

**Question Paper**  
**Operations Management - I (MB2E3-01): October 2010**

- Answer all 94 questions.
- Marks are indicated against each question.

**Total Marks : 100**

1. The operations manager of Skyline Electronics is busy in establishing provisions of union contracts. According to the decisions and activities of operations managers, this activity is related to
  - (a) Planning
  - (b) Organizing
  - (c) Motivating
  - (d) Controlling
  - (e) Directing.

( 1 mark)
2. Purchase and installation cost of machines for setting up a workshop is Rs.23,48,000. If the net investment is Rs.16,50,000, the anticipated future salvage value of the machines is
  - (a) Rs.4,98,000
  - (b) Rs.5,89,000
  - (c) Rs.6,98,000
  - (d) Rs.7,78,000
  - (e) Rs.8,88,000.

( 1 mark)
3. Diamond Finance Corporation Ltd. selected a forecasting model to predict the future demand for its services. During the assessment of the accuracy with which the selected forecasting model is able to predict demand, the tracking signal was calculated and found to be 0.29. What is the performance of the forecasting model?
  - (a) The forecasting model underestimates the demand
  - (b) The forecasting model overestimates the demand
  - (c) The forecasting model is accurate
  - (d) The forecasting model is no longer appropriate
  - (e) The forecasting model crossed the threshold limit.

( 1 mark)
4. Which of the following statements is/are true regarding the characteristics of linear programming problem?
  - I. The objective and the constraints are linear functions.
  - II. The decision variables are continuous and they accept any positive, negative and fractional values within the specified range.
  - III. The problem can also be solved by alternative courses of action.
  - (a) Only (I) above
  - (b) Only (II) above
  - (c) Both (I) and (II) above
  - (d) Both (I) and (III) above
  - (e) All (I), (II) and (III) above.

( 1 mark)
5. M/s Deon Fabrication Works has two plants located close to each other and the company wants to establish a new plant near the existing plants. The Managing Director wants to get maximum benefit by combining the operations of all the plants including the new plant. This will help the firm to view the entire group as a single entity rather than as a number of independent units. In this regard, which of the following factors is considered by the firm while selecting the location?
  - (a) Site cost
  - (b) Suitability of land and climate
  - (c) Availability of amenities
  - (d) Availability of labor and skills
  - (e) Integration with other parts of the organization.

( 1 mark)

6. One of the objectives of job design is that it should influence the perception jobholders have of themselves and their perception of others. The responsibilities assigned to a worker have to enhance his self-esteem and motivate and stimulate him to work harder. This particular objective to be fulfilled with the help of effective job design is referred to as
- Trade and industry feasibility
  - Technical feasibility
  - Economic feasibility
  - Behavioral feasibility
  - Environmental feasibility.
- ( 1 mark)

7. Managers use different techniques for setting work standards. Which of the following is **not** a work measurement technique?
- Standard data
  - Time series analysis
  - Predetermined motion time study
  - Historical analysis
  - Employee self-timing.
- ( 1 mark)

8. An automobile manufacturer developed monthly forecasts for a product and presented the data for the six month period from July to Dec in the following table:

Month	Jul	Aug	Sept	Oct	Nov	Dec
Expected Demand (units)	9,800	7,100	9,000	8,000	8,000	9,000
Production Days	22	18	21	21	22	20

The present workforce of the organization is 50. The productivity of worker is 8 units per day. The plant runs 8 hours a day. The regular pay rate of the worker is Rs.25 per hour and the overtime pay rate is Rs.35 per hour. The cost of an idle work hour is Rs.30. Based on the varying the utilization of the workforce strategy, the cost of idle labor hours is approximately equal to

- Rs.28,000
  - Rs.39,000
  - Rs.40,000
  - Rs.51,000
  - Rs.62,000.
- ( 2 marks)
9. Ramakrishna Ancillary Unit makes water proof polyethylene bags. The anticipated sale of the bags is 1,250 units per year. The firm incurs a setup cost of Rs.500 and the inventory carrying cost is said to be 7% of the item cost. If the bag costs Rs.25 per unit, what should be the optimal quantity of bags to be produced to keep in the inventory?
- 545 units
  - 645 units
  - 745 units
  - 845 units
  - 945 units.
- ( 1 mark)
10. Which of the following is **not true** for purchasing function?
- A small saving in the cost of the material can have a significant impact on the total performance of an organization
  - Centralized purchasing vests maximum purchasing power with the buyer
  - The primary responsibility of purchase manager includes vendor development, selection of suppliers and contract negotiation
  - Vendor selection procedure always ensures selecting a vendor with the lowest quotation price
  - Whenever a new item is indented the management has to take a make-or-buy decision.
- ( 1 mark)

11. Kareem Nagar Automobiles Limited is in the process of determining the reordering level and order quantities of materials for one year. As per the classification of operations management decisions, in which of the following categories do such decisions fall?

- I. Strategic decisions.
- II. Tactical decisions.
- III. Operational decisions.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) Both (II) and (III) above.

(1 mark)

12. The net present value of a project is estimated at Rs.5,72,820.69. The expected cash inflows of the project are as below:

Year	1	2	3	4	5
Cash in flows (Rs.'00,000s)	10	12	13	14	9

If the appropriate discount rate for the cash flows per year is 13%, the initial investment of the project is

- (a) Rs.15 Lakh
- (b) Rs.25 Lakh
- (c) Rs.35 Lakh
- (d) Rs.45 Lakh
- (e) Rs.55 Lakh.

(2 marks)

13. A departmental store owner took sales data from the last four months to predict the future demand. Using his experience, he assigned value to the data: 50 percent to the actual sales for the most recent month; 20 percent for the actual sales of two months ago; 10 percent to the sales of three months ago; and 20 percent to the actual sales of four months ago. Which of the following forecasting methods is used by the owner of the departmental store?

- (a) Simple Moving Average
- (b) Linear Regression
- (c) Time Series Analysis
- (d) Weighted Moving Average
- (e) Exponential smoothing.

(1 mark)

14. A process chart provides macro view of the movement of components and subassemblies of producing a product using certain symbols. Which of the following symbols reflects input activity in the process chart?

- (a)  $\Rightarrow$
- (b) D
- (c) O
- (d)  $\square$
- (e) V.

(1 mark)

15. A Chinese toy manufacturer, Xing Fu Nantong Group Ltd., opened its Indian subsidiary at Falta Export Processing Zone, near Kolkata. The forecast and actual demand of its product for the ten weeks is as follows:

Week	1	2	3	4	5	6	7	8	9	10
Actual demand	400	420	420	300	380	500	560	440	500	480
Forecast demand	450	510	400	380	360	400	500	480	400	500

Tracking signal of the forecasting method is approximately equal to

- (a) 0.23
- (b) 0.34
- (c) 0.45
- (d) 0.56
- (e) 0.63.

(2 marks)

16. Manufacturing and service organizations need to carefully evaluate the location for setting up their plants and service facilities because location will have a serious effect on the success of an organization. Which of the following are the location evaluation techniques used by an operations manager?
- Center of gravity method.
  - Computer search models.
  - Analytic Delphi method.
  - Critical ratio method.
- Both (I) and (III) above
  - Both (II) and (IV) above
  - (I), (II) and (III) above
  - (I), (III) and (IV) above
  - (II), (III) and (IV) above.
- ( 1 mark)
17. A job design should be beneficial to both employee and employer. Which of the following is **not** an outcome of a job design?
- Increase in motivation
  - Improve productivity
  - Increase in worker input
  - Improve efficiency
  - Improve job satisfaction.
- ( 1 mark)
18. The planning division of a manufacturing organization wants to formulate its aggregate output plan for six months on the basis of historical data available to the organization. For this purpose, which of the following models should the organization use?
- Linear Programming
  - Linear Decision Rules
  - Heuristic Model
  - Computer Search Model
  - Data Model.
- ( 1 mark)
19. Which of the following costs includes the costs associated with record keeping, accounting and material receiving?
- Stock-out cost
  - Acquisition cost
  - Carrying cost
  - Material cost
  - Opportunity cost.
- ( 1 mark)
20. Which of the following statements is/are **true** regarding purchasing systems?
- The centralization of purchasing activities leads to consistency in buying policies and uniformity in maintaining purchasing records.
  - Decentralized purchasing system is preferable for an organization with many autonomous production units within the same site which require materials with the same or similar specifications.
  - In a centralized purchasing system, the benefits of bulk purchasing can be realized by pooling all the requirements.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - Both (I) and (III) above.
- ( 1 mark)
21. The theory of modern operations management proposes the concept of improving productivity of workers through proper supervision by trained supervisors and proper incentive pay systems to motivate workers. Which of the following theories proposes this concept?
- Shop system
  - Moving assembly line
  - Hawthorne studies
  - Operations research applications
  - Human relations studies.
- ( 1 mark)

22. The demand for the product of a company is given below.

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.
Demand (units)	270	295	275	285	260	280

If the demand is not impacted by seasonal, trend, cyclic and promotional factors, the right demand forecast for the month of July is

- (a) 245.5 units
- (b) 257.5 units
- (c) 265.5 units
- (d) 277.5 units
- (e) 285.5 units.

