

COMPILATION OF SUGGESTED
ANSWERS TO THEORY
QUESTIONS SET IN THE
INSTITUTE'S EXAMINATIONS
MAY, 2010 – MAY, 2017

PAPER-5
ADVANCED MANAGEMENT
ACCOUNTING

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Chapter 1: Developments in the Business Environment

Q1. Classify the following items under the three measures used in the theory of constraints: viz Throughput Contribution, Operating Costs and Investments.

- (i) Research and Development Cost
- (ii) Rent/ Utilities
- (iii) Raw materials used for production
- (iv) Depreciation
- (v) Labour Cost
- (vi) Stock of raw materials
- (vii) Sales
- (viii) Cost of equipment and buildings
- (ix) Finished Goods Inventory

(May 2017, May 2014, May 2011)

Ans.

Throughput Contribution	Raw Material for Production
	Sales
Operating Costs	Rent / Utilities
	Depreciation
	Labour
Investments	Research and Development Cost
	Raw Material Stock
	Building and Equipment Cost
	Finished Goods Inventory

Q2. Briefly explain the principles associated with synchronous manufacturing.

(Nov 2016, Nov 2012, May 2010)

Ans. **Synchronous Manufacturing:**

It is an all-encompassing manufacturing management philosophy which includes a set of principles, procedures, and techniques where every action is evaluated in terms of common goals of the organization.

The seven principles are:

- (i) Focus on synchronizing the production flow than on idle capacities.
- (ii) Value of time at a bottleneck resource is equal to the throughput rate of products processed by the bottleneck.
- (iii) Value of time at a non-bottleneck resource is negligible.
- (iv) Level of utilization of a non-bottleneck resource is controlled by other constraints within the system.
- (v) Resources must be utilized, not simply activated.
- (vi) Transfer batch should not be equal to the process batch.
- (vii) A process batch should be variable both along its route and overtime.

Q3. 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

(May 2016)

Ans. **Classification of Items under Appropriate Categories in Balance Scorecard**

S. No.	Items(Goals)	Categories in Balance Scorecard
(i)	Research and Development	Innovation and Learning Perspective
(ii)	New Product Introduction	Internal Business Perspective
(iii)	Price	Customer Perspective
(iv)	Cost Leadership	Innovation and Learning Perspective
(v)	Sales Penetration	Internal Business Perspective
(vi)	Profitability	Financial Perspective
(vii)	Sales	Financial Perspective
(viii)	Quality	Customer Perspective

Q4. 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

(May 2016)

Ans. **Activity Cost Driver for Activity Cost Pools**

S.No.	Activity Cost Pools	Activity Drivers
(i)	Manufacturing Cost	1. Number of machine hours
		2. Number of direct labor hours
		3. Number of field support visits
		4. Number of jobs scheduled
		5. Number of machine setups
		6. Number of maintenance work orders
		7. Number of parts in product
		8. Number of parts in stock
		9. Number of price negotiations
		10. Number of purchase orders
		11. Number of scheduling changes
		12. Number of shipments
(ii)	Human Resource Cost	1. Number of employee
		2. Number of training Hours

		3. Number of benefit changes
		4. Number of insurance claims
		5. Number of pension changes
		6. Number of recruiting contacts
(iii)	Marketing and Sales Cost	1. Number of customer service contacts
		2. Number of orders processed
		3. Number of sales contact made
		4. Number of advertisement
		5. Number of sales personnel
(iv)	Accounting Cost	1. Number of billings
		2. Number of cash receipts
		3. Number of check payments
		4. Number of general ledger entries
		5. Number of reports issued
		6. Number of responsibility centre

Q5. 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

(Candidates may opt for the following format and fill in the appropriate Roman numerals under each column)

Cost →	PC	AC	IFC	EFC
Q.Nos. →	x	x	x	x

(Nov 2015)

Ans. **Appropriate Categories of Quality Costs**

Costs	PC	AC	IFC	EFC
Q. Nos.	(iii)	(iv)	(ii)	(i)
	(v)	(viii)	(vi)	---
	(x)	---	(ix)	(vii)

Q6. 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.

(Nov 2015)

Ans. **Target Costing – VALID or NOT VALID**

Sl. No	Statement	Valid or Not valid
(i)	Target costing is not applicable to a monopoly market.	Valid , Target costing is applied where the price is market determined and in the existence of competitive environment. In monopoly market, a firm is a price maker hence, target costing method is not applicable to a monopoly market.
(ii)	Target costing ignores non-value added activities.	Valid , In case of target costing the aim is to confine the total cost to set target. To achieve this target cost figure, non-value added activities are eliminated and hence ignored.

Q7. Quality products can be determined by using a few of the dimensions of quality. Identify the following under the appropriate dimension:

- (i) Consistency of performance over time.
- (ii) Primary product characteristics.
- (iii) Exterior finish of a product
- (iv) Useful life of a product.

(May 2015)

Ans. **Quality of Products with Appropriate Dimension**

Sl. No	Quality of Products (Examples)	Dimension
(i)	Consistency of performance over time	Reliability
(ii)	Primary product characteristics	Performance
(iii)	Exterior finish of a product	Aesthetics
(iv)	Useful like of a product	Durability

Q8. 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.	

(Candidates need to only write the 1st and last columns in the answer books.)

(May 2015)

Ans. **Identification of Perspectives of Independent Situation - 'Balance Scorecard'**

Sl. No.	Organization	Perspective
(i)	Courier Company	Customer Perspective
(ii)	Tuition Centre	Learning and Growth Perspective
(iii)	Computer Manufacturing Company	Internal Business Perspective
(iv)	Government Taxation Department	Learning and Growth Perspective

Q9. Classify the following business activities into primary and support activities under value chain analysis.

- (i) Material Handling and Warehousing.
- (ii) Purchasing of raw materials, supplies and other consumables.
- (iii) Order processing and distribution
- (iv) Selection, placement and promotion of employees.
- (v) Installation, repair and parts replacement
- (vi) Transforming inputs into final products
- (vii) General management, planning, finance, accounting
- (viii) Communication, pricing and channel management

(May 2015, Nov 2013)

Ans. **Classification of Business Activities into Primary and Support Activities**

Sl. No.	Business Activities	Primary/ Support
(i)	Material Handling and Warehousing	Primary Activities
(ii)	Purchasing of raw materials, supplies and other consumables	Support Activities
(iii)	Order processing and distribution	Primary Activities
(iv)	Selection, placement and promotion of employees	Support Activities
(v)	Installation, repair and parts replacement	Primary Activities
(vi)	Transforming inputs into final products	Primary Activities
(vii)	General management, planning, finance, accounting	Support Activities
(viii)	Communication, pricing and channel management	Primary Activities

Q10. 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. **(Nov 2014)**

Ans.

Non- Financial Perspective	Objective	Performance Measure
Customer Perspective	Increase the customer loyalty. Or Retaining the existing customers.	Percentage of customers using loyalty cards. Or No. of discount vouchers redeemed.
Internal Business Perspectives	For customers to pay for goods in a reasonable time. Or Paying proper attention to the customers and their product enquiries. Or Provide necessary support to the existing loyal customers.	Time spent by customers in queuing to pay for products at a check out. Or Time spent by customers care executives in handling customers queries. Or No. of times home delivery made.
Learning & Growth Perspectives	To have qualified staffs able to meet the needs of the customer. Or Adding new products for new segments.	No. of staff training days. Or No. of schemes launched.

Q11. How does the JIT approach help in improving an organization's Profitability? **(Nov 2014)**

Ans. JIT approach helps in the reduction of costs/increase in prices as follows:

- (i) Immediate detection of defective goods being manufactured so that early correction is ensured with least scrapping.
- (ii) Eliminates / reduces WIP between machines within working cell.
- (iii) Overhead costs in the form of rentals for inventory, insurance, maintenance costs etc. are reduced.
- (iv) Higher product quality ensured by the JIT approach leads to higher premium in the selling price.
Detection of problem areas due to better production / scrap reporting / labour tracing and inventory accuracy lead to reduction in costs by improvement.

Q12. 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. **(May 2014)**

Ans.

Point	Valid/ Invalid	Reason
(i)	Invalid	TQM advocates focus to be given on both external and internal customers. Hence, focus satisfying the needs of the external customers only will not be valid for the successful implementation of TQM.
(ii)	Valid	Training at the beginning would improve productivity by bringing standardization in work habits and eliminating variations in production.
(iii)	Invalid	For implementation of TQM, Management by Objectives should be eliminated as targets of production will encourage delivery of poor quality goods and thus will defeat the collective nature of TQM.
(iv)	Invalid	Appointing the head of each department as the responsible person is not valid for the successful implementation of TQM as Total Employee Involvement (TIE) principle is an important part of TQM.
(v)	Invalid	Documentation, procedures and awareness of current best practice are essential in TQM implementation. If documentation and procedures are in place then only improvement can be monitored & measured and consequently deficiency can be corrected.

Q13. Briefly explain the phases in the life cycle of a product.

