Paper 15 - Management Accounting –Enterprise Performance Management

Question 1.
(a) State whether the following statement are "True" or "False"

(i) To convert the assignment problem into a maximization problem, all elements of the matrix are deducted from the highest element in the matrix.

(ii) EVA encourages short-term performance.

(iii) A 'cost of quality report' indicates the total cost to the organization of producing products or services conforming with quality of requirements.

(iv) Balance Score Card is a performance measurement tool for controlling individual productivity.

(v) The Key factors of 'Theory of Constraints' are Contribution and Profit.

(b) Choose the most appropriate one from the stated options and write it down.

(i) Back flush costing is most likely to be used when
A. Management desires sequential tracking of costs
B. A Just-in-Time inventory philosophy has been adopted
C. The company carries significant amount of inventory
D. Actual production costs are debited to work-in-progress

(ii) In calculating the life cycle costs of a product, which of the following items would be included?
(i) Planning and concept design costs
(ii) Preliminary and detailed design costs
(iii) Testing costs
(iv) Production costs
(v) Distribution Costs

A. All of the Above
B. (Iv)And (v)
C. (ii), (iv) and (v)
D. (iv)

(iii) Quality Circle is
A. People-building philosophy
B. Based on the value of worker
C. Is a problem-solving technique
D. All of the above

(iv) In calculating the life cycle costs of a product, which of the following items would be included?
A. Planning and concept design costs
B. Preliminary and detailed design costs
C. Testing costs
D. Production costs

(v) Control in management parlance consists of five actions
1. Planning
2. Comparison of achievement of plan
3. Assessment of deviations
4. Corrective action for mismatch of performance with the plan
5. Execution.

The Correct sequence of these activities is
A. 1-2-3-4-5
B. 1-5-3-4-2
C. 1-4-5-3-2
D. 1-5-2-3-4

(c) Write out what the following abbreviations stands for in the context of Enterprise Performance Management.
   (i) MPS
   (ii) WAITRO
   (iii) JUSE
   (iv) FAST
   (v) QFD

   (d) Define the following terms in not more than two or three lines.

   (i) Zero defects
   (ii) The Shewhart Cycle
   (iii) Cost Driver
   (iv) Talent Drain
   (v) V in VAT Analysis

Answer to Question 1(a):

   (i) True
   (ii) False
   (iii) False
   (iv) False
   (v) False

Answer to Question 1(b):

   (i) B. A Just-in-Time inventory philosophy has been adopted
   (ii) A. All of the Above
   (iii) D. All of the above
   (iv) A. Planning and concept design costs
   (v) 1-5-2-3-4

Answer to Question 1(c):

   (i) Master Production Schedule
   (ii) World Association of Industrial and Technological Research Organisation
   (iii) Japanese Union of Scientists and Engineers
   (iv) Function Analysis System Technique
   (v) Quality Function Deployment

Answer to Question 1(d):

(i) Zero Defects does not mean mistakes never happen, rather that there is not allowable number of errors built into a product or process and that you get it right first time.

(ii) The Shewhart Cycle:
PLAN- Establish the objectives and processes necessary to delivery results in accordance with the specifications.
DO- Implement the process
CHECK- Monitor and evaluate the processes and results against objectives and specifications and report the outcome.
ACT- Apply actions to the outcome for necessary improvement.

(iii) Cost Driver, is the one that is selected and used as a basis with a view to assigning costs attached/attributed to an activity cost centre to cost objects-a term commonly used in ABC costing.

(iv) The talent Drain is the second potential problem in succession planning. Because upper management must identify a small group of managers to receive training and development promotion, those managers who are not assigned o development activities may feel overlooked leave the organizations. This turnover may reduce the number of talented managers of the lower and middle lower levels of the organization. They may work for a competing firm or start their own business, thus creating increased competition for their former company.

(v) V in VAT Analysis a logical structure (many-to-one-flow) starts with one or few raw materials and the product expands into a number of different products as it flows through its routings.

Question 2.
(a) Seasonal Ltd. is manufacturing Woolen Garments. It faces high demand during winter and slack demand during summer. Advise The Production Manager of Seasonal Ltd. how to adjust the production capacity to meet the current demand
Answer:
Options which can be used to increase or decrease capacity to match current demand include:

(i) **Hire/lay off -** By hiring additional workers as needed or by laying off workers not currently required to meet demand, firms can maintain a balance between capacity and demand.
(ii) **Overtime -** By asking or requiring workers to work extra hours a day or an extra day per week, firms can create a temporary increase in capacity without the added expense of hiring additional worker.
(iii) **Part-time or casual labor -** By utilizing temporary workers or casual labor (workers who are considered permanent but only work when needed, on an on-call basis, and typically without the benefits given to full-time workers).
(iv) **Inventory -** Finished-goods inventory can be built up in periods of slack demand and then used to fill demand during periods of high demand. In this way no new workers have to be hired, no temporary or casual labor is needed, and no overtime is incurred.
(v) **Subcontracting -** Frequently firms choose to allow another manufacturer or service provider to provide the product or service to the subcontracting firm's customer. By

subcontracting work to an alternative source, additional capacity is temporarily obtained.

(vi) Contract manufacturing: Sub letting spare or idle manufacturing facilities to other firms needing extra facilities. This is the reverse of sub-contracting.

(vii)Cross-training. Cross-trained employees may be able to perform tasks in several operations, creating some flexibility when scheduling capacity.

(viii)   Other methods. While varying workforce size and utilization, inventory buildup/ backlogging, and subcontracting are well-known alternatives, there are other, more novel ways that find use in industry. Among these options are sharing employees with countercyclical companies and attempting to find interesting and meaningful projects for employees to do during slack times.

(b) Enumerate the options available to a firm which wants to stimulate demand in order to utilize its idle capacity.
Answer:
Demand can be stimulated by the following ways:

(i) Pricing - Varying (lower) pricing to increase demand in periods when demand is less than peak. For example, matinee prices for movie theaters, off-season rates for hotels, night time rates for mobile telephone service, and off-season pricing for items that experience seasonal demand.

(ii) Promotion - Advertising, direct marketing, bulk purchase discounts, bonus/free offers and other forms of promotion are used to shift demand.

(iii) Back ordering - By postponing delivery on current orders demand is shifted to period when capacity is not fully utilized. This is really just a form of smoothing demand. Service industries are able to smooth demand by taking reservations or by making appointments in an attempt to avoid walk-in customer. Some refer to this as "partitioning" demand.

(iv) New demand creation - A new, but complementary demand is created for a product or service. When restaurant customers have to wait, they are frequently diverted into a complementary (but not complimentary) service, the bar. Other examples include the addition of video arcades within movie theaters, and the expansion of services at convenience stores.

(c) What is Linear Decision Rule?
Answer:
Linear decision rule is an optimizing technique. It seeks to minimize total production costs (labor, overtime, hiring/lay off, inventory carrying cost) using a set of cost-approximating functions (three of which are quadratic) to obtain a single quadratic equation. Then, by using calculus, two linear equations can be derived from the quadratic equation, one to be used to plan the output for each period and the other for planning the workforce for each period.

Question 3.
(a) What is the structure of the quality circle?
Answer:

A Quality Circle has an appropriate organizational structure for its effective and efficient performance. It varies from industry to industry, organization to organization. But it is useful to have a basic framework as a model. The structure of a Quality Circle consists of the following elements.

(i) A steering committee: This is at the top of the structure. It is headed by a senior executive and includes representatives from the top management personnel and human resources

development people. It establishes policy, plans and directs the program and meets usually once in a month.

(ii) Co-ordinator: He may be a Personnel or Administrative officer who co-ordinates and supervises the work of the facilitators and administers the programme.

(iii) Facilitator: He may be a senior supervisory officer. He co-ordinates the works of several quality circles through the Circle leaders.

(iv) Circle leader: Leaders may be from lowest level workers or Supervisors. A Circle leader organizes and conducts Circle activities.

(v) Circle members: They may be staff workers. Without circle members the porgramme cannot exist. They are the lifeblood of quality circles. They should attend all meetings as far as possible, offer suggestions and ideas, participate actively in group process, takes training seriously with a receptive attitude. The roles of Steering Committee, Co-0rdinator, Facilitator, Circle leader and Circle members are well defined.

(b) What is EFQM?

Answer:

EFQM a non-profit t membership foundation is the primary source for organizations in Europe looking to excel in their market and in their business. Founded in 1989 by the CEOs of prominent European businesses, EFQM is now the hub of excellent, globally minded organizations of all sizes and sectors, and both private and public. Specifically designed to help organizations achieve excellence in their business initiatives, the EFQM organization works to capture the best practices of globally-minded organizations and to turn this knowledge into practical resources for the business community. EFQM is a vibrant network of organizations that share the same ambitions to drive excellence through the organization and aspire to reach excellence. The **EFQM Excellence Model** is a framework for organizational management systems, promoted by the **European Foundation for Quality Management** (EFQM) and designed for helping organizations in their drive towards being more competitive.

Regardless of sector, size, structure or maturity, to be successful, organizations need to establish an appropriate management system. The EFQM Excellence Model is a practical tool to help organizations do this by measuring where they are on the path to excellence; helping them understand the gaps; and then stimulating solutions.

(c) What are the benefits of Kaizen Procedure?

Answer: Due to proper implementation of Kaizen Procedure, the following Tangible and Intangible benefits can be made available to the organizations :

Tangible Benefits – Sum total of small improvements contributed by all levels of employees can results in a big pile of improvements viz. Reduced Time/ Rejection/ Energy consumption etc. along with improved quality.

Intangible Benefits – There are many intangible benefits that go a long way in developing participative culture. These are :

(i) As the stress is on number (of small step improvements) it can be a single motivating factor for individual employees. They take pride in increasing this number.

(ii) As these are small step improvements calling for very negligible investment, it is virtually risk free.

(iii) It results in better team work due to certain principles of spiral thinking involved in basic philosophy.

(iv) With increased emphasis on waste elimination it gives the employees a sense of belonging towards organization while building a culture of loyalty.

(v) With emphasis on energy savings it helps the society as a whole in conserving improvement resources like electricity, fuel etc.

(vi) It results in change in attitude of work force from hostile to loyal, from destructive to constructive.

Question 4.
(a) What is Benchmarking? Discuss different types of Benchmarking.
Answer:

Benchmarking is the continuous, systematic process of measuring one's output and/or work processes against the toughest competitors or those recognized best in the industry. Benchmarking should not be treated as just comparison. It is necessary to have a point of reference to know how well one is doing. Comparing the results with a competitor helps the management to get a goal that is both desirable and achievable but provides no clue on how the goals are to be achieved. Benchmarking is a systematic and continuous measurement process. It is a process of measuring and comparing an organization's business processes against business process leaders anywhere in the world, to gain information which will help the organization to improve its performance. It is basically a quality practice. Companies choose to benchmark excellent companies whose business processes are analogous to their own.

Types of Benchmarking
Different types of benchmarking are outlined below, though some of them seem to overlap.

  (i) **Product Benchmarking (Reverse Engineering)** this is an age old practice of product oriented reverse engineering. Every organization buys its rival's products and tears them down to find out how the features and performances etc. compare with its products. This could be the starting point for improvement. When Ford Motor Company redesigned the Tauras in 1992, it benchmarked 209 features on the car against 7 competitors. The company then worked to match / excel the higher standard set by any of its rival, in each of these features with its own product. Japanese seemed to have excelled at this practice but to their credit it must be said that they just do not imitate, but ingeniously innovate.

  (ii) **Competitive Benchmarking** "A Measure of organizational performance compared against competing organization; studies the target specific product designs, process capabilities or administrative methods used by a company's direct competitors". Competitive Benchmarking moved beyond product oriented comparisons to include comparisons of process with those of competitors. In this benchmarking, the process studied may include marketing, finance, human resource, R & D etc. A typical example would be the classical study the Rank Xerox performed with those of Canon and other photo copier manufacturers when it faced heightened competition from US and Japanese companies.

  (iii) **Process Benchmarking** "The activity of measuring discrete performance and functionality against organizations through performance in excellent analogous business processes". To gain leadership position it is essential to look at a paradigm-shifting jump to a new way of managing a process; for this you may have to go beyond your industry and look at the "best-in-breed" to bring about a fundamental change and not just an incremental improvement. Cadbury India benchmarks its distribution and logistics function not with Nestle but with Hindustan Lever Ltd. For supply chain management the best practice would be that of Mumbai Dubbawallas, which has now won universal acclaim.

  (iv) **Internal Benchmarking** "An application of process benchmarking performed, within an organization by comparing the performance of similar business units or business processes". Hewlett Packard through an extensive internal benchmarking exercise on the Best Scheduling Practice amongst its several product groups was able to cut its "time-to-market" by half. For a company like HP introduction of new products in time was a crucial performance metric.

  (v) **Strategic Benchmarking** "The application of process benchmarking of the level of business strategy; a systematic process for evolving alternatives, implementing strategies, and improving performance by understanding and adapting successful strategy from

external partners who participated in an on-going business alliance". It will be seen that strategic benchmarking differs from operational benchmarking in its scope; it helps to develop a vision of the changed organizations; it will develop core competencies that will help sustained competitive advantage; targeting a specific shift in strategy such as entering new markets or develop new products, developing a new line of business or making an acquisition and creating an organization that is more capable of learning how to respond in an uncertain future because it has increased its acceptance of change.

