**Required:**

**Which** is Cat Co's best course of action under throughput accounting?

Reference	What's New
<b>Elevation of Bottleneck</b>	

**Answer**

Since the product has to pass through all the machines, machine capacity is the bottleneck. Bottleneck resource in order of preference is firstly machine 'Z', secondly machine 'Y' and lastly machine 'X' because the no. of units are in that order in the existing capacity.

Particulars	X	Y	Z	Demand
Current capacity per week	800	600	500*	1,000
Buy Z	800	600*	1,050	1,000
Buy Z & Y	800*	1,150	1,050	1,000
Buy Z, Y & X	1,100	1,150	1,050	1,000*

\* = bottleneck resource

All the three machines to be purchased in the above order to meet the existing demand.

## Q6

## CMA Mat

T Ltd, produces a product which passes through two processes - cutting and finishing.

The following information is provided:

	Cutting	Finishing
Hours available per annum	50,000	60,000
Hours needed per unit of product	5	12
Fixed operating costs per annum excluding direct material	10,00,000	10,00,000

The selling price of the product is ₹ 1,000 per unit and the only variable cost per unit is direct material, which costs ₹ 400 per unit. There is demand for all units produced.

**Evaluate** each of the following proposals independent of each other:

- An outside agency is willing to do the finishing operation of any number of units between 5,000 and 7,000 at ₹ 400 per unit.
- An outside agency is willing to do the cutting operation of 2,000 units at ₹ 200 per unit.
- Additional equipment for cutting can be bought for ₹ 10,00,000 to increase the cutting facility by 50,000 hour, with annual fixed costs increased by ₹ 2 lakhs.

Reference	What's New
<b>Elevation of Bottleneck</b>	

## Answer

Cutting process capacity	= 50,000 hours/5	= 10,000 units
Finishing process capacity	= 60,000 hours/12	= 5,000 units
Throughput contribution per unit	= Selling price – Material cost	
	= ₹ 1,000 – ₹ 400	= ₹ 600p.u.

<b>Alternative-I</b>	<p><b>If an outside agency is willing to do the finishing operation</b></p> <p>Increase in throughput contribution  <math>= (\text{Throughput contribution} - \text{Subcontracting charges}) \times \text{No. of finished units}</math>  <math>= (\text{₹ } 600 - \text{₹ } 400) \times 5,000 \text{ units} = \text{₹ } 10,00,000</math></p>
<b>Alternative-II</b>	<p><b>If an outside agency is willing to do the cutting operation</b></p> <p>Already the cutting process has got surplus capacity. It is not a bottleneck. It is not suggested to outsource cutting operation, since there is no benefit to TP Ltd. from outsourcing, and outsourcing of cutting process will reduce the throughput contribution of outsourced activity.</p>
<b>Alternative-III</b>	<p><b>Installation of additional equipment for cutting process.</b></p> <p>The cutting process has surplus capacity. It is not suggested to increase non-bottleneck capacity.</p>

**Q7**

**CMA Mat**

Given below is the basic data relating to New India Company for three years:

	Year 1	Year 2	Year 3
<b>Production and Inventory data</b>			
Planned production (in units)	2,500	2,500	2,500
Finished goods inventory (in units), Jan 1	0	0	750
Actual production (in units)	2,500	2,500	2,500
Sales (in units)	2,500	1,750	3,250
Finished goods inventory (in units), Dec 31	0	750	0

<b>Revenue and cost data, all three-years</b>	<b>₹</b>
Sales price per unit	48
<b>Manufacturing costs per unit</b>	
Direct material	12
Direct labour	8
Variable manufacturing overhead	4
<b>Total variable cost per unit</b>	<b>24</b>
<b>Used only under absorption costing:</b>	
Fixed manufacturing overhead = Annual fixed OH / Annual Production = ₹ 30,000 / 2,500	12
<b>Total absorption cost per unit</b>	<b>36</b>
Variable selling and administrative cost per unit	4
Fixed selling and administrative cost per year	5,000

You are **required** to Prepare:

- Absorption Costing Income Statement
- Variable Costing Income Statement.
- Reconciliation of Income under Absorption and Variable Costing.
- Throughput Costing Income Statement and Comment **how** it is relatively more useful. Draw your conclusion.

<p><b>Reference</b></p> <p><b>Income statement, Absorption, Variable &amp; Throughput costing, Reconciliation</b></p>	<p><b>What's New</b></p>
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**Answer**

Actual production is 2500 units in each year.

- (a) **Absorption Costing Income Statement**

**New India Company**  
**Income Statement as per Absorption Costing**

Particulars	Year 1 ₹	Year 2 ₹	Year 3 ₹
Sales revenue ( at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Cost of goods sold ( at absorption cost of ₹ 36 per unit)	90,000	63,000	1,17,000
Gross margin	30,000	21,000	39,000
Less: Selling and administrative expenses:			
Variable (at ₹ 4 per unit)	10,000	7,000	13,000
Fixed	5,000	5,000	5,000
Operating Income	15,000	9,000	21,000

- (b) **Variable Costing Income Statement**

**New India Company**  
**Income Statement as per Variable Costing**

Particulars	Year 1 ₹	Year 2 ₹	Year 3 ₹
Sales revenue ( at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Variable expenses:			
Variable manufacturing costs ( at variable cost of ₹ 24 per unit)	60,000	42,000	78,000

Variable selling & admn. Costs ( at ₹ 4 per unit)	10,000	7,000	13,000
Contribution margin	50,000	35,000	65,000
Less: Fixed expenses :			
Fixed manufacturing overhead	30,000	30,000	30,000
Fixed selling & admn. Expenses	5,000	5,000	5,000
Operating Income	15,000	0	30,000

(c) **Reconciliation of Income under Absorption and Variable Costing**

**New India Company**  
**Reconciliation of Income under Absorption and Variable Costing**

Particulars	Year1	Year 2	Year 3
	₹	₹	₹
Cost of goods sold under absorption costing	90,000	63,000	1,17,000
Variable manufacturing costs under variable costing	60,000	42,000	78,000
Difference	30,000	21,000	39,000
Fixed manufacturing overhead as a period expense under variable costing.	30,000	30,000	30,000
Balance	0	(9,000)	9,000
Operating Income under variable costing	15,000	0	30,000
Operating income under absorption costing	15,000	9,000	21,000
Difference in operating income	0	(9,000)	9,000

The following table shows, this difference in the amount of fixed overhead expenses explains the difference in reported income under absorption and variable costing:

Year	Change in Inventory (in units)	Fixed Overhead Rate	Difference in Fixed Overhead Expenses	Absorption Costing Income Minus Variable Costing Income
Year 1	0	x ₹ 12 =	= 0	= 0
Year 2	750 increase	x ₹ 12 =	= ₹ 9,000	= ₹ 9,000
Year 3	750 decrease	x ₹ 12 =	= (9,000)	= (9,000)

(d) **Throughput Costing Income Statement**

**New India Company**  
**Income Statement as per Throughput Costing**

Particulars	Year1	Year 2	Year 3
	₹	₹	₹
Sales revenue ( at ₹ 48 per unit)	1,20,000	84,000	1,56,000
Less: Cost of goods sold (at throughput cost: Direct material cost)	30,000	21,000	39,000

Throughput	90,000	63,000	1,17,000
Less: Operating costs:			
Direct labour	20,000	20,000	20,000
Variable manufacturing overhead	10,000	10,000	10,000
Fixed manufacturing overhead	30,000	30,000	30,000
Variable Selling & Admn. Costs	10,000	7,000	13,000
Fixed selling & Admn. Costs	5,000	5,000	5,000
Total Operating costs	75,000	72,000	78,000
<b>Operating Income</b>	15,000	(9,000)	39,000

**Notes:**

1. Standard direct-material cost per unit of ₹ 12 multiplied by sales volume in units.
2. Assume that management has committed to direct labour sufficient to produce the planned annual production volume of 2500 units; direct labour cost is used at a rate of ₹ 8 per unit produced.
3. Assumes management has committed to support resources sufficient to produce the planned annual production volume of ₹ 2500 units; variable overhead cost is used at a rate of ₹ 4 per unit produced. Fixed overhead is ₹ 30,000 per year.
4. Variable selling and administrative costs used amount to ₹ 1 per unit sold. Fixed selling and administrative costs are ₹ 5,000 per year.

Chapter **5**  
**Cost of Quality**



**Learning  
Objective**

1. CONCEPT OF QUALITY
2. DIFFERENCES BETWEEN MANUFACTURING AND SERVICE ORGANISATION
3. CONCEPTS OF QUALITY MANAGEMENT

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## 1. CONCEPT OF QUALITY [JUN'18]

**Quality as perception:** You will not be wrong when you state that the term **quality** is a perception which is personal to an individual. In plain terms, quality is “**features**” or “**worth**” or “**value**”. You will realise how this is true when you read the following phrases picked from literature on quality.

- (i) “**Quality is not an act. It is a habit**”: Aristotle. This is true and applicable to any act of a human being.
- (ii) “**Quality is conformance to requirements**”: This in line with the concept that quality is decided by the customer.
- (iii) “**Quality is zero defects**”: No customer wants defects in the products or services he or she pays for. This is a totally different idea on quality and is true when you make quality a habit.
- (iv) “**Quality is free**”: Phil Crosby. This is the utopian situation. When there are no defects then there is no wastage and thus quality becomes free.
- (v) “**Quality is the degree to which a set of inherent characteristics fulfils requirements**”: ISO 9000. This is an attempt to give universality to the term quality.

Today, there is no single universal definition of quality. Some people view quality as “**performance to standards**.” Others view it as “**meeting the customer’s needs**” or “**satisfying the customer**.” Let’s look at some of the more common definitions of quality.

- **Conformance to specifications** measures how well the product or service meets the targets and tolerances determined by its designers. **For example**, the dimensions of a machine part may be specified by its design engineers as 30.05 inches. This would mean that the target dimension is 3 inches but the dimensions can vary between 2.95 and 3.05 inches. Similarly, the wait for hotel room service may be specified as 20 minutes, but there may be an acceptable delay of an additional 10 minutes. Also, consider the amount of light delivered by a 60 watt light bulb. If the bulb delivers 50 watts it does not conform to specifications. As these **examples** illustrate, conformance to specification is directly measurable, though it may not be directly related to the consumer’s idea of quality.
- **Fitness for use** focuses on how well the product performs its intended function or use. **For example**, a Mercedes Benz and a Jeep Cherokee both meet a fitness for use definition if one considers transportation as the intended function. However, if the definition becomes more specific and assumes that the intended use is for transportation on mountain roads and carrying fishing gear, the Jeep Cherokee has a greater fitness for use. You can also see that fitness for use is a user-based definition in that it is intended to meet the needs of a specific user group.
- **Value for price paid** is a definition of quality that consumers often use for product or service usefulness. This is the only definition that combines economics with consumer criteria; it assumes that the definition of quality is price sensitive. **For example**, suppose that you wish to sign up for a personal finance seminar and discover that the same class is being taught at two different colleges at significantly different tuition rates. If you take the less expensive seminar, you will feel that you have received greater value for the price.

- **Support services** provided are often how the quality of a product or service is judged. Quality does not apply only to the product or service itself; it also applies to the people, processes, and organizational environment associated with it. For **example**, the quality of a university is judged not only by the quality of staff and course offerings, but also by the efficiency and accuracy of processing paperwork.
- **Psychological criteria** is a subjective definition that focuses on the judgmental evaluation of what constitutes product or service quality. Different factors contribute to the evaluation, such as the atmosphere of the environment or the perceived prestige of the product. For **example**, a hospital patient may receive average health care, but a very friendly staff may leave the impression of high quality. Similarly, we commonly associate certain products with excellence because of their reputation; Rolex watches and Mercedes-Benz automobiles are examples.

## 2. DIFFERENCES BETWEEN MANUFACTURING AND SERVICE ORGANIZATIONS

Defining quality in **manufacturing organizations** is often different from that of services. Manufacturing organizations produce a tangible product that can be seen, touched, and directly measured. Examples include cars, CD players, clothes, computers, and food items. Therefore, **quality** definition in manufacturing usually focus on **tangible product features**.

The most common **quality** definition in manufacturing is **conformance**, which is the degree to which a product characteristic meets preset standards. Other common definitions of quality in manufacturing include performance such as **acceleration of a vehicle**; **reliability** that the product will function as expected without failure; **features** the extras that are included beyond the basic characteristics; durability expected operational life of the product; and **serviceability** how readily a product can be repaired. The relative importance of these definitions is based on the **preferences** of each individual customer. It is easy to see how different customers can have different definitions in mind when they speak of high product quality.

In contrast to manufacturing, **service organizations** produce a product that is **intangible**. Usually, the complete product cannot be seen or touched. Rather, it is **experienced**. Examples include delivery of health care, experience of staying at a vacation resort, and learning at a university. The intangible nature of the product makes defining quality difficult. Also, since a service is experienced, perceptions can be highly subjective. In addition to tangible factors, quality of services is often defined by perceptual factors. These include **responsiveness** to customer needs, **courtesy** and friendliness of staff, promptness in resolving complaints, and **atmosphere**. Other definitions of quality in services include **time**—the amount of time a customer has to **wait** for the service; and **consistency**—the degree to which the service is the same each time. For these reasons, defining quality in services can be especially challenging. Dimensions of quality for manufacturing versus service organizations are shown in the Table.

### 3. DIMENSIONS OF QUALITY FOR MANUFACTURING VERSUS SERVICE ORGANIZATIONS

Manufacturing organizations	Service organizations
Conformance to specifications	Tangible factors
Performance	Consistency
Reliability	Responsiveness to customer needs
Features	Courtesy/friendliness
Durability	Timeliness/ promptness
Serviceability	Atmosphere

### 4. CONCEPTS OF QUALITY MANAGEMENT

Quality management is defined as **“Coordinated activities to direct and control an organization with regard to quality” (ISO 9000:2000)**. The activities are normally integrated into a system.

This is known as the **systems approach to managing quality** and the same approach needs to be adapted to business operations. Starting from early 60s and migrating to the 70s, the practices of quality management have shown an evolution. In the following paragraphs, you will get an overview of the way these evolution started from the activity or process of **“Inspection”**.

**Inspection:** Inspection is defined as **“Activities such as measuring, testing and gauging one or more characteristics of a product or service and comparing with specifications as in design to determine its conformity”**. This approach is the **“after the event”** approach, meaning the things which have happened and then which you verify by, measuring or testing and screen out those which do not meet specifications. Organisation is said to be working in a **“detection”** mode, having things or events which have happened! The result is that the nonconforming products are cost as they are a waste of material and as well as that of efforts or needing some rework or being sold as **“seconds”** at a lower price all resulting into a dent in profits. This also creates the culture of **“somebody else will check my outcome and it is that somebody’s responsibility to give the conforming product”**. This approach had several limitations and had to be replaced by another effective way of attaining quality and the concept of Quality Control was the result.

**Quality Control:** Defined as **“Operational techniques and activities that are used to fulfill requirements for quality”**. Organisations realized that **“Inspection”** alone was a costly affair as all that was segregated was a waste and a cost to the organisation, thus reducing profitability. The result was the idea of **“control on operations,”** as Quality control. This was not necessarily very different from Inspection but had a new look at inspection. Under a system of quality control, there was a need to find controls for an activity, in the form of **procedures, intermediate stage inspections and recording of performance of a process for giving feedback**. The methods of **inspection** got sophisticated with addition of tools like **sample checks, lot size**, etc for inspections at identified stages. However, the intention and activity of preventing a non-conforming product reaching a customer depended solely on the screening inspection at

the final stage of production or service delivery. Application of this concept of course resulted into lesser defects but remained in nature as “**detection mode**”, which we have discussed earlier.

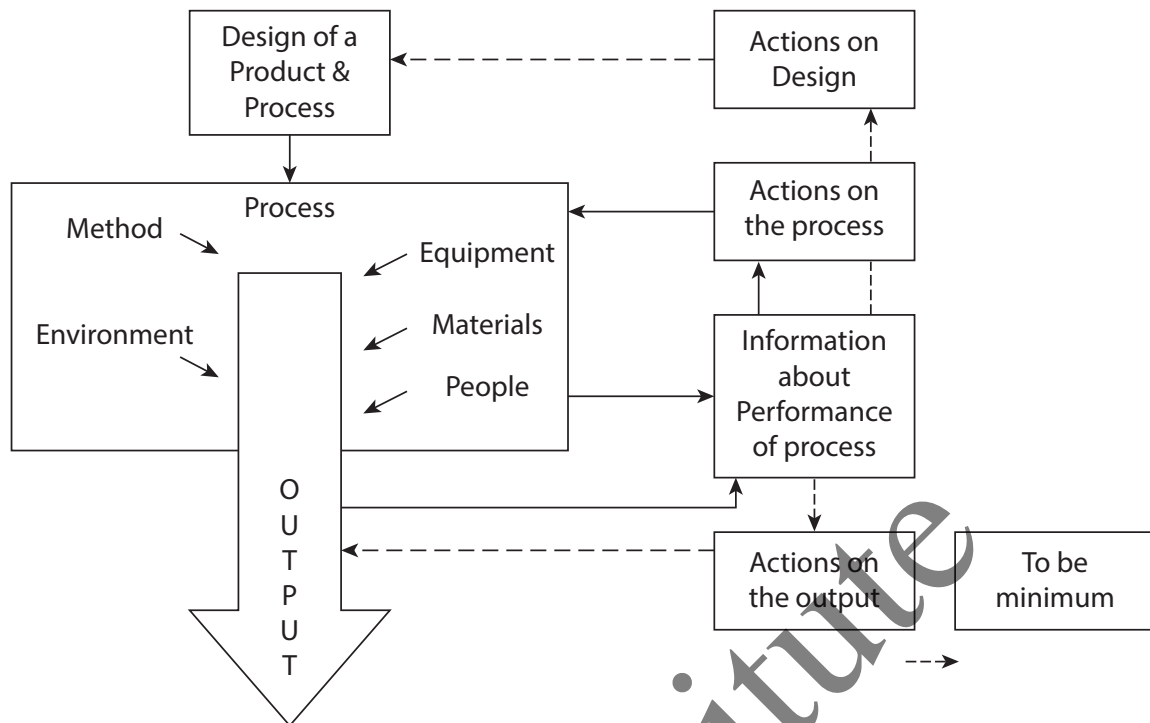
**Quality Assurance:** From the business point of view, eliminating non-conformance was the key to a better level of quality and assurance of quality. And then the concept of Quality Assurance (QA) was developed. The central idea is to identify the root cause of non-conformity, take steps to eliminate the cause and thus remove recurrence of the nonconformity in future deliveries to the customer. QA is defined as “**All those planned and systematic actions necessary to provide an adequate confidence that a product or service will satisfy the given requirements for quality**”.

Quality assurance is a **prevention based system**. The system improves product and service quality and increases productivity by placing emphasis on the design of product or service and relevant processes. The basis is that the process that makes the product or a service needs to be designed in such a manner that the variation in the process outcome is minimal in reference to design specifications, thus eliminating non-conformance. This is a proactive approach as compared to the reactive one in the “**detection mode**” discussed above.

In this system of operations, quality is created in the design stage and not in the control stage. The premise is that the design of the products and the processes makes the quality happen and not any verification or inspection as in the detection mode. Changing from “**detection mode**” to “**prevention based system**” requires the use of a set of quality management tools and techniques along with a new operating philosophy and approach –even of thinking, by the top management.

The new philosophy demands a **change in the management style** to integrate various functions or departments to work together to discover the root cause of non-conformance or variation and to pursue elimination. Quality planning and improvements begin when the top management includes prevention, as opposed to detection, in organisational policies because this philosophy directs the business towards the future.

Integrating various processes of the business into “**a whole**” was at the basis and thus a true system approach to business. Such thinking resulted into a new practice which came to be known as the “**Total Quality Management**” (TQM). To get an insight into this concept, you need to understand that no-business process can work in isolation. Interdependence and an interaction between each of the business processes exist, and must be addressed while operating a business. This is the systems approach.