(Nov 2014, Nov 2011)

Ans. **Phases in Life Cycle of a Product**

Phase	Characteristics
Introduction	Product is launched. Profits are almost non existent. Competition is almost negligible.
Growth	Sales/ Profits rise rapidly. Competition enters.
Maturity	Sales increases but at a declining rate. Some firms extend their product lines with new models.
Saturation and Decline	Drop in sales volume, need for product demand disappears. Better and cheaper substitutes are available in the market.

Q14. 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 $\frac{\text{Aggregate set up time of all machines}}{\text{Total number of machines.}}$

(Nov 2013)

Ans.

Situation		Valid / Invalid
(i)	A company produces LCD TVs. Presently total inventory turnover is measured annually.	Valid - JIT system emphasize extraordinary high inventory turnover. When a company is producing LCD TVs, total turnover of inventory will be high, when the recommendation of computing of inventory turnover and breaking it into raw material, W-I-P and finished goods is given JIT system is very much valid.
(ii)	Textile company.	Invalid - In textile industry, employees are paid extra if they exceed certain production volume targets. JIT focuses on producing only what is needed not to accumulate inventory on account of high incentives. So any piece rate system must be eliminated and replaced with measures that focus instead on the quality of output or the number of employee suggestions for improving the system, which are much more important outcomes in a JIT system.
(iii)	Sports goods manufacturing company.	Invalid - Monitoring Direct labour efficiency is highly inappropriate in JIT system. As JIT system unlike traditional system does not focus on fast workings of employees. Instead JIT focuses on quality of product manufactured. JIT system strives to avoid all unnecessary activities and hence eliminate non- value-added activities like monitoring direct labour variance including idle variance.
(iv)	Multiproduct production.	Invalid - The average setup time per machine is of great importance as it can be measured periodically and plotted on a trend line. The shortest possible setup intervals are crucial for the success of short production runs, so this is a major JIT measurement. It is best to measure it by machine, rather than in the aggregate, since an aggregate measure does not reveal enough

	information about which equipments requires more setup time reduction work.
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Q15. What are the focuses of Theory of Constraints? How it differs with regard to cost behaviour?

(May 2013)

Ans. The theory of constraint focuses its attention on constraints and bottlenecks within the organisation which hinder speedy production. The main concept is to maximize the rate of manufacturing output i.e. the throughput of the organisation. This requires examining the bottlenecks and constraints which are defined as:

- A bottleneck is an activity within the organisation where the demand for that resource is more than its capacity to supply.
- A constraint is a situational factor which makes the achievement of objectives/throughput more difficult than it would otherwise be. Constraints may take several forms such as lack of skilled employees, lack of customer orders or the need to achieve a high level of quality product output.

Using above definition, therefore, a bottleneck is always a constraint but a constraints need not be a bottleneck.

The theory of constraints assumes few costs are variable –generally materials, purchased parts, piecework labour, and energy to run machines. It assumes that most direct labour and overheads are fixed. This is consistent with the idea that the shorter the time period, the more costs are fixed, and the idea that the theory of constraints focuses on the short run.

Q16. In the context of Activity Based Costing System, explain the following statement:

"Strategic cost analysis should exploit internal linkages"

(Nov 2012)

Ans. Activity based costing is an accounting methodology that assigns cost to activities rather than to products or services. Activity based Costing tracks the flow of activities by creating internal link between activity/resource consumption and cost object. Exploiting internal linkages means taking advantage of the relationships among the activities that exist within a firm's segment of value chain. Activity cost and analysis are essential parts of this strategic analysis. Activities not based on production units/sales units, based on the variable activity drivers are analyzed. The traditional costing system is not rich enough to supply the information needed for thorough analysis of linkages.

Q17. What is target costing? It is said that target costing fosters team work within the organisation. Explain how target costing creates an environment in which team work fosters.

(Nov 2012)

Ans. Target cost is the difference between the estimated selling price of a proposed product with specified functionality and quality and target margin. This is a cost management technique that aims to produce and sell products that will ensure the target margin. It is an integral part of the product design. While designing the product the company allocates value and cost to different attributes and quality. Therefore, they use the technique of value engineering and value analysis. The target cost is achieved by assigning cost reduction targets to different operations that are involved in the production process. Eventually, all operations do not achieve the cost reduction targets, but the overall cost reduction target is achieved through team work. Therefore, it is said that target costing fosters team work.

Q18. 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. **(May 2012)**

Ans.

Sl. No	Item	
(i)	Polishing furniture used by a Systems Engineer in a software firm	Non-value added
(ii)	Maintenance by a software company of receivables management software for a banking company	Value-added
(iii)	Painting of pencils manufactured by a pencil factory	Value-added
(iv)	Customers' computer key board cleaning by a computer repair centre	Value-added
(v)	Providing brake adjustments in cars for repairs by a care service station.	Value-added

Q19. 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. **(May 2012)**

Ans.

Sl. No	Description	Recommend ABC Yes/No	Reason
i)	K produces one product. Overhead is mainly depreciation	No	• One product situation. For allocation of overhead, ABC is not required. • ABC for cost reduction not beneficial since most of the overhead is depreciation.
ii)	L produces 5 different products with different facilities.	Yes	• Multi product situation. ABC is required for allocation of overhead. • ABC is necessary for pricing. • Cost drivers are likely to be different. • Cost reduction may be possible.

			• Production facilities are different.
iii)	Professional services – lawyers/ accountants/ computer engineers	Yes	• Variety of services. Hence ABC is required for cost allocation. • Services are very different • ABC is necessary for pricing. • Cost reduction possible.
iv)	S produces 2 different labour intensive products. High unit contribution and efficient operations.	No	• Different products, but labour intensive. Hence, overhead allocation based on readily traceable direct labour cost will be accurate. Hence, ABC not required for cost allocation. • Low BEP level implies low level of fixed cost as a % of sale price or as a % of total cost. • Many fixed cost activity drivers are likely to align with the direct labour costs. Hence not required for cost allocation. • Efficient operation. Hence ABC not required even for cost reduction or ABC management.

Q20. Explain the features/components of balanced score card.

(May 2012, Nov 2010)

Ans. Well designed balanced score card combines financial measures of past performance with measures of the firm's drivers of future performance. Generally the Balanced Score Card has the following perspectives from which a company's activity can be evaluate

1. Customer perspective i.e how customers see us?
2. Internal perspective ie. In what processes must the firm excel?
3. Innovation & learning perspective i.e,can we continue to improve and create value?
4. Financial perspective i.e., how we look to our share holders?

Q21. 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

(May 2012)

Ans. **Classification of items under cost reduction/ cost control**

Sl. No.	Item	Category Cost Control (CC) Cost Reduction (CR)
(i)	Costs exceeding budgets or standards are investigated	CC
(ii)	Preventive function	CC
(iii)	Corrective function	CR
(iv)	Measures to standardize for increasing productivity	CR
(v)	Provision of proper storage facilities for materials	CC
(vi)	Continuous comparison of actual with the standards set	CC
(vii)	Challenges the standards set	CR
(viii)	Value analysis	CR

Q22. Classify the following items under appropriate categories of equality costs viz. Prevention Costs, appraisal Cost, Internal Failure Costs and External Failure costs:

(i) Rework

(ii) Disposal of scrap

(iii) Warranty Repairs

(iv) Revenue loss

(v) Repair to manufacturing equipments

(vi) Discount on defective sale

(vii) Raw material inspection

(viii) Finished product inspection

(ix) Establishment of quality circles

(x) Packaging inspection

(Nov 2011)

Ans.

i)	Rework	Internal Failure
ii)	Disposal of Scrap	Internal Failure
iii)	Warranty Repairs	External Failure
iv)	Revenue Loss	External Failure
v)	Repairs to Manufacturing Equipment	Internal Failure
vi)	Discount on Defective Sales	External Failure
vii)	Raw Material Inspection	Prevention Cost
viii)	Finished Product Inspection	Appraisal Cost
ix)	Establishment of Quality Circles	Prevention Cost
x)	Packaging Inspection	Appraisal Cost

Q23. Explain the concept of Just In time approach in a production process.

(Nov 2011)

Ans. **Just in Time in Production Process**

1. Products, Spare parts/materials are received directly at production floor. Inspection is completed before delivery of materials.

2. Setup time is minimized while also reducing long production runs, thereby eliminating defectives, scrap and product obsolescence.
3. Work-in-progress is reduced by use of kanban card or working cells or both.
4. Workers are trained on a variety of machines, allowed to stop machines when they identify a problem, fix it or call the repair team and adequately compensated.
5. Supporting systems such as administration, accounting and cost reporting are suitably modified to shift from the conventional mode to the improved JIT requirements.

Q24. Classify the following measures under appropriate categories in a balanced score card 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

(Students are not required to copy these statements into their answer books)

(May 2011)

Ans.

