Question Paper
Operations Management – I (MB2E3): October 2008

- **Answer all 85 questions.**
- **Marks are indicated against each question.**

Total Marks : 100

1. XYZ Ltd., is a manufacturer of electronic items like transistors, tape recorders, video games etc. These products can be made in batches. The company, in order to meet the intense competition, wants to produce new and different electronic goods in each batch. Which of the following would be the proper process design for the company?

   (a) Cellular manufacturing
   (b) Group technology
   (c) Process focused
   (d) Process manufacturing
   (e) Discrete unit manufacturing.

   (1 mark)

2. Organizations follow different types of strategies to match supply and demand. Which of the following statements are **true** regarding varying the size of inventory?

   I. Production varies according to the varying demand.
   II. Constant rate of production is maintained during all periods irrespective of the demand level.
   III. Constant workforce is maintained throughout the production cycle.
   IV. Workforce varies by hiring and firing to match the production requirements.

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

   (1 mark)

3. In a time study, the cycle time is 2.50 minutes, standard time is 2.21 minutes, and average allowance for the activity is 15 percent of the normal time. Worker performance rating is

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 85%
   (e) 95%.

   (1 mark)

4. Which of the following statements is/are **true** regarding simplex method?

   I. The row with minimum ratio is called the key row.

   II. The optimum solution in a maximization case is obtained if all the values in the $(C_j - Z_j)$ row are positive.

   III. The solution variable in the key row will be the departing variable.

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

   (1 mark)

1

5.

<Answer>

A firm produces three products X_1, X_2 and X_3. It uses two types of raw material, M1 and M2 of which 5,000 and 7,000 units respectively are available. The raw material requirements per unit of the products are given below:

Raw Material	Product X_1	Product X_2	Product X_3
M1	3	4	5
M2	5	3	5

The labor time of each unit of product X_1 is twice that of product X_2 and three times that of X_3. 3000 labor hours are available. The minimum demand of the products is 600, 650 and 500 units respectively. The profits per unit of X_1, X_2 and X_3 are Rs.50, Rs.50 and Rs.80 respectively. Identify the constraints from the given information.

I. $3X_1 + 4X_2 + 5X_3 \leq 5000$; $X_1 \geq 600$.

II. $3X_1 + 2X_2 + 1X_3 \leq 3000$; $X_2 \geq 650$.

III. $5X_1 + 3X_2 + 5X_3 \leq 7000$; $X_3 \geq 500$.

IV. $6X_1 + 3X_2 + 2X_3 \leq 3000$; $X_2 \geq 650$.

(a) Both (I) and (II) above
(b) Both (II) and (III) above
(c) (I), (II) and (III) above
(d) (I), (II) and (IV) above
(e) (I), (III) and (IV) above. **(2marks)**

6.

<Answer>

Now-a-days, service organizations are expanding and gaining importance. Service organizations use service facility layouts. Which of the following statements is **true** regarding the layout of a hospital?

(a) Hospital layouts are designed around customer receiving service functions
(b) Hospital layouts are designed around technology, processing of physical materials and production efficiency
(c) Hospital layouts are developed by mixed-model line balancing
(d) Hospital layouts are based on process layout
(e) Hospital layouts are developed by computerized relative allocation of facilities technique. **(1 mark)**

7.

<Answer>

An aggregate plan is to be developed carefully by considering several variables. Operation managers follow different strategies for developing aggregate plans. Which of the following describes a pure strategy for developing aggregate plans?

(a) A combination of two or more pure planning strategies
(b) A strategy using only one pure planning strategy without using other pure planning strategies
(c) A strategy aiming purely on profit maximization
(d) A strategy which fulfils organizational requirements
(e) A strategy developed purely by the top management. **(1 mark)**

8.

<Answer>

The following table provides details regarding number of engines manufactured and their costs for five months.

Production (units)	38	23	43	46	40
Cost (rupees '000)	17	13	18	23	19

Using regression analysis, find the production cost to produce 89 engines.

(a) Rs.16,870
(b) Rs.26,870
(c) Rs.36,870
(d) Rs.46,870
(e) Rs.56,870. **(2marks)**

9. Classification of inventory helps an organization to maintain proper control over it. In which of the following inventory classification models, is inventory classified on the basis of their turnover?

<Answer>

(a) ABC
(b) VED
(c) FSND
(d) JIT
(e) RFID.

(1 mark)

<Answer>

10. Reliance Industries, a leading corporation in India, has been looking at diversifying into various business areas. In the year 2007, 'Reliance' opened huge grocery stores called 'Reliance Fresh' in a few big cities, promising to provide customers all types of fresh grocery under single roof. Which of the following operations strategy did 'Reliance' adopt as a competitive weapon?

(a) Product variety and facility size
(b) Convenience and location
(c) Shorter product cycle
(d) Production flexibility
(e) Low-cost process.

(1 mark)

<Answer>

11. Managers generally use assembly charts to redesign, update and evaluate their production processes. Which of the following statement(s) is/are **true** regarding assembly charts?

I. Operations and inspections are indicated in these charts.
II. Operation delays and transportation are indicated in these charts.
III. Various steps of operation and their frequency is indicated in these charts.

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

(1 mark)

<Answer>

12. The company should select the location that best suits the products it offers, the location of its customers and materials, and other criteria that are specific to the company. Which of the following is/are the location evaluation model(s) used by the managers?

I. Break Even Analysis.
II. Point Rating Method.
III. Transportation method of linear programming.
IV. ABC classification.

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

(1 mark)

<Answer>

13. Which of the following are the activities performed by the purchase department?

I. Ensure that right type of material is purchased in right quantities at the right time.
II. Preparation of material requirement plan.
III. Provide necessary information about new products, materials and services to other departments.
IV. Obtain the right product at a lower cost.

(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)

14. Which of the following is **not true** about Cellular Manufacturing? <Answer>

(a)   Parts spend less time in waiting before they are processed and this results in a significant decrease in in-process inventory levels
(b)   Products have similar shapes and processing requirements
(c)   The route of production through cells is more direct
(d)   Cells are dedicated to a wide range of products
(e)   Changeover times between batches of parts are considerably reduced.   **(1 mark)**

15. Which of the following is **not** an advantage of Job Specialization? <Answer>

(a)   It results in lower production time or higher productivity by the learning curve effect due to repetition
(b)   It results in simpler work instructions and easy production control because of consistency in work assignment
(c)   It always results in higher work satisfaction
(d)   There is ease in recruiting new workers because fewer skills are required
(e)   There is scope for higher degree of mechanization or automation.   **(1 mark)**

16. The designing of layout is a creative exercise. In Kalyani Pistons Private Ltd., an industrial expert organizes all the departments in such a manner that their activities become easy to be carried on with the issuing and receiving departments. Which criteria has the expert utilized for a good layout in the firm? <Answer>

(a)   Maximum flexibility
(b)   Maximum coordination
(c)   Maximum visibility
(d)   Minimum handling
(e)   Maximum accessibility.   **(1 mark)**

17. Nidhi Motors purchases 9,000 motor spare parts for its annual requirements, ordering one month usage at a time. Each spare part costs Rs.20. The ordering cost per order is Rs.15 and the carrying charges are 15% of the average inventory per year. Which of the following statements is **true** when the company follows EOQ? <Answer>

(a)   The company saves 31% by ordering 300 parts at a time
(b)   The company saves 41% by ordering 400 parts at a time
(c)   The company saves 21% by ordering 300 parts at a time
(d)   The company saves 51% by ordering 500 parts at a time
(e)   The company saves 56% by ordering 400 parts at a time.   **(3marks)**

18. Manager (Operations) of a manufacturing firm is planning to set the production target for the month of January 2008. He uses first-order exponential smoothing technique to forecast the demand. Actual and forecasted demand for last four months (in 2007) are as follows: <Answer>

Month	Sep.	Oct.	Nov.	Dec.
Forecast (in units)	104.0	87.2	89.2	95.6
Actual (in units)	80.0	90.0	98.4	104.0

The demand forecast (in units) for the month of January 2008 would be

(a)   75.5
(b)   95.5
(c)   101.5
(d)   201.5
(e)   251.5.   **(2marks)**

<Answer>

19. An organization follows different policies to maintain finished goods inventory. For which of the following items, is produce-to-stock policy suitable?