**Schematic for a Prevention Based System**

## 5. COST OF QUALITY [JUN/18]

The reason quality has gained such prominence is that organizations have gained an understanding of the high cost of poor quality. Quality affects all aspects of the organization and has dramatic cost implications. The most obvious consequence occurs when poor quality creates dissatisfied customers and eventually leads to loss of business. However, quality has many other costs, which can be divided into two categories. The **first** category consists of costs necessary for achieving high quality, which are called quality control costs. These are of two types: **prevention costs and appraisal costs**. The **second** category consists of the cost consequences of poor quality, which are called quality failure costs. These include **external failure costs and internal failure costs**. The first two costs are incurred in the hope of preventing the second two.

**Prevention costs** are all costs incurred in the process of preventing poor quality from occurring. They include quality planning costs, such as the costs of developing and implementing a quality plan. Also included are the costs of product and process design, from collecting customer information to designing processes that achieve conformance to specifications. Employee training in quality measurement is included as part of this cost, as well as the costs of maintaining records of information and data related to quality.

**Appraisal costs** are incurred in the process of uncovering defects. They include the cost of quality inspections, product testing, and performing audits to make sure that quality standards are being met. Also included in this category are the costs of worker time spent measuring quality and the cost of equipment used for quality appraisal.

**Internal failure** costs are associated with discovering poor product quality before the product reaches the customer site. One type of internal failure cost is rework , which is the cost of correcting the defective item. Sometimes the item is so defective that it cannot be corrected and must be thrown away. This is called scrap, and its costs include all the material, labour, and machine cost spent in producing the defective product.

**External failure** Costs are incurred when inferior products are delivered to customers. They include cost of handling customer complaints, warranty replacements, repairs of returned products and cost arising from a damaged company reputation.

**Hence we can tabulate the above details with suitable examples as below:**

<p><b>Prevention costs</b></p>	<p>Ensuring the failures do not happen</p> <p><b>Example:</b></p> <ul style="list-style-type: none"> <li>• Quality training</li> <li>• Quality circles</li> <li>• Statistical process control activities</li> <li>• System Development for prevention</li> <li>• Quality improvement</li> </ul>
<p><b>Appraisal costs</b></p>	<p>Checking for failures</p> <p><b>Example:</b></p> <ul style="list-style-type: none"> <li>• Testing and inspecting materials</li> <li>• Final product testing and inspecting</li> <li>• WIP testing and inspecting</li> <li>• Package inspection</li> <li>• Depreciation of testing equipment</li> </ul>
<p><b>Internal failure costs</b></p>	<p>Keeping defective products from falling into the hands of customers</p> <p><b>Example:</b></p> <ul style="list-style-type: none"> <li>• Cost of Scrap (net of realization)</li> <li>• Cost of Spoilage</li> <li>• Cost of Rework</li> <li>• Down time due to defect in quality</li> <li>• Retesting</li> </ul>
<p><b>External failure cost</b></p>	<p>Costs of defects discovered by the customers</p> <p><b>Example:</b></p> <ul style="list-style-type: none"> <li>• Cost of field servicing</li> <li>• Cost of handling complaints</li> <li>• Warranty repairs</li> <li>• Lost sales</li> <li>• Warranty replacements</li> </ul>

## Q1

Jun'17

Nikee Ltd. manufactures and sells one variety of sports-shirt in India. Noted football clubs and supporters of these clubs are the main customers. Nikee's products show some rectifiable defects. These problems can generally be detected and repaired during internal inspection at a cost of ₹ 15 per unit.

During 2016, 50000 shirts were produced and sold. After inspection defect was detected in respect of 5% of output. Inspection cost is ₹25 per shirt. After sales, customers reported defects in respect of 6% of output. These shirts were received back from customers at a transportation cost of ₹8 per unit. Because of negative publicity due to defects, there would be loss of sales in 2017 to the extent of 5% of external failures.

### Required:

- (i) **Analyse** costs of quality showing separately (with workings) the:
- Inspection or appraisal cost
  - Internal failure cost
  - External failure cost
  - Opportunity cost due to external failure, and
  - Total costs of quality
- (ii) If the selling price per shirt is ₹250 and variable cost is 60% of sales, fixed cost ₹5,50,000 p.a., **prepare** a statement showing profitability of the product during 2016. [6 + 2 = 8]

Reference	What's New
<b>Cost of Quality</b>	<b>Profitability Statement</b>

### Answer

- (i) **Statement of Costs of Quality**

	₹
(a) Inspection or Appraisal Cost ( ₹ 25 × 50,000 shirts)	12,50,000
(b) Internal failure (re -work) cost (5% × 50,000 × ₹ 15)	37,500
(c) External failure cost (i.e., transportation + re-work cost) [6% × 50,000 × (₹ 8 + 15)]	69,000
(d) Opportunity cost (i.e., loss of contribution) 5 × (6% × 50,000) × 250 × 40%	15,000
<b>Total Quality Cost</b>	<b>13,71,500</b>

(ii) **Profitability statement**

	₹
Sales (50,000 × ₹ 250)	1,25,00,000
Less: Variable Cost (60%)	75,00,000
Contribution	50,00,000
Less: Quality Cost (as above)	13,71,500
Contribution, net of quality costs	36,28,500
Less: Fixed Cost	5,50,000
Net Profit	30,78,500

**Q2**

**Dec'18**

The following is the information regarding turnover and quality cost of a company.

- (i) Sales revenue ₹ 10,000,000 ; net income ₹ 10,00,000
- (ii) During the year, customers returned 30000 units needing repair. Repair cost averages ₹ 7 per unit.
- (iii) Six inspectors are employed, each earning an annual salary of ₹ 25,000. These six inspectors are involved only with final section (Production acceptance).
- (iv) Total scrap is 30000 units. All scrap is quality related. The cost of scrap is about ₹ 15 per unit.
- (v) Each year, approximately 150000 units are rejected in final inspection. Of these units, 80 per cent can be recovered through rework. The cost of rework is ₹ 3.00 per unit.
- (vi) A customer cancelled an order that would have increased the profits by ₹ 2,50,000. The customer's reason for cancellation was poor product performance. The accounting and marketing departments agree that the company loses at least this much during the year for the same reason.
- (vii) The company employs five full time employees in its complaint department. Each earns ₹20,000 a year.
- (viii) The company gave sales allowances totaling ₹ 1,30,000 due to substandard products being sent to the customer.
- (ix) The company requires all new employees to take in three hour Quality-Training programme. The estimated cost for the programme is ₹ 80,000.
- (x) Inspection of the final product requires testing equipment. The annual cost operating and manufacturing this equipment is ₹ 1,20,000.

**Required :**

**Prepare** a simple quality cost report classifying costs by rational category.

[8]

Reference

What's New

## Prepare Quality Cost Report

### Answer

#### Quality Cost Report

	Quality Costs	Percentage of sales
(i) <b>Prevention costs</b>		
Quality training	80,000	0.8%
(ii) <b>Appraisal costs :</b>		
Product inspection (25,000 × 6)	150,000	
Test equipment	120,000	
	270,000	2.7%
(iii) <b>Internal failure costs :</b>		
Scrap (30,000 × 15)	450,000	
Rework (1,50,000 × 80% × 3)	360,000	
	810,000	8.1%
(iv) <b>External failure costs :</b>		
Repair (30,000 × 7)	210,000	
Order cancellation	250,000	
Customer complaints	100,000	
Sales allowance	130,000	
	690,000	6.9%
<b>Total quality costs (i to iv)</b>	<b>1,850,000</b>	<b>18.5%</b>

### Q3

### RTP Jun'18

A Company manufactures a single product, which requires two components. The Company purchases one of the components from two Suppliers: A Ltd and B Ltd.

The price quoted by A Ltd is ₹180 per hundred units of the component and it is found that on an average 3% of the total receipt from this Supplier is defective. The corresponding quotation from B Ltd is ₹174 per hundred units, but the defective would go up to 5%. If the defectives are not detected, they are utilized in production causing a damage of ₹180 per 100 units of the component.

The Company intends to introduce a system of inspection for the components on receipt. The Inspection cost is estimated at ₹24 per 100 units of the component. Such an inspection will be

able to detect only 90% of the defective components received. No payment will be made for components found to be defective in Inspection.

**Required:**

1. **Advise** whether Inspection at the point of receipt is justified?
2. **Which** of the Suppliers should be asked to supply? Assume total requirement is 10,000 units of the component.

<b>Reference</b>	<b>What's New</b>
<b>Implementation of Inspection Programme</b>	

**Answer**

1. **Computation of Cost per 100 units of good components without Inspection**

Particulars	A Ltd.	B Ltd.
(a) Total Units Required	10,000 units	10,000 units
(b) Defective Units	3% of 10,000 = 300 units	5% of 10,000 = 500 units
(c) Defectives not detected (10%)	30 units	50 units
(d) Defectives Detected	270 units	450 units
(e) Components paid for (a – d)	9,730 units	9,550 units
(f) Purchase Price	$(9,730 \times 180) \div 100$ = ₹17,514	$(9,550 \times 174) \div 100$ = 16,617
(g) Inspection Cost	$(10,000 \times 24) \div 100$ = ₹2,400	$(10,000 \times 24) \div 100$ = 2,400
(h) Production Damage	$(30 \times 180) \div 100 = ₹54$	$(50 \times 174) \div 100 = 87$
(i) Total Costs (f + g + h)	₹19,968	₹19,104
(j) Cost per 100 good components	$(₹19,968 / 9,700 \text{ units}) \times 100$ = ₹205.86	$(₹19,104 / 9,500 \text{ units}) \times 100$ = ₹201.09

2. **Computation of Cost per 100 units of good components with Inspection**

Particulars	A Ltd	B Ltd
(a) Purchase Price	$₹180 \times 10,000 / 100$ = ₹18,000	$₹174 \times 10,000 / 100$ = 17,400
(b) Production Damage	$(18,000 \times 3\%) = 540$	$(17,400 \times 5\%) = 870$
(c) Total Costs (a + b)	₹18,540	₹18,270
(d) Number of good components	$(10,000 - 300) = 9,700$ units	$(10,000 - 500) = 9,500$ units

(e) Cost per 100 good components (c ÷ d)	$\frac{₹18,540}{9,700 \text{ units}} \times 100 = 191.13$	$\frac{₹18,270}{9,500 \text{ units}} \times 100 = 192.31$
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**Conclusion:**

- Inspection at the point of receipt is not advantageous, due to additional cost per 100 good components, i.e. ( ₹205.86 - ₹191.13) = ₹14.73 in case of A Ltd, and ( ₹201.09 – ₹192.31) = ₹8.78 in case of B Ltd.
- Purchase from A Ltd is cheaper, as there is cost saving of ₹1.18 per 100 good components.

**Q4**

**CMA Mat**

The following table gives the result of inspection of 20 samples of 100 items each taken on 20 working days. Draw a P-chart. **What** conclusion would you draw from the chart?

<b>Sample No.</b>	1	2	3	4	5	6	7	8	9	10
<b>No. of defectives</b>	9	17	8	7	12	5	11	16	14	15
<b>Sample No.</b>	11	12	13	14	15	16	17	18	19	20
<b>No. of defectives</b>	10	6	7	18	16	10	5	14	7	13

**Reference**

**P-Chart**

**What's New**

**Answer**

Given sample size n = 100

Sample No.	$d_i$	$p_i = d_i/100$
1	9	0.09
2	17	0.17
3	8	0.08
4	7	0.07
5	12	0.12
6	5	0.05
7	11	0.11
8	16	0.16
9	14	0.14
10	15	0.15
11	10	0.10
12	6	0.06

13	7	0.07
14	18	0.18
15	16	0.16
16	10	0.10
17	5	0.05
18	14	0.14
19	7	0.07
20	13	0.13
<b>Total</b>	--	2.20

We have  $\bar{P} = 2.2/20 = 0.11$

$$\bar{q} = 1 - \bar{p} = 0.89$$

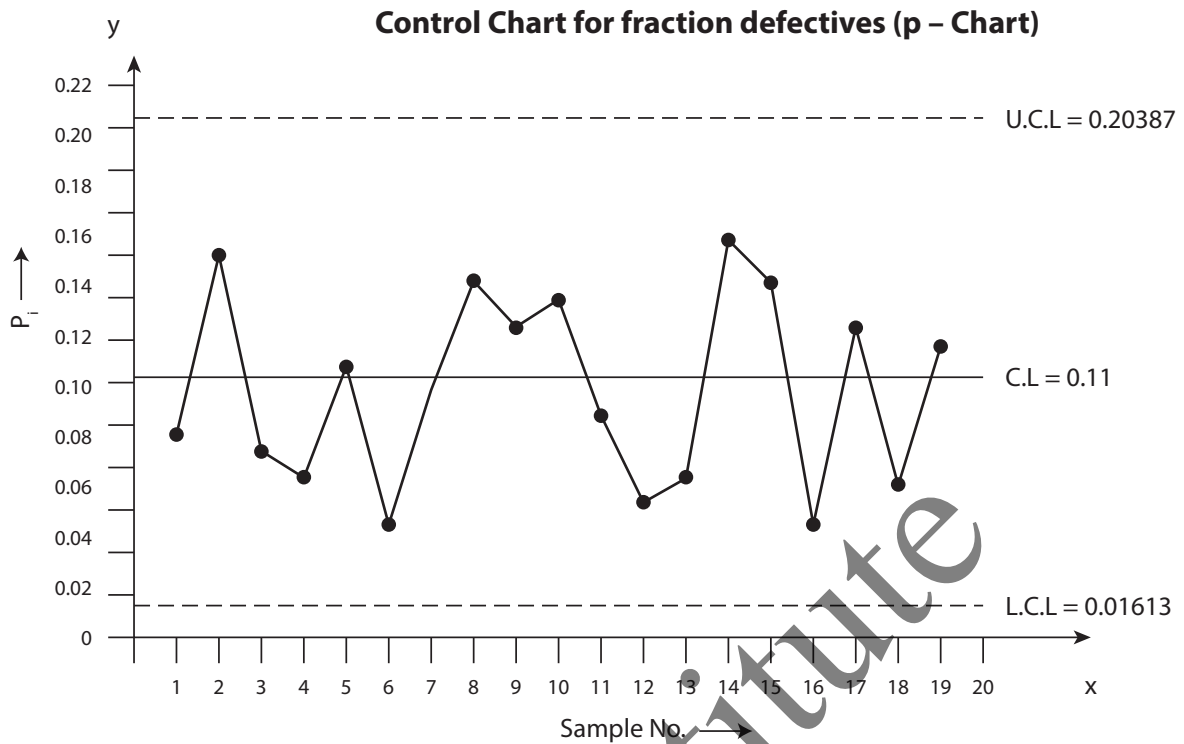
Therefore, the  $3\sigma$  control limits for P – chart are

$$\bar{p} \pm 3\sqrt{\frac{\bar{p}\bar{q}}{n}}$$

Therefore Central Line C. L =  $\bar{P} = 0.11$

$$\begin{aligned} \text{Lower Control Limit (L.C.L)} &= \bar{p} - 3\sqrt{\frac{\bar{p}\bar{q}}{n}} \\ &= 0.11 - 3\sqrt{\frac{(0.11)(0.89)}{100}} \\ &= 0.11 - 0.09387 \\ &= 0.01613 \end{aligned}$$

$$\begin{aligned} \text{Upper Control Limit (U.C.L)} &= \bar{p} + 3\sqrt{\frac{\bar{p}\bar{q}}{n}} \\ &= 0.11 + 3\sqrt{\frac{(0.11)(0.89)}{100}} \\ &= 0.11 + 0.09387 \\ &= 0.20387 \end{aligned}$$



From the P chart we observe that all the sample points lies within the  $3\sigma$  control limits. Hence the production process is in the state of statistical quality control.

**Q5**

**CMA Mat**

15 Samples of size 4 each were taken and the observed values are given below:

Samples	Observed values			
1	32	20	33	6
2	42	36	52	50
3	25	15	52	63
4	22	33	34	23
5	29	30	27	31
6	30	34	26	16
7	34	31	28	34
8	11	21	20	16
9	11	22	28	31
10	36	30	35	26
11	34	16	37	26
12	27	36	51	53
13	26	35	32	37
14	25	36	37	24
15	10	28	14	13

**Calculate** UCL and LCL for X Chart and R chart. Also prepare the chart on graph paper. For a sample size 4 the control factors are —

$$A_2 = 0.729, D_2 = 2.059, D_3 = 0, D_4 = 2.282.$$

<p><b>Reference</b></p> <p><b>X Chart and R Chart</b></p>	<p><b>What's New</b></p>
---	--------------------------

**Answer**

Given Sample size  $n = 4$

No. of samples  $k = 15$

Sample No.	Sample Mean	Sample Range
1	$91/4 = 22.75$	$33 - 6 = 27$
2	$180/4 = 45$	$52 - 36 = 16$
3	$155/4 = 38.75$	$63 - 15 = 48$
4	$112/4 = 28$	$34 - 22 = 12$
5	$117/4 = 29.25$	$31 - 27 = 4$
6	$106/4 = 26.5$	$34 - 16 = 18$
7	$127/4 = 31.75$	$34 - 28 = 6$
8	$68/4 = 17$	$21 - 11 = 10$
9	$92/4 = 23$	$31 - 11 = 20$
10	$127/4 = 31.75$	$36 - 26 = 10$
11	$113/4 = 28.25$	$37 - 16 = 21$
12	$167/4 = 41.75$	$53 - 27 = 26$
13	$130/4 = 32.5$	$37 - 26 = 11$
14	$122/4 = 30.5$	$37 - 24 = 13$
15	$65/4 = 16.25$	$28 - 10 = 18$
Total	443	260

We have,  $\bar{X} = 443/15 = 29.5333$

$$\bar{R} = 260 / 15 = 17.3333$$

Control Limits for  $\bar{X}$  - Chart

Central Line C.L =  $\bar{X} = 29.5333$

**Lower Control Limit (L.C.L)** =  $\bar{X} - A_2 \bar{R}$   
 $= 29.5333 - 0.729 (17.3333)$

$$= 29.5333 - 12.6360$$

$$= 16.8973$$

**Upper Control Limit (U.C.L)**  $= \bar{X} - A_2 \bar{R}$

$$= 29.5333 + 0.729 (17.3333)$$

$$= 29.5333 + 12.6360$$

$$= 42.1693$$

**Control Limits for R – Chart**

**Central Line (C.L)**  $= \bar{R} = 17.3333$

**Lower Control Limit (L.C.L)**  $= D_3 \bar{R}$

$$= 0 \times 17.3333$$

$$= 0$$

**Upper Control Limit (U.C.L)**  $= D_4 \bar{R}$

$$= 2.282 (17.3333)$$

$$= 39.5546$$

From  $\bar{X}\bar{X}$  – chart we observe that the 15th sample lies below L.C.L and 2nd samples goes outside U.C.L. Hence the production process is not in control w.r.t.  $\bar{X}\bar{X}$  – chart.

From R – Chart we observe that the 3rd sample lies above U.C.L. So the production process is not in control w.r.t to R – Chart.

Therefore, we infer that the entire production process is not in the state of Statistical Quality.

**Q6**

**CMA Mat**

Draw the control charts for (mean) and R (Range) from the following data relating to 20 samples, each of size 5. Only the control line and the upper and lower control limits may be drawn in each chart.

