

ADVANCED MANAGEMENT ACCOUNTING - REVISION BOOK

How to effectively use this book:

- ❖ Revision book covers past 11 RTP and exams
- ❖ Past experience indicates that minimum 60 percent of marks are asked from the past RTP and exam questions
- ❖ **Stage One:** Please read the theory for every chapter. Theory coverage would be sufficient to cover all practical theory questions and the same can help in answering problems
- ❖ **Stage two:** Start solving problems from individual chapters after completing theory. Try solving the question and in case you are stuck then please refer the summary of adjustments section. Summary of adjustments section has the guidance to solve a question
- ❖ **Stage three:** In case you are still not able to solve the question then please refer institute RTP and suggested answer to understand the question
- ❖ **Revision day before exam:** Please revise theory and summary of adjustments day before exam as the same can help in answering wide variety of questions. Also you can effectively work on various adjustments by quickly revising summary of adjustments section.

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THEORY FOR SOLVING PROBLEMS**Decision-Making using cost concepts and CVP analysis****Introduction:**

- ❖ Relevant means pertinent to the decision at hand.
- ❖ Relevant costs are those expected future costs that are essential but differ for alternative courses of action
- ❖ Relevant cost is a future cost that would arise as a direct consequence of the decision under review

Rules of relevance:

- ❖ **Opportunity cost** refers to the value of sacrifice made or benefit of opportunity foregone by selecting one particular alternative in preference to the other alternative. **All opportunity costs are considered to be relevant costs.**
- ❖ **All variable costs are generally considered to be relevant** unless the costs do not vary between alternative courses of action.
- ❖ **All fixed costs are generally considered to be irrelevant** unless the costs vary between alternative courses of action.
- ❖ Sunk or historical costs are irrelevant

Committed fixed cost versus discretionary fixed cost:

- ❖ Committed fixed costs are those that arise from the possession of asset and are normally unaffected by any short-term changes in volume of production. Example: Rent of factory, Insurance. **Committed fixed costs are otherwise known as unavoidable fixed costs.**
- ❖ Discretionary fixed costs are incurred as result of management discretion/decision. Example: Advertising. **Discretionary fixed costs are otherwise known as avoidable fixed costs.**

Marginal Costing:

- ❖ Marginal costing is a technique of decision-making which involves
 - Ascertainment of total costs
 - Classification of costs into fixed and variable and
 - Use of such information for analysis and decision making
- ❖ Marginal costing is also known as CVP (cost volume profit) analysis as it seeks to measure the impact of change in volume on company's cost and profits

Types of costs:

- ❖ Variable cost is that portion of cost which **varies proportionately with volume**. Variable cost per unit remains constant and any change in variable cost is to be interpreted as change in variable cost per unit
- ❖ Fixed costs are costs which are assumed to **remain constant for a given period of time** irrespective of the change in output. Fixed cost per unit is inversely proportional to volume. Any change in fixed cost has to be interpreted as change in total fixed cost.
- ❖ Semi-variable costs are those costs that exhibit characteristics of fixed and variable costs. Semi-variable costs can be split into variable cost and fixed cost using the following formula:
 - Variable cost per unit = Change in cost / Change in units
 - Total fixed cost = Total cost – total variable cost

Format of marginal cost statement:

Particulars	Per Unit	Total
Sales	XXX	XXX
Less: Variable Costs	(XXX)	(XXX)
Contribution	XXX	XXX
Less: Fixed Costs		(XXX)
Profit		XXX

Note:

1. The profit of the company does not vary proportionately with the change in sales on account of fixed costs. Hence therefore **change in contribution = change in profit**.
2. The cost does not vary proportionately with volume because of existence of fixed costs. Hence **change in total cost = change in variable cost**

Profit-Volume Ratio (PVR):

- ❖ PVR measures the extent of change in contribution/profit on account of change in sales. Net profit ratio keeps on changing for different sale amounts whereas PVR is constant.
- ❖ PVR is the true indicator of the profitability of the product

PVR = Contribution / sales	PVR = Change in contribution / Change in sales
PVR = Contribution per unit / SP	PVR = Change in profit / change in sales

Break-even point (BEP):

- ❖ BEP refers to the sales level at which the company earns no profit and no loss. This can be either expressed in units or rupees.
- ❖ If expressed in units it is called BEP and if expressed in rupees it is called Break even sales.
- ❖ Moreover at BEP, contribution = fixed cost and sales = total cost

BEP in units = Fixed cost / Contribution per unit	BEP in Rs. = Fixed cost / PVR
BEP in Rupees = BEP in units * Selling Price	

Margin of safety (MOS):

- ❖ MOS is the difference between the actual sales and break even sales. It is the extent of allowable drop in sales before the company starts incurring losses
- ❖ MOS can be expressed in rupees or in units or as a percentage of total sales

MOS in units = Profit / Contribution per unit	MOS in Rs. = Profit/ PVR
MOS in Rupees = MOS in units * Selling Price	
Sales in rupees = BEP in rupees + MOS in rupees	

Sales to achieve desired profit and profit at desired sales level:

1. Sales to earn desired profit = $\frac{\text{Target Profit} + \text{Total fixed cost}}{\text{PVR}}$
2. Profit at sales level = (Sales * PVR) – Total fixed cost

Note: For BEP, MOS, Sales, the answer would be in rupees if the denominator is PVR and the answer would be in units if the denominator is contribution per unit

Break-even point for multiple products:

- ❖ BEP is computed using fixed cost and PVR/Contribution per unit. However in case of multiple products there will be multiple PVR/Contribution per unit
- ❖ BEP for multiple products (in units) = TFC/Contribution per set. It would be assumed that one set would contain the product mix as given in the question

- ❖ BEP for multiple products (in rupees) = TFC/Composite PVR. Composite PVR would be calculated as overall contribution/overall sales

Steps for solving multiple break-even point problems:

Step 1: Identify class intervals

A new class interval will emerge whenever there is a change in fixed cost or variable cost per unit or selling price for the additional units.

Class Interval	Selling Price	VC/unit	Cont./unit	Total fixed cost

Step 2: Calculate BEP using the following format:

Class Interval (CI)	Fixed cost of CI	FC recovery till previous CI	FC to be recovered	Contribution per unit	Units to be sold	Final BEP
Step 1	Step 1	Contribution earned till previous CI	Col 2 – Col 3	Step 1	Col 4 / Col 5	

BEP with semi-variable costs:

- ❖ Assume the Semi-variable cost as variable cost and calculate contribution per unit
- ❖ Use the contribution per unit and calculate tentative BEP
- ❖ Use the BEP format and calculate BEP for one range above tentative BEP and one range falling in tentative BEP.

Marginal costing and absorption costing:

- ❖ Marginal costing and absorption costing are the two properly used methods of computing profits
- ❖ Marginal costing consider only variable manufacturing costs for stock valuation whereas absorption costing consider both variable and fixed manufacturing costs for valuing inventory

Profit statement under absorption costing:

Particulars	Calculation	Amount
Variable manufacturing costs	Units produced * Cost per unit	XXX
Fixed manufacturing costs (absorbed)	Units produced * OAR	XXX
Cost of production		XXX
Add: Opening FG	Units * Cost per unit	XXX
Less: Closing FG	Units * Cost per unit	(XXX)
Cost of goods sold		XXX
Variable non-manufacturing costs	Units sold * Cost per unit	XXX
Fixed non-manufacturing costs		XXX
Cost of sales		XXX
Add/Less: Under/over absorbed overheads		XXX
Revised cost of sales		XXX
Profit (Balancing figure)		XXX
Sales		XXX

Profit statement under marginal costing:

Particulars	Calculation	Amount
Sales	Units sold * Selling Price	XXX
Less: Variable costs	Note 1	(XXX)
Contribution		XXX
Less: Fixed costs	Fixed manufacturing + fixed non-manufacturing costs	XXX
Profit		XXX

Note 1: Calculation of variable costs:

Particulars	Calculation	Amount
Variable manufacturing costs	Units produced * Cost per unit	XXX
Add: Opening FG	Units * Cost per unit	XXX
Less: Closing FG	Units * Cost per unit	(XXX)
Variable cost of goods sold		XXX
Add: Variable non-manufacturing costs	Units sold * Cost per unit	XXX
Total costs		XXX

Reconciliation of profits:

- ❖ Profits as per marginal costing and absorption costing statement will be different due to different base for valuation of inventory
- ❖ Profit reconciliation under both methods can be done with the help of following format:

Particulars	Amount
Profit as per marginal costing	XXX
Add: Excess valuation of closing stock in absorption costing	XXX
Less: Excess valuation of opening stock in absorption costing	(XXX)
Profit as per absorption costing	XXX

BEP under marginal and absorption costing:

1. BEP under Marginal costing = $\text{TFC} / \text{Contribution per unit}$
2. However BEP under absorption costing cannot be $\text{TFC} / \text{Contribution per unit}$ on account of existence of stocks as some portion of fixed costs would be recovered in the next year with stocks absorbing a certain part of fixed costs.
3. BEP under absorption costing
 - a. When stock info is given = $\frac{\text{TFC} - \text{Fixed cost inside net stock (Note 1)}}{\text{Contribution per unit}}$
 - b. When production is given = $\frac{\text{TFC} - \{ \frac{\text{FMOH}}{\text{Normal Production}} * \text{Units produced} \}}{\text{SP} - \text{VC} - \{ \frac{\text{FMOH}}{\text{Normal production}} \}}$

Note 1: If the net stock is opening then add the fixed cost in the net stock to the total fixed cost

Indifference point:

1. In case of two different alternatives indifference point refers to a level wherein the two alternative decisions would provide the same result
2. For level below the indifference point, the alternative with lower fixed cost is preferable and for level above the indifference point, the alternative with higher fixed cost is preferable
3. Indifference point = $\frac{\text{Difference in Fixed costs}}{\text{Difference in VC per unit or difference in VCR or difference in PVR}}$

Shut-down point:

1. In case of adverse economic conditions a company might have to make a decision on whether to continue their business or temporarily shut the business unless the demand revives
2. Shut-down point (in units) =
$$\frac{\text{Normal Fixed costs} - (\text{FC during shutdown} + \text{Add. FC for shutdown})}{\text{Contribution per unit}}$$
3. Shut-down point (in Rs.) = Same Numerator / PVR
4. If the expected sales volume is less than the shutdown point then the company should close their business or else continue producing

Limiting factor:

1. Limiting factor is one which acts as a bottleneck and limits the company's ability to serve the demand of the external market
2. Limiting factor is a situation where in the demand for the limiting factor is always greater than the supply for the limiting factor

Steps for solving Limiting factor problems:

1. Identify the limiting factor – Limiting factor is one whose demand is more than supply
2. Calculate the contribution per unit of limiting factor and rank the products with maximum contribution being top ranked product

Particulars	Product A	Product B	Product C
Selling Price	XXX	XXX	XXX
Less: Variable cost	(XXX)	(XXX)	(XXX)
Contribution per unit (A)	XXX	XXX	XXX
No. of limiting factors required per unit (B)	XXX	XXX	XXX
Contribution per unit of limiting factor (A/B)	XXX	XXX	XXX
Rank	XXX	XXX	XXX

3. Use the following format for allocation of resources:

Product	No. of units	Units of limiting factor per unit	Limiting factor consumed	Total contribution

Concept: Make or Buy Decisions and Subcontracting decisions

1. A company on account of capacity constraints would not be able to meet the full demands of the external customers. Hence it becomes imminent for the companies to go for either subcontracting or buying the products from outside.
2. **Make or buy decision:** The Company should compare the purchase cost of a product with the variable costs of production and not the total costs of manufacture. If the variable cost of production is more than the purchase cost then the company should buy the product or else make it in house.
3. **Subcontracting decision:** We should compare the variable cost of production with the subcontracting cost and make the decision on the subcontracting. If the variable cost of production is more than the subcontracting cost then the company should subcontract the part or else make it in house
4. In order to solve these type of problems prepare statement of comparative cost showing manufacturing cost and purchase cost. (Only the relevant costs should be mentioned in these statements)

Limiting factor in subcontracting decision or make vs. buy decision:

Particulars	A	B	C	D
Variable Manufacturing cost				
Less: Purchase cost				
Saving in manufacturing (A)				
Units of limiting factor per unit (B)				
Saving per unit of limiting factor (A/B)				
Ranking				

Pricing decisions:

- Optimum price is the one that yields the maximum profits for the company.
- Practically companies in order to increase the sales of the product, they have to resort to reduction in selling price. Hence companies should find out the optimum price where the company derives **maximum profits and not maximum sales.**
- Pure competition:** Under pure competition a firm has no pricing policy of its own as it has to accept the prevalent market price and at this price, it can sell all of its production if it so desires. But at any higher price it can sell nothing. The firm can continue to produce so long as its marginal cost is less than or equal to its selling price.
- Monopoly:** The Company is a single seller and fix the price in a way to derive maximum profits. **Herein the company is a price maker and not a price taker.**
- Cost plus method:** The cost plus pricing method though common is not the best method because it ignores demand and fails to adequately reflect competition.
- Monopolistic competition:** Under monopolistic condition, consumers may buy more at a lower price than at higher price. The profit can be maximized by equating marginal revenue with marginal cost and the company should sell additional products as long as the marginal revenue is more than the marginal cost.
- Oligopoly:** If in a market there are a few large sellers occupying a major share of the market, the situation is called oligopoly. Under this situation the pricing is largely dependent on the pricing of the competitors.
- Advantages and disadvantages of cost plus method:**
 - Advantages:
 - Fair method
 - Assured profit
 - Reduced risks and uncertainties
 - Considers market factors
 - Disadvantages:
 - Ignores demand
 - Ignores competition
 - Arbitrary cost allocation
 - Ignores opportunity cost
 - Price - volume relationships
- Rate of return pricing:** Under this method the company instead of adding a margin based on cost, fixes the price in order to earn the required return on the investments. The required return is based on the industry and the risks involved in the industry.
- Variable costs pricing:** Since allocation of overheads is on arbitrary basis, some companies consider only variable costs for arriving at the pricing and determine the markup to cover fixed costs and the profit.
- Competitive pricing:** When a company sets up its price based on what the competitors are charging, its pricing policy under such a situation is called

- competitive pricing. Here the company **changes the price based on what the price change by the competitors** and not based on the change in cost of production.
12. **Going rate pricing:** Under going rate pricing the firm tries to keep its price at the average level charged by the industry. It provides a fair return to the company and is least disruptive to the industry's harmony.
 13. **Sealed bid pricing:** Competitive pricing also dominates in those situations where firms compete on the basis of bids, such as original equipment manufacturer and defense contract work. The bid is the firm's offer price, and it is a prime example of pricing based on expectations of how competitors will price rather than on a rigid relation based on the concern's own costs or demand.
 14. **Incremental pricing:** Incremental pricing is a method wherein the company compares the incremental revenues with incremental costs in order to decide whether the company should change its price.
 15. **Market-entry strategies:** Skimming pricing and Penetration pricing
 16. **Skimming pricing:** It is a policy of high prices during the early period of a product's existence. This can be synchronized with high promotional expenditure and in the later years the prices can be gradually reduced.
 17. **Penetration pricing:** This policy is in favor of using a low price as the principal instrument for penetrating mass markets early. It is opposite to skimming price. The low price policy is introduced for the sake of long-term survival and profitability and hence it has to receive careful consideration before implementation.

Note:

- ❖ If a product is newly introduced into the market then the price of the product should be at least equal to its variable cost. This is in line with penetration strategy
- ❖ If a product is well established in the market then it should cover all costs. Hence the minimum price of the product should at least be equal to total cost

Pareto Analysis or ABC Analysis:

- ❖ Pareto analysis is a rule that recommends focus on the most important aspects of decision making, in order to simplify the process of decision making
- ❖ It is based on 80:20 which indicates that 80 percent of results can be achieved by focusing on 20 percent of the constraints

Steps:

- ❖ Arrange the various products/items in the descending order of value
- ❖ Compute cumulative value and cumulative value as percentage of total value for various products
- ❖ Prepare a stacked column chart to reflect the contribution of the various items to total value

Marginal revenue and marginal cost:

- ❖ Profit is said to be maximum at a level where marginal revenue is equal to marginal cost
- ❖ The basic price equation, which is used to determine the price where profit is maximum is as below

Price = $a - bQ$
Where a = Price at which demand is zero
b = Slope of demand curve ; b = Change in price / Change in quantity
Q = Quantity demanded
Marginal Revenue = $a - 2bQ$

Standard Costing:**Introduction:**

1. Standard costing system reconciles budgeted profit and actual profit
2. Standard costing is also known as variance analysis because it analyzes the cost and sales variances into various components and fixes up the responsibility for variances
3. The variance is analyzed as:
 - a. Sales Variances
 - b. Cost variances
 - i. Material cost variances
 - ii. Labour cost variances
 - iii. Overhead cost variances
 1. Variable overhead variances
 2. Fixed Overhead Variances
4. If a variance increases actual profit it is called "favorable" (F) and if it decreases actual profits it is called "adverse" (A)

Understanding different costs:

1. Budgeted cost refers to the cost to be incurred for the budgeted output
2. Standard cost refers to the allowable cost for the actual output. In short standard cost is nothing but budgeted cost flexed to actual output.
3. Actual cost refers to the cost incurred by the company in producing the output
4. Cost variance is the difference between standard cost and actual cost and not the budgeted and actual cost

Fill the following:

Budgeted output = 20000 units Standard cost p.u = 20 Actual output = 12000 units and Actual cost = 2,88,000

1. Budgeted cost =
2. Actual cost =
3. Standard cost =
4. Cost variance =

Material Variances:

1. In order to compute the material variances we require the following information
 - a. Standard Quantity – This is the budgeted quantity flexed for actual output
 - b. Revised standard quantity – This is the total of the actual quantity apportioned in the standard mix. This is applicable only when there is more than one material
 - c. Actual quantity – Actual quantity used and this is normally directly given in the problem
 - d. Standard price – This is the budgeted price to be paid for procuring the material
 - e. Actual price – This refers to the actual price paid for procuring the raw materials

2. The objective of variance analysis is to fix responsibility and take corrective action wherever required. They are attention seekers rather than the problem solvers
3. Material variances compute the difference between the standard material cost and the actual material cost and fix the responsibility for the variances. The variance can either occur on account of quantity or price variances

Computation table for Material Variances calculation:

SP * SQ	SP * RSQ	SP * AQ	AP * AQ
Standard material cost			Actual Material cost

Note: In case there is only one material SP* RSQ is not to be computed as there cannot be mix variance and the variance computed are only cost, price and usage variance

Types of problems under material variances:

- Single material
- Multiple material

Labour Variances:

1. In order to compute the labour variances we require the following information
 - a. Standard Hours – This is the budgeted hours flexed for actual output
 - b. Revised standard hours – This is the total of the actual hours worked (**not actual hours paid**) apportioned in the standard mix. This is applicable only when there is more than one grade of labour
 - c. Actual hours worked – This refers to the number of hours actually worked.
AHW = Actual hours paid – Idle time
 - d. Actual Hours paid – This refers to the number of hours for which the company is paying. Actual hours worked and actual hours paid are different only when there is idle time because idle time refer to hours paid but not worked
 - e. Standard rate – This is the budgeted rate to be paid to the labour
 - f. Actual rate – This refers to the actual rate paid for using the labour
2. Labour variances compute the difference between the standard labour cost and the actual labour cost and fix the responsibility for the variances. The variance can either occur on account of efficiency or rate variances

Computation table for labour Variances:

SR * SH	SR * RSH	SR * AHW	SR * AHP	AR * AHP
Standard labour cost				Actual labour cost

Types of problems under labour variances:

- Single labour without idle time (Column 2 & Column 4 are not applicable)
- Single labour with idle time (Column 2 is not applicable)
- Multiple labour without idle time (Column 4 is not applicable)

- Multiple labour with idle time (All columns are applicable)

Variable overhead Variances:

1. In order to compute the Variable OH variances we require the following information
 - a. Standard Hours – This is the budgeted hours flexed for actual output
 - b. Actual Hours– This refers to the number of hours actually worked. It does not include idle time as it is assumed that the company does not incur variable overheads during idle time
 - c. Standard rate per hour – This is the budgeted rate to be incurred every hour and is calculated by dividing the budgeted hours from budgeted variable overheads. {SR. per hour = Budgeted VOH / BH}
 - d. Actual rate per hour – This refers to the actual rate incurred on variable overheads
2. VOH variances compute the difference between the standard VOH cost and the actual VOH cost and fix the responsibility for the variances. The variance can either occur on account of efficiency or rate variances

Computation table for VOH Variances:

SR * SH	SR * AH	AR * AH
Standard VOH cost		Actual VOH Cost

Conversion factor when information on output is given but hours not directly available:

- $SR/\text{per hour} * SH = SR/\text{per unit} * AO$
- $SR/\text{per hour} * AH = SR/\text{per unit} * SO$

Note:

- $SR/\text{per unit} = \text{Budgeted VOH} / \text{Budgeted units}$
- **Logic behind conversion:** The standard hours are always calculated with the help of the actual output and hence they standard hours are equated to actual output.

Fixed overhead Variances:

1. In order to compute the Fixed OH variances we require the following information
 - a. Actual output or standard hours
 - b. Actual Hours or standard output
 - c. Standard rate per hour – This is the budgeted rate to be incurred every hour and is calculated by dividing the budgeted hours from budgeted variable overheads. {SR. per hour = Budgeted FOH / BH}
 - d. Actual rate per hour – This refers to the actual rate incurred on fixed overheads
 - e. Possible FOH = BFOH * AD/BD

Computation table for FOH Variances:

AO * SR	AFOH	BFOH	AH * SR	PFOH
FOH absorbed	FOH incurred			

FOH ratios:

1. Volume or activity ratio = Standard hours / Budgeted hours * 100
2. Efficiency ratio = Standard hours / actual hours * 100
3. Capacity ratio = Actual hours / Possible hours * 100
4. Calendar ratio = Possible hours / Budgeted hours * 100

Sales Variances:

1. In order to compute the sales variances we require the following information
 - a. Budgeted Quantity – This is the budgeted quantity expected to be sold at the beginning of the period
 - b. Revised budgeted quantity – This is the total of the actual quantity apportioned in the standard mix. This is applicable only when there is more than one material
 - c. Actual quantity – Actual quantity sold and this is normally directly given in the problem
 - d. Budgeted price – This is the price at which the product was expected to be sold at the beginning of the period
 - e. Actual price – This refers to the price at which the products are actually sold.

Computation table for Sales Variances calculation:

BP * BQ	BP * RBQ	BP * AQ	AP * AQ
Budgeted sales			Actual sales

Note: In case there is only one material BP* RBQ is not to be computed as there cannot be mix variance and the variance computed are only total sales, price and volume variance

Margin approach:

The above indicated method is called as total approach which finds out the impact on the topline and margin approach is used to find the impact on the bottom-line. Here BP is replaced with BM and AP is replaced with AM and the calculation for BM and AM is provided below:

- Absorption costing: BM = SP-SC & AM = AP – SC (not actual cost)
- Marginal costing: BM = SP-SVC & AM = AP-SVC (not actual VC)

Marginal Costing vs. absorption costing:

1. Stocks are valued at cost and those costs that are considered for stock valuation are called product costs and others are called period costs.
2. Period costs expires fully in the current accounting period whereas product cost expires only to the extent of COGS; and remains unexpired to the extent of closing stock (i.e.) credited in this year's account and carried forward to the next year
3. All non-manufacturing costs are period costs and in marginal costing system fixed manufacturing costs is also called period costs.
4. In Marginal costing system stock is valued at variable manufacturing cost whereas in absorption costing system, stock is valued at full manufacturing cost (including fixed manufacturing cost)

5. For calculating fixed cost per unit absorption costing system uses pre-determined rates or standard rates. Pre-determined rate / unit = BFO/BO. For denominator consider normal activity or capacity. In absence of details use 100% capacity as denominator
6. Due to use of pre-determined rates the fixed OH charged to cost or production will be AO*SR. This is called absorbed OH.
7. When the actual OH is different from absorbed OH we would have under/over absorption which needs to be adjusted while calculating absorption costing profit.
8. In absence of info we can assume BFOH to be same as AFOH.

Income statement under marginal costing:

Particulars	Amount
Sales	XXX
Less: Variable manufacturing cost of goods sold:	
- Opening stock (VMC) XXX	
- Add: Variable cost of production XXX	
- Less: Closing stock (VMC) (XXX)	(XXX)
Gross contribution	XXX
Less: Variable administration and selling OH	(XXX)
Contribution	XXX
Less: Fixed manufacturing, admin & selling exp	(XXX)
Profit	XXX

Income statement under absorption costing:

Particulars	Amount
Sales	XXX
Less: COGS	
- Opening stock (FMC) XXX	
- Add: Cost of production XXX	
- Less: Closing stock (FMC) (XXX)	(XXX)
Gross Profit	XXX
Less: Admin & selling exp	(XXX)
Less: Under/over absorption of OH	(XXX)
Profit	XXX

Reconciliation:

1. Reconciliation statement is prepared in order to reconcile the budgeted profit as against the actual profit earned by the company
2. Following are the various approaches for profit reconciliation:
 - a. Budgeted profit to actual profit – Absorption costing system
 - b. Standard profit to actual profit – Absorption costing system
 - c. Budgeted profit to actual profit – Marginal costing system
 - d. Standard profit to actual profit – Marginal costing system

Reconciliation statement under various approaches:

Budgeted profit to actual profit - Absorption costing system

<u>Particulars</u>	<u>Amount</u> <u>Favorable variance</u>	<u>Amount</u> <u>Adverse variance</u>	<u>Amount</u>
Budgeted profit			XXX
Material price variance	XXX	XXX	
Material mix variance	XXX	XXX	
Material yield variance	XXX	XXX	
Labour rate variance	XXX	XXX	
Labour mix variance	XXX	XXX	
Labour revised eff. Variance	XXX	XXX	
VO Expenditure variance	XXX	XXX	
VO Efficiency variance	XXX	XXX	
FO Expenditure variance	XXX	XXX	
FO Capacity variance	XXX	XXX	
FO calendar variance	XXX	XXX	
FO Efficiency variance	XXX	XXX	
Sales Margin price variance	XXX	XXX	
Sales Margin qty variance	XXX	XXX	
Sales Margin mix variance	XXX	XXX	
Actual profit			XXX

Standard profit to actual profit - Absorption costing system

<u>Particulars</u>	<u>Amount</u> <u>Favorable variance</u>	<u>Amount</u> <u>Adverse variance</u>	<u>Amount</u>
Budgeted profit			XXX
Less: Sales volume variance			XXX
Standard profit			XXX
Material price variance	XXX	XXX	
Material mix variance	XXX	XXX	
Material yield variance	XXX	XXX	
Labour rate variance	XXX	XXX	
Labour mix variance	XXX	XXX	
Labour revised eff. Variance	XXX	XXX	
VO Expenditure variance	XXX	XXX	
VO Efficiency variance	XXX	XXX	
FO Expenditure variance	XXX	XXX	
FO Capacity variance	XXX	XXX	
FO calendar variance	XXX	XXX	
FO Efficiency variance	XXX	XXX	
Sales Margin price variance	XXX	XXX	
Sales Margin qty variance	NA	NA	
Sales Margin mix variance	NA	NA	
Actual profit			XXX

Budgeted profit to actual profit - Marginal costing system

<u>Particulars</u>	<u>Amount</u> <u>Favorable variance</u>	<u>Amount</u> <u>Adverse variance</u>	<u>Amount</u>
Budgeted profit			XXX
Material price variance	XXX	XXX	
Material mix variance	XXX	XXX	

Material yield variance	XXX	XXX	
Labour rate variance	XXX	XXX	
Labour mix variance	XXX	XXX	
Labour revised eff. Variance	XXX	XXX	
VO Expenditure variance	XXX	XXX	
VO Efficiency variance	XXX	XXX	
FO Expenditure variance	XXX	XXX	
FO Capacity variance	NA	NA	
FO calendar variance	NA	NA	
FO Efficiency variance	NA	NA	
Sales Margin price variance	XXX	XXX	
Sales Margin qty variance	XXX	XXX	
Sales Margin mix variance	XXX	XXX	
Actual profit			XXX

Standard profit to actual profit - Marginal costing system

<u>Particulars</u>	<u>Amount</u> <u>Favorable variance</u>	<u>Amount</u> <u>Adverse variance</u>	<u>Amount</u>
Budgeted profit			XXX
Less: Sales volume variance			XXX
Standard profit			XXX
Material price variance	XXX	XXX	
Material mix variance	XXX	XXX	
Material yield variance	XXX	XXX	
Labour rate variance	XXX	XXX	
Labour mix variance	XXX	XXX	
Labour revised eff. Variance	XXX	XXX	
VO Expenditure variance	XXX	XXX	
VO Efficiency variance	XXX	XXX	
FO Expenditure variance	XXX	XXX	
FO Capacity variance	NA	NA	
FO calendar variance	NA	NA	
FO Efficiency variance	NA	NA	
Sales Margin price variance	XXX	XXX	
Sales Margin qty variance	NA	NA	
Sales Margin mix variance	NA	NA	
Actual profit			XXX

Few equations between various variances:

1. **Absorption costing approach:** Sales Margin volume variance = Total sales volume variance * NP Ratio
2. **Marginal costing approach:** Sales margin volume variance = Total sales volume variance * PVR
3. **Marginal costing approach:** Sales margin volume variance = Sales margin volume variance under absorption costing + FOH Volume variance
4. Budgeted profit under absorption costing = Budgeted units * Budgeted profit per unit
5. Standard profit under absorption costing = Actual units * Budgeted profit per unit

6. Budgeted profit under marginal costing = Budgeted units * Budgeted cont. per unit – Budgeted Fixed Overheads
7. Standard profit under marginal costing = Actual units * Budgeted cont. per unit – Budgeted Fixed overheads

Partial plan vs. single plan of recognizing variances:

Partial Plan	Single Plan
Raw material stock valued at actual cost and WIP and FG valued at standard cost	All the 3 stocks are valued at standard cost
WIP account debited with actual cost	WIP account debited with standard cost
All variances originate from WIP accounts	All variances originate from their respective accounts
Material price variance computed at the time of consumptions	Material purchase price variance computed at the time of purchase
AQ for price variance means AQ consumed	AQ for price variance means AQ purchased

Single Plan and partial plan accounting:

- In partial plan accounting the WIP is first debited with actual cost and thereafter the variance are debited or credited. When the variances are adjusted the WIP value is brought to the standard cost.
- In single plan accounting the WIP is debited with the standard cost and the variances are adjusted in the respective ledger accounts.

Journal Entries (all entries are made assuming adverse variances. In case the variance is favorable then it will be the reverse entry)

Transaction	Single	Partial
Purchase of RM	RM Control A/c MPV A/c To GL Adjustment A/c	RM Control A/c To GL Adjustment A/c
Issue of raw material to stores	WIP Control A/c MUV A/c To RM Control A/c	WIP Control A/c To RM Control A/c
Recognition of MPV and MUV	Already recognized	MPV A/c MUV A/c To WIP Control A/c
Disposal of MPV and MUV	Costing P & L A/c To MPV A/c To MUV A/c	Costing P & L A/c To MPV A/c To MUV A/c
Payment of wages	Wages control A/c LRV A/c To GL Adjustment A/c	Wages control A/c To GL Adjustment A/c
Transfer of wages to WIP	WIP Control A/c LEV A/c To Wages Control A/c	WIP Control A/c To Wages Control A/c

Transaction	Single	Partial
Recognition of LRV and LEV	Already recognized	LRV A/c LEV A/c To WIP Control A/c
Disposal of LRV and LEV	Costing P& L A/c To LRV A/c To LEV A/c	Costing P& L A/c To LRV A/c To LEV A/c

Note: Similar entries are to be recorded for overheads

Planning and operating variances:

1. When the scenario at the time of implementing the budget has drastically changed as compared to the prevailing during budget preparation to properly measure the performance, the company should revise the budget.
2. The difference between the original and revised budget is called as PLANNING variances and the difference between the revised and actual is called as OPERATING variances.
3. The responsibility should be fixed only for the operating variances.
4. While calculating planning variances, standard means original budget and actual means revised budget; For operating variances standard means revised budget and actual means actual performances

Market size and share variance:

1. Market size variance measures the impact on the quantity sold due to change in the market size. It is similar to planning variance.
2. Market share variance measures the impact on the quantity sold due to change in the company's share in the overall market. It is similar to operating variance

Transfer pricing:

1. Division X manufactures an intermediate product and transfers to Division Y which further processes the product and sells it as finished product
2. Division X is the supplying division and Division Y is the receiving division. Basically the receiving division is the profit centre and the supplying division is the cost centre
3. Company for the purpose of performance evaluation may treat the supplying division also as profit centre, by making inter division transfer as sales. The price at which the intermediate product is transferred is called as transfer price.
4. Transfer price is the selling price for supplying division and purchase cost for receiving division and it is neither for the company
5. Transfer price affects divisional profits but prima facie doesn't affect company's profits

Fixation of transfer price:

Transfer price should be one which should enable both the divisions operate at the optimum level. If the divisions operate at different levels then there is goal conflict and

organization makes loss.

Identification of the optimum level:

Units	Revenue	Further Processing cost	Net revenue	Net Marginal revenue	Marginal cost
	Units*SP	Additional processing cost in receiving division	Column 2 - column 3	Additional revenue by moving from one level to next level	Processing cost in supplying division

Transfer price range when the supplying division cost is variable:

- Minimum transfer price = VC of intermediate product in supplying division
- Maximum transfer price = (NMR at optimum output level) / (optimum output level - level before optimum output level)

Transfer price range when the supplying division cost is marginal:

In case the cost of the supplying division is marginal and not variable the TP fixation is done as under:

Maximum TP for receiving division:

- Maximum transfer price = (NMR at optimum output level) / (optimum output level - level before optimum output level)

Minimum TP for supplying division:

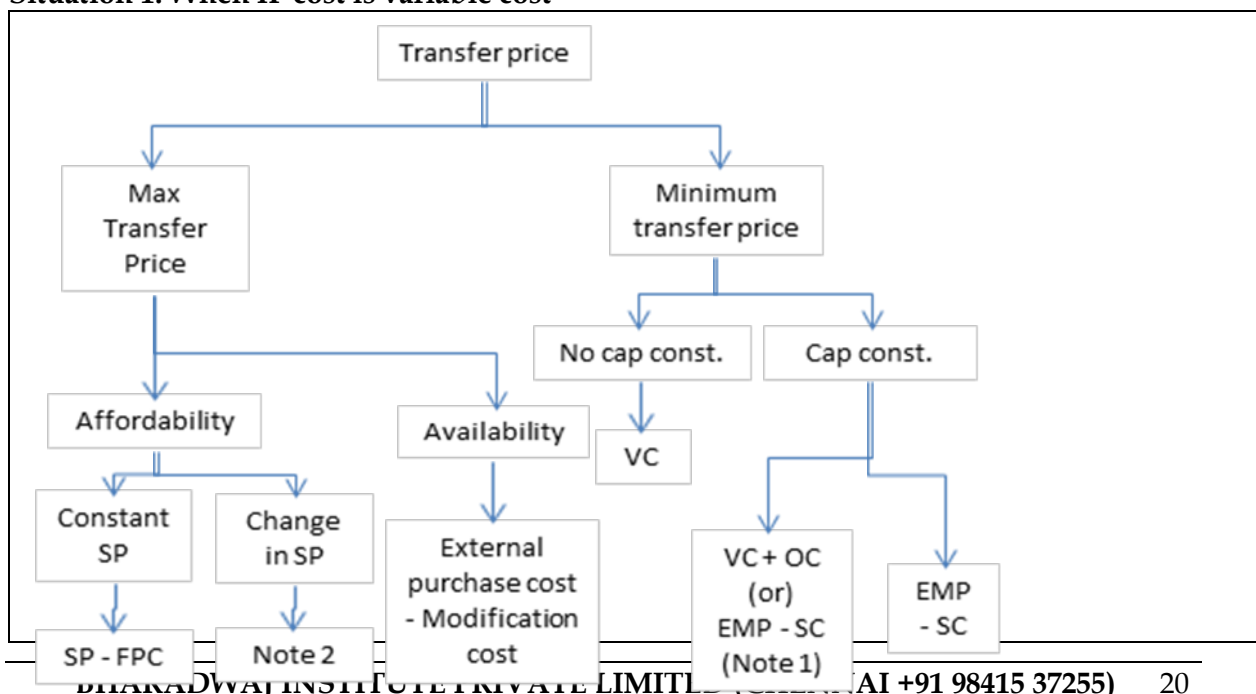
- Minimum transfer price = (MC at optimum output level) / (optimum output level - level before optimum output level)

Transfer price fixation when there is an alternative:

Whenever there is an alternative for the intermediate product then the transfer price is the opportunity cost from the next best alternative.

Transfer price summary:

Situation 1: When IP cost is variable cost



Notes:

1. When alternative use and external market exists then select highest of the two
2. $\text{Max Transfer Price} = \text{NMR at optimum level} / (\text{Opt. output} - \text{level before optimum output})$
3. When question has data for both affordability and availability then select lowest of the two and fix the maximum transfer price
4. If the minimum transfer price exceeds the affordability then do not transfer because the final product is infeasible economically
5. If minimum transfer price exceeds the availability then do not transfer because it is better for the company to purchase intermediate product externally and also use supplying division's capacity for external sales or alternate use.

Situation 2: When IP cost is marginal:

1. In this scenario we should calculate minimum price for supplying division and maximum price for the receiving division and then merge them together to arrive at the narrow range
2. In addition to this if we have external sales for Intermediate product whose price is elastic to demand. In such case we use tick technique to arrive at the optimum output and then fix narrow range.

Activity Based Costing:

Cost Object: It is an item for which cost measurement is required e.g. a product, a job or a customer.

Cost Driver: It is the factor that causes a change in the cost of an activity. Instead of using the term 'allocation bases' or 'overhead allocation rates' the term cost driver is used in ABC system. They are classified into:

- **Resource Cost Driver:** It is a measure of the quantity of resource consumed by activity. It is used to assign the cost of a resource to an activity or cost pool. An example of a resource cost driver is the percentage of total square feet occupied by an activity. This factor is used to allocate a portion of the cost of operating the facilities to the activity.
- **Activity Cost Driver:** It is a measure of the frequency and intensity of demand, placed on activities by cost objects. It is used to assign activity costs to cost objects. Activity cost drivers can be transaction drivers (e.g. No. of purchase orders processed, no. of customer orders processed, etc.) as well as duration drivers (it represent amount of time required to perform an activity e.g. Setup hours, inspection hours, etc.).

Activities: Activities comprise of units of work or tasks. For example, purchase of materials is an activity consisting a series of tasks like purchase requisition, advertisement inviting quotations, identification of suppliers, placement of purchase order, follow-up etc.

Application Theory - Types of Activities: Activities basically fall into four

different categories, known as the manufacturing cost hierarchy. These categories were first identified by Cooper in 1990 and help to determine the type of activity cost driver required. The categories are:

- (i) Unit level activities: These are activities for which the consumption of resources can be identified with the number of units produced. E.g. Use of indirect materials, Inspection or testing of every item produced or say every 100th item produced, Indirect consumables, etc.
- (ii) Batch level activities: The costs of some activities (mainly manufacturing support activities) are driven by the number of batches of units produced. These are activities related to setting up of a batch or a production run. The costs of such activities vary with the number of batches made, but is fixed for all units within that batch. E.g. Production scheduling, Material movement, Machine set up costs, Inspection of products – like first item of every batch, etc.
- (iii) Product level activities: The costs of some activities (often once only activities) are driven by the creation of a new product line and its maintenance. These are activities performed to support different products in the product line. E.g. Designing the product, Producing parts to a certain specification, Advertising costs, if advertisement is for individual products, etc.
- (iv) Facility level activities: These are activities necessary for sustaining the manufacturing process and cannot be directly attributed to individual products. E.g. Maintenance of buildings, Plant security, Production manager's salaries, Advertising campaigns promoting the co., etc.

Application Theory – Value and Non-value added activities:

Value-added activities (VA) : The value-added activities are those activities which are necessary for the performance of the process. Such activities represents work that is valued by the external or internal customer. The customers are usually willing to pay (in some way) for the service. For example polishing a furniture by a manufacturer dealing in furniture is value added activity.

Non-value-added activities (NVA) : The NVA activity represents work that is not valued by the external or internal customer. NVA activities do not improve the quality or function of a product or service, but they can adversely affect costs and prices. Non-value added activities create waste, result in delay of some sort, add costs to the products or services and for which the customer is not willing to pay. Moving materials and machine set up for a production run are examples of NVA activities. For example, in the Internal Revenue Service department, rerouting documents and the wait or delay time in completing a case are examples of NVA activities in the “installment agreements” area. The preparation of tax returns and other compliance work by organisations do not directly benefit the customers of their products and services, but because they are required by law. They are not considered NVA activities.

Basic understanding of ABC System:

In an ABC system the costs are initially allocated to the various activities and thereafter based on activity cost drivers the same are allocated to the cost objects.

For example: Rent of the factory would be allocated to the various activities such as stores department, purchasing department etc. Thereafter the stores department costs would get allocated to the various products (Cost objects) based on the number of stores requisition of each of the materials handled.

ABC System vs Traditional system:

Example: A company incurs total overheads of Rs.2,00,000 and manufacture two products A and B. The total machine hours used by A are 5000 and by B is 15000 hours.

Traditional system:

In the traditional system the costs are allocated based on machine hours and a total of Rs.50000 and Rs.150000 is allocated for product A and B respectively.

ABC System:

In the ABC system the total overheads are subdivided into various major activities and based on the cost driver the costs are allocated to the products.

The amount of Rs.2,00,000 can be divided into the following in an ABC System:

- Machine running activity : Rs.1,20,000 ~ Allocated based on machine hours
- Machine set up costs : Rs.40,000 ~ Allocated based on setup hours ; Machine setup hours for A was 4000 and for B was 1000
- Inspection costs of Rs.40,000 ~ Allocated based on inspection time ; Inspection time for A was 2000 hours and for B was 3000 hours.

Step 1: Calculation of cost driver rate:

Activity	Total cost	Cost driver name	Cost driver quantity	Cost driver rate
Machine Running	1,20,000	Machine hours	20000 hours	Rs.6
Machine setup	40000	Setup time	5000 hours	Rs.8
Inspection costs	40000	Inspection time	5000 hours	Rs.8

Step 2: Apportionment of OH

Activity	Product A		Product B	
	CDQ	Amount	CDQ	Amount
Machine Running	5000	30000	15000	90000
Set-up	4000	32000	1000	8000
Inspection time	2000	16000	3000	24000
Total OH allocated		78000		120000

Total Quality Management

TQM is defined as a set of concepts and tools for getting all employees focused on continuous improvement in the eyes of the customer. Quality is an important aspect of world-class manufacturing. The success of Japanese companies is grass rooted in their long-term commitment to improvement of quality. A world class manufacturing approach demands that the quality must be designed into product and the production process, rather than an attempt to remove poor quality by inspection.

Application Theory:Components of cost to be reported in a Cost of Quality Report

1. **Prevention Costs:** These are incurred in preventing the production of products that do not conform to specification. They include the costs of preventive maintenance, quality planning and training and the extra costs of acquiring higher quality.
2. **Appraisal Costs:** These are incurred to ensure that materials and product meet quality performance standards. They include the costs of inspecting purchased parts, work in process and finished goods, quality audits and field test.
3. **Internal Failure Costs:** These are associated materials and products that fail to meet quality standards. They include costs incurred before the product is dispatched to the customer, such as the costs of scrap, repair, downtime and work stoppages caused by defects.
4. **External failure Costs:** These are incurred when inferior products are delivered to customers. They include the cost of handling customer complaints, warranty replacement, repairs of returned products and the costs arising from a damaged company reputation.

Note: Prevention and appraisal cost are called Costs of Quality Compliance while Internal and costs are called Costs of Non-compliance.

Target costing

Target Costing is defined as “a structured approach to determine 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”

Steps in Target costing:

1. **Setting of target selling price:** The setting of target selling price of a product which customers are prepared to pay, depend on many factors like design specifications of the product, competitive conditions, customer's demand for increased functionality and higher quality projected production volume, sales forecasts etc. A concern can set its target selling price after taking into account all of the aforesaid factors.
2. **Determination of target costs:** Target profit margin may be established after taking into account long-term profit objectives and projected volume of sales. On deducing target profit margin from target selling price, target cost is determined.
3. **Estimate the actual cost of the product:** Actual cost of the product may be determined after taking into account the design specifications, material cost

and other costs required to produce the product.

4. **Comparison of estimated cost with actual cost:** In case the estimated cost of the product is higher than that of the target cost of the product then the concern should resort to cost reduction methods involving the use of Value Engineering / Value Analysis tools.

Life cycle costing

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. 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 may be 7 to 10 years. In case of cameras, photocopying machines etc. the life is more than 100 years.

Phases in product life cycle

The four identifiable phases in the Product Life Cycle are (a) introduction (b) Growth (c) Maturity and (d) Decline.

LIFE CYCLE COSTING

As per CIMA, Life-Cycle Costing (also known as Whole Life Costing) is the practice of obtaining over their life- times, the best use of physical asset at the lowest total cost to the entity.

Life Cycle Costing technique is particularly important when:

- (a) High percentage of total life-cycle costs are incurred before production begins and revenue are earned over several years and
- (b) High fraction of the life cycle costs are locked in at the R & D and design stages.

Cost control and Cost reduction:

Cost control implies guidance a reputation of cost by executive action. For this purpose, the executives are provided with some yard stick such as standards or budgets with which the actual costs and performances are compared to ascertain the degree of achievement made. Therefore Cost Control involves continuous comparisons of actual with the standards or budgets to regulate the former. Standards or budgets once set up are not attended during the period or until some mistakes are discovered in standards.

Cost reduction is the achievement of real and permanent reduction in unit cost of products manufactured. It, therefore, continuously attempts to achieve genuine savings in cost of production distributing, selling and administration. It does not accept a standard or budget as or fined. It rather challenges the standards/budgets continuously to make improvement in them. It attempts to excavate, the potential savings buried in the standards by continuous and planned efforts. Cost control relax that dynamic approach, it usually dealt with variances leaving the standards intact.

Back-flush costing

Backflushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiplies it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which are subtracted from the beginning inventory balance to arrive at the amount of inventory that should now be left on hand. Given the large transaction volumes associated with JIT,

this is an ideal solution to the problem.

Theory of Constraints (TOC)

TOC describes methods to maximize operating income under bottleneck situation. The three measures are:

- ❖ Through-put contribution equal to sales – direct materials cost
- ❖ Investments equal to sum of materials costs in direct materials, work-in-process and finished goods inventories along with R&D costs and cost of equipments and buildings
- ❖ Operating costs equal to all costs of operations (other than direct material) incurred to earn throughput contribution. Operating costs include salaries and wages, rent, utilities and depreciation

The objective of TOC is to maximize throughput contribution while minimizing operating costs and investments

Throughput Accounting Ratio:

- ❖ TA ratio for factor = Demand of factor / supply of factor
- ❖ TA ratio for product = Throughput return per minute / Cost per minute

Value Chain Analysis

Porter defined the value chain as internal processes or activities a company performs to design, produce, market, deliver and support its product. Porter classified business activities under two heads

- ❖ **Primary Activities** – Primary activities are directly involved in transforming inputs into outputs and delivery and after-sales support to output. It include
 - In-bound logistics: Material handling and warehousing
 - Operations: Transforming inputs into final product
 - Outbound logistics: Order processing and distribution
 - Marketing and sales: Communication, Pricing and channel management
 - Service: Installation, repair and parts replacement
- ❖ **Support Activities** – Activities which support primary activities. It include
 - Procurement
 - Technology Development
 - Human Resource Management
 - Firm Infrastructure

Balanced Scorecard:

Balanced scorecard classified measures of performance into four business perspectives:

Financial perspective	To succeed financially how should we appear to our shareholders?
Customer perspective	To achieve our vision how should we appear to our customers
Internal business perspective	To satisfy our shareholders and customers what business processes must we excel at?
Learning and growth perspective	To achieve our vision how will we sustain our ability to change and improve?

Assignment:

Introduction:

Assignment Problem is a special type of Linear Programming Problem, with the following features:

- **Objective:** The objective is either to maximize Profit/Revenue/Sales or to Minimize cost/time
- **Nature of Data:** 'm' jobs/products are to be assigned to 'n' persons/facilities. It is not always necessary that $m=n$. If they are equal, data is said to be **balanced**, otherwise, data is said to be **unbalanced**
- **Condition:** Assignment should be on a **one-to-one** basis (two jobs cannot be assigned to the same person, and two persons cannot be assigned the same job)

Steps:

Step 1: Verify **Objective = Minimisation**. In case of Maximisation objective, convert the same into an opportunity loss matrix, by subtracting each number from highest number in the matrix.

Step 2: Verify **Nature of data = Balanced**. Data is balanced if number of rows equal to number of columns. In case of unbalanced data, add a dummy row or column as required, with all elements being Zero.

Step 3: Perform **Row operations**. Subtract the smallest number in each row from all elements of that row.

Step 4: Perform **column operations**. In the resultant matrix from Step 3, subtract the smallest number in each column from all elements of that column.