I.   Seasonal components.
II.   High value specific purpose products.
III. General application spare parts.

(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)**

<Answer>

20. The following table is obtained in the solution process of a transportation problem.

(Cost in Rupees)

Market / Warehouse	1	2	3	4	Supply
A	10	8 / 5000	7	12	5000
B	12	13	6 / 4500	10 / 1500	6000
C	8 / 7000	10 / 500	12	14 / 1500	9000
Demand	7000	5500	4500	3000	20000

By using Stepping Stone Method for optimal solution, the net cost change for cell A3 is

(a)   1
(b)   2
(c)   3
(d)   –2
(e)   –1.   **(2marks)**

<Answer>

21. In an electronic organization, the daily consumption of capacitors is 380 units. When an order is placed with the supplier, it will take 25 days to receive the components. The reorder point for capacitors is

(a)   7,500 units
(b)   8,500 units
(c)   9,500 units
(d)   10,500 units
(e)   11,500 units.   **(1 mark)**

<Answer>

22. A job design develops a work atmosphere that satisfies the needs and requirements of both the organization and its workers. Which of the following components of job design contains information about job summary, position in the hierarchy, mental and physical efforts involved in the job etc.?

(a)   Job description
(b)   Job specification
(c)   Job rotation
(d)   Job enrichment
(e)   Job analysis.   **(1 mark)**

23. Which of the following is/are the major difference(s) in focus between location decision in the service sector and in the manufacturing sector?

<Answer>

I. The focus in manufacturing is on revenue maximization, while the focus in service is on cost minimization.
II. The focus in service is on revenue maximization, while the focus in manufacturing is on cost minimization.
III. The focus in manufacturing is on labor, while the focus in service is on raw materials.

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

(1 mark)

24. Abdullah Electronics Ltd., produces certain electronic goods, the demand for which is dynamic or unstable. If you were to forecast the demand for the next season by using exponential smoothing, which of the following statements indicates the right selection of smoothing coefficient?

<Answer>

(a) A low Alpha value is preferable
(b) A high Alpha value is preferable
(c) Alpha value is assigned based on the Beta value
(d) Alpha value is provided based on the value of D_{t-1}
(e) Alpha value is given based on the value of F_{t-1}.

(1 mark)

25. In a work sampling, an analyst has made a total of 120 observations during a period of 5-hour study, and 25 of these observations showed the tool being set to the machine. If the number of times, the tool was set during the study is 55, then the average normal time required for the tool setting is

<Answer>

(a) 1.14 min
(b) 2.24 min
(c) 3.34 min
(d) 4.24 min
(e) 5.14 min.

(1 mark)

26. The disadvantages of product layout include

<Answer>

I. Difficulty in supervising.
II. Unavoidable production bottlenecks.
III. Lack of flexibility in handling a variety of products.
IV. Tie up in the whole operation in the event of work stoppage at any point.

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

(1 mark)

27. Job design plays an important role in operations management, requiring the Operation's Manager to design the job properly. A good job design helps the organization in achieving optimum benefits. In this regard, which of the following statements is/are **false**?

<Answer>

I. Job title describes the purpose and responsibilities of the job.
II. Job identification describes the skills and qualifications.
III. Job specification describes the department, number of workers, reporting authority, etc.

(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)

28. Bombay Bearing Company purchases steel plates for Rs.60/- per unit. The company has sufficient capacity to produce in-house. Rs.70,000/- fixed costs and Rs.25/- variable costs are associated with in-house production. It is economical for the company to go for in-house production when the requirement is

<Answer>

(a) More than 1,000 units
(b) More than 2,000 units
(c) More than 3,000 units
(d) More than 4,000 units
(e) More than 5,000 units. **(2marks)**

29. In which of the following processes do the products flow through the facilities on irregular paths?

<Answer>

I. Line flow production system.
II. Process-focused production system.
III. Cellular manufacturing.
IV. Job shop production system.

(a) Both (I) and (II) above
(b) Both (I) and (III) above
(c) Both (II) and (III) above
(d) Both (II) and (IV) above
(e) Both (III) and (IV) above. **(1 mark)**

30. In line balancing, the tasks are assigned to workstations that allow the work to be performed in a feasible sequence within an acceptable cycle time. Which of the following statements is/are **true** regarding cycle time?

<Answer>

I. It is the ratio of daily operating time to desired level of production.
II. It is determined by the maximum allowable time at each workstation.
III. It is the time between two successive operations.

(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)**

31. For which of the following industries, is market proximity the most important factor affecting the location decision?

<Answer>

(a) Paper industry
(b) Retail industry
(c) Petrochemical industry
(d) Textile industry
(e) FMCG industry. **(1 mark)**

32. 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 is the **correct** sequence in the procedure of value analysis?

<Answer>

I. Gather all possible information about the product design, costs, scrap rates etc.
II. Evaluate the alternatives on criteria like cost and feasibility and eliminate the non- feasible alternatives.
III. Examine all the products that are being reordered and identify each product that needs improvements.
IV. Form a team that includes experts from various functional areas that are related to the functions performed by that material.
V. Refine the feasible alternatives and select the optimal alternative.
VI. Generate alternatives by generating new ideas and evaluate different ways of accomplishing the tasks.

(a) I, IV, II, III, VI, V
(b) III, I, IV, VI, II, V
(c) IV, V, III, I, II, VI
(d) III, I, IV II, V, VI
(e) I, IV, II, V, III, VI. **(1 mark)**

<Answer>

33. Which of the following issues falls under the purview of operational decisions?

(a) Production and process design
(b) Determining the appropriate inventory level for various materials
(c) Assigning jobs and responsibilities to workers
(d) Vendor identification
(e) Facility location and layout.

(1 mark)

<Answer>

34.

C_B	Basic variables	Solution variables	C_j				
			900	800	0	0	0
			X_1	X_2	S_1	S_2	S_3
0	S_1	400	1	2	1	0	0
0	S_2	300	2	1	0	1	0
0	S_3	250	1	1	0	0	1
		Z_j	0	0	0	0	0
		$(C_j - Z_j)$	900	800	0	0	0

In the above simplex table, the entering variable and the departing variable are

(a) X_1 and S_1

(b) X_2 and S_2

(c) X_3 and S_3

(d) X_1 and S_2

(e) X_2 and S_3.

(1 mark)

<Answer>

35. The main purpose of work measurement is to find the standard time for a job. Which of the following are **true** concerning different techniques used in work measurement?

I. Prerequisite for time study is that the job selected should be standardized.
II. The accuracy of work sampling is subject only to the competence of the analyst.
III. Time study assumes that the average observations made always represent the time required to perform each elemental task.
IV. Predetermined motion studies are useful in benchmarking and performance evaluation.

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

(1 mark)

<Answer>

36. Line balancing is a part of assembly line study. Which of the following statements are **true** regarding line balancing?

I. Line balancing mainly ensures that each workstation gets equal amount of time approximately.
II. The total amount of work on a line is divided into different tasks.
III. The cycle time is determined by the minimum time required at any workstation.
IV. The tasks are assigned to workstations that allow the work to be performed in a feasible sequence.

(a) Both (II) and (III) above
(b) Both (II) 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)

37. Managers use different models for developing a process layout. Which of the following statements are **true** concerning load distance model?