Sample No.	$\bar{X}$	R	Sample No.	$\bar{X}$	R
1	38.2	15	11	32.6	31
2	33.8	1	12	22.8	12
3	24.4	22	13	21.6	29
4	36.6	24	14	28.8	22
5	27.4	18	15	28.8	16
6	30.6	33	16	24.4	19
7	31.2	21	17	30.4	20
8	27.0	29	18	25.4	34

9	24.0	29	19	37.8	19
10	29.4	18	20	31.4	17

(For sample of size 5 -  $d_2 = 2.326$ ,  $d_3 = 0.864$ )

<p><b>Reference</b></p> <p><b>Control Chart</b></p>	<p><b>What's New</b></p> $A_2 = \frac{3}{d_2 \sqrt{n}}$
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**Answer**

Given sample size  $n = 5$

No. of samples  $k = 20$

Sample No.	$\bar{X}$	R
1	38.2	15
2	33.8	1
3	24.4	22
4	36.6	24
5	27.4	18
6	30.6	33
7	31.2	21
8	27.0	29
9	24.0	29
10	29.4	18
11	32.6	31
12	22.8	12
13	21.6	29
14	28.8	22
15	28.8	16
16	24.4	19
17	30.4	20
18	25.4	34
19	37.8	19
20	31.4	17
<b>Total</b>	586.6	429

Therefore,  $\bar{X} = 586.6 / 20 = 29.33$

$\bar{R} = 429/20 = 21.45$

### Control Limits for $\bar{X}$ - Chart

$$\text{Central Line (C.L.)} = \bar{\bar{X}} = 29.33$$

$$\text{Lower Control Limit (L.C.L.)} = \bar{\bar{X}} - A_2 \bar{R}$$

$$\text{Where } A_2 = \frac{3}{d_2 \sqrt{n}} = \frac{3}{2.326 \sqrt{5}}$$

$$= \frac{3}{2.326 \times 2.2361}$$

$$= \frac{3}{5.2012}$$

$$= 0.5768$$

$$\text{Therefore L.C.L.} = 29.33 - 0.5768 (21.45)$$

$$= 29.33 - 12.3724$$

$$= 16.9576$$

$$\text{Upper Control Limit U.C.L.} = \bar{\bar{X}} + A_2 \bar{R}$$

$$= 29.33 + 0.5768 (21.45)$$

$$= 29.33 + 12.3724$$

$$= 41.7024$$

### Control Limits for R-Chart:

$$\text{Central Line (C.L.)} = \bar{R}$$

$$= 21.45$$

$$\text{Lower Control Limit (L.C.L.)} = D_3 \bar{R}$$

$$\text{Where } D_3 = 1 - \frac{3d_3}{d_2}$$

$$= 1 - \frac{3(0.864)}{2.326}$$

$$= 1 - \frac{2.592}{2.326}$$

$$= 1 - 1.1143$$

$$= -0.1143$$

$$\cong 0 \text{ Since negative}$$

$$\text{Therefore L.C.L.} = 0 \times 21.45 = 0$$

**Upper Control Limit (U.C.L) =  $D_4 \bar{R}$**

$$\begin{aligned}\text{Where } D_4 &= 1 + \frac{3d_3}{d_2} \\ &= 1 + \frac{3(0.864)}{2.326} \\ &= 1 + \frac{2.592}{2.326} \\ &= 1 + 1.1143 \\ &= 2.1143\end{aligned}$$

Therefore, U.C.L = 2.1143 (21.45) = 45.3517

SJC Institute

# Activity Based Cost Management



## Learning Objective

1. LIMITATIONS OF TRADITIONAL COSTING
2. ACTIVITY BASED COSTING
  - (a) Important Terms
  - (b) Different Stages
  - (c) Significance
  - (d) Advantages
  - (e) Limitations
3. TRADITIONAL VS ACTIVITY BASED COSTING
4. COST DRIVERS

SJC Institute

## 1. INTRODUCTION [MTP DEC'17]

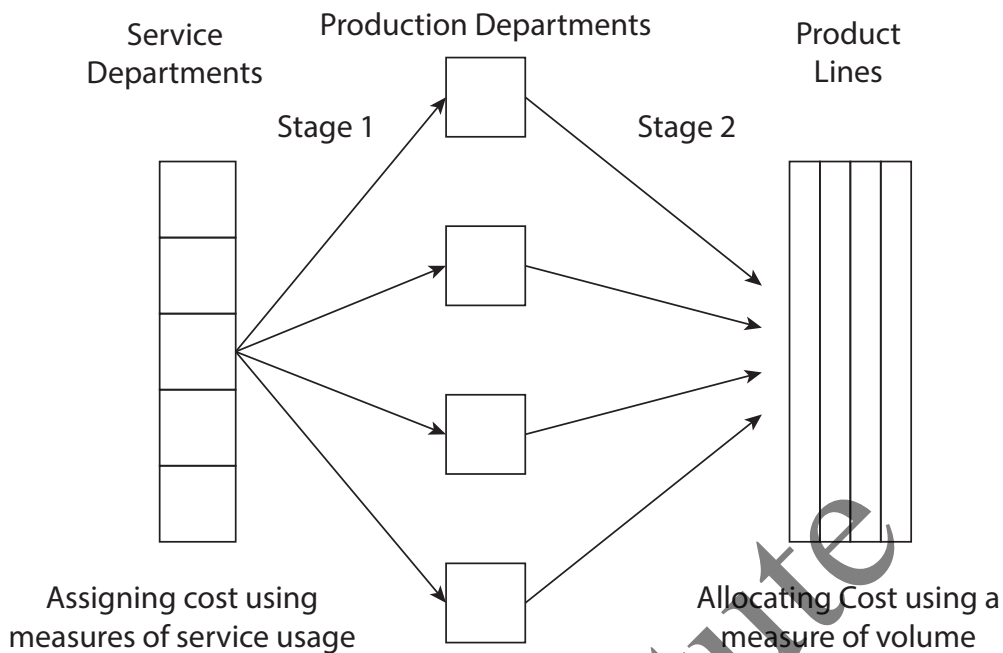
A powerful tool for measuring performance, **Activity-Based Costing (ABC)** is used to identify, describe, assign costs to, and report on agency operations. A more accurate cost management system than traditional cost accounting; ABC identifies opportunities to improve business process effectiveness and efficiency by determining the **"true"** cost of a product or service. Activity Based Costing is a method for developing cost estimates in which the project is subdivided into discrete, quantifiable activities or a work unit. **ABC systems** calculate the costs of individual activities and assign costs to cost objects such as products and services on the basis of the activities undertaken to produce each product or services. It accurately identifies sources of profit and loss.

## 2. LIMITATIONS OF TRADITIONAL COSTING SYSTEM

The cost of product arrived in traditional accounting system is not so accurate due to following reasons :

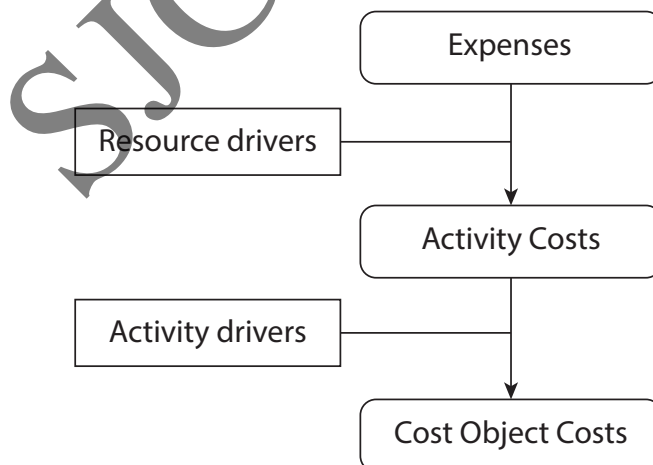
- (i) The present Costing system has developed convenient **overhead recovery basis and blanket overhead recovery** are acceptable when valuing stocks for financial reporting, but they are inappropriate when used for decision making and typical product strategy decisions. Such decisions have implications over 3-5 years and over this period many fixed costs become variable.
- (ii) The **traditional fixed verses variable cost split** is often unrealistic since, as business grows they often become more complex.
- (iii) In case of **companies manufacturing and selling multiple products** usually make decisions on pricing, product-mix, process technology etc., based on distorted cost information due to difficulties in traditional costing system in collection, classification, allocation and recovery of overheads to individual products.
- (iv) The **cost structure** is changing especially when making direct labour component to small proportion.
- (v) Traditional accounting was confined merely to furnishing information at product level. The **new manufacturing technology demands the feed back of performance** while production is still in progress rather than history.
- (v) There is also an **urgent need to integrate** the activity measurement and financial measurement.

Therefore, in order to overcome the inadequacies of traditional methods of overhead absorption and short-term biasing of marginal costing, Activity Based Costing (ABC) has been researched.



### 3. ACTIVITY-BASED COSTING

The concepts of **ABC** were developed in the manufacturing sector of the United States during the 1970s and 1980s. It is a practice in which **activities are identified and all related costs of performing them are calculated, providing actual costs chargeable**. The focus of activity based costing is activities. Thus identifying activities is a logical first step in designing an activity based costing. An activity is an event, task or unit of work with a specified purpose. For **example**; designing products, setting up machines, operating machines and distributing products.



The CIMA terminology defines ABC as a cost attribution to cost units on the basis of benefit received from indirect activities. Peter B. B. Turney defines ABC as **“a method of measuring the cost and performance of activities and cost objects. Assigns cost to activities based on their use of resources and assigns cost to cost objects based on their use of activities.**

**ABC recognizes the causal relationship of cost drivers to activities.** ABC can be defined by the following equation:

$$C/A = HD + M + E + S$$

Where C/A = Estimated cost per activity

H = Number of labour hours required to perform the activity one time

D = Wages per labour hour

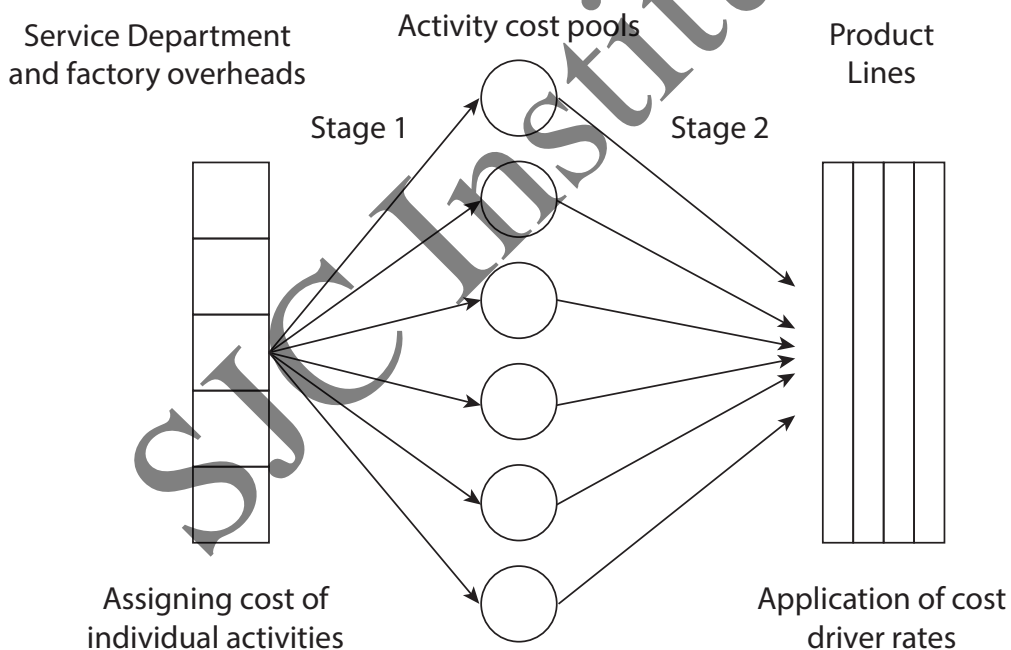
M = Material costs required to perform the activity one time

E = Equipment costs to perform the activity one time

S = Subcontracting costs to perform the activity one time

The total cost for performing the activity will be based on the number of times the activity is performed during a specific time frame. An activity based costing system first traces costs to activities and then to products and other cost objects. The following figure diagrammatically explains the basic flow of Activity-Based Costing.

### Activity-based Costing



## 4. IMPORTANT TERMS IN ACTIVITY BASED COSTING

The operation of the ABC system involves the use of the following terms:

**Activity:** An activity means an aggregate of closely related tasks having some specific functions which are used for completion of goal or objectives. For **example**, customer order processing is an activity. It includes receiving order from customers, interacting with production department regarding capacity to produce and giving commitment to the customer regarding delivery time. Other activities may be assembling, packaging, advertising etc.

**Resource :** Resources are elements that are used for performing the activities or factors helping in the activities. For **example**, order receiver, telephone, computers etc. are resources in customer order processing activity. It may include material, labour, equipment, office supplies etc.

**Cost :** Cost is amount paid for resource consumed by the activity. For example, salaries, printing stationary, telephone bill etc. are cost of customer order processing activity. It is also known as activity cost pool.

**Cost object:** It refers to an item for which cost measurement is required. e.g. a product, a service, or a customer.

**Cost pool:** A cost pool is a term used to indicate grouping of costs incurred on a particular activity which drives them.

**Cost driver:** Any element that would cause a change in the cost of activity is cost driver. Actually cost drivers are basis of charging cost of activity to cost object. Cost drivers are used to trace cost to product by using a measure of resources consumed by each activity. For example, frequency of order, number of order etc. may be cost driver of customer order processing activity. **Cost driver may be involved two parts:**

1. Resource cost driver
2. Activity cost driver

A resource cost driver is a measure of the quantity of resources consumed by an activity. An activity cost driver is a measure of the frequency and intensity of demand, placed on activities by cost objects.

#### For example

Activities	Resources	Cost pools	Cost driver
Consulting	Consultant, computer	Employee cost, maintenance cost	Level of consultant, time spent
Laser printing	Printing staff, printer	Colour cost, maintenance cost, printing stationary	No. of pages printed, font
Accounting administration	Administration staff	Salaries	No. of times account produced
Customer service	Telephone, staff	Telephone bill, salaries	Frequency of order, no. of order, time spent in servicing, no. of service calls
Research development	Staff, equipment, material	Salaries, maintenance cost, material cost	No. of research projects, time spent on a project, technical complexities of project

The cost drivers for various functions i.e., production, marketing, research, and developments are given below.

Production	Number of units Number of set-ups
Marketing	Number of sales personnel Number of sales orders
Research & development	Number of research projects Personnel hours spend on projects Technical complexities of the projects
Customer service	Number of service calls Number of products serviced Hours spend on servicing products

Let's illustrate the concept of activity based costing by looking at two common manufacturing activities: **(1) the setting up of a production machine for running batches of products, and (2) the actual production of the units of product.**

We will assume that a company has annual manufacturing overhead costs of ₹2,000,000—of which ₹200,000 is directly involved in setting up the production machines. During the year the company expects to perform 400 machine setups. Let's also assume that the batch sizes vary considerably, but the setup efforts for each machine are similar.

The cost per setup is calculated to be ₹500 (₹200,000 of cost per year divided by 400 setups per year). Under activity based costing, ₹200,000 of the overhead will be viewed as a batch-level cost. This means that ₹200,000 will first be allocated to batches of products to be manufactured (referred to as a Stage 1 allocation), and then be assigned to the units of product in each batch (referred to as Stage 2 allocation). **For example**, if Batch X consists of 5,000 units of product, the setup cost per unit is ₹0.10 (₹500 divided by 5,000 units). If Batch Y is 50,000 units, the cost per unit for setup will be ₹0.01 (₹500 divided by 50,000 units). For simplicity, let's assume that the remaining ₹1,800,000 of manufacturing overhead is caused by the production activities that correlate with the company's 100,000 machine hours.

For our simple two-activity example, let's see how the rates for allocating the manufacturing overhead would look with activity based costing and without activity based costing:

	With ABC	Without ABC
Mfg overhead costs assigned to setups	₹200,000	₹-0-
Number of setups	400	Not applicable
Mfg overhead cost per setup	₹500	₹-0-
Total manufacturing overhead costs	₹2,000,000	₹2,000,000
Less: Cost traced to machine setups	200,000	-0-
Mfg O/H costs allocated on machine hours	₹1,800,000	₹2,000,000
Machine hours (MH)	100,000	100,000
Mfg overhead costs per MH	₹18	₹20
Mfg Overhead Cost Allocations	₹500 setup cost per batch + ₹18 per MH	₹20 per MH

Next, let's see what impact these different allocation techniques and overhead rates would have on the per unit cost of a specific unit of output. Assume that a company manufactures a

batch of 5,000 units and it produces 50 units per machine hour, here is how the cost assigned to the units with activity based costing and without activity based costing compares:

	With ABC	Without ABC
Mfg overhead for setting up machine	₹500	₹-0-
No. of units in batch	5,000	Not applicable
Mfg O/ H caused by Setup – Per Unit	₹0.10	Not applicable
Mfg overhead costs per machine hour	₹18	₹20
No. of units produced per machine hour	50	50
Mfg O/ H caused by Production – Per Unit	₹0.36	₹0.40
Total Mfg O/ H Allocated – Per Unit	₹0.46	₹0.40

## 5. STAGES OF ACTIVITY BASED COSTING

The different steps or stages in ABC system can be given as follows:

### 1. Identify the chosen cost objects

The cost objects of any organization are the products or services and the goal is to first calculate the total cost of manufacturing and distributing these products and their unit cost.

### 2. Identify the different activities within the organization

After the identification of cost objects, the main activities, which are being performed in the organization, have to be identified. Usually the number of activities over cost centers in ABC will be much more as compared to traditional overhead system. The exact number will depend on how the management subdivides the organizations activities.

### 3. Identifying the direct cost of products

The direct cost of products or objects may comprise direct material cost, direct labor cost and direct expenses. Classification of as many of the total costs as direct costs as is economically feasible should be made. It reduces the amount of costs classified as indirect.

### 4. Relating the overhead to the activities

After identifying the organizations activities, the various items of overhead are related to activities both support and primary, that caused them. As a result of relating the items of overhead to various activities, cost pool or cost buckets are created.

### 5. Spreading the support activities across the primary activities

The spreading of support activities (i.e., activities which support or assist manufacturing) across the primary activities (correlated to the number of units produced) is done on some suitable base which reflects the use of support activity. The base is the cost driver and is measured of how the support activities are used.

## 6. Determining the activity cost drivers

The determination of the activity cost drivers is done in order to relate the overhead collected in cost pools to the cost objects of products. It is done on the basis of the factor that drives the consumption of the activities.

## 7. Calculating the activity cost driver rates

The activity cost rates for each activity are calculated in the way in which overhead absorption rates would be calculated under the traditional system. It can be presented as follows:

Activity cost driver rate = Total cost of activity/Activity driver

These activity cost driver rates are to be used for ascertaining the amount of overhead chargeable to various cost objects or products.

## 8. Computing the total cost of products or cost objects

The total costs of the products shall be computed by adding all direct and indirect costs assigned to them. The amount of overhead chargeable to a product or cost object shall be calculated by multiplying the activity cost drivers rates by different amounts of each activity that each product or other cost object consumes.

# 6. SIGNIFICANCE OF ACTIVITY BASED COSTING

The following list reflects the results of several surveys of practice in the United States, the United Kingdom, and

Canada to determine why companies choose ABC.

- **Cost Reduction:** ABC measures how much activities that are costly and then take steps to reduce their costs by changing the productions process or outsourcing those activities.
- **Product pricing and decisions** of whether to continue producing a product or keeping a particular customer. ABC implementers generally believe that ABC provides more accurate cost information than conventional costing does. Management can use this information to negotiate price increases with customers or to drop unprofitable products.
- **Budgeting and performance measurement:** Management can use more accurate cost information to improve budgets and measures of department and division performance.

# 7. ADVANTAGES OF ACTIVITY BASED COSTING

- (i) It provides **more accurate product costing** information by **reducing arbitrary cost allocations**.
- (ii) It **improves the quality of information** available for decision making by answering the questions such as **what activities and events are driving cost and where efforts should be made to control cost ?**
- (iii) It is **easiest way to allocate overhead** in the product.

- (iv) It **helps to identify the activities** that can be eliminated.
- (v) It links up **cause and effect relationship**.
- (vi) ABC **helps to identify the value added activities** (that increase the customer's satisfaction) and non-value added activities (that creates the problems in customer's satisfaction)
- (vii) ABC **translates cost in to a language that people** can understand and that can be linked up to business activities.