Step 5: Draw the minimum number of Horizontal and vertical lines to cover all zeroes in the matrix. Optimal assignment is possible only if **number of lines = order of the matrix**

Step 6: In case number of lines < order of the matrix, increase the number of zeroes as under:

- Select the smallest number not covered by the lines and call it as **Least Open Element (LOE)**
- Rewrite the matrix with the following adjustments:
 - Open Elements – Not covered by any line – Previous element **less** LOE
 - Covered elements – Covered by one line only – **No change**
 - Junction elements – Covered by intersection of two lines – Previous element **plus** LOE

Repeat Step 5 for such matrix till Number of lines = Order of the matrix

Step 7: Optimal assignment is made in the following manner

- Go row-wise, identify a row with one zero
- Select this zero as an assignment drawing a box around it
- Cancel all zeroes in that column since the same job cannot be assigned to a different facility
- Continue this procedure with columns and complete the assignment

In case of multiple optimal solutions or ties upto the last stage, arbitrary assignment can be made.

Treatment in special cases:

Situation	Treatment
Maximisation Objective	• Identify the Highest Element in the given maximization matrix • Subtract each element in the matrix from the highest

	element. This is called as Opportunity Loss Matrix. Continue the Assignment procedure in this matrix
Unbalanced Matrix	Insert a dummy row or column, with all entries equal to Zero. Insert dummy only after converting into Opportunity Loss matrix, if required
Prohibited Assignment (Restrictive Condition)	- Where a particular job cannot be assigned to a particular individual, it is called Prohibited Assignment - Such routes are given a high cost "M" where $M = \text{Infinity}$
Condition Assignment (Facilitative condition)	- Where a particular job should be assigned only to a particular individual, it is called as facilitative condition - Delete that row and column and reduce the matrix and continue the procedure

Transportation

Introduction:

Transportation applications relate to a LPP where goods are to be transported from "m" production locations (factories) to "n" sales locations (warehouses). The objectives are:

- To meet the differing availabilities and requirements of these locations and
- To minimize the total transportation costs

Steps in case of transportation:

Step 1: Verify the following in the question:

- Verify **objective = Minimization**. In case of maximization, convert the same into opportunity loss matrix by subtracting each number from highest number in the matrix.
- Verify **Nature of data = Balanced**. Data is said to be balanced if Total Availability = Total Requirement. In case of unbalanced data, a dummy column or row is to be introduced with zero transportation costs

Step 2: Deriving Initial Basic Feasible Solution (IBFS)

IBFS can be determined using any of the following methods:

- Northwest Corner Rule
- Least Cost Method and
- Vogel's Approximation Method (VAM)

Step 3: Optimality test (explained later)

Different methods for arriving IBFS

Northwest Corner Rule Method:

Step 1: Go to the top left hand corner of the matrix. Compare the availability and requirement, and allocate whichever is less, to that cell. Cancel the row/column where availability or requirement/condition is satisfied

Step 2: Go to top left hand corner cell of the resultant matrix (after cancellation of row or column in step 1). Repeat Step 1 till all the row availability and column requirements are satisfied.

Least cost Method:

Step 1: Identify the cell with lowest cost. In case of tie, arbitrary selection may be made. Compare the availability and requirement, and allocate whichever is less, to that cell. Cancel the row or column where availability or requirement condition is satisfied.

Step 2: Identify the next lowest cell in the matrix. Repeat Step 1 procedure till all row availability and column requirements are satisfied.

VAM:

Step 1: Compute the cost differences of each row and column. Cost difference is the difference between the least cost and the next least cost in that row/column. In case of tie in least cost, cost difference = 0

Step 2: Ascertain the maximum of cost differences and select that row or column for allocation

Step 3: Choose the least cost cell in the selected row or column for allocation. Compare the availability and requirement for that cell, and allocate whichever is less to that cell. Cancel the row or column where availability or requirement condition is satisfied.

Step 4: Repeat step 1, 2 & 3 till all row availability and column requirements are satisfied.

Optimality test:

Optimality test involves the following steps:

- **Table 1: $U_i + V_j$ for allocated cells:**

- Select the row/column with maximum number of allocations
- For that row/column, U_i/V_j is equal to zero [U_i for Rows & V_j for columns]
- The other set of numbers U_i/V_j are computed in such a way that $U_i + V_j = \text{Cost of allocated cells}$

Note: $U_i + V_j$ table can be computed only if the IBFS is non-degenerate. IBFS is said to be degenerate if number of allocations < {No. of rows + No. of columns - 1}. In case of degeneracy, a dummy allocation "e" (a number very close to zero) is made in the least cost independent unallocated cell. An independent unallocated cell is one which does not result in creation of loop when allocated.

- **Table 1: $U_i + V_j$ for unallocated cells:**

- Draw a matrix for the given rows and columns.
- Block out the allocated cell
- Compute $U_i + V_j$ (total of margin numbers) for all unallocated cells

- **Table 3: Δ Table or Decision table = Table 1 - Table 2**

- Draw a matrix for given rows and columns.
- Block out allocated cell
- Compute cost difference for all unallocated cells. Cost difference = Table 1 minus Table 2

Decision/Interpretation Table:

If all numbers of cost difference table are	IBFS is optimal and unique
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positive and greater than zero	
If all numbers are non-negative and one or more of the cells contains zero	IBFS is optimal but not unique. As many zeroes, that many alternative solutions exist
If any one number is negative	Solution is not optimal. Re-allocation should be made to determine Alternative Basic Feasible Solution (ABFS)

How is Alternative Basic Feasible Solution determined?

- Identify the worst negative in Table 3. If there is a tie, choose the least cost cell. (Call this as "Origin")
- Draw a loop with the following principles
 - Loop should commence from and end in the selected worst negative cell i.e. the Origin
 - It should have allocated cells as its other corners. But Loop can cross over allocated/unallocated cells
 - Only horizontal and vertical lines (not diagonal) can be used
 - Loop should result in an even sided figure
- Put positive (+) sign and negative (-) sign to the corners of the loop alternatively, with origin as +ve corner
- Re-allocation is done as under:
 - Identify the allocations to the negative corners of the loop (i.e. corners with (-) sign)
 - Select the minimum quantity out of the above allocations. Let this quantity be called **Selected Quantity**
 - Add this selected quantity to (+) corners and subtract this selected quantity from (-) corners. Other allocated and unallocated cells will remain unaffected
- This ABFS is tested for optimality using the same procedure as done in case of IBFS. In case there are negatives still arise in Table 3, then the re-allocation procedure should be continued further.

Treatment in special cases:

Situation	Treatment
Total availability not equal to total requirement	It is called unbalanced transportation problem. Introduce dummy row or column to balance availability and requirement. All entries (costs) of the dummy row/column shall be zeroes
Maximization objective	Select the highest element of profit in the matrix. Subtract each element from the maximum element. Take the resultant opportunity cost matrix with minimization objective, for allocation procedure
Degeneracy	Optimality test can be done only if number of allocations = (No. of rows + No. of columns - 1). If number of allocations < m+n-1, all U_i and V_j numbers cannot be computed. This situation is called degeneracy. If IBFS is degenerate, introduce a dummy allocation (e) in the least cost independent unallocated cell
Existence of zeroes in	Zero in the cost difference table indicates the availability of

the cost difference table	alternative solutions. The alternative optimal solutions can be determined by drawing a loop commencing from such cell having zero. Re-allocation would be based on loop drawing procedures
Prohibited routes	Sometimes some routes may not be available due to reasons like bad conditions, strike among others. Such prohibited routes are identified with a high cost represented by “M”, a very large cost close to infinity. Due to assignment of very large cost, such routes would automatically be eliminated in the final solution

CPM and PERT

Introduction:

- Network analysis (CPM and PERT) is used in managing the progress of a project.
- A project is a set of activities or jobs that are performed in a certain sequence to accomplish a given objective.
- These activities or jobs are to be completed within a specified time and within a specified cost. It should also meet the performance standards.

Steps in Network Analysis:

- **Step 1:** Analyse and break down the project in terms of specific activities and/or events
- **Step 2:** Determine the inter-dependence and sequence of specific activities and prepare a network diagram
- **Step 3:** Assign estimates of time, cost or both to all the activities of the network
- **Step 4:** Identify the longest or critical path through the network
- **Step 5:** Monitor, evaluate and control the progress by re-planning, rescheduling and reassignment of resources

Term	Meaning
Critical Path	The longest path through the network is called as the critical path. The length of the critical path determines the minimum duration in which the project can be completed.
Network	A network is a graphical representation of a project, depicting the flow as well as the sequence of well-defined objectives and events and their inter-relationships. They are also called Arrow Diagrams.
Activity	An activity is any portion of a project/network which consumes time or resources and has a definite beginning and ending. Activities are graphically represented by arrows and denoted by alphabets
Event	The beginning and ending points of an activity are called events. They are represented graphically by a numbered circle
Tail Event or Preceding events	All activities in a network must commence from some event called Tail Events. Since the arrow diagram is always drawn from left to right, the LHS node/event is called as Tail Event
Head event	All activities in a network must have terminal points called the Head event. The RHS node/event is called as Head event
Dummy activity	Dummy activity is a hypothetical activity which consumes no resource and time. It is represented by dotted lines in the network diagram.

Conventions used in network diagram:

- Activities are represented by arrows. They are designated by alphabets.

- Events are represented by Numbered circles called nodes. They are designated by numbers
- Time flows from left to right. Hence the activities can be indicated from left to right by way of straight horizontal lines/vertical lines, or diagonal lines also
- Every subsequent activity should be depicted to the right hand side of the preceding event. This will facilitate scheduling computations for each event
- Each event/node should be numbered without any ambiguity. The numbers should be assigned to events in such a way that the number assigned to the head event of an activity is greater than the number assigned to the tail event of that activity
- Each activity should be bound by two events. No activity should hang or dang loosely in the network. Moreover no two activities should have same head and same tail event
- Arrows that cross each other should be avoided to the extent possible. Where crossing of arrows is unavoidable, bridging may be done

Errors while drawing network diagram:

- **Looping:** Generally the arrow point from left to right, since time flows in that direction. If that convention is not followed the result is illogical looping
- **Dangling:** This represents a situation when an event is not continued further i.e. it hangs abruptly in the middle of the network without being connected to completion stage
- **Duplication:** Activities that have the same head and tail event are called duplicate activities. Duplication can be corrected by the introduction of the dummy activity

Scheduling computations:

The basic scheduling computations involve a forward pass and then a backward pass through the network. The process of tracing the network from START to END is called forward pass and from END to START is called backward pass. The forward pass computations give Earliest Start and Finish Times for each activity. The backward pass computations give the latest allowable start and finish times for each activity.

Forward Pass computation	• For the Initial Event $EST = 0$. For every subsequent event, $EST = EST \text{ of Tail event} + \text{Activity duration}$. For merge event, the EST shall be the maximum of the EST computed for each activity. • $EFT = EST + \text{Duration of activity}$
Backward Pass computations	• For the terminal event, $LFT = EST$ as computed by forward pass. For every preceding event, $LFT = LFT \text{ of Head event} - \text{activity duration}$. For Burst event, the LFT shall be the minimum of the computed LFT. • $LST = LFT - \text{Duration of activity}$

Floats:

Non-critical activities have some flexibility i.e. they can be delayed for some time without affecting the project duration. This flexibility is called as float for activities and slack for events.

Slack time for an event	Difference between the latest event time and earliest event time. $\text{Slack} = L \text{ value} - E \text{ value}$ as derived by scheduling computations
Total Float	$\text{Activity Float} = LST - EST \text{ (or) } LFT - EFT$. For all critical activities total float = 0 as they cannot be delayed
Free Float	Portion of total float within which an activity can be delayed without affecting the float of succeeding activities. $\text{Free Float} = \text{Total Float} - \text{head event slack}$. If a negative value is obtained then the free float is taken to be zero

Independent float	Portion of free float within which an activity can be delayed without affecting the float of the preceding activities. Independent float = Free float less tail event slack
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Time estimates used in PERT:

- Optimistic time estimate is the shortest possible time in which an activity can be completed. This is denoted by t_o
- Pessimistic time estimate is the maximum possible time which an activity could take to accomplish the job. It is denoted by t_p .
- Most likely time estimate lies between optimistic and pessimistic time estimates. It presumes normal conditions and is denoted by t_m .

Time estimates used in PERT:

Expected time	$(t_o + t_p + 4 t_m) / 6$
Range	$t_p - t_o$
SD	$(t_p - t_o) / 6$
Variance	SD^2

Probability analysis in achieving project completion:

- A project as a whole consists of several activities and will have a normal distribution. Hence the probability of completing the project in time is 50 percent
- The probability of completing the project in specified time is calculated using the following rules:
 - $Z = (T_r - T_{cp}) / SD$ where T_r = Duration in which the project is required to be completed, T_{cp} = Duration of the critical path.
 - Obtain the value of Z from normal tables and call it as NT (Z)
 - Probability of completing a project within required duration = $0.5 \pm NT (Z)$

CPM Versus PERT:

Particulars	CPM	PERT
Event/activity	CPM is activity oriented. Results of various calculations are considered in terms of activities	PERT is event-oriented
Uncertainty	It is a deterministic model. It does not consider uncertainties involved in project completion	It is a probabilistic model. It uses three estimates of time keeping time uncertainty in view
Emphasis	It places dual emphasis on time and cost and evaluates the trade-off between project cost and project time	It is primarily concerned with time
Nature of projects	It is used for projects of repetitive nature, where one has prior experience of handling similar projects	It is generally used for new projects where time required for various activities are not pre-determined

SIMULATION**Introduction:**

- Simulation is a quantitative procedure, which describes a process by developing a model of that process and then conducting a series of organized trial and error experiments to predict the behaviour of the process over time.
- Simulation can serve as a pre-service test to try out new policies and decision rules for operating a system before running the risk of experimenting on the real system

Steps in case of simulation:

- **Step 1:** Determine the objective which may be either maximisation of return or minimisation of cost/time etc.
- **Step 2:** Identify the variables that have significant influence on the objective
- **Step 3:** Determine the cumulative probability distribution of each variable under step 2. Obtain random numbers for each variable
- **Step 4:** Obtain a set of random numbers from the tables
- **Step 5:** Identify the variable with which the chosen random number falls in step 3. Repeat step 5 for all random numbers.

Linear Programming Problem**Meaning of LPP:**

A Linear Programming Problem (LPP) is a mathematical model dealing with the use or allocation of certain scarce resources (i.e. key factor like raw materials, labour hours, machine time, capital availability etc.) in the best possible manner in order to maximize profit or minimize cost.

Methods of solving LPP:

Method	Condition for applicability
Graphical Method	Number of variables should be Two (since there are only two axes x and y on the graph sheet). Any number of constraints / inequalities are permitted, but the feasible region may not be easily identified if numerous constraints are introduced
Trial and Error Method	Number of variables = Number of constraints. For example, two equations in two variables can be solved. However, as more variables and constraints are introduced, solving algebraic equations may become comparatively difficult
Simplex Method	No restrictions as to number of variables and constraints

Steps involved in simplex method:

Step 1: Objective: Determine the objective function (denoted by Z). (either maximisation or minimisation)

Step 2: Constraints: List the constraints applicable for the objective. For maximisation objective, atleast one constraint should bear $\leq$ sign. For minimization objective, atleast one constraint should bear $\geq$ sign.

Step 3: Conversion of inequalities into equalities: Convert inequalities into equalities as below:

Particulars	Slack Variable	Surplus variable	Artificial variable
Meaning	Idle or unused resources	Excess amount of resources utilized	No physical or economic meaning. It is fictitious.
When used	' $\leq$ ' inequality	' $\geq$ ' inequality	' $\geq$ ' and ' $=$ ' constraints
Co-efficient in the constraint	+1	-1	+1
Co-efficient in the objective function	0	0	+M for minimisation and -M for maximisation

Used as initial program variable	Used as starting point (initial table)	Cannot be used since unit matrix condition is not satisfied	Initially used but later eliminated
Presence in the optimal table	Helps to interpret idle & key resources	-	Indicates "No feasible" solution

Step 4: Revised objective: Redraft the objective function by including the variable in this order –

- Regular variables as given in the objective
- Slack variables with zero co-efficient
- Surplus variable with zero co-efficient and
- Artificial variables with +M for minimization and -M for maximisation

Step 5: Initial table: The format of the table is as under:

Fixed Ratio	Program Variable	Profit / cost	Quantity	Variables column				Replacement ratio
				A	B	S ₁	S ₂	
	Row 1							
	Row 2 etc.							
			Z					
			C					
			NER = Z - C					

Notes:

- Select slack variables as initial program variable. In case of minimization objective, slack and artificial variables constitute the initial program, forming a unit matrix of co-efficients.
- Fill up profit/cost of the program variable as per objective function
- Fill up quantity = RHS of constraints
- Fill-up co-efficients of various variables as per the constraints, in the respective columns
- Fill up values of Z against each variable as per objective function
- Compute C = Profit/cost * co-efficient of each variable
- Compute net evaluation row (NER) = Z - C
- Select maximum positive NER (Z - C) for maximisation objective and circle key column. Corresponding variable is the incoming variable. In case of minimisation objective, select worst negative NER
- Compute replacement ratio = Quantity / key column element
- Select minimum non-negative replacement ratio and circle key row. In case RR = 0, it shall be selected as minimum non-negative. In case of tie, arbitrary selection shall be made
- Identify pivot element. Junction of key row and key column is called as pivot element
- Fixed ratio is not applicable for key row. For other rows (non-key rows), Fixed ratio is calculated as = Key column element / pivot element
- Determine replacement decision: (a) Incoming variable = key column and (b) Outgoing variable = key row.

Step 6: Second and subsequent table:

- Fill up program variables by replacement decision as per earlier table
- Fill up profit/cost of the program variables based on objective function

- Update key rows by the transformation rule, previous table key row element / pivot element
- Update non-key rows by the transformation rule = (Previous table corresponding row element) Less (Key row element * fixed ratio)
- Fill up values of Z against each variable, as per objective function
- Compute C = Profit * Co-efficient of each variable
- Compute NER = Z - C
- Repeat the selection and reallocation procedure till all $Z-C \leq 0$ for maximization, and all $Z-C \geq 0$ for minimization objective

Procedure for minimisation objective:

- Introducing surplus variables, the constraint functions are to be re-written
- However, since these variables when introduced as initial program, violate the non-negativity assumption, artificial variables "M" of heavy cost (close to infinity) are introduced and the constraints and objective function are re-written
- Initial program is commenced using artificial variables only (since it satisfies the unit matrix condition)
- An artificial variable once eliminated (i.e. selected as key row) will never re-enter the simplex table in the subsequent iterations
- If artificial variable exists in the optimal table the solution is not optimal. There is no feasible solution for that case.

Treatment in special cases:

Situation	Treatment
Degeneracy	• It occurs if there is a tie in the minimum non-negative replacement ratio • In case of degeneracy, the outgoing variable should be selected on an arbitrary basis • The variable not selected as outgoing, will bear "0" in the quantity column in the subsequent table
Equality Constraints	• Artificial variable is introduced to the constraint
Multiple optimal solutions	• For any optimal solution, NER = 0 for all program variables • LPP is said to have alternative solutions if in the optimal table, a non-program variable has NER = 0 • The alternative solutions can be obtained by identifying such non-program variable (bearing NER = 0) as the incoming variable
No feasible solution	• Artificial variable, once eliminated, should not re-enter subsequent iterations (tables) • If artificial variable persists in the "optimal" table, there is no feasible solution
Unbounded solution	• Outgoing variable is selected on the basis of minimum non-negative replacement ratio • If all replacement ratios are negative, the outgoing variable cannot be identified • The LPP is said to have unbounded solution in such cases, when all RR are negative.

Learning Curve

Learning curve:

“Learning curve is a geometrical progression, which reveals that there is steadily decreasing cost for accomplishment of a given repetitive operation, as the identical operation is increasingly repeated. The amount of decrease will be less and less with successive unit produced. The slope of the decision curve is expressed as a percentage. The other names given to learning curve are experience curve, improvement curve and progress curve”.

Learning curve equation:

Mathematicians have been able to express relationships in equations. The basic equation is

$$y = ax^b$$

Where:

y	=	Average time per unit for x units
a	=	Time required for first unit
x	=	Cumulative number of units produced
b	=	Learning co-efficient

Learning curve ratio:

In the initial stage of a new product or a new process, the learning effect pattern is so regular that the rate of decline established at the outset can be used to predict labour cost well in advance. The effect of experience on cost is summarized in the learning ratio or improvement ratio.

$$\text{Learning ratio} = \frac{\text{Average labour cost of first } 2N \text{ units}}{\text{Average labour cost of first } N \text{ units}}$$

SUMMARY OF ADJUSTMENTS

Qn	Summary
Chapter 1: Development in Business Environment	
1	❖ Non-value added time will be waiting time, inspection time and move time ❖ Valued added time will be processing time ❖ Cycle efficiency = Value added time/total time ❖ Manufacturing cycle time = Total time / units per batch
2	❖ Key activities and drivers are purchase of medicines (no. of purchase orders), Scheduling of patients (no. of patients), Perform tests (no. of tests) and preparation of test reports (no. of reports)
3	❖ Calculate total life-cycle costs = Initial costs + Annual costs * PVAF ❖ Select the plan which has low life-cycle cost
4	❖ Valid, Valid, Invalid, Valid, Valid, Valid
5	❖ Back-flush costing require no entry for issue of raw material/apportionment of overheads ❖ Entry would be passed once the goods are finished ❖ Cost of goods sold entry is for 3,57,000 whereas for produced is 3,75,000. In an ideal JIT scenario the units produced should be equal to units sold
6	❖ Three way classification of costs are required. Controllable refer to those costs which can be reduced whereas uncontrollable refer to those costs which cannot be reduced ❖ Direct cost refers to cost directly related to the department whereas indirect costs refer to apportioned costs ❖ Sunk costs refer to past cost and out of pocket costs refer to future costs
7	❖ Cost-benefit analysis is to be done for the system. Benefits are reduction in damages and contribution from incremental revenues ❖ Savings in damaged cartons is to be valued at variable costs ❖ Part 3 the benefits should be equated to cost and we should get the desired contribution and then reverse work on the required sales
8	❖ Fixed costs under ABC remains same for situation one as there is no reduction in cost ❖ Fixed cost would reduce for part II due to lower set up cost and engineering cost and hence the same would reduce BEP
9	❖ Calculate cost driver rate for production line cost (no. of machine hours), transportation cost (60% based on number of deliveries and 40% based on distance travelled) ❖ Total cost of manufacture = DM + DL + ABC related OH ❖ Target cost = Target selling price - 25% margin ❖ Compare actual cost with target cost to get the cost gap
10	❖ TA ratio = Demand for factor/supply of factor ❖ Bottle-neck is to be considered based on highest TA ratio and then do the allocation based on bottle-neck
11	❖ Quality costs are prevention cost, appraisal cost, external failure and internal failure costs ❖ Units delivered to customers = Sales + Replacements ❖ Units produced = Units delivered + Faulty production ❖ RM Purchases = (Units produced * Input/Output) + RM scrapping
12	❖ Manufacturing cost = No of machine hours, no of labour hours ❖ HR = No of employees, No of training hours ❖ Marketing = No. of customer orders, No of sales contract ❖ Accounting cost = No. of billings, no of cash receipts

Qn	Summary
13	❖ AC (4 & 8), PC (3,5 & 10), IFC (2,6,9) & EFC (1 & 7)
14	❖ Inventory carrying cost is to be computed on average inventory. Average inventory = (Opening inventory of quarter + Closing inventory of quarter) / 2 ❖ Incremental production cost = Overtime cost + Increased production cost due to differential cost in each period
15	❖ Fixed cost of the company will reduce due to reduction in engineering hours and number of production runs. Production runs will come down due to increase in production units per run ❖ BEP = Revised fixed cost/contribution per unit. ❖ BEP in terms of production runs = BEP in units / Production run size
16	❖ Calculate life cycle cost per unit and compare with target cost
17	❖ Valid and valid
18	❖ TA ratio = Demand for factor/supply of factor ❖ Bottle-neck is to be considered based on highest TA ratio and then do the allocation based on bottle-neck
19	❖ Compute Cost driver rate, apportion OH and then calculate the cost per unit ❖ Machine dept expense (machine hours), assembly department (assembly hours), stores receiving (number of requisitions), order processing (customer orders) and Inspection and quality (number of production runs), set-up (number of runs)
20	❖ Reliability, Performance, aesthetics and durability
21	❖ Primary, Support, Primary and Support
22	❖ Calculate the cost of various activities ❖ Receiving materials (no of consignments received), set-up of machines (no of set-ups) and quality inspection (no of inspections) ❖ Design cost should be apportioned for every quarter for calculation of cost
23	❖ Invalid, Valid, Invalid, Invalid, Invalid
24	❖ No special adjustment - problem on ABC
25	❖ Three measures of TOC are throughput contribution (7), operating cost (2, 4 & 5) and investment (1, 3, 6 & 8)
26	❖ Sales = Minimum of production and demand ❖ Opportunity cost for every product = Maximum contribution of the other products
27	❖ Valid, Invalid, Invalid and Invalid
28	❖ No special adjustment - problem on ABC
29	❖ Primary, Primary, Support, Primary, Support, Primary, Support & Primary
30	❖ Product cost, Committed cost, Differential/Incremental cost & Shut down cost
31	❖ No special adjustment - problem on ABC
32	❖ TA ratio = Demand for factor/supply of factor ❖ Bottle-neck is to be considered based on highest TA ratio and then do the allocation based on bottle-neck
33	❖ Calculate cost driver rate and apportion OH ❖ Prepare profitability statement based on the revised OH ❖ Prepare revised profitability statement based on change in sales mix. Change in sales mix should also lead to increase in cost driver quantity and hence the overheads will increase
34	❖ Non-value, value, value, Value and Value
35	❖ Not required, Required, Required and Not required
36	❖ CC, CC, CR, CR, CC, CC, CR, CR
37	❖ Customer support (External Failure), Equipment testing (appraisal), warranty repair (external failure), manufacturing rework (internal failure), Supplier review

Qn	Summary
	(prevention) and downtime (internal failure)
38	❖ Calculate total cost for life-time for the two scenarios. Compare it with sales and calculate profit
39	❖ Invalid, Valid, Invalid and Invalid
40	❖ Calculate profits for the two price levels ❖ PVR for the original price is 40% and based on that variable cost is to be computed. Variable manufacturing cost = Total variable cost - Variable selling cost ❖ Variable manufacturing cost would remain same even with a lower price and hence the profitability will be impacted
41	❖ Loss due to faulty bats = Relevant cost of manufacture faulty bats + Contribution lost due to lower market share ❖ Implementation of inspection process before delivery will not remove faulty bats. However it can save delivery cost of faulty bats and also can earn contribution from higher market share
42	❖ Maturity phase is from week 31 to 70 and decline phase is from week 71 to 110 ❖ Get the appropriate SP, VC and contribution per unit ❖ Company has followed skimming strategy as the price was higher in the initial phases
43	❖ Carrying cost is to be computed on average inventory ❖ Work force has to be paid for minimum of 4000 hours and hence any utilization lower than 4000 hours during JIT will not lead to any savings ❖ Work beyond 4000 hours will involve overtime payment and the relevant expense will be the full amount paid (in a normal scenario only OT premium will be relevant as that would be the incremental amount - compare with question no.14)
44	❖ Calculate total inventory cost for various options ❖ Inventory carrying cost is to be calculated on average inventory. Average inventory is to be taken as half of quantity ordered
45	❖ Invalid, Invalid and Invalid
46	❖ Principles of Activity Based Costing is to be used for preparing profitability statement using DPP method ❖ Cost driver quantity is to be taken as cubic metres and the cost per cubic metre is to be calculated for various products. ❖ OH cost has been given per month and hence ❖ Overhead costs is to be divided by the number of units to get the OH cost per unit. Compare gross margin and OH cost/unit to get the profit
47	❖ Customer wise profitability statement has to be calculated based on the principles of ABC
48	❖ Do the cost classification as prevention, appraisal, internal failure and external failure cost
49	❖ Maximum Production = Highest of demand, production based on factor 1, factor 2 and factor 3. ❖ Select the product which can give maximum contribution
50	❖ Prepare profit statement for both products based on the changed cost driver quantity and cost structure ❖ Scenario II - BEP with semi-variable cost. Semi-variable cost change every 30 units. Set-up cost and step fixed cost are to be treated as fixed for the purpose of BEP calculation. Consider the semi-variable cost as VC/unit and get tentative BEP. Then get the final BEP
51	❖ Customer profitability statement is prepared based on the principles of ABC

Qn	Summary
Chapter 2: Decision making using CVP analysis	
1	❖ Problem focuses on calculation of shut-down point ❖ Direct labour is an irrelevant cost as the same is paid to permanent labour force which cannot be terminated ❖ Cost during operation = (2 lacs units * 7) ❖ Cost during shutdown = (1.25 lacs + 1.5 lacs - off-loading income) ❖ Shutdown point = (cost during operation - cost during shutdown)/ CPU
2	❖ Flight crew salary is irrelevant (unavoidable) and flight assistant salary is relevant ❖ Baggage charges is irrelevant, 1/3rd of liability insurance is relevant and the balance is irrelevant, Depreciation is irrelevant, hanger parking fee is irrelevant
3	❖ Sales value (PVR), RM (Cont/kg of RM), Labour (Cont/labour hour) and heavy demand (PVR)
4	❖ The current profitability statement does not present the true picture as all expenses have been apportioned on basis of machine hours ❖ Revised profitability statement is to be prepared and machine related OH are to be distributed on basis of Machine hours, Batch related OH on number of hours, product specific is to be allocated to specific product and general fixed OH are to be not charged to individual product ❖ BEP is to be computed assuming a scenario of semi-variable cost and BEP. Treat batch related OH as variable OH and calculate tentative BEP. Take one class interval in which tentative BEP falls and one below the same to get the final BEP
5	❖ Sunk cost (irrelevant), Opportunity cost (Relevant), Out of pocket cost (Relevant), Differential (Relevant) and Notional (Relevant)
6	❖ Shut down point = [Fixed cost during operation - fixed cost during shutdown - additional fixed cost to resume operations] / Contribution per unit ❖ Decision on shut-down point can be made by comparing the expected sales volume with shut-down point
7	❖ Compare variable manufacturing cost with cost of purchase and decide on products to be manufactured/purchased ❖ Compute the number of hours required to produce the products and see whether production capacity is limiting factor ❖ Do a statement of ranking based on savings per hour and then do the allocation ❖ Prepare the profitability statement based on the allocation
8	❖ The company wants to increase the profit to Rs.50,000 and hence the targeted contribution will increase to Rs.3,87,000 (Fixed cost goes up due to advertisement) ❖ We can calculate contribution per unit with the given sales volume and the same can help us in getting the targeted variable cost ❖ We need to eliminate material cost from this and the balance will be labour and variable OH per unit. We can use this and get the target labour time per unit
9	❖ Indifference point = Change in fixed cost / Change in variable cost/unit
10	❖ We have to calculate the profitability statement for both customers in the normal way. Discount of 5% will be applicable for both customers whereas discount of 8% on original price is applicable for customer B as he takes the delivery ❖ Profitability of customer B is significantly lower due to the above discount and hence the company should review its discount policy
11	❖ Compute contribution net of fixed cost per unit for all four products. Prepare the statement of ranking based on contribution per unit and do the allocation ❖ We need to take 10,000 units at a time while doing allocation and ensure that contribution from incremental units take care of specific fixed cost. In case the contribution is not sufficient then we should not manufacture those units. For

Qn	Summary
	example Q production will have to be restricted to 30,000 as those extra 10,000 units will not give contribution which is sufficient to cover incremental fixed cost ❖ Transfer price = (Variable cost + Lost contribution) / 20,000 ❖ Transfer can happen to B if the TP is less than Rs.45 per unit
12	❖ VC/unit remains same for both options, fixed cost that is not committed and is different between two options, additional future cost which is different between options, cost already have been incurred and cannot be recovered
13	❖ We need to compare the variable manufacturing cost with cost of purchase to decide on make versus buy decision ❖ Cost of make has to be adjusted with opportunity cost of loss of production of Product K. Product K can give a contribution of Rs.15,000 per unit. The proportionate contribution per hour is Rs.300 and hence the opportunity cost is Rs.12,000 per unit (300 * 40 hours) ❖ Relevant cost of make is Rs.29,000 and relevant cost of purchase is Rs.25,000 and hence we should go ahead with purchase
14	❖ Prepare a statement of ranking on the basis of contribution per machine hour. While evaluating the allocation we need to allocation for every 1,00,000 units and then compare the contribution with incremental fixed cost ❖ The company will not be meeting the full demand of P as the company will not be earning the incremental contribution to recover the incremental fixed cost ❖ Part two: Assume that we meet the full demand of P and then do the allocation. The overall profits will come down and the fall in profits will be regarded as opportunity cost
15	❖ Division C earns contribution of Rs.2,41,500 and also there is a saving in variable cost of Division A and B. Division A and B has economies of scale benefits and hence its cost is only at 90 percent of the normal cost. Normal cost hence should be Rs.23,00,000 and hence there is a cost saving of Rs.2,30,000 ❖ The company will save fixed cost of Rs.4,14,000 but would incur cost of around Rs.4,71,500 against it and hence should not close the division
16	❖ There are multiple limiting factors and hence we need to ranking based on contribution per unit, contribution per hour and contribution per kg of raw material. ❖ We will first produce Product Z as the same is preferred either as rank 1 or 2 on three parameters. The balance allocation will be done based on simultaneous equations
17	❖ Renewal of lease will lead to reduction of profits by Rs.24 lacs per annum ❖ Transfer to Factory B & Factory C: Prepare marginal costing statement wherein the contribution is shown. The same would move up due to transfer of sales and also increase in variable costs. Fixed costs would change by the amount of increase in fixed overheads and also the apportionment of head office expenses to the other division
18	❖ Compare variable manufacturing cost with cost of purchase and decide on products to be manufactured/subcontracted ❖ Compute the savings per hour in manufacture and then do a statement of ranking ❖ Prepare statement of allocation while considering twin factors. One is incremental fixed cost due to increase in production (units basis) and also on the basis of labour hours ❖ Minimum units to break-even: Identify the units which are getting manufactured and find the product having maximum contribution per unit. See whether it can recover the fixed cost or else move to the next product and identify the number of units at which break-even can happen

Qn	Summary
	❖ Unlimited assembly hours will not change the profits as the profitability is constrained currently due to step up fixed cost
19	❖ Sunk cost (Irrelevant) ❖ Sunk cost (Irrelevant) & Replacement cost (Relevant) ❖ Period cost (Relevant) & Committed cost (Irrelevant) ❖ Sunk cost (Irrelevant) & Opportunity cost (Relevant)
20	❖ Material A – Non-moving item – Realizable value ❖ Material B – Out of stock – Replacement cost ❖ Department X – Relevant ❖ Department Y – Spare capacity exist – Irrelevant ❖ Patterns and specifications = Cost to be incurred – Realizable value
21	❖ Indifference point = Change in fixed cost / Change in variable cost per unit ❖ Indifference point is to be done for (M1 & M2), (M1 & M3) and (M2 & M3)
22	❖ Shut-down point = ((Cost during normal operation – Cost during shut down – Add FC to resume operations) + Off-loading income during shut-down) / Contribution per unit ❖ Normal fixed cost = FC per unit * Normal Production ❖ Labor cost is irrelevant in this case as the same is paid to permanent labor force who cannot be terminated ❖ Company is expected to earn some income during shut-down due to offloading work. The same should be added in the formula one to arrive at shut-down point
23	❖ Material A (Replacement cost), Material B (Resale value) and Material C (Replacement cost) ❖ Skilled labour – Lost contribution + Wages payable (Answer given in suggested answer is incorrect), Unskilled labour – Nil ❖ Variable OH – Relevant, Fixed OH – Irrelevant
24	❖ $F1 + F2 = 1,50,000$ ❖ $C2 = 0.8C1$ ❖ $F1 = 1800C1$ ❖ Use the formula of indifference point and establish an equation for $F1 + F2$ and get the answer to the various things asked in the question
25	❖ Sales units is the limiting factor and hence the ranking is to be done on the basis of contribution per unit ❖ Compute the weighted contribution per set considering the present mix and then calculate the breakeven sets ❖ Incremental units: Company should prefer Product E as the same gives Rs.25 per unit and thereafter it can either do E or Z as both give Rs.10 per unit. Identify the number of units at which contribution equals fixed cost and the same would be the breakeven level ❖ Best mix for incremental 4,000 units would be 2,000 units of E and 2,000 units of Z as the same gives better contribution per unit
26	❖ Compare cost of purchase with manufacturing cost and decide on units to be purchased/manufactured ❖ Prepare statement of ranking and do a statement of allocation considering the current available hours ❖ Compare second shift working versus purchase for units which could not be manufactured due to non-availability of machine hours
27	❖ Scenario wherein there is a differential fixed and variable cost and the cost of the earlier level changes when we move from one level to another level ❖ Possible options are: 600 units, 750 units, 900 units, 1000 units and 1250 units as these undergo either a change in variable/fixed cost

Qn	Summary
	❖ Each class interval can have a BEP if the contribution is able to recover the fixed cost
28	❖ R1 will have a relevant benefit of Rs.1,250 as use of them will save disposal cost ❖ G1 will have relevant cost for non-idle portion whereas G2 will be entirely irrelevant
29	❖ The current profitability statement does not present the true picture as all expenses have been apportioned on basis of machine hours ❖ Revised profitability statement is to be prepared and machine related OH are to be distributed on basis of Machine hours, Batch related OH on number of hours, product specific is to be allocated to specific product and general fixed OH are to be not charged to individual product ❖ BEP is to be computed assuming a scenario of semi-variable cost and BEP. Treat batch related OH as variable OH and calculate tentative BEP. Take one class interval in which tentative BEP falls and one below the same to get the final BEP
30	❖ Committed cost, Differential cost, Sunk cost, Opportunity cost, Period cost and Direct cost
31	❖ Two limiting factors are possible in this question as M-1 and M-2 availability is restricted. We need to calculate the amount of M-1 and M-2 required for contracted units, non-contracted units and for material Z ❖ Identify the limited factor and then prepare statement of ranking. Material Z's contribution will be calculated by comparing current purchase price of Rs.200 per unit with variable cost of manufacture ❖ Identify the product whose production will have to be compromised to produce product Z. Relevant cost of manufacture = Cost of manufacture + Opportunity cost ❖ Prepare the optimum production plan with the available resources ❖ Decision can be sustained in part (i) as long as the cost of purchase is lower than relevant manufacturing cost
32	❖ Cost of change in Average Length of Stay (ALOS) = Rs.25,00,000 ❖ Readmission income = Rs.13,50,000 ❖ Savings in variable cost = Rs.37,50,000. We can go ahead with plan as savings are more than cost
33	❖ Committed, Discretionary, Discretionary and Discretionary
34	❖ Part one: VMC will be 20% of material and 10% of other cost. This is to be compared with the cost of purchase and decision is to be taken. Decision would be to manufacture for first 1,50,000 cans. The company should then compare for incremental 25,000 and 75,000 cans and decide on make versus buy. The company will continue to make first 1,50,000 cans and the balance can either be make/buy ❖ Part two : Indifference point = Change in fixed cost / Change in VC/unit ❖ Part three: Prepare a normal profitability statement
35	❖ Available options for the company are ○ Maintaining existing situation ○ Outsourcing only manufacturing ○ Outsourcing only maintenance ○ Outsourcing both manufacturing and maintenance
36	❖ Compare manufacturing cost with cost of purchase and decide on make versus buy ❖ Prepare statement of ranking based on saving per hour and then decide on the production mix ❖ The decision will continue to remain the same as long as the saving per hour of product A is lower than saving per hour of Product C

Qn	Summary
37	❖ The company has to reduce the variable cost per unit as the same PVR is maintained ❖ Fixed cost saving = Current fixed cost - Desired fixed cost ❖ Desired fixed cost = 400 units * Contribution per unit
38	❖ Retaining same profit per unit: The current profit per unit is Rs.240 per unit. In case the company wants to retain the same profit per unit then the cost of purchase option should match with cost of manufacture. Hence it can pay a maximum of Rs.204 per unit. The cost of manufacture is Rs.210 per part and hence considering the transportation cost it should be Rs.204 per unit ❖ If the company prefers any additional revenue then it would be fine taking the extra volume at zero incremental profit. It can currently sell 25,000 units and the same can give the company a profit of Rs.60,00,000. The target profit for 50,000 units will be Rs.60,00,000 and based on that the purchase price for lower part is to be calculated
39	❖ Relevant cost, Sunk cost and Opportunity cost
Chapter 3: Pricing Decisions	
1	❖ We need to prepare a profitability statement for the situation when strike happens and strike does not happen ❖ If the strike does not happen then only the variable labour cost increases and based on the profitability statement is prepared ❖ If the strike happens then there will be loss of sales of few products, it will incur overtime premium on few units, incremental fixed cost and also there will be a 10% increase in labour costs
2	❖ For a joint product the relevant cost is variable post separation cost and for a normal product then the relevant cost is overall variable cost ❖ Production of G is recommended in case it is a joint product and the same would not be preferred if it is not a joint product
3	❖ The current profit of the company is Rs.50,000 and based on that fixed OH is arrived at balancing figure ❖ We need to calculate the return on capital employed and see whether the company achieves the desired ROCE
4	❖ The company needs 12 percent post tax ROCE and hence it would need 20 percent pre-tax ROCE ❖ Sales is assumed as X and based on that Capital employed is to be calculated. Profit will be taken as 20% of ROCE ❖ Sales = Cost + Profit. Calculate selling price per unit after arriving at overall sales value
5	❖ Price = a - bQ. a refers to the price at which no sales is made. In this case it will be price of Rs.35 per unit. b refers to the rate of change which is measured as 500 units change for every 0.5 rupees ❖ MR = a-2bQ. Equate MR to MC and then find the optimum level. ❖ Price = 35 - (0.5/500)Q; MR = 35 - 2(0.5/500)Q ; When MR is equated to MC then we get optimum level as 9,000 units and the price would be Rs.26 per unit
6	❖ Penetration, Market Price or Just below Market Price, Skimming, any cash realizable value
7	❖ Invalid, Valid, Valid, Valid, Valid
8	❖ Arrange the products in the descending order of sales and calculate cumulative sales as percentage of total sales. Identify the products which contribute to 80 percent of sales ❖ Arrange the products in the descending order of contribution and calculate

Qn	Summary
	cumulative contribution as percentage of total contribution. Identify the products which contribute to 80 percent of contribution
9	❖ Contribution = 25% of investment. Investment = 40% of plant and machinery and working capital of Rs.2,72,800. Total investment is Rs.18,72,800 and hence desired contribution is Rs.4,68,200 and the cont per unit is Rs.19.51. Desired price = Variable cost + Contribution per unit ❖ Product is newly introduced = Minimum Price = Variable cost ❖ Product is well established = Minimum Price = Total cost
10	❖ Profitability statement for the existing distribution model and the new distribution model of dealers is to be analyzed ❖ Staff salary expense will come down by 50%, Commission will be an extra expense, saving in opportunity cost on inventory and savings in interest cost due to dealer deposit are to be considered while preparing the profitability statement
11	❖ The average individual output will increase by 60% and the same will lead to 20 percent increase in wage rate per unit ❖ Incremental contribution = New contribution - Old contribution
12	❖ Calculate contribution per unit and then total contribution. Select the level which gives maximum contribution
13	❖ Skimming, Skimming, Penetration and Skimming
14	❖ Assume sales price as X and get sales in terms of X. Capital employed = 8,00,000 + 50% of net sales ❖ Profit = 25 percent of capital employed. Profit = Sales - Total cost. Compute X based on the above equation
15	❖ The company makes profit of Rs.25 per unit and hence the total cost per unit should be Rs.117. The current cost adds upto Rs.115 and the balance Rs.2 per unit can be assumed as fixed/variable ❖ We need to calculate the cost for 6,000 units and compute the sales value to get a profit of Rs.1,67,300. Reverse work and get the selling price
16	❖ Profit = 20% of investment. Get the sales by adding cost and profit and then calculate selling price ❖ Assume list price as X. Profit is 6% of list price and then reverse work and get the list price
17	❖ The company needs a profit of 10% on selling price. Compute the current cost and compare with target cost. Difference in cost can be the inspection cost ❖ The selling price can be changed as current cost /90%. This would give profit of 10% on sales as the company wont be incurring inspection cost. Compare the revised price with Rs.1,600 and then calculate the percentage of discount
18	❖ Prepare a product input-output chart ❖ Compute incremental revenues and compare with incremental cost. A product can be processed further if incremental revenues are more than incremental cost and vice versa
19	❖ Penetration, Market Price or Just below Market Price, Skimming, any cash realizable value
20	❖ For a joint product the relevant cost is variable post separation cost and for a normal product then the relevant cost is overall variable cost ❖ Production of G is recommended in case it is a joint product and the same would not be preferred if it is not a joint product
21	❖ H and T are joint products. Calculate the existing profit as per the current sal mix ❖ The company receives additional order for T and the same will also lead to incremental order for H. We need to calculate the minimum price to ensure that

Qn	Summary
	profits are maintained
22	❖ We need to prepare profitability statement for 4 proposals ❖ Piece rate under personnel director proposal = Existing rate + 1% for every 2 % increase ❖ Chairman proposal – Reverse work and get units
23	❖ Research and consultant report cost is sunk cost ❖ Calculate initial outflow, in-between flows and terminal flow ❖ The price will be assumed as X and we need to find the price at which we can generate zero NPV
24	❖ Sales at 100 percent capacity is Rs.72 lacs and factory cost at full capacity is Rs.48 lacs. Prime cost will be Rs.36 lacs ❖ We need to prepare profitability statement at the current capacity. Calculate the relevant cost for the new order and then calculate sales revenues based on maintenance of same profit margin
25	❖ WIP is to be valued based on 100 percent of material cost and 50 percent of conversion cost ❖ Net benefit of new product = Profit of new product – Inventory carrying cost – loss in contribution of existing product
26	❖ Reduce price, Improve quality, improve customer satisfaction, enter new markets
27	❖ Cost of dismantled kit = Cost + Insurance + Freight. Customs duty is to be considered while calculating the cost ❖ Technology fee = 8 crores/ 8 lac computers ❖ Assume royalty as X and sale price to be Y. Based on the two equations finally get the selling price
28	❖ Me-too product & Market Price ❖ Revolutionary product & Premium Price ❖ Evolutionary product & Demand based pricing
29	❖ Calculate the total cost in the normal manner and compare it with target manufacturing cost of Rs.60 per unit. Also find out the amount of cost reduction if any required
30	❖ Arrange the defects in the descending order of value. Compute cumulative defects as percentage of total defects and this would help us in finding the most important reasons for defects
Chapter 4: Budget & Budgetary Control	
1	❖ Efficiency ratio = Standard hours/actual hours ❖ Activity ratio = Standard Hours/ Budgeted hours ❖ Capacity ratio = Actual hours/ Budgeted hours ❖ Activity ratio = Efficiency ratio * Capacity ratio
2	❖ Prepare a cost sheet to get the missing information ❖ $DM + DL + VOH + \text{Opening WIP} - \text{Closing WIP} = \text{Variable cost of goods manufactured}$ ❖ $\text{Variable cost of goods manufactured} + \text{Opening FG} - \text{Closing FG} = \text{Variable cost of goods sold}$
3	❖ Invalid, Invalid, Invalid, Valid & Valid
4	❖ Budget for street maintenance = No of KM * (Last year cost * (1+ inflation rate * (1+weather related increase) ❖ Zero based budgeting is a process wherein the budgets are prepared without taking any base information
4	❖ Actual sales has to be adjusted for sales price variance to get the percentage of capacity utilization. The capacity utilization will be 80.74%

Qn	Summary
	❖ Variable cost can be considered as 80.74% of the full capacity cost. Fixed cost will remain same. Semi-variable cost has to be split for fixed and variable and then the cost is to be calculated
5	❖ Cash budget is to be prepared which will show various receipts and payments ❖ Receipts = Cash sales, Collections from customers ❖ Payments = Purchases, office expenses, Interest, Advance Tax, Rent
6	❖ Production of M & N = Sales + Closing Stock - Opening Stock ❖ Compute the desired consumption of raw material using the formula: production * Input / Output ❖ $EOQ = \sqrt{2 \times \text{Annual Demand} \times \text{Ordering cost} / (\text{Carrying cost})}$
7	❖ Production = Sales + Closing stock - Opening stock ❖ Prepare RM consumption based on purchases. Based on RM consumption compute the amount of RM purchases to be made ❖ Principal budget factor is one which constrains the sale of units. If the company does not have adequate labour hours then the same become principal budget factor. If the company has adequate labour then sales will continue to be the principal budget factor
8	❖ Flexible budget is to be revised for 3,200 units ❖ DM, DL and VOH will change based on change in volume. FOH will remain same and then total cost can be calculated ❖ Variances have to be computed using the normal standard costing formulae
9	❖ Material units would be comparing budgeted quantity with budgeted output ❖ Material price would be computing by comparing the percentage increase in price and then applying the same percentage again on revised price ❖ Labour rate will increase by 20 paise but the number of labour hours will be computed as standard hours divided by 90 percent. The rate increase has to be applied on the actual labour rate. (Institute material they have multiplied with 110 percent. The same is incorrect and it should be divided by 90 percent)
10	❖ Calculate the VC per unit and total variable cost for the period. Total variable cost = Sales - FOH - profit ❖ Compute units to be produced as = Sales + Closing stock - Opening stock ❖ Compute units to be consumed based on production and post that calculate the units to be consumed
11	❖ Overhead A will proportionately change with units change and hence has to be measured for 5,000 units as Rs.12/hr * 2 hours * 5,000 units ❖ Overhead B is a semi-variable OH. We need to split into variable and fixed and then compute the semi-variable OH ❖ Overhead C is a fixed and will remain same for flexible budget
12	❖ Similar to question no.6
14	❖ Actual sales has to be adjusted for sales price variance to get the percentage of capacity utilization. The capacity utilization will be 80.74% ❖ Variable cost can be considered as 80.74% of the full capacity cost. Fixed cost will remain same. Semi-variable cost has to be split for fixed and variable and then the cost is to be calculated
15	❖ Annual production = Sales + Closing stock of FG - Opening stock. This has to be split into quarter wise based on 80% of current quarter sales and 20% of next quarter sales ❖ RM Consumption = Annual Production * (Input/Output) ❖ RM Purchases = Closing stock of RM + Consumption - Opening stock of RM
16	❖ Compute production with sales, closing stock and opening stock of FG