(vi) **Global Benchmarking:** This is defined as "the extension of strategic benchmarking to include benchmarking partners on a global scale". A classic example of global benchmarking is given by Michael Hammer in his book "Re-engineering the corporation". He cites the example of Ford Company of US, which benchmarked its accounts payable function with that of Mazda in Japan and found to its astonishment that the entire function was managed by 5 persons as against 500 in Ford.

(b) What is Intranet? What are its advantages?

Answer: An **intranet** is a private computer network that uses Internet protocols and network connectivity to securely share part of an organization's information or operations with its employees. Sometimes the term refers only to the most visible service, the internal website. Briefly, an **intranet** can be understood as "**a private version of an Internet,**" or as a version of the Internet confined to an organization. Through such devices and systems off-site employees can access company information, computing resources and internal communications.

(i) **Workforce productivity** – Intranets can help users to locate and view information faster and use applications relevant to their roles and responsibilities. Users can access data held in any database the organization wants to make available, anytime and - subject to security provisions - from anywhere within the company workstations.

(ii) **Time** – With intranets, organizations can make more information available to employees on a "pull" basis (i.e.: employees can link to relevant information at a time which suits them) rather than being deluged indiscriminately by emails.

(iii) **Communication** – Intranets can serve as powerful tools for communication within an organization, vertically and horizontally. From a communications standpoint, intranets are useful to communicate strategic initiatives that have a global reach throughout the organization. The type of information that can easily be conveyed is the purpose of the initiative and what the initiative is aiming to achieve, who is driving the initiative, results achieved to date, and who to speak to for more information. By providing this information on the intranet, staffs have the opportunity to keep up-to-date with the strategic focus of the organization.

(iv) **Knowledge Management** – Web publishing allows '**cumbersome**' corporate knowledge to be maintained and easily accessed throughout the company using hypermedia and Web technologies. Examples include: employee manuals, benefits documents, company policies, business standards, news feeds, and even training, can be accessed using common Internet standards (Acrobat files, Flash files, CGI applications). Because each business unit can update the online copy of a document, the most recent version is always available to employees using the intranet.

(v) **Business operations and management** – Intranets are also being used as a platform for developing and deploying applications to support business operations and decisions across the internetworked enterprise

(vi) **Cost-effective** – Users can view information and data via web-browser rather than maintaining physical documents such as procedure manuals, internal phone list and requisition forms.

(vii)**Promote common corporate culture** – Every user is viewing the same information within the Intranet.

(viii)   Enhance Collaboration – With information easily accessible by all authorised users, teamwork is enabled.

Question 5.

ABC Ltd. operates a simple chemical process to convert a single material into three separate items, referred to here as X, Y and Z. All three end products are separated simultaneously at a single split-off point.

Product X and Y are ready for sale immediately upon split off without further processing or any other additional costs. Product Z, however, is processed further before being sold. There is no available market price for Z at the split-off point.

The selling prices quoted here are expected to remain the same in the coming year. During 2012-13, the selling prices of the items and the total amounts sold were:

      X – 186 tons sold for ₹ 1,500 per ton
      Y – 527 tons sold for ₹ 1,125 per ton
      Z – 736 tons sold for ₹ 750 per ton

The total joint manufacturing costs for the year were ₹ 6,25,000. An additional ₹ 3,10,000 was spent to finish product Z.

There were no opening inventories of X, Y or Z at the end of the year; the following inventories of complete units were on hand:

      X   180 tons
      Y   60 Tons
      Z   25 tons

There was no opening or closing work-in-progress.

Required:

   (i) Compute the cost of inventories of X, Y and Z for Balance Sheet purposes and cost of goods sold for income statement purpose as of March 31, 2013, using:
    (a) Net realizable value (NRV) method of joint cost allocation
    (b) Constant gross-margin percentage NRV method of joint-cost allocation.
   (ii) Compare the gross-margin percentages for X, Y and Z using two methods given in requirement.

Answer:

(a) Statement of Joint Cost allocation of inventories of X, Y and Z for Balance Sheet purposes
  (By using net realisable value method)

	Product			
	X (₹)	Y (₹)	Z (₹)	Total (₹)
Final Sales Value of total production	5,49,000	6,60,375	5,70,750	17,80,125
(Refer to Working Note 1)	(366 tons x ₹ 1,500)	(587 tons x ₹1,125)	(761 tons x Rs. 750)	
Less: Additional cost	---------	---------	3,10,000	3,10,000
Net realisable value	5,49,000	6,60,375	2,60,750	14,70,125
(at split-off point)				
Joint cost allocated (Refer to working note 2)	2,33,398	2,80,748	1,10,854	6,25,000

Cost of goods sold for income statement as of march 2013
(By using a realizable value method)

	Products			
	X (₹)	Y (₹)	Z (₹)	Total (₹)
Allocated joint cost	2,33,378	2,80,748	1,10,854	6,25,000
Additional costs	-------	--------	3,10,000	3,10,000
Cost of goods available for sale (CGAS)	2,33,398	2,80,748	4,20,854	9,35,000
Less: Cost of ending inventory	1,14,785	28,692	13,846	(1,57,323)

X: 49.18% Y: 10.22% x (CGAS) Z: 3.29% (Refer to working note)				
Cost of goods sold	1,18,613	2,52,056	4,07,008	7,77,677

Income Statement
(Showing gross margin and gross margin percentage)
(By using net realizable value method)

	Product			
	X	Y	Z	Total
Sales revenue (₹)	2,79,000 (186 tons x₹1,500)	5,92,875 (527 tons x₹1,125)	5,52,000 (736 tons x₹750)	14,23,875
Less: Cost of goods sold (₹)	1,18,613	2,52,056	4,07,008	7,77,677
Gross margi8n (₹)	1,60,387	3,40,819	1,44,992	6,46,198
Gross margin (%)	57,49%	57,49%	26,26%	

(b) Statement of joint cost allocation of inventories of X, Y and Z for Balance Sheet Purposes
(By using constant gross margin percentage net-realisable value method)

	Product			
	X (₹)	Y (₹)	Z (₹)	Total (₹)
Final sales value of total production	5,49,000	6,60,375	5,70,750	17,80,125
Less: Gross margin (Refer to working note 3)	2,60,641	3,13,517	2,70,967	8,45,125
	2,88,359	3,46,858	2,99,783	9,35,000
Less: Additional cost	-------	--------	3,10,000	3,10,000
Joint cost allocated	2,88,359	3,46,858	(10,217)	6,25,000

Note: The negative joint cost allocation to product Z illustrates one 'unusual' feature of the constant gross margin NRV method.

Cost of goods sold for income statement purpose
(By using constant gross margin percentage net-realisable value method)

	Product			
	X	Y	z	Total
Allocated joint cost	2,88,359	3,46,858	(10,217)	6,25,000
Joint cost			3,10,000	3,10,000
Cost of goods available for sale (CGAS)	2,88,359	3,46,858	2,99,783	9,36,000
Less: Cost of ending inventory X: [49.18%] Y: [10.22%] x CCGS Z: [3.29%]	1,41,815	35,449	9,863	1,87,1274
Cost of goods sold	1,46,544	3,11,409	2,89,920	7,47,873

Income Statement
(Showing gross margin and gross percentage by using constant gross margin constant gross margin percentage NRV method)

	Product			
	X	Y	Z	Total
Sales revenue (₹)	2,79,000	5,92,875	5,52,000	14,23,875
Less: Cost of goods sold (₹)	1,46,544	3,11,409	2,89,920	7,47,873

Gross margin (₹)	1,32,456	2,81,466	2,62,080	6,76,002
Gross margin (%)	47.475%	47.475%	47.478%	47.478%

(ii) Comparative statement of gross percentage for X, Y and Z
(Using net realizable value and constant gross margin percentage NRV methods)

Method	Product gross margin percentage		
	X	**Y**	**Z**
Net realisable	57.49	57.49	26.26
Constant gross margin %NRV	47.48	47.48	47.48

Working notes
1. **Total production of three products for the year 2012-2013**

Items/Products (1)	Quantity sold in tons (2)	Quantity of ending inventory in tons (3)	Total production (4) =(2)+(3)	Ending inventory % (5)=(3)/(4)
X	186	180	366	49.18
Y	527	60	587	10.22
Z	736	25	761	3.29

2. **Joint cost apportioned to each product:**

$$\frac{\text{Total joint cost}}{\text{Total net realisable value}} \times \text{Net realisable value of each product}$$

$$= \text{Total cost of product X} = \frac{₹6,25,000}{₹14,70,125} \times ₹5,49,000$$

Similarly, the joint cost of inventories of products Y and Z comes to Rs. 2,80,748 and Rs 1,10,854 respectively.

1. **Gross margin percentage**

Final sales value production	17,80,125
Less: Joint cost and additional costs (₹6,25,000+₹3,10,000)	9,35,000
Gross margin	8,45,125
Gross margin % (₹8,45,125/₹17,80,125) x 100	47.4756%

Question 6.
A Modern Packing Corporation specialises in the manufacture of one-liter plastic bottles. The firm's customers include dairy processors, fruit juice manufactures and manufactures of edible oils. The bottles are produced by a process called blow moulding. A machine heats plastic to the melting point. A bubble of molten plastic is formed inside a mould, and a jet of hot air is forced into the bubble. This blows the plastic into the shape of the mould. The machine releases the moulded bottle, an employee trims off any flashing (excess plastic around the edge), and the bottle is complete.
The Firm has four moulding machines, each capable of producing 100 bottles per hour. The firm estimates that the variable cost of producing a plastic bottle is 20 paise. The bottles are sold for 50 paise each.
Management has been approached by a local toy company that would like the firm to produce a moulded plastic toy for them. The toy company is willing to pay ₹3.00 per unit for the toy. The variable cost of manufacture the toy will be ₹2.40. In addition, Modern Packing Corporation would have to incur a cost of ₹20,000 to construct the needed mould exclusively for this order. Because the toy uses more plastic and is of a more intricate shape than a bottle, a moulding machine can produce only 40 units per hour. The customer wants 1,00,000 units. Assume that Modern Packing Corporation has the total capacity of 10,000 machine hours available during

the period in which the toy company wants the delivery of toys. The firm's fixed costs, excluding the costs to construct the toy mould, during the same period will be ₹2,00,000.

Required:

(a) If the management predicts that the demand for its bottles will require the use of 7,500 machine hours or less during the period, should the special order be accepted? Give the reasons.

(b) If the management predicted that the demand for its bottles would be higher than its ability to produce bottles, should the order be accepted? Why?

(c) The management has located a firm that has just entered the moulded plastic business. The firm has considerable excess capacity and more efficient moulding machines and is willing to subcontract the toy job or any portion of it for ₹2.80 per unit. It will construct its own toy mould. Determine Modern Packing Corporation's minimum expected excess machine hour capacity needed to justify producing any portion of the order itself rather than subcontracting it entirely.

(d) The management predicated that it would have 1,600 hours of excess machine hour capacity available during the period. Consequently, it accepted the toy order and subcontracted 36,000 units to the other plastic company. In fact demand for bottles turned out to be 9,00,000 units for the period. The firm was able to produce only 8,40,000 units because it had to produce the toys. What was the cost of the prediction error failure to predict demand correctly?

Answer:

Contribution From M bottle per hour	[100(0.5-.2)]	₹30
Contribution from toy per hour	[40(3-2.4)]	₹24

a) When the demand for the bottles is 7500or less hours, it is better to accept, toy order because it gives additional profit of ₹40000

b) When the capacity for bottles is more than 7500 hours, the toy order should not be accepted because the contribution of bottle ₹30, is more than the contribution per hour of toy ₹24

c) The level at which it is necessary tom sub contract the toy order is
[20000/(2.8-2.4)] = 50000 units

d) Computation of cost of prediction error

(i) Statement showing computation of profit if 36000 toys are given for sub contract

		Bottles	Toy manufacture	Toy Sub Contract	Total
i.	No. of units	8,40,000.00	64,000	36,000	
ii.	Contribution per unit	0.30	0.60	0.20	
iii.	Total Contribution	2,52,000.00	38,400.00	7,200.00	2,97,600.00
iv.	Fixed Cost	2,00,000.00	20,000.00	------------	2,20,000.00
v.	Profit	52,000.00	18,400.00	7,200.00	77,600.00

(ii) Computation of profit at actual position

		Bottles	Toys	Total
i.	No. of units	9,00,000.00	1,00,000.00	
ii.	Contribution per unit	0.30	0.20	
iii.	Total Contribution	2,70,000.00	20,000.00	2,90,000.00
iv.	Fixed Cost	2,00,000.00		2,00,000.00
v.	Profit	70,000.00	20,000.00	90,000.00
Therefore cost of prediction error (90,000-77,600)				₹12,400

Question 7.
(a) What is life cycle costing? Explain the stages in product life-cycle?
Answer: Life cycle costing is a technique which takes account of the total cost of owning a physical asset, or making a product, during its economic life. It includes the costs associated with acquiring, using, caring for and disposing of physical assets, including the feasibility studies, research, design, development, production, maintenance, replacement and disposal, as well as support, training and operating costs generated by the acquisition, use, maintenance and replacement of permanent physical assets.