## 8. PROBLEMS OF TRADITIONAL COSTING ARISING OUT OF VOLUME

- (i) More time consuming to collect data
- (ii) Cost of buying, implementing and maintaining activity based system
- (iii) In some cases, the establishment of cause and effect relationship between cost driver and costs not be a simple affair.
- (iv) ABC does not conform to generally accepted accounting principles in some areas.

### Conclusion

Activity based costing has revolutionized product costing, planning, and forecasting in the last decade. It is based on a philosophy of estimation that "it is better to be approximately right, than precisely wrong." In summary, activity-based costing is a management decision-making tool. It provides financial support data structured in a fashion fundamentally different from accounting data provided in the general ledger. By associating cost to the activity, a clear relationship can be established between sources of activity demand and the related costs. This association can benefit the distributor in determining where costs are being incurred, what is initiating the costs and where to apply efforts to curb inflationary costs. This can be of particular value in tracking new products or customers.

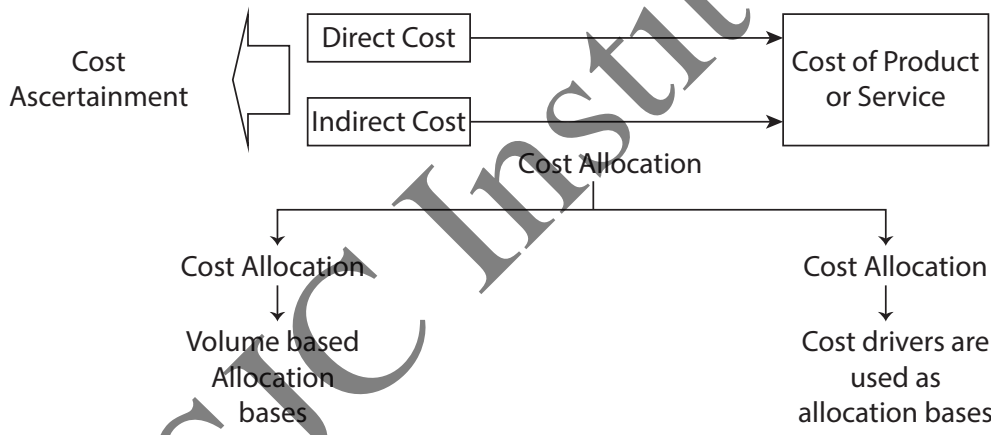
## 9. TRADITIONAL VS. ACTIVITY BASED COSTING

Activity-Based Costing (ABC) is a system that focuses on activities as the fundamental cost objects and uses the cost of these activities for computing the costs of products. **There are several reasons why managers are preferring ABC to traditional system.**

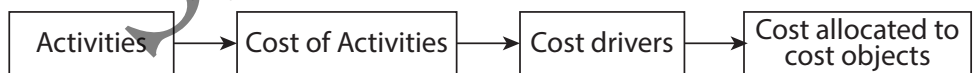
- (i) In the traditional system **cost analysis is done by product**. In ABC managers focus attention on activities rather than products because activities in various departments may be combined and costs of similar activities ascertained, **e.g. quality control, handling of materials, repairs to machines etc.** If detailed costs are kept by activities, the total company costs for each activity can be obtained, analysed, planned and controlled.
- (ii) **Managers manage activities and not products**. Changes in activities lead to changes in costs. Therefore, if the activities are managed well, costs will fall and resulting products will be more competitive.

- (iii) **Allocating overhead cost to production based on a single cost driver** ( allocation base, such as unit basis, percentage of material, percentage of prime cost, labour hour rate, machine hour rate etc.) can result in an unrealistic product cost because the traditional system fails to capture cause-and-effect relationships. To manage activities better and to make wiser economic decisions, managers need to identify the relationships of causes (activities) and effects ( costs) in a more detailed and accurate manner.
- (iv) **ABC highlights problem areas that deserve management’s attention and more detailed analysis.** Many actions are possible, on pricing, on process technology, on product design, on operational movements and on product mix.

Traditional costing can lead to undercosting or overcosting of products or services. Over or under costing of products distorts cost information. A poor quality of cost information causes management to make poor decisions for pricing, product emphasis, make or buy etc. ABC differs from the traditional system only in respect of allocations of overheads or indirect costs. **Direct costs are identified with, or assigned to, the cost object, in the same manner as is done in case of traditional costing system.** Overhead costs are linked to the cost objects based on activities. This is shown in the following figure:



The following figure explains the entire process of cost allocation under ABC.



## Q1

Dec'19

State with brief reason whether you would recommend an Activity Based Costing system in each of the following independent situations:

- A consultancy firm consisting of Lawyers, Accountants and Computer Engineers provides management consultancy services to clients.
- Company X produces one product. The overhead costs mainly consist of Depreciation.
- Company Z produces two different labour intensive products. The contribution per unit in both products is very high. The BEP is very low. All the work is carried on efficiently to meet target costs.
- Company Y produces 4 different products using different production facilities.  $1\frac{1}{2} \times 4 = 6$

<p><b>Reference</b></p> <p><b>Application of ABC System</b></p>	<p><b>What's New</b></p>
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### Answer

- ABC system **uses the cost of activities as the basis for assigning cost of services to jobs** which provides more accurate cost information for services. Hence ABC can be used for the consultancy firm.
- ABC is needed by organizations for product costing where there is a great diversity in product range. Since company X produces only one product, ABC is not necessary. Moreover overhead consists of mainly depreciation. ABC is not required.
- Company Z is highly labour intensive and does not have a great diversity of products. All work is carried out efficiently, hence ABC is not required. Moreover, Target costs are achieved, NVA activities have already been identified and eliminated.
- There is diversity in product range which use different amounts of OH resources as different production facilities are involved. ABC improves product costing by avoiding over or under costing of products. ABC system is recommended.

## Q2

**CMA Mat; MTP Jun'17; MTP Jun'19; MTP Jun'22**

The budgeted overheads and cost driver volumes of XYZ are as follows.

Cost Pool	Budgeted Overheads (₹)	Cost Driver	Budgeted Volume
Material procurement	5,80,000	No. of orders	1,100
Material handling	2,50,000	No. of movements	680
Set-up	4,15,000	No. of set ups	520

Maintenance	9,70,000	Maintenance hours	8,400
Quality control	1,76,000	No. of inspection	900
Machinery	7,20,000	No. of machine hours	24,000

The company has produced a batch of 2,600 components of AX-15, its material cost was ₹ 1,30,000 and labor cost ₹ 2,45,000. The usage activities of the said batch are as follows.

Material orders – 26, Maintenance hours – 690, Material movements – 18, Inspection – 28, Set ups – 25, Machine hours – 1,800

**Calculate** – cost driver rates that are used for tracing appropriate amount of overheads to the said batch and ascertain the cost of batch of components using activity Based Costing.

**Reference**

**Cost Driver Rates**

**What's New**

**Cost of Batch**

**Answer**

**Computation of Cost Driver Rates**

Particulars		(₹)
1.	Material procurement	5,80,000/1,100 = 527
2.	Material handling	2,50,000/680 = 368
3.	Set-up	4,15,000/520 = 798
4.	Maintenance	9,70,000/8,400 = 115
5.	Quality control	1,76,000/900 = 196
6.	Machinery	7,20,000/24,000 = 30

**Computation of Batch Cost of 2,600 units of AX-15**

		(₹)
Material cost		1,30,000
Labour Cost		2,45,000
Prime Cost		3,75,000
Add: Overheads		
Material orders (26 x 527)	13,702	
Material handling (18 x 368)	6,624	
Set-up (25 x 798)	19,950	
Maintenance (690 x 115)	79,350	
Quality Control (28 x 196)	5,488	
Machinery (1,800 x 30)	54,000	1,79,114
<b>Total Cost</b>		<b>5,54,114</b>

### Q3

## CMA Mat; MTP Dec'17

A company produces four products, viz. P, Q, R and S. The data relating to production activity are as under

Product	Quantity of production	Material cost/ unit ₹	Direct labour hours/unit	Machine hours/ unit	Direct Labour cost/ unit ₹
P	1,000	10	1	0.50	6
Q	10,000	10	1	0.50	6
R	1,200	32	4	2.00	24
S	14,000	34	3	3.00	18

Production overheads are as under:

	₹
(i) Overheads applicable to machine oriented activity:	1,49,700
(ii) Overheads relating to ordering materials	7,680
(iii) Set up costs	17,400
(iv) Administration overheads for spare parts	34,380
(v) Material handling costs	30,294

The following further information have been compiled:

Product	No. of set up	No. of materials orders	No. of times materials handled	No. of spare parts
P	3	3	6	6
Q	18	12	30	15
R	5	3	9	3
S	24	12	36	12

Required:

- Select a suitable cost driver for each item of overhead expense and calculate the cost per unit of cost driver.
- Using the concept of activity based costing, compute the factory cost per unit of each product.



Reference

**Cost Driver Rates**

What's New

**Factory Cost**

**Answer**

(i) **Computation of Cost Driver Rates**

- (1) Overheads relating to Machinery oriented activity  
 Cost Driver → Machine Hour Rate  
 $(1,000 \times 0.5) + (1,000 \times 0.5) + (1,200 \times 2) + (14,000 \times 3)$   
 $1,49,700/49,900 = ₹ 3$  per hour
- (2) Overheads relating to ordering materials  
 Cost driver → No. of Material orders  
 $7,680/30 = ₹ 256$  per order
- (3) Set up costs  
 Cost driver → No. of set ups  
 $17,400/50 = ₹ 348$  per set up
- (4) Administrative Overheads for spare parts  
 Cost driver → No. of spare parts  
 $34,380/36 = ₹ 955$  per spare part.
- (5) Material Handling costs  
 Cost driver → No. of times materials handled  
 $30,294/81 = ₹ 374$  per material handling

(ii) **Computation of factory cost for each product**

		P	Q	R	S
Materials		10.00	10.00	32.00	34.00
Labour		6.00	6.00	24.00	18.00
Overheads					
Machine oriented activity	1.500		1.50	6.00	9.00
Ordering of Materials	0.768		0.31	0.64	0.22
Set up costs	1.044		0.63	1.45	0.60
Administrative Spare Parts	5.730		1.43	2.39	0.82
Material handling	2.244	11.29	1.12	4.99	2.81
<b>Factory Cost (₹)</b>		<b>27.29</b>	<b>20.99</b>	<b>69.29</b>	<b>63.60</b>

## Q4 CMA Mat; MTP Dec'17; MTP Jun'18; MTP Jun'19

Trimake Limited makes three main products, using broadly the same production methods and equipment for each. A conventional product costing system is used at present, although an Activity Based Costing (ABC) system is being considered. Details of the three products, for typical period are:

	Labour Hours per unit	Machine Hours per unit	Material Per unit	Volumes Units
Product X	½	1 ½	₹ 20	750
Product Y	1 ½	1	12	1,250
Product Z	1	3	25	7,000

Direct labour costs ₹ 6 per hour and production overheads are absorbed on a machine hour basis. The rate for the period is ₹ 28 per machine hour.

You are **required**:

- (a) To **calculate** the cost per unit for each product using conventional methods.

Further analysis shows that the total of production overheads can be divided as follows

	%
Costs relating to set-ups	35
Costs relating to machinery	20
Costs relating to materials handling	15
Costs relating to inspection	30
Total production overhead	100%

The following activity volumes are associated with the product line for the period as a whole. Total activities for the period

	Number of Set-ups	Number of movements of materials	Number of Inspections
Product X	75	12	150
Product Y	115	21	180
Product Z	480	87	670
	670	120	1,000

You are **required**:

- (b) To **calculate** the cost per unit for each product using ABC principles; c) to comment on the reasons for any differences in the costs in your answers to ( a) and (b)

**Reference**

**Cost per unit for each Product**

**What's New**

**Conventional Method and ABC Principles**

**Answer**

(a) **Computation of cost per unit using Conventional Methods: Total overheads**

	₹
X = 750 x 1.5 x 28 =	31,500
Y = 1,250 x 1 x 28 =	35,000
Z = 7,000 x 3 x 28 =	5,88,000
	6,54,500

**Computation of Cost**

	X	Y	Z
	₹	₹	₹
Materials	20	12	25
Labour	3	9	6
Overheads	42	28	84
Factory Cost	65	49	115

(b) **Under ABC Costing**

	Setup Cost	Machine Cost	Material Handling Cost	Inspection Expenses	Total
Costs	₹ 2,29,075	1,30,900	98,175	1,96,350	6,54,500
Cost Driver	No. of setups	Machine hours	No. of Moment of Materials	No. of Inspections	
Cost driver rates	₹ 341.90 (2,29,075/670)	5.6 (1,30,900/23,375)	818.125 (98,175/120)	196.35 (1,96,350/1,000)	

**Cost per unit under ABC costing**

	X		Y		Z	
	₹	₹	₹	₹	₹	₹
Materials		20.00		12.00		25.00
Labour		3.00		9.00		6.00
Overheads						
Setup Cost	34.19		31.45		23.44	
Machine cost	8.40		5.60		16.80	
Machine Handling Cost	13.09		13.74		10.17	
Inspection Cost	39.27	94.95	28.27	79.06	18.79	69.20
Total Cost		117.95		100.06		100.20

**Note:** Computation of Machine Hours = (750 × 1.5) + (1,250 × 1) + (7,000 × 3) = 23,375.

## Q5

Dec'18

You are given the following data for a period in respect of two products, X and Y, which consume support services in different proportions :

	Product X	Product Y
Unit produced	40	40
Material moves per product unit	12	28
Direct labour hrs. per unit	1,740	1,740

Budgeted material handling costs : ₹ 3,48,000

### Required :

- Determine cost per unit of X and Y using the volume-based allocation method (direct labour hrs.)
- Compute cost per unit of X and Y using ABC.
- How would you explain the results ? [1 + 3 + 4 = 8]

Reference

**Cost per unit for each Product**

What's New

**Volume Based Allocation Method and ABC, Assumed that moves per product unit implies for entire production.**

### Answer

$$\begin{aligned}
 \text{(i) Direct labour hour rate} &= \frac{\text{Budgeted overheads}}{\text{Budgeted direct labour hours}} \\
 &= \frac{\text{₹ 3,48,000}}{(40 \times 1,740 + 40 \times 1,740)} = \frac{\text{₹ 3,48,000}}{1,39,200} = \text{₹ 2.5}
 \end{aligned}$$

	Product X	Product Y
Total direct labour hours taken	69,600	69,600
Labour rate	₹ 2.5	₹ 2.5
Material handling cost absorbed (hrs x Rate)	1,74,000	1,74,000
Units produced	40	40
Material handling cost per unit	4,350	4,350

- Since number of material moves causes material handling costs, use of this cost driven gives a better result :

$$\text{Rate per material move} = \frac{\text{₹ 3,48,000}}{12 + 28}$$

	Product X	Product Y
Total Material moves	12	28
Material handling costs applied @ ₹ 8,700/-	₹ 1,04,400	2,43,600
Units produced	40	40
Material handling cost per unit	₹ 2,610	6,090

- (iii) Product Y requires more material moves and hence shares nationally more material handling costs under (ii) above. In other words, the complexity or diversity of Product Y is taken care of when overhead costs are allocated to this product using appropriate cost driven under ABC.

**Q) 6**

MTP Dec'18

You are given, in respect of a manufacturing company, the following activity centres and their costs for a period:

	₹
1. Material handling	8,000
2. Machining	5,000
3. Assembly	4,800
4. Inspection	1,400

The other particulars are:

	₹
Number of materials parts	80,000
Machine hours	150
Numbers of assembly parts	8,000
Number of finished units	1,000

- (i) **Calculate** overhead allocation rates using ABC.
- (ii) **What** will be the cost of a product which uses the following?
- 8 units of materials
  - One-fourth of the machine hour
  - 8 assembly parts (₹100)
  - Power etc. (₹10)
- Given direct material cost for one unit ₹200.

[4 + 4 = 8]

Reference

Overhead allocation rates

What's New

Using ABC, Assumed that assembly part cost is included in D/M cost

### Answer

(i) Allocation rates:

	Per unit of application base (₹)
Material handling (₹ 8,000 ÷ 80,000)	0.10
Machining (₹ 5,000 ÷ 150)	33.33
Assembly (₹ 4,800 ÷ 8,000)	0.60
Inspection (₹ 1,400 ÷ 1,000)	1.40

(ii) Cost Statement:

	Per unit (₹)
Direct Material	200
Power etc.	10
Variable Costs	210
Other Costs:	
Material handling (8 parts × 0.10)	0.80
Machining (1/4 × ₹ 33.33)	8.33
Assembly (8 parts × 0.60)	4.80
Inspection (1 unit × 1.40)	1.40
Total	₹ 225.33

### Q7

### CMA Mat

Precision Auto comp Ltd. Manufactures and sells two automobile components A and B. Both are identical with slight variation in design. Although the market for both the products is the same, the market share of the company for product A is very high and that of product B very low. The company's accountant has prepared the following profitability statement for the two products Cost of production: (same for both the products)

Direct Material	₹ 125
Dirbect Labour	₹ 24
Direct Expenses (sub-contract charges)	₹ 36
Overheads (400% of direct labour)	₹ 96
Total Cost	₹ 281

		Product A	Product B	Total
Quantity sold	No.	1,24,000	23,150	1,47,150
Unit sale price	₹	300	290	
Total sales realisation	₹			4,39,13,500
Cost of sales as above	₹			4,13,49,150
Margin	₹			25,64,350

The company's marketing manager, after attending a workshop on activity-based costing challenges the accountant's figures. The nearest competitor's prices for the two products are ₹ 330 and ₹ 275 per unit respectively and, if the company can match the competitor's prices, it can sell 75,000 nos. each of the two products. The Production Manager confirms that he can produce this product mix with the existing facilities. The management engages you as consultant, and the following facts have been identified by you:

- (a) Product A undergoes 5 operations and product B undergoes two operations by sub-contractors, although the total subcontract charges are the same for both the products, and
- (b) 75% of the overheads is accounted for by three major heads relating to sub-contracting operations, viz., ordering, inspection and movement of components, to and from the sub-contractor's works.

**Prepare** a Revised Profitability Statement to find out if the marketing manager's proposal is viable.

<p><b>Reference</b></p> <p><b>Revised Profitability Statement</b></p>	<p><b>What's New</b></p> <p><b>Assumed that remaining OH is equal</b></p>
---	---

**Answer**

Total overheads = 1,47,150 x 96 = ₹ 1,41,26,400

Operations overhead = 1,41,26,400 x 75/100 = ₹ 1,05,94,800

Balance 25% assumed to be fixed i.e. ₹ 35,31,600

Allocation of Variable Overheads under ABC

A	= 1,05,94,800 x 5/7	= ₹ 75,67,714
B	= 1,05,94,800 x 2/7	= ₹ 30,27,086

**Statement showing computation profit under Activity Based Costing as per Manager's suggestion:**

		A		B		Total
No. of units		Units	75,000	Units	75,000	
Materials	₹	125	93,75,000	125	93,75,000	1,87,50,000

Labour	₹	24	18,00,000	24	18,00,000	36,00,000
Direct expenses	₹	36	27,00,000	36	27,00,000	54,00,000
<b>Prime Cost</b>	₹	185	1,38,75,000	185	1,38,75,000	2,77,50,000
Variable Overheads	₹	101	75,67,714	40	30,27,086	1,05,94,800
Fixed Overheads	₹	24	17,65,800	24	17,65,800	35,31,600
<b>Total Cost</b>	₹	310	2,32,08,514	249	1,86,67,886	4,18,76,400
Profit	₹	20	15,41,486	26	19,57,114	34,98,600
<b>Sales</b>	₹	330	2,47,50,000	275	2,06,25,000	4,53,75,000

As the profit is more at the Marketing Manager's proposal by ₹ 9,34,250 and hence this proposal may be accepted.