(1 mark)

23. Which of the following is/are the reason(s) for adopting simplex method for solving linear programming problem by operations managers?

- I. This method can be applied to problems where the number of decision variables is more than two.
- II. This method checks every sub-optimal extreme point for determining the optimal solution.
- III. The algorithm detects whether the problem is infeasible, unbounded or has multiple solutions.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) Both (I) and (III) above

(1 mark)

24. Dissimilar machines are grouped into work centers to work on products similar in shape and processing requirements. In which of the manufacturing systems are work centers used?

- (a) Discrete unit manufacturing system
- (b) Process manufacturing system
- (c) Process focused manufacturing system
- (d) Group technology manufacturing system
- (e) Product focused manufacturing system.

(1 mark)

25. The sequential relationship among different tasks is specified by using a precedence diagram. Which of the following statements are referred to as cycle time?

- I. The cycle time is determined by the daily operating time per day divided by desired level of production per day.
- II. The cycle time is determined by the maximum allowable time required at each workstation.
- III. The cycle time refers to the sum of the time required for all previous tasks that have been assigned to the station.
- IV. The cycle time refers to the time spent by the material between processing.

- (a) Both (I) and (II) above
- (b) Both (III) and (IV) above
- (c) (I), (II) and (III) above
- (d) (I), (II) and (IV) above ✓
- (e) All (I), (II), (III) and (IV) above.

(1 mark)

26. A job is more than a list of tasks that a worker has to carry out on a regular basis. Which of the following job characteristics defines clearly the exclusive tasks needed to complete the main task?

- ~~(a)~~ Skill variety
- ~~(b)~~ Task identity
- (c) Task content
- (d) Task significance
- ~~(e)~~ Task autonomy.

(1 mark)

27. Which of the following techniques is used to record standard time for the basic motions like reach, grasp, move, turn, stretch, apply pressure, release, and so on?
- Work factors
  - Historical analysis
  - Transaction processing systems
  - Expert systems
  - Manufacturing processing systems.
- ( 1 mark)
28. Which of the following is **not true** regarding functions of master production schedule?
- It sets a level of operations that balances market demand with the material, labor and equipment capabilities of the firm
  - It assigns loads for labor and equipment based on the requirements
  - It alerts material requirement planning system to produce or purchase necessary components to be used on final assembly schedules
  - It reflects the most economical usage of labor and equipment capacities
  - It helps in evaluating alternative schedules for the firm.
- ( 1 mark)
29. It is the responsibility of operations managers to update records continually to reflect the status of reorder point. Which of the following statements is/are **true** regarding reorder point?
- It is set equal to the expected usage of inventory during the lead time.
  - It also includes the safety stock needed.
  - It is calculated on the condition that a positive inventory level is attained at the end of each reordering cycle.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (I) and (III) above
  - Both (II) and (III) above.
- ( 1 mark)
30. In which of the following steps of purchasing do purchase managers develop terms and conditions that include the issues like price of the items, quality and other performance standards, technical specifications, delivery schedule and freight payment?
- Vendor development
  - Contract negotiation
  - Value analysis
  - Order processing
  - Selection of suppliers.
- ( 1 mark)
31. Which of the following systems was used by organizations in the initial years of industrialization, for planning and controlling operations and providing comprehensive information regarding demand forecasts, purchasing, and inventories and led to the development of materials requirement planning?
- Flexible Manufacturing System
  - Automated Storage and Retrieval System
  - Computer Aided Design
  - Computer Aided Manufacturing
  - Manufacturing information system.
- ( 1 mark)
32. For every firm, the motive behind carrying out a forecasting exercise is to implement decisions which are based on the forecast. Which of the following steps of forecasting process involves identifying the decisions that need to be implemented for appraising of all the supply chain members concerned about these decisions?
- Understanding the objective of forecasting
  - Integrating demand planning and forecasting
  - Identifying major factors that influence the demand forecast
  - Understanding and identifying customer segments
  - Determining appropriate forecasting technique.
- ( 1 mark)

33. Which of the following statements is/are **true** regarding Vogel's Approximation Method (VAM) used to determine the initial feasible solution for a transportation problem?
- This is the most preferred method as it results in an optimal or a near optimal solution.
  - In this method, allocations are made on the basis of highest net cost change.
  - In this method, the maximum possible quantities of products are assigned to the top left corner cell of the problem.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
34. Capital is one of the important resources required for setting up an organization. In general, which of the following production systems require(s) high initial investment in fixed assets?
- Cellular manufacturing.
  - Product-focused manufacturing.
  - Process-focused manufacturing.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - Both (II) and (III) above.
- ( 1 mark)
35. Load distance model is one of the models used for developing a process layout. Which of the following statements is/are **true** regarding load distance model?
- This model uses templates to develop product and fixed position layouts.
  - It is used to minimize the material flow.
  - In this model, the load represents standardized amount of material.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - Both (II) and (III) above.
- ( 1 mark)
36. Which of the following reflects the purpose and responsibilities of the job?
- Job specification
  - Job duties
  - Job title
  - Job identification
  - Job specialization.
- ( 1 mark)
37. Which of the following is/are the benefit(s) of setting work standards?
- It acts as a basis to evaluate workers' level of performance.
  - It helps in scheduling the departmental works.
  - It helps the managers to determine the appropriate compensation for the workers.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
38. Which of the following is the major input for make-to-stock items in master production schedule?
- Material requirement plan
  - Aggregate plan
  - Capacity plan
  - Demand forecast
  - Business plan.
- ( 1 mark)

39. Which of the following assumptions of economic order quantity model are **not true**?

- I. The price of the inventory item is dependent on the order quantity.
- II. Total holding cost of inventory is proportional to the number of inventory items stored.
- III. The cost of ordering is dependent on the quantity ordered.
- IV. No scope for shortage of inventory.
- V. The product usage rate varies over time.

- (a) (I), (II) and (III) above
- (b) (I), (II) and (IV) above
- (c) (I), (III) and (V) above
- (d) (II), (III) and (V) above
- (e) (III), (IV) and (V) above.

( 1 mark)

40. Which of the following are the reasons for organizations to opt for in-house production?

- I. To have control over all the value chain activities.
- II. To put excess plant capacity to productive use.
- III. To take advantage of knowledge and expertise of suppliers
- IV. To ensure that the design of a product is kept secret.

- (a) (I), (II) and (III) above
- (b) (I), (II) and (IV) above
- (c) (I), (III) and (IV) above
- (d) (II), (III) and (IV) above
- (e) All (I), (II), (III) and (IV) above.

( 1 mark)

41. If an idea finds to be both technically and economically feasible, then a prototype of the product will be developed. Which the following is **not true** regarding the prototype design?

- (a) Prototype will consist of all the features of final product.
- (b) Prototype will be tested under standard conditions and defects will be noted.
- (c) On the basis of tests, the necessary changes will be made in the prototype.
- (d) Process of test results will be carried out till the performance of the prototype reaches satisfactory level.

- (e) A profitable prototype will enter into the production design stage.

( 1 mark)

42. Delphi technique is one of the methods used by organizations for long-term forecasting. Which of the following statements is/are **true** regarding this technique?

- I. In this technique, ideas and forecasts are obtained from all participants through a questionnaire.
- II. In this technique, the cycle of collecting data is limited or fixed.
- III. In this technique, the response of any member, which deviates from the opinion of majority, is rejected by panel members.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) Both (I) and (III) above.

( 1 mark)

43. Which of the following is an assumption of linear programming model where it implies that economies of scale do not play a role?

- (a) Divisibility
- (b) Certainty
- (c) Objectivity
- (d) Proportionality
- (e) Additivity.

( 1 mark)

44. Due to lack of quality suppliers, Britannia Industries is planning to start a dairy farm for milk, to take land on lease for producing wheat etc. Which of the following strategies is being implemented by Britannia?

- (a) Modernization and expansion
- (b) Horizontal integration
- (c) Forward integration
- (d) Backward integration
- (e) Diversification.