- | | |
|------------------------------------|-----------------------------------|
| (i) New product tie up | - Innovation/learning perspective |
| (ii) Growth of Volume | - Financial perspective |
| (iii) Time for loan/Fresh products | - Customer perspective |

Q25. Explain the pre-requisites for successful operation of material requirement planning. **(May 2011)**

Ans. Pre-requisites for successful operation of MRP system are:

- (i) The latest production and purchasing schedules prepared should be strictly adhered to Day to Day change from predetermined schedules will cause chaos.
- (ii) Raw Materials, sub-assemblies and components required for production should be pre-determined in quantifiable terms. Standard should be set for the consumption quantity, quality, mix and yield of raw materials for every unit of finished product.
- (iii) Work-force must be appraised of the system and the need for absolute adherence to the schedules prepared.
- (iv) Necessary internal control system should be developed to ensure total adherence to the schedule.
- (v) Accuracy of the data supplied is vital to the MRP system.

Q26. Name any four stages in the process of bench marking.

(May 2011)

Ans. **Various stages in the process of benchmarking.**

- | | |
|------------|---|
| I Planning | - Determination of benchmarking goal statement |
| | - Identification of best performance |
| | - Establishment of the benchmarking or process improvement team |

- Defining the relevant benchmarking measures

- II Collection of data and information
- III Analysis of finding based on data collected
- IV Formulation and implementation of recommendation
- V Constant Monitoring and reviewing.

Q27. List out the remedies available for difficulties experienced during implementation of PRAISE.

(Nov 2010)

Ans. Remedies available for difficulties experienced in each step available during implementation of praise:

Sl. No.	Activities	Remedies
1.	Problem Identification	Participate in programs like brain storming, multi voting, GD etc Precise definition of a problem and quantification.
2.	Ranking	• Participative approach • Sub ordination of individual to group approach.
3.	Analysis	• Lateral thinking/Brain storming.
4.	Innovation	• Systematic evaluation of all aspects of each strategy. • Effective internal communication.
5.	Solution	• Training of personnel/managers • Participative approach
6.	Evaluation	• Effective control system to track actual feedback system

Q28. Mention the data required to operate the material requirement planning system.

(Nov 2010)

Ans. **Data requirements to operate material requirement planning system:**

1. The master Production schedule: This schedule specifies the quantity of each finished unit of products to be produced and the time at which each unit will be required.
2. The Bill of material file: The bill of material file specifies the sub-assemblies, components and materials required for each of the finished goods.
3. The inventory file: This file maintains details of items in hand for each sub-assembly, components and materials required for each of the finished goods.
4. The routing file: This file specifies the sequence of operations required to manufacture sub-assemblies, components and finished goods.
5. The master parts file: This file contains information on the production time of sub- assemblies; components produced internally and lead times for externally acquired items.

Q29. What is Backflushing in JIT? State the problems that must be addressed for the effective functioning of the system.

(May 2010)

Ans. Back flushing requires no data entry of any kind until a finished product is completed. At the 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.

To work system properly some serious problems must corrected.

- (i) **Production reporting:** The total production figure entered into the system must be absolutely correct.
- (ii) **Scrap reporting:** All abnormal scrap must be diligently tracked and recorded; otherwise these materials will fall outside the back flushing system and will not be charged to inventory.
- (iii) **Lot tracing:** Lot tracing is impossible under the back flushing system. It is required when a manufacturer need to keep records of which production lots were used to create a product in case all the items in a lot must be recalled.
- (iv) **Inventory accuracy:** Maintain accurate set of inventory records.

Chapter 2: Decision Making using Cost Concepts and CVP Analysis

Q1. 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

(May 2017)

Ans. **Cost Classification**

R & D costs indicated above	Relevant Cost
Cost of Market Survey	Sunk Cost
The profit of the Telephone Instruments Division	Opportunity Cost, Relevant Cost

Q2. Some statements are given below. Identify name of the cost with examples and state whether it is relevant/non-relevant in decision making.

(i) Costs are historical costs which have already been incurred and cannot change by any decision made in future.

(ii) It is measure of benefits foregone by rejecting the second best alternative of resources in favour of the best.

(iii) 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.

(iv) Total cost is changed (increase or decrease) due to change in the level of activity, technology or production process or method of production.

(v) Cost used in evaluation of a product to reflect the use of resources but that have no observable cost.

(Nov 2016)

Ans. **Relevant / Not Relevant**

S. No.	Name of the Cost	Example	Relevant / Not Relevant
(i)	Sunk Cost	Written down value of machine already purchased.	Not Relevant in decision making.
(ii)	Opportunity Cost	Funds invested in business or deposited into bank.	Useful in decision making.
(iii)	Out of Pocket Cost	Commission to salesman on sales, Carriage inward.	Relevant for decision making.
(iv)	Differential Cost	Include all fixed and variable cost which are increased /decreased.	Relevant in specific decision making.

(v)	Notional Cost	Notional Rent for use of space.	Relevant, if company benefit by using resource alternatively.
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Q3. 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)

(Nov 2015)

Ans. **Analysis of Costs for Evaluation of Proposal A against the Proposal B**

Sl. No	Condition under which classification happens
(i)	Variable Cost per unit that will not differ between the options/ Variable Cost has already been incurred in the past.
(ii)	Fixed Cost that is not committed and differ between the options.
(iii)	Additional future cost/ Differs between alternatives.
(iv)	Costs already have been incurred and it will not affect any current or future action.

Q4. Explain the concept of relevancy of cost by citing three examples each of relevant costs and non-relevant costs. (Nov 2014)

Ans. Relevant costs are those costs which are pertinent to a decision. In other words, these are the costs which are influenced by a decision. Those costs which are not affected by the decision are not relevant costs.

Examples of Relevant Costs are-

- (1) All variable costs are relevant costs.
- (2) Fixed Costs which vary with the decision are relevant costs.
- (3) Incremental costs are relevant costs.

Examples of Non-Relevant Costs are-

- (1) All fixed costs are generally non-relevant.
- (2) Variable costs which do not vary with the decision are not relevant costs.
- (3) Book value of the asset is not relevant

Q5. 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.

(Nov 2013)

Ans.

Cases	Type of Cost
(i) Cost associated with the acquisition and conversion of material into finished product.	Product Cost
(ii) Cost arising from a prior decision which cannot be changed in the short run.	Committed Cost
(iii) Increase in cost resulting from selection of one alternative instead of another.	Differential/Incremental Cost
(iv) Rent paid for a factory building which is temporarily closed.	Shut Down Cost

Q6. "Sunk cost is irrelevant in decision making, but all irrelevant costs are not sunk costs." Explain with examples. **(Nov 2012)**

Ans. Sunk costs are costs that have been created by a decision made in the past and that cannot be changed by any decision that will be made in the future.

Example, the written down value of assets previously purchased are sunk cost. Sunk costs are not relevant for decision making because they are past cost.

But not all irrelevant costs are sunk cost. For example, a comparison of two alternative production methods may result in identical material costs for both the alternatives. In this case, the direct material cost will remain the same whichever alternative is chosen. In this situation, through direct material cost is the future cost to be incurred in accordance with the production, it is irrelevant, but it is not a sunk cost.

Irrelevant is only with respect to alternatives being considered and not for fund flows whereas for sunk cost there is no further cash flow. Cash flows have already been incurred.

Q7. Two companies, H and L, have the same values for turnover and net profit and make a similar product. H has a higher P/V ratio than L. Which company will perform better when:

(i) the market demand is high ?

(ii) the market demand is low?

(Nov 2011)

Ans.

(i) In case Market Demand is High - Product H (Lower Variable Cost and Higher Fixed Cost)

(ii) In case Market Demand is Low - Product L

Q8. Pick out from each of the following items, costs that can be classified under 'committed fixed costs' or 'discretionary fixed costs'.

(i) Annual increase of salary and wages of administrative staff by 5% as per agreement

(ii) New advertisement for existing products is recommended by the Marketing Department for achieving sales quantities that were budgeted for at the beginning of the year.

(iii) Rents paid for the factory premises for the past 6 months and the rents payable for the next six months. Production is going on in the factory.

(iv) Research costs on a product that has reached 'maturity' phase in its life cycle and the research costs which may be needed on introducing a cheaper substitute into the market for facing competition.

- (v) Legal consultancy fees payable for patent rights on a new product Patenting rights have been applied for. **(May 2011)**

Ans.

Committed Fixed Cost	Discretionary Fixed Cost
(i) Salary and wage increase (iii) Rents payable for the next 6 months (v) Legal fees for filing for patent rights	(ii) New Advertisement Cost (iv) Research cost for substitutes

Q9. What are the applications of incremental/differential costs?

(May 2010)

Ans. **Applications of Incremental/Differential Cost:**

1. Whether to process a product further or not.
2. Dropping or adding a product line.
3. Optimizing investment plan.
4. Accepting an additional order from a special customer at lower than existing price.
5. Make or buy decision.
6. Opening a new sales territory or branch.
7. Optimizing investment plan out of multiple alternatives.
8. Submitting tenders.
9. Lease or buy decisions.
10. Equipment replacement decisions.

Chapter 3: Pricing Decisions

Q1. 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.