   I.   In load distance model, templates are used to develop product and fixed position layouts.
   II.   The load distance model is used to minimize the material movement.
   III. In load distance model, generally the load is fixed.
   IV. In load distance model, computerized relative allocation of facilities technique is used.

   (a)   Both (I) and (II) above
   (b)   Both (II) and (III) above
   (c)   (I), (II) and (III) above
   (d)   (I), (III) and (IV) above
   (e)   (II), (III) and (IV) above.   **(1 mark)**

38. Ramkumar Automobiles, the leading automobile company has an efficient production system that is capable of shifting quickly from producing one product to another. Which of the following is the key strategy adopted in the process design of Ramkumar Automobiles?

   (a)   Automation
   (b)   Vertical integration
   (c)   Product flexibility
   (d)   Customer contact
   (e)   Nature of demand.   **(1 mark)**

39. Which of the following statements is/are **false** regarding the batch size of various production processes?

   I.   The batch size in product-focused batch system is generally larger than the product-focused dedicated system.
   II.   The batch size in cellular manufacturing system is generally smaller than product- focused batch system.
   III. In process-focused job shop system, the batch sizes are comparatively lower than product-focused batch system.

   (a)   Only (I) above
   (b)   Only (II) above
   (c)   Only (III) above
   (d)   Both (II) and (III) above
   (e)   All (I), (II) and (III) above.   **(1 mark)**

40. Kalpana Steels and Alloys Limited is in the process of identifying material requirements for the next one year. As per the classification of decisions in operations management, in which of the following category do such decisions fall?

   (a)   Tactical decisions
   (b)   Facility planning
   (c)   Strategic decisions
   (d)   Scheduling decisions
   (e)   Operational decisions.   **(1 mark)**

41. A work sample study conducted over 100 hours yielded the following results:
The number of units of a product produced was 380 by an operator whose performance was rated at 85%. The operator's idle time was 25%. The total allowance given by the company for the task was 35 %. The standard time for producing one unit of the product is

   (a)   12.5 min
   (b)   15.5 min
   (c)   25.5 min
   (d)   32.5 min
   (e)   35.5 min.   **(2marks)**

42. Organizations need to plan to make different types of products to satisfy the market demand. The process of combining individual products into a product group or product type is known as

<Answer>

(a) Master planning
(b) Operations planning
(c) Capacity planning
(d) Production planning
(e) Aggregate planning.

(1 mark)

43. Which of the following are **true** with regard to inventory costs?

<Answer>

I. Suppliers provide discounts to their customers based on carrying cost.
II. If 'x' is the unit price of an item and 'n' is the number of items purchased then 'nx' is the total purchasing cost.
III. Carrying cost also include opportunity costs.
IV. Carrying cost is expressed as a percentage of material cost.

(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)

44. Which of the following inventory systems requires higher levels of safety stocks to tide over unexpected demand variations?

<Answer>

(a) Fixed-Order-Quantity System
(b) Fixed-Order-Period System
(c) Materials Requirements Planning System
(d) Two-Bin Inventory System
(e) EOQ system.

(1 mark)

45. Which of the following examines and identifies the activities to be performed by an employee, and how, when, and where they are performed, the equipment and machinery or tools that are used; the physical and social working conditions; the skill and ability requirements to perform the job and the nature and extent of training that is required for the employee?

<Answer>

(a) Job specification
(b) Job description
(c) Job content
(d) Job analysis
(e) Job identification.

(1 mark)

46. Managing the workers in an organization is a challenging job for the operations manager. He/she needs to design the job of an employee in such a manner that it benefits both the employee as well as the organization. Job content is the central aspect of job design. Which of the following statement(s) is/are **true** regarding job content?

<Answer>

I. Job content specifies the responsibilities of the jobholder.
II. Job content includes interaction with the people.
III. Job content states about the machinery and equipment.
IV. Job content determines the qualification and skills.

(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)

47. Which of the following shows the percentage of time an employee or equipment was occupied or idle? <Answer>

(a) Performance measurement
(b) Predetermined motion study
(c) Time study
(d) Ratio delay
(e) Historical Analysis. **(1 mark)**

48. Blue Star Ltd., wishes to forecast the demand for refrigerators for the four quarters of the financial year. Actual and forecasted demand for current year is given in the table below: <Answer>

Quarter	I	II	III	IV
Forecast	126	198	150	185
Actual	96	176	160	200

The Mean Absolute Percentage Error (MAPE) for the above data is

(a) 12.40 %
(b) 13.40 %
(c) 14.40 %
(d) 15.40 %
(e) 16.40 %. **(2marks)**

49. Which of the following planning activities is/are supplementary to the Master Production Schedule (MPS)? <Answer>

I. Materials requirement planning.
II. Capacity requirement planning.
III. Man-power requirement planning.

(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)**

50. <Answer>

Quarterly demand for Jaguar XJ6s at a Mumbai based auto dealer is forecasted and represented as $\hat{y} = 10 + 3x$, where $\hat{y}$ is the quarterly demand and x denotes the quarter.

Coded Time Variables				
Quarter \ Year	I	II	III	IV
2006	0	2	4	6
2007	8	10	12	14

The demand for sports sedans is seasonal, and the indices for Quarters I, II, III and IV are 130, 150, 180 and 140 respectively. The seasonalized estimates for quarters I, II, III and IV respectively for the year 2008 are

(a) 75.40, 96.0, 136.0, 126.40
(b) 78.40, 96.0, 126.0, 156.40
(c) 75.40, 96.0, 126.0, 106.40
(d) 70.40, 92.0, 116.0, 106.40
(e) 75.40, 96.0, 106.0, 126.40. **(3marks)**

51. Operations department plays a significant role in the initial stages of development of a new product. Which of the following steps in the development of new product precedes the others? <Answer>

(a) Prototype design
(b) Economic evaluation
(c) Feasibility studies
(d) Initial design of production model
(e) Market testing. **(1 mark)**

<Answer>

52. Which of the following statements is **not true**?

(a) Aggregate plans define how resources can be best employed to meet market demand
(b) The objective of an aggregate plan is to minimize production cost
(c) The objective of an aggregate plan is to improve profits
(d) Aggregate plans aim at better customer service
(e) Aggregate plans are prepared from master production schedules.

(1 mark)

<Answer>

53. Which of the following statements are **true** about operations strategy?

I. Operations strategy is concerned with setting broad policies and plans for using the resources of the firm to best support the firm's long-term competitive strategy.
II. Corporate objectives of an organization are derived from the operations strategy of the organization.
III. Operations strategy is influenced by the nature of goods or services to be produced and the markets to be served.
IV. Operations strategy is an integral part of the strategic planning process.

(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)

<Answer>

54. Firms maintain various types of inventory at various stages of the production process. Which of the following is a reason for holding 'finished goods' as inventory?

(a) Production of products as and when the customers demand them can be uneconomical
(b) Obtaining materials from suppliers exactly when needed for production
   schedules is not always possible
(c) Quantity discounts can result from larger purchase quantities
(d) Unequal production rates of processing stations may result in process
   slow-down in the absence of inventories
(e) Producing and transporting in larger batches reduce material handling and production costs.

(1 mark)

<Answer>

55. A corporation has three manufacturing plants and three warehouses. The production per plant (in units), requirement of the warehouses (in units), and shipping cost (in Rs) per unit from each plant to each warehouse is given below:

Warehouse / Plant	W_1	W_2	W_3	Production
P_1	1.80	1.40	1.60	140
P_2	2.00	1.80	2.60	130
P_3	1.40	1.20	3.20	110
Requirement	180	140	70	

The total transportation costs of initial basic feasible solution using the Least cost method is

(a) Rs.418
(b) Rs.518
(c) Rs.618
(d) Rs.718
(e) Rs.818.