( 1 mark)



45. Line balancing is a part of assembly line study. Which of the following statements are true regarding line balancing?
- Line balancing ensures each workstation gets equal amount of time approximately.
  - The total amount of work on a line is divided into different tasks.
  - At the end of line balancing, the actual number of work stations ( $N_a$ ) required maybe less than or equal to the theoretical number of work stations ( $N_t$ ).
  - The tasks are assigned to workstations that allow the work to be performed in a feasible sequence.
- Both (II) and (III) above
  - Both (II) and (IV) above
  - (I), (II) and (III) above
  - (I), (II) and (IV) above
  - All (I), (II), (III) and (IV) above.
- ( 1 mark)
46. Specialization of labor has both pros and cons. Which of the following is the problem that arises due to specialization?
- Lower production time
  - Low wage rate
  - Worker losing interest in the job
  - Complex work instructions
  - Complicated recruitment process.
- ( 1 mark)
47. When a firm expands beyond a point, diseconomies of scale become apparent. Which of the following is/are the reason(s) for diseconomies of scale?
- High automation costs of plant and equipment.
  - Lower fixed costs of production per unit of output.
  - Complexities in operation.
- Only (III) above
  - Both (I) and (II) above
  - Both (I) and (III) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
48. Which of the following is a heuristics model used in aggregate planning to generate a set of equations that represents historical patterns of a company's aggregate planning decisions?
- Management coefficient model
  - Computer search model
  - Linear decision rules
  - Linear programming problem
  - Graphical method.
- ( 1 mark)
49. To exercise proper control over the inventory items, organizations classify and categorize these items. Which of the following inventory classification models is based on the criticality of a particular item in the production process?
- VED classification
  - FSND classification
  - P-system
  - ABC classification
  - Q-system.
- ( 1 mark)

50. In 1911, Henry Ford applied the principles of scientific management to a moving assembly line for the manufacture of the Model T Ford automobile. Which of the following statements are **true** regarding the principles adopted in moving assembly line?
- The product design is standardized.
  - Assembly lines are mechanized.
  - Specialized labor employed.
  - Using fixed parts for every production unit.
- Both (I) and (II) above
  - Both (III) and (IV) above
  - (I), (II) and (III) above
  - (I), (III) and (IV) above
  - All (I), (II), (III) and (IV) above. (1 mark)
51. Which of the following components of operations strategy focuses on the optimal use of capital, men, material and machines?
- Designing the production system
  - Product/service design and development
  - Technology selection and process development
  - Allocation of resources to strategic alternatives
  - Facility planning. (1 mark)
52. Which of the following statements is/are **true** regarding basic time series forecasting techniques?
- It involves identifying the trend and seasonal components.
  - In this method, the effect of seasonality is removed using the seasonal indices.
  - It assumes that the most recent data is a better indicator of future trends than past data.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - All (I), (II) and (III) above. (1 mark)
53. Which of the following statements is/are **true** regarding Cost-Profit-Volume (CPV) analysis used for finding a location?
- It shows the relationship between volume of output, costs and revenue of two locations.
  - It assumes that the revenues and costs are linear functions of output volume.
  - It assumes that the revenues for two locations are different because of the differences in demand and price of the product.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - All (I), (II) and (III) above. (1 mark)
54. Which of the following production systems is considered to be highly suitable for producing variety of products in small batches as compared to other systems?
- Process-focused job shop system
  - Product-focused dedicated system
  - Discrete unit manufacturing system
  - Cellular manufacturing system
  - Product-focused batch system. (1 mark)
55. The overall objective of designing a layout is to provide a smooth work flow of material through the factory. A layout that involves grouping of all the similar equipment or functions in one area is referred to as
- Job-Shop Layout
  - Flow Shop Layout
  - Group Technology Layout
  - Hybrid Layout
  - Fixed Position Layout. (1 mark)

56. Recruitment is an important activity of human resource management. Therefore, the management selects qualified and skilled personnel for the organization. Which of the following aspects determines the qualification and skills of an employee?
- Job analysis
  - Job specification
  - Technical feasibility
  - Job identification
  - Monetary system.
- ( 1 mark)
57. Opening balance of inventory for a component is 800 units. Demand forecast of the component for the period is 6,550 units. If the closing balance of the inventory is 500 units, the actual production of the component is
- 6,000 units
  - 6,100 units
  - 6,250 units
  - 6,300 units
  - 6,450 units.
- ( 1 mark)
58. Which of the following are **not** the reasons for holding raw materials as inventory?
- Larger shipments can result in reduced incoming freight costs and material handling cost.
  - Production of products as and when the customers demand them can be uneconomical.
  - Backlogs in customer orders may not always be allowed.
  - Products can be shown to customers.
- (I), (II) and (III) above
  - (I), (II) and (IV) above
  - (I), (III) and (IV) above
  - (II), (III) and (IV) above
  - All (I), (II), (III) and (IV) above.
- ( 1 mark)
59. Kharagpoor Enterprises is procuring bearings from vendors at a price of Rs.275/- per unit. The company is now planning for in-house production. The variable cost for in-house production is Rs.15/- per unit. The in-house production is economical when it produces not less than 300 units. If the organization wants to go for in-house production, the estimated installation and setup cost of machinery and equipment will be
- Rs.28,000
  - Rs.55,000
  - Rs.78,000
  - Rs.85,000
  - Rs.98,000.
- ( 1 mark)
60. Which of the following systems is a specialized system that translates Computer Aided Design (CAD) information into instruction for numerically controlled automated machines?
- Computer simulation
  - Computer-aided manufacturing
  - Automated storage and retrieval
  - Manufacturing information systems
  - Computer aided design.
- ( 1 mark)
61. Operations managers should be familiar with various types of costs and the methods of measuring and controlling them. Which of the following statements is/are **not true** regarding various cost categories?
- Variable costs denote direct costs like wages and raw-material cost.
  - Administrative costs and maintenance costs come under the category of prime costs.
  - Rent on premises, depreciation on equipment, insurance etc., are the examples of fixed costs.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (I) and (III) above
  - Both (II) and (III) above.
- ( 1 mark)

62. For an automobile company, sales for the last six months averaged 600 units. The average increase for the component was 60 units per month. In the sixth month, the company sold 651 units. If the smoothing constants are  $\alpha = 0.11$  and  $\beta = 0.15$ , the exponential smoothed trend for the sixth month is approximately equal to
- 56.65 units
  - 59.85 units
  - 60.65 units
  - 62.65 units
  - 64.65 units.
- ( 1 mark)
63. A fertilizer company needs to produce minimum 240 tons of a mixture consisting of ingredients A and B. The ingredient A costs Rs.4 per ton and B costs Rs.6 per ton. Not more than 80 tons of A can be used and at least 50 tons of B must be used to obtain the minimum cost mixture. Formulate the linear programming problem using the given information to minimize cost and meet the needs of the fertilizer company.
- Min  $Z = 4x_1 + 6x_2$ ; sub to  $x_1 + x_2 \geq 240, x_1 \leq 80, x_2 \geq 50, x_1 \geq 0, x_2 \geq 0$
  - Min  $Z = 4x_1 + 6x_2$ ; sub to  $x_1 + x_2 \geq 240, x_1 \geq 80, x_2 \geq 50, x_1 \geq 0, x_2 \geq 0$
  - Min  $Z = 80x_1 + 50x_2$ ; sub to  $x_1 + x_2 \geq 240, x_1 \geq 4, x_2 \geq 6, x_1 \geq 0, x_2 \geq 0$
  - Min  $Z = 80x_1 + 50x_2$ ; sub to  $x_1 + x_2 \geq 240, x_1 \leq 4, x_2 \geq 6, x_1 \geq 0, x_2 \geq 0$
  - Min  $Z = 4x_1 + 6x_2$ ; sub to  $x_1 + x_2 \geq 240, x_1 \leq 80, x_2 \leq 50, x_1 \geq 0, x_2 \geq 0$ .
- ( 1 mark)
64. Mr.Gopal is planning to set up a manufacturing unit for producing various types of television sets ranging from small to giant sized sets. Which of the following types of production design is suitable for the plant?
- Process manufacturing
  - Delivery of services
  - Process-focused production system
  - Discrete unit manufacturing
  - Cellular manufacturing.
- ( 1 mark)
65. The cycle time of an assembly line is observed as 0.8 min. If the assembly line is working for 7 hours a day, the expected output from the assembly line per day is
- 325 units
  - 425 units
  - 525 units
  - 625 units
  - 725 units.
- ( 1 mark)
66. A work sample study conducted over 23 hours yielded the following results:
- Production of the worker = 380 units  
 Worker performance = 85%  
 Allowance given by the company for the task = 35 %.  
 Idle time of worker = 25%.
- The standard time for producing one unit of the product is
- 3.56 min
  - 5.46 min
  - 6.36 min
  - 7.26 min
  - 8.16 min.
- ( 2 marks)
67. Capacity planning is important as overestimation or underestimation of capacity requirements can have an adverse impact on an organization's performance. Which of the following is the input for capacity requirement plan?
- Business plan
  - Production plan
  - Strategic plans
  - Material requirement plan
  - Supplier requirement plan.
- ( 1 mark)