(May 17)

Ans. **New Product Pricing**

(i)	Me-too Product (MP)	Market Price that is determined by competitive forces for the successful product.
(ii)	Revolutionary Product (RP)	Premium Pricing , It can expect to make a tidy profit as a reward for innovation and taking its first initiative.
(iii)	Evolutionary Product (EP)	Demand Based Pricing , Price higher than the earlier version to justify its Costs and Benefits subject to what amount can be stepped up in the market.

Q2. 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
End Frame not equidistant from the centre	10
Non-uniform grinding of lenses	60
Power mismatches	20
Scratches on the surface	110
Spots / Stains on lenses	5
Rough edges of lenses	70
Frame colours-shade differences	25

Construct a frequency table so that a Pareto Chart can be constructed for the defect type. Which areas should the company focus on? **(May 2017)**

Ans. **Statement Showing “Pareto Analysis of Defects”**

Defect Type	No. of Items	% of Total Items	Cumulative Total
Scratches on the surface	110	36.67%	36.67%
Rough edges of lenses	70	23.33%	60.00%
Non-uniform grinding of lenses	60	20.00%	80.00%
Frame colours-shade differences	25	8.33%	88.33%
Power mismatches	20	6.67%	95.00%
End frame not equidistant from the centre	10	3.33%	98.33%
Spots/ Strain on lenses	5	1.67%	100.00%
	300	100.00%	

The company should focus on eliminating scratches on the surface, rough edges of lenses and grinding of lenses related defects which constitute **80% portion**, according to Pareto Theory.

Q3. Enumerate the users of Pareto Analysis. **(Nov 2016)**

Ans. **Pareto Analysis is useful to:**

- (i) Prioritize problems, goals and objectives.
- (ii) Identify the root causes.
- (iii) Select and define the key quality improvement programs, key employee relations improvement programs etc
- (iv) Verify the operating procedures and manufacturing processes.
- (v) Allocate physical, financial and human resources effectively.
- (vi) Maximise research and product development time.

Q4. Distinguish clearly between the skimming pricing policy and penetration pricing policy. **(Nov 2016)**

Ans.

Basis	Skimming Price	Penetration Pricing
Meaning	Pricing Policy of highly pricing a product at the entry level into the market and reducing it later.	Pricing Policy of entering the market with a low price, then establishing the product and then increasing the price.
Use	This method is preferred in the beginning because in the initial periods when the demand for the product is not known the price covers the initial cost of production.	This is used by companies with established markets, when products are in any stage of their life cycle, to avoid competition. This is also known as “stay-out pricing”.
Target Market	It is used when market is price insensitive, demand inelastic or to recover high promotional costs	It is a policy of using a low price as the principal instrument for penetrating mass markets early.
Example	Electronic goods, mobile phone, TVs, etc.	Entry of a new model small segment car into the market.

Q5. What is penetration pricing? What are the circumstances in which this policy can be adopted?

(May 2016)

Ans. Penetration Pricing means a price suitable for penetrating mass market as quickly as possible through lower price offers. This method is also used for pricing a new product. In order to popularize a new product penetrating pricing policy is used initially. This pricing policy is in favour of using a low price as the principal instrument for penetrating mass markets early. It is opposite to skimming pricing. The low pricing policy is introduced for the sake of long-term survival and profitability and hence it has to receive careful consideration before implementation. It needs an analysis of the scope for market expansion and hence considerable amount of research and forecasting are necessary before determining the price.

Circumstances for Adoption

The three circumstances in which penetrating pricing policy can be adopted are as under:

- (i) When demand of the product is elastic to price. In other words, the demand of the product increases when price is low.
- (ii) When there are substantial savings on large-scale production, here increase in demand is sustained by the adoption of low pricing policy.
- (iii) When there is threat of competition. The prices fixed at a low level act as an entry barrier to the prospective competitions.

Q6. 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.)

- (i) Modern patented drug entering the market.
- (ii) The latest version of a mobile phone is being launched by an established, financially strong company.
- (iii) An established company has recently entered the stationery market segment and launched good quality paper for printing at home and office.

- (iv) A car manufacturer is launching an innovative, technologically advanced car in the highly priced segment. **(Nov 2015)**

Ans.

Sl. No	Pricing Policy
(i)	Skimming Pricing
(ii)	Penetration Pricing
(iii)	Market Price
(iv)	Skimming Pricing

Q7. What are the applications of Pareto Analysis in customer profitability analysis? **(May 2015)**

Ans. **Application of Pareto Analysis in Customer Profitability Analysis ---**

Customer Profitability Analysis identifies customer service activities and cost drivers. It also determines profitability of each customer or group of customers. Pareto Analysis i.e. the rule of 80 : 20 identified by the Vilfredo Pareto is also applied for the better analysis of the customers behavior and profitability. Pareto Analysis helps to group the customers into 20% high revenue generating customers and 80% low revenue customer group. Based on this proposition the Pareto Analysis can be applied in customer profitability analysis in the following manner:

- Identify most profitable customers.
- Manage each customer's costs-to-serve.
- Discontinue unprofitable customer segment.
- Shift a customer's purchase mix towards higher- margin products and service lines.
- Offer discounts to attract profitable customers.
- Choose types of after sale services to provide.

Q8. How is Pareto analysis helpful in pricing of products in the case of a firm dealing with multiple products? **(May 2014)**

Ans. **Role of Pareto Analysis in Pricing of Product in the case of firm dealing with multiple products--**

In the case of firm dealing with multi products, it would not be possible for it to analyse price-volume relationship for all of them. Pareto Analysis is used for analysing the firm's estimated sales revenue from various products and it might indicate that approximately 80% of its total sales revenue is earned from about 20% of its products. Such analysis helps the top management to delegate the pricing decision for approximately 80% of its products to the lower level of management, thus freeing them to concentrate on the pricing decisions for products approximately 20% of which is essential for the company's survival. Thus, a firm can adopt more sophisticated pricing methods for small proportion of products that jointly account for 80% of total sales revenue. For the remaining 80% products, which account for 20% of the total sales value the firm may use cost based pricing method.

Q9. State the appropriate pricing policy in each of the following independent situations:

- (i) '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.

- (ii) '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.
- (iii) '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.
- (iv) 'D' is a perishable item, with more than 80% of its shelf life over. (Nov 2013)

Ans.

Situation		Appropriate Pricing Policy
(i)	'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.	Penetration Pricing
(ii)	'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.	Market Price or Price Just Below Market Price
(iii)	'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 unusual sources of capital have uncertainties blocking them.	Skimming Pricing
(iv)	'D' is a perishable item, with more than 80% of its shelf life over.	Any Cash Realizable Value

Q10. List out the qualities required for a good pricing policy.

(May 2013)

Ans. **Quality required for a good pricing policy:**

The pricing policy plays an important role in a business because the long run survival of a business depends upon the firm's ability to increase its sales and device the maximum profit from the existing and new capital investment. Although cost is an important aspect of pricing, consumer demand and competitive environment are frequently far more significant in pricing decisions.

The pricing policy structure should:

- provide an incentive to producer for adopting improved technology and maximising production;
- encourage optimum utilisation of resources;
- work towards better balance between demand and supply;
- promote exports; and
- avoid adverse effects on the rest of the economy.

Q11. What qualitative factors should be considered in a decision to outsource manufacturing of a product? (Nov 2012)

Ans. The following qualitative factors should be considered in an outsourcing decision:

- (i) Whether the vendor will acquire the technology and will emerge as a competitor?
- (ii) Whether the vendor will be able to maintain the quality? If the vendor fails to maintain the quality, will the company lose customers?
- (iii) Whether the company will lose its skills in manufacturing the product and it will find difficult to resume production internally?

- (iv) Whether laying off employees will demoralize the work force?
- (v) Whether the price quoted by the vendor is a penetrating price? If so, it is likely to increase i.e. Whether price will increase.

Q12. State the pricing policy most suitable in each of the following independent situations:

- (i) The company makes original equipments and does defence contract work. There are other companies which also undertake such projects.
- (ii) The product made by a company is new to the market. It is expected to enjoy a long- term demand. Competition is expected very soon, since the product will be desirable to most customers.
- (iii) Stock of processed ready-to-eat product, whose shelf-life will soon be over in the next 2 months. The product is going to be discontinued.
- (iv) A company sells a homogeneous product in a highly competitive market.

(Candidates need to only write the pricing policy with the corresponding sub-division numbers of the questions. The situations need not be copied into the answer books) **(Nov 2011)**

Ans.

- (i) Sealed Bid Pricing
- (ii) Penetration Pricing
- (iii) Any price that the market will pay (even below variable cost any cash received)
- (iv) Going rate pricing or market price

Q13. Explain briefly Pareto analysis and mention some of its uses.

(Nov 2011)

Ans.

Pareto Analysis

Pareto Analysis is based on 80:20 rule that was a phenomenon first observed by Vilfredo Pareto, a nineteenth century Italian economist. He noticed that 80% of the wealth of Milan was owned by 20% of its citizens. This phenomenon or some kind of approximation of it says, (70:30) can be observed in many different business situations. The Management can use it in a number of different circumstances to direct management attention to the key control mechanism or planning aspects.