Stages in Product Life Cycle :

There are five distinct stages in the life cycle of a product as follows:

Introduction stage – Research and engineering skill leads to product development. The product is put on the market and its awareness and acceptance are minimal. Promotional costs will be high, sales revenue low and profits probably negative. The skill that is exhibited in testing and launching the product will rank high in this phase as critical factor in securing success and initial market acceptance. Sales of new products usually rise slowly at first.
Growth Stage – In the growth stage product penetration into the market and sales will increase because of the cumulative effects of introductory promotion, distribution. Since costs will be lower than in the earlier stage, the product will start to make a profit contribution. Following the consumer acceptance in the launch stage it now becomes vital or secure wholesaler / retailer support. But to sustain growth, consumer satisfaction must be ensured at this stage. If the product is successful, growth usually accelerates at some point, often catching the innovator by surprise.
Maturity Stage – This stage begins after sales cease to rise exponentially. The causes of the declining percentage growth rate the market saturation – eventually most potential customers have tried the product and sales settle at a rate governed by population growth and the replacement rate of satisfied buyers. In addition there were no new distribution channels to fill. This is usually the longest stage in the cycle, and most existing products are in this stage. The period over which sales are maintained depends upon the firm's ability to stretch the cycle by means of market segmentation and finding new uses for it.
Saturation stage – As the market becomes saturated, pressure is exerted for a new product and sales along with profit begin to fall. Intensified marketing effort may prolong the period of maturity, but only by increasing costs disproportionately.
Declining Stage – Eventually most products and brands enter a period of declining sales. This may be caused by the following factors:
- Technical advances leading to product substitution
- Fashion and changing tastes
- Exogenous cost factors will reduce profitability until it reaches zero at which point the product's life is commercially complete.

(b) Indo Gulf Fertilizers Ltd. supports the concept of the terotechnology or life cycle costing for new investment decisions covering its engineering activities.

The company is to replace a number of its machines and the Production Manager is to run between the "X" machine, a more expensive machine with a life of 12 years, and the "W" machine with an estimated life of 6 years. If the "W" machine chosen it is likely that it would be replaced at the end of 6 years by another "W" machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below :

(₹)

Particulars	X	W
Purchase price	19,000	13,000
Trade-in-value	3,000	3,000
Annual repair costs	2,000	2,600
Overhead costs (p.a.)	4,000	2,000
Estimated financing costs averaged over machine life (p.a.)	10%	10%

You are required to recommend, with supporting figures, which machine to purchase, stating any assumptions made.

Answer:

Machine X – Life 12 years

	Year	Cost (₹)	Discount factor	Discounted cost (₹)
Purchase price	0	19,000	1.00	19,000
Overhead cost	8	4,000	0.47	1,880
Trade-in-value	12	(3,000)	0.32	(960)
Annual repair cost	1-12	2,000	6.81	13,620
				33,540

Annualised equivalent   =₹ 33,540/ 6.81   =₹ 4,925

Machine W – Life 6 years

	Year	Cost (₹)	Discount factor	Discounted cost (₹)
Purchase price	0	13,000	1.00	13,000
Overhead cost	4	2,000	0.68	1,360
Trade-in-value	6	(3,000)	0.56	(1,680)
Annual repair cost	1-6	2,600	4.36	11,336
				24,016

Annualised equivalent   =₹ 24,016/ 4.36   =₹ 5,508

Recommendation – Purchase Machine "X"

Assumptions:
   a. Same performance, capacity and speed
   b. No inflation
   c. 12 year-estimates are as accurate as 6-years estimates
   d. Cash flow at the year end.

Question 8.
(a) State the areas in which the application of learning curve theory can help a manufacturing organization?
Answer: The applicability of learning curve is more important in cases where the labour input in an activity is large and the activity is complex. The following are the areas where the effects of learning curve would be useful to decision making in a manufacturing organization:

   (i) Pricing decision – Since learning curve permit better cost prediction, it seems that they should be employed in pricing decision.
   (ii) Work scheduling – Learning curve increases a firm's ability to predict their required labour input and make it possible to forecast labour needs.

(iii) Capital budgeting – One of the most important aspects in capital budgeting problems is the amount of cash flows. The learning curve suggests that unit costs are likely to begin high and reducing afterwards.

(iv) Overtime decisions – Hiring more workers is not likely to be an easily reversible decision. Hence, if an organization is near the beginning its learning curve, it prefers to work overtime rather than hire additional workers who will not be needed later.

(v) Fixation of pay scales – In fixing pay scales and production bonus, the time needed to learn production process should be allowed for in calculating the wages and bonus for a period. The wage incentive schemes must recognize the learning curve i.e., the employees will need to be compensated during the early stages of learning for the lower than normal level of performance. This is due to lack of familiarity in the early stages of production rather than any lack of motivation of ability.

(vi) Cash budgets – Since learning effect reduces unit variable costs as more units are produced, it should be allowed for in cash flow projections.

(vii) Direct costs – The learning curve applies to an industry where there is a high labour turnover or when products and process are subject to frequent changes. As the labour hours or cost is reduced for repeat orders, a knowledge of learning curve helps in direct labour budget.

(viii) Setting of standard costs – If the learning phase is not recognized an incorrect standard may be established. When cumulative output is low the standard cost is high, resulting in favourable variances. The converse of this applies when cumulative output is high.

(b) A company has accepted an order for making 15 items of a specialized machine at a price of ₹4 lacs each. The delivery is to be completed within 4 months. The company works 23 days a month and the normal direct wages per day amount to ₹10,000. However, in case of need, the company can work over time upto 8 days during the said period at double the normal rate of wages. Overheads amount to ₹12,000 per normal working day but no overheads are charged on overtime working days. The material cost is ₹2,40,000 per machine. The company has estimated that it will take 10 working days to manufacture the first machine. The company is expected to experience a learning effect of 90% (b=0.152). The contract stipulates a penalty of ₹40,000 per machine delivered beyond the schedule of 4 months.

You are required to calculate the costs and advise the company whether it is preferable to work only during normal working days and pay penalty for any delayed delivery of the machines or to work overtime to avoid paying penalty.

Answer:

Working days 23 p.m. x 4	=	92 days	
Time per machine	=	10 days	
Learning curve	=	90%	
Average time for			
15 machines	$15 \times 10 \times 15^{-0.152}$	=	99.4 days
14 machines	$14 \times 10 \times 14^{-0.152}$	=	93.7 days
13 machines	$13 \times 10 \times 13^{-0.152}$	=	88.0 days

So 13 machines can be supplied in time

The company can work overtime or supply late with penalty

Alternative I – Profitability statement if worked overtime for balance 2 machines

		(₹)
Direct materials	(15 x 2,40,000)	36,00,000

Direct labour	Normal	(92 days x 10,000)	9,20,000
	Overtime	(7.4 days x 20,000)	1,48,000
Overheads		(92 days x 12,000)	11,04,000
Total cost			57,72,000
Profit			2,28,000
Sales			60,00,000

Alternative II – Profitability statement if supplied late with penalty

Direct materials	(15 x 2,40,000)	36,00,000
Direct labour	(99.4 days x 10,000)	9,94,000
Overheads	(92 days x 12,000)	11,04,000
Penalty	(2 x 40,000)	80,000
Total cost		57,78,000
Profit		2,22,000
Sales		60,00,000

Analysis: It is suggested to work overtime to maximize profit.

Question 9.
(a) A company is organized into two large Divisions. Division 'A' produces a component which is used by Division 'B' in making a final product. The final product is sold for ₹400 each. Division 'A' has a capacity to produce 2,000 units and the entire quantity can be purchased by Division B.
Division 'A' informed that due to installation of new machines, its depreciation cost had gone up and hence wanted to increase the price of the component to be supplied to Division B to ₹220. Division 'B' however can buy the component from the outside market at ₹200 each. The variable cost of Division 'B' in manufacturing the final product by using the component is ₹150 (excluding the component cost).
Present statement indicating the position of each Division and the company as a whole taking each of the following situations separately.

   (i) If there are no alternative use for the production facilities of A, will the company benefit if Division B buys from outside suppliers at Rs. 200 per component?
   (ii) If internal facilities of A are not otherwise idle and the alternative use of the facilities will give an annual cash operating saving of Rs. 30,000 to Division A, should Division B purchase the component from outside suppliers?
   (iii) If there are no alternative used for the production facilities of Division A and the selling price for the component in the outside market drops by Rs. 15, should Division B purchase from outside suppliers?
   (iv) What transfer price would you fix for the component in each of the above circumstances?
Answer:
(i) Statement of contribution
(a) When component is purchased by Division B from outside

			(₹)
Division A			Nil
Division B sales (2,000 x 400)		8,00,000	
Less: Cost of purchase (2,000 x 200)	4,00,000		
Variable Cost (2,000 x 150)	3,00,000	7,00,000	1,00,000
Company's total contribution			1,00,000

(b) When component is purchased from Division A by Division B

Division A			
Sales (2,000 x 220)		4,40,000	
Less: Variable cost (2,000 x 190)		3,80,000	60,000
Division B			
Sales (2,000 x 400)		8,00,000	
Less: Variable cost			
Purchase cost from Division A (2,000 x 220)	4,40,000		
Variable cost in Division B (2,000 x 150)	3,00,000	7,40,000	60,000
Company's total contribution			1,20,000

Thus, it will be beneficial for the company as a whole to ask Division B to buy the component from Division A.

(ii) Statement of total contribution if Division A could be put to alternative use :

Division A			
Contribution from alternative use of facilities			30,000
Division B			
Sales (2,000 x 400)		8,00,000	
Less: Variable cost			
Cost of purchase (2,000 x 400)	4,00,000		
Division B (2,000 x 150)	3,00,000	7,00,000	1,00,000
Company's total contribution			1,30,000

The company's contributions when component is purchased from outside, shows an increase of Rs. 30,000 as compared to when there is inter departmental transfer. Hence, it will be beneficial to purchase the component from outside.

(iii) Statement of total contribution when component is available from outside at Rs. 185

Division A			Nil
Division B			
Sales (2,000 x 400)		8,00,000	
Less : variable cost			
Cost of purchase (2,000 x 185)	3,70,000		
Division B	3,00,000	6,70,000	1,30,000
Company's total contribution			1,30,000

If the component is purchased by Division B from Division A, the contribution is only Rs. 1,20,000 as calculated under (i) above. Hence it will be beneficial to buy the component from outside.

(iv) Fixation of transfer price

> **(a)** When there are no alternative uses of production facilities of Division A In such a case the variable cost i.e. ₹190 per component will be charged

> **(b)** If facilities of Division A can be put to alternative uses :
>
> | Variable Cost | ₹190 |
> |---|---|
> | Opportunity cost | ₹15 |

Transfer Price	₹205

(c) If market price gets reduced to ₹185 and there is no alternative use of facilities of Division A.
The variable cost of ₹190 per component should be charged.

Question 10.
Short Notes:
(a) Backflush accounting
(b) Kaizen Costing
(c) Value Chain Management
(d) Margin of Safety
Answer:
(a) Backflush accounting

Backflush accounting is defined as 'a cost accounting system which focuses on the output of the organization and then work backwards to allocate costs between cost of goods sold and inventory'. In essence, backflush accounting is a simpler bookkeeping system designed to reflect key aspects of JIT system i.e. little or no work-in-progress and demand pull.

There are several variants of backflush accounting (BFA), a popular one being the replacement of separate raw material and WIP accounts with a single account; Raw and In Process (RIP) account. When items are sold the standard cost for the materials in the finished goods would be credited (or back flushed) to the RIP account. All conversion costs (labour and materials) would be applied to the cost of finished goods production, none would be applied to WIP.

(b) Kaizen Costing

Kaizen costing is a modification of standard costing which is essential to realize the planned cost reductions in continuous time. Kaizen costing is a Japanese contribution to cost accounting. Kaizen costing is continuous improvement applied to cost reduction in the manufacturing stage of a product's life. Like that of standard costing programme, the aim of Kaizen costing is to remove inefficiencies from production processes.

Kaizen costing tracks the cost reduction plans on a monthly basis. The Kaizen costing targets are expressed in the physical resources terms. If the head of a group fails to achieve the Kaizen costing target by 1 percent, review by senior will start. Resource consumption is so tightly controlled in many Japanese firms. Thus the planned cost reductions are planned and monitored through Kaizen cost targets in terms of physical resources.

While implementing the concept of Kaizen, following few rules are to be remembered :
   (i) List down your own problems.
   (ii) Grade your problems as to minor, difficult and major.
   (iii) Select the smallest minor problem and start with it. After tackling this, move on to next graded problem and so on.
   (iv) Know and always remember, improvement is a part of daily routine.
   (v) Never accept status quo.
   (vi) Never reject any idea before trying it.
   (vii) Share the experiments with colleagues.
   (viii) Eliminate already tried but failed experiments, while sharing the problems with your colleagues.
   (ix) Never hide problems, always highlight them.

(c) Value Chain Management

Value chain management (VCM) is a solution for smoothening the interaction between all partners of an enterprise, suppliers, dealers, bankers etc. VCM goes beyond supply chain management to bring synergy between business partner by way of providing business and knowledge information in the effective manner to help achieve business targets. There are three kinds of partners among whom a company try to build synergy.

(i) One if the normal supply chain management partners – suppliers, suppliers to suppliers, dealers, customers etc.

(ii) The second important partner category is the transporter who transports raw material and finished goods. The transporters play an important role in value chain.