68. Generally, marketing department of an organization prefers high levels of inventories to enhance sales. Storing huge inventory is risky and needs insurance. Insurance cost of inventory is a part of
- Purchase cost
  - Carrying cost
  - Stock out cost
  - Ordering cost
  - Setup cost.
- ( 1 mark)
69. The purchase department of an organization deals with various types of documents. Which of the following documents reflect(s) clear specification of required materials, quantity required, probable date of requirement, name of the department to which the costs are to be accounted?
- Purchase order.
  - Purchase requisition.
  - Quotation.
  - Request for quotation.
- Only (I) above
  - Only (II) above
  - (I), (II) and (III) above
  - (I), (II) and (IV) above
  - (II), (III) and (IV) above.
- ( 1 mark)
70. Achieving the production targets to meet the market demand is important for any organization. Productivity can be improved by dividing the job into sub-tasks and assigning them to workers based on their skills and capabilities. This concept was adopted by F.W.Taylor in his book "Principles of scientific management". This concept is known as
- Hawthorne studies
  - Scientific motion study of jobs
  - Division of labor
  - Scheduling techniques of employees
  - Moving assembly line.
- ( 1 mark)
71. Organizations follow different types of production systems based on their requirements. Which of the following statements is/are **true** regarding process-focused production system?
- It requires less supervision and easy production control.
  - It is suitable for firms producing wide spectrum of products in small batch sizes.
  - It is designed to support production departments that perform a single task like painting or packing.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
72. In a linear regression problem, the mean of independent variable and the mean of dependent variable are observed as 58.6 and 15.3. If the slope of the line is 0.25, Y-intercept of the line will be
- 0.35
  - 0.45
  - 0.55
  - 0.65
  - 0.75.
- ( 1 mark)
73. Which of the following refers to the entering variable used in simplex method for solving linear programming problem?
- The highest element in the index row
  - The value of solution variable with the highest ratio
  - The highest element among the coefficient of decision variable
  - The value of solution variable with the lowest ratio
  - The lowest element in the index row.
- ( 1 mark)

74. Which of the following types of process design **does not** permit the products or services to flow with back tracking or side tracking?
- Group technology
  - Process-focused
  - Product-focused
  - Cellular manufacturing
  - Intermittent.
- ( 1 mark)
75. Which of the following statements is/are **true** regarding point rating method for selecting a site or location?
- In this method, weightage is assigned to every factor in the form of points.
  - In this method, only tangible factors are assigned points.
  - In this method, a high score in any factor can overcome a low score in any other factor.
- Only (II) above
  - Only (III) above
  - Both (I) and (III) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
76. Certain unavoidable delays do exist while executing work. These delays should be considered during work measurement. In work measurement, consideration of unavoidable delays is known as
- Contingency allowance
  - Interference allowance
  - Relaxation allowance
  - Performance allowance
  - Environmental allowance.
- ( 1 mark)
77. Graphical method is one of the aggregate output planning models that help planners formulate the aggregate output plan. Which of the following statements is/are **true** regarding graphical method for aggregate output planning?
- It is a two dimensional model relating number of workers to cumulative output capacity.
  - It is used to identify the periods of excess inventory and shortages.
  - It is simple to understand and requires minimal computational effort.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
78. Which of the following systems assume(s) the lead time for replenishment of inventories to be zero?
- Fixed order period inventory system.
  - Fixed order quantity inventory system.
  - EOQ system.
- Only (I) above
  - Only (II) above
  - Only (III) above
  - Both (I) and (II) above
  - Both (II) and (III) above.
- ( 1 mark)
79. Value analysis involves the coordinated efforts of the engineering, production and purchasing personnel and helps in reviewing purchase activities to ensure that expenditures result in the receipt of appropriate value. Which of the following steps in the procedure of value analysis precedes the others?
- Gather all information about the product design, costs, scrap rates etc.
  - Evaluate the alternatives on criteria like cost and feasibility and eliminate the non- feasible alternatives
  - Examine all the products that are being reordered and identify each product that needs an improvement
  - Form a team that includes experts from various functional areas that are related to the functions performed by the material
  - Refine the feasible alternatives and select the optimal alternative.
- ( 1 mark)

80. Which of the following is a computer-controlled warehouse system that automates inflow and outflow of materials from the warehouse and shopfloor on the basis of production requirements?
- (a) Computer simulation
  - (b) Computer-aided manufacturing
  - (c) Automated storage and retrieval systems
  - (d) Manufacturing information systems
  - (e) Computer-aided design.
- ( 1 mark)

81. Which of the following stages of product life cycle depends on promotion or other marketing efforts for sale of products and reflects negative or quite insignificant profit?
- (a) Early maturity
  - (b) Growth
  - (c) Late maturity
  - (d) Introduction
  - (e) Decline.
- ( 1 mark)

82. Demand for a product is dynamic in the market. Changes in the demand pattern take place continuously. These changes could either show an upward or a downward movement. Which of the following forecast components refers to the demand patterns that exist for more than one year?
- (a) Cyclic
  - (b) Trend
  - (c) Promotional
  - (d) Seasonal
  - (e) Irregular.
- ( 1 mark)

83. Which of the following statements is/are **true** regarding artificial, surplus and slack variables used in simplex method for solving a linear programming problem?
- I. An artificial variable is used in a constraint with less than or equal sign.
  - II. A surplus variable is used in a constraint with greater than or equal sign.
  - III. A slack variable is used in a constraint with equal sign.
- (a) Only (I) above
  - (b) Only (II) above
  - (c) Only (III) above
  - (d) Both (I) and (II) above
  - (e) Both (II) and (III) above.
- ( 1 mark)

84. Which of the following statements is/are **true** regarding process planning and design?
- I. Operations strategy is driven by the choice of process design.
  - II. Product design of the organization influences its process design.
  - III. Process planning forms the basis for designing factory buildings and facility layouts, and selecting production equipment.
- (a) Only (I) above
  - (b) Both (I) and (II) above
  - (c) Both (I) and (III) above
  - (d) Both (II) and (III) above
  - (e) All (I), (II) and (III) above.
- ( 1 mark)

85. The task times for a process are given below.

Task	A	B	C	D	E	F	G
Task time( min)	40	48	30	35	37	45	65

The actual number of workstations of the balanced assembly line is 8. The company produces 12 units per day. If the assembly line expects to run with an efficiency of 75%, the production time per day will be

- (a) 6 hr
  - (b) 7 hr
  - (c) 8 hr
  - (d) 9 hr
  - (e) 10 hr.
- ( 2 marks)

86. In time study, when workers are aware that their performance is being recorded, they often behave differently from usual. Some may become nervous, or resentful, resulting in slowing down their pace of work. To nullify these effects, observations are recorded repeatedly across several workers. In time study, this particular step is known as
- Computing standard time
  - Computing allowances
  - Computing normal time
  - Pace rating the worker
  - Job identification and division.
- ( 1 mark)
87. Organizations follow different types of strategies to match supply and demand. Which of the following statements are **true** regarding varying the size of inventory strategy?
- It maintains varying production according to the varying demand.
  - It maintains constant workforce throughout the production cycle.
  - It involves risk of damage and obsolescence.
- Only (I) above
  - Only (II) above
  - Both (I) and (II) above
  - Both (II) and (III) above
  - All (I), (II) and (III) above.
- ( 1 mark)
88. Rajasthan Electronics Ltd., procures electronic circuit boards in lots of 115 units to fulfill the annual requirement of 675 units. Ordering cost is Rs.180 per lot. Carrying cost is 12% of the item cost. If the total inventory cost per annum is estimated at Rs.1,54,484, the cost of a circuit board will be
- Rs.525
  - Rs.425
  - Rs.325
  - Rs.225
  - Rs.125.
- ( 2 marks)

89. The initial feasible solution for a transportation problem is given below.

Plant \ Warehouse	W1	W2	W3	Production
F1	3	5	1.2	2
F2	3	4	6	10
F3	1	6	2	18
Requirement	8	7	15	30

The operations manager uses stepping stone method for determining the optimum solution. The closed path for the unoccupied cell (F2, W1) is

- (F2,W1) → (F2,W3) → (F3,W3) → (F3,W1)
  - (F2,W1) → (F2,W3) → (F3,W2) → (F3,W1)
  - (F2,W1) → (F1,W1) → (F1,W3) → (F2,W3)
  - (F2,W1) → (F1,W1) → (F1,W2) → (F2,W2)
  - (F2,W1) → (F3,W1) → (F3,W2) → (F2,W2).
- ( 1 mark)
90. Which of the following statements is/are **true** regarding smoothing constant?
- The value of a smoothing constant lies between  $-1$  and  $+1$ .
  - A high value for a smoothing constant is more appropriate for the products with stable demand.
  - A smoothing constant shows the effects of past demand on future demand forecasts.