That is, about 70 to 80% of the value corresponds to 30 to 20 % of the volume.

Use of Pareto Analysis

1. Prioritize problems, goals and objectives
2. Identify root causes
3. Select and define key quality improvement programs
4. Select key employee relations improvement programs
5. Select key customers relations and service programs
6. Maximise research and product development times
7. Verify operating procedures and manufacturing processes
8. Product or services sales and distribution
9. Allocate physical, financial and human resources

Q14. What are the disadvantages of Cost Plus Pricing?

(May 2011)

Ans. **Disadvantages of cost plus pricing:**

- (i) Ignores demand, fails to take into account buyers' needs and willingness to pay.
- (ii) Fails to reflect competition adequately.
- (iii) Assumes correct cost estimation, whereas in multiproduct firm, costs may be arbitrarily allocated.
- (iv) In many decisions, incremental costs are more relevant than full cost. This is ignored.
- (v) Fixed Overheads depend on volume; if volume is more, cost is less, and vice-versa.

Increase/decrease in sales volume depends on price. Thus it is a vicious circle – cost plus markup is a price based on sales volume & sales volume is based on price.

Q15. What is Price Discrimination? Under what circumstances is it possible?

(May 2010)

Ans. Price discrimination is charging different prices with respect to customers, products, places and time.

It is possible when

- The market being capable of being segmented
- The customer is not able to resell the product at a higher price
- The competitors' underselling is not possible

Chapter 4: Budget & Budgetary Control

Q1. (i) Is it necessary to start preparing a functional budget only after identifying the principal budget factor? Explain.

(ii) Is it practical to make a flexible production cost budget before the commencement of production activities of a certain production period? Why? **(May 2017)**

Ans. (i) The principal budget factor is the factor which limits the activities of the organization. The early identification of this factor is important in the budgetary planning process because it indicates which budget should be prepared first. For example, if sales volume is the principal budget factor, then the sales budget must be prepared first, based on the available sales forecasts. All other budgets should then be linked to this.

(ii) A flexible production cost budget calculates different cost levels but it depends on the activity levels experienced. It requires actual cost and activity levels (as input) of certain production period. Accordingly, it is not practicable to make a flexible production cost budget before the commencement of production activities.

Q2. What are the steps involved in Zero Based Budgeting?

(Nov 2015, Nov 2010)

Ans. **Steps involved in the process of Zero Based Budgeting**

- (i) Determination of a set of objects is the pre-requisite and essential step in the direction of ZBB technique.
- (ii) Deciding about the extent to which the technique of ZBB is to be applied whether in all areas of organization activities or only in few selected areas on trial basis.
- (iii) Identify the areas where decisions are required to be taken.
- (iv) Developing decision packages and ranking them in order of performance.
- (v) Preparation of budget that is translating decision packages into practicable units/items and allocating financial resources.

ZBB is simply an extension of the cost, benefit analysis method to the area of corporate planning and budgeting.

Q3. In each of the following independent situations, state with a brief reason whether 'Zero Base Budgeting' (ZBB) or 'Traditional Budgeting' (TB) would be more appropriate for year II.

- (i) A company producing a certain product has done extensive ZBB exercise in year I. The activity level is expected to marginally increase in year II.
- (ii) The sales manager of a company selling three products has the intuitive feeling that in year II, sales will increase for one product and decrease for the other two. His expectation cannot be substantiated with figures.
- (iii) The top management would like to delegate responsibility to the functional managers for their results during year II.
- (iv) Resources are heavily constrained and allocation for budget requirements is very strict. **(Nov 2013)**

Ans.

- (i) The company has done extensive exercise in year-I that can be used as a basis for budgeting in year-II by incorporating increase in costs / revenue at expected activity level. Hence, Traditional Budgeting would be more appropriate for the company in year-II.
- (ii) In Traditional Budgeting system budgets are prepared on the basis of previous year's budget figures with expected change in activity level and corresponding adjustment in the cost and prices. But under Zero Base Budgeting (ZBB) the estimations or projections are converted into figures. Since, sales manager is unable to substantiate his expectations into figures so Traditional Budgeting would be preferred against Zero Base Budgeting.
- (iii) Zero Base Budgeting would be appropriate as ZBB allows top-level strategic goals to be implemented into the budgeting process by tying them to specific functional areas of the organization, where costs can be first grouped, then measured against previous results and current expectations.
- (iv) Zero Base Budgeting allocates resources based on order of priority up to the spending cut-off level (maximum level upto which spending can be made). In an organisation where resources are constrained and budget is allocated on requirement basis, Zero Base Budgeting is more appropriate method of budgeting.

Q4. Discuss the characteristics of zero base budgeting.

(Nov 2012)

Ans. Zero base budgeting (ZBB) is defined as method of budgeting which requires each cost element to be specifically justified, as though the activities to which the budget relates were being undertaken for the first time. ZBB is prepared and justified from scratch (zero). Without approval, the budget allowance is zero.

Characteristics of ZBB:

- (i) Manager of a decision unit has to completely justify why there should be any budget allotment for his decision unit.
- (ii) Activities are identified in decision packages.
- (iii) Decision packages are ranked in order of priority
- (iv) Packages are evaluated by systematic analysis.
- (v) Decision packages are linked with corporate objectives, which are clearly laid down.
- (vi) Available resources are directed towards alternatives in order to prioritize to ensure optimal results.

Q5. Define the following:

- (i) maximum capacity (theoretical capacity)
- (ii) practical capacity
- (iii) normal capacity
- (iv) principal budget factor

(The first three relate to a manufacturing plant)

(May 2012)

Ans. (i) **Maximum Capacity** = Maximum no. of days in a period x no. of workers or
Maximum no. of hours x no. of workers

or

The maximum no. of units that can be produced by a manufacturing facility in a certain period.

(ii) **Practical Capacity** = Maximum capacity (minus) Sundays, holidays, normal maintenance & idle time

(iii) **Normal Capacity** = Average of past 3 years' normal performance excluding abnormal data.

(iv) **Principal budget factor** = The factor that limits the activities of the functional budgets of the organization.

Chapter 6: Costing of Service Sector

Q1. How customer costing is applied in service sector? Explain with example from any service sector area. **(Nov 2014)**

Ans. **Customer Costing in the Service Sector-** The customer costing is a new approach to management. The central theme of this approach is customer satisfaction. In some service industries, such as public relations, the specific output of industry may be difficult to identify and even more difficult to quantify. Further there are multiple customers, identifying support activities i.e. common costs with particular customer may be more problematic. In such cases it is important to cost customer. An ABC analysis of customers profitability provides valuable information to help management in pricing customer. Consider a banking sector. A bank's activities for customer will include the following types of activities. These are:

- (i) Stopping a Cheque
- (ii) Withdrawal of Cash
- (iii) Updation of Pass Book
- (iv) Issue of Duplicate Pass Book
- (v) Returning a Cheque because of Insufficient Funds
- (vi) Clearing of a Customer Cheque

Different customers or categories of customers use different amount of these activities and so customer profiles can be built up and customer can be charged according to the cost to serve them.

Customer Profile is important in analyzing cost under the following categories-

- (i) **Customer Specific Costs-** These are the direct and indirect cost of providing service to customer plus customer related cost assigned to each customer. For example: cost of express courier service to a client who requests over-night delivery of some agreement.
- (ii) **Customer – Line Categories-** These are the costs which are broken into broad categories of customers and not individual customers.
- (iii) **Company Costs-** These are those costs which are not allocated to either customer line or individual customers but charge to company. The example is the cost of advertisement to promote sale of service.

Q2. Discuss briefly two methods of costing in the service sector and give examples. **(Nov 2013)**

Ans. Methods of Costing in the service sector are as follows:

- (i) **Job costing method:** In job costing method the cost of a particular service is obtained by assigning costs to a distinct identifiable service. In service sector like Accounting firm, Advertising campaigns etc. job costing method is used. For assigning indirect costs (overheads) models such as Activity Based Costing may be used.
- (ii) **Process costing method:** In process costing system the cost of a service is obtained by assigning costs to masses of similar unit and then computing unit cost on an average basis. Retail banking, Postal delivery, Credit card etc. uses process costing method.

(iii) **Hybrid costing method:** Many companies use a method of costing which is neither job costing nor process costing method. They in fact use a hybrid costing method which combines elements of both job costing and process costing methods

Q3. "Customer profile is important in charging cost." Explain this statement in the light of customer costing in service sector. **(Nov 2010)**

Ans. Customer costing in the service sector: The customer costing is a new approach to management. The central theme of this approach is customer satisfaction. In some service industries, such as public relations, the specific output of industry may be difficult to identify and even more difficult to quantify. Further there are multiple customers, identifying support activities i.e. common costs with particular customer may be more problematic. In such cases it is important to cost customer. An ABC analysis of customers profitability provides valuable information to help management in pricing customer. Consider a banking sector. A bank's activities for customer will include the following types of activities. These are:

- i. Stopping a cheque
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- vi. Clearing of a customer cheque.