(2marks)

56. Which of the following statement(s) is/are **true** regarding 'shop system', proposed by F.W.Taylor?

<Answer>

I. Standardized work methods and work flow should be followed.
II. Standard output time is to be set for each task.
III. Each worker should be rotated on different jobs in order to acquire multi skills.

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

(1 mark)

<Answer>

57. The center of gravity method is used to find the optimal location for a distribution center. Which of the following statement(s) is/are **not true** regarding center of gravity method?

I. The aim of center of gravity method is to minimize the transportation cost.
II. Arithmetic averages are used when the shipping quantities for all the destinations are unequal.
III. The method considers factors like markets, cost of goods and cost of transportation.

(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)

<Answer>

58. Which of the following production systems is referred to as parts classification and coding system?

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

(1 mark)

<Answer>

59. Which of the following describes the department under which the job comes, the number of workers needed and reporting authority?

(a) Job identification
(b) Job title
(c) Job duties
(d) Job specification
(e) Job analysis.

(1 mark)

<Answer>

60. The acquisition costs are also referred to as

(a) Stock-out costs
(b) Ordering costs
(c) Carrying costs
(d) Purchase costs
(e) Opportunity costs.

(1 mark)

61. Which of the following statements are **true** regarding linear programming? <Answer>

I.   It is based on the assumption of proportionality.
II. The problem can solve only single objective function.
III. The decision variables are continuous and they can accept any non-negative or fractional values within the specified range.
IV. It does not consider any synergistic or anti-synergistic effects among the decision variables while calculating the total value for the objective function.

(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)**

<Answer>

62. Operations costs are divided into various types. Administrative costs and maintenance costs are relating to

(a)   Direct costs
(b)   Indirect costs
(c)   Fixed costs
(d)   Opportunity costs
(e)   Prime costs.   **(1 mark)**

<Answer>

63. 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 is referred as

(a)   Organizational feasibility of job design
(b)   Technical feasibility of job design
(c)   Economic feasibility of job design
(d)   Behavioral feasibility of job design
(e)   Environmental feasibility of job design.   **(1 mark)**

<Answer>

64. In which of the following production systems are the fixed costs high when compared to other production systems?

(a)   Process-focused production system
(b)   Cellular manufacturing
(c)   Product-focused production system
(d)   Intermittent production system
(e)   Job shop production system.   **(1 mark)**

<Answer>

65. Which of the following statements are **true** regarding historical analysis?

I.   In this technique, the output of a particular worker is divided by the number of work hours expended to arrive at the normal time.
II. Relative accuracy of the standards developed through this method is low.
III. The technique assumes that the performance varies over a period of time.
IV. The technique requires the presence of an analyst during the period of observation.

(a)   Both (I) and (II) above
(b)   (I), (II) and (III) above
(c)   (I), (II) and (IV) above
(d)   (II), (III) and (IV) above
(e)   All (I), (II), (III) and (IV) above.   **(1 mark)**

66. Which of the following techniques is a set of equations for calculating the optimal workforce, aggregate output rate and inventory level for each time period in a planning horizon considering non-linear cost relationships? <Answer>

(a) Linear programming
(b) Heuristic model
(c) Linear decision rules
(d) Computer simulation technique
(e) Hawthorne model.

(1 mark)

67. Which of the following statements are **true** regarding Fixed Order Period System? <Answer>

I. Order period is fixed.
II. Order quantity is fixed.
III. Higher level of safety stock is maintained.
IV. Higher costs are associated with constant review of inventory levels.

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

(1 mark)

68. Which of the following is an input for make-to-stock items in a master production schedule? <Answer>

(a) Material requirement plan
(b) Aggregate plan
(c) Capacity plan
(d) Demand forecast
(e) Business plan.

(1 mark)

69. The term 'purchasing' refers to buying of material or an item. Purchasing activity involves several steps and procedures. Purchasing process involves purchase instruments. Which of the following are **not** purchasing instruments? <Answer>

I. Bill of material.
II. Indent.
III. Material requirement plan.
IV. Purchase order.
V. Quotation.

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

(1 mark)

70. 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 <Answer>

(a) Contingency allowance
(b) Interference allowance
(c) Relaxation allowance
(d) Performance allowance
(e) Environmental allowance.

(1 mark)

71. Organizations spend more than 50 percent of the total cost on purchases. It is economical, when material and components are produced in-house. The cost for setting up the production equipment is known as setup cost. Setup cost is to be accounted in

<Answer>

(a) Purchase costs
(b) Carrying costs
(c) Holding costs
(d) Ordering costs
(e) Opportunity costs.

(1 mark)

<Answer>

72. Now-a-days, different types of advanced operations technologies are available to help operation managers. Royal Automobiles Ltd., has recently computerized its operations wherein, a group of automated machines are controlled by a central computer. The system is capable of producing a large quantity of products that have similar processing requirements. Which of the following systems is being referred to in the present context?

(a) Computer Aided Design
(b) Computer Aided Manufacturing
(c) Flexible Manufacturing System
(d) Automated Storage and Retrieval System
(e) Computer Integrated Manufacturing.

(1 mark)

<Answer>

73. 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)

<Answer>

74. In which of the following stages of product life cycle do organizations focus on improving efficiency of the process and minimizing costs?

(a) Research and development
(b) Introduction
(c) Growth
(d) Maturity
(e) Decline.

(1 mark)

<Answer>

75. Forecasting seeks to predict what is most likely to happen in the future. During forecasting, firms need to consider various components. Which of the following forecast components refers to the repeated pattern of increase and decrease in demand over a period of time?

(a) Trend component
(b) Seasonal component
(c) Promotional component
(d) Cyclic component
(e) Irregular component.

(1 mark)

76. 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

<Answer>

(a) Hawthorne studies
(b) Scientific motion study of jobs
(c) Division of labor
(d) Scheduling techniques of employees
(e) Moving assembly line.

(1 mark)

<Answer>

77. Which of the following is **not** among the steps involved in the time study?

(a) Job identification and division
(b) Observation
(c) Job analysis
(d) Pace rating the workers
(e) Consideration of allowances.

(1 mark)

<Answer>

78. In an automobile industry, a worker is capable to produce 5 components per day. The present worker strength is 50. Hiring costs are Rs.200/- and layoff costs are Rs.300/- per worker. Aggregate demand for two months is given in the following table:

	Jan	Feb
Demand	7000	5000
Working Days	22	25

Which of the following statements is **true** regarding the hiring costs and layoff costs?

(a) Hiring cost for January is Rs.7,200 and Layoff cost for February is Rs.2,800
(b) Hiring cost for February is Rs.6,200 and Layoff cost for January is Rs.3,800
(c) Hiring cost for January is Rs.2,800 and Layoff cost for February is Rs.7,200
(d) Hiring cost for January is Rs.4,800 and Layoff cost for February is Rs.7,200
(e) Hiring cost for February is Rs.2,800 and Layoff cost for January is Rs.6,200.

(3marks)

<Answer>

79. Which of the following is a disadvantage of 'varying the utilization of the workforce' as the strategy for aggregate planning?

(a) Hiring costs
(b) Overtime costs
(c) Lay-off costs
(d) Materials handling costs
(e) Stock-out costs.

(1 mark)

<Answer>

80. Which of the following is **true** for 'decentralized purchasing system'?

(a) All the purchasing activities are carried out by a separate department
(b) The benefits of bulk purchasing can be realized
(c) The individual departments are flexible to alter their purchasing policies on the basis of their specific requirements
(d) Uniformity in maintaining purchase records
(e) It is more effective for an organization which is having a number of production sites.

(1 mark)

<Answer>

81. Which of the following is a technique of setting work standards that uses the recorded standard time data for each of the basic motions associated with performing a task and summing them up to determine the time required to perform the whole task?