Qn	Summary
	❖ Use this and compute consumption. Based on consumption we need to purchase of RM ❖ Find the number of labour hours required. Anything upto 40 hours a week will be normal time and beyond that it will be overtime. We need to consider higher rate for hours beyond normal time
17	❖ Production for 6th Period = Sales + Closing stock – Opening stock ❖ Compute the RM consumption based on production and then find out the purchases to be made ❖ Calculate the daily inventory level and place a fresh purchase order based on ROL set in by the company ❖ Payment is to be made after 10 working days
18	❖ Consider sales data. Based on sales get production of FG ❖ Consider production of FG and then calculate RM consumption ❖ Consider RM consumption data and based on that calculate RM to be purchased ❖ COGS budget will list down the various expenses and it would be in same format of cost sheet ❖ Balance sheet is to be prepared in the normal way and we need to employ the technique of single entry to do the same
19	❖ Production = Closing stock of FG + Sales – Opening stock of FG ❖ Compute annual consumption of RM based on Production ❖ RM Purchases = Closing stock + Consumption – Opening stock. We need to consider processing loss while calculating this
Chapter 5: Standard Costing	
1	❖ Assume no of units as 100 and also it is assumed that one unit require 1 KG of RM and 1 labour hour ❖ Data of 2015 are standards and 2016 are actuals ❖ Compute all variances and use marginal costing approach for reconciliation
2	❖ Expenditure Variance = Difference between budgeted expenditure and actual expenditure ❖ Efficiency variance = The company should have done 21 deliveries for 2100 units and hence the difference between standard cost of 21 and 19 deliveries
3	❖ Favorable Fixed OH Volume Variance, Adverse Material Usage, Adverse material usage and favorable material price, adverse sales price, adverse material price, adverse labour efficiency, adverse market share variance
4	❖ Reconciliation will have sales variances and cost variances ❖ Sales variances will be split as sales price and sales volume variance. Sales volume variance can be split as market size and market share variance ❖ Cost variance will have variable cost variance and fixed cost variance. Variable cost variance will be the difference between standard variable cost and actual variable cost whereas fixed cost variance will be the difference between budgeted fixed cost and actual fixed cost
5	❖ Growth component can be split into market size and market share factor. Market share factor is attributable to product differentiation component ❖ Price recovery will get mapped to product differentiation component ❖ Productivity will get mapped to productivity component
6	❖ Sales mix variance is the difference between RBQ and AQ whereas sales quantity variance is the difference between BQ and RBQ ❖ Market size variance is the difference between original budget and new budget whereas market share is the difference between new budget and revised budget
7	❖ Efficiency ratio = Standard hours/actual hours

Qn	Summary
	❖ Activity ratio = Standard Hours/ Budgeted hours ❖ Capacity ratio = Actual hours/ Budgeted hours ❖ Activity ratio = Efficiency ratio * Capacity ratio
8	❖ Actual cost for each cost component is available and with the help of variances we can compute standard cost ❖ We can then go ahead compute SP, SQ, SR, SH and Standard variable OH rate
9	❖ Labour rate variance will be the difference between $SR * AH - AR * AH$ ❖ Labour efficiency variance is the difference between $SR * SH - SR * AH$ ❖ Sales volume Variance is the difference between $BM * AQ - BM * BQ$ ❖ Sales Price variance is the difference between $AM * AQ - BM * AQ$
10	❖ Simple problem for material variances with no special adjustments ❖ $SQ = AO * Input / Output$
11	❖ Calculate SQ of B using Material Usage Variance ❖ Mix of two products will be 1:1. Assume AQ of A as X and get RSQ as total of AQ split in the ratio of 1:1 ❖ Use the material mix variance and then get the missing figures
12	❖ Growth component can be split into market size and market share factor. Market share factor is attributable to product differentiation component ❖ Price recovery will get mapped to product differentiation component ❖ Productivity will get mapped to productivity component
13	❖ Simple problem for labour variances
14	❖ Use hours approach for calculation of missing figures ❖ There is no days information and hence the four columns would be $SR * SH$, AFOH, BFOH and $SR * AH$ ❖ Use the variances information and then compute missing information
15	❖ Material variances: Compute actual material cost by considering the opening stock purchase at standard price and current purchase at the purchase price ❖ Other variances are to be computed in the normal manner with no special adjustment
16	❖ No special adjustment
17	❖ Commission at 5% percentage is earned and the same can be used to compute actual sales ❖ Actual sales is to be adjusted with sales volume variance and sales price variance to get budgeted sales ❖ Budgeted margin = Budgeted sales - Budgeted cost. This amount is to be adjusted with sales price variance and sales margin mix variance to get the actual margin
18	❖ Critical success factors are quality, price, delivery options, attractive packing ❖ Purchase price variance and labour efficiency variance is favorable and the same may indicate that the company is using inferior quality raw material. Hence the company has been going against its critical success factor of quality
19	❖ Material variances - No special adjustment - Similar to question No.11
20	❖ Growth component is the Sales volume variance and the difference between budgeted cost and standard cost ❖ Price recovery component is material price variance, labour rate variance, FOH expenditure variance, VOH expenditure variance and sales price variance ❖ Productivity component is material usage variance, labour efficiency variance, FOH volume and VOH efficiency variance
21	❖ Number of units produced = $OH \text{ absorbed} / SR \text{ per unit}$ ❖ OH absorbed can be calculated by comparing it with overhead incurred and overhead incurred can be calculated with the help of FOH expenditure variance

Qn	Summary
22	❖ Reverse work problem with no special adjustment
23	❖ Traditional approach computes variances in the normal manner ❖ Planning variance is the difference between original budget and revised budget whereas operating variance is the difference between revised budget and actual
24	❖ Good problem on understanding all reconciliation approaches ❖ No special adjustment in computation of variances ❖ Budget to Actual – Absorption – All variances are considered ❖ Budget to Actual – Marginal – FOH volume variance is ignored ❖ Standard to Actual – Absorption – Sales margin volume variance is ignored ❖ Standard to Actual – Marginal – FOH volume and sales margin volume variance is ignored ❖ Budgeted profit – Absorption – Budgeted units * Budgeted profit/unit ❖ Budgeted profit – Marginal – (Budgeted units * Budgeted cont/unit) – BFOH ❖ Standard profit – Absorption – Actual units * Budgeted profit/unit ❖ Standard profit – Marginal – (Actual units * Budgeted cont/unit) – BFOH
25	❖ No special adjustment – compute variances in the normal manner
Chapter 6: Costing of Service Sector	
1	❖ Operating cost statement can be prepared for a single bus ❖ Petrol, lubricants & sundries etc will be calculated based on kilometres travelled ❖ KM per bus = (Passenger KM per bus/40) ❖ Get the total cost and add desired margin. The rate per passenger KM can be arrived by dividing the revenues with no of passenger KM ❖ Part two: The margins of the company will decline as some of the expenses will increase due to inflation. Depreciation and route permit charges will not have impact of inflation
2	❖ The current revenues has to be split into three segments. The gross margins for three segments are available and the same can be used for calculating the current profit ❖ The company needs 20 percent increase in profit and the same would be the additional targeted profit. Profit from existing operations are not impacted due to the two suggestions ❖ Profit per two night holiday = 70% of accommodation + 20% of restaurant + 30% of bar ❖ No of room nights to be sold = Incremental profit / Profit per two night holiday ❖ Second suggestion: The group will be making extra profit due to increase in charges in restaurant and bar division. Increase in prices will directly lead to higher profit as there are no costs associated with it. This will be compared with targeted increase in profit and the balancing figure would be requirement from accommodation. The required increase in accommodation charges is to be compared with original accommodation revenue to identify the percentage increase in accommodation revenues
3	❖ Simple problem on concept of relevance costs ❖ Capture the relevant costs of three proposals and select the proposal having the lowest cost
4	❖ Original scenario: The company will have 240 passengers and they will give contribution of Rs.4,200 per passenger (fare – commission – food cost). The fixed cost against this is annual lease cost, ground services and flight crew services cost, fuel cost. BEP can be computed by dividing the fixed cost with contribution per passenger ❖ Part 2: The company will have to first find out the number of passengers travelling in different routes. 50 passengers will travel from D to B as per haltgo

Qn	Summary
	offer. ❖ The no of passengers for A to B can be 215 (240 -25 lost). However the number will be restricted to 210 as 50 seats will have to be given to Haltgo passengers from D to B ❖ The no of passenger from A to D will be 50 as compared to demand of 60. Consider incremental contribution and fixed cost and decide on the selection of the alternative
5	❖ Direct wages per week for various activities are given and the same needs to be recorded ❖ Direct expenses per week needs to be computed for house keeping and restaurant activity ❖ The direct expenses of general departments needs to be apportioned between house-keeping and restaurant on the basis of direct wages ❖ Indirect expenses should be split between house-keeping and restaurant on the basis of floor area. The amount should be calculated as per week ❖ There will be 60% occupancy and hence 294 room nights per week. This will give the cost per room night for house-keeping and restaurant. We need to add food charges in restaurant. Add profit margins and then get the final charges
6	❖ Patient days, Room nights/room days, Passenger KM/Tonne KM, No of meals/staff
7	❖ Variable cost per room day is available. The occupancy levels for off-season and normal season can help in getting the number of room days. The same can be used for getting total variable cost ❖ Total cost = Variable cost + fixed cost. Sales is computed with the help of the given profit margin ❖ We can therefore calculate the tariff per day by dividing overall sales by the number of room days ❖ BEP = Total fixed cost / Contribution per room day. Subtract the number of rooms of off-season to get the required occupancy of normal season ❖ Contribution per room day is to be calculated and the same can be multiplied with overall room days to get contribution. We can compute profit with the help of this contribution ❖ Target contribution = Current profit + Fixed cost. Contribution per room day is 150 and overall contribution divided by contribution per day would give us the number of room days and hence the desired increase in occupancy
8	❖ Calculate the number of patients attended by multiplying the no of patient per physicians * No of physicians * Number of days * Number of weeks ❖ Split the number of patients into the various patient mix. Also identify the mix of patient appointments ❖ Compute the revenues as per the given revenue structure and calculate profit ❖ Compute contribution per patient and then find out the break-even number of patients. Then convert the same into occupancy percentages.
Chapter 7: Transfer Pricing	
1	❖ Division B wants to purchase 40,000 units and hence outside sale can be only 60,000 units. ❖ Revenues of 1,00,000 units = Total cost + Interest cost + Target Profit ❖ Revenues from internal transfers = Total revenues - external revenues. Based on this we need to compute the transfer price ❖ Part two: First 30,000 units does not have any external demand and hence the transfer price would be equal to variable cost. Balance 10,000 units have external demand and for this the transfer price would be variable cost + Opportunity cost

Qn	Summary
2	❖ Part one: Prepare a revised profitability statement with changes in selling price. The component cost is to be taken as Rs.35 per unit ❖ Part two: Division Y has production capacity of 85,000 units and hence has to lose external demand if it has to fully meet internal demand. Prepare two profitability statement and decide on the best option
3	❖ G, G, R, G
4	❖ Transfers have to happen at opportunity cost. Transfer price = $[(VC * \text{Units not having external demand}) + (SP * \text{Units having external demand})] / \text{Total units transferred}$ ❖ Impact on profit = $(\text{Purchase price} - \text{Transfer price}) * \text{Units transferred}$
5	❖ Department Y and Z need material X as their input ❖ We need to first identify the strategy of Division Z and decide whether to expand or not. Similarly strategy of Division Y is to be identified ❖ Strategy of Division X would depend on the strategy of Division Y and Division Z
6	❖ Identify the current product mix of the company based on the transfer price of Rs.290 per unit ❖ Transfer price will have an impact on overall company profits if the company operates at a level different from the optimum level due to wrong transfer price. Find the optimum level from company point of view and see whether the overall profits are impacted ❖ Transfer price will have a range. Minimum transfer price = $(VC + OC)$; Maximum transfer price = $NMR \text{ at } OL / \text{Incremental units}$
7	❖ We are required to find strategy of division A in this question. The benefit for Division A will be the reduced purchase price and the loss for Division A will be the loss in contribution ❖ We need to compare both and select an alternative which has the highest net benefit ❖ Rate of change in discount: Discount changes from Rs.1900 to Rs.1600 for two alternatives. Rate of change = $\text{Change in discount} / \text{Market price}$
8	❖ Transfer price = $VC + \text{Opportunity cost}$ ❖ Opportunity cost = $(\text{Contribution without internal transfer}) - (\text{Contribution with internal transfer})$
9	❖ Indian subsidiary will have cost savings due to purchase from the Indian supplier. This is because of lower purchase price and we need to calculate the post tax savings for indian subsidiary ❖ Chinese subsidiary will lose sale of 30,000 units and will incur excise duty on 1,20,000 units. We need to calculate post-tax savings additional cost and compare the savings with additional cost
10	❖ Price = $a - bQ$. a refers to the price at which no sales is made. b refers to the rate of change ❖ $MR = a - 2bQ$. Equate MR to MC and then find the optimum level.
11	<u>Transfer price from Division A point of view</u> ❖ Option 1 – Loss is sale of product PC and hence that contribution has to be recovered from internal transfer ❖ Option 2 – Proportionate loss of product PC and AC and hence the contribution of that has to be recovered from internal transfer ❖ Maximum Price which B will offer = External purchase price – Modification cost ❖ Part 4 & 5: Division A should transfer units to Division B as the minimum transfer price is lower than maximum transfer price
Chapter 9 – Profitability Analysis	

Qn	Summary
1	❖ Innovation/learning perspective, Financial perspective & customer perspective
2	❖ Innovation and learning, Internal business, Customer, Innovation and learning, Internal business, Financial, Financial, Customer
3	❖ Customer, Learning and Growth, Internal Business, Learning and Growth
4	❖ Customer perspective – Increase the customer loyalty – Percentage of customers using loyalty cards ❖ Internal business – Customer to pay in reasonable time – Time spent by customers in queue to pay for products ❖ Learning and Growth – Qualified staff able to meet the needs of customers – No of staff training days
5	❖ Customer wise profitability statement is required ❖ Profit = Sales – Order processing cost – Variable cost – Discount – Regular delivery cost – Expedited delivery cost ❖ General administration cost is to be deducted from the overall profit of the channel (small pharma and large pharma)
6	❖ Financial perspective – Operating ratio has increased for the year instead of the target of reducing it ❖ Financial perspective – Average revenue per user has increased but the target has not been met ❖ Customer perspective – The company wanted to reduce the number of customer complaints. However the complaints have increased ❖ Internal business perspective – Increasing the customer relationship centres is part of this perspective. Company has met this target ❖ Learning and growth perspective – Employee coverage under training is covered in this – the company has not been able to meet this target
7	❖ Internal business perspective, customer perspective, customer perspective, Internal business, Learning and growth, Financial, Learning and Growth, Customer, Financial, Customer
Chapter 1: Linear Programming	
1	❖ Objective is to maximize the number of principal buyers. The same would be 20,000 for A, 9,000 for B and 3,200 for C ❖ Constraints: Total advertisement cost, maximum limit on A, Minimum limit of B and C
2	❖ Objective function will have 3 products and its profits ❖ Constraint no.1 will be on operation 1 time and constraint no.2 will be on operation 2 time ❖ The company can sell maximum of product R and the same will also be one constraint ❖ Relationship between product Q and R to be shown as one constraint
3	❖ Contribution for three products are to be calculated by subtracting the raw material cost. RM cost is computed as given percentage of three products multiplied with respective cost per kg. The composition of inert ingredients will be 80 percent for all three products ❖ RM availability has to be developed as three constraints ❖ Production constraint of product 1 has to be developed as one constraint
4	❖ Three constraints and one objective function is to be developed ❖ We need to assume one of the variable as 0 and get the two co-ordinates for every constraint ❖ Prepare graph and find the common area. The other corners will form part of the feasible solution and select the level which gives maximum profit

Qn	Summary
5	❖ Objective function: Maximize return ❖ Constraints: Minimum return, maximum risk, maximum limit on investment of stock and mutual fund
6	❖ Co-efficient of S1, S2 and A2 = 0,0 & -M in equation 1 ❖ Co-efficient of S1, S2 and A2 = 0,-1 & 1 in equation 3 ❖ Slack variable = S1; Surplus variable = S2 ❖ S1 and A2 form part of initial solution ❖ Part 4: Co-efficient of S1, S2 and A2 = 0,0 & M in equation 1 ❖ Co-efficient of S1, S2 and A2 = 0,-1 & 1 in equation 3
7	❖ Objective is to maximize reach ❖ Variables: No of radio programmes and No of TV Programmes ❖ Constraints: Maximum budget, maximum radio and minimum TV
8	❖ There are three products in the question and hence the objective function will have three variables. However 30 units of X3 is to be exactly produced and hence the same can be converted into fixed profit of Rs.150 ❖ The available resources has to be reduced by the utilization for X3 and then the same should be solved by simplex method
9	❖ A feasible solution is one which does not have artificial variable in the solution. Hence the given solution is a feasible one ❖ The given solution is also an optimal one as the various variables of NER is less than or equal to zero. However there exist an alternative solution as one of the non-program variables (X2) has NER of 0. Perform one more step of iteration and get the shadow prices ❖ Shadow prices refers to the NER of the various slack variables ❖ NER of product X3 will tell us how much should be the price increase for it to form part of final solution ❖ Only one product has entered in the given table and hence the same would be the second table. We will have to reverse work and get the original table and then get to the desired answer
10	❖ Two products are there and three constraint equations can be formed ❖ We can solve this problem using graphical method
11	❖ Objective is to maximize return. We can assume the various variables as amount invested in each of the asset class ❖ Various constraints are investment in Govt Bonds, total investment, investment in shares, investment in money market, investment in shares to be not more than investment in mutual fund, investment in mutual fund
12	❖ We need to assume one of the variable as 0 and get the two co-ordinates for every constraint ❖ Prepare graph and find the common area. The other corners will form part of the feasible solution and select the level which gives maximum profit
13	❖ Test of optimality can be done by getting the NER and the solution will be optimal if all NER is less than or equal to zero ❖ Alternative optimal solution exist if one of the non-program variable has NER of zero ❖ Feasible solution is one which has no artificial variable in the solution ❖ Degeneracy is the situation where one of the variables has quantity of zero ❖ Objective function is the initial equation. Profit has to be computed by substituting the quantity in the objective function ❖ Machines not being fully utilized will form part of the final solution. S3 is not being fully utilized in this case ❖ Payment for one hour of machine would be equal to the shadow price as seen in

Qn	Summary
	NER ❖ Machine having highest shadow price should be given priority for expansion ❖ Loss in profit = Loss in hours * Shadow Price ❖ Price increase for Z = NER of Z ❖ Profitability of new product = Base profit - Shadow costs
14	❖ Objective function: Maximize return ❖ Constraints: Minimum return, maximum risk, maximum limit on investment of portfolio X and Y, maximum limit on overall investment
15	❖ Primal can be converted into dual by doing transpose of the matrix ❖ The minimization function will become maximization function in dual ❖ $\geq$ constraint will become $\leq$ constraint
16	❖ Objective is to maximize interest income ❖ Constraint: Loan limit, 30% limit for farm and commercial loans, 50% limit for home loans, 5% limit for bad debts
17	❖ Co-efficient in objective function = +M. M indicates infinity and hence you will have infinite cost in case the same part of final solution ❖ S1 and S2 will not form part of initial solution as they have negative 1 co-efficient
Chapter 2: Transportation Problem	
1	❖ Unbalanced maximization transportation problem with no special adjustment
2	❖ Initial basic feasible solution is given. We need to check for optimality directly ❖ Carrier of route C wants to II wants to take the entire quantity. This will have reallocation of other costs and hence the overall costs can go up. The increase in cost has to be absorbed as a discount by the carrier of route C to II
3	❖ Initial basic feasible solution is to be found and later on the same is to be tested for optimality ❖ An alternative solution can exist in case Delta (ij) table has zero for any of the non-allocated cells
4	❖ Convert the given matrix into an opportunity loss matrix. Opportunity loss matrix is identified by subtracting all elements of profit matrix from the highest element of the matrix ❖ Get the initial solution through VAM
5	❖ Initial solution through 3 methods to be found with no special adjustment
6	❖ A dummy row is to be introduced to make it a balanced transportation problem. There will be 9 columns and if the allocations are less than 8 then we will have degeneracy
7	❖ Not mandatory as R2C2 can form part of the solution
8	❖ Feasible is one where the supply and demand of various locations are met ❖ Degeneracy is a scenario where the number of allocations is less than $m+n-1$ ❖ An optimum solution is one where all elements of Delta (ij) table are greater than or equal to zero
9	❖ Initial solution through 3 methods to be found with no special adjustment
10	❖ A dummy row is to be introduced to make it a balanced transportation problem. There will be 9 columns and if the allocations are less than 8 then we will have degeneracy
11	❖ Similar to question no.2
12	❖ Given problem can be treated as an assignment problem and be solved using rules of assignment
13	❖ Initial solution has been given and an alternative solution exist as one of Delta (ij) element is zero. We need to draw a loop from zero and find the alternative solution

Qn	Summary
14	❖ Initial solution has to be computed as per least cost method and North west corner rule ❖ Degeneracy can come if the number of allocations are less than $m+n-1$. Number of allocations can be lesser if a row and column both get cancelled with one allocation. The same can happen if D2 and D3 is mapped with F3
Chapter 3: Assignment Problem	
1	❖ Unbalanced minimization problem with no special adjustment
2	❖ Two zeroes in initial matrix need not be same as one of the zero could have been created out of column operations ❖ Two allocations are already done and the balance allocation can be either combination of first row with 4th column or 1st column. Other allocation can be combination of fourth row with 1st column or 4th column
3	❖ We need to draw minimum number of lines to cover zeroes and the same would have been possible in less than 4 lines. Hence we will not get a solution ❖ Part two : We need to draw the matrix and do a reverse working to get the solution
4	❖ Unbalanced minimization problem with no special adjustment ❖ Rejected method has to be compared with other methods to find out the required savings in time
5	❖ We need to follow trial and error method to get the final allocation
6	❖ A is possible, B is not possible, C and D are not possible
7	❖ Two zeroes in initial matrix need not be same as one of the zero could have been created out of column operations ❖ Two allocations are already done and the balance allocation can be either combination of first row with 4th column or 1st column. Other allocation can be combination of fourth row with 1st column or 4th column
8	❖ Balanced minimization problem with no special adjustment
9	❖ We can get a solution if R3C3 is zero ❖ Second solution: If other elements are zero then we have to do column operations to get extra zero and then get a solution
10	❖ Balanced minimization problem with no special adjustment
11	❖ We need to follow trial and error method to get the final allocation
12	❖ Balanced maximization problem with no special adjustment
13	❖ Create a layover time for stay at Kolkata and a table for layover at Bangkok ❖ Compare both matrix and get minimum of every cell and then do normal row and column operations ❖ Check for optimality
14	❖ If we draw the number of lines then it will be only two and hence we have to find the least open element ❖ The LOE will be added at the intersection of first row and first column and hence it will not form part of the final solution
Chapter 4: CPM & PERT	
1	❖ Draw the network diagram and calculate E and L values for every node ❖ The path with the longest duration will be critical path. The activities on critical path will have same E and L ❖ Total float = LFT - EFT; Free float = Total Float - Slack of head event
2	❖ Invalid, Valid, Invalid, Invalid, Invalid and Valid
3	❖ Draw network diagram and find the various paths ❖ Prepare cost slope table and find the maximum possible reduction in time for every activity

Qn	Summary
	❖ Prepare crashing table till one of the paths is fully crashed out ❖ Find the duration which has the lowest cost and the same will be the optimum duration
4	❖ Draw the network diagram and find the various time estimates such as EST, EFT, LFT and LST ❖ Activities having LFT of less than 15 days should have been completed by day 15 and all activities have LST of less than 15 days should have been started by day 15. If these is not followed then overall project duration will increase ❖ We need to update the revised network diagram as per the changes in the various activities
5	❖ Draw network diagram and calculate E and L for various nodes ❖ Activities having same E and L will form part of critical path. Critical path will have the longest duration ❖ Project cost = Normal cost of various activities + Critical path duration * 115/day
6	❖ Expected time for an activity = $(\text{Pessimistic time} + \text{Optimistic time} + 4 * \text{Most likely time})/6$ ❖ Variance of an activity = $[(\text{Pessimistic time} - \text{Optimistic time})/6]^2$ ❖ Variance of critical path = Sum of variances of various activities forming part of critical path ❖ Critical path duration will get revised as the duration of one of the activities forming part of critical path undergoes a change
7	❖ Draw network diagram and find the various paths ❖ Prepare cost slope table and find the maximum possible reduction in time for every activity ❖ Prepare crashing table till one of the paths is fully crashed out ❖ Find the duration which has the lowest cost and the same will be the optimum duration ❖ Find the duration with minimum time and the associated cost
8	❖ Expected time for an activity = $(\text{Pessimistic time} + \text{Optimistic time} + 4 * \text{Most likely time})/6$ ❖ Variance of an activity = $[(\text{Pessimistic time} - \text{Optimistic time})/6]^2$ ❖ Variance of critical path = Sum of variances of various activities forming part of critical path ❖ Probability can be calculated with the help of Z value. $Z = (\text{Target time} - \text{Normal time})/\text{SD of critical path}$
9	❖ Draw network diagram and find the various paths ❖ Prepare cost slope table and find the maximum possible reduction in time for every activity ❖ Prepare crashing table till one of the paths is fully crashed out ❖ Find the duration which has the lowest cost and the same will be the optimum duration ❖ Find the duration with minimum time and the associated cost
10	❖ Draw network diagram and find the various paths ❖ Prepare cost slope table and find the maximum possible reduction in time for every activity ❖ Prepare crashing table till one of the paths is fully crashed out ❖ Find the duration which has the lowest cost and the same will be the optimum duration ❖ Find the duration with minimum time and the associated cost
11	❖ P and Q are parallel activities. These activities can be corrected by drawing a dummy activity

Qn	Summary
12	❖ Draw the network diagram and list down the various path ❖ Identify the various time estimates by doing a reverse working on EST, TF and duration
13	❖ Invalid, Valid, Invalid, Invalid, Invalid and Valid
14	❖ Normal network diagram with no special adjustments
15	❖ Draw the network diagram and find the various time estimates such as EST, EFT, LFT and LST ❖ Activities having LFT of less than 15 days should have been completed by day 15 and all activities have LST of less than 15 days should have been started by day 15. If these is not followed then overall project duration will increase ❖ We need to update the revised network diagram as per the changes in the various activities
16	❖ Prepare a time-scaled diagram. We can reschedule some of the non-critical activities and do the reallocation to smoothen the resource requirement ❖ Check when the resource requirement peaks and do a reallocation of the non-critical activities. In case adequate resources are not available then the company has to opt for overtime working
17	❖ Prepare a time-scaled diagram. We can reschedule some of the non-critical activities and do the reallocation to smoothen the resource requirement ❖ Check when the resource requirement peaks and do a reallocation of the non-critical activities.
18	❖ Draw network diagram and find the various paths ❖ Prepare cost slope table and find the maximum possible reduction in time for every activity ❖ Prepare crashing table till one of the paths is fully crashed out ❖ Find the duration which has the lowest cost and the same will be the optimum duration
19	❖ Duration of activity = Difference between EST and EFT ❖ $LST = LFT + Duration$ ❖ $TF = LFT - EST$ ❖ Activities with TF of 0 form part of critical path ❖ Draw a network diagram and then do the crashing of the low cost activities
Chapter 6: Simulation	
1	❖ Fit single digit random number for every year cash flow ❖ Run the model and get the cash flow of each year. Calculate NPV of the identified cash flow structure ❖ Find the average NPV for the five experiments
2	❖ Closing cash balance = Opening cash balance + Sales – Wages – RM cost ❖ Find sales, Wages and RM cost with the random number table
3	❖ Fit random number table for demand ❖ Find the stock position of each day with these columns, Opening balance, RN for demand, Demand Quantity, Units received, Closing balance, Units under order, Need for fresh order ❖ Select the option at which the total of ordering and carrying cost is lowest
4	❖ Draw a network diagram and find the normal duration of the project. The path with the longest duration is the critical path. Duration of the critical path is the project duration ❖ Crashing steps: Identify the various paths, prepare cost slope table, do step-by-step crashing to reduce duration, find the cost associated with the crashing for 5 days

Qn	Summary
	❖ Part three: Look at the network diagram and find the various activities which can be relaxed. We can relax only non-critical activities as the same will not increase the duration but will save cost for the company
5	❖ Random number tables have already been prepared for patient arrival time and consultation time ❖ The patient has to arrive every 20 mins and their time of arrival can change depending on whether they come early/late ❖ Patient waiting time is the difference between patient in time and patient service start time ❖ Dietician waiting time is the difference between service end time of one patient and the service start time of next patient ❖ The dietician should look at increasing the gap between two appointments for them to reduce the waiting time of patients
6	❖ Identify the demand for every day using the RN table ❖ Profit for 10 days = (Units sold * SP) - (Units produced * Production cost) - (Unmet demand * Penalty) - (Unsold cake * Penalty)
7	❖ Fit random number table for demand of fresh cake and one day old cake ❖ Order on day 1 would depend on the stock position of day 0 and also the demand of previous day. The order placed on day 1 would be received on day 2 and will be utilized for meeting the demand of day 2 ❖ Profit = Sale value of fresh cakes - sale value of old cake - Purchase cost
8	❖ Prepare a random number table for arrival and service ❖ Run the simulation exercise and find out the number of laptops under service by end of every day
9	❖ Fit in a random number table for demand ❖ Find the demand for every units ❖ To a unit reconciliation with these columns: Opening stock, Purchase, Sales, units scrapped, Closing stock ❖ Profit = Value of sales - Value of purchases + Value of closing stock - Value of opening stock
10	❖ Fit random number table for time to deal with clients and time between call arrivals ❖ Start with minute 0 and find the call in time of first caller. Service start time for first caller will be the call in-time itself ❖ Service start time for second caller will depend on service end time of first caller. If the waiting time is more 10 minutes then a gift voucher is to be given ❖ Weekly cost = (Cost during simulation period / Simulation period in mins) * 4500 mins
11	❖ Random number table is to be fit for type of service (manual and automated) and arrival rate ❖ The probabilities are given in the question and we need
12	❖ Draw a network diagram and identify the various possible paths ❖ Prepare random number table for each activity and find the time taken for each activity ❖ Critical path will be the one which takes the longest time for each of the trial
13	❖ Fit random number table for demand, CPU, advertising cost and investment ❖ Calculate profit for each trial. Profit = Demand * CPU - Advertising cost ❖ ROI = Profit / Investment
14	❖ Prepare random number table for receipt and payment. Find the closing cash balance as opening balance + Receipt - Payment

Qn	Summary
	❖ If the closing cash balance is negative then the same indicates that the bank will fall short in payment ❖ Probability of shortfall with OD of 45 crores = No of months having shortfall of more than 45 crores / 12
15	❖ Fit random number table for demand and supply ❖ Profit = Value of sales - Value of purchases - (unmet demand * 8)
Chapter 7: Learning Curve	
1	❖ Part one: The company plans to produce 4 units and hence the labour cost can be identifying using multiplication technique. Average labour time for 4 units = Average labour time of 2 units * 90%; Average labour time of 2 units = Time for 1st unit * 90%. ❖ Part two: Learning curve benefit is not applicable if different people work on the order and hence the price identified in part one cannot be justified
2	❖ The overall variable cost for unit 1 is 4,400. 50% of these costs are having learning benefit and the balance 50% do not have this benefit ❖ The average variable cost for 4 units is Rs.4,120. This will be split as 2,200 for part where learning benefit is not there and Rs.1,920 where learning benefit is available ❖ Average labour cost for 4 units = Average cost for 1 unit * LR * LR. Solving this equation we will get learning ratio ❖ Part two: We need to calculate the average cost at various levels and then find out the contribution which can be earned. The price level giving maximum contribution will be selected ❖ Learning co-efficient of learning ratio = Log of learning ratio / Log of 2
3	❖ Learning curve ratio will help us in getting the average time. Average time of 2 units = Time of unit 1 * Learning curve ratio ❖ Time for 2nd unit = Total time for 2 units - Time for 1st unit
4	❖ Average time for 25 batches = Average time for 1 batch * (25)^{Learning co-efficient} ❖ Time for 25th batch = Total time for 25 batches - Total time for 24 batches ❖ Average selling price for 500 units: Labour cost (total time for 25 batches + time of 25th batch * 25) + Other cost + Fixed cost + Desired Profit - Sales value of first 4,500 units
5	❖ Not valid, Valid, Valid and Not valid
6	❖ The company has two options for meeting the P Limited order. It can use its own workforce for P Limited order or use the services of P Limited's workforce ❖ The above options has different cost structure as the learning curve benefit is applicable for full 8 units (option 1) or first 4 units and then balance 4 units (option 2) ❖ Prepare profitability statement and decide the better option
7	❖ Not applicable, Not applicable, Not applicable and Not applicable
8	❖ Average time for 63 units and 64 units can be computed with the available values given in the question ❖ Time for 64th unit = Total time for 64 units - total time for 63 units ❖ Calculate cost for 256 units and compute the overall profit ❖ Part two: Calculate target labour cost = Total sales - Profit - Material cost - Other variable costs - Specific fixed cost. ❖ Get the target labour cost per unit and then use the below formula ❖ Average labour time for 256 units = Time for unit 1 * (LCR)⁸
9	❖ Sensitivity analysis is done to find the level of change in variable which can lead to reversal of decision

Qn	Summary
	❖ In this case the company is currently making profits. We need to find out the level at which zero profit will be made ❖ Target labour cost = Sales - All other costs. From this we will have to find the desired learning curve ratio. Sensitivity = $(\text{Change}/\text{Base}) * 100$
10	❖ The budget was prepared based on wrong learning curve and hence the same needs to be adjusted ❖ The budgeted figures can be used for calculating SR and actual figures can be used for calculating actual rate ❖ Standard time is to be re-computed based on the revised learning curve understanding. Variances are then to be computed in the normal manner
11	❖ Expected total labour hours = (AT for 250 units * 250 units) + (Time for 250th unit * 750 units) ❖ Time for 250th unit = Total time for 250 units - total time for 249 units ❖ Target labour cost = Sales - All other costs - profit. Target labour cost per unit = Total labour cost/No of units
12	❖ Material variances: SP is to be taken from the original budget whereas SQ is to be calculated using learning curve analysis. $SQ = \text{Total time for 320 batches} - \text{Total time for 319 batches}$ ❖ Labour and VOH Variances: SR is to be taken from the original budget whereas SH is to be calculated using learning curve analysis. $ST = \text{Total time for 320 batches} - \text{Total time for 319 batches}$
13	❖ We need to calculate average time for 40 units and 60 units ❖ Total time for 40 units and 60 units can be calculated. Incremental time for 20 units = Total time for 60 units - Total time for 40 units
14	❖ Standard time for 250 units = Average time for 250 units * 250 + Time for 250th unit * 250 units ❖ Compare ST and AT and then calculate efficiency variance ❖ Standard time will be taken as 40000 hours in case the concept of learning curve is not used and accordingly the variance will be calculated

Question No.1 – November 2016 RTP

Queenstown Furniture (QF) manufactures high-quality wooden doors within the forests of Queenstown since 1952. Management is having emphasize on creativity, engineering, innovation and experience to provide customers with the door they desire, whether it is a standard design or a one-of-a-kind custom door. The following information pertains to operations during April:

Processing time	9.0 hrs.*	Waiting time	6.0 hrs.*
Inspection time	1.5 hr.*	Move time	7.5 hrs.*
Units per batch	60 units		

(*) average time per batch

Required

Compute the following operational measures:

- Average non-value-added time per batch
- Average value added time per batch
- Manufacturing cycle efficiency
- Manufacturing cycle time

Question No.2 – November 2016 RTP

'SM' hospital is a primary medical care facility and trauma center that serves National Capital Territory. The hospital offers all the medical/ surgical services of typical small hospital.

Required

- Using your (limited, moderate, or in-depth) knowledge of a hospital's operations, identify 4 key activities that are important.
- For each of the activities, suggest an appropriate cost driver.

Question No.3 – November 2016 RTP

In WM Ltd. the 'OB' equipment is about to be replaced either by 'CF' system or by an 'OF' system. Finance costs 12% a year and the other estimated costs are as follows:

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Annual Operating Costs	24,000 p.a.	18,000 p.a.

Required

If the company expected the new system (either CF or OF) to last at least for 12 years, which system should be chosen?

Question No.4 – November 2016 RTP

Examine the Validity of following statements:

- (i) In the introduction stage, usual marketing strategy is to strengthen the supply chain relationships to make the product easily accessible by target customers.
- (ii) In the introduction stage, competitors will purchase the product to carry out reverse engineering and understand how the product works, so that they can develop their own similar, but different product.
- (iii) In the introduction phase, the firm will seek to avoid this competition by maintaining its selling price at the end of the introduction stage.
- (iv) In the growth stage, if the product cannot be differentiated in other ways, the firm may need further reductions in selling price to maintain growth.
- (v) In the maturity stage, firms are tempted to engage in costly promotional price wars to wean away market share from competitors.
- (vi) In the decline stage, failing sales may induce firms to slash marketing expenditure. Brand loyalty will be exploited to create profits.

Question No.5 – November 2016 RTP

Napier Company uses a backflush costing system with three trigger points:

- (a) Purchase of Direct Materials
- (b) Completion of Good Finished Units of Product
- (c) Sales of Finished Goods

You are provided with the following information for July 2016.

Direct Materials Purchased	₹2,64,000	Conversion Costs Allocated	₹1,20,000
Direct Materials Used	₹2,55,000	Costs Transferred to Finished Goods	₹3,75,000
Conversion Costs Incurred	₹1,26,600	Cost of Goods Sold	₹3,57,000

Required

- (i) Prepared journal entries for July (without disposing of under allocated/ over allocated conversion costs).
- (ii) Under an ideal JIT production system, how would the amounts in your journal entries change from the journal entries in requirement (i)?

Note

- There are no beginning inventories.
- Assume there are no direct material variances.

Question No.6 – November 2016 RTP

ANZB Financial Services Limited is an Indian banking and financial services company headquartered in Chennai, Tamil Nadu. Apart from lending to individuals, the company grants loans to micro, small and medium business enterprises. Listed below are several costs incurred in the loan division of ANZB Financial Services Limited.

- (i) Remuneration of the loan division manager.
- (ii) Cost of Printer Paper, File Folders, View Binders, Ink, Toner & Ribbons used in the loan division.
- (iii) Cost of the division's MacBook Pro purchased by the loan division manager last year.
- (iv) Cost of advertising in business newspaper by the bank, which is allocated to the loan division.

Cost Classification

Controllable by the loan division manager	Direct cost of the loan division	Sunk Cost
Uncontrollable by the loan division manager	Indirect Cost of the loan division	Out of Pocket Cost

Required

For each Cost, indicate which of the above mentioned Cost Classification best describe the cost.

Note

More than one classification may apply to the same cost item.

Question No.7 – May 2016 RTP

KNM Road Carriers is a transporting company that transports goods from one place to another. It measures quality of service in terms of:

- (i) Time required to transport goods
- (ii) On-time delivery
- (iii) Number of lost or damaged cartons.

To improve its business prospects and performance the company is seriously considering to install a scheduling and tracking system, which involves an annual outlay of ₹1,25,000. The company furnishes the following information about its present and anticipated future performance:

	Current	Expected
On-time delivery	85%	95%
Variable costs per carton lost or damaged	₹ 55	₹ 55
Fixed costs per carton lost or damaged	₹ 45	₹ 45
Number of cartons lost or damaged	2,500	1,200

Required

- (i) Should KNM Road Carriers acquire and install the new system?
- (ii) Also calculate additional amount of revenue required if benefits from new system is equal to cost & Contribution margin is 47.5%.

Question No.8 – May 2016 RTP, Nov 2017 RTP

A manufacturing company produces Ball Pens that are printed with the logos of various companies. Each Pen is priced at ₹5. Costs are as follows:

Cost Driver	Unit Variable Cost (₹)	Level of Cost Driver
Units Sold	2.5	-
Setups	225	40
Engineering hours	10	250

Other Data

Total Fixed Costs (conventional) ₹ 48,000

Total Fixed Costs (ABC) ₹ 36,500

Required

- (i) Compute the break-even point in units using activity-based analysis.
- (ii) Suppose that company could reduce the setup cost by ₹ 75 per setup and could reduce the number of engineering hours needed to 215. How many units must be sold to break even in this case?

Question No.9 – November 2016

Speedo Limited is a specialist car manufacturer that produces various models of cars. The organization is due to celebrate its 100th anniversary next year. To mark the occasion, Speedo Limited intends to produce a sports car; the Model Royal. As this will be a special edition, production will be limited to 1,000 numbers of Model Royal Cars.

Speedo Limited is considering using a target costing approach and has conducted market research to determine the features that consumers require in a sport car. Based on this market research and knowledge of competitor's products, company has decided to price the Model Royal at ₹9.75 Lacs. Company requires an operating profit margin of 25% of the selling price of the car. Details for the forthcoming year are as follows:

Forecast of direct costs for a Model Royal Car-

Labour..... ₹ 2,50,000

Material..... ₹ 4,75,000

Forecast of annual overhead costs-

	₹ In lacs	Cost driver
Production line cost	2,310	See note 1
Transportation costs	900	See note 2

Note 1

The production line that would be used for Model Royal has a capacity of 60,000 machine hours per year. The production line time required for Model Royal is 6 machine hours per car. This production line will also be used to make other cars and will be working at full capacity.

Note 2

Some models of cars are delivered to showrooms using car transporters, 60% of the transportation costs are related to the number of deliveries made. 40% of the transportation costs are related to the distance travelled.

The car transporters have forecast to make a total of 640 deliveries in the year and carry 10 cars each time. The car transporter will always carry its maximum capacity of 10 cars.

The total annual distance travelled by car transporters is expected to be 2,25,000 kms. 50,000 kms of this is for the delivery of Model Royal cars only. All 1,000 Model Royal cars that will be produced will be delivered in the year using the car transporters.

Required

- Calculate the forecast total cost of producing and delivering a Model Royal car using Activity Based Costing principles to assign the overhead costs.
- Calculate the cost gap that currently exists between the forecast total cost and the target total cost of a Model Royal car. (10 Marks)

Question No.10 – November 2016

ABC Ltd. produces three products A, B and C. The following information is available for a period:

Product	A	B	C
Contribution per unit (Sales – Direct Materials) (₹)	30	25	15

Machine hours required per unit of production:

Product	Machine hours required per unit			Through put Accounting ratio
	A	B	C	
Machine 1	10	2	4	133.33%
Machine 2	15	3	6	200.00%
Machine 3	5	1	2	66.67%

Estimated sales demand for A, B and C are 500 units each and machine capacity is limited to 6,000 hours for each machine.

Required

Analyse the above information and apply theory of constraints process to remove the constraints. How many units of each product will be made? (6 Marks)

Question No.11 – May 2016

A company produces and sells a single product. The cost data per unit for the year 2017 is predicted as below:

	₹ per unit
Direct material	35
Direct labour	25
Variable overheads	15
Selling price	90

The company has forecast that demand for the product during the year 2017 will be 28,000 units. However to satisfy this level of demand, production quantity will be increased?

There are no opening stock and closing stock of the product.

The stock level of material remains unchanged throughout the period.

The following additional information regarding costs and revenue are given:

- 12.5% of the items delivered to customers will be rejected due to specification failure and will require free replacement. The cost of delivering the replacement item is ₹ 5 per unit.
- 20% of the items produced will be discovered faulty at the inspection stage before they are delivered to customers.
- 10% of the direct material will be scrapped due to damage while in storage.

Due to above, total quality costs for the year is expected to be ₹ 10,75,556.

The company is now considering the following proposal:

1. To introduce training programmes for the workers which, the management of the company believes, will reduce the level of faulty production to 10%. This training programme will cost ₹ 4,50,000 per annum.
2. To avail the services of quality control consultant at an annual charges of ₹ 50,000 which would reduce the percentage of faulty items delivered to customers to 9.5%.

You are required to:

- (i) Prepare a statement of expected quality costs the company would incur if it accepts the proposal. Costs are to be calculated using the four recognised quality costs heads.
- (ii) Would you recommend the proposal? Give financial and non-financial reasons.

(8 Marks)

Question No.12 – May 2016

Indicate 2 activity drivers in respect of each of the following activity cost pools:

- (i) *Manufacturing cost*
- (ii) *Human resources cost*
- (iii) *Marketing and sales costs*
- (iv) *Accounting costs*

(4 Marks)

Question No.13 – November 2015

Classify the following items under appropriate categories of quality costs, viz., Prevention Costs (PC), Appraisal Costs (AC), Internal Failure Costs (IFC) and External Failure Costs (EFC):

- (i) *Unplanned replacement to customers*
- (ii) *Correction of a bank statement*
- (iii) *Design review*
- (iv) *Equipment accuracy check*
- (v) *Staff training*
- (vi) *Reprocessing of a loan operation*
- (vii) *Product liability warranty*
- (viii) *Product acceptance*
- (ix) *Wastage of material*
- (x) *Planned maintenance of equipment*

Question No.14 – November 2015

Innovation Ltd. has entered into a contract to supply a component to a company which manufactures electronic equipments.

Expected demand for the component will be 70,000 units totally for all the periods. Expected sales and production cost will be

Period	1	2	3	4
<i>Sales (units)</i>	<i>9,500</i>	<i>17,000</i>	<i>18,500</i>	<i>25,000</i>
<i>Variable cost per unit</i>	<i>30</i>	<i>30</i>	<i>32.50</i>	<i>35</i>

Total fixed overheads are expected to be ₹14 lakhs for all the periods.

The production manager has to decide about the production plan.

The choices are:

Plan 1: *Produce at a constant rate of 17,500 units per period. Inventory holding costs will be ₹ 6.50 per unit of average inventory per period.*

Plan 2: Use a just-in-Time (JIT) system

Maximum capacity per period normally 18,000 units

It can produce further up to 10,000 units per period in overtime.

Each unit produced in overtime would incur additional cost equal to 30% of the expected variable cost per unit of that period.

Answer zero opening inventory.

- (i) Calculate the incremental production cost and the savings in inventory holding cost by JIT production system.
- (ii) Advise the company on the choice of a plan. (8 Marks)

Question No.15 – November 2015

X Ltd. makes a single product with the following details:

Description	Current Situation	Proposed Change
Selling Price (₹/unit)	10	
Direct Costs (₹/unit)	5	
Present number of setups per production period, (before each production run, setup is done)	42	
Cost per set up (₹)	450	Decrease by ₹90
Production units per run	960	1,008
Engineering hours for production period	500	422
Cost per engineering hour (₹)	10	

The company has begun Activity Based Costing of fixed costs and has presently identified two cost drivers, viz. production runs and engineering hours. Of the total fixed costs presently at ₹96,000, after the above, ₹72,100 remains to be analyzed. There are changes as proposed above for the next production period for the same volume of output.

- (i) How many units and in how many production runs should X Ltd. produce in the changed scenario in order to break-even?
- (ii) Should X Ltd. continue to break up the remaining fixed costs into activity based costs? Why? (8 Marks)

Question No.16 – November 2015

A company is planning a new product. Market research information suggests that 40,000 units of the product can be sold at a maximum of ₹25 per unit. The company seeks a minimum mark-up of 25% on product cost. It is estimated that the lifetime costs of the product will be as follows:

- (1) Research and development, design costs ₹1,50,000

(2) Manufacturing costs ₹ 16 per unit

(3) End of life costs ₹ 70,000

(4) Promotion and capacity cost ₹ 20,000

Should the product be manufactured?

(4 Marks)

Question No.17 – November 2015

State whether and why the following statements are valid or not valid:

(Statements need not be copied into answer book.)

(i) Target costing is not applicable to a monopoly market.

(ii) Target costing ignores non-value added activities.

(4 Marks)

Question No.18 – May 2015

Genex Limited produces 3 products X, Y and Z using three different machines M_1 , M_2 and M_3 . Each machine's capacity is limited to 6,000 hours during the production period. The details given below are for the production period:

Particulars	X	Y	Z
Selling price per unit	₹ 12,000	₹ 10,000	₹ 8,000
Variable cost per unit	₹ 8,000	₹ 6,800	₹ 6,000
Machine Hours required per unit:			
M_1	18	12	6
M_2	18	16	8
M_3	20	8	2
Expected Demand (units)	200	200	200

(i) Determine the bottleneck activity.

(ii) Allocate the machine hours on the basis of the bottleneck.

(iii) Determine the unused spare capacity, if any, of each machine.