Different customers or categories of customers use different amount of these activities and so customer profiles can be built up and customer can be charged according to the cost to serve them.

Customer profile is important in analyzing cost under the following categories

1. **Customer specific costs:** These are the direct and indirect cost of providing service to customer plus customer related cost assigned to each customer.
For example: cost of express courier service to a client who requests over-night delivery of some agreement.
2. **Customer – line categories:** These are the costs which are broken into broad categories of customers and not individual customers.

Chapter 7: Transfer Pricing

Q1. Enumerate the expected disadvantages in taking divisions as profit centres.

(May 2013)

Ans. The expected disadvantages of taking divisions as profit centres are as follows:

- Divisions may compete with each other and may take decisions to increase profits at the expense of other divisions thereby overemphasizing short term results.
- It may adversely affect co-operation between the divisions and lead to lack of harmony in achieving organizational goals of the company. Thus it is hard to achieve the objective of goal congruence.
- It may lead to reduction in the company's overall total profits.
- The cost of activities, which are common to all divisions, may be greater for decentralized structure than centralized structure. It may thus result in duplication of staff activities.
- Top management loses control by delegating decision making to divisional managers. There are risks of mistakes committed by the divisional managers, which the top management, may avoid.
- Series of control reports prepared for several departments may not be effective from the point of view of top management.
- It may under utilize corporate competence.
- It leads to complications associated with transfer pricing problems.
- It becomes difficult to identify and define precisely suitable profit centres.
- It confuses division's results with manager's performance.

Chapter 8: Uniform Costing and Inter Firm Comparison

Q1. State the limitations of uniform costing.

(Nov 2016, Nov 2013)

Ans. **Limitations of Uniform Costing are:**

- (i) Sometimes it is not possible to adopt uniform standards, methods and procedures of costing in different firms due to differing circumstances in which they operate. Hence, the adoption of uniform costing becomes difficult in such firms.
- (ii) Disclosure of cost information and other data is an essential requirement of a uniform costing system. Many firms do not wish to share such information with their competitors in the same industry.
- (iii) Small firms in an industry believe that uniform costing system is only meant for big and medium size firms, because they cannot afford it.
- (iv) It induces monopolistic trend in the business, due to which prices may be increased artificially and supplies withheld.

Q2. State the advantages available in inter-firm comparison.

(May 2013)

Ans. **Advantages of Inter-firm comparison:** The main advantages of inter-firm comparison are:

- Such a comparison gives an overall view of the industry as a whole to its members– the present position of the industry, progress made during the past and the future of the industry.
- It helps a concern in knowing its strengths or weaknesses in relation to others so that remedial measures may be taken.
- It ensures an unbiased specialized reporting on particular problems of the concern.
- It develops cost consciousness among members of the industry.
- It helps Government in effecting price regulation.
- It helps to improve the quality of products manufactured and to reduce the cost of production. It is thus advantageous to the industry as well as to the society.

Q3. Discuss the essential requisites for installation of uniform costing system.

(Nov 2012, May 2010)

Ans. The following are the essential requisites for the installation of uniform costing system

- (i) Firms in the industry should be willing to share/furnish relevant data/information.
- (ii) A spirit of collaboration and mutual trust should prevail among the participating firms.
- (iii) Mutual exchange of ideas, methods, special achievements, research and knowhow should be frequent.
- (iv) Larger firms should take the lead towards sharing their experience and knowhow with smaller firms to enable the latter to improve their performance.
- (v) Uniformity must be established with regard to the following before introducing uniform costing:
 - ✓ Size of various units covered by uniform costing
 - ✓ Production method
 - ✓ Accounting principles, methods and procedures

Q4. Suggest suitable cost units for the following services:

- (i) Hospital
- (ii) Hotel
- (iii) Transport
- (iv) Staff canteen

(May 2012)

Ans.

- | | |
|--------------------|--|
| (i) Hospital | Patient days, or room days or patient nights |
| (ii) Hotel | Room nights/ Room days |
| (iii) Transport | Passenger – km or Tonne- km or quintal – km |
| (iv) Staff canteen | No. of meals or no. of staff |

Chapter 9: Profitability Analysis-Product Wise/Segment Wise/Customer Wise

Q1. Discuss the benefits of Customer Profitability Analysis.

(May 2014)

Ans. **Benefits of Customer Profitability Analysis**

- (i) It helps the supplier to identify which customers are eroding overall profitability and which customers are contributing to it.
- (ii) It can help to provide a basis for constructive dialogue between buyer and seller to improve margins.
- (iii) It enhances decision making related to customers.
- (iv) It helps in effective cost reporting, communication and information.
- (v) It helps to find out the value and profitability of each customer segment.

Q2. What do you mean by DPP? What are its benefits?

(May 2013)

Ans. Direct Product Profitability (DPP) is 'Used primarily within the retail sector, and involves the attribution of both the purchase price and other indirect costs such as distribution, warehousing, retailing to each product line. Thus a net profit, as opposed to a gross profit, can be identified for each product. The cost attribution process utilises a variety of measures such as warehousing space, transport time to reflect the resource consumption of individual products.'

Benefits of Direct Product Profitability:

- (i) Better Cost Analysis - Cost per product is analysed to know the profitability of a particular product.
- (ii) Better Pricing Decision- It helps in price determination as desired margin can be added with the actual cost.
- (iii) Better Management of Store and Warehouse Space- Space Cost and Benefit from a product can be analysed and it helps in management of store and warehouse in profitable way.
- (iv) The Rationalisation of Product Ranges etc.

Chapter 10: Linear Programming

Q1. 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.

- (i) What would be the coefficient of the artificial variables in the objective function? Why?
- (ii) Will s_1 and s_2 be part of the initial solution? Why? **(May 2017)**

Ans. (i) When the problem is of the minimization nature, we assign in the objective function a coefficient of $+M$ to each of artificial variables. It is attempted to prohibit the appearance of artificial variables in the solution by assigning these coefficients: an extremely large value when objective is to minimize.

(ii) s_1, s_2 will NOT be part of the initial solution.

If Surplus Variables are included in the basis, the elements of the Surplus Variables will be -1 . This is contrary to the non-negativity restriction. This problem is solved by adding Artificial Variable to the equations, that is, a variable that has a positive value.

Artificial Variables do not represent any quantity relating to the decision problem and must not be present in the final solution (if at all they do, it represents a situation of infeasibility).

Accordingly, in the initial tableau we will place Artificial Variables only to eliminate the impact of them first.

Q2. Write a short note on the characteristics of the dual problem. **(Nov 2012)**

Ans. Characteristic of the dual problem:

- (i) For any linear programming model called primal model, there exists a companion model called the dual model.
- (ii) The number of constraints in the primal model equals the number of variables in the dual model.
- (iii) The number of variables in the primal model equals the number of constraints in the dual model.
- (iv) If the primal model has a maximization objective then the dual model will have a minimization objective and vice-versa. Inequalities get reversed.
- (v) The solution of the primal model yields the solution of the dual model. Also, an optimal simplex table for the dual model yields the optimal solution to the primal model. Further, the objective functions of the two optimal tables will have identical values.
- (vi) Dual of the dual problem is the original primal itself.
- (vii) Feasible solutions to a primal and dual problem are both optimal if the complementary slackness conditions hold. If this relationship does not hold either the primal solution or the dual solution or both are not optimal.

(viii) If the primal problem has no optimal solution due to infeasibility, then the dual problem will have no optimal solution due to unboundedness.

(ix) If primal has no optimal solution due to unboundedness, then the dual will have no optimal solution due to infeasibility.

Chapter 11: The Transportation Problem

Q1. 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? **(Nov 2014, May 2012)**

Ans. The condition for degeneracy is that the number of allocations in a solution is less than $m+n-1$. The given problem is an unbalanced situation and hence a dummy row is to be added, since the column quantity is greater than that of the row quantity. The total number of rows and columns will be 9 i.e. (5 rows and 4 columns). Therefore, $m+n-1 = 8$, i.e. if the number of allocations is less than 8, then degeneracy would occur.

Q2. Will the solution for a minimization problem obtained by Vogel's Approximation Method and Least Cost Method be the same? Why? **(May 2014, May 2011)**

Ans. The initial solution need not be the same under both methods.

Vogel's Approximation Method (VAM) uses the differences between the minimum and the next minimum costs for each row and column. This is the penalty or opportunity cost of not utilising the next best alternative. The highest penalty is given the 1st preference. This need not be the lowest cost.

For example if a row has minimum cost as 2, and the next minimum as 3, penalty is 1; whereas if another row has minimum 4 and next minimum 6, penalty is 2, and this row is given preference. But Least Cost Method gives preference to the lowest cost cell, irrespective of the next cost. Solution obtained using Vogel's Approximation Method is more optimal than Least Cost Method.

Initial solution will be same only when the maximum penalty and the minimum cost coincide.

Q3. In a 3 x 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?