(iii) The third important category of partners are service providers and banks.

(d) Margin of Safety

The margin of safety refers to sales in excess of the break-even volume. It represents the difference between sales at a given activity level and sales at break-even point. It is important that three should be a reasonable margin of safety to run the operations of the company in profitable position. A low margin of safety usually indicates high fixed overheads so that profits are not made until there is a high level of activity to absorb the fixed costs. A margin of safety provides strengths and stability to a concern.

The margin of safety is an important measure, especially in times of receding sales, to know the real position to operate without incurring losses and to take steps to increase the margin of safety to improve the profitability.

Margin of safety is calculated by using the following formulae :

Margin of safety = Actual sales – Break-even sales

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

$$= \frac{\text{Profit x Selling Price p.u.}}{\text{Selling Price p.u. – Variable cost p.u.}}$$

The higher the margin of safety, the better profitability of the product/ product line. The margin of safety can be improved by adopting any of the following steps :

(i) Keeping the break-even point at lowest level and try to maintain actual sales at highest level.

(ii) Increase in sales volume.

(iii) Increase in selling price.

(iv) Change in product mix increasing contribution.

(v) Lowering fixed cost.

(vi) Lowering variable cost.

(vii) Discontinuance of unprofitable products in sales mix.

Question 11.

(a) A factory engaged in manufacturing plastic buckets is working at 40% capacity and produces 10,000 buckets per month. The present cost break-up for one bucket is as under :

Materials	₹20
Labour	₹6
Overheads	₹10 (60% fixed)

The selling price is Rs. 40 per bucket. If it is decided to work the factory at 50% capacity, the selling price falls by 3%. At 90% capacity, the selling price falls by 5% accompanied by a similar fall in the price of materials.

You are required to prepare a statement showing the profits at 50% and 90% capacities and also determine the break-even points at each of these production levels.

Answer:

Flexible budget

Capacity level	40% Present	50%	90%
Production and sales (units)	10,000	12,500	22,500
Selling price (₹)	40.00	38.80	38.00
Sales (a)	4,00,000	4,85,000	8,55,000
Variable cost			
Materials @ ₹20	2,00,000	2,50,000	4,27,500
Labour @ ₹6	60,000	75,000	1,35,000
Variable overheads (₹10 x 40/100)	40,000	50,000	90,000
Total (b)	3,00,000	3,75,000	6,52,500
Contribution (a) – (b)	1,00,000	1,10,000	2,02,500
Less: Fixed overheads (Rs. 10 x 60/100 x 10,000 units	60,000	60,000	60,000
Profit	40,000	50,000	1,42,500
Contribution per unit	10.00	8.80	9.00
Breakeven point (units) = Fixed Overhead Contribution per unit	6,000	6,818	6,677

(b) What is target costing and what are the stages to the methodology?
Answer: Target costing is defined 'as a cost management tool for reducing the overall cost of a product over its entire life cycle with the help of the production, engineering, R&D.'

The target cost is the estimated cost of a product that enables a company to remain and compete in the market in the long run. The idea of target costing, originally promoted in Japan, is about going upstream to achieve cost reduction. Target costing is not really a method of costing, but it is a technique used in cost management. The intent of target costing is to reduce cost, where reduction is aimed at the entire life cycle of any product. Target costing can also help in achieving certain broader objectives, such as, identifying and delivering various customer requirements in a product through effective management of different processes.
A firm's business plan and product market strategies provide the framework and basic guidelines for applying the target costing methodology. Specific steps involved in target costing may be summarized as follows:

(i) Determine customer wants precisely.

(ii) Translate them into desired product performance feature.

(iii) Estimate the proportion of value added by each feature and component.

(iv) Choose a product design assures a targeted profit, and cost targets for each component in total.

(v) Choose manufacturing design that assures targeted costs.

(vi) Choose suppliers that assure buying at targeted costs.

(vii) After each cost review, conduct value engineering to reduce target costs.

(viii) Monitor initial production to be sure that all product performance, cost, profit, targets are met.

Question 12.

The directors of ABC Ltd. manufactures three products A,B and C, have as ked for advice on the product mix of the company. The following information is given:

Particulars		Products		
		A	**B**	**C**
Standard cost per unit :				
Direct material		**20**	**60**	**40**
Variable overhead		**6**	**4**	**10**
Direct labour :				
Department	**Rate/ Hr.**	**Hrs.**	**Hrs.**	**Hrs.**
1	Re. 1	28	16	30
2	Rs. 2	5	6	10
3	Re. 1	16	8	30
Current production p.a.		**10,000**	**5,000**	**6,000**
Selling price per unit	₹	**100**	**136**	**180**
Forecast of sales for next year		**12,000**	**7,000**	**9,000**

Fixed overheads p.a. ₹4,00,000.

Further, the type of labour required by Dept. 2 is in short supply and it is not possible to increase the manpower of this department beyond its present level.

(a) You are required to prepare a statement showing the most profitable mix of the products to be made and sold. The statement which should be presented in two parts should show :

(i) the profit expected on current budgeted production; and

(ii) The profit which could be expected if the most profitable mix was produced.

(b) You are also required to bring out any problems which are likely to arise if the product mix in (a) (ii) above were to be adopted.

Answer:

(a) (i) Statement showing profit on current budgeted production

Products Units	A 10,000	B 5,000	C 6,000	Total
Sales (₹) (i)	10,00,000	6,80,000	10,80,000	27,60,000
Direct material	2,00,000	3,00,000	2,40,000	7,40,000
Direct wages :				
Dept 1	2,80,000	80,000	1,80,000	5,40,000
2	1,00,000	60,000	1,20,000	2,80,000
3	1,60,000	40,000	1,80,000	3,80,000

Variable overhead	60,000	20,000	60,000	1,40,000
Marginal cost (ii)	8,00,000	5,00,000	7,80,000	20,80,000
Contribution (i) – (ii)	2,00,000	1,80,000	3,00,000	6,80,000
Fixed overhead				4,00,000
Net profit				2,80,000

Particulars	A	B	C
Marginal cost (per unit)	80	100	130
Contribution (per unit)	20	36	50
Contribution (per hour of Dept 2)	4	6	5
Ranking	III	I	II

Since the key factor is labour hours, production hours should be applied for the products in the order B, C and A, as ranked above.

Total hours available in Dept. 2 on the basis of current production

A	(10,000 x 5)	50,000
B	(5,000 x 6)	30,000
C	(6,000 x 10)	60,000
Total hours		1,40,000

Reallocation on Hrs. available in Dept. 2

Product	Units	Hrs. per unit	Total hours
B	7,000	6	42,000
A	9,000	10	90,000
C	1,600	5	8,000*
			1,40,000

*balancing figure

ii. **Statement of profit as per revised programme**

Units	A 1,600	B 7,000	C 9,000	Total
Sales	1,60,000	9,52,000	16,20,000	27,32,000
Marginal costs	1,28,000	7,00,000	11,70,000	19,98,000
Contribution	32,000	2,52,000	4,50,000	7,34,000
Fixed cost				4,00,000
Net profit				3,34,000

iii. The following possible problems should be guarded against before taking the above decision :

(i) The demand for product A may be complementary to demand for the other products. If it is so, sales of B and C may fall with fall in demand of product A.

(ii) Lower production of product A may adversely affect customers' preferences for other products.

Question 13.
Short Notes:
(a) BPR
(b) JIT
(c) Demand Stimulation
(d) Level Strategy

Answer:

(a) BPR

Davenport and Short have defined BPR as 'the analysis and design of workflows and processes within and between organizations'.

According to Teng, BPR is 'the critical analysis and radical re-design of existing business processes to achieve improvements in performance measures'.

A comparison between Total Quality Management and BPR shows that BPR requires the change to be fundamental and thus more beneficial to the customers.

BPR is a continuous process of rethinking, re-assessment, re-design, evaluation of each element of business process and consequent improvement in structure and work place. It takes care of all facets of operation in an organization. It gives stress on management system, social system and behavioural system. It analyses them and comes out with proposed change in process of operation. Re-engineering efforts is towards brining changes.

While the concept is generally understood in relation to direct areas of operations of a business such as production, marketing or distribution, it is equally applicable to indirect areas such as finance, accounting, personnel etc. BPR means starting all over, starting from scratch
   (i) It starts with the top management and with a corporate vision.
   (ii) Targeting customers and trying to improve systems and procedures to achieve this.
   (iii) Increasing the clock speed of the organization.
   (iv) Drilled down the thinking process for each vital element of the organization like personnel, structure design, drawings, raw materials, accounting practices, MIS, finance and find out the constraints/ bottlenecks in the process.
   (v) Avoids unnecessary work, demolish obsolete methods and systems if required.

(b) JIT

Just in time (JIT) philosophy was first developed in Japan. Toyota introduced it in 50's and later, other companies in Japan have adopted it.

The overriding feature of JIT is that materials or parts are generated in the exact quantity required and just at the time they are needed. A classic JIT system consists of a series of manufacturing units each delivering to one another in successive stages of production. The amount delivered by each unit to the next unit is exactly what the needs for the next production period (usually one day). There are no safety margins in the form of buffer stock, live storage or work-in-progress. JIT is a sophisticated approach in eliminating wastage in the process of manufacturing in different stages, say, from the production design stage to the stage of delivery of finished product. JIT is sometimes regarded as an inventory control technique or a purchasing method. It aims at eliminating all activities which do not add 'value' to the product.

Schonberger defines JIT as being 'to produce and deliver finished goods just in time to be sold, sub assemblies just in time to be assembled into finished goods, fabricated parts just in time to go into sub assemblies and purchased materials just in time to be transformed into fabricated parts'.

(c) Demand Stimulation

Options for situations in which demand needs to be increased in order to match capacity include:
 (i) **Pricing -** Varying (lower) pricing to increase demand in periods when demand is less than peak. For example, matinee prices for movie theaters, off-season rates for hotels, night time rates for mobile telephone service, and off-season pricing for items that experience seasonal demand.
 (ii) **Promotion -** Advertising, direct marketing, bulk purchase discounts, bonus/free offers and other forms of promotion are used to shift demand.
 (iii) **Back ordering -** By postponing delivery on current orders demand is shifted to period when capacity is not fully utilized. This is really just a form of smoothing demand. Service industries are able to smooth demand by taking reservations or by making appointments in an attempt to avoid walk-in customer. Some refer to this as "partitioning" demand.
 (iv) **New demand creation -** A new, but complementary demand is created for a product or service. When restaurant customers have to wait, they are frequently diverted into a complementary (but not complimentary) service, the bar. Other examples include the addition of video arcades within movie theaters, and the expansion of services at convenience stores.

(d) Level Strategy

A level strategy seeks to produce an aggregate plan that maintains a steady production rate and/or a steady employment level. In order to satisfy changes in customer demand, the firm must raise or lower inventory levels in anticipation of increased or decreased levels of forecast demand. The firm maintains a level workforce and a steady rate of output when demand is somewhat low. This allows the firm to establish higher inventory levels than are currently needed. As demand increases, the firm is able to continue a steady production rate/steady employment level, while allowing the inventory surplus to absorb the increased demand.

A second alternative would be to use a backlog or backorder. A backorder is simply a promise to deliver the product at a later date when it is more readily available, usually when capacity begins to catch up with diminishing demand. In essence, the backorder is a device for moving demand from one period to another, preferably one in which demand is lower, thereby smoothing demand requirements over time. A level strategy allows a firm to maintain a constant level of output and still meet demand. This is desirable from an employee relations standpoint. Negative results of the level strategy would include the cost of excess inventory, subcontracting or overtime costs, and backorder costs, which typically are the cost of expediting orders and the loss of customer goodwill.

Question 14.
(a) What is Management Control System? What are its purposes?
Answer

Joseph Maciariello & Calvin Kirby have defined M.C.S. as follows MCS is a set of inter-related communication structures that facilitates the processing of information for the purpose of

assisting managers in coordinating the parts and attaining the purpose of an organization on a continuous basis.

They view "the entire organization as a control system. 'Control' is seen as a characteristic of a control system; it occurs when the organization is attaining its purpose. Purpose and attainment of purpose are central to the work of control system."

Purposes of MCS, according to them are

(i) Coordination of parts of organization
(ii) Steering those parts to achieve organizational goals.
(iii) Bring along unity out of the diverse activities of an organization

(b) Explain the impact of budgetary control system on human behavior.
Answer: The budget process affects behavior in three aspects

(i) Formulation of budgets - The budgeting process may be top – down, determined wholly by top management. This may engender a feeling of budgets being thrust upon employees who perceive them as pressure devices; as a result their full enthusiasm may not be forthcoming in implementing it. In case the budget is formulated with a bottom-up approach, involving employees, commitment for meeting the budget can be assured.

(ii) Fixing targets - Sales production and other targets that are fixed should be challenging but attainable so as to bring out the best efforts of individuals. If targets are so high, as to be unattainable, it may de motivate employees: in some cases it may also lead to manipulation of data to ensure conformity with budget. However such manipulations will have adverse effects in the long run. A common practice is far sales manager to dump stocks on their dealers at the year end to meet sales targets, perhaps giving unduly long credit.

(iii) Evaluation of performance - The evaluation of performance should be done in a constructive manner and not in vindictive style. While variances may be thrown up by the system, the causative factors may not be known readily. Hence it is necessary to analyze the reasons for variance and ensure proper accountability.