(8 Marks)

Question No.19 – May 2015

Linex Limited manufactures three products P, Q and R which are similar in nature and are usually produced in production runs of 100 units. Product P and R require both machine hours and assembly hours, whereas product Q requires only machine hours. The overheads incurred by the company during the first quarter are as under:

	₹
Machine Department expenses	18,48,000
Assembly Department expenses	6,72,000

Setup costs	90,000
Stores receiving cost	1,20,000
Order processing and dispatch	1,80,000
Inspect and Quality control cost	36,000

The data related to the three products during the period are as under:

	P	Q	R
Units produced and sold	15,000	12,000	18,000
Machine hours worked	30,000 hrs.	48,000 hrs.	54,000 hrs.
Assembly hours worked (direct labour hours)	15,000 hrs.	-	27,000 hrs.
Customers orders executed (in numbers)	1,250	1,000	1,500
Number of requisitions raised on the stores	40	30	50

Prepare a statement showing details of overhead costs allocated to each product type using activity based costing. (8 Marks)

Question No.20 – May 2015

Quality products can be determined by using a few of the dimensions of quality. Identify the following under the appropriate dimension:

- Consistency of performance over time.
- Primary product characteristics.
- Exterior finish of a product
- Useful life of a product. (4 Marks)

Question No.21 – May 2015

Classify the following business activities into primary and support activities under value chain analysis.

- Material Handling and Warehousing.
- Purchasing of raw materials, supplies and other consumables.
- Order processing and distribution
- Selection, placement and promotion of employees. (4 Marks)

Question No.22 – November 2014

A company manufactures several products of varying designs and models. It uses a single overhead recovery rate based on direct labour hours. The overheads incurred by the Company in the first half of the year are as under:

	₹
Machine operation expenses	20,25,000
Machine maintenance expenses	3,75,000
Salaries of technical staff	12,75,000
Wages and salaries of stores staff	5,25,000

During this period, the company introduced activity based costing system and the following significant activities were identified:

- Receiving materials and components
- Set up of machines for production runs
- Quality inspection

It is also determined that:

- The machine operation and machine maintenance expenses should be apportioned between stores and production activity in 1:4 ratio.
- The technical staff salaries should be apportioned between machine maintenance, set up and quality inspection in 3 : 4 : 3 ratio.

The consumption of activities during the period under review are as under:

- Direct labour hours worked 80,000
- Production set-ups 4,080
- Material and components consignments received from suppliers 3,920
- Number of quality inspection carried out 2,560

The direct wages rate is ₹ 12 per hour.

The data relating to two products manufactured by the company during the period are as under:

		P	Q
Direct Materials costs	₹	12,000	8,000
Direct labour hours	Hrs.	960	100
Direct Materials Consignments received	nos.	48	52
Production runs	nos.	36	24
Number of quality inspection done	nos.	30	10
Quantity Produced	units in nos.	15,000	5,000

A potential customer has approached the company for the supply of 24,000 units of a component 'R' to be delivered in lots of 3,000 units per quarter. The job will involve an initial design cost of ₹60,000 and the manufacture will involve the following per quarter.

Direct Material costs	₹	12,000
Direct labour hours	Hrs.	300
Production runs	nos.	6
Inspections	nos.	24

<i>Number of consignments of direct materials to be received</i>	<i>nos.</i>	<i>20</i>
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You are required to:

- 1. Calculate the cost of products P and Q based on the existing system of single overhead Recovery rate.*
- 2. Determine the cost of product P & Q using Activity Based Costing system.*
- 3. Compute the sales values per quarter of components 'R' using Activity Based Costing system. (considering a mark up of 25% on cost) (10 Marks)*

Question No 23 – May 2014

A Ltd. is going to introduce Total Quality Management (TQM) in its company. State whether and why the following are valid or not for the successful implementation of TQM.

- (i) Some departments serve both the external and internal customers. These departments have been advised to focus on satisfying the needs of the external customers.*
- (ii) Hold a training program at the beginning of a production cycle to ensure the implementation of TQM.*
- (iii) Implement Management by Objectives for faster achievement of TQM.*
- (iv) Appoint the Head of each department as the person responsible to develop improvement strategies and performance measures.*
- (v) Eliminate wastage of time by avoiding documentation and procedures. (5 Marks)*

Question No.24 – May 2014

PQR Ltd. specializes in the distribution of pharmaceutical products. It buys from pharmaceutical companies and resells to each of the three different markets:

- (i) General Supermarket Chains*
- (ii) Drug Store Chains*
- (iii) Chemist Shops*

The company plans to use activity based costing for analyzing the profitability of its distribution channels. The following data for the quarter ending March 2014 is given:

	<i>General Supermarket Chains</i>	<i>Drug Store Chains</i>	<i>Chemist Shop</i>
<i>Average sales per delivery</i>	<i>₹ 96,500</i>	<i>₹ 32,450</i>	<i>₹ 6,225</i>
<i>Average cost of goods sold per delivery</i>	<i>₹ 94,650</i>	<i>₹ 31,800</i>	<i>₹ 5,950</i>
<i>Number of deliveries</i>	<i>960</i>	<i>2,470</i>	<i>8,570</i>

<i>Total number of orders</i>	<i>1,000</i>	<i>2,650</i>	<i>9,500</i>
<i>Average number of cartons shipped per delivery</i>	<i>250</i>	<i>75</i>	<i>12</i>
<i>Average number of hours of shelf stocking per delivery</i>	<i>2</i>	<i>0.5</i>	<i>0.1</i>

The following information is available in respect of operating costs (other than cost of goods sold) for the quarter ending March 2014:

<i>Activity Area</i>	<i>Cost Driver</i>	<i>Total Cost (₹)</i>
<i>Customer purchase order processing</i>	<i>Purchase order by customers</i>	<i>5,91,750</i>
<i>Customer store delivery</i>	<i>Number of deliveries</i>	<i>9,60,000</i>
<i>Cartons dispatched to customer stores</i>	<i>Number of Cartons dispatched to customer stores</i>	<i>7,92,135</i>
<i>Shelf stocking at customer store</i>	<i>Hours of shelf stocking</i>	<i>80,240</i>

Compute the operating income of each distribution channel for the quarter ending March 2014 using activity based costing. (8 Marks)

Question No.25 – May 2014

Classify the following items appropriately under the three measures used in the Theory of Constraints:

- (i) Research and Development Cost*
- (ii) Rental/Utilities*
- (iii) Finished Goods Inventory*
- (iv) Depreciation*
- (v) Labour Cost*
- (vi) Stock of Raw Materials*
- (vii) Sales*
- (viii) Cost of Equipment and Buildings*

Question No.26 – November 2013

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:

	A	B	C	D
Selling Price (₹/unit)	40	50	60	70
Variable Cost (₹/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

What are the opportunity costs of A, B, C and D?

(5 Marks)

Question No.27 – November 2013

The following independent situations are given in JIT systems of production. You are required to state if each recommendation is valid or invalid and give a brief reason.

Sl. No.	Situation	Recommendation by the Cost Accountant
(i)	A company produces LCD TVs. Presently total inventory turnover is measured annually.	Compute inventory turnover every month. Break it down into raw material, WIP, expensive inventory and finished goods.
(ii)	Textile company.	Accept employees' claim for piece rate incentive for exceeding a certain production volume.
(iii)	Sports goods manufacturing company.	Closely monitor direct labour variances including idle time variances to convince employees to work faster.
(iv)	Multiproduct production	Monitor the average set up time per machine in a period which is given by <u>Aggregate set up time of all machines</u> Total number of machines.

(4 Marks)

Question No.28 – November 2013

MK Ltd. manufactures four products, namely A, B, C and D using the same plant and process. The following information relates to a production period:

Product	A	B	C	D
Output in Units	720	600	480	504

The four products are similar and are usually produced in production runs of 24 units and sold in batches of 12 units. The total overheads incurred by the company for the period are as follows:

	₹
Machine operation and maintenance cost	63,000
Setup costs	20,000

<i>Store receiving</i>	<i>15,000</i>
<i>Inspection</i>	<i>10,000</i>
<i>Material handling and dispatch</i>	<i>2,592</i>

During the period the following cost drivers are to be used for the overhead cost:

<i>Cost</i>	<i>Cost driver</i>
<i>Setup cost</i>	<i>No. of production runs</i>
<i>Store receiving</i>	<i>Requisitions raised</i>
<i>Inspection</i>	<i>No. of production runs</i>
<i>Material handling and dispatch</i>	<i>Orders executed</i>

It is also determined that:

- *Machine operation and maintenance cost should be apportioned between setup cost, store receiving and inspection activity in the ratio 4: 3: 2.*
- *Number of requisition raised on store is 50 for each product and the no. of orders executed is 192, each order being for a batch of 12 units of a product.*

Calculate the total overhead cost per unit of each product using activity based costing after finding activity wise overheads allocated to each product. (8 Marks)

Question No.29 – November 2013

In Value Chain analysis, business activities are classified into primary activities and support activities. Classify the following under the more appropriate activity.

- (i) Order processing and distribution*
- (ii) Installation, repair and parts replacement*
- (iii) Purchase of raw material and other consumable stores*
- (iv) Transforming inputs into final products*
- (v) Selection, promotion, appraisal and employee relations*
- (vi) Material handling and warehousing*
- (vii) General management, planning, finance, accounting*
- (viii) Communication, pricing and channel management (4 Marks)*

Question No.30 – November 2013

State the type of cost in the following cases:

- (i) Cost associated with the acquisition and conversion of material into finished product.*
- (ii) Cost arising from a prior decision which cannot be changed in the short run.*
- (iii) Increase in cost resulting from selection of one alternative instead of another.*
- (iv) Rent paid for a factory building which is temporarily closed. (4 Marks)*

Question No.31 – May 2013

DEF Bank operated for years under the assumption that profitability can be increased by increasing Rupee volumes. But that has not been the case. Cost analysis has revealed the following:

Activity	Activity Cost (₹)	Activity Driver	Activity Capacity
Providing ATM service	1,00,000	No. of transactions	2,00,000
Computer processing	10,00,000	No. of transactions	25,00,000
Issuing Statements	8,00,000	No. of statements	5,00,000
Customer inquiries	3,60,000	Telephone minutes	6,00,000

The following annual information on three products was also made available:

	Checking Accounts	Personal Loans	Gold Visa
Units of product	30,000	5,000	10,000
ATM transactions	1,80,000	0	20,000
Computer transactions	20,00,000	2,00,000	3,00,000
Number of statements	3,00,000	50,000	1,50,000
Telephone minutes	3,50,000	90,000	1,60,000

Required:

- Calculate rates for each activity.
- Using the rates computed in requirement (i), calculate the cost of each product.

(8 Marks)

Question No.32 – May 2013

Gupta Ltd. produces 4 products P, Q, R and S by using three different machines X, Y and Z. Each machine capacity is limited to 6,000 hours per month. The details given below are for July, 2013:

	P	Q	R	S
Selling price p.u. (₹)	10,000	8,000	6,000	4,000
Variable cost p.u. (₹)	7,000	5,600	4,000	2,800
Machine hours required p.u.				
Machine X	20	12	4	2
Machine Y	20	18	6	3
Machine Z	20	6	2	1
Expected Demand (units)	200	200	200	200

Required:

- Find out the bottleneck activity.
- Allocate the machine hours on the basis of the bottleneck.
- Ascertain the profit expected in the month if the monthly fixed cost amounts to ₹ 9,50,000.

(iv) Calculate the unused spare hours of each machine.

(8 Marks)

Question No.33 – November 2012

PQR Limited sells two versions: Deluxe and Premium of its only product GoGo Juicer. The GoGo Juicer uses patented technology to extract the last drop of juice from most fruits. The 'Premium' version can handle larger fruit and has more options relative to the 'Deluxe' version. The following table provides the financial results of the most recent year of operations:

Particulars	Deluxe 90,000 units	Premium 10,000 units	Total 1,00,000 units
Revenue (₹)	63,00,000	9,00,000	72,00,000
Material cost (₹)	10,80,000	2,50,000	13,30,000
Direct labour cost (₹)	14,40,000	1,60,000	16,00,000
Contribution margin (₹)	37,80,000	4,90,000	42,70,000
Allocated fixed manufacturing overhead (₹)	34,20,000	3,80,000	38,00,000
Allocated fixed selling and administrative overheads (₹)	2,51,563	35,937	2,87,500
Profit margin (₹)	1,08,437	74,063	1,82,500
Profit margin per unit (₹)	1.2048	7.4063	

Labour cost is ₹ 16 per hour and each product requires one hour of labour. The company currently allocates all fixed manufacturing overheads, using labour hours as the allocation basis. It allocates fixed selling and administrative overheads, using revenue as the allocation base.

Although the profit margin per unit of 'Deluxe' juicer is rather low, PQR Limited believes that it is important to keep this model in the product mix. However, PQR can tailor its promotion and sales strategies to improve the sales mix to 16:4 ratio from the current 9:1 ratio of 'Deluxe' to 'Premium' juicers, with total volume staying at 1,00,000 units.

PQR Limited finds that ₹ 1.1 million of the ₹ 3.8 million of fixed manufacturing overheads pertains to batch related activities such as scheduling production runs. Similarly, ₹ 1,15,000 is the amount of administrative overheads out of the ₹ 2,87,500 of selling and administrative overheads.

It is found that the 'premium' juicer is produced in smaller batches (250 units per batch) than that of 'Deluxe' juicer (500 units per batch). Similarly, it takes 10 sales visits to sell 1,000 units of the 'Deluxe' juicer, while it takes 25 visits to sell 1,000 units of 'Premium' juicer.

Required:

- (i) Prepare a profitability statement based on the proposed sales mix, using the most appropriate basis of allocating fixed overheads.

(In absence of an appropriate basis, do not allocate overheads to products)

- (ii) Advise the company on whether it should go ahead with the propose change in sales mix.

(10 Marks)

Question No.34 – May 2012

State whether each of the following independent activities is value-added or non-value-added:

- (i) Polishing of furniture used by a systems engineer in a software firm.*
- (ii) Maintenance by a software company of receivables management software for a banking company.*
- (iii) Painting of pencils manufactured by a pencil factory.*
- (iv) Cleaning of customers' computer key boards by a computer repair centre.*
- (v) Providing, brake adjustments in cars received for service by a car service station.*

(5 Marks)

Question No.35 – May 2012

(c) State with a brief reason whether you would recommend an activity based system of costing in each of the following independent situations:

- (i) Company K produces one product. The overhead costs mainly consist of depreciation.*
- (ii) Company L produces 5 different products using different production facilities.*
- (iii) A consultancy firm consisting of lawyers, accountants and computer engineers provides management consultancy services to clients.*
- (iv) Company S 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 the target costs.*

(5 Marks)

Question No.36 – May 2012

Classify the following items under the more appropriate category:

Category (CC) – Cost Control Or Category (CR) – Cost Reduction:

- (i) Costs exceeding budgets or standards are investigated.*
- (ii) Preventive function*
- (iii) Corrective function*
- (iv) Measures to standardize for increasing productivity*
- (v) Provision of proper storage facilities for materials.*
- (vi) Continuous comparison of actual with the standards set.*
- (vii) Challenges the standards set*
- (viii) Value analysis*

(4 Marks)

Question No.37 – November 2015 RTP

Hindustan Bikes Ltd. (HBL) formerly known as HELCO is an Indian multinational company. It's headquarter is located in Bengaluru, India. It has been founded in the year 1990 as a manufacturer of locomotives. The company is presently listed locally as well as in international stock market. HBL's parent company is Hindustan Group. The management of HBL recognizes the need to establish a culture at the company so that -

"Do the right things, right the first time, every time".

Management has provide you following actual information for the most recent month of the current year:

Cost Data

₹

Customer Support Centre Cost	35 per hr.
Equipment Testing Cost	18 per hr.
Warranty Repair Cost	1,560 per bike
Manufacturing Rework Cost	228 per bike

Volume and Activity Data

Bikes Requiring Manufacturing Rework	3,200 bikes
Bikes Requiring Warranty Repair	2,600 bikes
Production Line Equipment Testing Time	1,600 hrs.
Customer Support Centre Time	2,000 hrs.

Additional information

HBL carried out a quality review of its existing suppliers to enhance quality levels during the month at a cost of ₹1,25,000. Due to the quality issues in the month, the bike production line experienced unproductive 'down time' which cost ₹7,70,000.

Required:

Prepare a statement showing 'Total Quality Cost'.

Question No.38 – November 2015 RTP

P & G International Ltd. (PGIL) has developed a new product "K" which is about to be launched into the market and anticipates to sell 80,000 of these units at a sales price of ₹300 over the product's life cycle of four years. Data pertaining to product "K" are as follows:

Costs of Design and Development of Molds, Dies, and Other Tools	₹8,25,000
Manufacturing Costs	₹125 per unit
Selling Costs	₹12,500 per year + ₹100 per unit
Administration Costs	₹50,000 per year
Warranty Expenses	5 Replacement Parts per 25 units at ₹10 per part ; 1 Visit per 500 units (Cost ₹ 500 per visit)

Required:

- Compute the product "K"'s 'Life Cycle Cost'.
- Suppose PGIL can increase sales volume by 25% through 10% reduction in selling price. Should PGIL choose the lower price?

Question No.39 – May 2015 RTP, Nov 2017 RTP

ABC Ltd. is planning to introduce Kaizen Costing approach in its manufacturing plant. State whether and why the following are VALID OR NOT in respect of Kaizen Costing.

- (i) VP (Finance) is of the view that company has to make a huge initial investment to bring a large scale modification in production process.
- (ii) Head (Personnel) has made a point that introduction of Kaizen Costing does not eliminate the training requirement of employees.
- (iii) General Manager (Manufacturing) firmly believes that only shop floor employees and workers' involvement is prerequisite of Kaizen Costing approach.
- (iv) Manager (Operations) has concerns about creation of confusion among employees and workers regarding their roles and degradation in quality of production.

Question No.40 – May 2015 RTP, Nov 2017 RTP

Y-Connections, China based firm, has just developed ultra-thintablet S-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000. The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹79,600 per unit	₹69,600 per unit
Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

Required:

ADVISE Y-Connections, regarding the OPTIMAL PLANT CAPACITY to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.

Question No.41 – November 2014 RTP

7 Star Sports Co. (7SSC) is engaged in the manufacture of cricket bats. Following table shows the budgeted figures for the coming year:

Particulars	₹ per unit
Selling Price	4,800
Less: Components (1 Set)	1,200
Assembling Costs	2,000

Delivery Cost	800
Contribution	800

Components like willow, rubber grip and handle bar in a set, are bought in and an assembling process carried out to transform them into a single bat. Market is intensely competitive where 7SSC currently holds 30% market share. Annual demand of these bats is 1,00,000 units.

On reviewing previous performance it is revealed that 3% of the bats supplied to customers were returned for free replacement because of faults. Defective components, which are initially bought in to assembling process, are held responsible for this. These returned bats cannot be repaired and have no scrap value. Supply of faulty bats to customers could be eliminated by implementing an inspection process immediately before the goods are delivered. This would improve customer perception thus resulting in an increase of 5% in current market share (making in all a total share of 35%).

- Calculate the quality non-conformance cost for the coming year, based on the budgeted figures and sales returns rate.
- Calculate the impact on profitability due to implementation of inspection process for the bats.

Question No.42 – November 2014 RTP

P & G International Ltd. (PGIL) has developed a new product 'α³' which is about to be launched into the market. Company has spent ₹ 30,00,000 on R&D of product 'α³'. It has also bought a machine to produce the product 'α³' costing ₹ 11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value.

The company has decided to charge price that will change with the cumulative numbers of units sold:

Cumulative Sales (units)	Selling Price ₹ per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525
15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand <i>per week (units)</i>
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

	₹ per unit
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

PGIL uses just-in-time production system. Following is the total contribution statement of the product 'α³' for its Introduction and Growth phase:

	Introduction	Growth	
Weeks	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price <i>per unit</i> (₹)	750	600	525
Variable Cost <i>per unit</i> (₹)	375	300	300
Contribution <i>per unit</i> (₹)	375	300	225
Total Contribution (₹)	8,25,000	16,50,000	18,56,250

Required:

- Prepare the total contribution statement for each of the remaining two phases of the product's life cycle.
- Discuss Pricing Strategy of the product 'α³'.
- Find possible reasons for the changes in cost during the life cycle of the product 'α³'.

Question No.43 – November 2014 RTP

KP Ltd. (KPL) manufactures and sells one product called "KEIA". Managing Director is not happy with its current purchasing and production system. There has been considerable discussion at the corporate level as to use of 'Just in Time' system for "KEIA". As per the opinion of managing director of KPL Ltd. - *"Just-in-time system is a pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales. By using Just in Time system, it is possible to reduce carrying cost as well as other overheads"*.

KPL is dependent on contractual labour which has efficiency of 95%, for its production. The labour has to be paid for minimum of 4,000 hours per month to which they produce 3,800 standard hours.

For availing services of labour above 4,000 hours in a month, KPL has to pay overtime rate which is 45% premium to the normal hourly rate of ₹110 per hour. For avoiding this overtime payment, KPL in its current production and purchase plan utilizes full available normal working hours so that the higher inventory levels in the month of lower demand would be able to meet sales of month with higher demand level. KPL has determined that the cost of holding inventory is ₹70 per month for each standard hour of output that is held in inventory.

KPL has forecast the demand for its products for the first six months of year 2014 as follows:

Month	Demand (Standard Hrs)
Jan'14	3,150
Feb'14	3,760
Mar'14	4,060
Apr'14	3,350
May'14	3,650
Jun'14	4,830

Following other information is given:

- (a) All other production costs are either fixed or are not driven by labour hours worked.
- (b) Production and sales occur evenly during each month and at present there is no stock at the end of Dec'13.
- (c) The labour are to be paid for their minimum contracted hours in each month irrespective of any purchase and production system.

As a chief accountant you are requested to comment on managing director's view.

Question No.44 – May 2014 RTP

United Video International Company (UVIC) sells package of blank video tapes to its customer. It purchases video tapes from Indian Tape Company (ITC) @ ₹ 140 a package. ITC pays all freight to UVIC. No incoming inspection is necessary because ITC has a superb reputation for delivery of quality merchandise. Annual demand of UVIC is 13,000 packages. UVIC requires 15% annual return on investment. The purchase order lead time is two weeks. The purchase order is passed through Internet and it costs ₹ 2 per order. The relevant insurance, material handling etc ₹ 3.10 per package per year. UVIC has to decide whether or not to shift to JIT purchasing. ITC agrees to deliver 100 packages of video tapes 130 times per year (5 times every two weeks) instead of existing delivery system of 1,000 packages 13 times a year with additional amount of ₹ 0.02 per package. UVIC incurs no stock out under its current purchasing policy. It is estimated UVIC incurs stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of a stock out, UVIC has to rush order tape packages which costs ₹ 4 per package. Comment whether UVIC should implement JIT purchasing system.

Hindustan Tape Company (HTC) also supplies video tapes. It agrees to supply @ ₹ 136 per package under JIT delivery system. If video tape purchased from HTC, relevant carrying cost would be ₹ 3 per package against ₹ 3.10 in case of purchasing from ITC. However HTC. doesn't enjoy so sterling a reputation for quality. UVIC anticipates following negative aspects of purchasing tapes from HTC.

- To incur additional inspection cost of 5 paisa per package.
- Average stock out of 360 tapes packages per year would occur, largely resulting from late deliveries. HTC cannot rush order at short notice. UVIC anticipates lost contribution margin per package of ₹ 8 from stock out.
- Customer 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.

Comment whether UVIC places order to HTC.

Question No.45 – Nov 2017 RTP, May 2015 RTP

Examine the Validity of following statements along with the reasons:

- (i) The concepts, tools and techniques of value chain analysis apply only to all those organizations which produce and sell a product.
- (ii) Procurement activities are included in the Primary activities as classified by Porter under value chain analysis concept.
- (iii) Value chain analysis in the strategic framework consists of single cost driver concept.

Question No.46 – May 2014 RTP

Jigyasa India Ltd. (JIL) has 30 retail stores of uniform sizes 'Fruity & Sweety Retailers' across the country. Mainly three products namely 'Butter Jelly', 'Fruits & Nuts' and 'Icy Cool' are sold through these retail stores. JIL maintains stocks for all retail stores in a centralised warehouse. Goods are released from the warehouse to the retail stores as per requisition raised by the stores. Goods are transported to the stores through two types of vans i.e. normal and refrigerated. These vans are to be hired by the JIL.

Costs per month of JIL are as follows:

	(₹)
Warehouse Costs:	
Labour & Staff Costs	27,000
Refrigeration Costs	1,52,000
Material Handling Costs	28,000
Total	2,07,000
Head Office Cost:	
Salary & Wages to Head Office Staff	50,000
Office Administration Costs	1,27,000
Total	1,77,000
Retail Stores Costs:	
Labour Related Costs	33,000
Refrigeration Costs	1,09,000
Other Costs	47,000
Total	1,89,000

Average transportation cost of JIL per trip to any retail stores are as follows:

Normal Van	₹3,200
Refrigerated Van	₹4,900

The Chief Financial Manager asked his Finance managers to calculate profitability based on three products sold through Fruity & Sweety retail stores rather than traditional method of calculating profitability.

The following information regarding retail stores are gathered:

	Butter Jelly	Fruits & Nuts	Icy Cool
No. of Cartons <i>per cubic metre</i> (m ³)	42	28	40
No. of Items <i>per cartons</i> (units)	300	144	72
Sales <i>per month</i> (units)	18,000	4,608	1,152
Time in Warehouse (in months)	1	1.5	0.5
Time in Retail Stores (in months)	1	2	1
Selling Price <i>per unit</i> (₹)	84	42	26
Purchase Price <i>per unit</i> (₹)	76	34	22

Butter Jelly and Icy-Cool are required to be kept under refrigerated conditions.

Additional information:

Total Volume of All Goods Sold <i>per month</i>	40,000 m ³
Total Volume of Refrigerated Goods Sold <i>per month</i>	25,000 m ³
Carrying Volume of <i>each van</i>	64 m ³

Required:

Calculate the Profit *per unit* using Direct Product Profitability (DPP) method.

Question No.47 – November 2013 RTP

Edward Ltd. manufactures weighing machines of standard size and sells its products to two industrial customers namely MT Ltd. and KG Ltd. and to a dealer MG Bros. having shops in different cities. The maximum retail price per unit of weighing machine is ₹ 11,000 and per unit average cost of production is ₹ 5,500 (40% is general fixed overhead cost).

The Finance Officer has been asked to undertake a customer profitability analysis and calculate and compare the profit margin per customer (before deducting general fixed overhead) to know about the real customer profitability.

Following are the additional overhead information:

Delivery costs	₹ 200 per kilometer
Emergency delivery cost (in addition to delivery cost)	₹ 21,000 per delivery
Order processing cost	₹ 6,000 per order
Specific discount and sales commission	As per negotiation
Product Advertisement cost	Actual cost

The following data are available for each customer

Particulars	MT Ltd.	KG Ltd.	MG Bros.
Sales (in units)	2,000	1,000	800
Total delivery kilometer travelled	1,000	800	900
No. of emergency delivery	2	1	0
No. of orders processed	4	2	8
Specific Discount (percentage of sales revenue)	25%	20%	15%
Sales Commission (percentage of sales revenue)	15%	10%	5%
Advertisement Costs (₹)	8,75,000	6,15,000	4,30,000

You are required to analyse the profitability for each customer, which customer is the most profitable.

Question No.48 – November 2013 RTP

Galaxy Ltd has a dedicated set of production facilities for an auto component – coded X pertaining to the gearbox of its leading car – GX2. With a vendor park set up in the vicinity of the parent manufacturing plant, the Just – in – Time system ensures that no stock of materials; work in progress or finished goods are held.

At the beginning of the year 2009, the planned information relating to the production of component X through the dedicated facilities is as follows:

- (i) Each unit of component X has input materials; 5 units of materials A at ₹ 20 per unit and 4 units of materials B at ₹ 10 per unit.
- (ii) Variable cost per unit of component X (excluding materials) is ₹ 25 per unit worked on.
- (iii) Fixed costs of the dedicated facilities for the period: ₹ 250,000.
- (iv) It is anticipated that 7.5% of the units of X worked on in the process will be defective and will be scrapped.
- (v) It is estimated that customers will require replacement (free of charge) of faulty units of component X at the rate of 1 % of the quantity invoiced to them in fulfillment of order

Galaxy Ltd. is pursuing a TQM philosophy. Consequently all losses will be treated as abnormal in recognition of a zero defect policy and will be valued at variable cost of production.

Actual statistics for each of the years 2009-2011 for component X are shown given below–

	2009	2010	2011
Worked on in the process (units)	6,005	7,500	7,000
Invoiced to customers (units)	5,500	6,500	6,500
Total costs:			
Materials A and B (₹)	840,700	1,050,000	980,000
Variable costs of production (₹) (Excluding materials costs)	150,125	187,500	175,000
Fixed costs (₹)	287,500	262,000	290,000

No changes have occurred from the planned price levels from materials, variable overhead or fixed overhead costs.

Actual free replacement of components X to customers were 250 units and 40 units in years 2010 and 2011 respectively.

Galaxy Ltd. authorized additional expenditure during the year 2010 and 2011 as follows:

2010: Equipment accuracy checks of ₹ 10,000 and staff training of ₹ 5,000.

2011: Equipment accuracy checks of ₹ 10,000 plus ₹ 15,000 of inspection costs; also staff training costs of ₹ 5,000 plus ₹ 3,000 on extra planned maintenance of equipment.

Required:

- Analyse the figures given above in table to check whether in the year 2009 actual results were achieved at the planned level in respect of (i) quantities and losses and (ii) units cost levels for material and variable costs.
- Use your analysis from (a) in order to calculate the value of the internal and external failure costs for year 2009
- Prepare an analysis for the years 2010 and 2011 which provide reconciliation between the number of components invoiced to customers with those worked-on in the production process. The analysis should show the change from the planned quantity of process losses and changes from the planned quantity of replacement of faulty components in customer hands;
- Prepare a cost analysis for the years 2010 and 2011 which shows actual internal failure costs, external failure costs, appraisal costs and prevention costs;
- Prepare a report, which explains the meaning and inter – relationship of figures given above in table and in the analysis in (a), (b), (c) & (d). The report should also give examples of each cost type and comment on their use in the monitoring and progressing of the TQM policy being pursued by Galaxy Ltd.

[Note: Ignore fractions in case of units]

Question No.49 – May 2013 RTP

Alfa Ltd. manufactures two products. Each product passes through two departments A and B before it becomes a finished product. The data for the year are as under:

Products	X	Y
(i) Maximum Sales Potential (in units)	7,400	10,000
(ii) Product unit data:		
S.P. p.u	₹ 90	₹ 80
Machine hours p.u.		
Department A hours @ ₹ 40/hr.	0.50	0.30
Department B hours @ ₹ 60/hr.	0.40	0.45

- (i) Maximum capacity of Department A is 3,400 hours and Department B is 3,640 hours.
- (ii) Maximum quantity of direct materials available is 17,000 kgs. Each product requires 2 kg. of direct materials. The purchase price of direct materials is ₹ 5/kg.
- (a) You are required to formulate the information as a linear programming problem, with the objective of maximization the total profit, subject to the constraints mentioned above. (Only formulation is required. Solution is not needed).
- (b) In view of the aforesaid production capacity constraints, the company has decided to produce only one of the two products during the year. Which of the two products should be produced and sold in the year to maximise profit? State the number of units of that product and relevant contribution.

Question No.50 – May 2017

A company can make any or both of products A and B in a production period not exceeding a total of 10,000 units due to non-availability of the required material and labour. Until now, the company had been taking decisions on the product mix, based on the following marginal cost analysis.

	A (₹/u)	B (₹/u)	
Selling Price	100	120	
Variable Cost	60	70	
Contribution	40	50	
Total fixed costs			3,00,000

Since the decisions based on the above approach did not yield the required results, the fixed costs were analysed as follows for 10,000 units of only A or 10,000 units of only B.

Item of Cost	Details for A	A (Amt.)	B (Amt.)	Details for B
Set up cost	10 production runs	40,000	75,000	10 production runs
Distribution cost	₹ 120/ box	60,000	25,000	₹ 200 per box
Step fixed cost	₹ 4,000 per 2,000 units	20,000	50,000	₹ 5,000 per 1,000 units
	Total	1,20,000	1,50,000	

₹ 30,000 can be taken as the unanalysed fixed cost, and unavoidable whether A or B or both are produced.

The following cost reduction measures were taken by the Product Managers of A and B:

	A	B
Increase in number of units per run to	2,000 units	1,250 units
Increase in the number of units per box distributed to	30 units	125 units

Further, the Management ensured availability of raw material and labour to support a production of 15,000 units of either A or B or both together. There was no change to the step costs or contribution. However, the total unanalysed fixed cost increased to ₹ 32,000.

- Based on the principles of Activity Based Costing, prepare a statement showing the contribution and item wise analysed overheads for each product, arrive at the profitability of A and B and then the final profits if 15,000 units of only A or 15,000 units of only B are manufactured.
- Find the minimum break-even point in units if only product A is manufactured after the cost reduction. (12 Marks)

Question No.51 – May 2017

PH Ltd. makes and supplies pizzas to three college A, B and C across the city. It is exploring the viability of discontinuing C and supplying to a nearer college 'D'. However, there is an extra quantity of 800 units which it can supply to A if it discontinues C. The details are given below:

	A	B	C	D
No. of Pizzas (existing)	1,500	2,500	4,800	-
Proposed	*			4,000
Contribution ₹/unit excluding delivery costs	72	67	65	60
(km/delivery) distance	20	30	40	25
No. of deliveries (normal)	100	125	400	200
No. of rush deliveries (₹ 200 / rush delivery)	-	40	20	30
Normal Delivery Cost (₹ /km) (not applicable to rush deliveries)	20	20	20	20

- * If it has to supply 800 extra units to A, it has to reduce the price on the original supply also. Moreover, these 800 units will involve 65 normal deliveries and 20 rush deliveries.
- Prepare a customerwise profitability statement based on the existing quantities given in the table for A, B and C and the proposed 4,000 numbers for D.
 - By how much can PH reduce the price per unit supplied to college A in order to justify the additional supply? (8 Marks)

Question No.1 – May 2017 RTP

If AICI Limited operates its plant at normal capacity it produces 2,00,000 units from the plant 'C'. The unit cost of manufacturing at normal capacity is as under:

	₹
Direct material.....	65
Direct labour.....	30
Variable overhead.....	33
Fixed overhead.....	7
	<u>135</u>

Direct labour cost represents the compensation to highly-skilled workers, who are permanent employees of the company. The company cannot afford to lose them. One labour hour is required to complete one unit of the product.

The company sells its product for ₹ 200 per unit with variable selling expenses of ₹ 16 per unit. The company estimates that due to economic down turn, it will not be able to operate the plant at the normal capacity, at least during the next year. It is evaluating the feasibility of shutting down the plant temporarily for one year.

If it shuts down the plant, the fixed manufacturing overhead will be reduced to ₹ 1,25,000. The overhead costs are incurred at a uniform rate throughout the year. It is also estimated that the additional cost of shutting down will be ₹ 50,000 and the cost of re-opening will be ₹ 1,00,000.

Required

Calculate the minimum level of production at which it will be economically beneficial to continue to operate the plant next year if 50% of the labour hours can be utilized in another activity, which is expected to contribute at the rate of ₹ 40 per labour hour. The additional activity will relate to a job which will be off-loaded by a sister company only if the company decides to shut down the plant.

Question No.2 – November 2016 RTP

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 x 80% Occupancy x ₹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, 'Golden Bird' 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.

Question No.3 – May 2016 RTP

List out the basis for deciding the priority of selecting the best product in the different circumstances stated below:

- (i) When maximum sales (in value) is a limiting factor.
- (ii) When raw-material is a limiting factor.
- (iii) When labour hour is a limiting factor.
- (iv) When there is a heavy demand for the product.

Question No.4 – May 2016 RTP

DRB Ltd. is a leading Home Appliances manufacturer. The company uses just-in- time manufacturing process, thereby having no inventory. Manufacturing is done in batch size of 100 units which cannot be altered without significant cost implications. Although the products are manufactured in batches of 100 units, they are sold as single units at the market price. Due to fierce competition in the market, the company is forced to follow market price of each product. The following table provides the financial results of its four unique products:

	D ₁	D ₂	D ₃	D ₄	Total
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	
	(₹)	(₹)	(₹)	(₹)	(₹)
Revenue	26,00,000	45,20,000	42,40,000	32,00,000	145,60,000
Less: Material Cost	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Less: Labour Cost	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Less: Overheads	8,00,000	7,80,000	3,20,000	12,00,000	31,00,000
Profit / (Loss)	4,00,000	(1,60,000)	7,60,000	(2,00,000)	8,00,000

Since, company is concerned about loss in manufacturing and selling of two products so, it has approached you to clear picture on its products and costs. You have conducted a detailed investigation whose findings are below:

The overhead absorption rate of ₹2 per machine hour has been used to allocate overheads into the above product costs. Further analysis of the overhead cost shows that some of it is caused by the number of machine hours used, some is caused by the number of batches produced and some are product specific fixed overheads that would be avoided if the product were discontinued. Other general fixed overhead costs would be avoided only by the closure of the factory. Numeric details are summarized below:

	₹	₹
Machine hour related		6,20,000
Batch related		4,60,000
Product specific fixed overhead:		
D ₁	10,00,000	
D ₂	1,00,000	
D ₃	2,00,000	
D ₄	<u>1,00,000</u>	14,00,000
General fixed overheads		<u>6,20,000</u>
		<u>31,00,000</u>

The other information is as follows:-

	D ₁	D ₂	D ₃	D ₄	Total
Machine Hours	4,00,000	3,90,000	1,60,000	6,00,000	15,50,000
Labour Hours	1,00,000	2,60,000	1,60,000	1,50,000	6,70,000

Required

- Prepare a profitability statement that is more useful for decision making than the profit statement prepared by DRB Ltd.
- Calculate the break-even volume in batches and also in approximate units for Product 'D₁'.

Question No.5 – November 2016

Some statements are given below. Identify name of the cost with examples and state whether it is relevant/non-relevant in decision making.

- Costs are historical costs which have already been incurred and cannot change by any decision made in future.
- It is measure of benefits foregone by rejecting the second best alternative of resources in favour of the best.
- It is portioning of cost which involves payments to outsiders i.e., it gives rise to cash expenditure as opposed to such costs as depreciation.
- Total cost is changed (increase or decrease) due to change in the level of activity, technology or production process or method of production.
- Cost used in evaluation of a product to reflect the use of resources but that have no observable cost. (5 Marks)

Question No.6 – November 2016

G Ltd., produces and sells 95,000 units of 'X' in a year at its 80% production capacity. The selling price of product is ₹ 8 per unit. The variable cost is 75% of sales price per unit. The fixed cost is ₹ 3,50,000. The company is continuously incurring losses and management plans to shut-down the plant. The fixed cost is expected to be reduced to ₹ 1,30,000. Additional costs of plant shut-down are expected at ₹ 15,000.

Should the plant be shut-down? Find the shut-down point in units and also in percentage of capacity level of production. (5 Marks)

Question No.7 – November 2016

A company manufactures four products. The annual demand for products, selling prices and variable production costs are as follows:

Product	P	Q	R	S
Demand (Units)	1,20,000	1,86,000	1,71,000	99,000

Selling price/unit	23.88	28.68	55.08	47.88
Direct Material/Unit	10.08	13.20	30.48	24.96
Direct Labour/unit	4.08	4.08	6.72	6.36
Variable overheads/unit	1.44	1.44	2.40	2.16

Other data:

- The variable overheads are absorbed on a machine hour basis at a rate of ₹ 1.20 per machine hour.
- Fixed overheads total ₹ 46,84,000 per annum.
- Production capacity available 8,15,000 machine hours per annum.
- Products P, Q and R can be bought-in at ₹ 21.36 per unit, ₹ 24 per unit and ₹ 48 per unit respectively.

You are required to calculate the best product mix for the year and the resulting optimal profit. (8 Marks)

Question No.8 – May 2016

UK Ltd. prepared a draft budget for the next year as follows:

Quantity	10,000 units	₹
Selling price per unit		60
Variable cost per unit		
- Direct materials		16
- Direct labour (2 hours × ₹ 6)		12
- Variable overheads (2 hrs × ₹ 1)		2
Contribution per unit		30
Total budgeted contribution		3,00,000
Total budgeted fixed overheads		2,80,000
Total budgeted profit		20,000

The board of directors are not satisfied with this draft budget and suggested the following changes for the better profit:

The board of directors are not satisfied with this draft budget and suggested the following changes for the better profit:

- The budgeted profit is ₹ 50,000,
- The company should spend ₹ 57,000 on advertisement and the target sales price up to ₹ 64 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 work force 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 wages rate per hour is increased to ₹ 8. The hourly rate for variable overheads will be unaffected.

You are required to calculate the target labour time require to achieve the target profit.

(5 Marks)

Question No.9 – November 2015

The following are cost data for three alternative ways of processing work cases in an office system:

	A Manual (₹)	B Semi- Automatic (₹)	C Fully Automatic (₹)
Total fixed cost per month	3,000	9,000	25,000
Variable cost per case	48	28	8

Calculate cost indifference points, Interpret your result. State for what volumes of cases will you prefer each of A, B and C.

(5 Marks)

Question No.10 – November 2015

A and B are two customers of XYZ Electronics Ltd., a manufacturer of audio players.

Selling price per unit is ₹ 5,400. Its cost of production per unit is ₹ 4,420.

Additional costs are:

Order Processing Cost..... ₹ 2,000 per order

Delivery Costs..... ₹ 3,500 per delivery

Details of customers A and B for the period are given below:

	Customer A	Customer B
Audio Players purchased (nos.)	350	500
No. of orders	5 (each of 70 units)	10 (each of 50 units)
No. of deliveries	5	0

The company's policy is to give a discount of 5% on the selling price on orders for 50 units or more, and to further give 8% discount on the undiscounted selling price if a customer uses his own transport to collect the order. Assume that production levels are not altered by these orders.

(i) You are required to analyze the profitability by comparing profit per unit for each customer.

(ii) Comment on the discount policy on delivery.

(5 Marks)

Question No.11 – November 2015

Four products P, Q, R and S are produced by profit centre Division A. Each product is sold in the external market also. Data for the period are as follows:

	P	Q	R	S
Market price per unit (₹)	70	69	56	46
Variable cost of production per unit (₹)	66	59	36	37
Labour hours per unit	3	2	2	3
Specific fixed costs (₹) per 10,000 units of product	2,500	12,600	15,000	18,000

Product S can be transferred to Division B but the maximum quantity that might be required for transfer is 20,000 units of S. The specific fixed costs given above are avoidable if a product is not made. They are incurred for every 10,000 units.

The maximum sales (units) in the external market are:

P.....	30,000
Q.....	31,000
R.....	28,000
S.....	18,000

Division B can purchase the same product at a slightly cheaper price of ₹ 45 per unit instead of receiving transfers of product S from Division A without any extra transport/inspection costs. B can also take partial supplies from A.

The total labour hours available in Division A is 1,92,000 hours.

- What is A's optimal product mix and the corresponding contribution net of specific fixed costs?
- How many units should A transfer to B and at what price?
- Is it in the company's interest to transfer 20,000 units of S to B? (12 Marks)

Question No.12 – November 2015

Proposal A is being evaluated against Proposal B. Fill up column IV of the following table:

I	II	III	IV
Sl. No.	Type of Cost	Classification	Condition under which the classification happens
(i)	Variable cost per unit	Irrelevant	
(ii)	Unavoidable fixed costs	Relevant	
(iii)	Out of pocket costs in future	Relevant	
(iv)	Sunk cost	Irrelevant	

(Only Columns I and IV are required to be presented in the answers)

(4 Marks)

Question No.13 – May 2015

PQ Limited manufactures and sells a range of products. For one of its products, it makes 2,000 units of a component which has the following budgeted manufacturing cost:

	<u>Cost per unit</u> (₹)
Direct materials	8,000
Direct Labour (specially skilled) (40 hours @ ₹ 150 per hour)	6,000
Variable overhead (40 hours ₹ 75 per labour)	3,000
Allocated Fixed overhead	<u>10,000</u>
Total production cost	<u>27,000</u>

Softech Limited has offered to supply the component at a guaranteed price of ₹ 25,000 per unit.

If the component is not manufactured by PQ Limited, all the direct labour thus released can be employed in increasing the production by 1,600 units of an existing product K, which uses 50 of this type of direct labour hours per unit. K is sold for ₹ 45,000 per unit and has a marginal cost of production of ₹ 30,000 per unit and has sufficient market demand. The direct labour force cannot be retrenched or recruited for the next two production periods. From a financial perspective, using incremental cost analysis, would you advise PQ Ltd. to make or buy the component for the forthcoming production period?

(5 Marks)

Question No.14 – May 2015

Apex Limited manufacturer two products, P and Q, using the same production facility. The following information is available for a production period:

Particulars	Product P	Product Q
Demand (units)	2,20,000	1,75,000
Contribution (₹ / unit)	10	12

Machine hours required per 100 units	15	25
--------------------------------------	----	----

P and Q can be produced only in batches of 100 units, and whatever is produced has to be sold or discarded. Inventory build-up is not possible from one production period to another. The total fixed costs for each level of production and directly attributable to P and Q are given below:

Level of output	Total Fixed Costs (₹)	
	Product P	Product Q
Upto 1,00,000 units	6,00,000	5,50,000
1,00,001 to 2,00,000 units	13,50,000	12,20,000
2,00,001 to 3,00,000 units (maximum possible level)	18,70,000	15,50,000

75,000 machine hours are available in the production period.

- (i) Calculate the quantities of P and Q in the best product mix to achieve the maximum profit and compute the maximum profit.
- (ii) What will be the opportunity cost of meeting P's demand fully? (12 Marks)

Question No.15 – May 2015

Rabi Ltd. is considering the discontinuance of Division C. The following information is given:

Particulars	Divisions A & B	Division C	Total
Sales (Maximum achievable)	41,40,000	5,17,500	46,57,500
Less: Variable cost	20,70,000	2,76,000	23,46,000
Contribution	20,70,000	2,41,500	23,11,500
Less: Specific avoidable fixed cost	14,49,000	4,14,000	18,63,000
Divisional Income	6,21,000	(1,72,500)	4,48,500

The rates of variable costs are 90% of the normal rates due to the current volume of operation. There is adequate market demand.

For any lower volume of operation, the rates would go back to the normal rates.

Facilities released by discontinuing Division C cannot be used for any other purpose.

Evaluate the decision to discontinue Division C using relevant cost approach. (4 Marks)

Question No.16 – November 2014

On the basis of the following information determine the product-mix to give the highest profit if atleast two products are produced:

Product	X	Y	Z
Raw material per unit (kg)	20	12	30
Machine hours per unit (hours)	3	5	4
Selling price per unit (₹)	500	400	800
Maximum limit of production Unit	1,500	1,500	750

Only 9,200 hours are available for production at a cost of ₹20 per hour and maximum 50,000 kgs. of material @ ₹ 20 per kg., can be obtained.

(Only product mix quantities are to be shown, calculation of total profit at that product mix not required to be shown) (8 Marks)

Question No.17 – November 2014

A manufacturing company has three factories namely 'Factory A', 'Factory B' and 'Factory C'. All three factories produce the same product which are sold at ₹ 750 per unit. The factory-wise estimates of operation results for 2014 are as follows:

	Factory A	Factory B	Factory C	Total
Sales	600	2,400	1,200	4,200
Costs:				
Raw materials	150	700	290	1,140
Direct labour	150	560	280	990
Factory overheads-variable	40	220	110	370
Factory overheads-fixed	80	240	120	440
Selling overheads-variable	46	140	80	266
Selling overheads-fixed	30	100	60	190
Administrative overheads	40	180	80	300
Head office expenses	24	100	60	184
Profit	40	160	120	320

When the above estimates were under finalization, the company's legal department advised that the lease of Factory 'A' was due to expire on 31st December, 2013 and that it could be renewed by enhancing the lease rent by ₹ 24 lakhs per annum. Since this enhancement will have impact on the profitability of the company, the management is constrained to examine following proposals:

- Renew the lease and bear the impact.
- Close down factory 'A', sell off plant, machinery and stock and liquidate all liabilities including the staff and workers', pay retrenchment compensation from sale proceeds which are sufficient for the purpose.

In order however to maintain the customer relations, the total planned output of the factory 'A' will be transferred to EITHER factory 'B' OR factory 'C'. Plant capacity is available at both the factories to takeover the manufacture. The additional cost involved in the manufacture of the extra output so transferred in factory 'B' and 'C' are estimated as under:

		Factory B	Factory C
(a)	Additional fixed overheads due to increase in capacity utilization (per annum)	₹100 lakhs	₹80 lakhs
(b)	Additional freight, selling and other overheads to produce and distribute the output to the present customers of factory 'A'	₹50 per unit	₹70 per unit

You are required to prepare comparative statements of profitability in the aforesaid alternative courses of action and give your recommendations. (9 Marks)

Question No.18 – May 2014

AXE Ltd. manufactures four products A, B, C and D. The following details are available for a production period:

	A	B	C	D
Selling price	100	109	121	124
Material cost	40	42	46	40
Labour cost				
Assembly Dept. @ ₹ 10 per hour	15	20	15	20
Machine Dept. @ ₹ 12 per hour	18	24	36	30
Variable overheads @ ₹ 4 per labour hour in assembly dept.	6	8	6	8
Maximum external demand (units)	40,000	55,000	36,000	30,000

Total fixed cost is dependent on the output level and is tabulated below at different levels of output:

Production units (any combination of one or more of any A, B, C or D)	Total fixed cost (₹)
Zero to 1,00,000 units	8,43,000
1,00,001 to 1,50,000 units	12,50,000
1,50,001 to 2,00,000 units	16,00,000

Production facilities can be interchangeably used among the products.