### Q 8

Jun'19

Vikas Associates a firm of Chartered Accountants offers three different types of services, namely, accounting and auditing, taxation and management consultancy. Each service is charged on the basis of number of billable hours. The average charge per billable hours is ₹500. For the year ending 31.03.2019 the firm projects the following estimate of direct and indirect costs:

		₹ (Lakhs)	
<b>Direct Costs:</b>	Accounting and Auditing	100.00	
	Taxation	100.00	
	Management consultancy	50.00	250.00
<b>Indirect Costs:</b>	Planning and review	7.50	
	Computer processing	7.20	
	Professional salaries	5.60	
	Books, Seminars, periodicals	1.80	
	Programming costs	8.00	
	Building costs	4.90	
	General administration costs	15.00	50.00
<b>TOTAL</b>			<b>300.00</b>

Until 31.03.2018 the firm has been allocating the indirect costs on the basis of billable hours. For the year ending 31.03.2019 it was decided to introduce a system of activity based costing to capture the indirect cost more accurately. The following data were gathered accordingly:

Particulars	Accounting and Auditing	Taxation	Management Consultancy
Billable hours	55,000	35,000	10,000
EDP hours	5,000	2,500	500
Professionals (No)	30	16	10
Books, Seminars and periodicals (₹)	57,500	62,500	60,000

Programming hours	1,250	500	2,250
Building (Sqft) space occupied	8,000	4,000	2,000
Administration (No. of clients)	150	250	100

**Required:**

- (i) **Prepare** a comparative profitability statement on the basis of (A) conventional costing and (B) activity- based costing (ABC)
- (ii) Any suggestion for improving the billable charge on the basis of ABC? [4 + 4 = 8]

<p><b>Reference</b></p> <p><b>Comparative Profitability Statement</b></p>	<p><b>What's New</b></p> <p><b>Conventional Costing and ABC</b></p>
---	---

**Answer**

**SCHEDULE OF ALLOCATION OF INDIRECT COST BY ABC**

₹ In lakhs

Overhead	Cost Driver	Accounting & Auditing	Taxation	Management consulting	
	Ratio	Total			
		₹	₹	₹	
Planning and Review	Billable Hrs	7.500	4.125	2.625	0.750
Computer Processing	EDP Hour	7.200	4.500	2.250	0.450
Professional Salaries	30:16:10	5.600	3.000	1.600	1.000
Books, Seminar, Periodicals	Actual	1.800	0.575	0.625	0.600
Programming Costs	5:2:9	8.000	2.500	1.000	4.500
Building Costs	Sq Ft	4.900	2.800	1.400	0.700
Administration Cost	3:5:2	15.000	4.500	7.500	3.000
<b>Total</b>		<b>50</b>	<b>22</b>	<b>17</b>	<b>11</b>

**COMPARATIVE PROFITABILITY STATEMENT**

(₹ in Lakhs)

	Conventional			ABC		
	A&A	Tax	MGMT	A&A	Tax	MGMT
Revenue	275.00	175.00	50.00	275.00	175.00	50.00
Direct Costs	100.00	100.00	50.00	100.00	100.00	50.00
Overhead Cost	27.50	17.50	5.00	22.00	17.00	11.00
<b>Profit</b>	<b>147.50</b>	<b>57.50</b>	<b>-5.00</b>	<b>153.00</b>	<b>58.00</b>	<b>-11.00</b>

**Suggestions:**

On the basis of the ABC system the total cost of each division/service is ₹122 Lakhs, ₹ 117 Lakhs and ₹61 Lakhs respectively. Hence the billable charge should be revised accordingly. Assuming the same margin i.e. 40% of revenue overall or 662/3 % on cost the revenue works out to

	A&A	Tax	Mgmt
Cost	122.00	117.00	61.00
Margin	81.33	78.00	40.67
	203.33	195.00	101.67
Billable Hours	55,000	35,000	10,000
Charge per Hour	370	560	1,017

The analysis clearly reveals that Management consultancy services are under charged

**Q9****RTP Jun'18; RTP Dec'18**

ABG & Co. provides you with following data:

Total overhead	₹ 30,10,500
Total Machine hrs.	2,23,000
<b>Production :</b>	
Product L	10,000 units
Product M	3,000 units
Product N	2,10,000 units

	Direct cost per unit (₹)	Selling price per unit (₹)
Product L	20	₹50
Product M	20	45
Product N	9	45

Mr Krishnan is the Cost Accountant of this firm and he says that profit of this company is ₹38,74,500. The overhead has been distributed at the rate of ₹ 13.50 per machine hour and each unit produced in the company is presumed to have used one machine hour. Mr Krishnan has reported that all the units are profit-making.

Mr. Srinivasan is Director Finance of ABG & Co. He is a dynamic personality and is eager to find out ways to improve profit. He wants to implement Activity based Costing. With this objective in mind he has given a project to Mr Gupta to introduce ABC system. Mr. Gupta has held numerous interviews and surveys. He has gathered the following information:

(i) The overhead is caused by following activities.

(a) <b>Set-up</b>	1,37,600 set-ups to be charged at the rate of ₹10 per set -up.	₹13,76,000
(b) <b>Machining</b>	51,800 machine hours to be charged @ ₹15 per machine hours	₹7,77,000
(c) <b>Engineering</b>	24,750 engineering hrs. to be charged@ ₹20 per hour	₹4,95,000
(d) <b>Organisation costs cannot be linked with products</b>		₹3,62,500
		₹30,10,500

(ii) Based on the basis of factory records Mr. Gupta has established that activities have been assigned to different products as follows:

	<b>Set-up (hrs.)</b>	<b>Machining (hrs.)</b>	<b>Engineering (hrs.)</b>
<b>Product L</b>	8,000	6,000	
<b>Product M</b>	3,600	3,800	2,250
<b>Product N</b>	1,26,000	42,000	21,000
	1,37,600	51,800	24,750

Mr Gupta has recently left the organisation and Mr Srinivasan, who was keeping an overall watch over the project is very hopeful of the validity of the data. He expects you to answer following questions:

- (i) **What** are the profits made by different products, when conventional costing method of overhead distribution is used and overall profit is ₹ 38,74,500 ?
- (ii) (a) **What** will be the profit of different products, if ABC costing is used presuming that work done by Mr Gupta is quite reliable ?
- (b) **Can** we discontinue any product, if discontinuing a loss-making product does not harm the organisation otherwise? **What** will be increase in profit, if loss-making product is discontinued ?
- (c) Reasons for difference in results shown by conventional costing and Activity - based Costing System.

<p><b>Reference</b></p> <p><b>Profit made by Different Products</b></p>	<p><b>What's New</b></p> <p><b>Discontinuation of product</b></p>
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### Answer

- (i) **Product-wise profit position using Conventional Costing (i.e., overhead rate per machine hour)**

	Product L (10,000 units)		Product M (3,000 units)		Product N (2,10,000 units)		Total
	Per Unit	Total	Per Unit	Total	Per Unit	Total	
Product Revenue	50.00	5,00,000	45.00	1,35,000	40.00	84,00,000	90,35,000
Product Costs:							
Direct	20.00	2,00,000	20.00	60,000	9.00	18,90,000	
Overhead @ ₹13.50 per unit	13.50	1,35,000	13.50	40,500	13.50	28,35,000	51,60,500
Total	33.50	3,35,000	33.50	1,00,500	22.50	47,25,000	
		1,65,000		34,500		36,75,000	38,74,500

- (ii) (a) **Product-wise profit position using Activity -based Costing System**

	Product L (10,000 units)		Product M (3,000 units)		Product N (2,10,000 units)		Total
	Per unit	Total	Per unit	Total	Per unit	Total	
Product Revenue	50	5,00,000	45	1,35,000	40	84,00,000	90,35,000
Product Cost : Direct	20	2,00,000	20	60,000	9	18,90,000	
Overhead charge for different activities							
Set-up (Refer to note)	8	80,000	12	36,000	6	12,60,000	
Machining (Refer to note 2)	9	90,000	19	57,000	3	6,30,000	
Engineering : (Refer to note 3)	3	30,000	15	45,000	2	4,20,000	
Total	40	4,00,000	66	1,98,000	20	42,00,000	47,98,000
Product line income / loss		1,00,000		(63,000)			42,37,000
Organisational Costs							3,62,500
							38,74,500

- (b) From the table given above it is apparent that product M can be discontinued, because it is a loss-making product. The suggestion is based on the presumption that there will not be adverse consequences of this decision otherwise. The total profit will increase by ₹60,000, if product M is discontinued.

(c) **Reasons for difference**

The overhead distribution was not based on activity consumption in conventional costing. Due to this reason, product N's position was poorly shown. Product M was shown as making profit whereas it is making loss of ₹60,000. Even position of product L was not properly shown. It is making a profit of ₹1,00,000, whereas in conventional costing, it was shown making a profit of ₹1,65,000. Illogical overhead distribution was the main reason for distorted results.

**Working Notes**

1. <b>Set-Up</b>	Product L	8,000 x ₹10	₹ 80,000
	Product M	3,600 x 10	36,000
	Product N	1,26,000 x 10	12,60,000
			13,76,000
2. <b>Machining</b>	Product L	6,000 x ₹15	₹90,000
	Product M	3,800 x 15	57,000
	Product N	42,000 x 15	6,30,000
			7,77,000
3. <b>Engineering</b>	Product L	1,500 x ₹20	₹30,000
	Product M	2,250 x 20	45,000
	Product N	21,000 x 20	4,20,000
			4,95,000



## Learning Objective

### THEORY

1. FEATURES OF TARGET COSTING
2. STEPS IN TARGET COSTING
3. ADVANTAGES OF TARGET COSTING
4. THE ROLE OF COST AND MANAGEMENT ACCOUNTANT IN TARGET COSTING
5. CONTROL PROCESS CONSIDERED IN TARGET COSTING

### PRACTICAL

1. TARGET COST

SJC Institute

## 1. TARGET COSTING [DEC'19; MTP JUN'19; JUN'19]

**Target Costing:** This technique has been developed in Japan. It aims at profit planning. It is a device to continuously control costs and manage profit over a product's life cycle. In short, it is a part of a comprehensive strategic profit management system. For a decision to enter a market prices of the competitors' products are given due consideration. Target Costing initiates cost management at the earliest stages of product development and applies it throughout the product life cycle by actively involving the entire value chain. In the product concept stage selling price and required profit are set after consideration of the medium term profit plans, which links the operational strategy to the long term strategic plans.

**Target Cost = Planned Selling Price – Required Profit.**

From this, the necessary target cost can be arrived at. Target cost, then, becomes the residual or allowable sum. If it is thought that the product cannot generate the required profit, it will not be produced as such and aspects of the product would be redesigned until the target is met. Value engineering and value analysis may be used to identify innovative and cost effective product features in the planning and concept stages. Throughout the product's life target costing continues to be used to control costs. After the initial start up stage target costs will be set through short-period budget. Thus all costs including both variable and fixed overheads are expected to reduce on a regular (monthly) basis. Target profit is a commitment agreed by all the people in a firm, who have any part to play in achieving it.

### Determination of Target Cost

The market requirement is identified regarding design, utility, need for the product. Target selling price is determined based on customer expectation and sales forecast. Target production volume is set based on price volume relationship. Target profit margin is established based on the company's long term profit objectives, projected volumes, course of action, et c.

The target cost or allowable cost is determined as the target selling price minus the target profit margin.

## 2. FEATURES OF TARGET COSTING [DEC'18; MTP DEC'19]

Target Costing is defined as **“a structured approach in determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price.”** The main **features** or practices followed in Target Costing are :

<b>Step 1</b>	Identify the market requirements as regards design, utility and need for a new product or improvements of existing product.
<b>Step 2</b>	Set Target Selling Price based on customer expectations and sales forecasts.
<b>Step 3</b>	Set Target Production Volumes based on relationships between price and volume.
<b>Step 4</b>	Establish Target Profit Margin for each product, based on the company's long term profit objectives, projected volumes, and course of action, etc.

<b>Step 5</b>	Set Target Cost ( or Allowable cost) per unit, for each product. <b>Target cost = Target selling price less Target profit margin</b>
<b>Step 6</b>	Determine Current Cost of producing the new product, based on available resources and conditions.
<b>Step 7</b>	Set cost reduction Target in order to reduce the Current Cost to the Target Cost.
<b>Step 8</b>	Analyze the Cost Reduction Target into various components and identify cost reduction opportunities using Value Engineering (VE) and Value Analysis (VA) and Activity Based Costing (ABC)
<b>Step 9</b>	Achieve cost reduction and Target profit by Effective Implementation of Cost Reduction decisions
<b>Step 10</b>	Focus on further possibilities of cost reduction ie Continuous Improvement program.

### 3. STEPS IN TARGET COSTING

Target Costing is viewed as integral part of the design and introduction of new products. It is part of an overall Profit Management Process, rather than simply a tool for Cost Reduction and Cost Management.

#### **Step 1: Customer product Design Specification:**

- The customer requirements as to the functionality and quality of the product is of prime importance
- The design specification of the new product is based on customer's tastes, expectations and requirements.
- Competitor's products and the need to have extra features over competitor's products are also considered. However the need to provide improved products, without significant increase in prices, should be recognized as charging a higher price may not be possible in competitive conditions.

#### **Step 2 & Step 3: Market - Target Selling Price and Production Volume:**

- The Target Selling Price is determined using various sales forecasting techniques.
- The price is also influenced by the offers of competitors, product utility, prices, volumes and margins.
- In view of competition and elasticity of demand, the Firm has to forecast the price volume relationship with reasonable certainty. Hence the Target Selling Price is market driven and should encompass a realistic reflection of the competitive environment.
- Establishment of Target Production Volumes is closely related to Target Selling price, given the relationship between price and volume.
- Target Volumes are also significant in computation of unit costs particularly Capacity Related Costs and Fixed Costs. Product Costs are dependent upon the production levels over the life cycle of the product.

**Step 4: Profitability - Target Profit Margin:**

- (a) Since profitability is Critical for survival, a Target Profit Margin is established for all new products.
- (b) The Target Profit Margin is derived from the company's long term business plan, objectives and strategies.
- (c) Each product or product line is required to earn atleast the Target Profit Margin.

**Step 5: Setting Target Costs:**

- (a) The difference between the Target Selling Price and Target Profit Margin indicates the **"Allowable Cost"** for the product.
- (b) Ideally, the Allowable Cost becomes the **"Target Cost for the product"**. However, the Target Cost may exceed the Allowable Cost, in light of the realities associated with existing capacities and capabilities.

**Step 6: Computing Current Costs:**

- (a) The **"Current Costs"** for producing the new product should be estimated.
- (b) The estimation of Current Cost is based on existing technologies and components, taking into account the functionalities and quality requirements of the new product.
- (c) Direct Costs are determined by reference to design specifications, materials prices, labour processing time and wage rates. Indirect Costs may be estimated using Activity Based Costing Principles.

**Step 7: Setting Cost Reduction Targets:**

- (a) The difference between Current Cost and Target Cost indicates the required cost reduction.
- (b) This amount may be divided into two constituents namely -
  - (i) Target Cost - Reduction Objective and
  - (ii) Strategic Cost - Reduction Challenge.
- (c) The former is viewed as being achievable (yet still a very challenging target) while the latter acknowledges current inherent limitations.
- (d) After analyzing the **Cost Reduction Objective**, a Product-Level Target Cost is set which is the difference between the current cost and the target cost-reduction objective.

**Step 8: Identifying Cost Reduction Opportunities:**

- (a) After the Product-Level Target Cost is set, a series of analytical activities, commence to translate the cost challenge into reality.
- (b) These activities continue from the design stage until the point when the new product goes into production.
- (c) The total target is broken down into its various components, each component is studied and opportunities for cost reductions are identified.

- (d) These activities are referred to as
  - (i) Value Engineering (VE) and
  - (ii) Value Analysis (VA).

#### 4. ADVANTAGES OF TARGET COSTING [RTP JUN'18; MTP JUN'22; DEC'21]

- (a) **Innovation:** It reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved.
- (b) **Competitive Advantage:** It enables a Firm to achieve competitive advantage over other Firms in the industry. The firm which achieves cost reduction targets realistically stands to gain in the long run.
- (c) **Market Driven Management:** It helps to create a Company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.
- (d) **Real Cost Reduction:** It uses management control systems to support and reinforce manufacturing strategies, and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost.

#### 5. THE ROLE OF COST & MANAGEMENT ACCOUNTANT IN TARGET COSTING

##### Cost Accountant's Role in a Target Costing Environment

- (i) The cost accountant should be able to provide for the other members of the design team a running series of cost estimates based on initial design sketches and activity-based costing reviews.
- (ii) The cost accountant helps the project team in capital budgeting decisions.
- (iii) The cost accountant works with the design team to help it understand cost-benefit-tradeoffs of using different design or cost options in the new product.
- (iv) The cost accountant continues to compare a product's actual cost to the target cost even after the design is completed.

#### 6. CONTROL PROCESS CONSIDERED IN TARGET COSTING

**Following three important control points should take care properly in all target costing projects:**

- (i) **Identification** of principal control point over the course of target costing programme.

- (ii) **Point of go/no go decision:** If target costing is not reached, management retains power to abandon the design project. There comes a point, when actual performance is very close to expected performance in matter of cost recurrence.
- (iii) **Milestone** can be in terms of timer (say one month) and/or points (say in design process) at which specific activities are completed.

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## CMA Mat; Jun'17

B manufacturing company sells its product at ₹ 1,000 per unit. Due to competition, its competitors are likely to reduce price by 15%. B wants to respond aggressively by cutting price by 20% and expects that the present volume of 1,50,000 units p.a. will increase to 2,00,000. B wants to earn a 10% target profit on sales.

Particulars	Existing (₹)	Target (₹)
Direct material cost per unit	400	385
Direct manufacturing labour per unit	55	50
Direct machinery costs per unit	70	60
Direct manufacturing costs per unit	525	495
Manufacturing overheads :		
No. of orders (₹ 80 per order)	22,500	21,250
Testing hours (₹ 2 per hour)	4,500,000	30,00,000
Units reworked (₹ 100 per unit)	12,000	13,000

Manufacturing overheads are allocated using relevant cost drivers. Other operating costs per unit for the expected volume are estimated as follows:

	Amount (₹)
Research and Design	50
Marketing and customer service	130
	180

**Required:**

- Calculate** target costs per unit and target costs for the proposed volume showing break up of different elements.
- Prepare** target product profitability statement.

**Reference**  
**Target cost**

**What's New**  
**Target product profitability statement**

**Answer**

(i)

	Amount (₹)
Target selling price : ₹ 1,000 less 20%	800
Less: Target profit margin (10%)	80
Target costs per unit	720

The break-up of ₹ 720 per unit is as follows:

**Target Costs per unit**

Particulars	Per unit (₹)	
Direct materials		385
Direct manufacturing labour		50
Direct machining costs		60
Direct manufacturing costs		495
Add: Manufacturing overheads:		
Ordering and receiving	8.50	
(21,250 x ₹ 80) ÷ 2,00,000		
Testing and inspection	30.00	
(30,00,000 x ₹ 2) ÷ 2,00,000		
Rework	6.50	
(13,000 x ₹ 100) ÷ 2,00,000		45
Total manufacturing costs		540
Other operating costs:		
Research and Design	50	
Marketing and Customer service	130	180
Full Product Costs		720

(ii) **Target Product Profitability**

Particulars	Per unit (₹)	2,00,000 units (₹)
1. Sales	800	16,00,00,000
2. Costs of goods sold:		
Direct materials	385	7,70,00,000
Direct labour	50	1,00,00,000
Direct machining costs	60	1,20,00,000
	495	9,90,00,000
Manufacturing overheads	45	90,00,000
	540	10,80,00,000

3. Gross margin (1-2)	260	5,20,00,000
4. Operating costs:		
Research and Design	50	1,00,00,000
Marketing and customer service	130	2,60,00,000
	180	3,60,00,000
5. Operating profit (3-4)	80	1,60,00,000

**Q2**

**CMA Mat; MTP Jun'17; MTP Dec'17; MTP Jun'18;  
MTP Dec'18; MTP Jun'19; MTP Jun'22**

Desktop Co. manufactures and sells 7,500 units of a product. The full Cost per unit is ₹ 100. The Company has fixed its price so as to earn a 20% return on an Investment of ₹ 9,00,000.