(c) What is operations strategy? What are the criteria for evaluating an operation strategy?
Answer: According to Slack and Lewis, operations strategy holds the following definition:
Operations strategy is the total pattern of decisions which shape the long-term capabilities of any type of operations and their contribution to the overall strategy, through the reconciliation of market requirements with operations resources.

Criteria for Evaluating an Operations Strategy
Consistency (internal and external)
Between the operations strategy and the overall business strategy
Between the operations strategy and the other functional strategies within the business
Among the decision categories that make up the operations strategy
Between the operations strategy and the business environment (resources available, competitive behaviour, governmental restraints, etc.)
Contribution (to competitive advantage)
Making trade-offs explicit, enabling operations to set priorities that enhance the competitive advantage.
Directing attention to opportunities that complement the business strategy Promoting clarity regarding the operations strategy throughout the business unit so its potential can be

fully realized.
Providing the operations capabilities that will be required by the business in the future.

Question 15.
Distinguish between
(a) Strategic Planning and Management Control
(b) Management Control and Operational Control
Answer:

(a) Strategic Planning and Management Control

Characteristic	Strategic Planning	Management Control
Focus of plans	On one aspect at a time	On whole organization
Complexities	Many variables	Less complex
Degree of structure	Unstructured and irregular: each problem different	Rhythmic: prescribed Procedures
Nature of information	Tailor-made for the problem; more external and predictive; less accurate	Integrated; more internal and historical; more accurate
Communication of information	Relatively simple	Relatively difficult
Purpose of estimates	Show expected results	Lead to desired results
Persons primarily involved	Staff and to management	Line and top management
Number of persons involved	Small	Large
Mental activity	Creative; analytical	Administrative: persuasive
Source discipline	Economics	Social psychology
Planning and control	Planning dominant, but some Control	Emphasis on both planning and control
Time horizon	Tends to be long	Tends to be short
End result	Policies and precedents	Action within policies and Precedents
Appraisal of the job done	Extremely difficult	Much less difficult

(b) Management Control and Operational Control

Characteristic	Management Control	Operational Control
Focus of activity	Whole operation	Single task or transaction
Judgment	Relatively much; subjective decision	Relatively little; reliance on rules
Nature of structure	Psychological	Rational
Nature of information	Integrated; financial data throughout; approximations acceptable; future and historical	Tailor – made to the operation often non – financial; precise; often in real time

Persons primarily involved	Management	Supervisors (or none)
Mental activity	Administrative; persuasive	Follow directions (or none)
Source discipline	Social psychology	Economics; physical sciences
Time horizon	Weeks, months years	Day to day
Type of costs	Discretionary	Engineered

Question 16.

After observing heavy congestion of customers over a period of time in a petrol station, Mr. Khan has decided to set up a petrol pump facility on his own in his nearby site. He has complied statistics relating to the potential customer arrival pattern and service pattern as given below. He has also decided to evaluate the operations by using the simulation technique.

Arrivals		Services	
Inter-arrival time (minutes)	Probability	Inter-arrival time (minutes)	Probability
2	0.22	4	0.28
4	0.30	6	0.40
6	0.24	8	0.22
8	0.14	10	0.10
10	0.10		

Assume:
  (i) The clock starts at 8.00 hours
  (ii) Only one pump is set-up
  (iii) The following 12 Random Nos. are to be used to depict the customer arrival pattern

78	26	94	08	46	63	18	35	59	12	97	82

  (iv) The following 12 Random Nos. are to be used to depict the service pattern

44	21	73	96	63	35	57	31	84	24	05	37

You are required to find out the
  (i) Probability of the pump being idle
  (ii) Average time spent by a customer waiting in queue.

Answer:

Inter-arrival time				Service time			
Inter-arrival time (minutes)	Probability	Cumulative probability	Range	Inter-arrival time (minutes)	Probability	Cumulative probability	Range
2	0.22	0.22	00-21	4	0.28	0.28	00-27
4	0.30	0.52	22-51	6	0.40	0.68	28-67
6	0.24	0.76	52-75	8	0.22	0.90	68-89
8	0.14	0.90	76-89	10	0.10	1.00	90-99
10	0.10	1.00	90-99				

Sl.no	Random No. for inter-arrival	Inter-arrival time	Entry time in queue	Service start time	Random no. for service	Service time	Service end time	Waiting time of customer	Idle time
1	78	8	8.08	8.08	44	6	8.14	-	8
2	26	4	8.12	8.14	21	4	8.18	2	-
3	94	10	8.22	8.22	73	8	8.30	-	4

4	08	2	8.24	8.30	96	10	8.40	6	
5	46	4	8.28	8.40	63	6	8.46	12	
6	63	6	8.34	8.46	35	6	8.52	12	
7	18	2	8.36	8.52	57	6	8.58	16	
8	35	4	8.40	8.58	31	6	9.04	18	
9	59	6	8.46	9.04	84	8	9.12	18	
10	12	2	8.48	9.12	24	4	9.16	24	
11	97	10	8.58	9.16	05	4	9.20	18	
12	82	8	9.06	9.20	37	6	9.26	14	
Total Validity Time								140	12

Average waiting time spent by the customer= 140/12= 11.67 minutes.
Probability of idle time of the petrol station= 12/86= 0.1395 or 13.95% idle, say 14%.

Question 17.
(a) "Purpose of Sensitivity analysis is to identify the critical variable in project analysis."-Discuss.
Answer: Sensitivity analysis applied to a Capital project will show the margin of error in various parameters of a project which can be allowed before the project ceases to be profitable. Sensitivity analysis is a good technique for focusing the attention of management on critical variable and showing where additional analysis may be beneficial before finally accepting a project. It does not directly measure risk and it is limited by only being able to examine the effect of change in one variable, while the others remaining constant, an unlike occurrence in practice.

(b) The sales Manager of the Electronic Toy Company is considering two toys: a doll and a game. The toys have discrete probability distribution of cash inflows in each of the next three years.

Event	Doll (₹)	Probability	Game
Prosperity	20,000	0.2	42,000
Normal	15,000	0.5	20,000
Recession	9,000	0.3	(5,000)

    (i)   For each toy item, compute
      1. The expected value of the cash inflow in each of the next three years.
      2. The standard deviation
    (ii) Which toy would you select and why?
Answer:

For the doll:
Expected Value= ₹20,000 x 0.2 + ₹15,000 x 0.5 + ₹9,000 x 0.3= ₹14,200

For the game:
Expected Value=₹42,000 x 0.2 + ₹20,000 x 0.5 - ₹5,000 x 0.3=₹16,900

For the doll:
$\sigma= [0.2(20,000-14,200)^2 + 0.5(15,000-14,200)^2 +0.3(9,000-14,200)^2]^{1/2}$
= ₹3,893.58
For the game:
σ=₹16,573.77

Coefficient of variation: doll $\frac{3893.85}{14,200} \times 100 = 27.4\%$

Game $\frac{16,573.77}{16,900} \times 100 = 98.1\%$

CV is lower in Doll-Therefore Doll should be chosen-Risk is lower

(c) What is Extended Supply Chain?

Answer: The extended supply chain is a clever way of describing everyone who contributes to a product. So if you make text books, then your extended supply chain would include the factories where the books are printed and bound, but also the company that sells you the paper, the mill where that supplier buys their stock, and so on. It is important to keep track of what is happening in your extended supply chain because with a supplier or a supplier's supplier could end up having an impact on you (as the old saying goes, a chain is only a strong as its weakest link). For example, a fire in a paper mill might cause the text book manufacturer's paper supplier to run out of inventory. If the text book company knows what is happening in its extended supply chain it can find another paper vendor.

Question 18.

The Managers of Soundtrack Ltd. were surprised at a recent newspaper article, which suggested that the company's performance in last two years had been poor. The MD commented that the turnover had increased by nearly 17% and pre-tax profit by 25% between the last two financial years and that the company compared well with others in the same industry.

The Company seeks your opinion on the issue and provides you with the following details:

₹in Crores

Profit and Loss Account extracts for the year		
	2011-12	**2012-13**
Turnover	**326**	**380**
Pre-tax accounting profit (*)	**67**	**84**
Taxation	**23**	**29**
Profit after tax	**44**	**55**
Dividends	**15**	**18**
Retained earnings	**29**	**37**

Balance sheet extracts for the year ending

	2011-12	**2012-13**
Fixed Assets	**120**	**156**
Net Current Assets	**130**	**160**
	250	**316**
Financed by:		
Shareholders' funds	**195**	**236**
Medium and long-term loans	**55**	**80**
	250	**316**

(*) After deduction of the economic depreciation of the Company's fixed assets. This is also the depreciation used for tax purposes.

Other information:

(i) Soundtrack had non-capitalized leases Valued at ₹10 crore in each year 2011-13.

(ii) Balance sheet capital employed at 31.03.2011 was ₹223 crore.

(iii) The company's pre-tax cost of debts was estimated to be 9% in 2011-2012 and 10% in 2012-13.

(iv) The Company's cost of equity was estimated to be 15% in 2011-2012 and 17% in 2012-2013.
(v) The target capital structure is 60% equity and 40% debt.
(vi) The effective tax rate was 35% in both 2011-2012 and 2012-13.
(vii)Economic depreciation was ₹30 crore in 2011-12 and ₹35 crore in 2012-13.
(viii)   Other than cash expenses were ₹10 crore per year in both 2011-12 and 2012-13.
(ix) Interest expenses was ₹4 crore in 2011-12 and ₹6 crore in 2012-13.
Required:
(i)   Estimate the Economic Value Added (EVA) for Soundtrack Ltd., for both 2011-12 and 2012-13.
(ii) Comment upon the performance of the Company.

Answer:

The following adjustments are made to arrive at the Economic Value Added (EVAs):
(i)   No adjustment is needed for depreciation as the question gives the profits (computed) using economic depreciation.
(ii) Non-cash expenses are added back so that the adjusted profits attempt to approximate cash flows.
(iii) Net interest is added back as the returns required by the providers of funds will be reflected in the cost of capital deduction.
(iv) EVA is calculated on the capital employed at the start of each period, which should approximate book economic value. Because insufficient information is given, the book value of the shareholders funds plus medium and long-term loans at the end of 2011-12 is used as the starting point to determine capital employed at the beginning of 2012-13.

(₹ in crore)

(i)	2011-12	2012-13
Adjustment profit	44+10+4(0.65)=56.6	55+10+6(0.65)=68.9
Capital employed	(223+10)=233	(250+10)=260

Cost of capital:
The weighted average cost of capital should be based on the target capital structure:
For 2011-12 it is (15% x 0.6) + (9% x 0.65 x 0.4)=11.34%
For 2012-13 it is (17% x 0.6) + (10% x 0.65) x 0.4=12.8%

EVA for 2011-12= 56.6- (233 x 0.1134)=₹30.18 cr.
EVA for 2012-13=68.9-(260 x 0.128)=₹35.62 cr.

(ii) Comment on the performance of the Company:
The EVA measures indicate that the company has added significant value in both years and achieved a satisfactory level of performance.

Question 19.
(a) Discuss Matrix structure of organization. What are its advantages and disadvantages?

Answer:

Matrix Structure
Matrix Organization Structure combines the coordination and control of the decentralized structure with the technical excellence economies of scale of the functional structures to reap the benefits of both. While managing complex programs as in large high-technology programs, complex products and services and multinational business, organization face several coordination problems. A matrix avoids such problems as the total responsibility for achieving the goals and objective of the program lies with Program Manager but must share resources

from the various functional heads. The functional managers assigned to the projects are administratively reporting to the Project Manager but functionally to the Function Head.

The distinguishing feature of the matrix structure is thus the dual dimensions of management embodied in it. The outputs produced by the organization may be identified in the rows of the matrix while functional inputs utilized by each project may be identified in the columns of the matrix. The total outputs of the functions are found in the last column of the matrix. Though the Project Manager assumes full responsibility for delivery of a product which meets performance specifications he does not have direct authority over the functional organization that actually performs the work. The functional personnel thus operate under the knowledge-based authority of the function and the resource-based authority of the Project Manager. This may create a friction in the course of the work but it is up to the Project Manager to use it as a creative friction to further the goals of the program.

The matrix organization structure is suitable for projects which are not large enough to warrant a fully decentralized set-up, with all functional managers under each project. Decentralization may result in loss of scale economics, by way of duplication of functional services for several projects. The matrix structure is suitable for projects of short duration.

Advantages
- **(i)** Ensures better coordination and control of the decentralized structure along with achieving technical excellence and economies of scale of the functional organization.
- **(ii)** Fosters creativity and multiple sources of diversity.
- **(iii)** Broader middle-management exposure to strategic issues of the business.
- **(iv)** Acts as a good training ground for future leaders.

Disadvantages
- **(i)** Dual accountability as explained above, which may create confusion.
- **(ii)** Necessitates tremendous horizontal and vertical coordination.
- **(iii)** Difference in orientation between Program and Functional personnel. The functional person may aim for high technical performance not warranted by project requirement.
- **(iv)** Diffuse responsibility - As responsibility is distributed between program and functional personnel becomes difficult to administer system of accountability, leading to potential conflict.
- **(v)** Program personnel may have a sense of insecurity as soon as a project is completed and this may lower their morale.
- **(vi)** The design of the reward structure for program and functional personnel is a ticklish issue which should be worked out in a fair and transparent manner to satisfy all.