(a) Time study
(b) Work sampling
(c) Historical analysis
(d) Employees self-timing
(e) Predetermined motion time study.

(1 mark)

82. Which of the following statements is/are **true** regarding process charts? <Answer>
   I. These charts include information like description of the steps involved, their frequency of occurrence, time for each step and the distance travelled etc.
   II. Both productive and non-productive activities are included in these charts.
   III. They show the material requirements, assembly operations and sub-assembly operations.

   (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)**

83. 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 will the operations manager use to represent storage activity in a process chart? <Answer>

   (a) $\Rightarrow$
   (b) D
   (c) O
   (d)
   (e) ∇. **(1 mark)**

84. A high valued item has a tracking signal of 4 and has been forecasted as shown in table. Compute the tracking signal and indicate whether some corrective action is appropriate. <Answer>

Period in years	1	2	3	4	5	6
Actual demand	80	92	71	83	90	102
Forecasted demand	78	79	83	79	80	83

   (a) Action limit of 4 is not exceeded; therefore no corrective action is required
   (b) Action limit of 4 is exceeded; therefore shift to some other forecasting method
   (c) Action limit of 4 is not exceeded; therefore increase the value of α
   (d) Action limit of 4 is not exceeded; therefore decrease the value of α
   (e) Action limit of 4 is exceeded; therefore ensure that α remains constant. **(2marks)**

85. One of the prime considerations of an operations manager when developing production-process designs is the level of vertical integration. Which of the following are **true** in this regard? <Answer>

   I. It relieves an organization of a part of its purchasing function.
   II. It provides flexibility in manufacturing.
   III. Helps in obtaining economies of scale.
   IV. Increases profits due to decentralized overheads.

   (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)**

END OF QUESTION PAPER

Suggested Answers
Operations Management – I (MB2E3): October 2008

	Answer	**Reason**	

1.   E   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. $\leq$

2.   B   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. $\leq$

3.   C   Standard time = 2.21 min $\leq$

Available fraction =1-0.15=0.85

$$\text{Standard time} = \frac{\text{Normal time}}{\text{Available fraction time}}$$

$\therefore$ Normal time=Standard time $\times$ Available fraction time

Normal time=$2.21 \times 0.85 = 1.88$ min

Average cycle time = 2.50 minutes

Normal time = Average cycle time x performance rating

$\therefore$ Performance rating = Normal time / Average cycle time

=   1.88/2.50

=   0.752=0.75 or 75%

4.   A   The following statements are true regarding simplex method. $\leq$

     I.   The row with minimum ratio is called the key row.

     II.   The optimum solution in a maximization case is obtained when there are **no positive** values in the $(C_j - Z_j)$ row, i.e., when the values are either '0' or 'negative'.

     III.   The **Basic** variable in the key row will be the departing variable.

5.   E   Objective function: $\leq$

$$Z = 50X_1 + 50X_2 + 80X_3$$

Material M1 constraint: $3X_1 + 4X_2 + 5X_3 \leq 5000$

Material M2 constraint: $5X_1 + 3X_2 + 5X_3 \leq 7000$

Labor time for X_1 is twice that of X_2 and thrice that of X_3.

$\therefore X_1 : X_2 : X_3 = 6 : 3 : 2$

Labor constraint: $6X_1 + 3X_2 + 2X_3 \leq 3000$

Demand constraints are: $X_1 \geq 600$; $X_2 \geq 650$; $X_3 \geq 500$

Hence formulation is:

Maximize $Z = 50X_1 + 50X_2 + 80X_3$

Subject to

$$3X_1 + 4X_2 + 5X_3 \leq 5000$$

$$5X_1 + 3X_2 + 5X_3 \leq 7000$$

$$6X_1 + 3X_2 + 2X_3 \leq 3000$$

$$X_1 \geq 600$$

$$X_2 \geq 650$$

$$X_3 \geq 500$$

6. **B** The fundamental difference between a service facility and a manufacturing facility is that service facility exists to bring together the customer and the organization's services. There are two different types of layouts of service facilities based on the degree of customer contact. At one extreme is that layout which is totally designed around customer receiving service functions, and the other is that layout which is designed around technology, processing of physical materials and production efficiency.

In banks, layouts are designed around customer receiving service functions. They give importance for customer convenience.

In hospitals, layouts are designed around technology, processing of physical materials and production efficiency. The primary focus in hospitals is on the medical treatment which depends on the medical technology used such as surgery, radiology, laboratory tests and patient treatment etc.

7. **B** Pure planning strategies: - Functions in demand and uncertainties in production activities can be effectively managed by varying size and utilization of the workforce, and the size of the inventory and through backorders, subcontracts and varying plant capacity. If only one of these strategies is adopted without using others, then the strategy is called pure strategy.

8. **C**

	X	Y	XY	X^2	Y^2
	38	17	646	1444	289
	23	13	299	529	169
	43	18	774	1849	324
	46	23	1058	2116	529
	40	19	760	1600	361
Total	190	90	3537	7538	1672

$\sum X = 190; \sum Y = 90; n = 5$

$\sum XY = 3537; \sum X^2 = 7538; \sum Y^2 = 1672$

$\overline{X} = \dfrac{190}{5} = 38 \quad \overline{Y} = \dfrac{90}{5} = 18$

$b = \dfrac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2}$

$b = \dfrac{5(3537) - (190)(90)}{5(7538) - (190)^2} = \dfrac{17685 - 17100}{37690 - 36100} = \dfrac{585}{1590} = 0.37$

$a = \overline{Y} - b\overline{X}$

$a = 18 - 0.37 \times 38 = 18 - 14.06 = 3.94$

Hence the regression equation $Y = a + bX$ is $Y = 3.94 + 0.37X$

For the production of 89 engines the cost is

$$Y = 3.94 + 0.37 \times 89 = 3.94 + 32.93 = 36.87$$
Hence production cost = $36.87 \times 1000 = 36{,}870$ Rs.

9.   C   In FSND classification, the goods are classified on the basis of their turnover.   ≤

10.   A   Reliance is offering a variety of fruits and vegetables in a large store. This allows them to display their variety and thus benefit from economies of scale.   ≤

11.   A   Assembly charts:- Assembly charts are used to obtain a general understanding of the entire process involved in producing products which involve assembly of a number of parts. They provide an overall macro view of the movement of components and sub-assemblies in the process of producing a finished product. In these charts, it is a standard practice to indicate operations by circles and inspections by squares. Statement I only relate to assembly charts.   ≤

Process charts: Process charts are similar to assembly charts, except that they include extra information like description of the various steps involved, their frequency of occurrence, the time for each step, the distance travelled and so on. Non-productive activities like storage, delay and transport are indicated in the process charts. Statements II and III relate to process charts.

12.   D   (I), (II) and (III) are correct location evaluation methods used by the managers.   ≤

(IV)-Incorrect: In ABC classification, items are classified on the basis of their annual consumption value. Category "A" represents the materials of high usage value (per annum) and so forth.

13.   C   Following are the activities performed by purchase department: ≤
   I.   Ensure that right type of material is purchased in the right quantities at the right time.
   III.   Provide necessary information about new products, materials and services to other departments.
   IV.   Obtain the right product at a lower cost.

Statement II is not true. Preparation of Material Requirement Plan (MRP) is not the responsibility of purchase department. MRP is derived from Master Production Schedule. The preparation of MRP is the responsibility of operations manager.

14.   D   In **Cellular Manufacturing,** total production area is divided into cells, each cell consisting of a group of dissimilar machines which work on products that have similar shapes and processing requirements. The layout used in this type of manufacturing is similar to a product layout in that the cells are dedicated to a **limited range** of products.   ≤

All the other options i.e., (a), (b), (c) and (e) are true for **Cellular Manufacturing**.