**Required:**

- Calculate** the Selling Price per unit from the above. Also, calculate the mark-up % on the Full Cost per unit.
- If the Selling Price as calculated above represents a mark-up% of 40% on Variable Cost per unit. **calculate** the Variable Cost per unit.
- Calculate** the Company's Income if it had changed the Selling Price to ₹ 115. At this price, the Company would have sold 6,750 units. **Advise** whether this price reduction is advisable
- In response to competitive pressures, the Company must reduce the price to ₹ 105 next year, in order to achieve sales of 7,500 units. The company also plans to reduce its investment to ₹ 8,25,000. If a 20% return on Investment should be maintained, **what** is the Target Cost per unit for the next year?



Reference

**Target Cost**

What's **New**

**SP, Markup, VC/unit, Target income**

**Answer**

- Computation of Selling Price and mark - up % on the Full Cost per unit**

Target Sale Price per unit = Full Cost + Target Profit = ₹ 100 + 24	₹ 124
So, Mark - up price is	24%

- Computation of Variable Cost per unit:**

Above sale Price ₹ 124 = VC + 40% thereon, i.e. 140% on VC. So, Var. Cost =  $\frac{₹ 124}{140\%} = ₹ 89$

(iii) Calculate the company's Income if selling price are increased

Present Contribution at 7,500 units = (₹ 124 – ₹ 89) × 7,500 units =	₹ 2,62,500
Revised Contribution at 6,750 units = (₹ 115 – ₹ 89) × 6,750 units =	₹ 1,75,500
	₹ 87,000

Hence, Increase in Sale Price is not beneficial. Due to reduction in Contribution by ₹ 87,000

(iv) Calculate the company's Target Profit if selling price are reduced and Target cost if investment is ₹ 8,25,000

$$\text{Target Profit for next year} = \frac{\text{₹ } 8,25,000 \times 20\%}{7,500 \text{ units}} = \text{₹ } 24$$

$$\text{Target cost} = 105 - 24 = \text{₹ } 83/\text{unit}$$

**Q)3**

**CMA Mat**

ABC Enterprises has prepared a draft budget for the next year follows:

Quantity	10,000 units (₹)
Sales price per unit	30
Variable costs per unit:	
Direct Materials	8
Direct Labour	6
Variable overhead (2 hrs × 0.50)	1
Contribution per unit	15
Budgeted Contribution	1,50,000
Budgeted Fixed costs	1,40,000
Budgeted Profit	10,000

The Board of Directors is dissatisfied with this budget, and asks working party to com up with alternate budget with higher target profit figures.

The working party reports back with he following suggestions that will lead to budgeted profit of ₹ 25,000. The company should spend ₹ 28,500 on advertising, & set the target sales price up to ₹ 32 per unit. It is expected that the sales volume will also rise, inspite of the price rise, to 12,000 units.

In order to achieve the extra production capacity, however, the workforce must be able to reduce the time taken to make each unit of the product. It is proposed to offer a pay and productivity deal in which the wage rate per hour in increased to ₹ 4. The hourly rate for variable overhead will be unaffected.

**Ascertain** the target labour time required to achieve the target profit.

Reference

Target Labour time

What's New

Back calculation

### Answer

	₹	₹
Target profit	25,000	
Add: Fixed cost	1,40,000	
Add: Additional Advertisement	28,500	
Total contribution	1,93,500	
Sales volume	12,000	
Contribution per unit (₹ 1,93,500/12,000)	16.125	
Target Selling price per unit		32.000
Less: Contribution per unit		16.125
Target variable cost p.u.		15.875
Less: Material cost p.u.		8.000
Labour + Variable overhead p.u.		7.875
(1) Let revised labour time be x Labour cost per hour	= hour x ₹ 4 per hour = ₹ 4x	
Variable overhead per hour	= hour ₹ 0.5 per hour = ₹ 0.5x	
Total labour & variable overhead per hour = 4.5x		
Time required per unit = 7.875 = 4.5x or, x = 1.75 hrs.		
(2) Time required to achieve the target profit		
1.75 hours per unit		
So, for 12,000 units	= 12,000 × 1.75 hour	
	= 21,000 hours	

### Q4

### CMA Mat

You the manager of a paper mill (M Ltd) and have recently come across a particular type of paper, which is being sold at substantially lower rate (by another company -ABC Ltd) than the price charged by your own mill. The value chain for one of tonne of such paper for ABC Ltd is follows,

ABC Ltd. → Merchant → Printer → Customer

ABC Ltd sells this particular paper to the merchant at the rate of ₹ 1,466 per tonne ABC Ltd pays for the freight which amounts to ₹ 30 per tonne

Average returns and allowances amount to 4% of sales and approximately equal ₹ 60 per tonne.

The value chain of your company, through which the paper reaches the ultimate customer is similar to the of ABC Ltd. However, your mill does not sell directly to the merchant, the latter receiving the paper from a huge distribution center maintained by your company at Haryana. Shipment costs from the mill to the Distribution Center amount to ₹ 11 per tonne while the operating costs in the Distribution Center have been estimated to be ₹ 25 per tonne. The return on investments required by the Distribution Center for the investments made amount to an estimated ₹ 58 per tonne.

You are required to **compute** the “Mill manufacturing Target Cost” for this particular paper for your company. You may assume that the return on the investment expected by your company equals ₹ 120 per tonne of such paper.

<ul style="list-style-type: none"> <li>Reference</li> <li><b>Target Cost</b></li> </ul>	<p>What's New</p> <p><b>Target Price at Mill</b></p>
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**Answer**

**Computation of Target Cost**

	Per tonne (in ₹)	
ABC Ltd selling price to the merchant		1,466
Less: freight paid by ABC Ltd	30	
Less normal sales returns and allowances	60	
Capital charge of M Ltd	120	210
Target cost		1256
Less: Shipment cost Distribution Centre	11	
Operating cost in the Distribution Centre	25	36
Distribution centre capital charge		1220
Less: Target manufacturing cost of the Mill		58
		1162

# Life Cycle Costing



## Learning Objective

### THEORY

1. PRODUCT LIFE CYCLE
2. LIFE CYCLE CHARACTERISTICS
3. BENEFITS OF PRODUCT LIFE CYCLE COSTING
4. USE OR IMPORTANCE OF THE PRODUCT LIFE CYCLE

### PRACTICAL

1. PRODUCT LIFE CYCLE INCOME STATEMENT
2. EQUIVALENT ANNUAL COST
3. LIFE CYCLE COST

SJC Institute

# Life Cycle Costing

## 1. MEANING OF LIFE CYCLE COSTING [MTP DEC'17; MTP JUN'19; JUN'19]

- (a) **Life Cycle Costing**; aims at cost ascertainment of a product, project etc. over its projected life.
- (b) It is a system that tracks and accumulates the actual costs and revenues attributable to cost object (i.e.; product) from its inception to its abandonment.
- (c) Sometimes the terms; **cradle-to-grave** costing and **womb-to-tomb** costing convey the meaning of fully capturing all costs associated with the product from its initial to final stages.

## 2. MEANING OF PRODUCT LIFE CYCLE [JUN'18; DEC'18]

- (a) Product Life Cycle is a pattern of expenditure, sale level, revenue and profit over the period from new idea generation to the deletion of product from product range.
- (b) Product Life Cycle spans the time from initial R&D on a product to when customer servicing and support is no longer offered for the product. For products like motor vehicles, this time-span may range from 5 to 7 years. For some basic pharmaceuticals, the time-span be 7 to 10 years.

## 3. CHARACTERISTIC OF PLCC

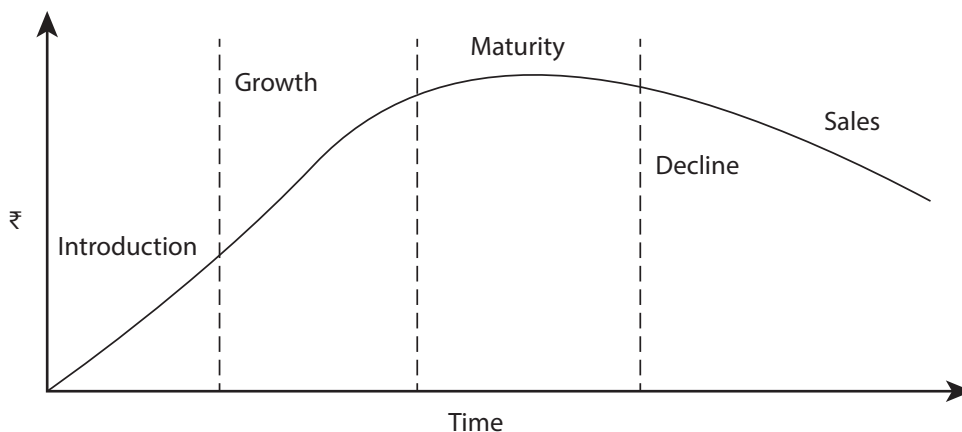
- (a) Involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle.
- (b) Traces research, design and development costs and total magnitude of these costs for each individual product and compared with product revenue.
- (c) Assists report generation for costs and revenues.

## 4. PHASES IN PRODUCT LIFE CYCLE

The 4 identifiable phases in the product Life Cycle are – **(a) Introduction (b) Growth (c) Maturity and (d) Decline**. A comparative analysis of these phases is given below –

Particulars Phase	Introduction 1	Growth II	Maturity III	Decline IV
<b>Sales Volumes</b>	Initial stages, hence low.	Rise in sales levels at increasing rates.	Rise in sales levels at decreasing rates	Sales level off and then start decreasing
<b>Prices of products</b>	High levels to cover initial costs and promotional exps.	Retention of high level prices except in certain cases.	Prices fall closer to cost, due to effect of competition.	Gap between price and cost is further reduced.
<b>Ratio of promotion expenses to sales</b>	Highest, due to effort needed to inform potential customers, launch products, distribute to customers etc.	Total expenses remain the same, while ratio of S&D OH to sales is reduced due to increase in sales.	Ratio reaches a normal level of sales. Such normal level becomes the industry standard.	Reduced sales promotional efforts as the product is no longer in demand.
<b>Competition</b>	Negligible and insignificant	Entry of a large number of competitors.	Fierce Competition	Starts disappearing due to withdrawal of products.
<b>Profits</b>	Nil, due to heavy initial costs	Increase at a rapid pace	Normal rate of profits since costs and prices are normalized.	Decline profits due to price competition new products etc.

- in the growth stage, maintain the prices at high levels, in order to realize maximum profits.
- Price reduction will not be undertaken unless (a) the low prices will lead to market penetration, (b) the Firm has sufficient production capacity to absorb the increased sales volume, and (c) Competitors enters the market.



## 5. BENEFITS OF PLCC

- (a) Results in earlier actions to generate revenue or to lower costs than otherwise might be considered.
- (b) Ensures better decision from a more accurate and realistic assessment of revenues and costs atleast within a particular life cycle stage.
- (c) Promotes long-term rewarding.
- (d) Provides an overall framework for considering total incremental costs over the life span of the product.

## 6. IMPORTANCE OF PRODUCT LIFE CYCLE COSTING

**Product Life Cycle Costing is considered important due to the following reasons –**

- (a) **Time based analysis:** Life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their life cycle. Costs and revenues can analysed by time periods. The total magnitude of costs for each individual product can be reported and compared with product revenues generated in various time periods.
- (b) **Overall Cost Analysis:** Production Costs are accounted and recognized by the routine accounting system. However non-production costs like R&D; design; marketing; distribution; customer service etc. are less visible on a product by product basis. Product Life Cycle Costing focuses on recognizing both production and non-production costs.
- (c) **Pre-production costs analysis:** The development period of R&D and design is long and costly. A high percentage of total product costs maybe incurred before commercial production begin. Hence; the Company needs accurate information on such costs for deciding whether to continue with the R&D or not.
- (d) **Effective Pricing Decisions:** Pricing Decisions; in order to be effective; should include market considerations on one hand and cost considerations on the other. Product Life Cycle Costing and Target Costing help analyze both these considerations and arrive at optimal price decisions.
- (e) **Better Decision Making:** Based on a more accurate and realistic assessment of revenues and costs, at least within a particular life cycle stage, better decisions can be taken.
- (f) **Long Run Holistic view:** Product Life Cycle Costing can promote long-term rewarding in contrast to short-term profitability rewarding. It provides an overall framework for considering total incremental costs over the entire life span of a product, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.
- (g) **Life Cycle Budgeting:** Life Cycle Budgeting, i.e., Life Cycle Costing with Target Costing principles, facilitates scope for cost reduction at the design stage itself. Since costs are avoided before they are committed or locked in the Company is benefited.
- (h) **Review:** Life Cycle Costing provides scope for analysis of long term picture of product line profitability, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

## 7. CHARACTERISTICS AND STRATEGIES AT EAC STAGE OF PRODUCT LIFE CYCLE

Phases	Characteristics	Strategies
Introduction	<ul style="list-style-type: none"> <li>Product identity / awareness</li> <li>High distribution Cost</li> <li>Pricing - Skimming</li> <li>Competitors start copying</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen Supply chain</li> <li>Make product more visible</li> <li>Set price as per market</li> <li>Induce customer to try</li> </ul>
Growth	<ul style="list-style-type: none"> <li>High volume</li> <li>Increased competition</li> <li>Price reduction to grow</li> <li>New channels to handle growth</li> <li>New features</li> </ul>	<ul style="list-style-type: none"> <li>Induce customer to buy</li> <li>Make product available</li> <li>Long term relationship with customer/partners</li> <li>Promote differentiation features</li> </ul>
Maturity	<ul style="list-style-type: none"> <li>Fierce competition</li> <li>Overcapacity in industry</li> <li>Selling Price further reduces</li> <li>No new channels left</li> <li>Customers move to another product</li> </ul>	<ul style="list-style-type: none"> <li>Strong marketing effort</li> <li>Reduce price to attract price sensitive customers</li> <li>Huge incentive to channel partners</li> <li>Start R&amp;D to increase life</li> </ul>
Decline	<ul style="list-style-type: none"> <li>Sales may drop significantly</li> <li>Competitors drop out</li> <li>Consumer's taste changed completely</li> </ul>	<ul style="list-style-type: none"> <li>Revive / discontinue the product</li> <li>Use this product to launch a new product</li> </ul>

## 8. IMPACT ON SELLING PRICE AND COST PER UNIT AT DIFFERENT STAGES

	Introduction	Growth	Maturity	Decline
Selling price	Very High	High	Moderate	Low
	To cater to esteem value customers and skimming through premium pricing.	To capture market share, price is reduced.	To match with competitors	Product is obsolete or no more desirable for change of customer tastes or preferences.
Cost per unit	High	Low	Very low	High

	Introduction	Growth	Maturity	Decline
	To cover the high initial costs of funds, research and development costs and high promotional expenses.	Due to benefits from learning curve effect and economies of scale.	Due to larger benefits from economies of scale, efficiency and reduced promotion expenses.	Due to lost benefits from scale, high promotional spending.

## 9. SKIMMING PRICING POLICY

Price skimming is a pricing strategy which companies adopt when they launch a new product, in this strategy while launching a product company sets high price for a product initially and then reduce the price as time passes by so as to recover cost of a product quickly.

An example of price skimming would be mobiles which have some added features and due to those features they are sold initially at higher prices and then prices began to decline as time passes by, another example of price skimming would be 3D televisions which are right now being sold.

### Advantages

1. Price skimming helps the company in recovering the research and development costs which are associated with the development of new product.
2. If the company caters to consumers who are quality conscious rather than price conscious than this type of strategy can work in a great way for a company.

## 10. PENETRATION PRICING CIRCUMSTANCES OF ACCEPTANCE OF POLICY [MTP DEC'17]

1. Penetration Pricing is a policy of using a low price as the principal instrument for penetrating mass markets early. This method is used for pricing a new product and to popularize it initially.
2. Profits may not be earned in the initial stages. However, Prices may be increased as and when the product is established and its demand picks up.
3. The low price policy is introduced for the purpose of long-term survival and profitability. Hence, careful analysis of the scope for market expansion and considerable amount of research and forecasting are necessary before determining the price under this strategy.
4. The circumstances in which Penetrating Pricing can be adopted are –
  - (a) **Elastic demand:** The demand of the product is high when price is low. Hence, lower prices mean large volume and so more profits.

- (b) **Mass Production:** When there are substantial savings in large-scale production, increase in demand is sustained by the adoption of low pricing policy.

**Frighten off competition:** The prices fixed at a low-level act as an entry barrier to the prospective competitors. The use of this policy by existing Firms will discourage the new firms to enter the market. The pricing policy is also known as “**Stay-out-pricing**”.

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**Q1**

**CMA Mat; Dec'17; Dec'21**

Wipro is examining the profitability and pricing policies of its Software Division. The Software Division develops Software Packages for Engineers. It has collected data on three of its more recent packages - (a) ECE Package for Electronics and Communication Engineers, (b) CE Package for Computer Engineers, and (c) IE Package for Industrial Engineers.

**Summary details on each package over their two year cradle to grave product lives are -**

Package	Selling Price	Number of units sold	
		Year 1	Year 2
ECE	₹ 250	2,000	8,000
CE	₹ 300	2,000	3,000
IE	₹ 200	5,000	3,000

Assume that no inventory remains on hand at the end of year 2. Wipro is deciding which product lines to emphasize in its software division. In the past two years, the profitability of this division has been mediocre.

Wipro is particularly concerned with the increase in R & D costs in several of its divisions. An analyst at the Software Division pointed out that for one of its most recent packages (IE) major efforts had been made to reduce R&D costs.

Last week, Amit, the Software Division Manager, decides to use Life Cycle Costing in his own division. He collects the following Life Cycle Revenue and Cost information for the packages -

Amount (₹)

Particulars	Package ECE		Package CE		Package IE	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Revenues	5,00,000	20,00,000	6,00,000	9,00,000	10,00,000	6,00,000
Costs						
R&D	7,00,000	-	4,50,000	-	2,40,000	-
Design of Product	1,15,000	85,000	1,05,000	15,000	76,000	20,000
Manufacturing	25,000	2,75,000	1,10,000	1,00,000	1,65,000	43,000
Marketing	1,60,000	3,40,000	1,50,000	1,20,000	2,08,000	2,40,000
Distribution	15,000	60,000	24,000	36,000	60,000	36,000
Customer Service	50,000	3,25,000	45,000	1,05,000	2,20,000	3,88,000

**Present** a Product Life Cycle Income Statement for each Software Package. **Which** package is most profitable and which is the least profitable? **How** do the three packages differ in their cost structure (the percentage of total costs in each category)?

Reference

What's New

## Product Life Cycle Income Statement

### Answer

#### Life cycle Income Statement (in ₹ 000s)

Particulars	Package ECE				Package CE				Package IE			
	Y1	Y2	Total	%	Y1	Y2	Total	%	Y1	Y2	Total	%
Revenues	500	2,000	2,500	100%	600	900	1,500	100%	1,000	600	1,600	100%
Costs												
R&D	700	-	700	28%	450	-	450	30%	240	-	240	15%
Design	115	85	200	8%	105	15	120	8%	76	20	96	6%
Manufacturing	25	275	300	12%	110	100	210	14%	165	43	208	13%
Marketing	160	340	500	20%	150	120	270	18%	208	240	448	28%
Distribution	15	60	75	3%	24	36	60	4%	60	36	96	6%
Cust. Service	50	325	375	15%	45	105	150	10%	220	388	608	38%
Total Costs	1065	1,085	2150	86%	884	376	1260	84%	969	727	1696	106%
<b>Profit</b>			350	14%			240	16%			(96)	-6%

**Observation:** Package ECE is most profitable, while package IE is least profitable.

### Q2

### MTP Jun'22

Z Ltd. manufacturers tablet batteries. The company is preparing a product life cycle budget for a new type of battery. Development on the new battery is to start shortly. Estimates for the new battery are as follows:

Life cycle units manufactured and sold	2,00,000
Selling price per battery	₹ 55
Life cycle costs:	
R&D and Design cost	₹ 8,00,000
Manufacturing:	
Variable cost per battery	₹ 25
Variable cost per batch	₹ 300
Battery per batch	250
Fixed costs	₹ 12,00,000
Marketing	
Variable cost per battery	₹ 3.50

Fixed costs	₹ 8,00,000
Distribution:	
Variable cost per batch	₹ 140
Battery per batch	100
Fixed costs	₹ 4,60,000
Customer service cost per battery (Variable)	₹ 1.70

Ignore the time value of money.