(b) Discuss Management Style & Culture

Answer:

Management Style may be summarized as a continuum between highly autocratic or external style or Theory X Style and highly participative or internal style or Theory Y style.

In the external style there is
(a) Centralization of authority and decision making and lower levels of management have to strictly comply with the formal procedures laid.
(b) The organization structure is pyramidal in nature.
(c) Detailed formal planning and control systems are formulated which are rigid in nature.
(d) There is strict supervision and guided tight control.

(e) There is no freedom given and no empowerment at lower level.

(f) Rewards and incentives are used effectively to motivate employee.

This system does produce results, but it may de motivate employees who like to have more freedom in the works environment. Further it may thwart the innovative spirit. The intense competition amongst employee may even create a tense atmosphere in the organization which may not be conducive to long term growth.

However in case the employee are very subservient and not enterprising, this style may suit such organization.

The classic illustration of this external style was the one practiced by Harold Geneen of ITT in U.S. with a highly centralized tight central system. He personally made detailed evaluations of the performance of business units instead of monitoring the overall performance only, leaving the details to the unit managers.

Internal Style: The internal style is participative in nature and employees are given the freedom to offer suggestions, come out with innovations and take part in the decision making process. There is thus

(a) Decentralization of authority i.e., bottom-up approach

(b) The organization structure is flat.

(c) Rules and procedures are flexible.

(d) There is empowerment of employee which may encourage their creative spirit to blossom.

(e) The organization promotes commitment and self-control rather than thrusting a stifling control on employees.

In this style of management there may be a tendency on the part of some employees, who are not self motivated, to be passengers, without making any positive contribution to the organization. There is also the danger of each employee going his own way resulting in chaos, and to avoid such eventuality suitable coordinating mechanism must be in places. Moreover, the individual behavior must be goal-congruent with that of the organization.

John Chambers of CISCO practiced a participatory approach and encouraged his employees to lead, make good decision and take risks willingly.

Jack Welch the legendary CEO of General Electric was an autocratic leader in his early career, inviting the nickname of "Newtron Jack". From 1990s he transformed his style into one of involving people in decision-making and making use of the brain of every worker. His ambitions goal was to remove the "boss element" for G.E and to make it a boundary less organization.

Jeff Immelt who succeeded Jack Welch in 2001 is adored by everyone in G.E. for being a friendly likeable leader, with a proven track record.

In India, Infosys is a typical example of a company practicing a democratic approach in management.

Toyota is well-known for its philosophy of encouraging employees to come out with suggestions for improvement and rewarding them.

Mixed Style This is a composite of both the above styles, blending the advantages of each, without their drawbacks. Human nature being what it is, proper functioning of any organization requires suitable checks and balances. A control style based exclusively on intrinsic motivation seems to be naïve. A rigid authoritarian style, cast in a rule-bound framework, may be a noose

round the organization Murugappa group is a good example of this modified style of management. While the Board lays down the major policies and broad guidelines the professional divisional managers are given total freedom to attain the organizations goals.

Management Culture

Culture consists of shared values, beliefs and norms of organization which grew over time based upon the assumptions of what it takes to be successful. While management style is associated with individual managers, corporate culture is pervasive and is an organizational concept.

Culture facilitates cooperation & communication within the organization; however, if the beliefs are not consistent with the needs of business, dysfunctional consequences may follow.

A shared belief also ensures greater commitment of the employee to the organization. BSNL's complacent culture in a monopolized environment had to undergo a radical shift to a market oriented approach when the telecom sector was de-regulated.

Question 20

Home Build construction company is interested in taking loans from banks for its projects – P, Q, R, S, T. The rates of interest and the lending capacity differ from bank to bank. All these projects are to be completed. The relevant details are provided below. Assuming the role of a consultant, advice the Company as to how it should take the loans so that the total interest payable is least. Find out alternate optimum solutions, if any.

Source Bank	Interest rate in % for projects					MAX Credit (in 000s)
	P	Q	R	S	T	
Private bank	20	18	18	17	17	Any amount
Nationalized Bank	16	16	16	15	16	400
Co- operative Bank	15	15	15	13	14	250
Amount required (in 000s)	200	150	200	125	75	

Solution: Total amount required as loan = ₹750 (000s). The private Bank can give any amount. The date is made balanced by putting 100 against the Private bank.

Initial Basic feasible solution is determined as under:

Part.	P	Q	R	S	T	Amount	Cost Differences I II III IV V VI
Private	20	18 [100]	18	17	17	100/0	0 1 0 0 0 18
National	16 [150]	16 [50]	16 [200]	15	16	400/250/50/0	1 0 0 0 0 16
Co- op	15 [50]	15	15	13 [125]	14 [75]	250/125/50/0	1 1 0 - - -
Required	200/150/0	150/0	200/0	125/0	75/0	750	

Cost Diff:

I	1	1	1	[2]	2
II	1	1	1	-	[2]
III	1	1	1	-	-
IV	[4]	2	2	-	-
V	-	2	[2]	-	-
VI	-	2	-	-	-

In the above IBFS.
- Number of allocated cell is 7
- M + n – 1 (i.e. Rows + Columns – 1)
  = 3+5-1 = 7
    Hence, there is no degeneracy. This can be tested for optimality.

Optimality Test:

Table 2 = Ui + Vj for allocated cells computed as below:

Ui & Vj	15-0= 15	16-1= 15	16-1 = 15	13-0= 13	14 – 0= 14
18 – 15 = 3	20	**100** 18	18	17	17
16 – 15= 1	**150** 16	**50** 16	**200** 16	15	16
(based) 0	**50** 15	15	15	**125** 13	**75** 14

Table 2 = Ui + Vj for unallocated cells computed as below:

3 + 15 = 18		3 + 15 = 18	3 + 13 = 16	3 + 14 = 17
			1 + 13 = 14	1 + 14 = 15
	0 + 15 = 15	0 + 15 = 15		

Table 3 = Net Evaluation Table (NET) = Table 1 – Table 2 for unallocated cells is computed below:

20 - 18 = 2		18 - 18 = 0	17 - 16 = 1	17 - 17 = 0
			15 - 14 = 1	16 - 15 = 1
	15 - 15 = 0	15 - 15 = 0		

The above solution is optimal since all elements in NET are non- negative. However there are four zeroes and so the solution is not unique. **There are four alternate solutions.**

Computation of Minimum Cost: (amount in '000s and interest rate in %)

Particulars	P	Q	R	S	T
Private		100 x 18 = 18			
National	150 x 16 = 24.00	50 x 16 = 8	200 x 16 = 32		
Co- op	50 x 15 = 7.50			125 x 13 = 16.25	75 x 14 = 10.50

Minimum Cost = Total of above = ₹**1,16,250**

Question 21.
(a) What is Cost of lost opportunity?
Answer: The most difficult cost of quality to quantify is the cost of lost opportunities. This is the lost revenue resulting from the loss of existing customers, the loss of potential customers and the lost business growth arising from the failure to deliver products and services at the required quality standards. Examples include cancellations due to inadequate service response times, ordering of competitors' products because the company's products are not available, and the wrong products offered for the specific customer's application.

(b) What is cost of quality? How it can be reduced?
Answer: The cost of quality is the sum of cost of conformance, cost of non-conformance and cost of lost opportunity. The quality costs amount to somewhere between 5-25% of turnover depending on industry. The quality cost will be much more if we include the potential loss of business from the affected customers. With cost of quality accounting for such a large proportion of turnover any reduction in quality cost will improve profitability and provide competitive edge to the company.
The quality cost reduction can be achieved in the following two stages:

(i) **First,** when prevention costs are increased to pay for the right kind of systems engineering work in quality control, a reduction will occur in rejection, defect and rework of output. This defect reduction means a substantial reduction in both types of failure costs.

(ii) **Secondly,** a reduction in defective output will have a positive effect on appraisal costs because defect reduction means a reduced need for routine inspection and test activities. It follows that as prevention is increased the need for appraisal decreases. The end result is a substantial reduction in the cost of quality and an increase in the level of quality.

(c) What is the definition of quality? Explain.
Answer: Quality is defined as "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs."

Within the context of manufacturing, the definition of quality would include the following factors:

(i) **Form:** All dimensions, appearance, configuration of the manufacturing practice must meet the prescribed requirement.

(ii) **Fix:** Features of the product must be applicable to its use, including proper function, interchangeability, consistent geometry and so forth.

(iii) **Function:** The products performance should conform to the design and meet the customer applications.

(iv) **Reliability:** The product item should function according to the expectations over a reasonable life time.

(v) **Consistency:** Every product has the same properties, functions and performance. The customers will expect consistent service from each product.

Question 22.
(a) What is Quality Management Principle? Discuss different types of Quality Management Principles.
Answer

A Quality Management Principle is a comprehensive and fundamental rule or belief, for leading and operating an organization aimed at continually improving performance over the long-term by focusing on customers while addressing the needs of all other stakeholders.

Eight Quality Management Principles have been identified. These are:

PRINCIPLE-1: CUSTOMER FOCUS
Organizations depend on their customers and therefore should understand current and future Customer needs, should meet customer requirements and strive to exceed customer expectations.

PRINCIPLE-2: LEADERSHIP
Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving organization's objectives.

PRINCIPLE-3: INVOLVEMENT OF PEOPLE
People of all levels are the essence of an organization and their full involvement enables their abilities to be used for the organizations benefit.

PRINCIPLE-4: PROCESS APPROACH
A desired result is achieved more efficiently when activities and related resources are managed as a process.

PRINCIPLE-5: SYSTEM APPROACH TO MANAGEMENT

Identifying, understanding and managing interrelated processes as a system contributes to organization's effectiveness and efficiency in achieving its objectives.

PRINCIPLE-6: CONTINUAL IMPROVEMENT

Continual improvement of the organization's overall performance should be a permanent objective of the organization.

PRINCIPLE-7: FACTUAL APPROACH TO DECISION MAKING

Effective decisions are based on the analysis of data and information.

PRINCIPLE-8: MUTUALLY BENEFICIAL SUPPLIER RELATIONSHIPS

An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

(b) What are the disadvantages of Simulation technique?

Answer: Disadvantages of Simulation Technique are as follows:

  (i) Simulation is not an optimizing technique. It simply allows us to select the best of the alternative systems examined.
  (ii) Reliable results are possible only if the simulation is continued for a long period.
  (iii) A computer is essential to cope with the amount of calculation in simulation modeling.
  (iv) To develop a simulation model means consumption of voluminous data and it may be very costly. Each simulation model is unique and its solution cannot be applied to other problems however similar they may be.
  (v) The simulation model does not produce answers by itself. Managers must generate all of the conditions and constraints for solutions they want to examine.
  (vi) Simulation methods generally are not as efficient as the analytical methods.

Question 23

(a) Standard cost specification for a product are as follows:

Times 15 hours per unit		
Cost ₹3 per hour		
Actual performance in a cost period is as follows:		
Production 500 units		
Hours taken	Production	7,800 hours
	Idle time	200 hours
Total time		8,000 hours

Payment made ₹24,800 (average per hour ₹3.10).

Calculate Labour variances.

Solution:

(i) DLRV	=Actual Time paid for X (Standard Rate- Actual Rate)	
	=8,000 hours X (₹3.00-₹3.10)	=₹800 (Adverse)
(ii) DLEV	=Standard Rate X (Standard time for actual output- Actual Time worked)	
	=₹3 X (7,500 hours- 7,800 hrs.)	=₹900 (Adverse)
(iii) ITV	=Idle Hours X Standard Hourly Rate	
	=200 hours X ₹3	=₹600 (Adverse)

The total of (ii) and (iii) may be termed as 'Total Labour Efficiency Variance'. It can be calculated by the following formula:

LEV	=Std. Rate X (std. time for actual output-Actual time paid for)	
	=3 X (7,500 hrs. – 8,000 hrs.)	=₹1,500 (A)
LCV	=₹800(A)+₹900(A)+₹600(A)	=₹2,300(A)

Verification:

DLCV	=Standard Cost-Actual Cost

=₹3 X 15 X500-₹24,800	=₹22,500-₹24,800
=₹2,300 (Adverse)	

(b) What are the problems associated with apportionment of joint cost?

Answer: Problems associated with apportionment of joint costs include:

(i) Apportionment of joint costs is made on the basis of some assumed parameters. Therefore, the same need to be accurate.

(ii) As the apportioned costs do not relate to activities and use of resources, reliable decisions may not be made from them.

Question 24

Sun Ltd. is considering renting additional factory spaces to make two products, P-1 and P-2. You are the company's management accountant and have prepared the following monthly budget:

	P-1(₹)	P-2(₹)	Total(₹)
Sales (unit)	4,000	2,000	6,000
Sales revenue	80,000	1,00,000	1,80,000
Variable material and labour costs	(60,000)	(62,000)	(1,22,000)
Fixed production overhead (allocated on direct labour hours)	(9,900)	(18,000)	(27,900)
Fixed administrative overheads (allocated on sales value)	(1,600)	(2,000)	(3,600)
Profit	8,500	18,000	26,500

The fixed overhead in the budget can only be avoided if neither product is manufactured. Facilities are fully interchangeable between products.

As an alternative to the manual production process assumed in the budget, Sun Ltd. has the option of adopting a computer aided process. This process would cut variable costs of production by 15% and increase fixed costs by ₹12,000 per month.