- Only (I) above
- Only (II) above
- Only (III) above
- Both (I) and (II) above
- Both (II) and (III) above.

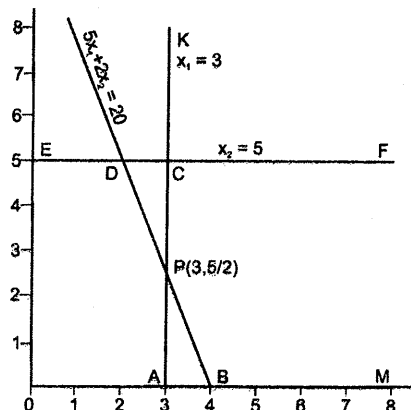
( 1 mark)



91. The following graph provides solution for the linear programming problem:

$$\text{Maximize } Z = 9,00,000x_1 + 3,00,000x_2;$$

$$\text{Subject to: } 5x_1 + 2x_2 \leq 20; x_1 \geq 3; x_2 \leq 5; x_1, x_2 \geq 0$$



The feasible region of the solution is

- (a) Region bounded by O, A, P, D and E
- (b) Region bounded by A, P and B
- (c) Region bounded by P, D and C
- (d) Region bounded by O, B, P, D and E
- (e) Region bounded by O, A, C and E.

(1 mark)

92. The forecasted figures of a product in the month of September and October 2010 are 44 and 52 units respectively. If the manager uses first-order exponential smoothing technique with a smoothing constant of 0.5, the actual demand for the month of September 2010 was

- (a) 44 units.
- (b) 48 units
- (c) 52 units
- (d) 54 units
- (e) 60 units.

(1 mark)

93. Which of the following statements are true regarding constrained optimization model?

- I. A constraint is a practical limitation that restricts the choice of the decision variable.
- II. A less than or equal to constraint imposes a lower limit on function of decision variables.
- III. Decision variables are the physical quantities that operations managers can control.
- IV. A greater or equal to constraint provides upper limit on function of decision variables.

- (a) Both (I) and (II) above
- (b) Both (I) and (III) above
- (c) (I), (II) and (III) above
- (d) (II), (III) and (IV) above
- (e) All (I), (II), (III) and (IV) above.

(1 mark)

94. Which of the following types of products can be manufactured by a company opting for produce-to-order policy?

- I. Seasonal demand products.
- II. Products meant exclusively for specific purposes.
- III. Products, parts or components of high value.
- IV. General application products.

- (a) Both (I) and (II) above
- (b) Both (II) and (III) above
- (c) Both (III) and (IV) above
- (d) (I), (II) and (III) above
- (e) (II), (III) and (IV) above.

(1 mark)

END OF QUESTION PAPER

## Suggested Answers

### Operations Management - I (MB2E3-01): October 2010

#### ANSWER

#### REASON

1. E Establishing provisions of union contracts is related to directing aspect of decisions and activities of operations managers.
2. C Purchase and installation cost = Rs.23,48,000  
 Net investment = Rs.16,50,000  
 Net investment = Purchase and installation cost – Anticipated future salvage value  
 $\therefore$  Anticipated future salvage value = Purchase and installation cost – Net investment  
 $= \text{Rs.}23,48,000 - \text{Rs.}16,50,000$   
 $= \text{Rs.}6,98,000$
3. A The performance of a forecasting model can be monitored by tracking signal. If a forecast model makes accurate predictions then the tracking signal will be very close to zero. If demand deviates widely from the forecast over a period of time the tracking signal deviates significantly from zero. A positive tracking signal indicates that the forecasts are lower than actual demand (underestimating). A negative tracking signal indicates that the forecasts are higher than the actual demand (overestimating).  
 Thus the performance of a forecasting model is monitored over a period.  

Tracking signal	Forecasts	Actual	Performance of the forecasting model
+ ve	Lower	More	Underestimating
- ve	More	Lower	Overestimating
4. D The following statements are true regarding linear programming problem.
  - The objective and the constraints are linear functions.
  - The decision variables are continuous and they accept any **positive and fractional** values within the specified range.
  - The problem can also be solved by alternative courses of action.
5. E **Integration with other parts of organization:-** An organization that already has some plants and wants to establish a new plant would like to locate it near to the existing plants so that its work can be integrated with other plants. This helps firms view the entire group as a single entity. By integration, the resources can be utilized effectively. Integration of operations leads to achievement of the production targets of the group as a whole.
6. D **Behavioral feasibility:** The nature of duties and responsibilities that characterize a job influence the perception jobholders have of themselves and their perception of others. When an important responsibility is delegated to a worker, it enhances his self-esteem and motivates and stimulates him to work harder. These behavioral traits and attitudes of people have a significant impact on the effectiveness of an organization. Job design need to take these behavioral factors into consideration.
7. B Time series analysis is not a work measurement technique. This is one of the demand forecasting methods.

8. B Under varying the utilization of the workforce strategy, the firm maintains a stable workforce and varies the utilization of the workforce in accordance with demand or required output. When demand is lean, the workforce is scheduled to produce only the output to meet demand, resulting in idle work hours. On the other hand, if the demand is high, the same workforce works overtime to meet the demand. So, the workforce is overworked when demand is high, and underutilized when demand is less.

Fixed workforce = 50 workers.

Productivity = 8 units per worker per day.

Productivity = 1 unit per worker per hour.

Regular working hours of the plant = 8 hours per day.

Regular pay rate of worker = Rs.25 per hour.

Overtime pay rate of worker = Rs.35 per hour.

Cost of idle work hour = Rs.30

Regular labor hours in a month

= No of hours per day × No of production days × No of workers

Month	Jul	Aug	Sept	Oct	Nov	Dec
Expected Demand (units)	9800	7100	9000	8000	8000	9000
Production Days	22	18	21	21	22	20
Regular labor hours of the month	8800	7200	8400	8400	8800	8000
Regular production capacity (units)	8800	7200	8400	8400	8800	8000
Additional production requirement (units)	1000	-Nil-	600	-Nil-	-Nil-	1000
Overtime labor hours required	1000	-Nil-	600	-Nil-	-Nil-	1000
Regular production cost (Rs.)	2,20,000	1,80,000	2,10,000	2,10,000	2,20,000	2,00,000
Overtime production cost (Rs.)	35,000	-Nil-	21,000	-Nil-	-Nil-	35,000
Idle labor hours of the month	-Nil-	100	-Nil-	400	800	-Nil-
Cost of idle labor hours (Rs.)	-Nil-	3000	-Nil-	12000	24000	-Nil-
Total cost for the month (Rs.)	2,55,000	1,83,000	2,31,000	2,22,000	2,44,000	2,35,000

Cost of idle labor hours = 3,000 + 12,000 + 24,000 = Rs.39,000

9. D This is in house production. The number of bags to be made in a lot is nothing but the economic order quantity. So, we need to find out the economic order quantity.

$$EOQ = \sqrt{\frac{2C_o D}{C_h}}$$

Where  $C_o$  is the fixed cost per order or set up cost

$D$  is the annual usage or demand

$C_h$  is the carrying cost per unit.

The setup cost is considered as order cost.

$\therefore C_o = \text{Rs.}500$

$D = \text{Rs.}1250 \text{ units}$

Item cost = Rs.25

Carrying cost ( $C_h$ ) = 7% of item cost

$$= 0.07 \times 25 = 1.75$$

$$EOQ = \sqrt{\frac{2 \times 500 \times 1250}{1.75}} = \sqrt{7,14,285.71}$$

$$= 845.15 = 845 \text{ units.}$$

10. D This is not true for purchasing function. While selecting a supplier from those listed in the vendor database, before ordering an item, purchase managers have to ensure that the purchase is made on the most advantageous terms. The lowest price does not always ensure for a supply at a low cost, since the supply may attract other costs like rectification, in case defective material has been supplied. Hence quotations are examined for items such as delivery charges, discount structure, and other supplementary charges like tax payable. The selection is also made on the basis of other criteria like quality, quantity and promptness of deliveries. Purchase managers then select suppliers by rating their merit on relative scale, which is also known as vendor rating.

11. B The decisions which are having a time frame of one or two years are called tactical decisions. Determining the reordering level and order quantities of materials are the examples of tactical decisions.