15.   C   Specialization of labor is a two-edged sword in job design as it has both advantages and disadvantages. Becoming a specialist in some particular area can provide a worker a great sense of pride. The fewer the tasks a worker does and the narrower the range of his responsibilities, the more skilled and efficient the worker becomes, up to a point.   ≤

However, specialization is not preferable for some jobs because, if specialized, they become monotonous and boring for workers. Therefore, it results in loss of work satisfaction.

16.   B   The expert has considered the maximum co-ordination criteria to ensure that the work or the task is carried out easily.   ≤
   (a)   Incorrect: The question has not highlighted about the modification that has to been done

with the changing environment. It only deals with the coordination of departments. And not their modification with changing times or environment.

(c) Incorrect: The query is not concerned with the visibility of the departments rather than with the coordination of work.

(d) Incorrect: The query is not highlighting the discomfort levels, like sunlight, heat, noise, vibrations etc.

(e) Incorrect: Inapplicable here.

17. **A** Annual consumption (D) = 9000 units.

Cost per unit (C) = Rs.20

Order cost (C_O) = Rs.15

Carrying cost (C_h) = 15% of average inventory = 15% of 20 = Rs.3 per year per unit

As per present purchasing policy:

Order quantity (Q) = One month usage at a time = $\dfrac{\text{Demand}}{\text{Number of orders}} = \dfrac{9000}{12} = 750\,\text{units}$

Order cost = Number of orders $\times$ cost per order = 12×15 = Rs.180

Holding cost = $\left(\dfrac{Q}{2}\right)C_h = \left(\dfrac{750}{2}\right) \times 3$ = Rs.1125

Total cost = Order cost + Holding cost = 180 + 1125 = Rs.1305

As per EOQ policy:

$$EOQ = \sqrt{\dfrac{2C_O D}{C_h}} = \sqrt{\dfrac{2 \times 15 \times 9000}{3}} = \sqrt{90000} = 300\,\text{units}$$

Number of orders = $\dfrac{9000}{300} = 30$

Order cost = 30 $\times$ 15 = Rs.450

Holding cost = $\dfrac{300}{2} \times 3 = 150 \times 3 = $ Rs.450

Total cost = Order cost + Holding cost = 450 + 450 = Rs.900

Hence, savings in cost = 1305 – 900 = Rs.405 or $\left(\dfrac{405}{1305} \times 100\right) = 31\%$

(The third component of total cost, the variable item cost is not considered in the problem because in either case, the variable cost = 9000 $\times$ 20 = Rs.1,80,000 is same.)

18. **C** Let the coefficient of smoothing be α.

In the first order exponential smoothing method, the demand forecast for the next period is given by the equation

$F_t = \alpha \times D_{t-1} + (1 - \alpha) F_{t-1}$

F_{t-1} = forecast for period t – 1

α = smoothing constant

D_{t-1} = Actual demand for period t – 1

Forecast for month of October 2007 is 87.2.

$\therefore \alpha \times 80.0 + (1 - \alpha)\, 104.0 = 87.2$

$\alpha \times 80.0 + 104.0 - \alpha \times 104.0 = 87.2$

$\alpha(80.0 - 104.0) = 87.2 - 104.0$

or $\alpha = \dfrac{(87.2 - 104.0)}{(80.0 - 104.0)} = \dfrac{-16.8}{-24} = 0.7$

$\therefore$ For January 2008, the forecast = $\alpha \times 104.0 + (1 - \alpha) \times 95.6$

$= (0.7 \times 104.0) + (0.3 \times 95.6)$

$$= 72.8 + 28.68 = 101.48 = 101.5$$

19. D In produce-to-stock policy, products are produced well in advance and are stored in warehouses, from where they are dispatched as per the customer orders. This policy is suitable for organizations manufacturing products, parts or components, which have seasonal demand (like refrigerators and air-coolers) or, those which have general applications (like bolts and nuts).

Hence statements (I) and (III) are true.

Produce-to-order policy allows production to start only after the company receives customer orders and halts production until another order is received. This policy is suitable for organizations that produce products, parts, components of **high value** (like spares of aircraft engine) or those that are meant exclusively for specific purposes (like dyes, castings, etc.).

20. E

Market / Warehouse	1	2	3	4	Supply
A	10	8 / 5000	7	12	5000
B	12	13	6 / 4500	10 / 1500	6000
C	8 / 7000	10 / 500	12	14 / 1500	9000
Demand	7000	5500	4500	3000	20000

The number of occupied cells for feasible solution = $m + n - 1 = 4 + 3 - 1 = 6$

The above solution is feasible as the number of occupied cells is 6 and it satisfies the demand and supply constraints.

Optimality test:-

Calculate the opportunity cost for unoccupied cells for optimality test.

Unoccupied cell	Closed path	Opportunity cost
A_1	A1 - C1 - C2 - A2	$10 - 8 + 10 - 8 = 4$
A_3	A3 - A2 - C2 - C4 - B4 - B2	$7 - 8 + 10 - 14 + 10 - 6 = 27 - 28 = -1$
A_4	A4 - C4 - C2 - A2	$12 - 14 + 10 - 8 = 22 - 22 = 0$
B_1	B1 - C1 - C4 - A4	$12 - 8 + 14 - 10 = 26 - 18 = 8$
B_2	B2 - C2 - C4 - B4	$13 - 10 + 14 - 10 = 27 - 20 = 7$
C_3	C3 - C4 - B4 - B3	$12 - 14 + 10 - 6 = 22 - 20 = 2$

Opportunity cost for cell A3 = -1

21. C Daily demand = 380

Lead time = 25 days

Reorder point = (demand rate)(lead time)

Reorder point = $380 \times 25 = 9,500$ units.

22. A Job description contains the information and facts about the job identification, job summary, relationship with the supervisors, location in the hierarchy, responsibilities, conditions of work, location of work, mental and physical efforts involved in the job etc.

23. B The focus in service is revenue maximization, while the focus in manufacturing is cost minimization.

24. **B** The selection of alpha is more critical. Alpha shows the effects of past demand on future ≤ demand. A high alpha results in more weightage and a low alpha results in relatively low weightage. New products for which demand is dynamic or unstable are having more effect, more influence on the future demand. A high alpha is more appropriate for these products. If the demand is stable and believed to influence less on the future demand, then a low alpha can be selected.

Product demand	Alpha value
Dynamic & unstable	High
Stable (uniform)	Low

25. **A** Total number of observations = 120 ≤

Total time of study = 5 hr = 5 × 60 = 300 min.

Number of tool setting observations = 25

Time taken for tool setting observations = $\frac{25}{120} \times 300 = 62.5 \,min$.

The total number of tool settings during the study = 55 times

In 62.5 min of time 55 number of times tool setting has been made.

Average normal time for tool setting = $\frac{62.5}{55} = 1.136 \,min = 1.14 \,min$.

26. **D** The disadvantages of product layout are: ≤

I.   High volume is required because of the large investment needed to set up the process.

III.   There is a lack of flexibility in handling a variety of products.

IV.   Work stoppage at any one point ties up the whole operation.

Statement II, 'Production bottlenecks cannot be avoided' is not a correct statement. In product layout, one of the advantages is that 'bottlenecks can be avoided', whereas bottlenecks are a disadvantage in process layout. In process layout, there will be accumulation of work at different production units.

27. **D** The following statements are true regarding job design. ≤

•   Job title describes the purpose and responsibilities.

Job **specification** describes the skills and qualifications.

Job **identification** describes the department, number of workers, reporting authority, etc.

28. **B** Purchase cost = Rs.60 ≤

Fixed cost for in-house production = Rs.70,000

Variable cost for in-house production = Rs.25

Let us assume the demand be x

Purchase cost for x units = 60 × x = 60 x

In-house production cost for x units = Fixed cost + Variable cost

= 70,000 + (25 × x)

= 70,000 + 25 x

At break even point,

Purchase cost = in-house production cost

60x=70,000 + 25 x

35 x =70,000

x $= \frac{70,000}{35} = 2,000$ units.