The management is not sure about demand for the new products.

The management believes the company will have to depart from its usual cash sales policy in order to sell P-2. An average of three months credit would be given and bad debts and administration costs would probably amount to 4% of sales revenue for this product.

Both products will be sold at the prices assumed in the budget. Sun Ltd. has a cost of capital of 2% per month. No stock will be held.

  (a) Calculate the sales revenues at which operation will break-even for each process (manual and computer aided) and calculated the sales revenue at which Sun Ltd. will be indifferent between the two processes.

  (i) If P-1 alone is sold;

  (ii) If P-1 and P-2 units in the ratio 4:1, with P-2 being sold on credit.

  (b) Explain the implications of your results with regard to the financial viability of P-1 and P-2.

Solution:

(a)

	Material Production		Computer-aided	
	P_1	P_2	P_1	P_2
	Manual Production		Computer-aided	
	₹	₹	₹	₹
Selling price	20.00	50.00	20.00	50.00
Variable production costs	15.00	31.00	12.75	26.35
Bad debts at 4% of SP	-	2.00	-	2.00
Finance cost (2% X ₹50 X 3 months)	-	3.00	-	3.00
Contribution	5.00	14.00	7.25	18.65

Fixed cost per month	₹31,500	₹43,500

(i) P1 only is sold:

Manual process break-even point	=6,300 units [₹31,500/₹5]
	=₹1,26,000 sales revenue
Computer aided break-even point	=6,000 units [₹43,500/₹7.25]
	=₹1,20,000 sales revenue
Point of indifference: Let X	=point of indifference
Then under manual process indifference point is where:	
5x-31,500	=7.25x-43,500
	=5,333.33 units
	=₹1,06,667 sales revenue

(ii) P1 and P2 are sold in the ratio of 4:1

Manual process:	Average contribution per unit
=(4X ₹5+1X ₹14)/5	=₹6.80 Break-even point
	=4,632.35 units [₹31,500/₹6.80]
	=₹1,20,441 sales revenue
Computer-aided process:	Average contribution per unit
=(4X ₹7.25+1X ₹18.65)/5	=₹9.53 Break-even point
	=4,564.53 units [₹43,500/₹9.53]
	=₹1,18,678 sales revenue
Indifference point: Let X	=point of indifference
Then under computer aided process indifference point is	
Where 6.80x-₹31,500	=9.53x-43,500
	=4,395.60 units
	=₹1,14,286 sales revenue

(b) Budgeted sales of P1<BE sales. As such, production P1 alone cannot be considered. Also, it is not worth selling on its own even if P1 and P2 are substitutes. That the products are perfect substitutes and ₹1,80,000 sales can be generated is likely to be over-optimistic. In short, the single-product policy is very risky.

With the alternative proposal of selling P1 and P2 in 4:1 proportion, the BE point is 4,565 units-P1 and P2 in 4:1 proportion, the BE point is 4,565 units - P1 3,652 units and P2 913 units. This will mean a margin of safety of 348 units for P1 and 1,087 units for P2 as compared with the budgeted quantities. Launching both products is clearly the most profitable alternative.

We note that the budgeted sales mix is in the ratio of 2:1 to yield an average contribution per unit of ₹8 (manual process) and ₹11.05 (computer aided process); the break-even point based on this is 3,937 units for both the processes, consisting of 2,625 units of P1 and 1,312 unit of P2. This represents a margin of safety of 1,375 units of P1 (34%) and 688 units of P2 (34%). It is obviously better to sell P2 in preference to P1. It is recommended that both products be sold and the computer-aided process be adopted.

Question 25

(c) **A company has developed a special purpose Electronic Security Device and once introduced in the market, the same expected to have a life cycle of 3 years from the time of its introduction in the market before the device becomes obsolete due to technological advancement of other competitive products.**

You have been asked by the company to prepare a product life cycle budget.
The following information is available:

	Year 1	Year 2	Year 3
No. of units to be manufactured and sold	50,000	2,00,000	1,50,000
Price per device (₹)	500	400	350
R & D and Design cost (₹)	9,00,000	1,00,000	Nil

Production cost:			
Variable cost per device(₹)	200	150	150
Fixed cost(₹)	70,00,000	70,00,000	70,00,000
Marketing cost:			
Variable cost per device(₹)	100	70	60
Fixed cost(₹)	30,00,000	25,00,000	25,00,000
Distribution cost:			
Variable cost per device(₹)	50	50	50
Fixed cost(₹)	10,00,000	10,00,000	10,00,000

Prepare the budgeted life cycle operating profit.

It has been further indicated that if a discount of 10% is given to customer, the unit to be sold per year will increased by 5%. Would you recommend introduction of such discount?

Solution:

A company
PREPARATION OF BUDGETED LIFE CYCLE OPERATING PROFIT

(₹ In Lakh)

	Year I	Year II	Year III	Life Cycle
Sales Revenue	250.00	800.00	525.00	1,575.00
R & D, Design cost	9.00	1.00		10.00
Production cost:				
Variable cost	100.00	300.00	225.00	625.00
Fixed cost	70.00	70.00	70.00	210.00
Marketing Cost:				
Variable cost	50.00	140.00	90.00	280.00
Fixed cost	30.00	25.00	25.00	80.00
Distribution cost:				
Variable cost	25.00	100.00	75.00	200.00
Fixed cost	10.00	10.00	10.00	30.00
	294.00	646.00	495.00	1,435.00
Operating profit	(44.00)	154.00	30.00	140.00

Operating results if discount given:

WN: Revised sales revenue	Total Units X SP (₹)	=Total (₹ Lakh)
Year I	50,000+ 5%=52,500 X 450	=236.25
Year II	2,00,000+5%=2,10,000X 360	=756.00
Year III	1,50,000+5%= 1,57,500X 315	=496.12
		1,488.37

BUDGETED LIFE CYCLE PROFIT (With discount of 10% to customers and sales increase by 5%)

(In ₹ Lakh)

	Year I	Year II	Year III	Total Life Cycle
Sales Revenue	236.25	756.00	496.12	1,488.37
R & D, Design	9.00	1.00		10.00
Production cost:				
Variable	105.00	315.00	236.25	656.25
Fixed	70.00	70.00	70.00	70.00
Marketing Cost:				
Variable	52.50	147.00	94.50	294.00
Fixed	30.00	25.00	25.00	80.00
Distribution Cost:				
Variable	26.25	105.00	78.75	210.00

Fixed	10.00	10.00	10.00	30.00
	302.75	673.00	514.50	1,490.25
Operating profit	(66.50)	83.00	(18.38)	(1.88)

The second alternative is not acceptable, as that would result in overall loss during the life cycle.

(d) Enumerate the steps involved in target costing?
Answer: The following are the steps involved in target costing.
   (i) Ascertain from market studies the demand and the price at which the product can be sold.
   (ii) Deduct the required profit percentage from the selling price.
   (iii) The balance represents the target cost.
   (iv) Compare the actual/estimated cost with the target cost.
   (v) If the actual/estimated target cost is greater than the target cost, introduced cost reduction measures to bring down the cost to the level of target cost. If the required reduction in cost is not possible, reject the proposal to produce the product.

Question 26.
(a) Five Swimmers are eligible to compete in a relay team that should have four swimmers swimming different styles- backstroke, breaststroke, free style and butterfly. The time taken for the five swimmers - Anand, Balu, Chandru, Deepak and Eswar – to cover a distance of 100 metres in various swimming styles are given below in minutes: seconds. Anand swims backstroke in 1:09, breaststroke in 1:15 and has never competed in free style or butterfly. Balu is a free style specialist averaging 1:01 for 100 metres but can also swim breaststroke in 1:16 and butterfly in 1:20. Chandru swims all styles, backstroke 1:10, breaststroke 1:12, free style 1:05 and butterfly 1:20. Deepak swims only butterfly at 1:11 while Eswar swims backstroke 1:20, breaststroke 1:16, free style 1:06 and butterfly 1:10. Which swimmers should be assigned to which swimming style? Who will not be in the team?

Solution:
I. The Time taken matrix is first derived (in seconds)

Swimmers	Backstroke	Breaststroke	Freestyle	Butterfly
Anand	69	75	-	-
Balu	-	76	61	80
Chandru	70	72	65	80
Deepak	-	-	-	71
Eswar	80	76	66	70

The objective is minimization of time taken. The combinations not available for assignment are indicate by M where M = infinity. A dummy column is introduced in the above matrix.

II. Inserting Dummy Column   **III. Row and Column Operations**

```
69  75  M   M   0          0   3   M   M   0
M   76  61  80  0          M   4   0   10  0
70  72  65  80  0          1   0   4   10  0
M   M   M   71  0          M   M   M   1   0
80  76  66  70  0          11  4   5   0   0
```

IV. Inserting Dummy Column

0 3	M	M	✗	
M 4	**0**	10	✗	
1	**0** 4	10	✗	
M M	M	1	**0**	
11 4	5	**0**	✗	

Answer: Total Time taken will be 272 seconds or 4 min and 32 seconds.

Swimmer	Anand	Balu	Chandru	Deepak	Eswar
Style	Backstroke	Freestyle	Breaststroke	Dummy - will not be in the race.	Butterfly
Time Taken	69	61	72		70

(b) What is PDCA?
Answer: PDCA ("**Plan-Do-Check-Act**") is an iterative four-step problem-solving process typically used in quality control. PDCA was made popular by Dr. W. Edwards Deming, who is considered by many to be the father of modern quality control; however it was always referred to by him as the "Shewhart cycle." Later in Deming's career, he modified PDCA to "Plan, Do, Study, Act" (PDSA) so as to better describe his recommendations.

The concept of PDCA comes out of the Scientific Method. The scientific method can be written as "hypothesis" - "experiment" - "evaluation" or Plan, Do, and Check. Shewhart described manufacture under "control" - under statistical control - as a three step process of specification, production, and inspection. The also specifically related this to the Scientific Method of hypothesis, experiment and evaluation. Shewhart, says that the statistician "must help to change the demand [for goods] by showing... how to close up the tolerance range and to improve the quality of goods." Clearly, Shewhart intended the analyst to take action based on the conclusions of the evaluation. PDCA has an inherent circular paradigm, it assumes that everything starts with Planning. Plan has a limited range of meaning. Shewart intended that experiments and quality control should be planned to deliver results in accordance with the specifications, which is good advice. However, Planning was not intended to cover aspects such as creativity, innovation, invention. In these aspects particularly when based upon imagination, it is often impossible or counterproductive to plan. Hence, PDCA is inapplicable in these situations.

Question 27.
(a) A review, made by the top management of XYZ ltd., (which makes only one product), of the result of the first quarter of the year revealed the following:

Sales (in units)	**10,000**
Loss	**₹ 10,000**
Fixed cost (for the year ₹ 1,20,000)	**₹30,000**
Variable cost/unit	**₹8.00**

The finance Manager, who feels perturbed, suggests that the company should at least break even in the second quarter with a drive for increased sales. Towards this, the company should introduce better packing, which will increase the cost by re. 0.50 per unit.

The Sales Manager has an alternative proposal. For the second quarter, additional sales promotion expenses can be increased to the extent of ₹ 5,000 and a profit of ₹5,000 can be aimed at during the period with increased sales.

The production Manager feels otherwise. To improve the demand, the selling price/ unit has to be reduced by 3%. As a result, the sales volume can be increased to attain a profit level of ₹ 4,000 for the quarter.

The Manager Directors asks you, as a Cost and Management Accountant, to evaluate the three proposals and to calculate the additional sales volume that would be required in each case, in order to help him to take a decision.

Answer:

Calculation of selling Price:

Variable Cost	(8x10,000)	80,000
Add: Fixed Cost		30,000
Total Cost		1,10,000
Profit		(10,000)
Sales		1,00,000
Selling Price	(1,00,000/10,000)	₹10

Statement showing evaluation of alternatives and the number of units require attain the targets of respective managers:

Particulars	Finance Manager	Sales Manager	Production Manager
Selling price (₹)	10.00	10.00	9.70
Variable Cost (₹)	8.50	8.00	8.00
Contribution/unit (₹)	1.50	2.0	1.70
Fixed Cost (₹)	30,000	35,000	30,000
Target (Units)	B.E.P	Profit of ₹5,000	Profit of ₹4,000
	30,000/1.5	35,000/2	34,000/1.7
	20,000	20,000	20,000
Additional units required	10,000	10,000	10,000

Conclusion: The additional sales volume that would be required in each case will be exactly the same, namely-10,000 units.

(b) What is MRP II and what are the essential elements of it?
Answer: Manufacturing Resource Planning (MRP II) is a computer based system designed to manage all the resources of a manufacturing organization. It acts as a planning and scheduling system, linking manufacturing with the sales and finance departments and providing tools for joint decision making among all three departments.

The essential elements of MRP II system are as follows:

   (i) **Demand forecast:** Which takes into account firm orders and sales forecasts.
   (ii) **Production planning:** Which converts the demand forecast into a broad statement of output requirements and the necessary production programme?
   (iii) **Resource planning:** Which determines the manufacturing resources (materials and bought-in-components etc.) required to meet the production programme.

(iv) Rough-cut capacity planning: Which is used to test the feasibility of meeting the production programme, taking into account the capacity available?

(v) Master production schedule: Which is prepared on the basis of the information obtained from the demand forecasting, production planning, resource planning and rough-cut capacity planning processes?