Labour availability in the assembly department is limited to 2,20,000 hours for the production period. A local firm has offered to make any quantity of any of the products on a sub-contract basis at the following rates:

	A	B	C	D
Sub-contract Price (₹ /unit)	85	95	101	100

- Advise the management on how many units of each product are to be manufactured or subcontracted to fulfill maximum market demand. What would be the corresponding profits?
- What is the minimum number of units to be produced to achieve break-even point?
- What would you advise as the best strategy to maximize profits if assembly labour is not a limiting factor and if there is no compulsion to fulfill market demand?

(Only relevant figures need to be discussed. A detailed profitability statement is not required).
(10 Marks)

Question No.19 - May 2014

Buildico, a company that builds houses presents the following facts relating to a certain housing contract that it wishes to undertake:

The CEO's and Marketing Director's food and hotel expenses of ₹ 3,750 were incurred for a meeting with a prospective client.

1,200 kgs of raw material Z will be required for the house. Inventory of Z available is 550 kg. It was purchased at ₹ 580 per kg. It is used by Buildico in other projects. Its current market price is ₹ 650 per kg. Its resale value is ₹ 350 per kg.

The house will require 90 hours of engineer's time. The engineers are paid a fixed monthly salary of ₹ 47,500 per engineer who can work 150 hours a month. Spare time is not available now and an engineer has to be hired for this house for one month. He cannot be used in any other project once he does this contract.

Buildico will use a special earthquake proof foundation material. This was developed by Buildico at a cost of ₹ 30,000 for some other project that had to be abandoned. If it does not use it in this project, it can use it in some other project and charge the client ₹ 50,000 for it.

A list of items is given below. You are required to name the type of cost and state whether it is relevant or not in calculating the cost of the given housing project:

S. No.	Item	Type of Cost	Relevant (R)/ Irrelevant (IR)
1	Food and hotel expenses ₹ 3,750		
2. (i)	Material Z : 550 kg × ₹ 580/kg		
(ii)	Material Z : 550 kg × ₹ 650 per kg		
3. (i)	Engineer's salary ₹ 47,500		
(ii)	Engineer's free time cost $\frac{60}{150} \times ₹ 47,500$		
4. (i)	Design cost ₹ 30,000		
(ii)	Design cost ₹ 50,000		

(8 Marks)

Question No.20 – November 2013

A company has to decide whether to accept a special order or not for a certain product M in respect of which the following information is given:

Material A required	5,000 kg	Available in stock. It was purchased 5 years ago at ₹ 35 per kg. If not used for M, it can be sold as scrap @ ₹ 15 per kg.
Material B required	8,000 kg	This has to be purchased at ₹ 25 per kg from the market.
Other hardware items	₹ 10,000	To be incurred
Dept X - Labour oriented	5 men for 1 month @ ₹ 7,000 per month per man	Labour to be freshly hired. No spare capacity available.

Dept Y - Machine oriented	3,000 machine hours @ ₹ 5 per machine hour	Existing spare capacity may be used.
Patten and Specification	₹ 15,000	To be incurred for M, but after the order, it can be sold for ₹ 2,000

Considering relevant costs, find out the minimum value above which the company may accept the order. (5 Marks)

Question No.21 – May 2013

X Ltd. wants to replace one of its old machines. Three alternative machines namely M_1 , M_2 and M_3 are under its consideration. The costs associated with these machines are as under:

	M_1	M_2	M_3
	₹	₹	₹
Direct material cost p.u.	50	100	150
Direct labour cost p.u.	40	70	200
Variable overhead p.u.	10	30	50
Fixed cost p.a.	2,50,000	1,50,000	70,000

You are required to compute the cost indifference points for these alternatives. Based on these points suggest a most economical alternative machine to replace the old one when the expected level of annual production is 1,200 units. (5 Marks)

Question No.22 – November 2012

If Moonlite Limited operates its plant at normal capacity it produces 2,00,000 units from the plant 'Meghdoot'. The unit cost of manufacturing at normal capacity is as under:

	₹
Direct material	65
Direct labour	30
Variable overhead	33
Fixed overhead	<u>7</u>
	<u>135</u>

Direct labour cost represents the compensation to highly-skilled workers, who are permanent employees of the company. The company cannot afford to lose them. One labour hour is required to complete one unit of the product.

The company sells its product for ₹ 200 per unit with variable selling expenses of ₹ 16 per unit. The company estimates that due to economic down turn, it will not be able to operate the plant at the normal capacity, at least during the next year. It is evaluating the feasibility of shutting down the plant temporarily for one year.

If it shuts down the plant, the fixed manufacturing overhead will be reduced to ₹ 1,25,000. The overhead costs are incurred at a uniform rate throughout the year. It is

also estimated that the additional cost of shutting down will be ₹ 50,000 and the cost of re-opening will be ₹ 1,00,000.

Required:

Calculate the minimum level of production at which it will be economically beneficial to continue to operate the plant next year if 50% of the labour hours can be utilized in another activity, which is expected to contribute at the rate of ₹ 40 per labour hour. The additional activity will relate to a job which will be off-loaded by a sister company only if the company decides to shut down the plant.

(Assume that the cost structure will remain unchanged next year. Ignore income tax and time value of money) (5 Marks)

Question No.23 – May 2012

A company has decided to launch a new product X which is, expected to have demand of 10,000 units during the year at ₹160 per unit. The following information is furnished by the company:

- (i) Material - The manufacture of one unit of X requires one unit of each of materials A, B and C.

Raw Material	Current stock (units)	Cost per unit (₹)		
		Original cost	Current Purchase Price	Resale Value
A- Regularly being used	10,000	16	20	14
B- Old stock (Not in use)	6,000	28	24	8
C- New stock	---	---	48	---

- (ii) Direct labour

Skilled labour is paid at ₹80 per hour. It takes 0.25 hours/unit. Skilled labour has to be drawn from another production line which has a contribution of ₹ 240 per unit, with each unit requiring 2 hours of skilled labour.

Unskilled labour - 2 hours/unit @ ₹ 56 per hour. There is abundant Unskilled labour in the factory, but according to an agreement with the labour union, no unskilled worker can be retrenched.

- (iii) Variable overhead - ₹ 10 per unit.

- (iv) Fixed Costs –no increase.

Using relevant cost approach, you are required to find out the average variable cost per unit of X. (5 Marks)

Question No.24 – May 2012

XY Ltd. makes two products X and Y, whose respective fixed costs are F_1 and F_2 . You are given that the unit contribution of Y is one-fifth less than the unit contribution of X, that the total of F_1 and F_2 is ₹ 1,50,000, that the BEP of X is 1,800 units (for BEP of X F_2 is not considered) and that 3,000 units is the indifference point between X and Y. (i.e. X and Y make equal profits at 3,000 unit volume, considering their respective fixed costs). There is no inventory build up as whatever is produced is sold.

You are required to find out the values F_1 and F_2 and units contributions of X and Y.

Question No.25 – May 2012

Ezee Ltd makes two products, E and Z. All units produced are sold. There is no inventory build up. Production facilities may be used interchangeably for both the products. Sales units are the limiting factor. The following information is given:

	Price Level			Proposed increase
	E	Z	Total	Total
Contribution ₹/units	25	20		
Fixed Cost ₹			46,000	47,500
Sales units (nos)	3,000	2,000	5,000	4,000

For increase in quantities above 4,000 units for each product, there will be an increase in variable selling costs, (for the increased portion only), thereby reducing the contribution per unit to the following figures:

Units	Contribution per unit (₹)	
	E	Z
4001-5000	20	15
5001-6000	15	10
Above 6000	No Sales possible	

- For the present level, find the break-even point with the present product
- What is the minimum number of incremental units to be sold to recover the additional fixed cost off ₹ 47,500 to be incurred? (Present product mix need not be maintained):
- If you are allowed to choose the best product mix for the incremental level, (while taking the present mix given in the first table above for the present level), what would be the individual product quantities and the corresponding total contributions, the total average contribution per unit and the total profits for the complete production? (8 Marks)

Question No.26 – May 2012

A machine manufacturing company needs four components A, B, C and D.

The components may be procured from outside. The cost, market price for the components and other information are given below.

<i>Number of units required</i>	<i>3,000</i>	<i>3,500</i>	<i>2,000</i>	<i>3,000</i>
	<i>Figs. ₹ per unit</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>Direct Material</i>	<i>120</i>	<i>140</i>	<i>150</i>	<i>120</i>
<i>Direct Wages</i>	<i>60</i>	<i>80</i>	<i>120</i>	<i>80</i>
<i>Direct expenses at ₹40 per machine hour</i>	<i>80</i>	<i>60</i>	<i>80</i>	<i>80</i>
<i>Fixed Cost</i>	<i>40</i>	<i>40</i>	<i>30</i>	<i>50</i>
<i>Total Cost</i>	<i>300</i>	<i>320</i>	<i>380</i>	<i>330</i>
<i>Market Price</i>	<i>300</i>	<i>320</i>	<i>400</i>	<i>270</i>

There are constraints on the machine time in manufacturing all the components. Total machine hours available is only 12,000 hours.

It is possible to use the machine time in a second shift which will attract 20 % extra wages and other fixed overheads at ₹6,000 for every 1,000 hours or part thereof.

With relevant supporting figures, advise the best course of action to maximize the profits.

(Note: Students need not work out the complete profitability statement). (8 Marks)

Question No.27 – November 2015 RTP

You have been approached by a friend who is seeking your advice as to whether he should give up his job as an engineer, with a current salary of ₹14,800 per month and go into business on his own assembling and selling a component which he has invented. He can procure the parts required to manufacture the component from a supplier.

It is very difficult to forecast the sales potential of the component, but after some research, your friend has estimated the sales as follows:

- Between 600 to 900 components per month at a selling price of ₹250 per component.*
- Between 901 to 1,250 components per month at a selling price of ₹ 220 per component for the entire lot.*

The costs of the parts required would be ₹ 140 for each completed component. However if more than 1,000 components are produced in each month, a discount of 5% would be received from the supplier of parts on all purchases.

Assembly costs would be ₹ 60,000 per month up to 750 components. Beyond this level of activity assembly costs would increase to ₹ 70,000 per month.

Your friend has already spent ₹ 30,000 on development, which he would write – off over the first five years of the venture.

Required:

- (i) Calculate for each of the possible sales levels at which your friend could expect to benefit by going into the venture on his own.
- (ii) Calculate the 'Break – Even Point' of the venture for each of the selling price.
- (iii) Advise your friend as to the viability of the venture.

Question No.28 – November 2015 RTP

XL Polymers, located in Sahibabad Industrial Area, manufactures high quality industrial products. AT Industries has asked XL Polymers for a special job that must be completed within one week.

Raw material R_1 (highly toxic) will be needed to complete the AT Industries' special job. XL Polymers purchased the R_1 two weeks ago for ₹7,500 for a job 'A' that recently was completed. The R_1 currently in stock is the excess from that job and XL Polymers had been planning to dispose of it. XL Polymers estimates that it would cost them ₹1,250 to dispose of the R_1 . Current replacement cost of R_1 is ₹6,000.

Special job will require 250 hours of labour G_1 and 100 hours of labour G_2 . XL Polymers pays their G_1 and G_2 employees ₹630 and ₹336 respectively for 42 hours of work per week. XL Polymers anticipates having excess capacity of 150 [G_1] and 200 [G_2] labour hours in the coming week. XL Polymers can also hire additional G_1 and G_2 labour on an hourly basis; these part-time employees are paid an hourly wage based on the wages paid to current employees.

Suppose that material and labour comprise XL Polymers's only costs for completing the special job.

Required:

Calculate the 'Minimum Price' that XL Polymers should bid on this job?

Question No.29 – November 2014 RTP

Electro Life Ltd. is a leading Home Appliances manufacturer. The company uses just-in-time manufacturing process, thereby having no inventory. Manufacturing is done in batch size of 100 units which cannot be altered without significant cost implications. Although the products are manufactured in batches of 100 units, they are sold as single units at the market price. Due to fierce competition in the market, the company is forced to follow market price of each product. The following table provides the financial results of its four unique products:

	Alpha	Beta	Gamma	Theta	Total
Sales (units)	2,00,000	2,60,000	1,60,000	3,00,000	
	(₹)	(₹)	(₹)	(₹)	(₹)
Revenue	26,00,000	45,20,000	42,40,000	32,00,000	145,60,000
Less: Material Cost	6,00,000	18,20,000	18,80,000	10,00,000	53,00,000
Less: Labour Cost	8,00,000	20,80,000	12,80,000	12,00,000	53,60,000
Less: Overheads	8,00,000	7,80,000	3,20,000	12,00,000	31,00,000
Profit / (Loss)	4,00,000	(1,60,000)	7,60,000	(2,00,000)	8,00,000

Since, company is concerned about loss in manufacturing and selling of two products so, it has approached you to clear picture on its products and costs. You have conducted a detailed investigation whose findings are below:

The overhead absorption rate of ₹ 2 per machine hour has been used to allocate overheads into the above product costs. Further analysis of the overhead cost shows that some of it is caused by the number of machine hours used, some is caused by the number of batches produced and some are product specific fixed overheads that would be avoided if the product were discontinued. Other general fixed overhead costs would be avoided only by the closure of the factory. Numeric details are summarized below:

	₹	₹
Machine hour related		6,20,000
Batch related		4,60,000
Product specific fixed overhead:		
Alpha	10,00,000	
Beta	1,00,000	
Gamma	2,00,000	
Theta	<u>1,00,000</u>	14,00,000
General fixed overheads		<u>6,20,000</u>
		<u>31,00,000</u>

The other information is as follows:-

	Alpha	Beta	Gamma	Theta	Total
Machine Hours	4,00,000	3,90,000	1,60,000	6,00,000	15,50,000
Labour Hours	1,00,000	2,60,000	1,60,000	1,50,000	6,70,000

- You are required to prepare a profitability statement that is more useful for decision making than the profit statement prepared by Electro Life Ltd.
- Calculate the break even volume in batches and also in approximate units for Product 'Alpha'.

Question No.30 – November 2014 RTP

Identify the type of cost along with the reasons.

- (i) An advertising program has been set and management has signed the non negotiable contract for a year with an agency. Under the terms of contract, agency will create 5 advertisements within the contract duration for the company and company will pay ₹12,00,000 for each advertisement.
- (ii) A manager has to decide to run a fully automated operation that produces 100,000 widgets per year at a cost of ₹1,200,000, or of using direct labour to manually produce the same number of widgets for ₹1,400,000.
- (iii) A Company had paid ₹5,00,000 a Marketing Research company to find expected demand of the newly developed product of the company.
- (iv) A company has invested ₹25 lacs in a project. Company could have earned ₹2 lacs by investing the amount in Government securities.
- (v) A Oil Refining Co. has paid a salary of ₹20,00,000 to the chairman for a particular year. The Company has sold 25 MT of Oil in that particular year.
- (vi) Accountant of a cloth factory paid ₹25,000 for water that has been used for washing clothes before they go for final drying process.

Question No.31 – May 2014 RTP

Aditya Ltd. manufactures four products A-1, B-2, C-3 and D-4 in Gurgaon and one product F-1 in Faridabad. Aditya Ltd. operates under Just-in-time (JIT) principle and does not hold any inventory of either finished goods or raw materials.

Company has entered into an agreement with M Ltd. to supply 10,000 units per month of each product produced from Gurgaon unit at a contracted price. Aditya Ltd. is bound to supply these contracted units to M Ltd. without any fail. Following are the details related with non contracted units of Gurgaon unit.

	A-1	B-2	C-3	D-4
Selling Price <i>per unit</i>	360.00	285.00	290.00	210.00
Direct Labour @ ₹ 45 <i>per hour</i>	112.50	67.50	135.00	67.50
Direct Material M-1 @ ₹ 50 <i>per kg.</i>	50.00	100.00	---	75.00
Direct Material M-2 @ ₹ 30 <i>per litre.</i>	90.00	45.00	60.00	---
Variable Overhead (varies with labour hrs)	12.50	7.50	15.00	7.50
Variable Overhead (varies with machine hrs)	9.00	12.00	9.00	15.00
Total Variable Cost	274.00	232.00	219.00	165.00
Machine Hours <i>per unit</i>	3 hours	4 hours	3 hours	5 hours
Maximum Demand per month (units)	90,000	95,000	80,000	75,000

The products manufactured in Gurgaon unit use direct material M-1 and M-2 but product F-1 produced in Faridabad unit is made by a distinct raw material Z. Material Z is purchased from the outside market at ₹ 200.00 per unit. One unit of F-1 requires one unit of material Z.

Material Z can also be manufactured at Gurgaon unit but for this 2 hours of direct labour, 3 hours of machine time and 2.5 litres of material M-2 will be required.

The Purchase manager has reported to the production manager that material M-1 and M-2 are in short supply in the market and only 6,50,000 Kg. of M-1 and 6,00,000 litre of M-2 can be purchased in a month.

Required:

- (i) Calculate whether Aditya Ltd. should manufacture material Z in Gurgaon unit or continue to purchase it from the market and manufacture it in Faridabad unit.
- (ii) Calculate the optimum monthly usage of Gurgaon unit's available resources and make decision accordingly.
- (iii) Calculate the purchase price of material Z at which your decision in (i) can be sustained.

Question No.32 – November 2017 RTP

Recently, Ministry of Health and Family Welfare along with Drug Control Department have come hard on health care centres for charging exorbitant fees from their patients. Indraprastha Health Care Ltd. (IHCL), a leading integrated healthcare delivery provider company is feeling pinch of measures taken by authorities and facing margin pressures due to this. IHCL is operating in a competitive environment so; it's difficult to increase patient numbers also. Management Consultant of the company has come out with some plan for cost control and reduction.

IHCL provides treatment under package system where fees is charged irrespective of days a patient stays in the hospital. Consultant has estimated 2.50 patient days per patient. He wants to reduce it to 2 days. By doing this, consultant has targeted the general variable cost of ₹ 500 per patient day. Annually 15,000 patients visit to the hospital for treatment.

Medical Superintendent has some concerns with that of Consultant's plan. According to him, reducing the patient stay would be detrimental to the full recovery of patient. They would come again for admission thereby increasing current readmission rate from 3% to 5%; it means readmitting 300 additional patients per year. Company has to spend ₹ 25,00,000 more to accommodate this increase in readmission. But Consultant has found a blessing in disguise in this. He said every readmission is treated as new admission so it would result in additional cash flow of ₹ 4,500 per patient in the form of admission fees.

Required

Calculate the impact of Management Consultant's plan on profit of the company. Also comment on result and other factors that should be kept in mind before taking any decision.

Question No.33 – May 2014 RTP

Classify the following fixed cost as normally being either committed or discretionary.

- (i) Depreciation on assets
- (ii) Advertising
- (iii) Research
- (iv) Employees Training

Question No.34 – November 2013 RTP

Jupiter Ltd, a 'Fast-Moving Consumer Goods (FMCG)' company intends to diversify the product line to achieve full utilisation of its plant capacity. As a result of considerable research made, the company has been able to develop a new product called 'EXE'.

'EXE' is packed in *cans* of 100 ml capacity and is sold to the wholesalers in cartons of 24 *cans* at ₹120 per carton. Since the company uses its spare capacity for the manufacture of 'EXE', no additional fixed expenses will be incurred. However accountant has allocated a share of ₹1,12,500 per month as fixed expenses to be absorbed by 'EXE' as a fair share of the company's present fixed costs to the new product for costing purposes.

The company estimates the production and sale of 'EXE' at 1,50,000 *cans* per month and on this basis the following cost estimates (per carton) have been developed:

	₹
Direct Materials	54
Direct Wages	36
All Overheads	<u>27</u>
Total Costs	117

After a detailed market survey the economy is confident that the production and sales of 'EXE' can be increased to 1,75,000 *cans* per month and ultimately to 2,25,000 *cans* per month.

The company at present has a capacity for the manufacture of 1,50,000 empty *cans* and the cost of the empty *cans* if purchased from outside will result in a saving of 20% in material and 10% in other costs of 'EXE'. The price at which the outside firm is willing to supply the empty *cans* is ₹ 0.675 per empty *can*. If the company desires to manufacture empty *cans* in excess of 1,50,000 *cans*, a machine involving an additional fixed overhead of ₹ 7,500 per month will have to be installed.

Required:-

- State by showing your workings whether the company should make or buy the empty *cans* at each of the three volumes of production of 'EXE' namely, 1,50,000, 1,75,000 and 2,25,000 *cans*.
- At what volume of sales will it be economical for the company to install the additional equipment for the manufacture of empty *cans*?
- Evaluate the profitability on the sale of 'EXE' at each of the aforesaid three levels of output based on your decision and showing the cost of empty *cans* as a separate element of cost.

Question NO.35 - May 2013 RTP

'EXE' Ltd. manufactures a product called 'HN-2'. The company is organized into two divisions, viz., Division 'KXA' and Division 'KXB'. Division 'KXA' manufactures 'HN-2' and Division 'KXB', which manufactures the bottles, packs 'HN-2' in the bottles and stores them by using a protective material called 'P-6'. The details of the expenses incurred by Division 'KXB' during 2011 are as under:

	₹
Direct materials including 'P-6'	5,25,000
Direct labour	3,75,000
Rent of a part of the warehouse used	33,750
Maintenance of Machine	27,000
Depreciation of machine	1,12,500
Miscellaneous overheads	1,18,125
Supervision	60,000
Administration overheads apportioned to the Division	<u>1,80,000</u>
	<u>14,31,375</u>

'WYE' Ltd. a company engaged in warehousing of a variety of a products, approached 'EXE' Ltd. to undertake to manufacture the bottles required on contract basis for a period of four years for ₹ 9,37,500 per annum and/or store the packed product for a further sum of ₹1,87,500 per annum.

Division 'KXB' uses a machine for the manufacture of bottles. This machine was installed four years ago at a capital cost of ₹ 9,00,000 and it has a useful life of four more years. It can be currently sold at ₹ 1,87,500.

Division 'KXB' purchased 'P-6' worth ₹ 7,50,000 during the last year. Out of this, one-fifth was used during the last year and the cost thereof is included in the material cost of 2011. The original purchase price of 'P-6' was ₹ 3,750 per tonne but, if sold now, the stock of 'P-6' would fetch only ₹3,000 per tonne. Its current replacement cost is ₹ 4,500 per tonne.

Division 'KXB' hired a warehouse for storage of the product for ₹ 67,500 per annum. It uses only half of the space and has taken only half the amount of rent into account. The remaining space of the warehouse is idle

You are required to evaluate the following three proposals on a four-year term basis and state recommendations.

- (a) If the contract for manufacture of the bottles and the storage of the product, 'HN-2' is given to 'WYE' Ltd. Division 'KXB' will be close down. In that event the supervisory staff will be transferred to another department and there will be 100% saving in direct labour cost.
- (b) If 'EXE' Ltd. continues to store the product 'HN-2' and leaves the manufacture of the bottles to 'WYE' Ltd., The machine in Division 'KXB' will not be required and the storage space requirements cannot be dispensed with. The supervisory staff will be required to be retained in Division 'KXB' and only 10% of all material will be used. The saving on account of labour retrenchment will come to ₹ 18,750 per annum. The miscellaneous overheads will be reduced by 80%.
- (c) If 'EXE' Ltd. continues to manufacture the bottles and leaves the storage of 'HN-2' to 'WYE' Ltd. Division 'KXB' will retain the machine and the warehouse space for use. The supervisory staff will also be retained and 90% of all materials will be required. The labour force will continue and the miscellaneous overheads will be reduced by 20%.

Question No.36 – May 2017

A company manufactures three components, A, B and C. these components pass through machines P and Q. The machine hour capacity of Q is limited to 7,800 hours a month. The company is interested in fulfilling the market demand to retain its market share. The following information is given:

	A	B	C
Demand (units/ month)	1,200	1,200	1,500
Variable cost (₹/ unit)	187	215	111
Fixed cost (₹/ unit) (at normal capacity utilization)	115	115	55
Hours per unit			
P	2	2	1½
Q	3	3	1

Component B has to be made by the company. There is a supplier available for components A and C at ₹ 280 and ₹ 161 per unit respectively.

- (i) Which component(s) and in what quantities should be purchased to minimize costs?
- (ii) From a financial perspective, what do you need to ensure in order to justify your answer in (i) above?
(5 Marks)

Question No.37 – May 2017

XY Ltd. manufactures two types of mobile phones, X and Y. Due to severe competition, it has to reduce the prices for the next production period. The following information is provided:

	X	Y
Current Period:		
Selling price (₹ / unit)	10,000	12,000
P/V ratio	25%	30%
Product-specific fixed cost (₹)	10,00,000	15,00,000
Next Period:		
Selling price (₹ /unit)	8,000	9,000

For the next period the company wants the present P/V ratio to be maintained and achieve a break-even for both the products at 400 units.

What is the cost reduction programme envisaged?

(5 Marks)

Question No.38 – May 2017

ABC Ltd. produces a gadget made up of special steel plates. The company gets an order for supply of 50,000 gadgets at a price of ₹ 680 per unit.

The gadgets are made of two halves (upper part and lower part) and then welded together.

The cost structure is:

Materials 15 kg. per half @ ₹ 10 per kg; Labour ₹ 60 per half.

Welding charges and fitting charges would be ₹ 20 per gadget.

The special steel plates are in short supply and ABC Ltd. has stock of only 750 Tons. A supplier has only the lower part and has offered to supply 50,000 numbers. Transportation and handling will cost ₹ 6 per half. (consider 1 ton = 1,000 kg)

ABC Ltd. could either execute its order to the extent of material available, or could fulfil the entire order by buying the lower part from the supplier. Evaluate both the options and find out the maximum price that ABC would be willing to pay the supplier per lower part if.

- it wants to retain the same level of profit per unit as in own manufacture.
- if any additional revenue is preferred.

Present your calculations to the nearest rupee.

(6 Marks)

Question No.39 – May 2017

Classify the following costs into one or more the following categories: Relevant cost, Opportunity cost, Sunk cost, Notional cost and Historical cost.

A company wishes to manufacture 'Smart' watches that can be interactive with mobile phones, computers and CCTV systems. It is planning to do research on the compatibility. It has done market survey and is satisfied about the demand being sufficient for making the product profitable. Some facilities can be made available by discontinuing its existing line of telephone instruments division.

- (i) R & D costs indicated above*
- (ii) Cost of Market Survey*
- (iii) The profit of the Telephone Instruments Division*

CHAPTER 3 – PRICING DECISIONS

Question No.1 – May 2017 RTP, May 2015 RTP

If DBC Ltd. is producing a component called 'DBC'. Estimated costs are:

	Fixed Cost per year (₹ '000)	Variable Cost per 'DBC' (₹)
Production	32,000	3,600
Distribution	2,000	200

Direct labour costs are 40% of the variable production costs. In the production department machining and assembling of 'DBC', 90 men work 8 hours per day for 300 days in a year. Each worker can machine and assemble 1 'DBC' per uninterrupted 180 minutes time frame. In each 8 hours working day, 20 minutes are allowed for coffee-break, 30 minutes on an average for training and 22 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out changing operations, getting materials and other miscellaneous matters.

DBC Ltd. has been facing industrial relations problem as the workers of company have a very strong union. Company is faced with the possibility of a strike by direct production workers engaged on the assembly of 'DBC'. The trade union is demanding an increase of 15%, back-dated from the beginning of financial year, but the company expects that if a strike does take place, it will last 25 Days after which the union will settle for an increase of 10% similarly back-dated. The only product of the company is being sold at ₹6,000.

If the strike takes place, Sales of 1,300 'DBC' would be lost. The balance that would ordinarily have been produced during the strike period could, however be sold, but these 'DBC' would have to be made up in overtime working which would be at an efficiency rate of 90% of normal. This would entail additional fixed cost of ₹1,00,000 and wage payments at time and one-half.

Required

Give necessary advice to the management to allow the strike to go ahead or to accept the union's demand.

Question No.2 – May 2017 RTP

If A process industry unit manufactures three joint products: L, B and G. G has no realisable value unless it undergoes further processing after the point of separation. The cost details of G are as follows:

	p.u. ₹
Upto point of separation	
Marginal cost.....	30
Fixed Cost.....	20

After point of separation

Marginal cost.....	15
Fixed cost.....	<u>5</u>
	70

G can be sold at ₹ 37 per unit and no more.

Required

- Would you recommend production of G?
- Would your recommendation be different if L, B and G are not joint products?

Question No.3 – May 2017 RTP

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

Sales.....	₹5,00,000
Direct Materials.....	₹2,50,000
Direct Labour.....	₹1,00,000
Variable Overheads.....	₹40,000
Capital Employed.....	₹4,00,000

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

Required

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

Question No.4 – May 2017 RTP

The cost of production and sales of 80,000 units per annum of product 'I' are:

Material.....	₹ 4,80,000	Labour.....	₹ 1,60,000
Variable Overhead.....	₹ 3,20,000	Fixed overhead.....	₹ 5,00,000

The fixed portion of capital employed is ₹12 lacs and the varying portion is 50% of sales turnover.

Required

Determine the selling price per unit to earn a return of 12% net on capital employed (net of Tax @ 40%).

Question No.5 – May 2017 RTP

APV Ltd. has developed a new product which is about to be launched into the market. The variable cost of selling the product is ₹ 17 per unit. The marketing department has estimated that at a sale price of ₹ 25, annual demand would be 10,000 units. However, if

the sale price is set above ₹ 25, sales demand would fall by 500 units for each ₹ 0.50 increase above ₹ 25. Similarly, if the price is below ₹ 25, demand would increase by 500 units for each ₹ 0.50 stepped reduction in price below ₹ 25.

Required

Determine the price which would maximise APV Ltd.'s profit in the next year.

Question No.6 – May 2017 RTP

State the appropriate pricing policy in each of the following independent situations:

- (i) 'W' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.
- (ii) 'X' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.
- (iii) 'Y' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the usual sources of capital have uncertainties blocking them.
- (iv) 'Z' is a perishable item, with more than 80% of its shelf life over.

Question No.7 – May 2017 RTP

State whether the following statements are VALID or INVALID.

- (i) When price reductions are introduced to increase sales revenue, the revenue line will be a straight line.
- (ii) In fixing selling prices, volume consideration should be taken into account so that fuller utilisation of plant capacity is achieved.
- (iii) There is no price policy in perfect competition.
- (iv) The rate of return to be earned by factory should cover the risk involved in business.
- (v) Survival and progress of a firm depend on its ability to maintain and replace, whenever necessary, its fixed assets.

Question No.8 – May 2016 RTP, Nov 2014 RTP

Nine Plus Technology Ltd. develops cutting-edge innovations that are powering the next revolution in mobility and has nine tablet smart phone models currently in the market whose previous year financial data is given below:

Model	Sales (₹'000)	Profit-Volume (PV) Ratio
Tab - A001	5,100	3.53%
Tab - B002	3,000	23.00%
Tab - C003	2,100	14.29%
Tab - D004	1,800	14.17%
Tab - E005	1,050	41.43%

Tab - F006	750	26.00%
Tab - G007	450	26.67%
Tab - H008	225	6.67%
Tab - I009	75	60.00%

Required

Using the financial data, carry out a Pareto analysis (80/20 rule) of Sales and Contribution. Discuss your findings with appropriate recommendations.

Question No.9 - May 2016

A company manufactures a product Y in addition to other products by using the same machines in department A and department B.

The usage details are:

Per Unit of Product Y	Department A		Department B	
	Usage	Rate	Usage	Rate
Direct Material	8 kg	₹ 4	4 kg	₹ 6
Direct Labour	2 hours	₹ 14	3 hours	₹ 12

Basis of overhead recovery are given below:

	Deptt. A per rupee of direct material ₹	Deptt. B per direct labour hour ₹
Variable overheads	0.80	2.00
Fixed overheads	2.20	3.00

Other Details are:

Value of Plant & Machinery in department A is ₹ 22 Lacs and in department B is ₹ 18 Lacs.

The Working Capital requirement of Product Y based on a target volume of output of 2,000 units per month is estimated at ₹ 2,72,800 per annum which is 40% of the potential capacity.

Required:

- Calculate the selling price of Product Y to ensure contribution equivalent to 25% of investment made.
- If Product Y is a new product about to be launched in the market, on what basis should the price be fixed and what would be the minimum price?
- If Product Y is a well established product, what should be the basis for price fixing and what would be the minimum price? (8 Marks)

Question No.10 – May 2016

1. XY Ltd. is manufacturing a consumer product and doing marketing through 200 depots all over the country. The company is considering closing down the depots and resorting to dealership arrangements. The total turnover of the company is ₹ 160 crores per annum. The following information is given for each depot.

₹ in lakhs

Annual turnover.....	80.00
Average inventory.....	16.00
Administrative expenses per annum.....	1.60
Staff salary per annum.....	2.88

The inventory carrying cost is 16% p.a. which is also the interest rate prevailing in the market for working capital finance. The other fixed cost per annum is ₹ 16 crores. Marketing through dealers would involve engaging dealers for each area. The dealers will assure minimum sales for each area. This would result in increasing the capacity utilization from 80% to 100%. At present the company's P/V ratio is 20%. Marketing through dealers would involve payment of commission of 8% on sales. Half of the existing depot staff will have to be absorbed in the company. The dealer will deposit ₹ 3.20 crores with company on which interest at 12% p.a. will be paid.

You are required to work out the impact on profitability of the company by accepting the proposal. (8 Marks)

Question No.11 – May 2016

A manufacturing unit of ABC Co. Ltd. has presented the following details:

Average units produced and sold per month...	2,40,000
No. of workers.....	80
Sales value.....	₹ 60 Lacs
Contribution.....	₹ 24 Lacs
Wage rate.....	₹ 5 per unit

The production manager proposes to introduce a new automated machine due to which following changes will take place:

1. No. of units produced and sold are expected to increase by 20%.
2. No. of workers will be reduced to 60.
3. With a view to provide incentive for increased production, production manager intends to offer 1 % increase in wage rate for every 3% increase in average individual output achieved.
4. Decrease in selling price by 2%.

Required:

Calculate amount of extra contribution after introduction of new automated machine and give your recommendations. (8 Marks)

Question No.12 – November 2015

The budgeted cost data of a product manufactured by XYZ Co. Ltd. is furnished as below:

Budgeted units to be produced.....	2,00,000
Variable cost (₹).....	32 per unit
Fixed cost (₹).....	16 lacs

It is proposed to adopt cost plus pricing approach with a mark-up of 25% on full budgeted cost basis.

However, research by the marketing department indicates that demand of the product in the market is price sensitive. The likely market responses are as follows:

Selling price (₹ per unit)	44	48	50	56	60
Annual Demand (units)	1,68,000	1,52,000	1,40,000	1,28,000	1,08,000

Analyse the above situation and determine the best course of action. (4 Marks)

Question No.13 – November 2015

State the most appropriate pricing policy to be adopted in the following independent situations:

(Situations need not be copied. Only the Roman numeral and policy need to be mentioned in the answer book.)

- Modern patented drug entering the market.
- The latest version of a mobile phone is being launched by an established, financially strong company.
- An established company has recently entered the stationery market segment and launched good quality paper for printing at home and office.
- A car manufacturer is launching an innovative, technologically advanced car in the highly priced segment.

(4 Marks)

Question No.14 – May 2015

A company produces a single product 'Impex'.

For an annual sales of 40,000 units of Impex, fixed overhead is ₹ 5,50,000. The variable cost per unit is ₹ 60. Capital employed in fixed assets is ₹ 8,00,000 and in current assets is 50% of net sales (i.e. sales less discount). The company sells goods at 20% discount on the maximum retail price (M.R.P.), which is ₹ X per unit. The company wants to earn a return of 25% before tax on capital employed in fixed and current assets.

Determine the value of X.

(5 Marks)

Question No.15 – November 2014

A shoe manufacturer has a net profit of ₹ 25 per pair on a selling price of ₹143. He is producing 6,000 pairs per annum which is 60% of the potential capacity. The cost per pair is as under:

	₹
Direct Materials	35.00
Direct Wages	12.50
Works Overheads (50% fixed)	62.50
Administrative Overheads (75% fixed)	6.00

During the current year the manufacturer also estimates demand of 6,000 pairs but anticipates that the fixed charges to go up by 10% while the rate of direct labour and direct materials will increase by 8% and 6% respectively. But he has no option of increasing the selling price. Under this situation he obtains an offer to utilise further 20% of capacity. What minimum price will you recommend to ensure an overall profit of ₹ 1,67,300? (5 Marks)

Question No.16 – November 2014

An IT company produces a CD, particulars of which are detailed below:

	₹
Annual Production (Units)	40,000
Cost per Annum (₹)	
Material	1,00,000
Other Variable Cost	1,20,000
Fixed Cost	80,000
Apportioned Investment (₹)	3,00,000

Determine the unit selling price under two strategies mentioned below.

Assume company's tax rate as 30%.

- 20% return on investment.
- 6% profit on list price, when trade discount is 40%. (5 Marks)

Question No.17 – May 2014

PQR Ltd., a manufacturer of tool kits has just completed XY's domestic order of 100 kits at a price of ₹ 1,650 per kit. The details of cost for XY's order are:

	Cost (₹)
Direct Material	90,000
Direct Labour	32,000
Tools and Consumables	16,400

Variable overheads	9,600
Fixed overheads (allocated)	15,000
Total	1,63,000

The company wishes to evaluate a special export order from Expo Ltd. of similar 300 kits at ₹ 1,600 per kit. For the export order, special packing has to be done at ₹ 20 per kit. An additional fixed inspection cost specific to this export order has to be incurred. The allocation of fixed overheads will be revised to increase by ₹ 25,000. Tools, and Consumables above include special purpose tools costing ₹ 10,000 incurred for XY's order and these can be reused for the export order and the remaining portion is variable. PQR Ltd. wishes to accept the export order at 10% profit on the selling price.

What should be the maximum amount that can be incurred as inspection cost for making such an acceptance possible?

If Expo Ltd. offers to take the products without inspection, what is the maximum discount (as a percentage of the existing export price) that PQR Ltd. can offer to retain its 10% profit on the revised selling price? (Round off calculations to two decimal places). (5 Marks)

Question No.18 – May 2014

A company processes different products from a certain raw material. The raw material is processed in process I (where normal loss is 10% of input) to give products A and B in the ratio 3 : 2. B is sold directly. A is processed further in process II (where normal loss is 12.5% of output) to give products C and D in the ratio 5:3. At this point C and D have sale values ₹ 55 and ₹ 40 per kg respectively. C can be processed further in process III with processing cost ₹ 3,95,600 and normal wastage 5% of input and then be sold at ₹ 66 per kg. D can be processed further in process IV with processing cost ₹ 3,82,500 and normal wastage 12.5% of output and then be sold at ₹ 55 per kg. The normal wastage of each process has no realizable value. During the production period, 2,00,000 kgs of raw material is to be introduced into Process I.

Using incremental cost-revenue approach, advise whether sale at split off or further processing is better for each of the products C and D. (5 Marks)

Question No.19 – November 2013

State the appropriate pricing policy in each of the following independent situations:

- 'A' is a new product for the company and the market and meant for large scale production and long term survival in the market. Demand is expected to be elastic.
- 'B' is a new product for the company, but not for the market. B's success is crucial for the company's survival in the long term.
- 'C' is a new product to the company and the market. It has an inelastic market. There needs to be an assured profit to cover high initial costs and the usual sources of capital have uncertainties blocking them.
- 'D' is a perishable item, with more than 80% of its shelf life over. (4 Marks)

Question No.20 – May 2013

A process industry unit manufactures three joint products: A, B and C. C has no realisable value unless it undergoes further processing after the point of separation. The cost details of C are as follows:

	Per Unit ₹
<i>Upto point of separation</i>	
Marginal cost	30
Fixed Cost	20
<i>After point of separation</i>	
Marginal cost	15
Fixed cost	5
	70

C can be sold at ₹ 37 per unit and no more.

- (i) Would you recommend production of C?
- (ii) Would your recommendation be different if A, B and C are not joint products?

(5 Marks)

Question No.21 – May 2013

HTM Ltd., by using 12,00,000 units of a material M produces jointly 2,00,000 units of H and 4,00,000 units of T. The costs and sales details are as under:

	₹
Direct Material M @ ₹ 5 per unit	60,00,000
Other variable costs	42,00,000
Total fixed costs	18,00,000
Selling price of H per unit	25
Selling price of T per unit	20

The company receives an additional order for 40,000 units of T at the rate of ₹ 15 per unit. If this order has been accepted, the existing price of T will not be affected.

However, the present price of H should be reduced evenly on the entire sale of H to market the additional units to be produced.

Find the minimum average unit price to be charged on H to sustain the increased sales.

Question No.22 – May 2013

Better and Best Ltd. manufacture only one product. Production is regular throughout the year and the capacity of the factory is 1,50,000 units per annum. The summarized Profit and Loss Account for the year ended 31st December is being reviewed by the Board of Directors.

	₹
Sales @ ₹ 10 per unit	10,00,000
Cost of sales:	
Direct materials	2,50,000
Direct labour	1,50,000
Production overheads:	₹
Variable	30,000
Fixed	2,30,000
Administrative overheads:	
Fixed	1,00,000
Selling and distribution overhead:	
Variable	50,000
Fixed	1,50,000
(i) The Production Director proposed to reduce selling price to ₹ 9 in order to utilize full capacity.	
(ii) The Sales Director proposed to increase selling price by 20 percent. By spending ₹ 2,25,000 on advertisement, sales will be increased to 1,20,000 units per annum.	
(iii) The Personnel Director pleaded for a change in the method of wage payment. For the present piece rate of ₹ 1.50 per unit, a bonus scheme (for each 2% increase in production over the target, there would be an increase of 1% in the basic wage of each employee) will be implemented. A target of 2,000 units per week for the company will be set for 50 week year. Selling price increase by 10%. With an additional advertisement cost of ₹ 1,60,000, 20% increase in present sales will be achieved.	
(iv) The Chairman felt that the packaging of the product required improvement. He wanted to know the sales required to earn a target profit of 10% on turnover with the introduction of an improved packing at an additional cost of 20 paise per unit (no change in selling price).	

You are required to evaluate individually the proposals of each of the board member and give your recommendation. (12 Marks)

Question No.23 – November 2012

The Board of Directors XY Company Limited are considering a new type of handy sewing machine which their R & D Department has developed. The expenditure so far on research has been ₹ 95,000 and a consultant's report has been prepared at a cost of ₹ 22,500. The report provides the following information:

Cost of production per unit:

	₹
Material	45.00
Labour	75.00
Fixed overheads (Based on Company's normal allocation rates)	20.00
	<u>140.00</u>

Anticipated additional fixed costs:

Rent for additional space ₹ 1,25,000 per annum

Other additional fixed costs ₹ 70,000 per annum

A new machine will be built with the available facilities with a cost of ₹ 1,10,000 (material ₹ 90,000 and labour ₹ 20,000). The materials are readily available in stores which are regularly used. However, these are to be replenished immediately. The price of these materials have since been increased by 50%. Scrap value of the machine at the end of the 10th year is estimated at ₹ 20,000. The product scraps generated can be disposed off at the end of year 10 for a price of ₹ 1,43,000.

Years 1-5		Years 6-10	
Demand (Unit)	Probability	Demand	Probability
40,000	0.15	24,000	0.30
20,000	0.60	16,000	0.50
12,000	0.25	4,000	0.20

It is estimated that the commercial life of the machine will be no longer than 10 years and the after tax cost of capital is 10%. The full cost of the machine will be depreciated on straight line basis, which is allowed for computing the taxable income, over a period of 10 years. Tax rate is 30%.

DCF factors at 10%:	
1 - 5 years (cumulative)	3.79
6 - 10 years (cumulative)	2.355
10th year	0.386

Required:

Compute minimum selling price for the handy sewing machine. (12 Marks)

Question No.24 - May 2012

A company is operating at 60 % of its capacity with a turnover of ₹ 43.20 lacs. If the company works at 100 % capacity, the sales-cost relation is:

Factory cost is two thirds of sales value. Prime cost is 75% of factory cost. Administration and selling expenses (75% variable) are 20% of the sales value. Factory overhead will vary according to operating capacity as given below:

Operating capacity (%)	60	80	100	120
Factory overheads (₹ in lacs)	9.90	10.80	12	15

The company has planned to operate at 80 % of its capacity. Moreover, it has received an export order and its execution will involve 40 % of the capacity.

The prime cost of the order is estimated at ₹ 6.0 lacs and the shipping involved will be around ₹ 1.0 lac. Administration and selling expenses will be avoided on the export order. Taking the same percentage of profits as on the domestic sales, determine the minimum price to be quoted for the export order. (8 Marks)

Question No.25 - May 2012

PQR Ltd is considering introducing a new product at a price of ₹ 105 per unit. 'PQR Ltd's controller has compiled the following incremental cost information based on an estimate of 1,20,000 units of sales annually for the new product:

<i>Direct material cost</i>	<i>₹ 36,00,000</i>
<i>Direct Labour cost</i>	<i>₹ 24,00,000</i>
<i>Flexible manufacturing support</i>	<i>₹ 12,00,000</i>
<i>Sales commission</i>	<i>10% of sales</i>
<i>Capacity- related cost</i>	<i>₹ 20,00,000</i>

The average inventory levels for the new product are estimated as follows:

<i>Raw materials:</i>	<i>2 months' production</i>
<i>Work-in-progress (100% complete for Materials and 50% complete for labour and Flexible manufacturing support)</i>	<i>1 month production</i>
<i>Finished goods</i>	<i>2 months' production</i>

Annual inventory carrying costs not included in the flexible manufacturing support listed earlier are estimated to be 12% of inventory value. In addition, the sales manager expects the introduction of new product to result in a reduction in sales of existing product from 3,00,000 to 2,40,000 units. The contribution margin for the existing product is ₹20 per unit.

Prepare a statement showing the budgeted impact on PQR's profits on the introduction of the new product. Should the new product be introduced? (8 Marks)

Question No.26 – Nov 2017 RTP

'S' is a leading IT security solutions and ISO 9001 certified company. The solutions are well integrated systems that simplify IT security management across the length and depth of devices and on multiple platforms. 'S' has recently developed an Antivirus Software and company expects to have life cycle of less than one year. It was decided that it would be appropriate to adopt a market skimming pricing policy for the launch of the product. This Software is currently in the Introduction stage of its life cycle and is generating significant unit profits.

Required

Explain, with reasons, the changes, if any, to the unit selling price that could occur when the Software moves from the Introduction stage to Growth stage of its life cycle.

Also suggest necessary strategies at this stage.

Question No.27 – May 2013 RTP

Computer Tec a manufacturing firm, has entered into an agreement of strategic alliance with Comp Inc. of United States of America for the manufacture of Super Computers in India. Broadly, the terms of agreement are:

- (i) Comp Inc. will provide Computer Tec with kits in a dismantled condition. These will be used in the manufacture of the Super Computer in India. On a value basis, the supply, in terms of the FOB price will be 50% thereof.
- (ii) Computer Tec will procure the balance of materials in India.
- (iii) Comp Inc will provide to Computer Tec with designs and drawings in regard to the materials and supplies to be procured in India. For this, Computer Tec will pay Comp Inc. a technology fee of ₹ 8 crores.
- (iv) Comp Inc. will also be entitled total royalty at 10% of the selling price of the computers fixed for sales in India as reduced by the cost of standard items procured in India and also the cost of imported kits from Comp Inc..
- (v) Computer Tec will furnish to Comp Inc. detailed quarterly returns.

Other information available:

- (a) FOB price agreed \$2,040. Exchange rate to be adopted \$1 = ₹ 55.00
- (b) Insurance and freight – ₹ 2,000 per imported kit;
- (c) Customs duty leviable is 200% of the CIF prices; but as a concession, the actual rate leviable has been fixed at 40% of CIF.
- (d) The technology agreement expires with the production of 8,00,000 computers;
- (e) The quoted price on kits includes a 25% margin of profits on cost to Comp Inc.
- (f) The estimated cost of materials and supplies to be obtained in India will be 150% of the cost of supplies made by Comp Inc.
- (g) 50% of the value in rupees of the locally procured goods represent cost of the standard items.
- (h) Cost of assembly and other overheads in India will be ₹ 8,000 per Super Computer.

Required: Calculate the selling price, of a personal computer in India bearing in mind that Computer Tec Ltd has targeted a profit of 20% to itself on the selling price.

[Note: In making calculations, the final sum may be rounded to the next rupees]

Question No.28 – May 2017

The following independent situations relate to new product pricing. Classify the products into the appropriate category: Revolutionary Product (RP), or Evolutionary Product (EP) or a Me-Too Product (MP) and state the corresponding pricing to be followed:

Sl. No.	Situation	RP/EP/MP	Pricing
I	II	III	IV
(i)	Adjustable work table like a stool, has been successfully capturing the market. Company X makes a small variant of this product and is trying to enter the market.		
(ii)	R & D has just been completed on an innovative computer processor in the shape of a pen, with accompanying pen-like devices to act as keyboard projector and monitor projector. This is expected to get the laptops out of business due to extreme ease of portability of just 3 pen-like light weight devices.		
(iii)	A successful mobile manufacturing company has built into its latest mobile phone, an additional sliding screen and improved its processor capabilities so that the phone is almost a laptop.		

You may present only columns I, III & IV. You are required to explain the pricing in one sentence. (5 Marks)

Question No.29 – May 2017

A toy company 'T' expects to successfully launch Toy Z based on a film character. T must pay 15% royalty on the selling price to the film company. 'T' targets a selling price of ₹ 100 per toy and profit of 25% selling price.