Hence it is economical for the company to go for in-house production only when the requirement is more than 2,000 units.

29. **D** In **Process-focused Production,** similar equipment or functions are grouped together. In this ≤

type of design, products flow through the facilities on irregular paths. This system allows both backtracking and sidetracking in the product flow route. Process-focused production system is also known as job shop production system.

30. C   Statements (I) and (II) are true regarding cycle time $\leq$
    I.   It is the ratio of daily operating time to desired level of production.
    II.   It is determined by the maximum allowable time at each workstation.
    Statement III is not true. In order to complete a cycle, an item should go through all operations, right from the beginning of the raw-material to final finished product. The time between completion of two successive **items** on the line is termed as cycle time. For example if the first component completes all operations at 6.10 am and the second component completes at 6.20 am, then the cycle time is considered as 10 min.

31. B   The selection of location is influenced by a number of factors. The market proximity is the $\leq$ prime consideration aspect for pure service providing organizations such as hotels, hospitals, retail stores and theatres as they must be located close to the market. In the retail industry, consumer is the final player without any mediators thereby making market proximity as one of the important factors affecting location decisions, whereas in options a, c, d and e, there exist many mediators between the industry and consumer, hence market proximity is not a prime factor affecting their location decisions.

32. B   The step -by- step procedure of value analysis is : $\leq$
    III.   Examine all the products that are being reordered and identify each product needs and improvements
    I.   Gather all information about the product design, costs, scrap rates etc.
    IV.   Form a team that includes experts from various functional areas that are related to the functions performed by that material
    VI   Generate all alternatives by generating new ideas and evaluate different ways of accomplishing the tasks
    II.   Evaluate the alternatives on criteria like cost and feasibility and eliminate the non-feasible alternatives
    V.   Refine the feasible alternatives and select the optimal alternative.

33. C   Operational Decisions are short-term decisions which are routinely taken and generally have a $\leq$ time frame of less than a week. They address the problems at the grass-roots level such as scheduling the weekly production, assigning jobs to persons etc.

    Hence, from above discussion, we can infer that option (c) is correct.

    Options (a) and (e) are incorrect because they fall under the purview of Strategic Decisions.

    Options (b) and (d) are incorrect because they fall under the purview of Tactical Decisions.

34. D $\leq$

			C_j	900	800	0	0	0	
C_B	Basic variables	Solution variables	X_1	X_2	S_1	S_2	S_3	Ratio
0	S_1	400	1	2	1	0	0	400/1=400
0	S_2	300	2	1	0	1	0	300/2=150
0	S_3	250	1	1	0	0	1	250/1=250
		Z_j	0	0	0	0	0	
		$(C_j - Z_j)$	900	800	0	0	0	

S_2 is the key row with minimum ratio 150.

X_1 is the key column.

 2 is the key element.

X_1 is the entering variable.

S_2 is the departing variable.

35. B   Following are true: $\leq$
    I.   Prerequisite for time study is that the job selected should be standardized.

II. The accuracy of work sampling is subject to the competence of the analyst and the observations recorded.

III. Time study **does not** assume that the average observations made always represent the time required to perform each elemental task. Since the workers are aware that their performance is being recorded so they often behave unusually.

IV. Predetermined motion studies are useful in benchmarking and performance evaluation.

36. D The following statements are true regarding line balancing. $\leq$

I. Line balancing mainly ensures that each workstation gets equal amount of time approximately.

II. The total amount of work is divided into different tasks.

III. The cycle time is determined by the **maximum** time required at any workstation.

IV. The tasks are assigned to workstations such that the work is performed in a feasible sequence.

37. B Following are true concerning load distance model: $\leq$

II. The load distance model is used to minimize the material movement.

III. In load distance model the load has a standardized amount of material moved between each pair of process centers. Hence it is generally fixed.

Statements (I) and (IV) are not true because of the following reasons.

Templates are used in graphic and schematic analysis for developing product and fixed-position layouts.

Computerized Relative Allocation of Facilities Technique (CRAFT) is a computerized layout program used to develop process layouts. The model develops a layout by evaluating thousands of alternative layouts quickly.

38. C Product/service flexibility is the ability of the production system to shift quickly from producing one product to another. This is the strategy adopted by Ramkumar Automobiles. $\leq$

39. A The following statements are true regarding batch sizes of various production processes. $\leq$

I. The batch size in product-focused batch system is generally **smaller** than the product-focused dedicated system.

II. The batch size in cellular manufacturing system is generally smaller than product-focused batch system.

III. In process-focused job shop system, the batch sizes are comparatively lower than product-focused batch system.

40. A The decisions which are having a time frame of one or two years are called Tactical decisions. Identifying manpower requirement is an example of tactical decisions. $\leq$

41. B Given data: $\leq$

Total time of study = 100 hours = $100 \times 60 = 6000$ minutes

Allowance = 35%

Idle time = 25%

Worker performance rating = 85%

Number of parts produced = 380

Calculations:

Available fraction of time = 1 – Allowance factor

$$= 1 - 0.35 = 0.65.$$

$\therefore$ Working time = 1- idle time = 75%

Normal time = Average cycle time x worker rating

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

$$= \frac{6000}{380} \times (0.75) \times (0.85) = 10.07 \, \text{min/part}$$

$$\text{Standard time} = \frac{\text{Normal Time}}{\text{Available fraction}} = \frac{10.07}{0.65} = 15.49 = 15.5 \, \text{min/part.}$$

42.   E   In aggregate plan, individual products are combined together as a product group and product type. $\leq$

43.   D   Following are true regarding inventory costs: $\leq$

II.   If 'x' is the unit price of an item and 'n' is the number of items purchased then 'nx' is the total purchasing cost.

III.   Carrying cost also include opportunity costs.

IV.   Carrying cost is expressed as a percentage of material cost.

I.   Suppliers provide discounts to their customers based on purchasing cost **not on carrying cost**.

44.   B   Fixed-Time-Period System / Fixed-Order-Period System: In this system, the order size is determined on the basis of available and required inventory level. This system is based on periodic review of inventory level. In this system, the order period is fixed, but the order quantity varies. In order to maintain inventory requirements for an inventory cycle and to face the unexpected demand variations, the system requires higher levels of safety stocks. $\leq$

45.   D   Job analysis examines and identifies the activities to be performed by an employee, and how and when, and where they are performed, the equipment and machinery or tools that are used; the physical and social working conditions; the skill and ability requirements to perform the job and the nature and extent of training that is required for the employee. $\leq$

46.   E   All the statements are true regarding job content. $\leq$

I.   Job content specifies the responsibilities of the jobholder.

II.   Job content includes interaction with the people.

III.   Job content states about the machinery and equipment.

IV.   Job content determines the qualification and skills.

47.   D   Ratio delay shows the percentage of time an employee or equipment was occupied or idle. $\leq$

48.   C $\leq$

$$\text{MAPE} = \left(\frac{100}{n}\right) . \sum_{t=1}^{n} \frac{\left|A_t - F_t\right|}{A_t}$$

Quarter	Forecast (F_t)	Actual (A_t)	$A_t - F_t$	$\dfrac{A_t - F_t}{A_t}$	$\dfrac{\left\|A_t - F_t\right\|}{A_t}$

I	126	96	−30	−0.313	0.313
II	198	176	−22	−0.125	0.125
III	150	160	+10	+0.063	0.063
IV	185	200	+15	+0.075	0.075
				Total	0.576

$$\therefore \text{MAPE} = \frac{100}{4} \times 0.576$$
$$= 14.40\ \%.$$

49. B The master production scheduling process involves the planning of activities to determine whether or not an operation can achieve its production as stated in the MPS. Materials requirement planning (MRP) and capacity requirement planning (CRP) are the two supplementary planning activities involved in this process $\leq$

50. C $\leq$

Year	Quarter	Coded time variables(x)
2006	I	0
	II	2
	III	4
	IV	6
2007	I	8
	II	10
	III	12
	IV	14

First all the four quarters of year 2008 need to be coded. Looking at the trend in the above table it can be easily estimated that the coded variable for the four quarters of 2008 will be 16, 18, 20 and 22 respectively.