(vi) Bills of materials: Which maintain the basic data for defining product i.e., lists of the components and material required to produce an end produce or assembly.

(vii)Materials requirement planning: Which determines component and material requirements on the basis of information from the master production schedules and the purchasing and inventory control function.

(viii) Detailed material and capacity plans: Which set out the detailed schedules for providing material and capacity as derived from the material requirement plans and detailed capacity planning – only if capacity is available is the plan allowed to proceed.

(ix) Shop and purchase order release: Which activate production and purchasing.

(x) Shop-floor control: Which monitors production against the plan and feeds back which enables the master production schedule and capacity and material plans to be updated?

(xi) Purchase and Inventory control: Which monitors purchasing against the material plans and feeds back to the master production schedules and materials plans to enable updating to take place as required. Inventory controls are also maintained on the basis of shop-floor usage.

Question 28.
The following figures are available. Find out the missing figures, given appropriate formulae –

Particulars	₹	₹
Budgeted Profit		15,000
Less: Adverse variance: Contribution Price variance	10,600	
Direct Material variance	1,000	
Fixed Overhead variance	600	12,200
		2,800
Add: Favourable Variance: Contribution Quantity Variance	1,800	
Direct Wages Variance	600	
Variable Overhead Variance	1,800	4,200
Actual Profit		7,000

There is no inventory. Also, production units = sales units for both actual and budget.
Other information:

Standard selling Price	₹ 18 per unit	Actual Labour Hours at Actual rate	₹ 63,000
Standard Variable Cost	₹ 15 per unit	Actual Labour Hours at Standard rate	₹61,950
Standard Contribution	₹3 per unit	Variable Overhead Standard rate	₹2
Actual selling Price	₹ 17 per unit	Standard Hours of Production	4 per unit
Budgeted sales	10,000 units	Variable Overhead at Standard rate	₹ 84,800
Std Material Cost p.u	Re.1(5 kg. at 20	Variable Overhead Expenditure	400 (A)
Material Usage variance	paise/kg)	Variance	₹ 15,000
	400(Adv0	Budgeted Fixed overhead	

Find out the following:

(a)	Actual sales Units	**(e)**	Actual Variable Overhead in rupees
(b)	Actual sales Rupees	**(f)**	Variable Overhead Efficiency Variance
(c)	Actual Quantity of Raw Materials used	**(g)**	Actual Fixed Overheads
(d)	Labour Efficiency variance	**(h)**	Operating Profit Variance

Solution:

1. **Sales Variances**

BQ x BP (1)	AQ x AP (2)	AQ x BP (3)	Sales Variances Total (1)-(2)=200F	
10,000x18=1,80,000	10,600x17=1,80,200 Qtty from **WN (a)**	10,600x18 =1,90,800	Price(3)-(2) =10,600A (given)	Volume(1)-(3) =10,800F

2. **Material Variances**

SQ x SP (1)	AQ x AP (2)	AQ x SP (3)	Material Variances Cost (1)-(2)=1,000A (given)	
(10,600x5)x0.20 =10,600	55,000x0.21 =11,600 **[WN (d)]**	55,000X0.20 =11,000 **[WN (C)]**	Price (3)-(2) =600A (Bal. figure)	Usage(1)-(3) =400A (given)

3. **Labour Variances**

SH x SR (1)	AH x AR (2)	AH x SR	Labour Variances Cost(1)-(2)=600F (given)	
(10,600x4)x1.50 =63,600 **[WN (e)]**	41,300 x1.53 =63,000 (given)	41,300X 1.50 =61,950 (given)	Rate(3)-(2) =1,050A	Efficiency(1)-(3) =1,650F

4. **VOH Variances**

SH x SR	AVOH	AH x SR	VOH Variances Cost(1)-(2)= 1,800F (given)	
(10,600x4)x2 =84,800 (given)	**[WN (f)]** 83,000	41,300x2 =82,600 [Hrs from LCV]	Exp. (3)-(2) =400A	Efficiency(1)-(3) =2,200F

5. **FOH Variances**

AO x SR (1)	AFOH (2)	BFOH (3)	FOH Variances Cost (1)-(2) =? (NA under Merg Costing)	
10,600 ×? =?	**[WN (g)]** 15,600	Given 15,000	Exp. (3)-(2) =600A	Efficiency(1)-(3) =NA

Working Notes:

a.	**Contribution Quantity Variance**	=(BQ-AQ)x Std. Contribution per unit		=1,800F	
		=(10,000-AQ)x₹3	= -1,800.	On solving, AQ=10,600 units	
b.	Since Contribution Quantity Variance is given in the reconciliation Statement as per the question, Marginal Costing system has been used in the reconciliation. Accordingly, FOH Variance as per the Reconciliation statement constitutes only FOH Expenditure Variance.				
c.	**Material usage variance**=(1)-(3)		=400A		
	10,600-(3) = -400.	Hence,(3)=11,000 On balancing,		AQ of Raw Material (AQ) = 55,000 kg.	
d.	**Material Cost Variance** (1)-(2)		=1,000A		
	10,600-(2) = -1,000.	Hence, (2)=11,600, on balancing		AP of Raw Material (AP) = 0.21 per kg.	
e.	**Labour Cost Variance**=(1)-(2)		=600A		
	(1)-63,000= -600. Hence, (1)= 63,600.		On balancing, Std Rate ph of Labour		

		(SR)= ₹1.50 ph	
F.	**VOH Cost Variance** =(1)-(2)	=1,800A	
	84,800-(2) = -1,800.	Hence, (2) = 83,000.	Hence, AVOH= ₹83,000
g.	**FOH Expenditure Variance**	=(3)-(2)=600A	So, 15,000-(2) = -600.	Hence, (2) = 15,600.

Answer:

a.	Actual Sales Units	10,600 units
b.	Actual Sales Rupees	₹1,80,200
c.	Actual Quantity of RM used	55,00 kg
d.	Labour Efficiency Variance	₹1,650 F
e.	Actual Variable Overhead in rupees	₹83,000
f.	VOH Efficiency Variance	₹2,200F
g.	Actual Fixed Overheads	₹15,600
h.	Operating profit Variance	₹8,000A

Question 29.
(a) Discuss some mathematical techniques that can be used in aggregate planning applications.
Answer: The following are some of the better known mathematical techniques that can be used in more complex aggregate planning applications.

Linear Programming
Linear programming is an optimization technique that allows the user to fi nd a maximum profit or revenue or a minimum cost based on the availability of limited resources and certain limitations known as constraints. A special type of linear programming known as the Transportation Model can be used to obtain aggregate plans that would allow balanced capacity and demand and the minimization of costs.

However, few real-world aggregate planning decisions are compatible with the linear assumptions of linear programming. Supply Chain Management: Strategy, Planning and Operation, by Sunil Chopra and Peter Meindl, provide an excellent example of the use of linear programming in aggregate planning.

Mixed-integer Programming
For aggregate plans that are prepared on a product family basis, where the plan is essentially the summation of the plans for individual product lines, mixed-integer programming may prove to be useful Mixed-integer programming can provide a method for determining the number of units to be produced in each product family.

Linear Decision Rule
Linear decision rule is another optimizing technique. It seeks to minimize total production costs (labor, overtime, hiring/lay off, inventory carrying cost) using a set of cost-approximating functions (three of which are quadratic) to obtain a single quadratic equation. Then, by using calculus, two linear equations can be derived from the quadratic equation, one to be used to plan the output for each period and the other for planning the workforce for each period.

Management Coefficients Model
The management coefficients model, formulated by E.H. Bowman, is based on the suggestion that the production rate for any period would be set by this general decision rule:
$P_t = aW_{t-1} - bI_{t-1} + cF_{t+1} + K$, where
P_t = the production rate set for period t

Wt-1 = the workforce in the previous period
It-1 = the ending inventory for the previous period
Ft+1 = the forecast of demand for the next period
a, b, c, and K are constants
It then uses regression analysis to estimate the values of a, b, c, and K. The end result is a decision rule based on past managerial behavior without any explicit cost functions, the assumption being that managers know what is important, even if they cannot readily state explicit costs. Essentially, this method supplements the application of experienced judgment.

Search Decision Rule
The search decision rule methodology overcomes some of the limitations of the linear cost assumptions of linear programming. The search decision rule allows the user to state cost data inputs in very general terms. It requires that a computer program be constructed that will unambiguously evaluate any production plan's cost. It then searches among alternative plans for the one with the minimum cost. However, unlike
linear programming, there is no assurance of optimality.

Simulation
A number of simulation models can be used for aggregate planning. By developing an aggregate plan within the environment of a simulation model, it can be tested under a variety of conditions to find acceptable plans for consideration. These models can also be incorporated into a decision support system, which can aid in planning and evaluating alternative control policies. These models can integrate the multiple conflicting objectives inherent in manufacturing strategy by using different quantitative measures of productivity, customer service, and flexibility.

Functional Objective Search Approach
The functional objective search (FOS) system is a computerized aggregate planning system that incorporates a broad range of actual planning conditions. It is capable of realistic, low-cost operating schedules that provide options for attaining different planning goals. The system works by comparing the planning load with available capacity. After management has chosen its desired actions and associated planning objectives for specific load conditions, the system weights each planning goal to reflect the functional emphasis behind its achievement at a certain load condition. The computer then uses a computer search to output a plan that minimizes costs and meets delivery deadlines.

(b) What is Enterprise Risk Management?
Answer: Enterprise risk management deals with risks and opportunities affecting value creation or preservation, defined as follows:

Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

The underlying premise of enterprise risk management is that every entity exists to provide value for its stakeholders. All entities face uncertainty and the challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value. Uncertainty presents both risk and opportunity, with the potential to erode or enhance value. Enterprise risk management enables management to effectively deal with uncertainty and associated risk and opportunity, enhancing the capacity to build value.

Value is maximized when management sets strategy and objectives to strike an optimal balance between growth and return goals and related risks, and efficiently and effectively deploys resources in pursuit of the entity's objectives.

Question 30.
(a) State briefly the shortcoming of Balance Scorecard.
Answer: Balance Scorecard (BSC) is a new approach to strategic Management. It is a performance management and strategy deployment methodology that helps executives translate an organization's mission statement and overall business strategy into specific quantifiable goals and monitors the organization's performance in terms of these goals. The BSC also aligns budgets to strategy and helps in developing an enterprise performance Management System.

Shortcoming of Balanced Score Card: The following are the shortcomings of BSC:
   (i) Community and environmental issues are missing in BSC. These are very vital and critical issues today.
   (ii) Competitors have not been included. Companies need to monitor the environment to track competitor activity and technological developments.

These criticisms mainly stem from the fact that the BSC is not a multiple stakeholder framework. Any performance measurement framework needs to reflect the needs of all the important stakeholder.

Conclusion: These shortcomings, however, should not detract from the inherent merit of BSC, which helps to clarify, consolidate and gain consensus around the strategy of the organization. BSC is a very power full tool for strategy implementation. The shortcoming as pointed out may be added as its additional perspectives.

(b) DB p.l.c operates a conventional stock control system based on re-order levels and Economic Ordering Quantities. The various control levels were set originally based on estimates which did not allow for any uncertainty and this has caused difficulties because, in practice, lead times, demands and other factors do vary.

As part of a review of the system, a typical stock item, Part No. X206, has been studied in detail as follows:

Data for part No. X206	
Lead time	Probability
15 Working days	0.2
20 working days	0.5
25 working days	0.3
Demand per working day	Probability
5,000 units	0.5
7,000 units	0.5

Note: It can be assumed that the demands would apply for the whole of the appropriate lead time.
DB p.l.c works for 240 days per year and it costs Re. 0.15 p.a. to carry a unit of X 206 in stock. The re-order level for this part is currently 1,50,000 units and the re-order cost is Rs. 1,000.
You are required:
   a) **to calculate the level of buffer stock implicit in a re-order level of 1,50,000 units.**
   b) **To calculate to probability of a stock-out**
   c) **To calculate the expected annual stock-outs in units;**
   d) **To calculate the stock out cost per unit at which it would be worth while raising the re-order level to 1,75,000 units;**

Answer:

a) Buffer stock level

Expected value = lead time x total demand in lead time x joint probability

    =15x5000x0.2x0.5=7500
    =15x7000x0.2x0.5=10500
    =20x5000x0.5x0.5=25000
    =20x7000x0.5x0.5=35000
    =25x5000x0.3x0.5=18750
    =25x7000x0.3x0.5=<u>26250</u>
                      <u>123000</u>

Expected value of demand in lead time = 123000

Buffer stock = 150000-123000 = 27000 units

b) Stock out(shortage) = p>150000 = 0.15 joint pr0bability at 17500 units

c) EOQ = $\sqrt{\dfrac{2 \times 6,000 \times 240 \times 1,000}{0.15}}$ = 1,38,564 units

Demand per working day = (5000x0.5) + (7000x0.5) = 6000 units

Orders per annum = (6000x240) / 138564 =10.39 (on an average)

Expected stock out per annum = (175000-150000) x 0.15 x 10.39 = 38962 units

d) At 150000 reorder level, stock out is 38962 units

    At 175000 reorder level, stock out is nil
    Additional cost is 25000x0.15 = Rs.3750
    Additional cost per unit = 3750/38962 = Rs0.96 (or) 96paise