12. C Net Present Value (NPV) = Rs.5,72,820.69

Cost of investment is to be considered as discount rate ( $r$ ) = 13% = 0.13

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1+r)^t} - I$$

$$5,72,820.69 = \frac{10,00,000}{(1.13)} + \frac{12,00,000}{(1.13)^2} + \frac{13,00,000}{(1.13)^3} + \frac{14,00,000}{(1.13)^4} + \frac{9,00,000}{(1.13)^5} - I$$

$$5,72,820.69 = \frac{10,00,000}{1.13} + \frac{12,00,000}{1.2769} + \frac{13,00,000}{1.4429} + \frac{14,00,000}{1.6305} + \frac{9,00,000}{1.8424} - I$$

$$5,72,820.69 = 8,84,955.75 + 9,39,776.02 + 9,00,963.33 + 8,58,632.32 + 4,88,493.27 - I$$

$$5,72,820.69 = 40,72,820.69 - I$$

$$\therefore I = 40,72,820.69 - 5,72,820.69 = \text{Rs.}35,00,000$$

13. D The forecasting method used by the owner of the store is weighted moving average. Here, the owner did not want all the four periods equally weighted owing to some trend or seasonality demand.

14. D Various symbols used in a process chart are given below:

Symbol	Activity
O	Operation
⇒	Transport
□	Input
D	Delay
▽	Storage

15. B

Forecast $F_t$	Actual( $A_t$ ) $A_t$	Deviation $A_t - F_t$	Abs.Deviation $ A_t - F_t $
450	400	-50	50
510	420	-90	90
400	420	20	20
380	300	-80	80
360	380	20	20
400	500	100	100
500	560	60	60
480	440	-40	40
400	500	100	100
500	480	-20	20
		20	580

Sum of deviations = 20

Deviation is nothing but the forecasting error.

Running Sum of Forecasting Error is the sum of deviations (RSFE) = 20

Sum of absolute deviations = 580

$$\text{Mean absolute deviation} = \frac{\text{Sum of absolute deviations}}{\text{no of periods}} = \frac{1}{n} \sum_{t=1}^n |A_t - F_t| = \frac{580}{10} = 58$$

$$\text{Tracking signal} = \frac{\text{RSFE}}{\text{MAD}} = \frac{20}{58} = 0.34$$

16. A Several models and techniques are available that help managers make appropriate location decisions. Some of the models are:
- Cost-Profit-Volume analysis
  - Point rating method
  - Transportation method
  - Center of gravity method
  - Analytic Delphi method
- Computer search models are used in aggregate planning and critical ratio method is used in scheduling.
17. C A good job design leads to minimizing the worker input. It helps in higher production with lower inputs.
18. C The organization should use heuristic model, as such a model is based on historical aggregate planning data available with an organization. Hence option (c) is the correct answer.
19. B Ordering costs are associated with the process of purchasing inventory. These costs include costs associated with preparing the purchase order, postage, telephone calls to the vendors, set up costs if produced in-house, record keeping and accounting costs and material receiving costs. These costs are also known as acquisition costs.
20. E The following statements are true regarding purchasing system.
- The centralized of purchasing activities leads to consistency in buying policies and uniformity in maintaining purchasing records.
  - Centralized** purchasing system is preferable for an organization with many autonomous production units within the same site which require materials with the same or similar specifications.
  - In a centralized purchasing system the benefits of bulk purchasing can be realized by pooling all the requirements.
21. A F.W.Taylor proposed a systematic approach called the 'shop system' and implemented in Midvale Steel Works to improve labor efficiency and productivity. Following are the some of the key concepts of the system.
- Proper supervision by carefully selected and trained supervisors.
  - Incentive pay systems to motivate workers.
22. D Base demand is the average of sales over a given time period.  
This figure can be taken as the right forecast if the product's demand is not impacted by seasonal, trend, cyclic and promotional factors.
- $$\therefore \text{Right forecast for the month of July} = \frac{270+295+275+285+260+280}{6}$$
- $$= \frac{1665}{6} = 277.5 \text{ units.}$$
23. E The following statements are true regarding the advantages of simplex method.
- This method can be applied to problems where the number of decision variables is more than two.
  - This method **skips** sub-optimal extreme points and checks only **limited** number of points to determine the optimal solution.
  - The algorithm detects whether the problem is infeasible, unbounded or has multiple solutions.
24. D Work centers are used in group technology layout or group technology production system. In this, dissimilar machines are grouped into work centers to work on products similar in shape and processing requirements.
25. D Cycle time is referred to as:
- Daily operating time spend divided by desired level of production per day.
  - The maximum allowable time required at each work station.
  - The time spent by the material between processing.

26. B Task identity defines clearly the identifiable tasks needed to complete the main task.
27. A Work factors is one of the methods widely used in predetermined motion-time data systems. They are used to record standard time for the basic motions like reach, grasp, move, turn, stretch, apply pressure, release, and so on.
28. A Option (a) is not true regarding master production schedule.  
The aggregate plan sets a level of operations that balances market demand with the material, labor and equipment capabilities of the firm, whereas the master schedule is more detailed and translates the aggregate plan into a specific number of individual products to be produced in specific time periods at specific workstations.
29. C **Reorder point:-** The calculation of the reorder point should ensure that the inventory level reaches zero at the end of each reordering cycle. This is because a positive inventory level at the end of cycle results in an increase in average inventory and associated costs. To ensure that this condition is satisfied, reorder level is set equal to the number of units that are estimated to be used during the lead time plus the safety stock needed.
30. B Contract negotiation and communication is one of the steps of purchasing. In this step purchase managers develop terms and conditions including the issues such as price of the items, quality and other performance standards, technical specifications, delivery schedule and freight payment.
31. E During 1970s, organizations started using manufacturing information systems to manage operations. Manufacturing information systems are used for planning and controlling operations. These systems provide comprehensive information regarding production, such as demand forecasts, purchasing, inventories, etc. These information systems led to the development of Material Requirement Planning (MRP).
32. A **Understand the Objective of Forecasting:** This is the first step in forecasting process. It is extremely important for a firm to be clear about the objectives of the forecasting process. For every firm, the motive behind carrying out a forecasting exercise is to implement decisions which are based on the forecast. Thus, first the firm should identify the decisions that need to be implemented. It should also appraise all the supply chain members concerned about these decisions.
33. A Statement (I) is true regarding Vogel's approximation method used to determine an initial feasible solution for a transportation problem.  
Net cost change is calculated in Stepping Stone Method for finding out optimal solution for a transportation problem. Hence statement (II) is not related to Vogel's approximation method.  
In North West Corner method, maximum possible quantities of products are assigned to the top left corner cell of the problem. Hence, statement (III) is not true.
34. B Product-focused production system requires high initial investment in fixed cost. These costs are related to the expensive machinery automated controls and fixed position material handling equipment.
35. E Statements (II) and (III) are true regarding load distance model.  
Templates and two-dimensional cutouts of equipment drawn to scale are the most common layout planning tools used in graphic and schematic analysis model.
36. C Job title, job identification, job duties and job specifications are the basic components of job description. And Job title reflects the purpose and responsibilities of the Job.
37. E Following are the benefits of setting work standards:  
I. It acts as a basis to evaluate workers level of performance.  
II. It helps in scheduling the departmental works.  
III. It helps the managers to determine the appropriate compensation for the workers.
38. D The major input for make-to-stock items in master production is the demand forecast.

39. C The following are the assumptions of economic order quantity model.
- I. The price of the inventory item is **independent** of the order quantity.
  - II. Total holding cost of inventory is proportional to the number of inventory items stored.
  - III. The cost of ordering is **independent** of the quantity ordered.
  - IV. No scope for shortage of inventory.
  - V. The product usage rate is **fixed** over time.
40. B Organizations usually opt for in-house production for the following reasons:
- To have control over all value chain activities.
  - To put excess plant capacity to productive use.
  - To ensure that the design of a product is kept a secret.
- 'To take advantage of knowledge and expertise of suppliers' is one of the reasons for organizations to opt for outsourcing.
41. A Option (a) is incorrect statement. Prototype may not have all the features of the final product but has all basic characteristics of the product. All other statements are true.
42. A The following statements are true regarding Delphi technique.
- In this technique, ideas and forecasts are obtained from all participants through a questionnaire.
  - New questions are developed on the basis of the responses. This cycle is repeated till the results are in a range that is narrow enough to be used as a forecast.
  - The response of any member deviates from the opinion of the majority is **requested to reconsider or provide justification for the deviation**.
43. D In linear programming, it is assumed that the contribution of individual decision variables in the objective function is proportional to their numeric value. This means that economies of scale do not play a role in linear programming problems.
44. D Backward integration refers to the ownership of the production and distribution chain backwards i.e. towards source of supplies.
45. D The following statements are true regarding line balancing.
- I. Line balancing ensures each workstation gets equal amount of time approximately.
  - II. The total amount of work is divided into different tasks.
  - III. At the end of the process of line balancing, the actual number of work stations ( $N_a$ ) required may be **greater than or equal** to the theoretical number of work stations ( $N_t$ ).
  - IV. The tasks are assigned to workstations such that the work is performed in a feasible sequence.
46. C Job specialization lead to the worker losing interest in the job, and this may ultimately result in poor quality, lower production rates, and higher rates of absenteeism and employee turnover. Other options are not the problems, they are the benefits of specialization.
- Benefits of specialization are:
- Lower production time
  - Lower wage rates
  - Simple work instructions
  - Easy recruitment process