The following are the cost data forecast:

	₹/toy
Component A	8.50
Component B	7.00
Labour: 0.4 hr. @ ₹ 60 per hr	24.00
Product specific overheads	13.50

In addition, each toy requires 0.6 kg of other materials, which are supplied at a cost of ₹ 16 per kg with a normal 4% substandard quality which is not usable in the manufacture.

You are required to determine if the above cost structure is within the target cost. If not, what should be the extent of cost reduction? (4 Marks)

Question No.30 – May 2017

the following information is given about the type of defects during a production period and the frequencies of their occurrence in a spectacle manufacturing company:

Defect	No. of items
<i>End Frame not equidistant from the centre</i>	<i>10</i>
<i>Non-uniform grinding of lenses</i>	<i>60</i>
<i>Power mismatches</i>	<i>20</i>
<i>Scratches on the surface</i>	<i>110</i>
<i>Spots / Stains on lenses</i>	<i>5</i>
<i>Rough edges of lenses</i>	<i>70</i>
<i>Frame colours-shade differences</i>	<i>25</i>

Construct a frequency table so that a Pareto Chart can be constructed for the defect type. Which areas should the company focus on?

CHAPTER 4 - BUDGET & BUDGETARY CONTROL

Question No.1 – May 2017 RTP

Calculate from the following figures:

- (i) Efficiency ratio,
- (ii) Activity, Ratio and
- (iii) Capacity Ratio:

Budgeted Production..... 528 units

Standard Hours per unit.....10

Actual Production..... 450 units

Actual Working Hours..... 6,000

Question No.2 – May 2017 RTP

Following information are extracted from monthly budgets of JIT Ltd.

	November	December
Beginning WIP Inventory	36,000	???
Beginning Finished Goods Inventory	44,000	???
Variable Cost of Goods Sold	1,23,000	???
Direct Material Usage	50,000	56,000
Direct Labour	53,100	69,000
Variable Overhead	25,000	29,000
Variable Cost of Goods Manufactured	1,07,500	1,15,900
Ending WIP Inventory	???	???
Ending Finished Goods Inventory	???	45,000

Required

Find out missing figures.

Question No.3 – May 2017 RTP

Which of the following statements are VALID in respect of flexible budgeting.

- (i) A flexible budget is one which changes from year to year.
- (ii) It is a budget which departmental heads can change at will.
- (iii) It is a system of budgeting which will recast the budgets because of a change in fixed expenses.
- (iv) It is a system of budgeting under which budgets are recast quickly for changes in the volume of activity.
- (v) It involves careful differentiation between fixed and variable expenses.

Question No. – November 2016 RTP

Country N's regional administration is organized in 10 states, with 9 of them subdivided into 210 municipalities. The municipal sector is a provider of vital services to the country N's public. The municipalities have wide powers over the local economy, with the state exercising strict supervision. They have the right to tax and to use their resources to support education, libraries, social security, and public works such as streetcar lines, gas and electricity works, roads, and town planning, but they are usually aided in these activities by state funds. The municipalities submit a budget each year to respective state which forms the basis of the fund received.

The following information is available as part of the 2016 budget preparation about a municipality NZ.

Street Maintenance

Like all structures, streets deteriorate over time. Deterioration is primarily due to accumulated damage from vehicles, however environmental effects often contribute. In 2016 it is anticipated that 5 km of the street will need maintenance but a contingency of extra 10% has been decided.

In 2015 the average cost of a street maintenance was ₹14 million per km maintained, but this excluded any cost effects of extreme weather conditions. The following probability estimates have been made in respect of 2016

Weather Type Predicted	Probability	Increase in Maintenance Cost
Good	0.65	0
Poor	0.05	+5%
Lousy	0.30	+30%

Inflation on street revamping costs is anticipated to be 2% between 2015 & 2016.

New Streets

New streets are budgeted on a zero basis and will have to enter for funds along with other capital projects such as hospitals and libraries.

Required

- Calculate the budgets for street maintenances for 2016.
- Explain the process involved for zero based budgeting.

Question No.4 – May 2016 RTP

WDG Ltd. Had prepared fixed and flexible budget for the financial year 2015-16 as under:

	Fixed Budget for full capacity (₹)	Flexible Budget for 75% level (₹)
Sales	13,50,000	10,12,500
Direct Material	4,25,000	3,18,750
Direct Labour	1,85,000	1,38,750

Variable Overheads	2,15,000	1,61,250
Semi-Variable Overheads	3,65,000	3,23,750
Profit	1,60,000	70,000

After the closing of the financial year 2015-16, total actual sales stood at ₹11,07,000 and there was a favourable sales price variance of ₹17,000 (F).

Required

Prepare a flexible budget for the actual level of sales.

Question No.5 – November 2016

From the information given below, prepare a cash budget of the company for the first half of 2016, assuming that cost would remain unchanged.

- Sales are both on credit and for cash, the latter being one-third of the former.
- Realisation from debtors are 25% in the month of sale, 60% in the following month and the balance in the month after that.
- Company's policy of selling price is 25% over cost.
- Budgeted sales of each month are purchased and paid for in the preceding month.
- Rent payable is ₹2,000 per month.
- Sales forecast for the different months are:
 2015– October ₹1,60,000; November ₹1,80,000; December ₹2,00,000
 2016– January ₹2,20,000; February ₹1,40,000; March ₹1,60,000; April ₹1,50,000; May ₹2,00,000; June ₹1,80,000 and July ₹1,20,000
- The company has outstanding debentures of ₹2 Lakhs on 1st January carrying interest at 15% per annum payable on the last date of each quarter on calendar year basis. 20% debentures are due for redemption on 30 June 2016.
- The company has to pay advance tax of ₹54,000 in March.
- Anticipated office costs for the six months are :
 January ₹25,000; February ₹20,000; March ₹40,000; April ₹35,000; May ₹30,000 and June ₹45,000.
- Opening cash balance is ₹10,000 on January 1, 2016. (8 Marks)

Question No.6 – May 2016

A company is engaged in manufacturing two products M and N. Product M uses one unit of component P and two units of component Q. Product N uses two units of component P, one unit of component Q and two units of component R. Component R which is assembled in the factory uses one unit of component Q. Components P and Q are purchased from the market. The company has prepared the following forecast of sales and inventory for the next year:

	Product M	Product N
Sales (in units)	80,000	1,50,000
At the end of the year	10,000	20,000
At the beginning of the year	30,000	50,000

The production of both the products and the assembling of the component R will be spread out uniformly throughout the year. The company at present orders its inventory of P and Q in quantities equivalent to 3 months production. The company has compiled the following data related to two components:

	P	Q
Price per unit (₹)	20	8
Order placing cost per order (₹)	1,500	1,500
Carrying cost per annum	20%	20%

Required:

- Prepare a Budget of production and requirements of components for next year.
- Suggest the optimal order quantity of components P and Q. (8 Marks)

Question No.7 – November 2015

JCL Corporation manufactures and sells two products RB and RD. Three types of materials, A, B and C are required for producing these products. Projected information for 2015-16 is given below:

Product	Projected Sales for 2015-16 (units)	Inventory (in units)		Direct Labour Requirement (Hours/Unit)
		On 1-4-2015	On 31-3-2016	
RB	75,000	25,000	31,250	4
RD	50,000	10,000	11,250	6

Raw material stock and usage are as follows:

Direct Material	Required per unit		Inventory on 1-4-2015	Inventory on 31-3-2016
	RB	RD		
A	5.00 kg	5.00 kg	40,000 kg	45,000 kg
B	2.50 kg	3.00 kg	36,250 kg	40,000 kg
C	0	1.00 kg	7,500 kg	8,750 kg

You are required to prepare the following for 2015-16:

- Production budget (in units)
- Direct material purchase budget in quantities for A, B and C.
- After (i) and (ii), you are told that only 6,00,000 labour hours will be available for production. If there is no requirement to hold the stated level of finished goods closing inventory, what would be the principal budget factor? Substantiate your view with appropriate figures. (8 Marks)

Question No.8 – May 2015

Tricon Co. has prepared the following statement for the month of April 2015.

Particulars	Budget Details	Static Budget	Actual
Units produced & Sold		4,000	3,200
		₹	₹
Direct Materials	3 kg p.u. @ ₹ 15 per kg.	1,80,000	1,55,000
Direct Labour	1 hr. p.u. @ ₹ 36 per hour	1,44,000	1,12,800
Variable Overhead	1 hr. p.u. @ ₹ 22 per hour	88,000	73,600
Fixed Overhead		90,000	84,000
Total Cost		5,02,000	4,25,400
Sales		6,00,000	4,48,000
Profit		98,000	22,600

During the month 10,000 kg. of materials and 3,100 direct labour hours were utilized.

- Prepare a flexible budget for the month.*
- Determine the material usage variance and the direct labour rate variance for the actual Vs the flexible budget. (8 Marks)*

Question No.9 – November 2014

The following are the details regarding budgeted and actual production costs for the year 2013 of an industrial concern. You are required to prepare a Production Cost Budget for the year 2014.

	Budget		Actual	
Output (units)	39,900		40,600	
	Units	₹	Units	₹
Materials consumed	42,000	42,000	43,000	53,750
Wages at 1 hour per unit at ₹ 1 per unit Budget	---	39,900	---	44,660
Variable Overhead at ₹1 per unit Budget	---	19,950	---	20,600
Fixed Overheads	---	30,000	---	35,000
		1,31,850		1,54,010

During the budget period:

- Production is expected to reach 50,000 units,*
- Material price are expected to increase further by the same percentage as they had increased over the budget period.*
- Labour rates are expected to increase by ₹ 0.20 per hour above the actual rates shown above; efficiency is expected to decline by 10%; upto 31st December, 2013, there has been no decline in efficiency.*

- (4) Variable overhead of previous year to be maintained.
 (5) Fixed overheads are expected to rise by 10% per annum.
 (6) Wastage of materials to be maintained at 2013 budget level. (6 Marks)

Question No.10 – May 2014

DEF Ltd manufactures and sells a single product and has estimated sales revenue of ₹ 397.80 lacs during the year based on 20% profit on selling price. Each unit of product requires 6 kg of material A and 3 kg of material B and processing time of 4 hours in machine shop and 2 hours in assembly shop. Factory overheads are absorbed at a blanket rate of 20% of direct labour. Variable selling & distribution overheads are ₹ 6 per unit sold and fixed selling & distribution overheads are estimated to be ₹ 7,20,000.

The other relevant details are as under:

Purchase Price	Material A	₹ 16 per kg	
	Materials B	₹ 10 per kg	
Labour Rate	Machine Shop	₹ 14 per hour	
	Assembly Shop	₹ 7 per hour	
	Finished Stock	Material A	Material B
Opening Stock	25,000 units	75,000 kg	40,000 kg
Closing Stock	30,000 units	80,000 kg	55,000 kg

You are required to calculate:

- (i) Number of units of product proposed to be sold and selling price per unit.
 (ii) Production budget in units.
 (iii) Material purchase budget in units. (7 Marks)

Question No.11 – November 2013, November 2015 RTP

The PLN Co. presents the following static budgets for 4,000 units and 6,000 units activity levels for October 2013:

	4,000 units activity level	6,000 units activity level
Overhead A ₹ 12/hr. x 2 hr. /unit	96,000	1,44,000
Overhead B	1,40,000	1,90,000

Overhead C was omitted to be listed out. It is a fixed plant overhead, estimated at ₹ 12.5/hr. at 4,000 units activity level. This has to also feature in the flexible budget. The actual production was 5,000 units and 9,600 hours were needed for production.

You are required to present the flexible budget amount of each overhead to enable appropriate comparison with the actual figures. (5 Marks)

Question No.12 – May 2013

KG Ltd. is engaged in the production of two products K and G. One unit of product K requires two units of material A and four units of material B. Each unit of product G needs four units of material A, two units of material B and four units of material C. Material C is locally produced in the factory of the company by using two units of material B for each unit of C.

Material A and B are purchased in the open market. Production of products K, G and C is carried out evenly throughout the year. At present the company has purchased its 3 months requirements of A and B in one purchase. That is four purchases per annum. The other particulars provided by the company are:

	Products	
	K Units	G Units
Budgeted sales for the next year	40,000	75,000
Desired stock at the end of the year	5,000	10,000
Expected stock at the beginning of the year	15,000	25,000

	Products	
	A	B
Purchase price p.u. (₹)	15	25
Ordering cost per order (₹)	1,000	1,000
Carrying cost p.a.	10%	10%

You are required to:

- Prepare a production budget and a material requirement budget for the next year.
- Calculate the number of material purchases to be made, if the company wants to purchase materials in optimal quantity. (8 Marks)

Question No.14 – May 2014 RTP

Satjuj Motors Ltd. had prepared fixed and flexible budget for the financial year 2013-14 as under:

	Fixed Budget for full capacity (₹)	Flexible Budget for 75% level (₹)
Sales	13,50,000	10,12,500
Direct Material	4,25,000	3,18,750
Direct Labour	1,85,000	1,38,750

Variable Overheads	2,15,000	1,61,250
Semi-Variable Overheads	3,65,000	3,23,750
Profit	1,60,000	70,000

After the closing of the financial year 2013-14, total actual sales stood at ₹ 11,07,000 and there was a favourable sales price variance of ₹ 17,000 (F).

Required:

Prepare a flexible budget for the actual level of sales.

Question No.15 – November 2013 RTP

A single product company estimated its sales for the next year quarter wise as under:

Quarter	Sales Units
I	60,000
II	75,000
III	82,500
IV	90,000

The opening stock of finished goods is 20,000 units and the company expects to maintain the closing stock of finished goods at 32,500 units at the end of the year. The production pattern in each quarter is based on 80% of the sales of the current quarter and 20% of the sales of the next quarter.

The opening stock of raw materials in the beginning of the year is 20,000 Kg. and the closing stock at the end of the year is required to be maintained at 10,000 Kg. Each unit of finished output required 2 Kg. of raw materials.

The company proposes to purchase the entire annual requirement of raw materials in the first three quarters in the proportion and at the prices given below:

Quarter	Purchase of raw materials % total annual requirement in quantity	Price per Kg. (₹)
I	30%	2
II	50%	3
III	20%	4

The value of the opening stock of raw materials in the beginning of the year is ₹ 40,000.

You are required to present the following for the next year, quarter wise:

- Production budget in units.
- Raw material consumption budget in quantity.
- Raw material purchase budget in quantity and value.

Question No.16 – November 2013 RTP

SIAM Ltd. manufactures two products using one type of material and one grade of labour. Shown below is an extract from the company's working papers for the next period's budget.

Particulars	Product A	Product B
Budgeted Sales (Units)	1,800	2,400
Budgeted Material Consumption per Product (Kg.)	5	3
[Budgeted Material Cost ₹12 per Kg.]		
Standard Hours Allowed per product	5	4
[Budgeted Wage Rate ₹8 per hour]		

Overtime premium is 50% and is payable, if a worker works for more than 40 hours a week. There are 45 direct workers.

The target productivity ratio (or efficiency ratio) for the productive hours worked by the direct workers in actually manufacturing the products is 80%; in addition the non-productive downtime is budgeted at 20% of the productive hours worked.

There are twelve 5-day weeks in the budget period and it is anticipated that sales and production will occur evenly throughout the whole period.

It is anticipated that stock at the beginning of the period will be:

Product A 510 units; Product B 1,200 units; Raw material 2,150 Kg.

The target closing stock, expressed in terms of anticipated activity during budget period are - Product A 15 days sales; Product B 20 days sales; Raw material 10 days consumption.

Required:

- the material purchases budget, and
- the wages budget for the direct workers, showing the quantities and values, for the next period.

Question No.17 – November 2013 RTP

Bintan-Indo Manufacturers Ltd. (BIML) is specialist in the manufacturing of Industrial Products. They manufacture and market two types of products under the name 'X' and 'Y'. Company produces two products from three basic raw materials 'A', 'B', and 'C'. Company follows a 13-period reporting cycle for budgeting purpose. Each period is four weeks long and has 20 working days. Data relating to the purchase of raw materials are presented below:

Raw Material	Purchase Price (Per Kg)	Standard Purchase Lot (Kg)	Reorder Point (Kg)	Projected Inventory Status <i>at the end of 5th period</i> (Kg)		Lead Time in Working Days
				On Hand	On Order	
A	₹ 1.00	90,000	72,000	96,000	90,000	10
B	₹ 2.00	30,000	45,000	54,000	-	25
C	₹ 1.00	60,000	60,000	84,000	60,000	20

Past experience has shown that adequate inventory levels for 'X' and 'Y' can be maintained if 40 percent of the next period's projected sales are on hand at the end of a reporting period. Other relevant information is as follows:

Product	Raw Material Specifications			Projected Inventory Levels	Projected Sales		
	A	B	C		6 th	7 th	8 th

				current (5 th) period	Period	Period	Period
	Kg	Kg	Kg	Units	Units	Units	Units
X	1.25	0.50	-	18,000	45,000	52,500	57,000
Y	2.00	-	1.50	16,800	42,000	27,000	24,000

The sales of 'X' and 'Y' do not vary significantly from month to month. Consequently, the safety stock incorporated into the reorder point for each of the raw materials is adequate to compensate for variations in the sales of the finished products.

Raw materials orders are placed the day the quantity on hand falls below the reorder point. BIML's suppliers are very trustworthy so that the given lead times are reliable.

The outstanding orders for raw materials 'A' and 'C' are due to arrive on the 10th and 4th working day of the 6th period, respectively. Payments for all raw material orders are remitted by the 10th day of the delivery.

You are required to determine the following items for raw materials 'A', 'B', and 'C' for inclusion in the 6th period report to management:

1. Projected quantities (in Kg) to be issued to production.
2. Projected quantities (in Kg) ordered and the date (in terms of working days) the order is to be placed.
3. The projected inventory balance (in Kg) at the end of the period.
4. The payments for purchases with due date.

Question No.18 – May 2013 RTP

Star Ltd. manufactures two products A and B. The summarised Balance Sheet of the company as at 31st March, 2012 is as under :-

Equity and Liabilities	(₹)
Shareholder's funds	
Share Capital	12,00,000
Reserve and Surplus	96,000
Current Liabilities	
Trade Payables	48,000
Short-Term Provisions	
Provision for Income Tax	60,000
	14,04,000

Assets	(₹)
Non-Current Assets	
Fixed Assets (Net)	9,00,000
Current Assets	
Inventories	3,54,000
Trade Receivables	90,000
Cash and Cash Equivalents	60,000
	14,04,000

The following information has been furnished to you for the preparation of the budget for the year ending 31st March, 2013:—

(i) Sales forecast :—

Product A 24,000 units at ₹ 30 per unit.

Product B 15,000 units at ₹ 40 per unit.

(ii) Raw materials :—

	Products	
	A	B
Material X @ ₹ 3 per kg.	2 kgs.	4 kgs.
Material Y @ ₹ 1 per kg.	1 kg.	2 kgs.

(iii) Direct Labour:—

Dep. P : 2 Hrs @ ₹ 1 per hour for A.

1 Hrs. @ ₹ 2 per hour for B.

Dep. Q: 1 Hrs. @ ₹ 3 per hour for A.

1 Hrs. @ ₹ 3 per hour for B.

(iv) Overheads :—

	Dept. P ₹	Dept. Q ₹
Fixed overheads per annum :—		
Depreciation	48,000	12,000
Others	96,000	30,000
Variable overheads per hour	0.50	1.50

(v) Inventories :—

(a) Raw materials :

Opening stock

X	36,000 kgs.	}	₹ 1,14,000
Y	6,000 kgs.		

Closing stock

X	48,000 kgs.
Y	12,000 kgs.

(b) Finished goods :

Opening stock

A	600 Units	}	₹ 2,40,000
B	6,000 Units		

Closing Stock

A	6,600 units
B	3,000 units

(vi) Selling, Distribution and Administration expenses are estimated at ₹ 1,80,900 per annum.

(vii) The cost of raw material purchases, direct wages, factory overheads, selling, distribution and administration overheads of the year will be met in full in cash during the year. The estimated position of debtors and creditors as on 31st March, 2013 is ₹ 1,50,000 and ₹ 48,000 respectively. Income tax provision standing at the beginning of the year will be paid during the year. Rate of income tax is 30%. An equipment purchased at ₹ 1,20,000 will be paid during the year.

You are required to prepare for the year ending 31st March, 2013:

(a) Cost of Goods Sold Budget

(b) Cash Budget

(c) Projected Balance Sheet as at 31st March, 2013 in the same format as given in the question.

The detailed working for each of the above should be shown.

Question No.19 – May 2017

A Tea company manufactures two brands of tea namely Super and Normal by blending of four grades of tea leaves as raw material in the following proportion:

Raw Material	Product Super	Product Normal
Grade A	70%	-
Grade B	30%	-
Grade C	-	40%
Grade D	-	60%

During the month of May 2017. It is expected that 200 tons of brand Super and 80 tons of brand Normal will be sold. Actual and budgeted inventories for the month of May 2017 are as follows:

	<i>Actual inventories on 1st May, quantity in Tons</i>	<i>Budgeted inventories on 31st May, quantity in Tons</i>
Grade A	40	50
Grade B	25	56
Grade C	150	250.90
Grade D	60	40.50
Product Super	40	20
Product Normal	20	15

Purchased tea leaves are seasoned and then held in stock or issued for production. During seasoning, they lost 15% of their initial weight. Calculate the following:

- (i) The Production Budget for the month of May 2017 (in quantity)
- (ii) the Raw Material Purchase Budget for May 2017 (in quantity) (8 Marks)

CHAPTER 5 - STANDARD COSTING

Question No.1 - May 2017 RTP

HKT Ltd. has provided the following summarized results for two years:

	Year ended (₹ In lacs)	
	31-03-2015	31-3-2016
Sales	3,000	3,277.50
Material	2,000	2,357.50
Variable overheads	500	525.00
Fixed overheads	300	367.50
Profit	200	27.50

During the year ended 31-3-2016 sale price has increased by 15% whereas material and overhead prices have increased by 15% and 5% respectively.

Required

- Analyse the variances of revenue and each element of cost over the year in order to bring out the reasons for the change in profit.
- Present a profit reconciliation statement starting from profits in 2014-15 showing the factors responsible for the change in profits in 2015-16.

Note – Consider 'Contribution Variances' for solving this question.

Question No.2 - November 2016 RTP

N & S Co. (NSC) is a multiple product manufacturer. NSC produces the unit and all overheads are associated with the delivery of units to its customers.

Particulars	Budget	Actual
Overheads (₹)	4,000	3,900
Output (units)	2,000	2,100
Customer Deliveries (no.'s)	20	19

Required

Calculate Efficiency Variance and Expenditure Variance by adopting ABC approach.

Question No.3 - November 2016 RTP

State possible Impact on Variances in each of the following independent situations:

- More units were produced than was budgeted.
- Careless handling of materials by production personnel
- The purchase of inferior quality material
- New competition entered the market.

- (v) New suppliers were used.
- (vi) New production staff were recruited.
- (vii) Market share has fallen from 20% to 18%

Question No.4 – May 2016 RTP

Sapporo Manufacturing Co. (SMC) is a leading consumer goods company. The budgeted and actual data of SMC for the year 2014-15 are as follows:-

Particulars	Budget	Actual	Variance
Sales / Production (units)	2,00,000	1,65,000	(35,000)
Sales (₹)	21,00,000	16,92,900	(4,07,100)
Less: Variable Costs (₹)	12,66,000	10,74,150	1,91,850
Less: Fixed Costs (₹)	3,15,000	3,30,000	(15,000)
Profit	5,19,000	2,88,750	(2,30,250)

The budgeted data shown in the table is based on the assumption that total market size would be 4,00,000 units but it turned out to be 3,75,000 units.

Required

Prepare a statement showing reconciliation of budget profit to actual profit through marginal costing approach for the year 2014-15 in as much detail as possible.

Question No.5 – November 2016

X Limited is a manufacturer of cardboard boxes. An analysis of its operating income between 2014 and 2015 shows the following:

	Income Statement (amount in 2014)	Revenue & Cost effect of Growth Component in 2015	Revenue & Cost effect of Price Recovery Component in 2015	Cost effect of Productivity Component in 2015	Income Statement (amount in 2015)
Revenue (₹)	40,00,000	2,00,000(F)	4,20,000(F)	---	46,20,000
Cost (₹)	29,20,000	60,000 (A)	2,56,000(A)	58,000(F)	31,78,000
Operating Income(₹)	10,80,000	1,40,000(F)	1,64,000(F)	58,000(F)	14,42,000

X limited sold 4,00,000 boxes and 4,20,000 boxes in 2014 and 2015 respectively. During 2015, the market for cardboard boxes grew 3% in terms of number of units and all other changes are due to company's differentiation strategy and productivity.

Required

Compute how much of the change in operating income from 2014 to 2015 is due to the industry market size factor, productivity and product differentiation and also reconcile the profit of both years due to these factors.

(5 Marks)

Question No.6 – November 2016

Zed company manufactures two types of flooring rolls. Budgeted and actual data for 2015 are-

	Static Budget			Actual Result		
	Industrial	Domestic	Total	Industrial	Domestic	Total
Unit Sales in Rolls ('000)	200	600	800	252	588	840
Contribution Margin (₹ In lacs)	100.00	240.00	340.00	119.70	246.96	366.66

In late 2014, a marketing research estimated industrial volume for industrial and domestic flooring at 80 lacs Rolls. Actual industry volume for 2015 was 70 lacs Rolls.

Compute

- (i) Sales Mix Variance and Sales Quantity Variance by type of flooring rolls and in total.
- (ii) Market Share Variance and Market Size Variance. (8 Marks)

Question No.7 – November 2016

A company manufactures two products X and Y. Product X requires 5 hours to produce while Y requires 10 hours. In a month of 25 effective working days of 8 hours a day, 1,000 units of X and 600 units of Y were produced. The company employs 50 workers in the production department to produce X and Y. The budgeted hours are 1,02,000 for the year.

Calculate Capacity Ratio, Activity Ratio and Efficiency Ratio. Also establish their inter-relationship. (4 Marks)

Question No.8 – May 2016

A company operates a standard cost system to control the variable works cost of its only product. The following are the details of actual production, costs and variances for November, 2015.

Production and cost (actual)

Production..... 10,000 units
Direct Materials (1,05,000 kg.)..... ₹ 5,20,000
Direct Labour (19,500 hrs.)..... ₹ 3,08,000
Variable Overheads..... ₹ 4,10,000

Cost variances

Direct materials – Price..... ₹ 5,000 (F)
Direct materials – Usages..... ₹ 25,000 (A)
Direct labour – Rate..... ₹ 15,500(A)

Direct labour – Efficiency..... ₹ 7,500 (F)

Variable overheads..... ₹ 10,000 (A)

The Cost Accountant finds that the original standard cost data for the product is missing from the cost department files. The variance analysis for December, 2015 is held up for want of this data.

You are required to calculate:

- (i) Standard price per kg. of direct material.
- (ii) Standard quantity for each unit of output.
- (iii) Standard rate of direct labour hour.
- (iv) Standard time for actual production.
- (v) Standard variable overhead rate. (8 Marks)

Question No.9 – November 2015

Alpha Ltd. uses standard costing system for manufacturing its single product 'APS'.

Standard cost card is as follows:

	Per unit (₹)
Selling Price.....	120
Direct Material (1 kg per unit).....	20
Direct Labour (6 hrs @ ₹ 8 per hour).....	48
Variable Overheads.....	24
Contribution.....	28

Actual and budgeted activity levels in units for the month of September are:

	Budget	Actual
Sales.....	50,000	51,200
Production.....	50,000	52,000

Actual sales revenue and variable costs for the month of September are given as under:

Sales.....	61,33,760
Direct Material.....	10,65,600
Direct Labour (3,00,000 hrs).....	24,42,000
Variable Overheads.....	12,28,000

Calculate:

- (i) Direct Labour Rate Variance
- (ii) Direct Labour Efficiency Variance
- (iii) Sales Volume Variance
- (iv) Sales Price Variance
- (v) Comment on your findings in (i) and (ii) above. (8 Marks)

Question No.10 – May 2015

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

40% of Material A @ ₹ 30 per kg

60% of Material B @ ₹ 40 per kg

A standard loss of 10% of input is expected in production. The following actual cost data is given for the period.

350 kg Material – A at a cost of ₹ 25

400 kg Material - B at a cost of ₹ 45

Actual weight produced is 630 kg.

You are required to calculate the following variances raw material wise and indicate whether they are favourable (F) or adverse (A):

- (i) Cost variance*
- (ii) Price variance*
- (iii) Mix variance*
- (iv) Yield variance*

(8 Marks)

Question No.11 – November 2014

Compute the missing data, indicated by question marks from the following:

<i>Particulars</i>	<i>Product A</i>	<i>Product B</i>
<i>Standard price per unit (₹)</i>	<i>24</i>	<i>30</i>
<i>Actual price per unit (₹)</i>	<i>30</i>	<i>40</i>
<i>Standard input (kg)</i>	<i>50</i>	<i>??</i>
<i>Actual input (kg)</i>	<i>??</i>	<i>70</i>
<i>Material price variance</i>	<i>??</i>	<i>??</i>
<i>Material usages variance (₹)</i>	<i>??</i>	<i>600 (A)</i>
<i>Material cost variance</i>	<i>??</i>	<i>??</i>

Material Mix variance for both products together was ₹90 adverse.

(7 Marks)

Question No.12 – May 2014

Y Limited is a manufacturer of Cardboard boxes. An analysis of its operating income between 2012 and 2013 shows the following:

	<i>Income Statement (amount in 2012)</i>	<i>Revenue & Cost effect of Growth component in 2013</i>	<i>Revenue & Cost effect of Price recovery component in 2013</i>	<i>Cost effect of productivity component in 2013</i>	<i>Income Statement (amount in 2013)</i>
<i>Revenue (₹)</i>	<i>40,00,000</i>	<i>2,00,000(F)</i>	<i>4,20,000(F)</i>	<i>-</i>	<i>46,20,000</i>
<i>Cost (₹)</i>	<i>29,20,000</i>	<i>60,000 (A)</i>	<i>2,56,000(A)</i>	<i>58,000(F)</i>	<i>31,78,000</i>

Operating Income (₹)	10,80,000	1,40,000(F)	1,64,000(F)	58,000(F)	14,42,000
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Y limited sold 4,00,000 boxes and 4,20,000 boxes in 2012 and 2013 respectively. During 2013 the market for cardboard boxes grew 3% in terms of number of units and all other changes are due to company's differentiation strategy and productivity. Compute how much of the change in operating income from 2012 to 2013 is due to the industry market size factor, productivity and product differentiation and also reconcile the profit of both years due to these factors.
(5 Marks)

Question No.13 - November 2013

The following information relates to the labour element of X Ltd.

Type of labour	Skilled	Semi-skilled	Unskilled	Total
No. of workers in the standard gang	4	3	2	9
Standard rate per hour (₹)	6	3	1	
Number of workers in actual gang				9
Actual rate per hour (₹)	7	2	2	

In a 40 hour week, the gang produced 270 standard hours. The actual number of semi-skilled workers is two times the actual number of unskilled workers.

The rate variance of semi-skilled workers is ₹160 (F).

Find the following:

- The number of workers in each category*
- Total gang variance*
- Total sub-efficiency variance*
- Total labour rate variance*

Indicate if the variances are Favourable (F) or Adverse (A or U).

(8 Marks)

Question No.14 - May 2013

The following are the information regarding overheads of a company:

- Overheads cost variance = ₹2,800 (A)*
- Overheads volume variance = ₹2,000 (A)*
- Budgeted overheads = ₹12,000*
- Actual overhead recovery rate = ₹8 per hour*
- Budgeted hours for the period = 2,400 hours*

You are required to compute the following:

- Overheads expenditure variance.*
- Actual incurred overheads.*
- Actual hours for actual production.*

- (iv) Overheads capacity variance.
- (v) Overheads efficiency variance.
- (vi) Standard hours for actual production.

Question No.15 – November 2012

Sunglow Limited manufactures and sells a single product. From the records of the company the following information is available for November 2012:

The standard cost comprises the following:

Direct material	Unit	₹
X	8	320
Y	24	1,680
Z	16	400
		<u>2,400</u>
Direct wages (₹ 40 per hour)		1,600
Variable overhead (25% of direct wages)		400
Fixed overhead (based on budgeted production of 10,000 units of the final product per month)		600
		<u>5,000</u>

The budgeted selling price is ₹ 700 each and the budgeted sales for the month were 14,000 units.

The following were the transactions for the month:

Direct material:	Units	Purchased Price per unit	Issued unit
X	44,000	42	82,400
Y	1,40,000	71	2,46,400
Z	60,000	24	1,64,000
Direct Wages:	₹ 90,00,000 (3,98,000 hours)		
Overheads:			
Variable	₹ 2,00,000		
Fixed	₹ 3,00,000		
Production:	11,000 units		
Sales:	9,000 units at ₹ 700 each and 3,500 units at ₹ 750 each		

Required:

Calculate (i) Material price variance; (ii) Material mix variance; (iii) Labour rate variance (iv) Labour efficiency variance (v) Variable overhead efficiency variance; and (vi) Fixed overhead efficiency variance. (9 Marks)

Question No.16 – May 2012

The standard set for a chemical mixture of a company is as under:

Material	Standard Mix(%)	Standard Price ₹/Kg
A	80	50
B	20	100

Standard yield in production is 75 %.

The actual quantity produced was 1800 kg of output from the following:

Material	Quantity (kg)	Actual Price
A	1400	60
B	600	90

Calculate the total material price, mix and yield variances, indicating whether they are favorable (F) or adverse (A or U). (6 Marks)

Question No.17 – November 2015 RTP

Universal LTD. is engaged in marketing of wide range of consumer goods. M, N, O and P are the zonal sales officers for your 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 M, N, O and P are ₹ 5,00,000, ₹ 3,75,000, ₹ 4,00,000 and ₹ 4,25,000 respectively.
- M, N, O and P respectively earned ₹ 29,900, ₹ 23,500, ₹ 24,500 and ₹ 25,800 as commission at 5% on actual sales effected by them during the previous year.
- The relevant variances as computed by a qualified accountant are as follows:

Particulars	M (₹)	N (₹)	O (₹)	P (₹)
Sales Price Variance	4,000 (F)	6,000 (A)	5,000 (A)	2,000 (A)
Sales Volume Variance	6,000 (A)	26,000 (F)	15,000 (F)	8,000 (F)
Sales Margin Mix Variance	14,000 (A)	8,000 (F)	17,000 (F)	3,000 (A)

Note: (A) = Adverse variance and (F) = Favorable variance

Required:

- Compute the amount of 'Sales Target Fixed' and the 'Actual Margin Earned' in case of each of the zonal sales officer.
- Evaluate the overall performance of these zonal sales officers taking three relevant base factors and then recommend whose performance is the best.

Question No.18 – November 2015 RTP

Natural Spices manufactures and distributes high-quality spices to gourmet food shops and top quality restaurants. Gourmet and high-end restaurants pride themselves on using the freshest, highest-quality ingredients.

Natural Spices has set up five state of the art plants for meeting the ever growing demand. The firm procures raw material directly from the centers of produce to maintain uniform taste and quality. The raw material is first cleaned, dried and tested with the help of special machines. It is then carefully grounded into the finished product passing through various stages and packaged at the firm's ultraclean factory before being dispatched to customers.

The following variances pertain to last week of operations, arose as a consequence of management's decision to lower prices to increase volume.

Sales Volume Variance	18,000 (F)
Sales Price Variance	14,000 (A)
Purchase Price Variance	10,000 (F)
Labour Efficiency Variance	11,200 (F)
Fixed Cost Expenditure Variance	4,400 (F)

Required:

- Identify the 'Critical Success Factors' for Natural Spices.
- Evaluate the management's decision with the 'Overall Corporate Strategy' and 'Critical Success Factors'.

Question No.19 – May 2015 RTP, Nov 2017 RTP

A company produces a product X, using raw materials A and B. The standard mix of A and B is 1: 1 and the standard loss is 10% of input. You are required to COMPUTE the MISSING INFORMATION indicated by "?" based on the data given below:

	A	B	Total
Standard price of raw material (₹ / kg.)	24	30	
Actual input (kg.)	?	70	
Actual output (kg.)			?
Actual price ₹ / kg.	30	?	
Standard input quantity (kg.)	?	?	
Yield variance (sub usage)			270(A)
Mix variance			?
Usage variance	?	?	?
Price variance	?	?	?
Cost variance	0	?	1,300(A)

Question No.20 – May 2015 RTP

Aditya Decors Ltd. (ADL) is a leading manufacturer of luxury sanitary products and has divided its whole business into different product segments. At the Last year the management of ADL has decided to make some changes in its one of product-line 'AADee', the improved version was made available for sale from 1st of April 2014.

At the end of the financial year 2014-15, the finance and accounts department has extracted some relevant data for the product line 'AADee' to analyse the decision taken last year. The data related with AADee for the financial year 2013-14 and 2014-15 are as follows:

	2013-14	2014-15
No. of Units Sold	4,00,000	4,30,000
Selling Price <i>per unit</i>	₹4,175	₹ 4,325
Direct Materials Consumed	24,00,000 kg.	25,10,000 kg.
Cost <i>per kg.</i> of Direct Materials	₹470	₹485
Direct Labour Used	32,00,000 hrs.	34,80,000 hrs.
Rate <i>per labour hour</i>	₹30	₹ 31
Fixed Costs	₹1,60,00,000	₹ 1,76,00,000

ADL has the capacity to produce 5,00,000 units of AADee a year.

Required:

- (i) ANALYSE the changes in the operating income from financial year 2013-14 to 2014-15 with respect to the following components:
 - (a) Growth, (b) Price- Recovery and (c) Productivity Components
- (ii) RECONCILIATION of Operating Profit from 2013-14 to 2014-15.

Question No.21 – November 2014 RTP

KYC Ltd. uses a standard absorption costing system. The following details have been extracted from its budget for year 2013-14.

Fixed Overhead Cost	₹ 7,20,000
Production	36,000 units

In 2013-14 the Fixed Overhead Cost was over-absorbed by ₹3,200 and the Fixed Overhead Expenditure Variance was ₹20,000(F). What was the actual number of units produced in 2013-14?

Question No.22 – May 2014 RTP

S. Ltd. operates a system of standard costing in respect of one of its products which is manufactured within a single cost centre, the following information is available:

For one unit of product the standard material input is 20 litres at a standard price of ₹2 per litre. The standard wage rate is ₹6 per hour and 5 hours are allowed to produce one unit. Fixed production overhead is absorbed at the rate of 100% of direct wages cost.

During the month just ended the following occurred -

	₹
Actual Price (paid for material purchased)	1.95 <i>per litre</i>
Total Direct Wages Cost	1,56,000
Fixed Production Overhead	1,58,000

Variance	Favourable (₹)	Adverse (₹)
Direct Material Price	8,000	-
Direct Material Usage	-	5,000
Direct Labour Rate	-	5,760
Direct Labour Efficiency	2,760	-
Fixed Production Overhead Expenditure	-	8,000

Calculate the following for the month-

- Budgeted output in units.
- Number of litres purchased.
- Number of litres used above standard allowed.
- Actual units produced.
- Actual hours worked.
- Average actual wage rate per hour.

Question No.23 – November 2013 RTP

Managing Director of Petro-KL Ltd (PTKLL) thinks that Standard Costing has little to offer in the reporting of material variances due to frequently change in price of materials.

PTKLL can utilize one of two equally suitable raw materials and always plan to utilize the raw material which will lead to cheapest total production costs. However PTKLL is frequently trapped by price changes and the material actually used often provides, after the event, to have been more expensive than the alternative which was originally rejected.

During last accounting period, to produce a unit of 'P' PTKLL could use either 2.50 Kg of 'PG' or 2.50 kg of 'PD'. PTKLL planned to use 'PG' as it appeared it would be cheaper of the two and plans were based on a cost of 'PG' of ₹ 1.50 per Kg. Due to market movements the actual prices changed and if PTKLL had purchased efficiently the cost would have been:

'PG' ₹ 2.25 per Kg;

'PD' ₹ 2.00 per Kg

Production of 'P' was 1,000 units and usage of 'PG' amounted to 2,700 Kg at a total cost of ₹ 6,480/-

You are required to analyze the material variance for 'P' by:

- (i) Traditional Variance Analysis; and
- (ii) An approach which distinguishes between Planning and Operational Variances.

Question No.24 – May 2013 RTP

New Tech Enterprises manufactures one product, and the entire product is sold as soon as it is produced. There are no opening or closing stocks and work in progress is negligible. The company operates a standard costing system and analysis of variances is made every month. The standard cost card for the product is as follows:

		₹
Direct material	0.5 kgs at ₹ 4 per kg.	2.00
Direct Wages	2 hrs at ₹ 2 per hour	4.00
Variable overheads	2 hrs at ₹ 0.30 per hour	0.60
Fixed overheads	2 hrs at ₹ 3.70 per hour	<u>7.40</u>
Standard cost		<u>14.00</u>

Standard profit		<u>6.00</u>
Standard selling price		<u>20.00</u>

Budgeted output for April 2012 was 5,100 units.

Actual results for April 2012 were as follows:

Production of 4,850 units was sold for ₹ 95,600.

Materials consumed in production amounted to 2,300 kgs. At a total cost of 9,800.

Labour hours paid for amounted to 8,500 hours at a cost of ₹ 16,800.

Actual operating hours amounted to 8,000 hours.

Variable overheads amounted to ₹ 2,600.

Fixed overheads amounted to ₹ 42,300.

You are required to

- Calculate Material, Labour, Variable Overhead, Fixed Overhead, Sales Value & Sales Margin Variances.
- Prepare an operating statement for the month ended 30th April 2012.
- Prepare a reconciliation Statement between 'Budgeted Profit & Actual Profit' under 'Absorption Costing Method'.
- Prepare a reconciliation Statement between 'Budgeted Profit & Actual Profit' under 'Marginal Costing Method'.
- Prepare a reconciliation Statement between 'Standard Profit & Actual Profit' under 'Absorption Costing Method'.

Question No.26 – May 2017

The following data pertains to a company which uses standard marginal costing for manufacture and sale of a single product during the year.

Particulars	Budget	Actual
Sales (in units)	60,000	66,000
Sales (₹)	1,80,00,000	2,14,50,000
Direct Materials (₹)	28,80,000	36,30,000
Direct Labour (₹)	43,20,000	52,80,000
Variable Overheads (₹)	72,00,000	81,84,000
Total Variable Costs	1,44,00,000	1,70,94,000

Additional information is as follows:

	Standard	Actual
Direct material price per kg	₹12	₹11
Direct labour rate per hour	₹9	₹10

Calculate the following variance for the year and indicate the type of variance favourable (F), unfavourable (U) or adverse (A).

- Direct material usage variance
- Direct material price variance
- Direct labour efficiency variance
- Direct labour rate variance
- Variable overhead cost variance
- Sales margin volume variance

(8 Marks)

CHAPTER 6 - COSTING OF SERVICE SECTOR

Question No.1 – May 2016 RTP, May 2015 RTP

South Roadways Services Pvt. Ltd. is planning to run a fleet of 15 buses in Chittoor District on a fixed route. Company has estimated a total of 2,51,85,000 passenger kilometers per annum. It is estimated buses to have 100% load factor. Buses are purchased at a price of ₹ 44,00,000 per unit whose scrape value at the end of 5 years life is ₹ 5,50,000. Seating capacity of a bus excluding a Driver's seat is 42. Each bus can give a mileage of 5 kmpl. Average cost of fuel is ₹ 66 per liter. Cost of Lubricants & Sundries per 1,000 km would be ₹ 3,300. Company will pay ₹ 27,500 per month to Driver and two attendants for each bus.

Other annual charges per bus: Insurance ₹ 55,000, Garage Charges ₹ 33,000, Repairs & Maintenance ₹ 55,000. Route Permit Charges upto 20,000 km is ₹ 5,500 and ₹ 2,200 for every additional 5,000 km or part thereof.

Required

- Calculate a suggested fare per passenger/km taking into account markup on cost @ 20% to cover general overheads and sufficient profit.
- The Transport Sector of Chittoor is highly regulated. The Government has fixed the fare @ ₹ 1.35 for next 2 years. Comment on the two year's profitability taking into consideration the inflation rate of 8%.

Note: Route permit charges is not subject to Inflation.

Question No.2 – November 2016

The budget of a hotel for the year 2016 shows following room occupancy:

Quarter	January – March	April – June	July – September	October – December
Average occupancy %	45	60	90	55

Revenue for the year is estimated to be ₹ 60,00,000 and arises from three profit centres namely Accommodation * 45%, restaurant 35% and Bar 20%.

*The accommodation revenue is earned from several different categories of guests each of which pays a different rate per room.

The three profit centres have following percentage of margin:

	Accommodation (%)		Restaurant (%)		Bar (%)	
Revenue		100		100		100
Wages	20	30	30	80	15	70
Cost of sale	-		35		50	
Direct cost	10		15		5	
Gross Margin		70		20		30

Fixed cost for the year is estimated to be ₹ 9,15,000.

As a means of improving the budgeted profitability by 20%, following two suggestions have been made:

- (1) To offer special two night holidays at a reduced price of ₹250/- per night. It is expected that those accepting the offer would spend an amount equal to 40% of the accommodation charges in the restaurant and 40% of the accommodation charges in the bar.*
- (2) To increase prices Management is confident that there will be no drop in volume of sales if restaurant prices are increased by 7.50% and bar prices by 10%. Accommodation prices would also need to be increased.*

You are required to:

- (i) Calculate the budgeted profit.*
- (ii) How many two night holidays would need to be sold each week in three quarters, totalling 39 weeks, when occupancy is less, to achieve the desired profitability as per suggestion (1)?*
- (iii) By what percentage the prices of accommodation would need to be increased as per suggestion (2) to achieve the desired profitability? (10 Marks)*

Question No.3 – May 2016

A company is considering three alternative proposals for conveyance facilities for its sales personnel who have to do considerable travelling, approximately 20,000 kilometres every year. The proposals are as follows:

- (i) Purchase and maintain its own fleet of cars. The average cost of a car is ₹ 1,00,000.*
- (ii) Allow the Executive to use his own car and reimburse expenses at the rate of ₹ 1.60 per kilometre and also bear insurance costs.*
- (iii) Hire cars from an agency at ₹ 20,000 per year per car. The company will have to bear costs of petrol, taxes and tyres.*

The following further details are available:

Petrol..... ₹ 0.60 per km

Repairs and maintenance..... ₹ 0.20 per km

Tyres..... ₹ 0.12 per km

Insurance..... ₹ 1,200 per car per annum

Taxes..... ₹ 800 per car per annum

Life of the car..... 5 years with annual mileage of 20,000 kms

Resale value..... ₹ 20,000 at the end of the fifth year

Work out the relevant costs of three proposals and rank them.

(5 Marks)

Question No.4 – November 2013

Flyway Ltd. has hired an aircraft to specially operate between cities A and B. All the seats are economy class.

The following information is available:

<i>Seating capacity of the aircraft</i>	<i>:</i>	<i>260 passengers</i>
<i>Average number of passengers per flight</i>	<i>:</i>	<i>240 passengers</i>
<i>Average one-way fare from A to B</i>	<i>:</i>	<i>₹ 5,000 per passenger</i>
<i>Fuel costs per flight from A to B</i>	<i>:</i>	<i>₹ 90,000</i>
<i>Food cost (A to B sector)</i> <i>(no charge to passenger)</i>	<i>:</i>	<i>₹ 300 per passenger</i>
<i>Commission to travel agents</i> <i>(All tickets are through agents)</i>	<i>:</i>	<i>10% of the fare</i>
<i>Annual lease costs allocated to each flight</i>	<i>:</i>	<i>₹ 2,00,000</i>
<i>Ground services, baggage handling/checking in</i> <i>service costs per flight A to B</i>	<i>:</i>	<i>₹ 40,000</i>
<i>Flight crew salaries per flight A to B</i>	<i>:</i>	<i>₹ 48,000</i>

There is an offer from another airlines operator, Haltgo Ltd. for a stop-over at destination D, which is on the way from A to B. Due to this, the flight will operate from A to D, then from D to B.

The following terms are considered for the stop-over:

50 seats from D to B will be booked by Haltgo at ₹ 2,700 per ticket, whether or not Haltgo is able to sell them to its customers. No agents' commission is payable on these tickets. However, Snacks must be provided to these passengers also by Flyway Ltd. at no further charge to Haltgo or the passengers.

A maximum of 60 tickets can be sold by Flyway's travel agents for the A to D sector at a fare of ₹ 3,000 per passenger.

Since the stop-over wastes more time, 25 of Flyway's original passengers in the A to B sector will voluntarily drop out in favour of other airlines offering direct flights between A and B.

Due to the stop-over, fuel costs will increase from ₹ 90,000 to ₹ 1,35,000. Additional airport landing/baggage handling charges of ₹ 19,000 per stop-over will have to be incurred by Flyway Ltd.

Flyway Ltd. will have to serve snacks to all the passengers in the D to B sector at no charge to passengers. Each snack will cost Flyway ₹ 200. This will be in addition to the original food at ₹ 300 served in the A to D sector.

You may assume that fuel costs are not affected by the actual number of passengers in the flight, ignore non-financial considerations, additional wear and tear to aircraft due to extra landing/take-off.

Without considering Haltgo's offer,

- (i) What is the profit earned by Flyway Ltd. per flight from A to B?
- (ii) What is the Break-even number of passengers for each flight from A to B? Considering the effects of Haltgo's offer,
- (iii) Evaluate whether Flyway should accept the offer.