(May 2014)

Ans. The Initial solution obtained by the North-West Corner Rule in transportation need not always contain the R_2C_1 cell. In the North-West Corner Rule the first allocation is made at R_1C_1 cell and then it only moves towards R_2C_1 cell when the resources at the first row i.e. R_1 is exhausted first than the resources of first column i.e. C_1 . On the contrary if resources at first column i.e. C_1 is exhausted first then the next allocation will be at R_1C_2 .

For example the resource availability at first row (R_1) is 1,500 units and the demand in first column (C_1) is 1,000 units. In this case resource availability of first row (R_1) will be exhausted to the extent of the demand in first column (C_1) first and then the remaining resource availability at first row (R_1) will be used to meet the demand of the second column (C_2). In this example cell R_2C_1 will not come in initial solution obtained by the North-West Corner Rule.

Q4. Define the following terms in relation to a transportation problem:

- (i) Degeneracy
- (ii) Prohibited routes

(Nov 2013)

Ans.

- (i) **Degeneracy:** A transportation problem's solution has $m+n-1$ basic variables, (where m, n are the number of rows and columns) which means that the number of occupied cells in such a solution is one less than the number of rows and number of columns.

When the number of occupied cells in a solution is less than $m+n-1$, the solution is called a degenerate solution.

Such a situation is handled by introducing an infinitesimally small allocation 'e' in the least cost and independent cell.

- (ii) **Prohibited Routes:** Sometimes in a given transportation problem, some routes may not be available. There could be several reasons for this such as bad road conditions or strike etc. In such situations, there is a restriction on the route available for transportation. To handle such type of a situation, a very large cost (or a negative profit for the maximization problem) represented by ∞ or 'M' is assigned to each of such routes which are not available. Due to assignment of very large cost, such routes would automatically be eliminated in the final solution. The problem is solved in its usual way.

Q5. Explain the term 'Degeneracy' in the context of a transportation problem. How can this be solved?

(Nov 2012, May 2010)

Ans. A transportation problem's solution has $m+n-1$ basic variables, (where m, n are the number of rows and columns) which means that the number of occupied cells in such a solution is one less than the number of rows and number of columns.

When the number of occupied cells in a solution is less than $m+n-1$, the solution is called a degenerate solution.

Such a situation is handled by introducing an infinitesimally small allocation 'e' in the least cost and independent cell.

If the number of occupied cells $< m+n-1$ by one, then only one 'e' needs to be introduced. If the number of occupied cells is less by more than one, to the extent of shortage, 'e's will have to be introduced till the condition that no. of occupied cells = $m+n-1$. For e.g. if no. of occupied cells in a solution is 7 and we have $m+n-1 = 9$, then, we have to introduce two quantities of 'e', say e_1 and e_2 in 2 of the least cost independent cells.

Degeneracy occurs because in any particular allocation (earlier than the last allocation), the row and column totals get simultaneously fulfilled. (In the last allocation, it is always that row and column get fulfilled). Then, we have a degeneracy by one number, i.e. no. of occupied cells $+1 = m+n-1$. We need to put one 'e'. In the subsequent allocation, if again row and column totals get fulfilled simultaneously, again there will be a shortage of occupied cells and another 'e' will be required.

Due to this concept, an assignment problem, solved by transportation technique taking demand quantity = supply quantity = 1 in every row and column will require an 'e' for each allocation other than the last one. For e.g. in a 5 x 5 assignment problem, there are 4 allocations other than the last one.

Therefore, 4 'e's will be required. i.e. $m + n - 1$ will be $5+5-1, =9$, whereas, the no. of occupied cells will be 5. To resolve the degeneracy, we will need 4 'e's.

The 'e' has to be placed in the least cost independent cell, for arriving at the optimal solution as early as possible. If, by mistake, we place 'e' in the second least cost but independent cell, after the u_i, v_j step, the 'e' will be shifted to the least cost independent cell, thereby necessitating one more iteration. This is similar to the simplex table. If we bring in a wrong variable by mistake, it will go out in the next iteration. The only thing is that the solution will be reached later.

Chapter 12: The Assignment Problem

Q1. Answer the following independent situation relating to an assignment problem with a minimization objective:

- (i) Just after row and column minimization operations, we find that a particular row has two zeros. Does this imply that the 2 corresponding numbers in 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 assignment? Why? **(May 2016, Nov 2013)**

Ans. (i) Under the Hungarian Assignment Method, the prerequisite to assign any job is that each row and column must have a zero value in its corresponding cells. If any row or column does not have any zero value then to obtain zero value, each cell values in the row or column is subtracted by the corresponding minimum cell value of respective rows or columns by performing row or column operation. This means if any row or column have two or more cells having same minimum value then these row or column will have more than one zero. However, having two zeros does not necessarily imply two equal values in the original assignment matrix just before row and column operations. Two zeroes in a same row can also be possible by two different operations i.e. one zero from row operation and one zero from column operation.

(ii) The order of matrix in the assignment problem is 4×4 . The total assignment (allocations) will be four. In the assignment problem when any allocation is made in any cell then the corresponding row and column become unavailable for further allocation. Hence, these corresponding row and column are crossed mark to show unavailability. In the given assignment matrix two allocations have been made in A_{24} (2nd row and 4th column) and A_{32} (3rd row and 2nd column). This implies that 2nd and 3rd row and 2nd and 4th column are unavailable for further allocation.

Therefore, the other allocations are at either at **A11 and A43 or at A13 and A41**.

Q2. Prescribe the steps to be followed to solve an assignment problem. **(May 2013)**

Ans. The assignment problem can be solved by applying the following steps:

Step 1: Subtract the minimum element after row operation of each row from all the elements in that row. From each column of the matrix so obtained, subtract its minimum element. The resulting matrix is the starting matrix for the following procedure.

Step 2: Draw the minimum number of horizontal and vertical lines that cover all the zeros. If this number of lines is n , order of the matrix, optimal assignment can be made by skipping steps 3 and 4 and proceeding with step 5. If, however, this number is less than n , go to the next step

Step 3: Here, we try to increase the number of zeros in the matrix. We select the smallest element out of these which do not lie on any line. Subtract this element from all such (uncovered) elements and add it to the elements which are placed at the intersections of the horizontal and vertical lines. Do not alter the elements through which only one line passes.

Step 4: Repeat steps 1, 2 and 3 until we get the minimum number of lines equal to n .

Step 5(A): Starting with first row, examine all rows of matrix in step 2 or 4 in turn until a row containing exactly one zero is found. Surround this zero by $\square$, indication of an assignment there. Draw a vertical line through the column containing this zero. This eliminates any confusion of making any further assignments in that column. Process all the rows in this way.

Step 5(B): Apply the same treatment to columns also. Starting with the first column, examine all columns until a column containing exactly one zero is found. Mark $\square$ around this zero and draw a horizontal line through the row containing this marked zero. Repeat steps 5A and B, until one of the following situations arises:

- (i) No unmarked ($\square$) or uncovered (by a line) zero is left,
- (ii) There may be more than one unmarked zero in one column or row. In this case, put around one of the unmarked zero arbitrarily and pass 2 lines in the cells of the remaining zeros in its row and column. Repeat the process until no unmarked zero is left in the matrix.

Chapter 13: Critical Path Analysis

Q1. List the 5 steps involved in the methodology of critical path analysis.

(Nov 2010)

Ans. **Working Methodology of PERT:**

The working methodology of PERT which includes both CPM and PERT, consists of following five steps:

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

Chapter 14: Programme Evaluation and Review Technique

Q1. Under what circumstance PERT is more relevant? How?

(May 2013)

Ans. PERT (Program Evaluation and Review Technique) is more relevant for handling such projects which have a great deal of uncertainty associated with the activity durations.

To take these uncertainty into account, three kinds of times estimates are generally obtained. These are:

- The Optimistic Times Estimate: This is the estimate of the shortest possible time in which an activity can be completed under ideal conditions. For this estimate, no provision for delays or setbacks are made. We shall denote this estimate by t_o
- The Pessimistic Time Estimate: This is the maximum possible time which an activity could take to accomplish the job. If everything went wrong and abnormal situations prevailed, this would be the time estimate. It is denoted by t_p .
- The Most Likely Time Estimate: This is a time estimate of an activity which lies between the optimistic and the pessimistic time estimates. It assumes that things go in a normal way with few setbacks. It is represents by t_m .

Q2. Write a short note on the distinction between PERT and CPM.

(Nov 2012, May 2011)

Ans. The PERT and CPM models are similar in terms of their basic structure, rationale and mode of analysis. However, there are certain distinctions between PERT and CPM networks which are enumerated below:

- (i) CPM is activity oriented, while PERT is event oriented
- (ii) CPM is a deterministic model. It completely ignores the probabilistic element of the problem. PERT is a probabilistic model. It uses three estimates of activity time. Optimistic, pessimistic and most likely, with a view to take into account time uncertainty.
- (iii) PERT is primarily concerned with time. It helps the manager to schedule and coordinate various activities so that the project can be completed on scheduled time. CPM places dual emphasis on time and cost and evaluates the trade-off between project cost and project time. By deploying additional resources, it allows the project manager to manipulate project duration within certain limits so that the project duration can be shortened at an optimal cost.
- (iv) CPM is commonly used for those projects which are repetitive in nature and where one has prior experience of handling similar projects. PERT is generally used for those projects where time required to complete various activities are not known as prior.