47. C The basic theory behind economies of scale is that as the size of an operation increases, per unit cost of production decreases. The reasons include the decrease in fixed costs of production per unit of output, and adoption of efficient process and technologies like automation. But when a firm expands beyond a point, diseconomies of scale becomes apparent, because the expenditure incurred for maintaining large operations becomes uneconomical. The reasons are:  
Increased distribution and storage cost.  
Complexities in operation.  
High automation costs.  
(Automation helps only when the organization enjoying the economies of scale. After particular point diseconomies of scale occur. In such a situation high automation costs are the burden to the organization.) Lower fixed cost of production per unit is a reason for economies of scale.
48. A Management coefficient model is a heuristics model which uses the regression method to identify capacity requirements based on the management past decisions.
49. A VED classification is based on the importance of a particular item in the production process. Under VED, the items, which are critical for production are classified as V (vital), the items, which are important in the production process but not critical are classified as E (essential) and the items, which consists of non essential and do not influence the production process are classified as D (desirable).
50. C The following statements are true regarding the principles adopted in moving assembly line.
- The product design is standardized.
  - Assembly lines are mechanized.
  - Specialized labor employed.
  - Interchangeable parts are used in production units.
51. D 'Allocation of resources to strategic alternatives' is the component of operations strategy where the operations manager focuses on the optimal use of the resources like, capital, men, material and machines.
52. D Static forecasting methods are also known as basic time series forecasting techniques. Statement (I) and (II) are true regarding basic time series forecasting techniques.  
I. It involves identification of trend and seasonal components.  
II. In this method seasonal variations are identified and their effects are removed.  
Statement (III) is not true regarding basic time series forecasting techniques. Basic time series forecasting techniques assume that trend and seasonal components do not vary from year to year. Adaptive forecasting techniques assume that most recent data is a better indicator of future trends than past data.
53. D The following statements are true regarding Cost-Profit-Volume (CPV) analysis.
- It shows the relationship between volume of output, costs and revenue of two locations.
  - It assumes that the revenues and costs are linear functions.
  - It assumes the revenues for two locations are **same** as there will not be much difference in demand if the price of the product remains the same irrespective of the location it was produced at.
54. A Process-focused production system is highly suitable for producing variety of products in small batches as compared to other systems. The product flexibility decreases in the following order.  
Process focused production system → Cellular manufacturing → Product focused batch system → Product focused production system → Product-focused dedicated system.
55. A Process layouts also known as Job-shop layouts, involve grouping of similar equipment or functions in one area.
56. B Job specification determines the qualifications and skills of an employee.



57. C Opening balance = 800 units  
Demand forecast = 6,550 units  
Closing balance = 500 units  
Closing inventory = (Opening balance + Actual production) – Demand forecast  
 $500 = 800 + \text{Actual production} - 6,550$   
Actual production =  $500 + 6,550 - 800 = 6,250$  units.
58. D Following are not the reasons for holding raw materials as inventory, but are the reasons for holding finished goods as inventory.  
II. Production of products as and when the customers demand them can be uneconomical.  
III. Backlogs in customer orders may not always be allowed.  
IV. Products can be shown to customers.  
Larger shipments can result in reduced incoming freight costs and material handling cost, is a reason for holding raw materials as inventory.
59. C Purchase price = Rs.275 per unit  
Variable cost of production = Rs.15 per unit  
As it is economical for the organization producing minimum of 300 units, BEP occurs at this quantity.  
 $\therefore \text{BEP} = 300$  units.  
At BEP:  
Total production cost = Total purchase cost  
Fixed cost + variable cost = unit price  $\times$  quantity  
Fixed cost +  $(15 \times 300) = 275 \times 300$   
Fixed cost + 4,500 = 82,500  
Fixed cost =  $82,500 - 4,500 = \text{Rs.}78,000$   
The fixed cost is the installation and setup cost of machinery and equipment.
60. B Computer Aided Manufacturing (CAM) is a specialized computer system, which translates Computer Aided Design (CAD) design information into instruction for numerically controlled automated machines.
61. B The following statements are true regarding various cost categories.  
i. Variable costs denote direct costs like wages to workers and raw-material cost.  
ii. Administrative cost and maintenance costs come under the category of indirect costs.  
iii. Rent on premises, depreciation on equipment, insurance etc. are the examples of fixed costs.

62.

B

Average sales ( $A_0$ ) = 600 unitsSales in sixth month ( $D_6$ ) = 651 unitsAverage increase ( $T_0$ ) = 60 unitsSmoothing constants;  $\alpha=0.11$  and  $\beta = 0.15$ 

Exponential smoothed estimates for the sixth month is obtained by:

$$A_t = \alpha D_t + (1 - \alpha)(A_{t-1} + T_{t-1})$$

$$T_t = \beta(A_t - A_{t-1}) + (1 - \beta)T_{t-1}$$

Exponential smoothed average for the sixth month is:

$$A_6 = \alpha D_6 + (1 - \alpha)(A_5 + T_5)$$

Average sales ( $A_0$ ) and Average trend ( $T_0$ ) are to be taken for  $A_5$  and  $T_5$ .

$$A_6 = \alpha D_6 + (1 - \alpha)(A_0 + T_0)$$

$$A_6 = (0.11 \times 651) + (1 - 0.11)(600 + 60)$$

$$A_6 = 71.61 + (0.89)(660)$$

$$A_6 = 71.61 + 587.40 = 659.01$$

Exponential smoothed trend for the sixth month is:

$$T_6 = \beta(A_6 - A_5) + (1 - \beta)T_5$$

$$T_t = 0.15(659.01 - 600) + (1 - 0.15)60$$

$$T_t = 0.15(59.01) + (0.85)60$$

$$T_t = 8.85 + 51.00 = 59.85$$

63.

A

Let variable  $x_1$  indicate a mixture of ingredient A(in tons)Let variable  $x_2$  indicate a mixture of ingredient B(in tons)

The fertilizer company needs to produce minimum of 240 tons of a mixture consisting of ingredients A and B.

$$x_1 + x_2 \geq 240.$$

The ingredients A costs Rs.4 per ton and B costs Rs.6 per ton. Therefore the total cost will be  $4x_1 + 6x_2$ . Hence the objective function is minimize  $Z = 4x_1 + 6x_2$ .A can be used not more than 80 tones  $\Rightarrow x_1 \leq 80$ .B must be used at least 50 tones  $\Rightarrow x_2 \geq 50$ .

To minimize the cost mixture.

The formulation of given linear programming problem is

$$\text{Minimize(costs)} Z = 4x_1 + 6x_2$$

Subject to the constraints

$$x_1 + x_2 \geq 240.$$

$$x_1 \leq 80$$

$$x_2 \geq 50.$$

Where,  $x_1 \geq 0$  and  $x_2 \geq 0$ .

64.

D

Discrete unit manufacturing refers to the production of distinct products by using the same production system, i.e., after one batch the same system can be utilized for the production of different or new items of the same type to be produced in the next batch. This is more suitable for the production of television sets.

65. C Cycle time = 0.8 min  
 Production time per day = 7 hr = 7 × 60 = 420 min  

$$\text{Cycle time} = \frac{\text{Production time per day}}{\text{Required output per day}}$$

$$\therefore \text{Required output per day} = \frac{\text{Production time per day}}{\text{Cycle time}} = \frac{420}{0.8} = 525 \text{ units.}$$
66. A Given data:  
 Total time study = 23 hr = 23 × 60 min = 1,380 min  
 Allowances = 35% = 0.35  
 Idle time = 25% = 0.25  
 Worker performance = 85% = 0.85  
 Production of the worker = 380 units  
 Calculations:  
 Available fraction of time = 1 – Allowances = 1 – 0.35 = 0.65  
 Actual working time = 1 – Idle time = 1 – 0.25 = 0.75  
 Normal time = Average cycle time × worker rating  

$$= \frac{\text{Total time}}{\text{Number of units completed}} \times (\text{Percent of time working}) \times (\text{Rating factor})$$

$$= \frac{1,380}{380} \times (0.75) \times (0.85) = 2.315 \text{ min/part}$$

$$\text{Standard time} = \frac{\text{Normal Time}}{\text{Available fraction}} = \frac{2.315}{0.65} = 3.5617 \approx 3.56 \text{ min/part.}$$
67. D Material requirement plan is the input for capacity requirement plan.  
 Aggregate plan → Master production schedule → Material requirement plan → Capacity requirement plan
68. B Insurance cost belongs to carrying or holding cost.  
 Carrying (holding) cost :- Carrying cost includes opportunity cost (cost of capital), storage costs (rent, lighting, refrigeration etc.), staffing, equipment, maintenance, insurance, taxes on godown, taxes on inventory, security, obsolescence (deterioration costs like breakage, spoil, etc.)
69. B The purchase department deals with various types of documents. A purchase requisition consist of a clear specification of required materials, quantity required, probable date of requirement, name of the department to which the costs are to be accounted.
70. C Division of job into sub-tasks and assigning them to workers based on their skills and capabilities is called division of labor.
71. D The following statements are true regarding process-focused production system.
- Process-focused production system requires **more** supervision and **complex** production control.
  - It is suitable for firms producing wide spectrum of products in small batch sizes.
  - It is designed to support production departments that perform a single task like painting or packing.
72. D In a linear regression problem the value of Y-intercept is obtained by:  
 $a = \bar{Y} - b\bar{X}$  where a - is Y-intercept of the line  
 b - is slope of the line  
 $\bar{X}$  - is the mean of independent variable and  
 $\bar{Y}$  - is the mean of dependent variable.  
 $\bar{X} = 58.6$   
 $\bar{Y} = 15.3$   
 $b = 0.25$   
 $a = \bar{Y} - b\bar{X} = 15.3 - (0.25 \times 58.6) = 15.3 - 14.65 = 0.65$