Question No.5 – November 2012

XY Hotel has 40 bed rooms with a maximum occupancy of 490 sleeper nights per week. Average occupancy is 60% throughout the year. Meals provided to guests have been costed and the average food cost per person per day is as follows:

	₹
Breakfast	72.00
Lunch	220.00
Dinner	<u>268.00</u>
	<u>560.00</u>

Direct wages and staff meals per week are as under:

	₹
Housekeeping	39,040.00
Restaurant and kitchen	68,600.00
General	35,200.00

Direct expenses per annum are ₹ 9,15,200 for house keeping and ₹ 10,40,000 for restaurant. Indirect expenses amount to ₹ 68,22,400, which should be apportioned on the basis of floor area. The floor areas are as follows:

	Sq. Mt.
Bed rooms	3,600
Restaurant	1,200
Service Area	600

A net profit of 10% must be made on the restaurant taking and also on accommodation takings.

Required:

Calculate what inclusive term per person should be charged per day and also show the split between meals and accommodation charges. (7 Marks)

Question No.6 – May 2012

Suggest suitable cost units for the following services:

- (i) Hospital
- (ii) Hotel
- (iii) Transport
- (iv) Staff canteen

(4 Marks)

Question No.7 – May 2014 RTP

A Hotel having 50 single rooms is having 80% occupancy in normal season (8 months) and 50% in off- season (4 months) in a year (take 30 days month).

Annual Fixed Expenses:	₹ Lakh
Salary of the Staff (excluding Room Attendant)	7.50
Repair & Maintenance	2.60
Depreciation on Building & Furniture	2.40
Other Fixed Expenses like Dusting, Sweeping etc.	<u>3.25</u>
Total	15.75

Variable Expenses (per Guest per Day):	₹
Linen, Laundry & Security Support	30.00
Electricity & Other Facilities	20.00
Misc Expenses like Attendant etc	25.00

Management wishes to make a Margin of 25% of Total Cost.

- Calculate the Tariff Rate per Room.
- Calculate the Break Even Occupancy in Normal Season assuming 50% Occupancy is Off-Season.
- Management is proposing 10% cut in Tariff to improve Occupancy at 100% and 70% in Normal Season and Off-Season respectively. Give your views on it.
- What is the minimum rise in Occupancy % to take care of risk of fall in Profit due to Tariff-Cut?

Question No.8 – May 2013 RTP

Modern health centre provides health and other related services to the citizens who are covered under insurance plan. The health centre receives a payment from the insurance company each time any patient attends the centre for consultation as under:

Consultations involving	Payment from Insurance company ₹
No treatment	30
Minor treatment	125
Major treatment	250

In addition, the adult patients will have to make a co-payment which is equivalent to the amount of payment for the respective category of treatment made by the insurance company. However, children and senior citizens are not required to make any such co-payment.

The health centre will remain open for 6 days in a week for 52 weeks in a year. Each physician treated 20 patients per day although the maximum number of patients that could have been treated by a physician on any working day is 24 patients.

The health centre received a fixed income of ₹ 20,000 per month for promotion of health products from the manufacture.

The annual expenditure of the health centre is estimated as under:

Materials and consumable (100% variable)	₹ 11,16,000
Staff salaries per annum per employee (fixed):	
Physician	₹ 2,25,000
Assistants	₹ 75,000
Administrative staff	₹ 45,000
Establishment and other operating costs (fixed)	₹ 5,00,000

The non-financial information is as under:

(i)	Staff:	
	Number of physicians employed	8
	Assistants	8
	Administrative staff	2
(ii)	Patient Mix:	
	Adults	50%
	Children	40%
	Senior Citizens	10%
(iii)	Mix of patient appointments (%)	
	Consultation requiring no treatment	60%
	Minor treatment	30%
	Major treatment	10%

Required:

- (i) Calculate the Net income of the city health centre for the next year;
- (ii) Determine the percentage of maximum capacity required to be utilized next year in order to break even.

CHAPTER 7 - TRANSFER PRICING

Question No.1 – May 2016 RTP, Nov 2017 RTP

AWB Ltd. has two divisions Division W and Division B. Division W produces product Z, which it sells to external market and also to Division B. Divisions in the AWB Ltd. are treated as profit centres and divisions are given autonomy to set transfer prices and to choose their supplier. Performance of each division measured on the basis of target profit given for each period.

Division W can produce 1,00,000 units of product Z at full capacity. Demand for product Z in the external market is for 70,000 units only at selling price of ₹ 2,500 per unit. To produce product Z Division W incurs ₹ 1,600 as variable cost per unit and total fixed overhead of ₹ 4,00,00,000. Division W has employed ₹ 12,00,00,000 as working capital, working capital is financed by cash credit facility provided by its lender bank @ 11.50% p.a. Division W has been given a profit target of ₹ 2,50,00,000 for the year.

Division B has found two other suppliers C Ltd and H Ltd. who are agreed to supply product Z.

Division B has requested a quotation for 40,000 units of product Z from Division W.

Required

- Calculate the transfer price per unit of product Z that Division W should quote in order to meet target profit for the year.
- Calculate the two prices Division W would have to quote to Division B, if it became AWB Ltd. policy to quote transfer prices based on opportunity costs.

Question No.2 – May 2016

Division X and Y are two divisions of XY Ltd., which operates as profit centres. Division X makes and sells product X. The budgeted Income statement of Division X, based on a sales volume of 30,000 units, is given below:

Budgeted Income Statement of Division X

Particulars	₹ In '000
Sales Revenue	6,000
Component purchase costs	1,050
Other variable costs	1,680
Fixed costs	480
Variable marketing costs	270
Fixed marketing overheads	855
Operating profit	1,665

The manager of Division X suggests that sales can be increased by 9,600 units, if the selling price is reduced by ₹ 20 per unit from the present price of ₹ 200 per unit and that for this additional volume, no additional fixed costs will be incurred.

Division Y makes a component Y which is sold outside at a price of ₹ 50 per unit.

Division X presently uses a component which is purchased from outside at ₹ 35 per unit. This component is similar to component made by Division Y. Division Y can make this component for Division X with a minor modification in specification which would cause reduction in direct material cost for the Division Y by ₹ 1.5 per unit and would require extra labour hour of 1 per unit at the rate of ₹ 1.5 per hour.

Further the Division Y will not incur variable selling marketing cost on units transferred to the Division X. Division X's manager has offered to buy the component from Division Y at ₹ 25.00 per unit. Division Y has the capacity to produce 85,000 units.

The current budgeted information of Division Y are as follows:

Number of units sold outside 60,000 units @ ₹ 50 per unit, variable cost including material and labour ₹ 15 per unit, variable marketing cost ₹ 3 per unit, operating profit ₹ 12,00,000 and fixed overheads ₹ 7,20,000.

Advise

- (i) Should the Division X reduce the selling price by ₹ 20 per unit even if it is not able to procure the component from Division Y at ₹ 25 per unit?
- (ii) Should the Division Y be willing to supply 39,600 units to Division X at ₹ 25 per unit?

Support each of your conclusions with appropriate calculations.

(8 Marks)

Question No.3 – May 2015

G is the transferring division and R, the receiving division in a company. R has a demand for 20% of G's production capacity which has to be first met as per the company's policy.

State with reason, which division, G or R enjoys more advantage in each of the following independent situations, assuming no inventory build up.

Sl. No.	G Transfers to R at Transfer Price equal to	G's Production level	External Demand	Division having more advantage	Reason
(i)	Full cost: No markup	60%	40%		
(ii)	Market Price	80%	60%		
(iii)	Marginal Cost	100%	80%		
(iv)	Market Price	100%	90%		

(Only the Sl. No. column and last two columns need to be written in the answer books)

(5 Marks)

Question No.4 – November 2014

X Division and Y Division are two divisions in the XY group of companies. X Division manufactures one type of component which it sells to external customers and also to Y Division.

Details of X Division are as follows:

<i>Market price per component</i>	<i>₹300</i>
<i>Variable cost per component</i>	<i>₹157</i>
<i>Fixed costs</i>	<i>₹20,62,000 per period</i>
<i>Demand from Y Division</i>	<i>20,000 components per period</i>
<i>Capacity</i>	<i>35,000 components per period</i>

Y Division assembles one type of product which it sells to external customer. Each unit of that product requires two of the components that are manufactured by X Division.

Details of Y Division are as follows:

Selling price per unit *₹1,200*

Variable cost per unit:

(i) Two components from X *2 @ transfer price*

(ii) Other variable costs per unit *₹375*

Fixed costs *₹13,50,000 per period*

Demand *10,000 units per period*

Capacity *10,000 units per period*

Group Transfer Pricing Policy

Transfers must be at opportunity cost.

Y must buy the components from X.

X must satisfy demand from Y before making external sales.

Required:

(1) Calculate the profit for each division if the external demand per period for the components that are made by X Division is:

(i) 15,000 components

(ii) 19,000 components

(iii) 35,000 components

(2) Calculate the financial impact on the Group if Y Division ignored the transfer pricing policy and purchased all of the 20,000 components that it needs from an external supplier for ₹255 each. Your answer must consider the impact at each of the three levels of demand (15,000, 19,000 and 35,000 components) from external customers for the component manufactured by X Division. *(10 Marks)*

Question No.5 – November 2013

B Ltd. makes three products X, Y and Z in Divisions X, Y and Z respectively. The following information is given:

	X	Y	Z
Direct Material (₹ / Unit) (excluding material X for Divisions Y and Z)	8	22	40
Direct Labour (₹ / Unit)	4	6	8
Variable Overhead (₹ / Unit)	2	2	2
Selling price to outside customers (₹ / Unit)	25	65	90
Existing capacity (no. of units)	6,000	3,000	3,000
Maximum external Market demand (no of units)	5,000	5,500	5,000
Additional fixed cost that would be incurred to install additional capacity (₹)	45,000	9,000	23,100
Maximum additional units that can be produced by additional capacity	6,000	2,000	2,250

Y and Z need material X as their input. Material X is available in the market at ₹ 23 per unit. Defectives can be returned to suppliers at their cost. Division X supplies the material free from defects and hence is able to sell at ₹ 25 per unit. Each unit of Y and Z require one unit of X as input with slight modification.

If Y purchases from outside at ₹ 23 per unit, it has to incur ₹ 3 per unit as modification and inspection cost. If Y purchases from Division X, it has to incur, in addition to the transfer price, ₹ 2 per unit to modify it.

If Z gets the material from Division X, it can use it after incurring a modification cost, of ₹ 1 per unit. If Z buys material X from outside, it has to either inspect and modify it at its own shop floor at ₹ 5 per unit or use idle labour from Division X at ₹ 3 per unit. Division X will lend its idle labour as per Z's requirement even if Z purchases the material from outside.

The transfer prices are at the discretion of the Divisional Managers and will remain confidential. Assume no restriction on quantities of inter-division transfers or purchases.

Discuss with relevant figures the best strategy for each division and for the company as a whole.

(12 Marks)

Question No.6 – November 2012

PEX is a manufacturing company of which division PQR manufactures a single standardized product. Some of the output is sold externally whilst the remainder is transferred to division RPQ where it is a subassembly in the manufacture of that division's product. PQR has the capacity (annual) to produce 30,000 units of the product. The unit costs of division PQR's product are as under:

	₹
Direct material	40
Direct labour	20
Direct expenses	20
Variable manufacturing overheads	20
Fixed manufacturing overheads	40
Sells and packaging expenses-variable	<u>10</u>
	<u>150</u>

Annually 20,000 units of the product are sold externally at the standard price of ₹ 300 per unit.

In addition to the external sales, 10,000 units are transferred annually to division RPQ at an internal transfer price of ₹ 290 per unit. This transfer price is obtained by deducting variable selling and packing expenses from the external price since those expenses are not incurred for internal transfers.

Division RPQ incorporates the transferred-in goods into a more advanced product. The unit costs of this product are as follows:.

	₹
Transferred-in-item (from division PQR)	290
Direct material and components	230
Direct labour	30
Variable overheads	120
Fixed overheads	120
Selling and packing expenses-variable	<u>10</u>
	<u>800</u>

Division RPQ's manager disagrees with the basis used to set the transfer price. He argues that the transfers should be made at variable cost plus an agreed (minimal) mark up because his division is taking output that division PQR would be unable to sell at the price of ₹ 300.

Partly because of this disagreement, a study of the relationship between selling price and demand has recently been carried out for each division by the company's sales director. The study has brought out the following demand schedule:

Division PQR

Selling price (₹)	200	300	400
Demand (units)	30,000	20,000	10,000

Division RPQ

Selling price (₹)	800	900	1,000
Demand (units)	14,400	10,000	5,600

The manager of the division RPQ claims that this study supports his case. He suggests that a transfer price of ₹ 120 would give division PQR a reasonable contribution to its fixed overheads while allowing division RPQ to earn a reasonable profit. He also believes that it would lead to an increase of output and an improvement in the overall level of company profits.

Required:

- Calculate the effect of the transfer price of ₹ 290 per unit on company's operating profit. Calculate the optimal product mix.
- Advise the company on whether the transfer price should be revised to ₹ 120 per unit. (11 Marks)

Question No.7 – May 2012

AB Ltd. makes component 'C' and billing machines. Division A makes component 'C' that is used in the final assembly of the machine in Division B.

(One unit of Component 'C' is used per machine). Component C has an outside market also. A and B operate as profit centres and each can take its own decisions. The following data is given in the existing scenario for Divisions A and B, under which Division A has enough special and external demand to use its capacity and hence is offering B rates of 800 ₹/Unit for quantity up to 750 units and 900 Rs/unit for more than 750 units, so that its outside contribution is not affected by transfers to B. A

and B can sell any quantity up to the maximum indicated under 'units sold', without affecting their future demands.

	Division A		Division B	
	External Market (normal sales)	Special sales	External Market (normal sales)	
Selling Price (₹/u)	1,000	800	4,000	
Variable manufacturing cost (₹/u)	600	600	1,500*	(* excluding component C)
Variable selling cost (₹/u)	100**	--	200**	(** Not incurred on inter division transfers)
Total variable cost (₹/unit)	700	600	1,700*	(* excluding component C)
Contribution (₹/unit)	300	200		
Units Sold	1,250	750	900	
Production capacity	2,000 units		900 units	

For the next period, A requires for its own use in its selling outlets, 50 units of billing machines produced by B. B's manager proposes as follows:

Option I - B will supply 50 machines to A on its variable manufacturing cost basis provided A supplies to B, 500 units of Component C at A's variable manufacturing cost basis.

Option II - Both A and B resort to total variable cost per unit basis applicable to normal external sale, though neither A nor B incurs any selling cost on inter division transfers. A will be given 50 machines for its use. A will have to supply B all the 900 units that B requires.

Option III - Both A and B use the external market selling price (i.e. 1,000 and 4,000 ₹/Unit for 900 units of Component 'C' and 50 machines respectively).

From a financial perspective, advise Division A's manager what he should choose. Support your advice with relevant figures.

What is the change in the rate of discount per unit given by B to A (based on unit transfer price to market price ratio) from option I to option II?

Question No.8 – November 2015 RTP

Division Z is a profit center which produces four products A, B, C and D. Each product is sold in the external market also. Data for the period is:

	A	B	C	D
Market Price <i>per unit</i> (₹)	150	146	140	130
Variable Cost of Production <i>per unit</i> (₹)	130	100	90	85
Labour Hours Required <i>per unit</i>	3	4	2	3

Product D can be transferred to Division Y, but the maximum quantity that may be required for transfer is 2,500 units of D.

The maximum sales in the external market are:

- A 2,800 units
- B 2,500 units
- C 2,300 units
- D 1,600 units

Division Y can purchase the same product at a price of ₹125 per unit from outside instead of receiving transfer of product D from Division Z.

Required:

Calculate the 'Transfer Price' for each unit for 2,500 units of D, if the total labour hours available in Division Z are 20,000 hours?

Question No.9 – May 2015 RTP

Standard Corporation Inc. (SCI) is a US based multinational company engaged in manufacturing and marketing of Printers and Scanners. It has subsidiaries spreading across the world which either manufactures or sales Printers and Scanners using the brand name of SCI.

The Indian subsidiary of the SCI buys an important component for the Printers and Scanners from the Chinese subsidiary of the same MNC group. The Indian subsidiary buys 1,50,000 units of components per annum from the Chinese subsidiary at CNY (¥) 30 per unit and pays a total custom duty of 29.5% of value of the components purchased.

A Japanese MNC which manufactures the same component which is used in the Printer and Scanners of SCI, has a manufacturing unit in India and is ready to supply the same component to the Indian subsidiary of SCI at ₹ 320 per unit.

The SCI is examining the proposal of the Japanese manufacturer and asked its Chinese subsidiary to presents its views on this issue. The Chinese subsidiary of the SCI has informed that it will be able to sell 1,20,000 units of the components to the local Chinese manufactures at the same price i.e. ¥ 30 per unit but it will incur an excise duty @ 10% on sales value. Variable cost per unit of manufacturing the component is ¥ 20 per unit. The Fixed Costs of the subsidiaries will remain unchanged.

The Corporation tax rates and currency exchange rates are as follows:

Corporation Tax rates		Currency Exchange Rates
China	25%	1 US Dollar (\$) = ₹61.50
India	34%	1 US Dollar (\$) = ₹ 6.25
USA	40%	1 CNY (¥) = ₹ 9.80

Required:

- PREPARE a financial appraisal for the impact of the proposal by the Japanese manufacturer to supply components for Printers and Scanners to Indian subsidiary of SCI. [Present your solution in Indian Currency and its equivalent.]
- IDENTIFY other issues that would be considered by the SCI in relation to this proposal.

Question No.10 - May 2014 RTP

Eastern Company Ltd. has two Divisions namely Casnub Bogie Division (CBD) and Wagon Division (WD). CBD manufactures Casnub Bogies and WD manufactures BOBN type of Wagons. To manufacture a Wagon WD needs four Casnub Bogies. CBD is the only manufacturer of the Casnub Bogies and supplies both WD and outside customers. Details of CBD and WD for the coming financial year 2014-15 are as follows:

	CBD	WD
Fixed Costs (₹)	9,20,20,000	16,45,36,000
Variable Cost per unit (₹)	2,20,000	4,80,000*
Capacity per month (units)	320	12

* excluding transfer costs

Market research has indicated that the demands in the market for Eastern Company Ltd.'s products at different quotations are as follows:

For Casnub Bogies: Quotation price of ₹3,20,000 no tender will be awarded, but demand will increase by 30 Casnub Bogies with every ₹10,000 reduction in the unit quotation price below ₹3,20,000.

For Wagons: Quotation price of ₹17,10,000 no tender will be awarded, but the demand for Wagons will be increased by two Wagons with every ₹50,000 reduction in the unit quotation price below ₹17,10,000.

Required:

- (i) Calculate the unit quotation price of the Wagon that will maximise Eastern Company Ltd.'s profit for the financial year 2014-15.
- (ii) Calculate the unit quotation price of the Wagon that is likely to emerge if the divisional managers of CBD and WD both set quotation prices calculated to maximise divisional profit from sales to outside customers and the transfer price is set at market selling (quotation) price.

[Note: If $P = a - bQ$ then $MR = a - 2bQ$]

Question No.11 – May 2017

Supreme Limited has two Divisional Profit Centres A and B. A produces two components 'AC' and 'PC' and has a maximum capacity of 1,20,000 hours per annum, which can be used for AC or PC.

The following information is given:

Details	Division A		Division B
	AC	PC	RAC
Direct Material ₹ / unit	25	10	100
Imported Component (equivalent of AC) ₹ / unit	-	-	450
Direct Labour and Variable overhead ₹ / unit			
@ ₹ 50 / hour	200	50	-
@ ₹ 35 / hour	-	-	350
Fixed cost ₹ / annum	30,00,000		6,00,000
External demand (no of units)	18,000	Unlimited	6,000
External selling price (₹ / unit)	450	90	1,050

Division B presently imports a component which is similar to AC at ₹ 450. If it uses AC from Division A, it has to make some modification which will involve two direct labour hours, thereby increasing the cost by ₹ 70/- per modified unit.

What is the minimum transfer price per unit that A will agree to, if the requirement of B is

- (i) 12,000 units
- (ii) 15,000 units?
- (iii) What is the maximum price that B will offer A per unit of AC transferred if its labour hours are restricted to 6,00,000 hours?

Is it in the company's interest that A transfers units to B after meeting its external demand for AC.

- (iv) If B's labour hours are restricted to 6,00,000 hours?
- (v) If B's labour hours have no limitation?

(Present your answers from a financial perspective and with only relevant figures. A detailed profitability statement is not required). (8 Marks)

CHAPTER 9 - PROFITABILITY ANALYSIS

Question No.1 – May 2017 RTP

Classify the following measures under appropriate categories in a Balanced Scorecard for a banking company which excels in its home loan products:

- (i) A new product related to life insurance is being considered for a tie up with the successful housing loan disbursements.
e.g. every housing loan applicant to be advised to take a life policy or compelled to take a fire insurance policy.
- (ii) How different sectors of housing loans with different interest rates have been sanctioned, their volumes of growth in the past 4 quarters.
- (iii) How many days are taken to service a loan, how many loans have taken longer, what additional loans are to be released soon, etc.

Question No.2 – May 2016

Classify the following under appropriate categories in Balanced Score Card:

- (i) Research and development
- (ii) New product introduction
- (iii) Price
- (iv) Cost leadership
- (v) Sales penetration
- (vi) Profitability
- (vii) Sales
- (viii) Quality

(4 Marks)

Question No.3 – May 2015

In the context of a balanced scorecard, identify the perspectives of the following independent situations:

Sl. No.	Organisation	Target Parameter	Perspective
(i)	Courier Company	100% on-time delivery of priority dispatches.	
(ii)	Tuition Centre	Set up class-on-internet facility for better reach of more number of students and absentees.	
(iii)	Computer Manufacturing Company	Set up service centres in all major cities for after sales support.	
(iv)	Government Taxation Department	Ensure Computer training to all officers above a certain rank to improve their capabilities.	

Question No.4 – November 2014

ABC Ltd. has supermarkets located in most towns and cities. Over the last few years, profits have fallen. ABC Ltd. has recognized that customer care has been paid insufficient attention. ABC Ltd. has now realized the importance of the customer experience at its supermarkets.

ABC Ltd. has introduced a loyalty card scheme that rewards customers with discount vouchers based on their spend and buying patterns at supermarkets in an attempt to earn the loyalty of its customers.

The management of ABC Ltd. is considering the introduction of a Balanced Scorecard approach to manage the performance of its stores.

Required:

Recommend an objective and a suitable performance measure for each of three non-financial perspectives of a Balanced Scorecard that ABC Ltd. could use to support its new strategy of improving the customer experience. You should state three perspectives, an objective and a performance measure for each one of the three perspectives.(5 Marks)

Question No.5 – November 2015 RTP

Oxford Medical Care Co. (OMCC) is a pharmaceutical firm, operating its entire business through its four customers Ox₁, Ox₂, Ox₃, and Ox₄. Ox₁ and Ox₂ are small pharmaceutical stores while Ox₃ and Ox₄ are large discount stores with attached pharmacies. OMCC uses discount pricing strategy and prices its products at variable cost plus 25%.

Item	Small Pharmaceuticals		Large Pharmaceuticals		Activity Rate
	Ox ₁	Ox ₂	Ox ₃	Ox ₄	
Number of Orders	4	9	6	3	₹750
Order Size	₹40,000	₹20,000	₹4,25,000	₹4,00,000	n/a
Average Discount	4.50%	9.50%	17.50%	11.50%	n/a
Regular Deliveries	4	9	6	3	₹375
Expedited Deliveries	2	0	2	0	₹1,250
General Administration Cost	₹20,250		₹48,375		

Required:

- Prepare a 'Customer Profitability Statement' that shows the profit from each customer and each customer channel.
- Recommend some points to improve OMCC's profit.

Question No.6 – Nov 2017 RTP, May 2015 RTP

Star Telecom Ltd. is a leading cellular service provider having a global presence. It aims to be the most innovative and trusted telecom company in the world. To achieve this aim, it is constantly working on its overall functioning. It is trying to adopt best managements practices in the world. Following are some information related to the company's performance for a particular period:

Particulars	Current Year	Base Year	Target
Operating Ratio	60%	54%	Reduce it to 50%
Average Revenue <i>per user</i>	₹ 225	₹ 210	Increase it to ₹250
Unresolved Consumer Complaints	27,500	25,000	Reduce it by 20%
Customer Relationship Centres	280	200	Take the total to 250
Employee Coverage under Training Programme	10%	8%	At least 15%

Evaluate the performance of the company using Balance Scorecard approach.

Question No.7 – May 2014 RTP

- . Identify Balance Scorecard Perspectives from the following potential measures observed in different business sectors.
 - (i) Weekly Patient Complaints
 - (ii) Patient Satisfaction Survey
 - (iii) Flight Cancellation Rate
 - (iv) On-time Performance of an Airline
 - (v) Number of Grants Awarded to a Healthcare unit
 - (vi) Outstanding Loan Balances / Deposit Balances of a Banking Company
 - (vii) Employee Turnover Rate of a Healthcare unit
 - (viii) Patient Referral Rate
 - (ix) Non-interest Income of a Banking Company
 - (x) Lost of Bag Reports per 5,000 Passengers

CHAPTER 1: LINEAR PROGRAMMING

Question No.1 – May 2017 RTP

The owner of Fancy Goods Shop is interested to determine, how many advertisements to release in the selected three magazines A, B and C. His main purpose is to advertise in such a way that total exposure to principal buyers of his goods is maximized. Percentages of readers for each magazine are known. Exposure in any particular magazine is the number of advertisements released multiplied by the number of principal buyers. The following data are available:

Particulars	Magazines		
	A	B	C
Readers	50,000	30,000	20,000
Principal buyers	40%	30%	16%
Cost per advertisement	₹12,000	₹9,000	₹7,500

The budgeted amount is at the most ₹ 1.5 lakh for the advertisements. The owner has already decided that magazine A should have no more than 8 advertisements and that B and C each gets at least 4 advertisements.

Required

Formulate a Linear Programming model for this problem.

Question No.2 – November 2016 RTP

In a chemical industry two products P and Q are made involving two operations. The production of Q also results in a by-product R. The product P can be sold at a profit of ₹ 3 per unit and Q at a profit of ₹ 8 per unit. The by-product R has a profit of ₹ 2 per unit. Forecast show that upto 5 units of R can be sold. The company gets 3 units of R for each unit of Q produced. The manufacturing times are 3 hrs per unit for P on each of the operation one and two and 4 hrs and 5 hrs per unit for Q on operation one and two respectively. Because the product R results from producing Q, no time is used in producing R. The available times are 18 hrs and 21 hrs of operation one and two respectively. The company desires to know that how much P and Q should be produced keeping R in mind to make the highest profit.

Required

Formulate LP model for this problem.

Question No.3 – May 2016 RTP

The manufacturing company has 100 kg of A, 180 kg of B and 120 kg of C ingredients available per month. Company can use these materials to make three basic products namely 5-10-5, 5-5-10 and 20-5-10, where the numbers in each case represent the percentage of weight of A, B and C respectively in each of products. The cost of these raw materials are as follows:

Ingredient	Cost per Kg. (₹)
A	64
B	16
C	40
Inert Ingredients	16

Selling price of these products are ₹ 32.60, ₹ 34.80, and ₹ 36.00 per Kg, respectively. There is capacity restriction of the company product 5-10-5, so that company cannot produce more than 30 Kg per month.

Required

Formulate this problem as an LP model to determine the productions (in Kg.) of each product which will maximise its monthly profit.

Note: Formulate Only

Question No.4 – May 2016

A manufacturer produces two types of products i.e. X and Y. Each of these products requires three types of processing. The processing time for each unit and the profit per unit are given in the following table:

	Product X (hours/unit)	Product Y (hours/unit)	Available capacity per day (hours)
Process I	12	12	840
Process II	3	6	300
Process III	8	4	480
Profit per unit (₹)	5	7	

Applying Graphical method, how many units of each product should the company manufacture per day in order to maximize profit? (8 Marks)

Question No.5 – November 2015

Mr. X has ₹ 10 lacs which he wants to invest in the share market in anticipation of having good returns. He wants to invest only in two stock and one mutual fund with an investment allowed in each stock or mutual fund not being more than ₹ 7 lacs.

	Expected rate of Return	Risk rating (on a scale of 0 to 10)
Stock L	15%	5
Stock M	18%	8
Mutual Fund	13%	4

He does not want to accept an average rate of return below 12% or a risk factor above 6.

How much money he should invest in each alternative so as to obtain the highest annual total return?

Formulate the above as a, linear program and present the inequalities with coefficients in their simplest integer forms. (8 Marks)

Question No.6 – May 2015

The following information is given relating to the simplex method of a linear program with the usual notations.

Objective function:

$$Z = x_1 + 5x_2 \quad \rightarrow (1)$$

Subject to:

$$6x_1 + 8x_2 \leq 12 \quad \rightarrow (2)$$

$$5x_1 + 15x_2 \geq 10 \quad \rightarrow (3)$$

$$x_1, x_2 \geq 10 \quad \rightarrow (4)$$

Let s_1 be the variable introduced to restate (2) as an equality and let s_2 and A_2 be variables to restate (3) as an equality.

If the objective is to maximize Z ,

- (i) What will be the coefficients of s_1 , s_2 and A_2 in equation (1) and (3) restated as equality?*
- (ii) Identify the slack and surplus variables.*
- (iii) Which variables will form part of the initial solution? Why?*
- (iv) If the objective is to minimize Z what will be your answer to (i) above? (8 Marks)*

Question No.7 – November 2014

A market advertising firm desires to reach two type of audiences customer of annual income of more than ₹50,000 (target audience A) and customers with annual income of less than ₹50,000 (target audience B).

The total advertising budget is ₹2,000 crores. One programme of TV advertising costs ₹500 crores and one programme on Radio advertising costs ₹ 200 crores. Contract conditions ordinarily require that there should be atleast 3 programmes for TV and the number of programmes on radio must not exceed 5. Survey indicates that a single TV programme reaches 7,50,000 customers in target audience A and 1,50,000 in target audience B. One Radio programme reaches 40,000 customers in target audience A and 2,60,000 customers in target audience B.

Formulate this as a linear programming problem and determine the media mix to maximize the total reach using graphic method. (8 Marks)

Question No.8 – May 2014

A factory produces 3 products X_1 , X_2 and X_3 . Each of these products is processed in two departments, machining and Assembly. The processing time in hours for each product in each department and the total available time in hours in the departments and contribution per unit are given below:

Product	Processing time (in hours)		Contribution ₹ /unit
	Machining Department	Assembly Department	
X_1	4	3	8
X_2	4	2	6
X_3	6	4	5
Available time (hours)	384	288	

Exactly 30 units of X_3 must be produced.

- (i) Determine the optimal product mix using simplex method and find the optimal profit.
(ii) Comment on the solution, objective function and the constraints. (6 Marks)

Question No.9 – November 2013

Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products X_1 , X_2 and X_3 .

$C_j \rightarrow$			6	4	10	0	0	0
	Basic Variable	Quantity	X_1	X_2	X_3	S_1	S_2	S_3
0	S_1	400	0	4/3	0	1	-1/3	0
6	X_1	400	1	2/3	2	0	1/3	0

0	S_3	400	0	5/3	0	0	-2/3	1
Z_j		2,400	6	4	12	0	2	0
$C_j - Z_j$			0	0	-2	0	-2	0

Answer the following questions:

- (i) Is the above solution feasible?
(ii) Perform one more iteration with X_2 entering the solution to get a solution with the same value for the objective function.
(iii) Indicate the shadow prices.
(iv) If customer is prepared to pay higher price for product X_3 then by how much should the price be increased so that the company's profit remains unchanged?
(v) From the given table, derive any one original constraint inequality with the coefficients of variables in their simplest whole number forms. (8 Marks)

Question No.10 – May 2013

A company manufactures two products A and B, involving three departments - Machining, Fabrication and Assembly. The process time, profit/unit and total capacity of each department is given in the following table :

	Machining (hours)	Fabrication (hours)	Assembly (hours)	Profit (₹)
A	1	5	3	80
B	2	4	1	100
Capacity	720	1,800	900	

Set up Linear Programming problem to maximize profits. What will be the product-mix at maximum profit level? What will be the profit? (8 Marks)

Question No.11 – November 2012

An investor is interested in investing ₹ 15,00,000 in a portfolio of investments. The investment choices and expected rates of return on each one of them are :

Investment	Projected Rate of Return
Mutual Fund 'XY'	15%
Mutual Fund 'HN'	9%
Money Market Fund	8%
Government Bonds	8.75%
Shares 'P'	17%
Share 'Q'	18%

The investor wants at least 40% of his investment in Government Bonds. Because of the higher perceived risk of the two shares, he has specified that the combined investment in these two shares not to exceed ₹ 2,60,000. The investor has also specified that at least 25% of the investment should be in the money market fund and that the amount of money invested in shares should not exceed the amount invested in Mutual Funds. His final investment condition is that the amount invested in mutual fund 'XY' should be no more than the amount invested in mutual fund 'HN'. The problem is to decide the amount of money to invest in each alternative so as to obtain the highest annual total return.

Required:

Formulate the above as a linear programming problem.

(5 Marks)

Question No.12 – May 2012

The following linear program is presented to you:

Objective: Maximize $Z = 30x + 45Y$

Subject to: (i) $2x+3y \leq 1,440$
(ii) $9x + 12y \geq 2,160$
(iii) $3x + 4y \geq 1,080$
(iv) $x, y \geq 0$

You are required to draw the graph taking quantities of x and y in the respective axes in steps of 60 units (scale 1 cm. = 60 units), determine the optimality and offer your comments on the solution and the constraints. (8 Marks)

Question No.13 – November 2015 RTP

Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products x , y and z . Each of these products is processed in three machines KA-07, KB-27 & KC-49 and each machine has limited available hours.

$C_j \rightarrow$			30	40	20	0	0	0
C_B	Basic Variable (B)	Value of Basic Variables b ($=X_B$)	x	y	z	s_1	s_2	s_3
30	x	250	1	0	-26/16	10/16	-12/16	0
40	y	625	0	1	31/16	-7/16	10/16	0
0	s_3	125	0	0	11/16	-3/16	1/8	1

s_1 , s_2 and s_3 are slack variables for machine KA-07, KB-27 and KC-49 respectively. Answer the following questions, giving reasons in brief:

- Does the table above give an 'Optimal Solution'?
- Are there more than one 'Optimal Solution' / 'Alternate Optimal Solution'?
- Is this solution 'Feasible'?
- Is this solution 'Degenerate'?

- (v) Write down the 'Objective Function' of the problem.
- (vi) Write the 'Optimal Product Mix' and 'Profit' shown by the above solution.
- (vii) Which of these machines is being used to the full capacity when producing according to this solution?
- (viii) How much would you be prepared to pay for another hour of capacity each on machine KA-07, machine KB-27, and machine KC-49?
- (ix) If the company wishes to expand the production capacity, which of the three resources should be given priority?
- (x) What happens if 16 machine hours are lost due to some mechanical problem in machine KB-27?
- (xi) A customer would like to have one unit of product z and is willing to pay higher price for z in order to get it. How much should the price be increased so that the company's profit remains unchanged?
- (xii) A new product is proposed to be introduced which would require processing time of 4 hours on machine KA-07, 2 hours on machine KB-27 and 4 hours on machine KC-49. It would yield a profit of ₹12 per unit. Do you think it is advisable to introduce this product?

Question No.14 – May 2014 RTP

Let us assume that you have inherited ₹1,00,000 from your father that can be invested in a combination of only two stock portfolios, with the maximum investment allowed in either portfolio set at ₹75,000. The first portfolio has an average rate of return of 10%, whereas the second has 20%. In terms of risk factors associated with these portfolios, the first has a risk rating of 4 (on a scale from 0 to 10), and the second has 9. Since you wish to maximize your return, you will not accept an average rate of return below 12% or a risk factor above 6. Hence, you then face the important question. How much should you invest in each portfolio?

Formulate this as a Linear Programming Problem and solve it by Graphic Method.

Question No.15 – November 2013 RTP

Find the dual problem for the following:

Minimize

$$Z = 2x_1 - 3x_2 + 4x_3$$

Subject to the constraints

$$3x_1 + 2x_2 + 4x_3 \geq 9$$

$$2x_1 + 3x_2 + 2x_3 \geq 5$$

$$7x_1 - 2x_2 - 4x_3 \leq 10$$

$$6x_1 - 3x_2 + 4x_3 \geq 4$$

$$2x_1 + 5x_2 - 3x_3 = 3$$

$$x_1, x_2, x_3 \geq 0$$

Question No.16 – May 2013 RTP

Global Bank is in the process of formulating a loan policy that involves a maximum of ₹ 25 lakhs. The following table provides Interest Rate and Bad-Debt Ratio about available types of loans.

Type of loan	Interest Rate	Bad-Debt Ratio
Personal	0.135	0.09
Credit Card	0.145	0.12
Home	0.115	0.02
Farm	0.120	0.04
Commercial	0.105	0.01

Bank allocates at least 30% of the funds to farm and commercial loans. To assist the housing industry in the region, home loans must equal at least 50% of the personal, credit card and home loans. The bank also has a stated policy of not allowing the overall ratio of bad debts on all loans to exceed 5%. Formulate this as a Linear Programming Problem

Question No.17 – May 2017

The following is the data for a minimisation problem of a linear program in the simplex method.

Minimise $Z = 3x_1 + 4x_2$, subject to

$$2x_1 + 3x_2 \geq 150$$

$$4x_1 + 3x_2 \geq 120$$

$$x_1, x_2 \geq 0$$

Assume usual notations for additional variables s_1, s_2 for conversion to equality.

- What would be the coefficient of the artificial variables in the objective function? Why?
- Will s_1 and s_2 be part of the initial solution? Why?

CHAPTER 2: TRANSPORTATION PROBLEM

Question No.1 – May 2016 RTP

Coupers Partners a leading CA firm has three managers. Each manager can work up to 176 hours during the next month, during which time three assignments must be completed. Tax Accounting (TA) Assignment will take 143 hours, Tax Performance Advisory (TPA) will take 154 hours, and Global Compliance & Reporting (GCR) will take 176 hours. The amount per hour that can be billed for assigning each manager to each assignment is given below:

Manager	Assignment		
	TA (₹)	TPA (₹)	GCR (₹)
C ₁	1,800	2,250	2,850
C ₂	2,100	1,950	1,800
C ₃	2,400	2,100	2,250

Required

Formulate this as a transportation problem and find the optimal solution. Also find out the maximum total billings during the next month.

Note: A manager may be involved in more than one assignment.

Question No.2 – November 2016

The following table shows all the necessary information on the available supply from each warehouse, the requirement of each market and the unit transportation cost in rupees from each warehouse to each market.

Warehouses	Markets				Supply in Units
	I	II	III	IV	
A	5	2	4	3	22
B	4	8	1	6	15
C	4	6	7	5	8
Requirement in Units	7	12	17	9	45/45

The shipping clerk has worked out the following schedule from experience:

12 units from A to II, 1 unit from A to III,

9 units from A to IV, 15 units from B to III,

7 units from C to I and 1 unit from C to III.

- Check if the clerk has made the 'Optimum Schedule'.
- Find the 'Optimum Schedule' and 'Minimum Total Shipping Cost'.
- Carrier of route C to II offers to transport entire supply of warehouse C at a reduced price. By how much must the rate be reduced by the Carrier before the clerk should consider giving him business?

(8 Marks)

Question No.3 – May 2016

The cost per unit of transporting goods from the factories X, Y and Z to destination A, B, C and D and the quantities demanded and supplied are given:

Factories	Destinations				Supply
	A	B	C	D	
X	25	50	20	25	100
Y	30	40	35	10	250
Z	20	10	25	35	200
Demand	250	100	150	50	550

Answer the following question with reasons taking u_3 as zero while calculating u_i & v_j :

- (i) Is this solution is optimum?
 (ii) If yes, can there be any alternate optimum solution? (5 Marks)

Question No.4 – November 2015

The unit profit matrix based on four factories and three sales depots of a company and unbalanced quantities of demand and supply are tabulated below. The main object of the company is to maximize profit. Assume that there is no profit in case of surplus production.

Factories	Sales Depots			Supply (Nos.)
	S1	S2	S3	
F1	6	6	1	10
F2	-2	-2	-4	150
F3	3	2	2	50
F4	8	5	3	100
Demand (Nos.)	80	120	150	

Formulate the above as a usual transportation minimization problem and find the initial solution by using Vogel's Approximation Method (VAM). (5 Marks)

Question No.5 – May 2015

Four student A, B, C and D were asked to work out the initial solution of the following matrix showing unit transportation costs from plants to sales outlets, with a minimization objective and unbalanced quantities of supply and demand. A introduced a dummy row D on top (above S_1 position), while others introduced the dummy row D at the bottom (below S_3 position). A and B were asked to do the North West Corner Rule, while C did Least Cost Method and D did Vogel's method.

<i>Plants</i> <i>Sales outlets</i>	P_1	P_2	P_3	<i>Demand</i>
S_1	9	27	18	80
S_2	12	12	18	120
S_3	24	10	15	140
<i>Supply</i>	120	150	90	

Using the usual notation of cell reference (e.g. $S_2 P_3$ refers to the cell at the intersection of the S_2 row and P_3 column), what would be the 3rd allocation step in the initial allocation by each student?

You are advised to use the following format for your answers.

<i>Student</i>	<i>Allocation Details at Step III</i>		
	<i>Cell Reference</i>	<i>Quantity Allocated (units)</i>	<i>Unit Cost at that cell</i>
<i>A</i>			
<i>B</i>			
<i>C</i>			
<i>D</i>			

(Candidates are not expected to show a fair version of the transportation matrix showing the calculations.) (8 Marks)

Question No.6 – November 2014

In a transport problem for cost minimization, there are 4 rows indicating quantities demanded and these totals up to 1800 units. There are 4 columns giving quantities supplied and these totals up to 2,100 units. What is the condition for a solution to be degenerate?

Question No.7 – May 2014

In a 3×4 transportation problem for minimizing costs, will the R_2C_1 cell (at the intersection of the 2nd row and 1st column) always figure in the initial solution by the North West Corner Rule? Why? (4 x 4 = 16 Marks)

Question No.8 – May 2013

XYZ Company has three plants and four warehouses. The supply and demand in units and the corresponding transportation costs are given. The table below shows the details taken from the solution procedure of the transportation problem :

		WAREHOUSES									
		I		II		III		IV		Supply	
Plants	A		5		10	10	4		5	10	
	B	20	6		8		7	5	2	25	
	C	5	4	10	2	5	5		7	20	
Demand		25		10		15		5			

Answer the following questions. Give brief reasons:

- Is this solution feasible?
- Is this solution degenerate?
- Is this solution optimum?

(8 Marks)

Question No.9 – May 2012

The following table gives the unit transportation costs and the quantities demanded/supplied at different locations for a minimization problem:

Demand \ Supply	C_1	C_2	C_3	C_4	Total Units
R_1	100	120	200	110	20000
R_2	160	80	140	120	38000
R_3	180	140	60	100	16000
Total Units	10000	18000	22000	24000	

You are required to find out which cell gets the 3rd allocation in the initial basic feasible solution under each of the following methods and to give the cell reference, cost per unit of that cell and the quantity allocated to that cell :

- North West Corner Rule
- Vogel's Approximation Method
- Least Cost Method

(Candidates may use the standard notation of $C_i R_j$ for cell reference.(e.g. $C_2 R_3$ means the cell at the intersection of Column 2 and Row 3)

(Note: The full solution is not required to be worked out).

(5 Marks)

Question No.10 – May 2012

In a transportation problem for cost minimization, there are 4 rows indicating quantities demanded and this totals up to 1,200 units. There are 4 columns giving quantities supplied. This totals up to 1,400 units. What is the condition for a solution to be

degenerate?

Question No.11 – November 2015 RTP

The following table shows all the necessary information on the available supply from each warehouse, the requirement of each market and the unit transportation cost in rupees from each warehouse to each market.

Warehouses	Markets				Supply
	I	II	III	IV	
A	5	2	4	3	22
B	4	8	1	6	15
C	4	6	7	5	8
Requirement	7	12	17	9	45/45

The shipping clerk has worked out the following schedule from experience:

12 units from A to II, 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I and 1 unit from C to III.

- Check if the clerk has made the 'Optimal Schedule'.
- Find the 'Optimal Schedule' and 'Minimum Total Shipping Cost'.
- Carrier of route C to II offers to transport entire supply of warehouse C at a reduced price. By how much must the rate be reduced by the Carrier before the clerk should consider giving him business?
- If the supply from warehouse B reduces to 11 units and simultaneously the requirement of market III reduces to 13 units, find the 'Optimal Transportation Schedule'.
- Further, if supply from warehouse A also reduces to 19 units and simultaneously the requirement of III reduces further to 10 units, will the optimal solution of part (iv) change?

Question No.12 – November 2014 RTP

A project consists of four (4) major jobs, for which four (4) contractors have submitted tenders. The tender amounts, in thousands of rupees, are given in the each cell. The initial solution of the problem obtained by using Vogel's Approximation Method is given in the Table below:

Contractors	Job P	Job Q	Job R	Job S
A	112.50	100.00	127.50	167.50
B	142.50	105.00	157.50	137.50
C	122.50	130.00	120.00	160.00
D	102.50	112.50	150.00	137.50

Find the assignment, which minimizes the total cost of the project. Each contractor has to be awarded one job only.

Question No.13 – May 2014 RTP

The following matrix is a minimization problem for transportation cost. The unit transportation costs are given at the right hand corners of the cells and the Δ_i values are encircled.

	D ₁	D ₂	D ₃	Supply
F ₁	3	4	4	500
F ₂	8 9	300 6	8 7	300
F ₃	0 4	8 6	200 5	200
Demand	300	400	300	1,000

Find the optimum solution (s) and the minimum cost.

Question No.14 – May 2017

The following matrix is a transportation cost matrix giving unit costs from Factories F_1 , F_2 and F_3 to Destinations D_1 , D_2 and D_3 :

Factory Destination	F_1	F_2	F_3	Demand
D_1	<u>3</u>	<u>6</u>	<u>7</u>	60
D_2	<u>8</u>	<u>5</u>	<u>7</u>	30
D_3	<u>4</u>	<u>9</u>	<u>11</u>	30
Supply	35	55	30	

 $u_1=0$

- (i) Find the initial solution by the Least Cost Method.
- (ii) Is the solution non-degenerate? Can you expect a degenerate solution in such a situation? Why?
- (iii) Compute the Δ_{ij} matrix by taking $u_1 = 0$ as shown.
- (iv) If you considered $u_1=5$ and did the $u_i + v_j$ matrix, would the Δ_{ij} matrix be different from the one you have computed in (iii) above? Why? (You are expected to show the revised computation.)
- (v) Find the initial solution by the North West Corner Rule. (10 Marks)

CHAPTER 3: ASSIGNMENT PROBLEM

Question No.1 – May 2017 RTP

A factory is going to modify of a plant layout to install four new machines X_1 , X_2 , X_3 and X_4 . There are 5 vacant places P, Q, R, S and T available. Because of limited space machine X_2 cannot be placed at R and X_3 cannot be placed at P. The cost of locating machine to place in Rupees is shown below:

(₹)

	P	Q	R	S	T
X_1	9	11	15	10	11
X_2	12	9	--	10	9
X_3	--	11	14	11	7
X_4	14	8	12	7	8

Required

Determine the optimal assignment schedule in such a manner that the total costs are kept at a minimum.

Question No.2 – May 2016

Answer the following independent situation relating to an assignment problem with a minimization objective:

- Just after row and column minimization operations, we find that a particular row has two zeros. Does this implies that the 2 corresponding numbers in original matrix before any operation were equal? Why?
- Under the usual notation, where A_{32} means the element at the intersection of the 3rd row and 2nd column, we have, in a 4×4 assignment problem, A_{24} and A_{32} figuring in the optimal solution. What can you conclude about the remaining assignment? Why?

(4 Marks)

Question No.3 – November 2015

R_3C_2 denotes the element at the intersection of the third row and 2nd column. Under this notation, R_1C_1 , R_2C_1 , R_3C_1 , R_3C_2 , R_3C_3 , R_4C_3 , R_4C_4 , were the only zero elements in a 4×4 minimization assignment problem after the row minimum and column minimum operations.

- In the next step to draw lines to cover zeroes, a student drew 4 horizontal lines covering rows R_1 , R_2 , R_3 , and R_4 . Will he arrive at the optimal assignment at the next step? Why? Explain the concept.
- Independent of (i), if you are given the additional information that R_2C_2 element is lesser than the Row 1 and Row 2 non-zero values, how will you arrive at the optimal solution?

(8 Marks)

Question No.4 – May 2015

Methods I, II, III and IV are available for one-to-one assignment to factories A, B and C. The time taken (in hours) for implementing these methods in the factories is tabulated below with the objective of minimization.

↓ Methods Factories→	(Time Taken – hours)		
	A	B	C
I	35	25	28
II	23	32	25
III	25	42	21
IV	35	35	28

- (i) Show the optimal assignment by circling the cells using the assignment algorithm (description of algorithm is not required). Which method will not be implemented?
- (ii) What is the minimum savings (in hours) required over the current given duration, for preferring the implementation of the method identified in (i) above? When it so justifies, which method will it replace? Why? (5 Marks)

Question No.5 – November 2014

A salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost (in ₹ '000) of travelling from one city to another is given below. You are required to find out the least cost route.