Q3. State any 5 limitations of the assumptions of PERT and CPM.

(Nov 2011)

Ans. **Limitations of the assumption of PERT and CPM**

- (i) Beta distribution may not always be applicable
- (ii) The formulae for expected duration and standard deviation are simplification. In certain cases, errors due to these have been found up to 33 %
- (iii) The above errors may get compounded or may cancel each other

- (iv) Activities are assumed to be independent. But the limitations on the resources may not justify the assumption.
- (v) It may not always be possible to sort out completely identifiable activities and to state where they begin and where they end
- (vi) If there exist alternatives in outcome, they need to be incorporated by way of a decision tree analysis.
- (vii) Time estimates have a subjective element and to this extent, techniques could be weak. Contractors can manipulate and underestimate time in cost plus contract bids. In incentive contracts, overestimation is likely.
- (viii) Cost-time tradeoffs / cost curve slopes are subjective and even experts may be widely off the mark even after honest deliberations

Chapter 15: Simulation

Q1. How would you use the Monte Carlo simulation method in inventory control? **(May 2016)**

Ans. Use of **Monte Carlo Simulation** can be explained with the following steps involved in the method:

- (i) Define the problem and select the measure of effectiveness of the problem that might be inventory shortages per period.
- (ii) Identify the variables which influence the measure of effectiveness significantly for example, number of units in inventory.
- (iii) Determine the proper cumulative probability distribution of each variable selected with the probability on vertical axis and the values of variables on horizontal axis.
- (iv) Get a set of random numbers.
- (v) Consider each random number as a decimal value of the cumulative probability distribution with the decimal enter the cumulative distribution plot from the vertical axis. Project this point horizontally, until it intersects cumulative probability distribution curve. Then project the point of intersection down into the vertical axis.
- (vi) Then record the value generated into the formula derived from the chosen measure of effectiveness. Solve and record the value. This value is the measure of effectiveness for that simulated value. Repeat above steps until sample is large enough for the satisfaction of the decision maker.

Q2. Brief the reasons for using simulation technique to solve problems. **(May 2013)**

Ans. **Reasons for using simulation technique to solve problems:**

- It is not possible to develop a mathematical model and solutions without some basic assumptions.
- It may be too costly to actually observe a system.
- Sufficient time may not be available to allow the system to operate for a very long time.
- Actual operation and observation of a real system may be too disruptive.

Q3. What are the steps involved in the simulation process? **(Nov 2011)**

Ans. **Steps in Simulation Process**

1. Define the problem or system you intend to simulate.
2. Formulate the model you intend to use.
3. Test the model; compare its behavior with the behavior of the actual problem environment.
4. Identify and collect the data needed to test the model.
5. Run the simulation.
6. Analyse the results of the simulation and, if desired, change the solution you are evaluating.
7. Rerun the simulation to test the new solution.
8. Validate the simulation, that is, increase the chances that any inferences you draw about the real situation from running the simulation will be valid.

Q4. What are the steps involved in carrying out Monte Carlo simulation model?

(Nov 2010)

Ans. **Steps involved in Monte Carlo simulation are:**

- (i) To select the measure of effectiveness of the problem, that is, what element is used to measure success in improving the system modeled. This is the element one wants to maximize or minimize.
- (ii) Identifying the variables which influence the measure of effectiveness significantly.
- (iii) Determining the proper cumulative probability distribution.
- (iv) To get a set of random numbers.
- (v) Consideration of each random number as a decimal value of the cumulative probability distribution. With the decimal, enter the cumulative distribution plot from the vertical axis, Project this point horizontally, until it intersects cumulative probability distribution curve.
- (vi) Recording the value generated in step(v) into the formula derived from the chose measures of effectiveness. Solve and record the value.
- (vii) Repeating steps (v) and (vi) until sample is large enough for the satisfaction of the decision maker.

Chapter 16: Learning Curve Theory

Q1. 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.

(May 2015)

Ans. **Valid or Invalid for Learning Curve Theory-**

Sl. No.	Situation	Valid or Not Valid	Reason
(i)	Learning curve theory applies to a division of a company which is fully automated	Not Valid	It can be very effective in labour oriented industry but not in fully automated company.
(ii)	Learning curve theory helps in setting standards	Valid	If budgets and standards are set without considering the learning effect, meaning less variances are likely to occur. The learning curve is quite helpful in setting standards in learning phase.
(iii)	Learning curve helps in pricing decisions	Valid	The use of cost data adjusted for learning effect helps in development of advantageous pricing policy.
(iv)	Experienced workmen are more prone to learning effect	Not Valid	Activities being performed by experienced workmen, who are thoroughly familiar with those activities, will not be subject to learning effect.

Q2. State whether the learning curve theory can be applied to the following independent situations briefly justifying your decision:

- (i) 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.
- (ii) 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.
- (iii) Skilled workers have been employed for a long time. The company has adequate market for the craft pieces done by these experts.
- (iv) A company finds 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.

(Nov 2013)

Ans.

- (i) 'Learning Curve Theory' will not be applicable as alloy combination of the input metal is quite different among the suppliers hence learning experience with one type of metal may not be beneficial for the workers to deal with other metal with separate alloy composition.
- (ii) 'Learning Curve Theory' will not be applicable as in this situation rotation of labour is done frequently, labours will not be able to get the benefit of learning and apply their learning. Hence, learning curve theory cannot be applied.
- (iii) 'Learning Curve Theory' will not be applicable as in this situation as workers are skilled and employed for a long time, they have already achieved maximum level of expertise by taking advantage of learning. Hence, at this point of time learning curve theory cannot be applied.
- (iv) 'Learning Curve Theory' will not be applicable as indirect materials are the materials which are not used directly in the production (not directly proportionate with volume of output) and usually used machines (e.g. lubricants, spares parts etc.) with less human interactions. Adverse usage of indirect materials can be controlled through proper monitoring and appropriate standard settings and not from applying learning curve theory.

Q3. Bring out the main applications of Learning Curve.

(May 2013)

Ans. Knowledge of learning curve can be useful both in planning and control. Standard cost for new operations should be revised frequently to reflect the anticipated learning pattern. The main applications are summarised below:

- **Helps to analyse CVP relationship during familiarisation phase:** Learning curve is useful to analyse cost-volume-profit relationship during familiarisation phase of product or process and thus it is very useful for cost estimates. Learning curve can be used as a tool for forecasting.
- **Helps in budgeting and profit planning:** Budget manager should select those costs which reflect learning effect and then he should be able to incorporate this effect in process of developing budgets or in the exercises relating to project planning.
- **Helps in pricing:** The use of cost data adjusted for learning effect helps in development of advantageous pricing policy.
- **Design makers:** It helps design engineers in making decisions based upon expected (predictable from past experience) rates of improvement.
- **Helps in negotiations:** It is very useful to Government in negotiations about the contracts.
- **Helps in setting standards:** The learning curve is quite helpful in setting standards in learning phase.

Q4. What are the distinctive features of learning curve theory in manufacturing environment? Explain the learning curve ratio.

(Nov 2012, Nov 2010)

Ans. Learning curve ratio:

$$\frac{\text{Average Labour cost of first } 2N \text{ units}}{\text{Average Labour cost of first } N \text{ units}}$$

As the production quantity of a given item is doubled, the cost of the item decreases at a fixed rate. It occurs because of the following distinctive features of manufacturing environment.

- (i) Better tooling methods are developed and used.

- (ii) Design bugs are detected and corrected.
- (iii) More productive equipments are designed and used to make product.
- (iv) Better design engineering reduces material and labour costs.
- (v) Earlier teething problems are overcome. As production progresses management is prompted to achieve better planning and better management.
- (vi) Rejections and rework tend to diminish overtime.
- (vii) As quantity produced increases the Cost per unit decreases, since each unit entails:
 - ✓ Lesser labour
 - ✓ Greater productivity of material and labour
 - ✓ Fewer days and lesser time losses.

Q5. What are the limitations of the learning curve theory?

(Nov 2011)

Ans. **Limitations of Learning Curve Theory**

1. All activities of a firm are not subject to learning effect. (Activities that have not been performed in the present operational mode, those performed by new or unfamiliar employees are subjected to learning effect, while those performed by familiar or experienced workmen will not be subjected to learning effect)
2. It is correct that learning effect does take place and average time taken is likely to reduce. But in practice it is highly unlikely that there will be a regular consistent rate of decrease. Therefore any cost prediction based on conventional learning curves should be viewed with caution.
3. Considerable difficulty arises in obtaining valid data that will form basis for computation of learning effect.
4. Even slight change in circumstances quickly renders the learning curve obsolete. While the regularity of conventional learning curves can be questioned, it would be wrong to ignore learning effect altogether in predicting costs for decision purposes.