73. A Entering variable is the highest element in the index row.
74. C In product-focused process design, products or services tend to flow along linear paths. It does not permit the products or services to flow with back tracking or side tracking
75. C The following statements are true for point rating method.
- I. Weightages are assigned to the objectives in the form of points.
  - II. In this method, **only intangible** factors assigned points.
  - III. The drawback of this method is that a high score in any factor can overcome a low score in any other factor.
76. A In work measurement, the normal time estimated is not always equal to the standard time required to perform a task, as a person cannot perform consistently over a period of time for a variety of reasons. So, when calculating the standard time, allowances should be considered. The unavoidable delays are considered as contingency allowances.
77. D The following statements are true regarding graphical method for aggregate output planning.
- It is a two dimensional model relating number of **cumulative productive days** to cumulative units of output for the planning period.
  - It is used to identify the periods of excess inventory and shortages.
  - It is simple to understand and requires minimal computational effort.
78. B Fixed order quantity system assumes that the demand for inventories over a period of time is constant and the lead time for replenishment is zero.
79. C The step -by- step procedure of value analysis is :
- Examine all the products that are being reordered and identify each product needs and improvements
  - Gather all information about the product design, costs, scrap rates etc.
  - Form a team that includes experts from various functional areas that are related to the functions performed by the material
  - Generate all alternatives by generating new ideas and evaluate different ways of accomplishing the tasks
  - Evaluate the alternatives on criteria like cost and feasibility and eliminate the non- feasible alternatives
  - Refine the feasible alternatives and select the optimal alternative.
80. C Automated Storage and Retrieval Systems (AS/RS) is a computer controlled warehouse system that automates inflow and outflow of materials from the warehouse and shop-floor on the basis of production requirements.
81. D Introduction is the first stage of a typical product life cycle. In this stage, sales are dependent on promotion and other marketing efforts and profits are either negative or quite insignificant.
82. A Cyclic component of forecasting refers to changes in the demand patterns, which exist for more than one year. These changes could show an upward or downward movement.
83. E Statements (II) and (III) are true regarding artificial, surplus and slack variables.  
In simplex method the use of artificial, surplus and slack variables is explained below.

<u>Variable</u>	<u>Used in constraint</u>
Artificial (DummY)	=and $\geq$
Surplus (- sign)	$\geq$
Slack (+ sign)	$\leq$

84. D The following statements are true regarding process planning and design.
- i. The choice of process design is driven by the operations strategy.
  - ii. Product design of the organization influences its process design.
  - iii. Process planning forms the basis for designing factory buildings and facility layouts, and selecting production equipment.

85. E Sum of task times =  $40 + 48 + 30 + 35 + 37 + 45 + 65 = 300$  min.  
 Actual number of work stations of the balanced assemble like = 8  
 Output = 12 units/day.  
 Efficiency of the assembly line is =  $75\% = 0.75$   

$$\text{Efficiency} = \frac{T}{N_a \times C}$$
 where T is sum of task times  
 $N_a$  is actual number of work stations and  
 C is cycle time  

$$0.75 = \frac{300}{8 \times C}$$

$$\therefore C = \frac{300}{8 \times 0.75} = 50 \text{ min.}$$

$$\text{Cycle time} = \frac{\text{Production time per day}}{\text{Output per day}}$$

$$50 = \frac{\text{Production time per day}}{12}$$

$$\therefore \text{Production time per day} = 50 \times 12 = 600 \text{ min} = 10 \text{ hr}$$
86. D Pace rating the worker:- During time study when workers are aware that their performance is being recorded, they often behave differently resulting in slowing down their pace of work. To avoid, these effects, observations are recorded repeatedly across several workers. Based on this, each worker's performance is rated as a percentage of normal workers.
87. D **Varying size of inventory:** - Under this strategy, an organization maintains a constant workforce and level of production. **Constant rate of production** is maintained during all periods irrespective of the demand. When the demand is low, there will be accumulation of production. This excess production is utilized during the periods of high demand. The accumulation of production leads to the risk of damage and obsolescence.

88.

D

Order quantity (Q) = 115 units

Annual demand = 675 units

Cost per unit ( $C_p$ ) = Let Rs.  $x$ 

Carrying cost per unit ( $C_h$ ) = 12% of the item cost  
 $= 0.12 \times x$

Ordering cost ( $C_o$ ) = Rs. 180 per lot

Annual inventory cost = Ordering cost + Carrying cost + Variable cost

$$TC = C_o \left[ \frac{D}{Q} \right] + C_h \left[ \frac{Q}{2} \right] + C_p D$$

Where

 $C_o$  = Fixed cost per order

D = Annual demand

Q = Order quantity

 $C_h$  = Carrying cost per unit $C_p$  = Cost per unit

$$TC = C_o \left[ \frac{D}{Q} \right] + C_h \left[ \frac{Q}{2} \right] + C_p D$$

$$1,54,484 = 180 \times \frac{675}{115} + (0.12 \times x) \times \frac{115}{2} + (x \times 675)$$

$$1,54,484 = 1,056.52 + 6.90x + 675x$$

$$1,54,484 - 1,056.52 = (6.90 + 675)x$$

$$1,53,427.48 = 681.90x$$

$$\therefore x = \frac{1,53,427.48}{681.90} = \text{Rs. } 225$$

89.

A

The closed path for unoccupied cell (F2, W1) is:

(F2, W1)  $\rightarrow$  (F2, W3)  $\rightarrow$  (F3, W3)  $\rightarrow$  (F3, W1)

90.

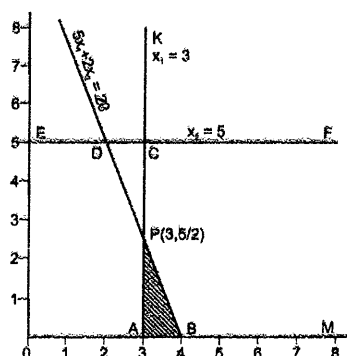
C

The following statements are true regarding smoothing constant.

- I. The value of a smoothing constant lies between 0 and +1.
- II. A low value for a smoothing constant is more appropriate for the products with stable demand.
- III. A smoothing constant shows the effects of past demand on future demand forecasts.

91.

B



ABP is the feasible region satisfying all the constraints.

92. E In first order exponential smoothing method,  
the demand forecast for period t is given by:  

$$F_t = \alpha \times D_{t-1} + (1-\alpha)F_{t-1}$$
Where  $F_t$  is the forecast for period t  
 $F_{t-1}$  is the forecast for period (t-1)  
 $D_{t-1}$  is the actual demand for period t and  
 $\alpha$  is the smoothing constant.  

$$52 = 0.5 \times D_{t-1} + (1-0.5)44$$

$$52 = 0.5 \times D_{t-1} + 22$$

$$52 - 22 = 0.5 \times D_{t-1}$$

$$30 = 0.5 \times D_{t-1}$$

$$D_{t-1} = \frac{30}{0.5} = 60 \text{ units.}$$
93. B The following statements are true regarding constrained optimization model.
1. A constraint is a practical limitation that restricts the choice of the decision variable.
  2. A less than or equal to constraint imposes an **upper** limit on function of decision variables.
  3. Decision variables are the physical quantities that operations managers can control.
  4. A greater than or equal to constraint provides **lower** limit on function of decision variables.
94. B Produce-to-stock policy is useful for:
- I. Seasonal demand products.
  - IV. General application products.
- Produce-to-order policy is useful for:
- II. Products meant exclusively for specific purposes.
  - III. Products, parts or components of high value.

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