From \ To	P	Q	R	S	T
P	-	6	12	4	6
Q	6	-	10	4	6
R	12	10	-	12	8
S	4	4	12	-	12
T	6	6	8	12	-

(5 Marks)

Question No.6 – May 2014

Can there be (i) more than one dummy row or column or (ii) one dummy row and a dummy column in a given problem of (a) assignment (b) transportation? Why? (In other words, state whether and why each of situations A, B, C and D is possible or not):

	Assignment	Transportation
More than one dummy row or column	A	B
One dummy row and one dummy column	C	D

(4 Marks)

Question No.7 – November 2013

Answer the following independent situations relating to an assignment problem with a minimization objective:

- (i) Just after row and column minimum operations, we find that a particular row has 2 zeroes. Does this imply that the 2 corresponding numbers in the original matrix before any operation were equal? Why?
- (ii) Under the usual notation, where a_{32} means the element at the intersection of the 3rd row and 2nd column, we have, in a 4×4 assignment problem, a_{24} and a_{32} figuring in the optimal solution. What can you conclude about the remaining assignments? Why? (5 Marks)

Question No.8 – November 2012

A production supervisor is considering how he should assign five jobs that are to be performed to five operators. He wants to assign the jobs to the operators in such a manner that the aggregate costs to perform the job is the least. He has the following information about the wages paid to the operators for performing these jobs.

Operators	Jobs				
	1	2	3	4	5
A	10	3	3	2	8
B	9	7	8	2	7
C	7	5	6	2	4
D	3	5	8	2	4
E	9	10	9	6	10

Required:

Assign the jobs to the operators so that the aggregate cost is the least. (8 Marks)

Question No.9 – May 2012

The following matrix was obtained after performing row minimum operations on rows R_1 and R_2 in an assignment problem for minimization. Entries "xx" represent some positive numbers. (It is not meant that all "xx" numbers are equal). State two circumstances under which an optimal solution is obtained just after the row minimum and column minimum operations.

(Candidates may use cell references as $C_i R_j$ for uniformity. e.g. $C_1 R_1$ represents the cell at the intersection of Column1 (C_1) and Row 1 (R_1) etc.

	C_1	C_2	C_3
R_1	0	xx	xx
R_2	xx	0	xx
R_3	xx	xx	xx

(4 Marks)

Question No.10 – May 2014 RTP

A BPO company is taking bids for 4 routes in the city to ply pick-up and drop cabs. Four companies have made bids as detailed below-

Bids for Routes (₹)

Company / Routes	R ₁	R ₂	R ₃	R ₄
C ₁	4,000	5,000	–	–
C ₂	–	4,000	–	4,000
C ₃	3,000	–	2,000	–
C ₄	–	–	4,000	5,000

Each bidder can be assigned only one route. Determine the minimum cost that the BPO should incur.

Question No.11 – November 2015 RTP

A salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost (in ₹ '000) of travelling from one city to another is given below:

	P	Q	R	S	T
P	-	5	14	20	2
Q	17	-	8	23	5
R	23	20	-	11	20
S	35	11	17	-	14
T	2	8	5	23	-

Required:

Find out the 'Least Cost Route'.

Question No.12 – November 2013 RTP

Imagine yourself to be the Executive Director of a 5-Star Hotel which has four banquet halls that can be used for all functions including weddings. The halls were all about the same size and the facilities in each hall differed. During a heavy marriage season, 4 parties approached you to reserve a hall for the marriage to be celebrated on the same day. These marriage parties were told that the first choice among these 4 halls would cost ₹ 25,000 for the day. They were also required to indicate the second, third and fourth preferences and the price that they would be willing to pay. Marriage party A & D indicated that they won't be interested in Halls 3 & 4. Other particulars are given in the following table:

Revenue/Hall

Marriage Party	Hall 1	Hall 2	Hall 3	Hall 4
A	₹25,000	₹22,500	X	X
B	₹20,000	₹25,000	₹20,000	₹12,500
C	₹17,500	₹25,000	₹15,000	₹20,000
D	₹25,000	₹20,000	X	X

Where X indicates that the party does not want that hall. Decide on an allocation that will maximize the revenue to your hotel.

Question No.13 – May 2013 RTP

'Air-Pacific' airways operating 7 days a week has given the following time-table. Crews must have a minimum layover of 5 hours between flights. Obtain the pairing flights and minimizes layover time away from home. For any given pairings the crew will be based at the city that results in the smaller layover:

Kolkata – Bangkok			Bangkok - Kolkata		
Flight Number	Depart.	Arrive	Flight Number	Depart.	Arrive
KX1	05:15 AM	07:15 AM	BX1	07:15 AM	09:15 AM
KX2	07:15 AM	09:15 AM	BX2	08:15 AM	10:15 AM
KX3	01:15 PM	03:15 PM	BX3	01:15 PM	03:15 PM
KX4	07:15 PM	09:15 PM	BX4	06:15 PM	08:15 PM

Question No.14 – May 2017

The following 3×3 matrix arises after the Row minimum and Column minimum operation of a minimization assignment problem:

Columns \ Rows	C_1	C_2	C_3
R_1	0	0	0
R_2	0	a	b
R_3	0	c	d

Given that $a \neq b \neq c \neq d \neq 0$, (i.e. a, b, c, d are non zero and unequal), will $R_1 C_1$ (cell at the intersection of Row 1 and Column 1) appear in the final solution under the assignment algorithm? Why? Interpret this part of the algorithm. (5 Marks)

Question No.1 – May 2017 RTP

The following table gives the activities in a construction project and the time duration of each activity:

Activity	Predecessors	Normal Time (Days)
A	---	16
B	---	20
C	A	8
D	A	10
E	B,C	6
F	D,E	12

Required

- Draw the activity network of the project.
- Find critical path.
- Find the total float and free-float for each activity.

Question No.2 – May 2016 RTP, Nov 2017 RTP

State the Validity of following statements along with the reasons:

- Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.
- In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.
- The difference between the latest event time and the earliest event time is termed as free float.
- For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.
- The optimal duration of a project is the minimum time in which it can be completed.
- Resource leveling aims at smoothening of the resource usage rate without changing the project duration.

Question No.3 – November 2016

The following table shows for each activity needed to complete the road construction project, the normal time, the shortest time in which the activity can be completed and cost per day for reducing the time of each activity. The contract includes a penalty clause of ₹ 80 per day over 19 days. The overhead cost is ₹ 150 per day. The cost of completing the eight activities in normal time is ₹ 6,000.

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Activity	Normal time in days	Shortest time in days	Cost of reduction per day (₹)
1-2	7	5	90
1-3	9	5	100
1-4	7	4	40
2-4	4	4	—
2-5	6	4	50
3-6	13	9	210
4-6	8	5	60
5-6	6	6	—

Required

- Draw the network diagram for the project and identify the critical path and show normal duration and minimum duration of different paths.
- Calculate the total cost associated to normal duration of the project.
- Crash the relevant activities systematically and determine the lowest cost and the associated time. (8 Marks)

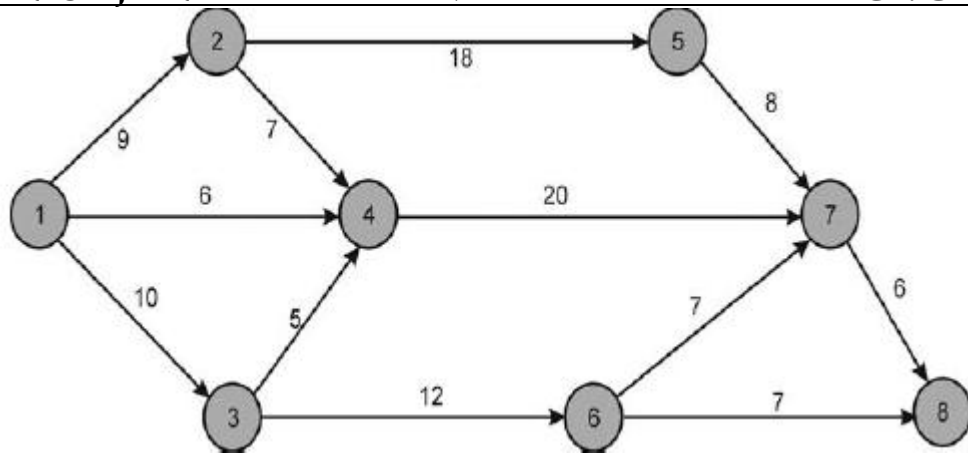
Question No.4 – May 2016

After 15 days of working the following progress is noted for the network of an erection job:

- Activity 1-2, 1-3, and 1-4 completed as per original schedule.
- Activity 2-4 is in progress and will be completed in 3 more days.
- Activity 3-6 is in progress and will need 18 days more for completion.
- Activity 6-7 appears to present some problem and its new estimated time of completion is 12 days.
- Activity 6-8 can be completed in 5 days instead of originally planned for 7 days.

You are required to:

- Updated the above diagram after 15 days of the start of work based on the assumption given above.
- Write down the critical path with total project duration (8 Marks)

**Question No.5 - May 2015**

A project comprised of 10 activities whose normal time and cost are given as follows:

Activity	Normal Time (Days)	Normal Cost (₹)
1 - 2	3	800
2 - 3	3	100
2 - 4	7	900
2 - 5	9	1,400
3 - 5	5	600
4 - 5	0	0
5 - 6	6	590
6 - 7	4	720
6 - 8	13	1,490
7 - 8	10	1,780

Indirect cost ₹ 115 per day.

- Draw the network.
- List all the paths along with their corresponding durations and find the critical path.
- When and at what cost will the project be completed? (8 Marks)

Question No.6 - November 2014

The activities involved in a project are detailed below:

Duration (Weeks)

Job	Optimistic	Most likely	Pessimistic
1-2	3	6	15
2-3	6	12	30

3-5	5	11	17
7-8	4	19	28
5-8	1	4	7
6-7	3	9	27
4-5	3	6	15
1-6	2	5	14
2-4	2	5	8

- (i) Draw a network diagram.
- (ii) Find the critical path after estimating the earliest and latest event times for all nodes, expected project length, variance of critical path, standard deviation of critical path and
- (iii) What will be the effect on current critical path if the most likely time of activity 3-5 gets revised to 14 instead of 11 weeks given above? (6 Marks)

Question No.7 - May 2014

The following table relates to a network:

Activity	Normal Time (Days)	Crash Time (Days)	Normal Cost (₹)	Crash (₹)
1-2	5	4	30,000	40,000
2-3	6	4	48,000	70,000
2-4	8	7	1,25,000	1,50,000
2-5	9	6	75,000	1,20,000
3-4	5	4	82,000	1,00,000
4-5	7	5	50,000	84,000

The overhead cost per day is ₹ 5,000 and the contract includes a penalty clause of ₹ 15,000 per day if the project is not completed in 20 days.

- (i) Draw the network and calculate the normal duration and its cost.
- (ii) Find out:
- (1) the lowest cost and the associated time.
 - (2) the lowest time and the associated cost.

Question No.8 - November 2013

A project consists of seven activities whose time estimates (optimistic - t_o , pessimistic - t_p and most likely - t_m) in days are given below:

Activity	t_o	t_p	t_m
1-2	1	5	3
1-3	1	7	4
1-4	2	10	6

2-5	2	8	2
3-5	3	15	6
4-6	2	8	5
5-6	2	14	5

Required:

- Draw the network and find out the expected time and variance for each activity. What is the expected duration for completion of the project?
- If the target time is 22 days, what is the probability of not meeting the target?
- Within how many days can the project be expected to be completed with 99 percent chance?

Given $Z_{2.33} = 0.9901$ and $Z_{1.67} = 0.9525$

(8 Marks)

Question No.9 - May 2013

The Noida Nirman Authority intends to install a road traffic regulating signal in a heavy traffic prone area. The total installation work has been broken down into six activities. The normal duration, crash duration and crashing cost of the activities are expected as given in the following table :

Activity	Normal Duration (Days)	Crash Duration (Days)	Crashing Cost per day (₹)
1-2	9	6	30,000
1-3	8	5	40,000
1-4	15	10	45,000
2-4	5	3	15,000
3-4	10	6	20,000
4-5	2	1	60,000

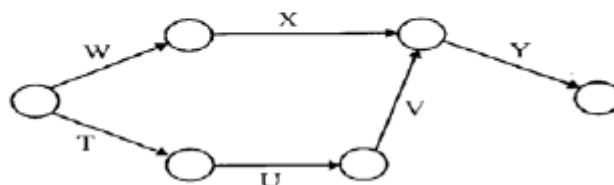
You are required to :

- draw the network and find the normal and minimum duration of the work.
- compute the additional cost involved if the authority wants to complete the work in the shortest duration.

(7 Marks)

Question No.10 - May 2012

The following network and table are presented to you:

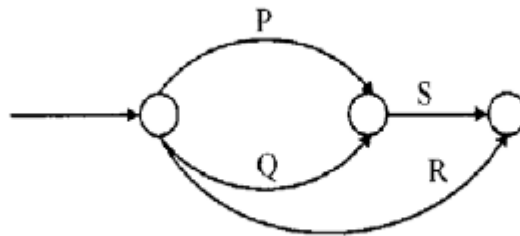


Activity	Normal Duration (Days)	Normal Cost (₹)	Crash Duration (Days)	Crash Cost (₹)
T	8	2,250	6	2,750
U	16	1,875	11	2,750
V	14	2,250	9	3,000
W	12	3,000	9	3,750
X	15	1,000	14	2,500
Y	10	2,500	8	2,860

Perform step by step crashing and reduce the project duration by 11 days while minimizing the crashing cost. What would be the cost of the crashing exercise? (8 Marks)

Question No.11 – May 2012

The following is a part of a network.



What are activities P and Q called? How would you rectify the situation? (4 Marks)

Question NO.12 – November 2014 RTP

The number of days of total float (TF), earliest start times (EST) and duration in days are given for some of the following activities.

Activity	TF	EST	Duration
1-2	0	0	???
1-3	2	???	???
1-4	5	???	???
2-4	0	4	???
2-5	1	???	5
3-6	2	12	???
4-6	0	12	???
5-7	1	???	???
6-7	???	23	???
6-8	2	???	???
7-8	0	23	???
8-9	???	30	6

- (i) Find??? Figures.
- (ii) Draw the network.
- (iii) List the paths with their corresponding durations and state when the project can be completed.

Question No.13 – November 2014 RTP

State the validity of following statements along with the reasons:

- (i) Two activities have common predecessor and successor activities. So, they can have common initial and final nodes.
- (ii) In respect of any activity whether real or dummy, the terminal node should bear a number higher than the initial node number.
- (iii) The difference between the latest event time and the earliest event time is termed as free float.
- (iv) For every critical activity in a network, the earliest start and the earliest finish time as well as the latest finish time and the latest start time are the same.
- (v) The optimal duration of a project is the minimum time in which it can be completed.
- (vi) Resource leveling aims at smoothening of the resource usage rate without changing the project duration.

Question No.14 – May 2014 RTP

A project has the following time schedule:

Activity	Duration (in Weeks)	Activity	Duration (in Weeks)
1 – 2	4	5 – 7	8
1 – 3	1	6 – 8	1
2 – 4	1	7 – 8	2
3 – 4	1	8 – 9	1
3 – 5	6	8 – 10	8
4 – 9	5	9 – 10	7
5 – 6	4		

- (i) Draw the arrow diagram.
- (ii) Identify critical path and find the total project duration.
- (iii) Determine total, free and independent floats.

Question No.15 – May 2014 RTP

A company had planned its operations as follows:

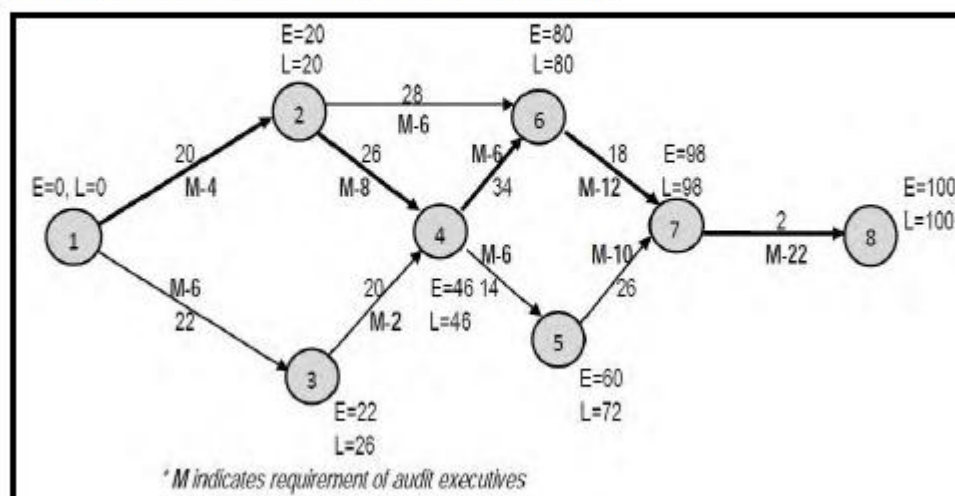
Activity	Duration (Days)	Activity	Duration (Days)
1 – 2	7	4 – 7	19
2 – 4	8	3 – 6	24
1 – 3	8	5 – 7	9
3 – 4	6	6 – 8	7
1 – 4	6	7 – 8	8
2 – 5	16		

- (i) Draw the network and find the critical paths.
- (ii) After 15 days of working, the following progress is noted:
 - (a) Activities 1 – 2, 1 – 3 and 1 – 4 completed as per original schedule.
 - (b) Activity 2 – 4 is in progress and will be completed in 4 more days.
 - (c) Activity 3 – 6 is in progress and will need 17 more days to complete.
 - (d) The staff at activity 3 – 6 are specialised. They are directed to complete 3 – 6 and undertake an activity 6 – 7, which will require 7 days. This rearrangement arose due to a modification in a specialisation.
 - (e) Activity 6 – 8 will be completed in 4 days instead of the originally planned 7 days.
 - (f) There is no change in the other activities.

Update the network diagram after 15 days of start of work based on the assumption given above. Indicate the revised critical paths along with their duration.

Question No.16 – November 2013 RTP

Rearrange the activities suitably for leveling the audit executives with the help of *time scale diagram* if during first 52 days only 8 to 10 audit executives and during remaining days 16 to 22 audit executives can be made available.



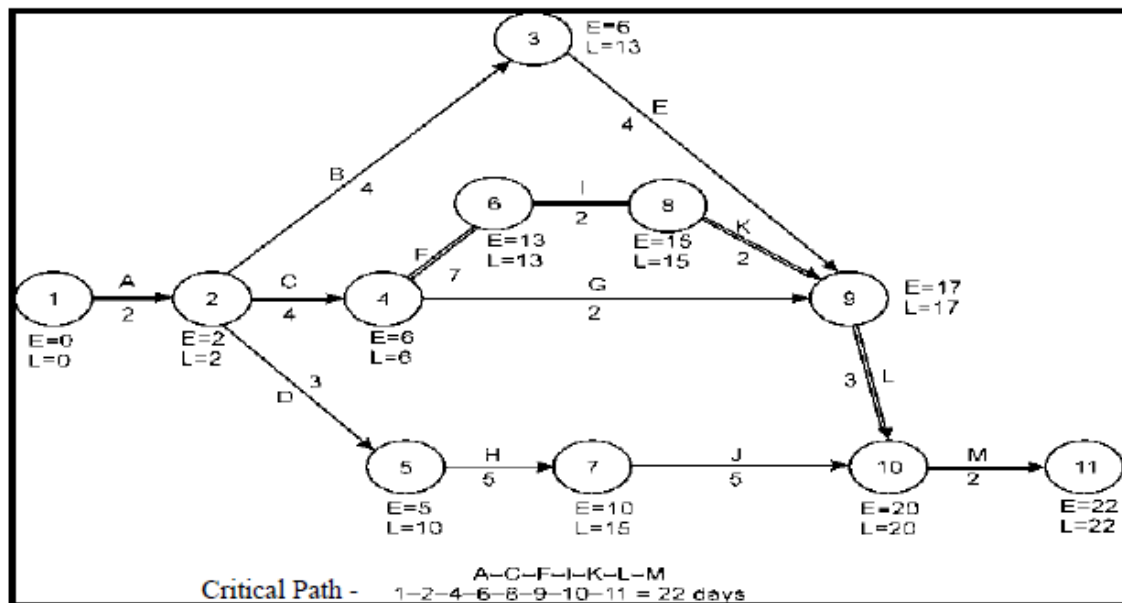
Question No.17 – May 2013 RTP

A project consisting of thirteen activities having duration and resource requirements shown below:

Activity	Duration (days)	Labourers required
A	2	2L

B	4	2C,2L
C	4	4C
D	3	2L
E	4	6C
F	7	2L
G	2	4C
H	5	4C,2L
I	2	2C
J	5	2C
K	2	2L
L	3	4L
M	2	4L

* L stands for labourers and C stands for carpenters



Analyse the project from the point of view of resources and to bring out the necessary steps involved in the analysis and smoothing of resources.

Question No.18 – May 2013 RTP

The following is a table showing details of a project.

Activity	Immediate Predecessor	Normal Time in weeks	Normal Cost ('000)	Crash Time in weeks	Crashing Cost ('000)
A	—	20	40	14	60
B	—	16	30	12	40
C	B	10	16	8	28
D	B	12	22	8	30
E	B	16	18	10	30
F	E	10	10	8	16
G	A, D, C	24	6	16	8

Indirect cost is ₹ 800 per day. Required:

- Draw the network and identify the critical path.
- What is the normal project duration?
- What is the associated cost?
- Find out crash cost slope of activities.

Question No.19 – May 2017

The following information on activities, the Earliest Start Time (EST), Latest Start Time (LST), Earliest Finish Time (EFT) in days is given for a certain project:

Activity	EST	LST	EFT	Crashing Cost ₹/ day
A	0	0	5	1,000
B	0	6	6	2,000
C	5	8	9	3,000
D	5	7	8	4,000
E	5	5	6	5,000
F	6	6	10	6,000
G	10	10	24	7,000
H	9	12	21	8,000
I	24	24	26	9,000

Given that: G is immediately preceded by F and D.

B's successor is H and H's successor is I. It is not possible to have a zero duration activity.

Given that: G is immediately preceded by F and D.

B's successor is H and H's successor is I. It is not possible to have a zero duration activity.

- (i) What is the project completion time?
- (ii) Find the LFT (Latest Finish Times) of activities C, D, H and B.
- (iii) Reduce the project duration by three days, by performing step by step crashing to minimize crashing cost assuming that no activity can be crashed by more than one day.
- (iv) After the crashing exercise, if activity H's duration is increased by one day, by how many days can you increase the duration of each of the activities B and C without delaying the project beyond its crashed duration? Explain the underlying concept.

(You are not expected to present the network diagram).

(You may opt the following format for your answer).

Sl. No.			
(i)	Duration	=	
(ii)	LFT:		
	C :		
	D :		
	H :		
	B :		
(iii)	Step	Crash Activity	Days
	I		
	II		
	III		
(iv)	Activity	Increase duration by (days)	
	B		
	C		
Concept			

(10 Marks)

CHAPTER 6: SIMULATION

Question No.1 – November 2016 RTP

JCB Ltd. is considering a new project which will require an initial investment of ₹ 25,000. The company has determined the following probabilities for net cash flows for three years generated by this project:

Annual Net Cash Flows

Year 1		Year 2		Year 3	
CF	Prob.	CF	Prob.	CF	Prob.
7,500	0.20	10,000	0.10	7,500	0.10
10,000	0.50	12,500	0.30	10,000	0.20
12,500	0.30	15,000	0.20	12,500	0.50
		17,500	0.40	15,000	0.20

The firm wants to perform 5 simulation runs of this project's life. The firm's cost of capital is 10%.

To simulate the probability distributions of annual net cash flows, use the following sets of random numbers

4, 4, 2; 9, 6, 3; 5, 7, 8; 0, 1, 6; 3, 1, 5

Required

Using simulation results. Calculate the average NPV.

Note

Assign a value ranging from 0 to 9 (in digits) to each year's cash flow in such a way that the number of digits assigned is proportionate to the probability of cash flow.

Question No.2 – May 2016 RTP, Nov 2017 RTP

Finance Controller of Dunk Limited has drawn the following projections with probability distribution:

Raw Material		Wages & Other Variable Overheads		Sales	
₹ in 000	Probability	₹ in 000	Probability	₹ in 000	Probability
08 – 10	0.2	11 – 13	0.3	34 – 38	0.1
10 – 12	0.3	13 – 15	0.5	38 – 42	0.3
12 – 14	0.3	15 – 17	0.2	42 – 46	0.4
14 – 16	0.2			46 – 50	0.2

Opening cash balance is ₹ 40,000 and fixed cost is estimated at ₹ 15,000 per month.

Required

Simulate cash flow projection and expected cash balance at the end of the sixth month. Use the following single digit random numbers.

Raw Material	4 3 1 0 4 6
Wages & Other Variable Overheads	2 7 9 1 8 9
Sales	0 6 6 0 2 8

Question No.3 – November 2016

A book-store wishes to carry systems analysis and design in stock. Demand is probabilistic and replenishment of stock takes 2 days (i.e, if an order is placed on March 1, it will be delivered at the end of the day on March 3).

The probabilities of demand are given below:

Demand of books (Daily)	0	1	2	3	4
Probability	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of ₹ 100 per order. The store also incurs a carrying cost of ₹ 5 per book per day. The inventory carrying cost is calculated on the basis of stock at the end of each day. The manager of the book-store wishes to compare two options for his inventory decision:

- Order 5 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books
- Order 8 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (beginning of the first day) the store has stock of 8 books plus 6 books ordered 2 days ago are expected to arrive next day. Further it can be assumed that the demand occurring during the day can be met out of stock received at the end of the day.

Required

Using Monte-Carlo simulation for 10 days, recommend which option the manager should choose?

The two digit random numbers are given below:

89, 34, 78, 63, 61, 81, 39, 16, 13, 73

(8 Marks)

Question No.4 – November 2015

The following information is given for a certain project:

Activity	Normal Duration (Days)	Crash Duration (Days)	Difference (Days)	Normal Cost (₹)	Crash Cost (₹)	Difference (₹)	Activity Slope (₹/day)
	I	II	III = I - II	IV	V	VI = V - IV	VII = VI/ III
1-2	9	6	3	640	700	60	20

1-3	8	5	3	500	575	75	25
1-4	15	10	5	400	550	150	30
2-4	5	3	2	100	120	20	10
3-4	10	6	4	200	260	60	15
4-5	2	1	1	100	140	40	40

- (i) What is the normal project duration?
- (ii) Perform step-by step crashing to reduce the project duration by 5 days. What is the cost incurred for the optional crashing exercise?
- (iii) Independent of (ii) above, if the Project Manager is able to save as per rates in Column VII of the above table for every day relaxed for the activities, compute the number of days and associated savings for 5 days of relaxation, in the order of optimality, without extending the project duration as per (i). The Project Manager is interested in this exercise to schedule resources. (8 Marks)

Question No.5 – November 2015

A dietician wants to simulate arrivals of her patients and her consultation time with the following random numbers. Her assistant has already prepared the random number allocation tables.

The dietician wants to have an idea of her idle time and patients' waiting time. She starts her consultation at 10:00 a.m. and wants to give an appointment an interval of 20 minutes. The Random Number table is as follows:

Arrival of patient	15	4	35	67	75	86	25
Consultation time	17	15	12	58	60	72	30

Random Number Allocation Table: 1

Patient Punctuality	Probability	Cumulative Probability	Random No.
Minutes early 3	0.05	0.05	00 – 04
2	0.18	0.23	05 – 22
1	0.40	0.63	23 – 62
On time	0.25	0.88	63 – 87
Minutes late 2	0.08	0.96	88 – 95
4	0.04	1.00	96 – 99

Random Number Allocation Table: 2

Consultation Time	Probability	Cumulative Probability	Random No.
15	0.13	0.13	00 – 12
18	0.15	0.28	13 – 27
20	0.28	0.56	28 – 55
25	0.34	0.90	56 – 89

30	0.10	1.00	90 – 99
----	------	------	---------

- (i) Simulate the arrival and consultation times and find out the dietician's idle times and patients' waiting times.
- (ii) If clients are sensitive to waiting, how would you advise the dietician as a Management Accountant, based on the results of your exercise? (8 Marks)

Question No.6 – May 2015

A bakery bakes 100 cakes per day. The sale of cakes depends upon demand which has the following distribution:

Sale of Cakes (Nos.)	Probability
97	0.10
98	0.15
99	0.20
100	0.35
102	0.15
103	0.05

There is no carryover of inventory.

The following details are given:

	₹
Variable Production cost per cake	14
Selling price per cake	18
Penalty attracted per unsold cake	3
Penalty attracted per unit of demand not met	1

Random Numbers to be used:

9, 98, 64, 98, 94, 01, 78, 10, 15, 19

- (i) Estimate the profit/loss for the next ten days using the above random numbers and assuming 100 cakes are produced per day.
- (ii) If the bakery decides to produce 97 cakes per day, will the profits as per (i) above increase or decrease? Why? (8 Marks)

Question No.7 – November 2014, May 2015 RTP

A cake vendor buys pieces of cake every morning at ₹4.50 each by placing his order one day in advance and sale them at ₹7.00 each. Unsold cake can be sold next day at ₹ 2.00 per piece and there after it should be treated as no value. The pattern for demand of cake is given below:

Fresh Cake:

Daily Sale	100	101	102	103	104	105	106	107	108	109	110
Probability	.01	.03	.04	.07	.09	.11	.15	.21	.18	.09	.02

One day old cake:

Daily Sale	0	1	2	3
Probability	.70	.20	.08	.02

Use the following set of random numbers:

Fresh Cake	37	73	14	17	24	35	29	37	33	68
One day old cake	17	28	69	38	50	57	82	44	89	60

The vendor adopts the following rule.

If there is no stock of cake with him at the end of previous day, he orders for 110 pieces otherwise he orders 100 or 105 pieces whichever is nearest actual fresh cake sale on the previous day. Starting with zero stock and a pending order of 105 pieces, simulate for 10 days and calculate vendor's profit. (7 Marks)

Question No.8 - May 2014

A computer service centre services laptops. It is proposed to study the arrival and servicing pattern of the service centre. The following information was collected, over a period of 100 days.

No. of computers	Frequency of arrival	Frequency of service
8	10	15
9	25	20
10	20	25
11	15	16
12	18	14
13	12	10

Simulate the arrival and servicing pattern for 10 days and find out the average number of laptops held for more than one day for service. Assume FIFO method is followed for service/repair and there is one laptop held from previous day for repair at the beginning of the first day.

Use the following series of random numbers:

Arrivals	69	45	46	10	82	16	35	70	57	92
Service	52	36	62	49	68	77	55	66	51	88

(6 Marks)

Question No.9 – November 2013

A bakery sells a popular brand of bread. Cost price per bread is ₹ 16 and selling price per bread is ₹ 20. Shelf life of the bread is 2 days and if it is not sold within two days, then it has no sale value at the end of second day. Daily demand based on past experience is as under:

Daily Demand	0	20	25	35	40	45
Probability	.01	.15	.30	.40	.10	.04

Consider the following sequence of random numbers:

58, 80, 51, 09, 47, 26, 64, 43, 86, 35

Using the sequence, simulate the demand for the next 10 days and find out the total profit or loss for 10 days assuming 35 breads are purchased every day in the morning and there is an opening stock of 5 breads (purchased the previous day) on the 1st day morning. Assume LIFO basis (Last In First Out basis - where the fresh bread is sold first).

(8 Marks)

Question No.10 – November 2012

An international tourist company deals with numerous personal callers each day and prides itself on its level of service. The time to deal with each caller depends on the client's requirements which range from, say, a request for a brochure to booking a round-the-world cruise. If a client has to wait for more than 10 minutes for attention, it is company's policy for the manager to see him personally and to give him a holiday voucher worth ₹15.

The company's observations have shown that the time taken to deal with clients and the arrival pattern of their calls follow the following distribution pattern:

Time to deal with clients	Minutes	2	4	6	10	14	20	30
	Probability	0.05	0.10	0.15	0.30	0.25	0.10	0.05
Time between call arrivals	Minutes	1	8	15	25			
	Probability	0.2	0.4	0.3	0.1			

Required:

- Describe how you would simulate the operation of the travel agency based on the use of random number tables;
- Simulate the arrival and serving of 12 clients and show the number of clients who receive a voucher (use line 1 of the random numbers below to derive the arrival pattern and line 2 for serving times); and
- Calculate the weekly cost of vouchers; assuming the proportion of clients receiving vouchers derived from (ii) applies throughout a week of 75 operating hours.

Random Numbers

Line 1	03	47	43	73	86	36	96	47	36	61	46	98
Line 2	63	71	62	33	26	16	80	45	60	11	14	10

Question No.11 – May 2012

A refreshment centre in a railway station has two counters - (i) self-service (opted by 60 % of the customers) and (ii) attended service (opted by 40 % of the customers). Both counters can serve one person at a time. The arrival rate of customers is given by the following probability distribution:

No.of arrivals	1	3	4	0	2
Probability	0.10	0.30	0.05	0.20	0.35

Formulate the associated interval of 2 digit random numbers for generating

(i) the type of service and

(ii) the arrival rate

(4 Marks)

Question No.12 – November 2015 RTP

The following table gives the activities in a construction project and the time durations with associated probability of each activity:

Activity	Predecessors	Time (in Days)	Probability
A	---	6	0.50
		8	0.50
B	---	4	0.30
		5	0.20
		6	0.50
C	A	8	0.50
		16	0.50
D	A, B	8	0.30
		10	0.70
E	C, D	2	0.20
		4	0.80

To simulate the project, use the following random numbers taking the first five random numbers digits (representing the five activities) for each trial and so on:

11, 16, 23, 72, 94; 83, 83, 02, 97, 99; 83, 10, 93, 4, 33; 53, 49, 94, 37, 7

Required:

Determine the 'Critical Path' and the 'Project Duration' for each trial.

Question No.13 – November 2014 RTP

An Investment Corporation wants to study the investment projects based on four factors: market demand in units, contribution per unit, advertising cost and the investment required. These factors are felt to be independent of each other. In analyzing a new consumer product, the corporation estimates the following probability distributions:

Demand (units)		Contribution per unit		Advertising Cost	
No.	Probability	₹	Probability	₹	Probability
10,000	0.20	25	0.25	50,000	0.22
20,000	0.25	35	0.30	60,000	0.33
30,000	0.30	45	0.35	70,000	0.44
40,000	0.25	55	0.10	80,000	0.01

The data for proposed investments are as follows:

Investment (₹)	50,00,000	55,00,000	60,00,000	65,00,000
Probability	0.10	0.30	0.45	0.15

Using simulation process, repeat the trials 5 times, compute the Return on Investment (ROI) for each trial and find the highest likely return.

Using the sequence (First 4 random numbers for the first trial, etc)

09 24 85 07 84 38 16 48 41 73 54 57 92 07 99
64 65 04 78 72

Question No.14 – May 2014 RTP

ABC Co-operative Bank receives and disburses different amount of cash in each month. The bank has an opening cash Balance of ₹15 crores in the first month. Pattern of receipts and disbursements from past data is as follows:

Monthly Cash Receipts		Monthly Cash Disbursements	
(₹ in Crores)	Probability	(₹ in Crores)	Probability
30	0.20	33	0.15
42	0.40	60	0.20
36	0.25	39	0.40
99	0.15	57	0.25

Simulate the cash position over a period of 12 months.

Required:

- Calculate probability that the ABC Cooperative Bank will fall short in payments.
- Calculate average monthly shortfall.

- (iii) If ABC bank can get an overdraft facility of ₹ 45 crores from other Nationalized banks. What is the probability that they will fall short in monthly payments?

Use the following sequence (row-wise) of paired random numbers.

1778 4316 7435 3123 7244 4692 5158 6808 9358 5478 9654 0977

Question No.15 – May 2013 RTP

'Super Egg Products' a retail shop deals in a perishable commodity. The daily demand and supply are variables. The data for the past 50 weeks show the following demand and supply:

Supply		Demand	
Availability (Kg)	No. of days	Demand (Kg)	No. of days
5	20	5	25
10	25	10	55
15	95	15	100
20	75	20	50
25	35	25	20

The retail shop buys the commodity at ₹20 per kg and sells it at ₹30 per kg. Any commodity remains at the end of the day, has no saleable value. Moreover, the loss (unearned profit) on any unsatisfied demand is ₹8 per kg. 'Supper Egg Products' retail shop opens five days in a week.

Given the following pair of random numbers, simulate 5 days sales, demand and profit.

(20, 32); (85, 65); (35, 17); (33, 07) (80, 45)

The first random number in the pair is for demand and the second random number is for supply.

CHAPTER 7: LEARNING CURVE THEORY

Question No.1 – May 2017 RTP

The Crocodile Ltd. makes mementos for offering chief guests and other dignitaries at functions. A customer wants 4 identical pieces of hand-crafted gifts for 4 dignitaries invited to its function.

For this product, Company estimates the following costs for the 1st unit of the product.

Particulars of Costs	₹ / unit
Direct Variable Costs (excluding labour)	1,000
Direct Labour (20 hours @ ₹ 25 hour)	500

90 % learning curve ratio is applicable and one labourer works for one customer's order.

Required

- What is the price per piece to be quoted for this customer if the targeted contribution is ₹ 750 per unit?
- If 4 different labourers made the 4 products simultaneously to ensure faster delivery to the customer, can the price at (i) above be quoted? Why?

Question No.2 – May 2016 RTP

Marketing manager of AV Ltd. has conducted a market research on the price-demand relationship for its consumer durable product 'K-2'. K-2 is a recently launched product. The price-demand pattern will be as follows:

Price per unit (₹)	Demand (units)
11,100	1,000
10,700	2,000
9,600	3,000
8,700	4,000

K-2 is produced in batches of 1,000 units. Production manager of AV Ltd. has also researched and studied the production pattern and has believe that 50% of the variable manufacturing cost would have learning and experience curve effect. This learning & experience curve effect will be continued upto 4,000 units of production at a constant rate. But after 4,000 units of production, unit variable manufacturing cost would be equal to the unit cost at the 4th batch. The manufacturing unit cost of the first batch will be ₹ 4,400 of which only 50% is subjected to learning and experience curve effect. The average unit variable cost of all 4 batches will be ₹4,120.

Required

- Calculate the rate of learning that has been expected by the Production manager.
- Calculate the price at which AV Ltd. should sell the K-2 in order to maximise its contribution.

$$\log 0.93 = -0.0315, \log 2 = 0.3010, 2^{-0.1047} = 0.9299, 3^{-0.1047} = 0.8913, 4^{-0.1047} = 0.8649$$

Question No.3 – November 2016

A company which has developed a new machine has observed that the time taken to manufacture the first machine is 600 hours.

Required

Calculate the time which the company will take to manufacture the second machine if the actual learning curve rate is (i) 80% and (ii) 90%.

Explain which of the two learning rates will show faster learning. (5 Marks)

Question No.4 – May 2016

MP Ltd. has developed a special product. Details are as follows:

The product will have a life cycle of 5,000 units. It is estimated that market can absorb first 4,500 units at ₹ 64 per unit and then the product will enter the "decline" stage of its life cycle.

The company estimates the following cost structure:

Direct Labour..... ₹ 6 per hour

Other variable costs..... ₹ 19 per unit

Fixed costs will be ₹ 40,000 over the life cycle of the product. The labour rate and both of these costs will not change throughout the product's life cycle.

The first batch of 100 units will take 1,000 labour hours to produce. There will be an 80% learning curve that will continue until 2,500 units have been produced. Batches after this level will each take the same amount of time as the 25th batch. The batch size will always be 100 units.

Calculate:

- (i) The cumulative average time per batch for the first 25 batches.
- (ii) The time taken for the 25th batch if average time for 24 batches is 359.40 hours.
- (iii) The average selling price of the final 500 units that will allow the company to earn a total profit of ₹ 80,000 from the product.

(Note: Learning coefficient is -0.322 for learning rate of 80%).

The values of Logs have been given for calculation purpose:

$\log 2 = 0.30103$, $\log 3 = 0.47712$, $\log 5 = 0.69897$, antilog of 2.534678 = 342.51, antilog of 2.549863 = 354.70, antilog of 2.555572 = 359.40, antilog of 2.567698 = 369.57 (8 Marks)

Question No.5 – May 2015

State whether and why the following are valid or not for learning curve theory:

- (i) Learning curve theory applies to a division of a company which is fully automated.
- (ii) Learning curve theory helps in setting standards.
- (iii) Learning curve helps in pricing decisions.
- (iv) Experienced workmen are more prone to learning effect. (4 Marks)

Question No.6 – November 2014

A labour intensive product is made and sold by XY Ltd. Its labour force has a learning rate of 80%, applicable only to direct labour and not to variable overheads.

The cost per unit of the first product is as follows:

	₹
Direct Materials	20,000
Direct Labour (@ ₹8 per unit)	16,000
Variable Overheads	4,000
Total Variable Cost	40,000

XY Ltd. has received an order from P Ltd. for 4 units of the product. Another customer, Q Ltd. is also interested in purchasing 4 units of the product. XY Ltd. has the capacity to fulfill both the orders. Q Ltd. presently purchases this product in the market for ₹34,400 and is willing to pay this price per unit of XY Ltd. product. But P Ltd. lets XY Ltd. choose one of the following options:

- (i) *A price of ₹33,000 per unit for the 4 units it proposes to take from XY Ltd.*

OR

- (ii) *Supply P Ltd.'s idle labour force to XY Ltd. for only 4 units of production, with XY Ltd. having to pay only ₹2 per labour hour to P Ltd.'s workers. P Ltd.'s workers will be withdrawn after the first 4 units are produced. In this case, XY Ltd. need not use its labour for producing P Ltd.'s requirements. P Ltd. assures XY Ltd. that its labour force also has a learning rate of 80%. In this option, P Ltd. offers to buy the product from XY Ltd. at only 28,000 per unit.*

P Ltd. and Q Ltd. shall not know of each other's offer.

If both orders came before any work started, what is the best option that XY Ltd. may choose? Present suitable calculations in favour of your arguments. (9 Marks)

Question No.7 –November 2013

State whether the learning curve theory can be applied to the following independent situations briefly justifying your decision:

- A labour intensive sculpted product is carved from the metal provided to the staff. The metal is sourced from different suppliers since it is scarce. The alloy composition of the input metal is quite different among the suppliers.*
- Pieces of hand-made furniture are assembled by the company in a far off location. The labourers do not know anything about the final product which utilizes their work. As a matter of further precaution, rotation of labour is done frequently.*
- Skilled workers have been employed for a long time. The company has adequate market for the craft pieces done by these experts.*
- A company funds that it always has an adverse usage of indirect material. It wants to apply learning curve theory to improve the way standards have been set. (4 Marks)*

Question No.8 – November 2015 RTP

AUD International Co. is a multiproduct firm. It is planning to launch a new product 'X-500' in coming months. Production will be in batches of 1,000 units throughout the life of the product. It is also possible to achieve 90% learning rate but the learning would cease after 64th batch. Other relevant data of product 'X-500' is as follows:

Expected Life	2,56,000 units
Selling Price <i>per unit</i>	₹123
Direct Material <i>per unit</i>	₹36
Direct Labour Cost <i>first batch</i>	₹52,500
Other Variable Costs	₹24
Specific Fixed Cost	₹38,75,000

Required:

- (i) Calculate the 'Expected Profit' to be earned from the product over its lifetime.

Note: The learning index for a 90% learning curve is -0.152; $(64)^{-0.152} = 0.5314$; $(63)^{-0.152} = 0.5327$

- (ii) It is now thought that a learning effect will continue for all of the 256 batches that will be produced. Calculate the 'Rate of Learning' required to achieve a lifetime product profit of ₹1,00,00,000, assuming that a constant rate of learning applies throughout the product's life.

Question No.9 – May 2015 RTP, Nov 2017 RTP

B-Parts Inc., USA based firm, has just invented a new part 'B-20'. New part has a budgeted total profit of ₹75,000 from the first 256 parts. The time taken to produce the first part was 112.50 hours. The labour rate is ₹20 per hour. A 90% learning curve is expected to apply indefinitely.

Required:

CALCULATE the SENSITIVITY of the budgeted total profit from the first 256 parts to changes in the learning rate.

Question No.10 – November 2014 RTP

City International Co. is a multiproduct firm and operates standard costing and budgetary control system. During the month of June firm launched a new product. An extract from performance report prepared by Sr. Accountant is as follows:

Particulars	Budget	Actual
Output	30 units	25 units
Direct Labour Hours	180.74 hrs.	118.08 hrs.
Direct Labour Cost	₹1,19,288	₹ 79,704

Sr. Accountant prepared performance report for new product on certain assumptions but later on he realized that this new product has similarities with other existing product of the company. Accordingly, the rate of learning should be 80% and that the learning would cease after 15 units. Other budget assumptions for the new product remain valid.

The original budget figures are based on the assumption that the labour has learning rate of 90% and learning will cease after 20 units, and thereafter the time per unit will be the same as the time of the final unit during the learning period, i.e. the 20th unit. The time taken for 1st unit is 10 hours.

Show the variances that reconcile the actual labour figures with revised budgeted figures in as much detail as possible.

Note:

The learning index values for a 90% and a 80% learning curve are -0.152 and -0.322 respectively.

[log 2 = 0.3010, log 3 = 0.47712, log 5 = 0.69897, log 7 = 0.8451, antilog of 0.6213 = 4.181, antilog of 0.63096 = 4.275]

Question No.11 – November 2013 RTP

Great Eastern Appliances Ltd. (GEAL) manufactures consumer durable products in a very highly competitive market. GEAL is considering launching a new product 'Kitchen Care' into the market and gathered the following data:

Expected Market Price- ₹5,000 per unit

Direct Material Cost- ₹1,850 per unit

Direct Labour Cost- ₹80 per hour

Variable Overhead Cost- ₹1,000 per unit

Packing Machine Cost (specially to be purchased for this product)- ₹5,00,000

GEAL expects the selling price for the new product will continue throughout the product's life and a total of 1,000 units can be sold over the entire lifetime of the product.

Direct labour costs are expected to reduce as the volume of output increases due to the effects of 80% learning curve (index is -0.3219). The expected time to be taken for the first unit is 30 hours and the learning effect is expected to end after 250 units have been produced. Units produced after first 250 units will take the same time as the 250th unit.

You are required to-

- (i) Calculate the expected total labour hours over the life time of the product 'Kitchen Care'.
- (ii) Profitability of product 'Kitchen Care' that GEAL will earn over the life time of the product.
- (iii) Average target labour cost per unit over the life time of the product if GEAL requires average profit of ₹ 800 per unit, to achieve its long term objectives.

Note: $250^{-0.3219} = 0.1691$, $249^{-0.3219} = 0.1693$

Question No.12 – November 2013 RTP

Genting Mfg Co. has developed a product for which the following standard cost estimates have been made for the first batch to be manufactured in Jan'13:

	₹
Direct Materials (100 Kgs. @ ₹ 55 per Kg.)	5,500
Direct Labour (100 hours @ ₹ 40 per hour)	4,000
Variable Overhead (100 hours @ ₹ 75 per hour)	<u>7,500</u>
	<u>17,000</u>

From experience the firm knows that labour will benefit from a learning effect and labour time will be reduced. This is expected to approximate to an 80% learning curve. In addition, the growing expertise of labour is expected to improve the efficiency with which materials are used. The usage of materials is expected to approximate to a 95% learning curve.

The actual production for Jan'13 to Jun'13 was 320 batches. During Jun'13 following results were recorded for the 320th batch made:

Direct Materials (80 Kgs.)	₹ 4,000
Direct Wages (20 hours)	₹ 1,000
Variable Overhead	₹ 1,800

You are required to calculate variances in connection with 320th batch.

[Note: Learning Coefficient is -0.322 and -0.074 for learning rate of 80% and 95% respectively, $\log 2 = 0.30103$, $\log 5 = 0.69897$, $\log 319 = 2.50379$, Antilog of 1.81462 = 65.26, Antilog of 1.81472 = 65.27, Antilog of 1.19334 = 15.61, Antilog of 1.19378 = 15.62]

Question No.13 – May 2013 RTP

The chief officer at manufacturing plant of '789 Dreamliner' aircraft observed that workers performing manufacturing operations at the plant showed signs of a definite learning pattern. He noted that most aircraft manufacturing tasks experienced what he called an 80 percent learning rate, meaning that workers need 20 percent fewer hours to make a part each time their cumulative experience making that part doubled. Thus, if the first part took 100 minutes, the second would require 80 minutes, the fourth would require 64 minutes, and so on. Accordingly he requires calculating the time required for parts 41 to 60. [Note: learning coefficient is -0.322 for learning rate of 80%, $\log 2 = 0.30103$, $\log 3 = 0.47712$, $\log 5 = 0.69897$, Antilog of 1.484 = 30.48, Antilog of 1.4274 = 26.75]

Question No.14 – May 2017

PAL Limited is considering manufacture and launch of 1,000 units of a special product 'L X 4' into the market.

The Direct labour Rate budgeted is ₹ 96 per hour.

Direct labour costs are expected to reduce as the volume of output increase due to the effects of 80% learning curve (index is -0.3219). The expected time to be taken for the first unit is 40 hours and the learning effect is expected to end after 250 units have been produced. The units produced after the first 250 units will take the same time as the 250th unit.

- (i) Calculate the standard labour hours expected over the 1,000 units.*
- (ii) If the actual hours were 6,000, compute the labour efficiency variance over the 1,000 units.*
- (iii) Without the learning curve application, how would you have reported the efficiency variance, taking the standard time per unit as the expected time for the first unit?*

[Note: $250^{-0.3219} = 0.1691$; $249^{-0.3219} = 0.1693$]

(6 Marks)