- (i) **What** is the Estimate of Total Cost, Revenue and Operating Income? [7]
- (ii) **Express** the R&D design cost as a percentage of total product life cycle? [3]

**Reference**

**Life Cycle Cost**

**What's New**

**Total Cost, Revenue and Operating Income, cost as a percentage of total Product Life Cycle**

### Q3 CMA Mat; Jun'17; RTP Jun'18; MTP Jun'17; MTP Dec'17; MTP Dec'21

A2Z p.l.c supports the concept of zero technology or life cycle costing for new investment decisions covering its engineering activities. The financial side of this philosophy is now well established and its principles extended to all other areas of decision making. The company is to replace a number of its machines and the Production Manager is torn between the Exe Machine, a more expensive machine with a life of 12 years, and the Wye machine with an estimated life of 6 years. If the Wye machine is chosen it is likely that it would be replaced at the end of 6 years by another Wye machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below:

	Exe ₹	Wye ₹
Purchase price	19,000	13,000
Trade-in value/brakeup/scrap	3,000	3,000
Annual repair costs	2,000	2,600
Overhaul costs	( at year 8) 4,000	( at year 4) 2,000

Estimated financing costs averaged over machine life

10%p.a – Exe	10% p.a. – Wye
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You are **required** to: recommend with supporting figures, which machine to purchase, stating any assumptions made.

<b>Reference</b> <b>Equivalent Annual Cost</b>	<b>What's New</b>
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### Answer

#### Computation of present value of outflows and Equivalent Annual Cost

	₹	Exe machine ₹	₹	WYE machine ₹
Initial cost		19,000.00		13,000.00
Less : Scrap at the end of the life	(3000 x 0.32)	960.00	(3000 X .56)	1,680.00
		18,040.00		11,320.00
Present value of total annual cost	(2000 x 6.81)	13,620.00	(2600 x 4.36)	11,336.00
Overhaul cost	(4000 X .47)	1,880.00	(2000 X .68)	1,360.00
		33,540.00		24,016.00
Capital recovery factor	(1/6.81)	0.15	(1/4.36)	0.23
Equivalent annual cost		4,925.00		5,508.00

As the Equivalent Annual Cost is less for exe machine, it is better to purchase the same.

### Q4

### CMA Mat

Company X is forced to choose between two machines A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10%.

**Which** machine Company X should buy?

<b>Reference</b> <b>Equivalent Annual Cost</b>	<b>What's New</b>
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**Answer**

Compound present value of 3 years @ 10%	= 2.486	
P.V. of running cost of Machine A for 3 years	= ₹ 40,000 x 2.486	= ₹ 99,440
Compound present value of 2 years @ 10%	= 1.735	
P.V. of running cost of Machine B for 2 years	= ₹ 60,000 x 1.735	= ₹ 1,04,100

**Statement Showing Evaluation of Machines A and B**

(₹)

Particulars	Machine A	Machine B
Cost of purchase	1,50,000	1,00,000
Add: P.V. of running cost for 3 years	99,440	1,04,100
P.V. of Cash outflow	2,49,440	2,04,100
	2,49,440	2,04,100
Equivalent present value of annual cash outflow	2.486	1.735
	= 1,00,338	= 1,17,637

**Analysis:** Since the annual cash outflow of Machine B is higher, Machine A can be purchased.

**Q5**

**CMA Mat**

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Amount (₹)

Year	Maintenance	Salvage
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%.

**When** should the company replace the machine?

(Notes: Present value of an annuity of ₹ 1 per period for 8 years at interest rate of 15% : 4.4873; present value of ₹ 1 to be received after 8 years at interest rate of 15% : 0.3269)

<b>Reference</b> <b>Equivalent Annual Cost</b>	<b>What's New</b> <b>Year of Replacement</b>
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### Answer

#### Calculation of Equivalent Annual Cost of New Machine

		Amount (₹)
Cost of New Machine		90,000
Add: Present value of annual maintenance cost for 8 years	(₹ 10,000 × 4.4873)	44,873
		1,34,873
Less: Present value of salvage value at the end of 8th year	(₹ 20,000 × 0.3269)	6,538
Total present value of life cycle costs of new machine.		1,28,335

Equivalent Annual cost = ₹ 1,28,335/4.4873 = ₹ 28,600

#### Calculation of Equivalent Annual cost in continuing with Existing Machine

##### 1st Year

		Amount (₹)
P.V. of salvage value at the beginning of 1st year		40,000
Add: P. V. of Maintenance cost	(10,000/1.15)	8,696
		48,696
Less: P.V. of salvage value at the end of the year	(25,000/1.15)	21,739
		26,957
Equivalent Annual cost at the end of 1st year	(26,957 × 1.15)	31,000

##### 2nd Year

		Amount (₹)
P.V. of salvage value at the beginning of 2nd year		25,000
Add: P. V. of Maintenance cost	(20,000/1.15)	17,391
		42,391
Less: P.V. of salvage value at the end of the 2nd year	(15,000/1.15)	13,043
		29,348
Equivalent Annual cost at the end of 2nd year	(29,348 × 1.15)	33,750

### 3rd Year

		Amount (₹)
P.V. of salvage value at the beginning of 3rd year		15,000
Add: P. V. of Maintenance cost	(30,000/1.15)	26,087
		41,087
Less: P.V. of salvage value at the end of the 3rd year	(10,000/1.15)	8,696
		32,391
Equivalent Annual cost at the end of 3rd year	(32,391 × 1.15)	37,250

### 4th Year

		Amount (₹)
P.V. of salvage value at the beginning of 4th year		10,000
Add: P. V. of Maintenance cost	(40,000/1.15)	34,783
		44,783
Less: P.V. of salvage value at the end of the 4th year		Nil
		44,783
Equivalent Annual cost at the end of 4th year	(44,783 × 1.15)	51,500

**Analysis:** Since the equivalent annual cost of new machine is lesser than that of existing machine, it is suggested to replace the existing machine with new machine. The equivalent annual cost of existing machine is higher in all the four years as compared to new machine.

### Q6

### CMA Mat; MTP Jun'18

A company is considering the purchase of a machine for ₹ 3,50,000. It feels quite confident that it can sell the goods produced by the machine as to yield an annual cash surplus of ₹ 1,00,000. There is however uncertainty as to the machine working life. A recently published Trade Association Survey shows that members of the Association have between them owned 250 of these machines and have found the lives of the machines vary as under:

No. of year of machine life	3	4	5	6	7	Total
No. of machines having given life	20	50	100	70	10	250

Assuming discount rate of 10% the net present value for each different machine life is follows:

Machine life	3	4	5	6	7
NPV (₹)	(1,01,000)	(33,000)	29,000	86,000	1,37,000

You **required to advice** whether the company should purchase a machine or not.

<b>Reference</b> <b>Expected NPV</b>	<b>What's New</b>
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### Answer

Computation of NPV of an asset considering the probability of life of machine.

Year	Probability (a) ₹	NPV (b) ₹	Expected value (a × b)
3	20/250	(1,01,000)	(8,080)
4	50/250	(33,000)	(6,600)
5	100/250	29,000	11,600
6	70/250	86,000	24,080
7	10/250	1,37,000	5,480
			26,480

So, Assets should be purchased.

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## Learning Objective

1. JIT STRATEGY
2. JIT SYSTEM
3. ADVANTAGES OF JIT
4. DISADVANTAGES OF JIT
5. PRECAUTIONS WHILE IMPLEMENTING JIT
6. FINANCIAL IMPACT OF JIT POLICY

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## 1. JUST-IN-TIME

**Just in time (JIT) is a 'pull' system of production**, so actual orders provide a signal for when a product should be manufactured. Demand-pull enables a firm to produce only **what is required, in the correct quantity and at the correct time**.

This means that **stock levels of raw materials, components, work in progress and finished goods can be kept to a minimum**. This requires a carefully planned scheduling and flow of resources through the production process. Modern manufacturing firms use sophisticated production scheduling software to plan production for each period of time, which includes ordering the correct stock. Information is exchanged with suppliers and customers through EDI (Electronic Data Interchange) to help ensure that every detail is correct.

Supplies are delivered right to the production line only when they are needed. **For example**, a car manufacturing plant might receive exactly the right number and type of tyres for one day's production, and the supplier would be expected to deliver them to the correct loading bay on the production line within a very narrow time slot.

## 2. THE JIT STRATEGY

By taking a **JIT approach** to inventory and product handling, companies can often cut costs significantly. Inventory costs contribute heavily to the company expenses, especially in manufacturing organizations. By minimizing the amount of inventory you hold, you save space, free up cash resources, and reduce the waste that comes from obsolescence.

## 3. JIT SYSTEMS

To **facilitate a JIT approach**, you need a variety of systems in place. The most notable is a kanban. This is a Japanese approach to ensuring a continuous supply of inventory or product. Kanbans were designed to support the JIT philosophy.

A **kanban** is a visual signal that indicates it is time to replenish stock and possibly reorder. For instance, as the supply of bolts in a bin on the assembly line falls below a certain number, it may uncover a yellow line painted around the inside of the storage bin. This yellow line indicates to the foreman that he needs to prepare a requisition for more bolts. That requisition is given to the purchasing department, which processes the order. This prevents the supply of bolts from dropping below a critical amount and allows production continues to flow smoothly.

## 4. ADVANTAGES OF JUST-IN-TIME SYSTEM

Following are the **advantages** of adopting Just-In-Time Manufacturing System:

- (i) Just-in-time manufacturing **keeps stock holding costs to a bare minimum**. The release of storage space results in better utilization of space and thereby bears a favorable impact on the rent paid and on any insurance premiums that would otherwise need to be made.

- (ii) Just-in-time manufacturing **eliminates waste**, as out-of-date or expired product; do not enter into this equation at all.
- (iii) As under this technique, **only essential stocks are obtained, less working capital is required to finance procurement**. Here, a minimum re-order level is set, and only once that mark is reached fresh stocks are ordered, making this a boon to inventory management too.
- (iv) Due to the **afore-mentioned low level of stocks held**, the organization's return on investment (referred to as ROI, in management parlance) would generally be high.
- (v) As just-in-time production works on a **demand-pull basis**, all goods made would be sold, and thus it incorporates changes in demand with surprising ease. This makes it especially appealing today, where the market demand is **volatile** and somewhat **unpredictable**.
- (vi) Just-in-time manufacturing **encourages the right first time concept**, so that inspection costs and **cost of rework is minimized**.
- (vii) **High quality products and greater efficiency** can be derived from following a just-in-time production system.
- (viii) **Close relationships are fostered along the production** chain under a just-in-time manufacturing system.
- (ix) Constant communication with the customer **results in high customer satisfaction**.
- (x) **Over production is eliminated**, when just-in-time manufacturing is adopted.

## 5. DISADVANTAGES

Following are the **disadvantages** of adopting Just-In-Time Manufacturing Systems:

- (i) Just-in-time manufacturing **provides zero tolerance for mistakes**, as it makes re-working very difficult in practice, as inventory is kept to a bare minimum.
- (ii) There is a **high reliance on suppliers**, whose performance is generally outside the purview of the manufacturer.
- (iii) As there will be no buffers for delays, **production downtime and line idling can occur**, which would bear a detrimental effect on finances and on the equilibrium of the production process.
- (iv) The organization **would not be able to meet an unexpected increase in orders**, due to the fact that there are no excess finish goods.
- (v) **Transaction costs would be relatively high**, as frequent transactions would be made.
- (vi) Just-in-time manufacturing may have certain **detrimental effects on the environment**, due to the frequent deliveries that would result in increased use of transportation which in turn would consume more fossil fuels.

## 6. PRECAUTIONS

Following are the things to Remember When Implementing a Just-In-Time Manufacturing System:

- (i) Management **buy-in and support** at all levels of the organization are required; if a just-in-time manufacturing system is to be successfully adopted.
- (ii) **Adequate resources should be allocated**, so as to obtain technologically advanced software, that is generally required if a just-in-time system is to be a success.
- (iii) **Building a close, trusting relationship** with reputed and time-tested suppliers will minimize unexpected delays in the receipt of inventory.
- (iv) Just-in-time manufacturing cannot be adopted overnight. **It requires commitment in terms of time and adjustments to corporate culture would be required**, as it is starkly different to traditional production processes.
- (v) The **design flow process needs to be redesigned and layouts need to be re-formatted**, so as to incorporate just-in-time manufacturing.
- (vi) Lot sizes need to be **minimized**.
- (vii) Work station capacity should be **balanced** whenever possible.
- (viii) **Preventive maintenance should be carried out**, so as to minimize machine breakdowns.
- (ix) **Set up times should be reduced** wherever possible.
- (x) **Quality enhancement programs should be adopted**, so that total quality control practices can be adopted.
- (xi) **Reduction** in lead times and frequent deliveries should be incorporated.
- (xii) **Motion waste should be minimized**, so the incorporation of conveyor belts might prove to be a good idea when implementing a just-in-time manufacturing system.

## 7. IMPACT OF JUST-IN-TIME ON PRODUCT PRICES

When a company achieves a higher level of product quality, along with ability to deliver products on the dates required, customers may be willing to pay a premium. This is particularly true in industries where quality or delivery reliability is low. If customers are highly sensitive to these two factors, it may be possible to increase the price substantially. Alternatively, if these factors are not of great importance, if customers place a higher degree of importance on other factors, then there will be no opportunity for a price increase.

In industries where many companies are adopting JIT systems at the same time or have already installed them, an improvement in product quality and delivery times does not differentiate a company from its peers. Instead, since everybody else is offering the same level of quality and service it just keeps a company from losing sales to its competitors. In such a situation it is more likely that all companies remaining in the industry will use their new-found lower costs to initiate a price war that will result in a drop in prices. Consequently, the impact of a JIT system



on product pricing is primarily driven by customers' perceived need for higher product quality and reliable delivery times, as well as the presence of competitors with JIT system, the same installation, and operational base.

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## Q1

Jun'18

Prism Ltd. has decided to adopt JIT policy for materials. The following effects of JIT policy are identified :

- (i) To implement JIT, the company has to modify its production and material receipt facilities at a capital cost of ₹ 2,00,000. The new machine will require a cash operating cost ₹ 2,16,000 p.a. The capital cost will be depreciated over 10 years.
- (ii) Raw material stockholding will be reduced from ₹ 40,00,000 to ₹ 15,00,000.
- (iii) The company can earn 12% on its long-term investments.
- (iv) The company can avoid rental expenditure on storage facilities amounting to ₹ 66,000 per annum. Property Taxes and Insurance amounting to ₹ 44,000 will be saved due to JIT programme.
- (v) Presently there are 7 workers in the Store department at a salary of ₹ 10,000 each per month. After implementing JIT scheme, only 4 workers will be required in this department. Balance 3 workers' employment will be terminated.
- (vi) Due to receipt of smaller lots of Raw Materials, there will be some disruption of production. The costs of stockouts are estimated at ₹ 1,54,000 per annum.
- (vii) Since the supplier is new having no reputation as yet in the market, an additional inspection cost of ₹ 12,000 p.a. has to be incurred.

### Required :

**Determine** the financial impact of the JIT policy. **Is** it advisable for the company to implement JIT system ? [6 + 2 = 8]

Reference	What's New
<b>Financial Impact of JIT Policy</b>	

### Answer

Cost-Benefit Analysis of JIT policy.

Costs	₹	Benefits	₹
Interest on capital for	24,000	Interest on investment on released funds (₹ 40,00,000 – ₹ 15,00,000) x 12%	3,00,000
Modifying production facilities (₹2,00,000 x 12%)		Saving in salary of 3 workers terminated (₹ 10,000 x 12 months x 3)	3,60,000

Operating Costs of new production facilities	2,16,000	Saving in rental Expenditure	66,000
Depreciation of new production facilities	Nil	Saving in Property Tax & Insurance	44,000
Stock-Outs costs (given)	1,54,000		
Inspection cost	12,000		
Net benefit due to JIT policy	3,64,000		
<b>Total</b>	<b>7,70,000</b>	<b>Total</b>	<b>7,70,000</b>

**Conclusion :** The JIT policy may be implemented, as there is a Net Benefit of ₹ 82000 per annum.

**Note :** Depreciation, being apportionment of non-cash capital cost, is ignored in decision-making. Tax saving on Depreciation is not considered in the above analysis.

## Q2

## CMA Mat; Dec'18; MTP Dec'19

B Ltd. has decided to adopt JIT policy for materials. The following effects of JIT policy are identified-

- (1) To implement JIT, the company has to modify its production and material receipt facilities at a capital cost of ₹10,00,000. The new machine will require a cash operating cost ₹1,08,000 p.a. The capital cost will be depreciated over 5 years.
- (2) Raw material stockholding will be reduced from ₹40,00,000 to ₹10,00,000.
- (3) The company can earn 15% on its long-term investments.
- (4) The company can avoid rental expenditure on storage facilities amounting to ₹33,000 per annum. Property Taxes and insurance amounting to ₹22,000 will be saved due to JIT programme.
- (5) Presently there are 7 workers in the store department at a salary of ₹5,000 each per month. After implementing JIT scheme, only 5 workers will be required in this department. Balance 2 workers' employment will be terminated.
- (6) Due to receipt of smaller lots of Raw Materials, there will be some disruption of production. The costs of stock-outs are estimated at ₹77,000 per annum.

**Determine** the financial impact of the JIT policy. **Is** it advisable for the company to implement JIT system?

Reference	What's New
<b>Financial Impact of JIT Policy</b>	

## Answer

### Cost-Benefit Analysis of JIT policy

Costs	₹	Benefits	₹
Interest on capital for modifying production facilities (₹10,00,000×15%)	1,50,000	Interest on investment on released funds (₹40,00,000 - ₹10,00,000) ×15%	4,50,000
Operating Costs of new production facilities	1,08,000	Saving in salary of 2 workers terminated (₹5,000 × 12 months × 2)	1,20,000
Depreciation of new production facilities	Nil	Saving in rental Expenditure	33,000
Stock-Outs Costs (given)	77,000	Saving in Property Tax & Insurance	22,000
Net Benefit due to JIT policy	2,90,000		
<b>Total</b>	<b>6,25,000</b>	<b>Total</b>	<b>6,25,000</b>

**Conclusion:** The JIT policy may be implemented, as there is a Net Benefit of ₹2,90,000 per annum.

**Note:** Depreciation, being apportionment of capital cost, is ignored in decision-making, Tax Saving on Depreciation is not considered in the above analysis.

### Q3

### CMA Mat

Altra Video Company sells package of blank Video tapes to its customers. It purchases video tapes from Yash Tape Company at ₹150 per packet. Yash Tape Company pays all freight to Altra Video Company. No incoming inspection is necessary because Yash Tape Company has a superb reputation for delivery of quality merchandise. Annual demand of Altra Video Company is 15,600 packages. Altra Video Company requires 10% annual return on its investment. The purchase order Lead time is 2 weeks. The purchase order is passed through internet and it costs ₹20 per order. The relevant insurance, material handling etc. is ₹10 per package per year.


Altra Video has to decide whether or not to shift to JIT purchasing. Yash Tape Company agrees to deliver 100 packages of Video tapes 156 times per year (6 times every 2 weeks) instead of existing delivery system of 1,200 packages 13 times a year, with additional amount of Re.0.05 per package. Altra Video Company incurs no stock out under its current purchasing policy. It is estimated that Altra Video Company will incur stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of stock out, Altra video company has to rush order tape packages, which costs ₹8 per package. **Comment** whether Altra Video Company should implement JIT purchasing system.

Ram Co. also supplies video tapes. It agrees to supply at ₹145 per package under JIT delivery system. If video tape is purchased from Ram Co. relevant carrying cost would be ₹9 per package against ₹10 in case of purchasing from Yash Tape Company. However Ram Co. does not enjoy a sterling reputation for quality, Altra Video Company anticipates the following negative aspects

of purchasing tapes from Ram Co.

- (1) Incurring additional inspection cost of ₹0.05 per package.
- (2) Average stock out of 360 tape packages per year would occur, largely resulting from late deliveries. Ram Co. cannot rush order at short notice. Altra Video Company anticipates lost contribution margin per package of ₹10 from stock out.
- (3) Customers would likely return 2% of all packages due to poor quality of the tape and to handle this return, an additional cost of ₹25 per package would be incurred.

**Comment** on whether Altra Video Company can place an order with Ram Co.

 <b>Reference</b> <b>Implementation of JIT Purchasing System</b>	<b>What's New</b>
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### Answer

(1) **Computation of Carrying Costs**

**Carrying Cost = Interest + Others (Insurance, Material Handling, etc.), which is calculated as under:**

Particulars	Current Policy	JIT with Yash Tape Co.	JIT with Ram Co.
(i) Interest cost	$₹150 \times 10\% = ₹15.00$	$₹150.05 \times 10\% = ₹15.005$	$₹145 \times 10\% = ₹14.50$
(ii) Others	₹10.00	₹10	₹9.00
(a) Total carrying cost p.u. p.a.	₹25.00	₹25.005	₹23.50
(b) Average Inventory	$1/2 \times 1200 = 600$ units	$1/2 \times 100 = 50$ units	$1/2 \times 100 = 50$ units
(c) Carrying Costs p.a. (a × b)	₹15,000	₹1,250	₹1,175

(2) **Comparative Statement of Relevant Annual Costs of Purchasing Policies**

Particulars	Current policy	JIT with Yash Tape Co.	JIT with Ram Co.
(a) Cost of tapes purchased	$15,600 \text{ tapes} \times ₹150 = ₹23,40,000$	$15,600 \text{ tapes} \times ₹150.05 = ₹23,40,780$	$15,600 \text{ tapes} \times ₹145 = ₹22,62,000$
(b) Ordering or buying costs	$13 \text{ orders} \times ₹20 = ₹260$	$156 \text{ orders} \times ₹20 = ₹3,120$	$156 \text{ orders} \times ₹20 = ₹3,120$
(c) Carrying costs [As calculated in (1)]	₹15,000	₹1,250	₹1,175

(d) Stock out costs	Nil	50 units × ₹8 = ₹400	360 units × ₹10 = ₹3,600
(e) Inspection Costs	Nil	Nil	15,600 units × 0.05 = ₹780
(f) Customer Return costs	Nil	Nil	15,600 units × 2% × ₹25 = ₹7,800
<b>Total Relevant costs</b>	₹23,55,260	₹23,45,550	₹22,78,475

**Conclusions:**

- (1) Compared to present system, JIT with Yash Tape Co. will result in cost saving of ₹23,55,260 - ₹23,45,550 = ₹9,710. Hence, JIT system may be implemented.
- (2) Comparing present system, JIT with Yash Tape Co and Ram Co., JIT with Ram Co. results in the least total cost. Hence, the packages may be bought from Ram Co.

**Q4****RTP Jun'18**

AXE Ltd wants to implement a JIT Programme, with the impact on the three types of Stocks as given below. **Find out** the Cost Savings to the Company, due to implementation of JIT with the following Information -

Particulars	Present Situation, i.e. before JIT	After JIT
<b>Sales Value</b>	₹ 12,00,00,000	Same as present
<b>Percentage of Costs to Sales Value</b>	Materials 40%, Conversion 30%	Materials 44%, Conversion 32 %
<b>Stockholding</b>	Raw Materials: 1 month WIP: 0.5 month Finished Goods: 0.5 month	Raw Materials: 25% less than present WIP: 50% less than present Finished Goods: 40% less than present
<b>Percentage of Completion of WIP</b>	Materials 90%, Conversion 75%	Materials 90%, Conversion 75%
<b>Stock-related Costs are as under -</b>		
<b>Raw Materials</b>		
Fixed	₹2,00,000	15% less than present
Variable	₹0.09 per Rupee of Stock held	₹0.05 per Rupee of Stock held
<b>WIP</b>		
Fixed	₹3,00,000	20% less than present
Variable	₹ 0.04 per Rupee of Stock held	₹0.02 per Rupee of Stock held
<b>Finished Goods</b>		
Fixed	₹2,50,000	40% less than present
Variable	₹0.02 per Rupee of Stock held	₹0.01 per Rupee of Stock held

Financial Charges due to Impact of stockholding on working capital requirement =18% per annum on the value of stocks held.

<b>Reference</b>	<b>What's New</b>
<b>Cost Savings</b>	

**Answer**

Particulars	Before JIT Programme		After JIT Programme	
	Computation	₹	Computation	₹
1. <b>Sales Value</b>		12,00,00,000	Given	12,00,00,000
2. <b>Raw Material Stock</b>	12,00,00,000 × 40% RM Cost × 1/12 Stockholding	40,00,000	(12,00,00,000 × 44% RM Cost × 1/12 Stockholding) less 25%	33,00,000
3. <b>RM Related Costs</b>	Given	2,00,000	₹2,00,000 less 15%	1,70,000
<b>Fixed</b>	₹40,00,000 × ₹0.09	3,60,000	₹33,00,000 × 0.05	1,65,000
<b>Variable Interest</b>	₹40,00,000 × 18%	7,20,000	₹33,00,000 × 18%	5,94,000
Sub-Total		12,80,000		9,29,000
			<b>Cost Saved = ₹3,51,000</b>	
4. <b>WIP Stock (Note)</b>	12,00,00,000 × 58.5% WIP Cost × 0.5/12 Stockholding	29,25,000	12,00,00,000 × 63.6% WIP Cost × 0.5/12 Stockholding × 50%	15,90,000
5. <b>WIP Related Costs</b>	Given	3,00,000	3,00,000 less 20%	2,40,000
<b>Fixed</b>	₹29,25,000 × 0.04	1,17,000	15,90,000 × ₹0.02	31,800
<b>Variable Interest</b>	29,25,000 × 18%	5,26,000	22,80,000 × 18%	2,86,000
Sub-Total		9,43,000		5,58,000
			<b>Cost Saved = ₹3,85,000</b>	
6. <b>Finished Goods Stock</b>	12,00,00,000 × 70% FG Cost × 0.5/12 Stockholding	35,00,000	12,00,00,000 × 76% FG Cost × 0.5/12 Stock holding × 60%	22,80,000
7. <b>FG Related Costs</b>	Given	2,50,000	₹2,50,000 less 40%	1,50,000
<b>Fixed</b>				
<b>Variable Interest</b>	₹35,00,000 × 0.02	70,000	₹22,80,000 × 0.01	22,800
	35,00,000 × 18%	6,30,000	₹22,80,000 × 18%	4,10,400
		9,50,000		5,83,200
			<b>Cost Saved = 3,66,800</b>	

**Note:** WIP Cost is computed as under -

**Before:** (Materials 90% Complete × 40%) + (Conversion 75% Complete × 30%)  
= 36% + 22.5% = 58.5% on Sales.

**After:** (Materials 90% Complete × 44%) + (Conversion 75% Complete × 32%)  
= 39.6% + 24% = 63.6% on Sales.

**Total Cost Savings** = ₹3,51,000 + ₹3,85,500 + ₹3,66,800 = ₹11,03,300

**Q5**

## CMA Mat; MTP Jun'18; MTP Dec'18

Dandia Ltd. follows JIT system. It had following transactions in May, 2014:

- (i) Raw materials were purchased for ₹2,00,000.
- (ii) Direct labour cost incurred ₹36,000
- (iii) Actual overhead costs ₹3,00,000
- (iv) Conversion costs applied ₹3,16,000

All materials, that were purchased, were placed into production and the production was also completed and sold during the month. The difference between actual and applied costs is computed.

You are **required** to **pass** both Traditional journal entries and Backflush journal entries.

Reference	What's <b>New</b>
<b>Traditional and Backflush Accounting-Journals</b>	

### Answer

**In the books of Dandia Ltd.**

Journal Entries (Traditional)

Particulars		Debit (₹)	Credit (₹)
Material A/c	Dr.	2,00,000	
To, Accounts Payable			2,00,000
(being purchase of raw materials)			
WIP A/c	Dr.	2,00,000	
To, Materials A/c			2,00,000
(being materials issued to production)			

WIP A/c	Dr.	36,000	
To, Direct wages A/c (being direct labour cost incurred)			36,000
Overhead Control A/c	Dr.	3,00,000	
To, Accounts Payable (being overhead cost incurred)			3,00,000
WIP A/c	Dr.	2,80,000	
To, Overhead Control A/c (Being application of overhead)			2,80,000
Finished Goods A/c	Dr.	5,16,000	
To, WIP A/c (Being completion of goods)			5,16,000
Cost of Goods Sold A/c	Dr.	5,16,000	
To, Finished Goods (being cost of finished goods sold transferred)			5,16,000
Cost of Goods Sold A/c	Dr.	20,000	
To, Overhead Control A/c (being variance is recognized)			20,000

**In the books of Dandia Ltd. Journal Entries (Backflush)**

Particulars		Debit (₹)	Credit (₹)
Raw Material in Process A/c	Dr.	2,00,000	
To, Accounts Payable (being purchase of raw materials)			2,00,000
Conversion Cost Control A/c	Dr.	3,36,000	
To, Direct wages A/c			36,000
To, Accounts Payable (being overhead cost incurred)			3,00,000
Finished Goods A/c	Dr.	5,16,000	
To, Raw Material in Process A/c			2,00,000
To, WIP A/c (Being completion of goods)			3,16,000
Cost of Goods Sold A/c	Dr.	5,16,000	
To, Finished Goods (being cost of finished goods sold transferred)			5,16,000
Cost of Goods Sold A/c	Dr.	20,000	
To, Overhead Control A/c (being variance is recognized)			20,000

# Backflush Accounting



## Learning Objective

1. VARIANTS OF BACKFLUSH ACCOUNTING
2. TRADITIONAL VS BACKFLUSH

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## 1. INTRODUCTION [JUN'18]

**Backflush accounting** is when you wait **until the manufacture of a product has been completed**, and then record all of the related issuances of inventory from stock that were required to create the product. This approach has the advantage of avoiding all manual assignments of costs to products during the various production stages, thereby eliminating a large number of transactions and the associated labor.

This system records the transaction only at the termination of the production and sales cycle. The emphasis is to measure cost at the beginning and at the end with greater emphasis on the end or outputs. Since back flushing is usually employed in parallel with JIT, **there is no work-in-progress to considered nor, does work-in-progress materially fluctuate**. What is essential, however, is an accurate bill of materials goods measures of yield generally effective production control and accurate engineering change notice when yields do change.

The principle of a **just-in-time system** is that production is pulled by customer demand and this in turn pulls the purchasing procedures. Thus, theoretically there are zero stocks of raw materials. Work-in-progress and finished goods. **For such a situation to exist there needs to be an excellent system of production planning and communication with materials suppliers.**

Backflush accounting is entirely automated, with a computer handling all transactions. The **backflushing formula is:**

**Number of units produced x unit count listed in the bill of materials for each component**

Backflushing is a theoretically elegant solution to the complexities of assigning costs to products and relieving inventory, but it is difficult to implement. **Backflush accounting is subject to the following problems:**

- **Requires an accurate production count.** The number of finished goods produced is the multiplier in the backflush equation, so an incorrect count will relieve an incorrect amount of components and raw materials from stock.
- **Requires an accurate bill of materials.** The bill of materials contains a complete itemization of the components and raw materials used to construct a product. If the items in the bill are inaccurate, the backflush equation will relieve an incorrect amount of components and raw materials from stock.
- **Requires excellent scrap reporting.** There will inevitably be unusual amounts of scrap or rework in a production process that are not anticipated in a bill of materials. If you do not separately delete these items from inventory, they will remain in the inventory records, since the backflush equation does not account for them.
- **Requires a fast production cycle time.** Backflushing does not remove items from inventory until after a product has been completed, so the inventory records will remain incomplete until such time as the backflushing occurs. Thus, a very rapid production cycle time is the best way to keep this interval as short as possible. Under a backflushing system, there is no recorded amount of work-in-process inventory.

Backflushing is **not suitable for long production processes**, since it takes too long for the inventory records to be reduced after the eventual completion of products. It is also not suitable for the production of customized products, since this would require the creation of a unique bill of materials for each item produced.

The cautions raised here do not mean that it is impossible to use backflush accounting. Usually, a manufacturing planning system allows you to use backflush accounting for just certain products, so you can run it on a compartmentalized basis. This is useful not just to pilot test the concept, but also to use it only under those circumstances where it is most likely to succeed. Thus, backflush accounting can be incorporated into a hybrid system in which multiple methods of production accounting may be used.

## 2. THE VARIANTS OF BACKFLUSH ACCOUNTING [JUN'17; JUN'18]

There are a number of variants of the Backflush system, each differing as to the 'trigger points' at which costs are recognized within the cost accounts and thus associated with products. All variants, however, have the following common features :

- **The focus is on output** – costs are first associated with output (measured as either sales or completed production) and then allocated between stocks and costs of goods sold by working back.
- **Conversion costs (labour and overheads) are never attached to products until they are complete (or even sold)** – thus the traditional WIP account doesn't exist. Materials are recognized at different points according to the variant used, but only to the extent of being either stock of raw materials or part of the cost of stock of finished goods. Again, materials are not attached to WIP.

Two variants of the Backflush system are summarized below. Note that in each as conversion costs (labour and overheads) are incurred they will be recorded in a conversion cost (CC) account.

### Variant 1

**This has two trigger points (TP) :**

**TP 1** - purchase of raw materials / components. A 'raw and in process (RIP)' account will be debited with the actual cost of materials purchased, and creditors credited.

**TP 2** - completion of good units. The finished goods (FG) account will be debited with the standard cost of unit produced and the RIP and CC account will be credited with the standard cost.

**Under this variant, then, there will be two stock accounts :**

- raw materials (which may, in fact, be incorporated into WIP)
- finished goods

## Variant 2

**This has only one trigger point** – the completion of good units. The FG account is debited with the standard cost of units produced, with corresponding credits to the CC account and the creditors account.

Thus the cost records exclude :

- raw materials purchased but not yet used for complete production
- the creditors for these materials ( and any price variance )

and there is only stock account, carrying the standard cost of finished goods stock.

Other variants include those using the sale of complete goods units as a trigger point for the attachment of conversion cost to unit -- thus there is no finished goods account, just a raw materials stock account, carrying the materials cost of raw materials, WIP and finished goods.

It should be seen that as stock of raw materials, WIP and finished goods are decreased to minimal levels, as in a 'pure' JIT system, these variants will give the same basic results.

SJC Institute



## CMA Mat

The manufacturing cost information for March for a division of XYZ plc is as follows :

Cost incurred in March		₹'000
Purchase of raw materials		4,250
Labour		2,800
Overheads		1,640
Activity in March		Units ('000)
Finished goods manufactured during the period		180
Sales		145
Standard cost per unit		₹
Materials		20
Labour		15
Overhead		9
		44

There were no opening stocks of raw materials, WIP or finished goods. It should be assumed that there are no direct materials variance for the period.

**Show** Journal Entries in both the variants in Backflush Costing

Reference	What's New
<b>Journal Entries</b>	

### Answer

#### Variant 1

The double entry would be as follows

	Dr. ₹'000	Cr. ₹'000
1. RIP account	4,250	
Creditor		4,250
2. CC account	4,440	
Cash		2,800
Cash/ creditor		1,640

3.	FG account (180 X 44)	7,920	
	CrS account (180 X 20)		3,600
	CC account (180 X 24)		4,320
4.	COGS (145 X 44)	6,380	
	FG account		6,380

The ledger would appear as follows

**Raw and in process materials**

	₹'000		₹'000
Creditor	4,250	FG	3,600
		Bal c/d	650
	4,250		4,250
Bal b/d	650		

**Conversion costs**

	₹'000		₹'000
Cash/creditor	4,440	FG	4,320
		Bal c/d	120
	4,440		4,440
Bal b/d	120		

**Finished goods**

	₹'000		₹'000
RIP	3,600	COGS	6,380
CC	4,320	Bal c/d	1,540
	7,920		7,920
Bal b/d	1,540		

**Cost of goods sold**

	₹'000		₹'000
FG	6,380		

The stock balances at the end of March would be

	₹'000
Raw and in process materials	650
Finished goods	1,540
	2,190

The balance on the Conversion Cost (CC) Account would be carried forward and written off at the end of the year.

### Variant 2

The accounting entries where there is only one trigger point (on completion of units) would be simpler.

	Dr. ₹'000	Cr. ₹'000
1. CC account	4,440	
Cash		2,800
Cash/creditors		1,640
2. FG account (180 X 44 )	7,920	
WIP Account (180 X 20 )		3,600
Crs. account (180 X 24 )		4,320
3. COGS	6,380	
FG account		6,380

This variant is thus only suitable for JIT system with minimal raw materials stocks.

### Q2

### CMA Mat

Dandia Ltd. follows JIT system. It had following transactions in May, 2014:

- (i) Raw materials were purchased for ₹ 2,00,000.
- (ii) Direct labour cost incurred ₹ 36,000
- (iii) Actual overhead costs ₹ 3,00,000
- (iv) Conversion costs applied ₹ 3,16,000

All materials, that were purchased, were placed into production and the production was also completed and sold during the month. The difference between actual and applied costs is computed.

You are **required** to **pass** both Traditional journal entries and Backflush journal entries.

Reference	What's <b>New</b>
<b>Tradational VS Backflush</b>	

**Answer**

**In the books of Dandia Ltd.**  
**Journal Entries (Traditional)**

Particulars	Dr. (₹)	Cr. (₹)
Material A/c... To, Accounts Payable (being purchase of raw materials)	Dr. 2,00,000	2,00,000
WIP A/c... To, Materials A/c (being materials issued to production)	Dr. 2,00,000	2,00,000
WIP A/c... To, Direct wages A/c (being direct labour cost incurred)	Dr. 36,000	36,000
Overhead Control A/c... To, Accounts Payable (being overhead cost incurred)	Dr. 3,00,000	3,00,000
WIP A/c... To, Overhead Control A/c (Being application of overhead)	Dr. 2,80,000	2,80,000
Finished Goods A/c... To, WIP A/c (Being completion of goods)	Dr. 5,16,000	5,16,000
Cost of Goods Sold A/c... To, Finished Goods (being cost of finished goods sold transferred)	Dr. 5,16,000	5,16,000
Cost of Goods Sold A/c... To, Overhead Control A/c (being variance is recognized)	Dr. 20,000	20,000

**In the books of Dandia Ltd.**  
**Journal Entries (Backflush)**

Particulars	Dr. (₹)	Cr. (₹)
Raw Material in Process A/c... To, Accounts Payable (being purchase of raw materials)	Dr. 2,00,000	2,00,000
Conversion Cost Control A/c... To, Direct wages Payable	Dr. 3,36,000	36,000

To, Accounts Payable (being overhead cost incurred)			3,00,000
Finished Goods A/c...	Dr.	5,16,000	
To, Raw Material in Process A/c			2,00,000
To, Conv Cost (Being completion of goods)			3,16,000
Cost of Goods Sold A/c...	Dr.	5,16,000	
To, Finished Goods (being cost of finished goods sold transferred)			5,16,000
COGS	Dr.	20,000	
To, Convirson Cost (being variance is recognized)			20,000

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