Substituting the values in the trend equation $\hat{y}$ (demand) for I, II, III and IV quarters of 2008, the deseasonalized estimates are derived as 58, 64, 70 and 76 respectively.

Next step is to calculate the seasonalized estimates by multiplying the deseasonalized sales ($\hat{y}$) with the respective seasonal indices and expressing them as a fraction of 100. The values obtained by dividing the seasonal indices with 100 for the four quarters are 1.30, 1.50, 1.80 and 1.40 respectively.

Year	Quarter	Coded time variables(x)	$\hat{y}$ =10+3x	Seasonal Index/100	Seasonalized estimates
2008	I	16	10+3(16) = 58	130/100 = 1.30	58×1.30= 75.40
	II	18	10+3(18) = 64	150/100 = 1.50	64×1.50=96.0
	III	20	10+3(20) = 70	180/100 = 1.80	70×1.80 =126
	IV	22	10+3(22) = 76	140/100 = 1.40	76×1.40 = 106.40

51. C The following are the important steps involved in the development of new products. $\leq$

- Idea generation
- Feasibility studies
- Prototype design
- Prototype testing
- Initial design of production model
- Economic evaluation
- Market testing
- Final design of product model.

52. E Master production schedules are prepared from aggregate plans by disintegrating the operations. $\leq$

53. **C** Following statements are **true** about operations strategy:

    I.   Operations strategy is concerned with setting broad policies and plans for using the resources of the firm to best support the firm's long-term competitive strategy.

    III.   Operations strategy is influenced by the nature of goods or services to be produced and the markets to be served.

    IV.   Operations strategy is an integral part of the strategic planning process.

An operations strategy should be in line with the organizations strategy, and is derived from corporate objectives. Initially corporate policies, objectives and goals will be set and from these objectives, the respective functional goals, objectives and strategies will be derived. Hence statement II is wrong.

54. **A** Production of products as and when the customers demand them can be uneconomical. This is a reason for holding finished goods as inventory.

(b) and (c) are the reasons for holding raw-materials as inventory

(d) and (e) are the reasons for holding semi-finished goods as inventory.

55. **C**

Plant \ Warehouse	W_1	W_2	W_3	Production
P_1	1.80	1.40	1.60	140
P_2	2.00	1.80	2.60	130
P_3	1.40	1.20	3.20	110
Requirement	180	140	70	380 / 390

As the production and requirement is not matching, a dummy plant is required.

Plant \ Warehouse	W_1	W_2	W_3	Production
P_1	1.80	1.40	1.60	140
P_2	2.00	1.80	2.60	130
P_3	1.40	1.20	3.20	110
Dummy Plant				10
Requirement	180	140	70	390 / 390

Least Cost Method:

Plant \ Warehouse	W_1	W_2	W_3	Production
P_1	1.80 40	1.40 30	1.60 70	140
P_2	2.00 130	1.80	2.60	130
P_3	1.40	1.20 110	3.20	110
Dummy Plant	0 10	0	0	10
Requirement	180	140	70	390

Transportation cost $=$ $(40 \times 1.80) + (30 \times 1.40) + (70 \times 1.60) + (130 \times 2.00) + (110 \times 1.20) + (10 \times 0) = 72 + 42 + 112 + 260 + 132 + 0 =$ Rs.618

56. D The following statements are true regarding 'shop system' proposed by Taylor. $\leq$

- Standardized work methods and work flow should be followed.
- Standard output time is to be set for each task.
- Each worker should be assigned a particular task based on his skill.

57. B Statements (I) and (III) are true regarding center of gravity method. $\leq$

Statement (II) is not true. If the shipping quantities for all destination points are equal, the location at which the transportation cost will be minimum can be identified by taking the arithmetic averages of the X and Y co-ordinates of destination. But if the shipping quantities are unequal, the location can be found using a weighted average approach (the quantities to be shipped are taken as weights).

58. C In a group technology production system, each part manufactured is given a code. The code has several digits; each digit represents a physical characteristic of the part. The group technology is also referred to as parts classification and coding system. $\leq$

59. A Job identification describes the department under which the job comes, the number of workers needed and reporting authority. $\leq$

60. 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. $\leq$

61. E All are true regarding linear programming. $\leq$
I.   It is based on the assumption of proportionality.
II. The problem can solve only single objective function.
III. The decision variables are continuous and they can accept any non-negative or fractional values within the specified range.
IV. It does not consider any synergistic or anti-synergistic effects among the decision variables while calculating the total value for the objective function.

62. B Operations costs are divided into direct costs and indirect costs. Direct costs or prime costs are those cost components, which can be identified individually for each product or service produced, e.g., the cost of direct material, the cost of direct labor etc. Indirect costs or operations overhead are those which cannot be tied to a specific product or service, e.g., administrative costs, maintenance costs. $\leq$

63. 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. $\leq$

64.   C   The product focused production system is associated with high fixed costs when compared to other production systems. This is because of the expensive machinery, automated controls and fixed position material handling equipment.   ≤

65.   A   Statement (I) and (II) are true regarding historical analysis.   ≤

     I.   In this technique, the output of a particular worker is divided by the number of work hours expended to arrive at the normal time.

     II.   Relative accuracy of the standards developed through this method is low.

     Statement (III) and (IV) are not true.

     III.   The technique assumes the performance is consistent over a period and it won't consider the variations in performance.

     IV.   The technique **does not require the presence** of an analyst during the period of observation.

66.   C   Linear decision rules are a set of equations for calculating the optimal workforce, aggregate output rate and inventory level for each time period in a planning horizon. Similar to linear programming, this method guarantees an optimal solution and eliminates trial and error computations. It also overcomes the limitation of linear programming by taking into account non-linear cost relationships.   ≤

67.   B   The following statements are true regarding Fixed Order Period System.   ≤

     I.   Order period is fixed.

     II.   Order quantity is **variable**.

     III.   Higher level of safety stock is maintained.

     IV.   Fixed order period system is based on **period review** of inventory level; hence the costs involved in constant review can be saved.

68.   D   The major input for make-to-stock items in master production is the demand forecast.   ≤

69.   D   The purchasing instruments are: ≤

- Purchase indent (requisition)
- **Request for** quotation
- Purchase order

     Request for quotation will be sent by the purchase manager to the vendor, and in response to this request, purchase manager receives the quotation from the vendor. Request for quotation is a purchase instrument that belongs to purchasing organization and the quotation is a document that contains the product/service specifications, prices, terms and conditions etc.

70.   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.   ≤

71.   D   When the item is produced within the firm, there are costs associated with the set up of the production equipment for running the production. These may be ordering cost for equipment, transportation, installation etc. These costs are accounted under ordering costs.   ≤

72. C   Flexible Manufacturing System:- Flexible Manufacturing System (FMS) is a set of automated ≤ machines, which is controlled by a central computer. FMS systems are capable of producing a large quantity of products that have similar processing requirements.

73. 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.

74. D   During maturity stage, organizations focus on improving the efficiency of process and ≤ minimizing the costs.

75. B   The repeated pattern of increase and decrease in demand over a period of time is known as ≤ seasonal component of forecasting.

76. C   Division of job into subtasks and assigning them to workers based on their skills and ≤ capabilities is called Division of labor.

77. C   Job analysis is not a step in the time study. ≤

Following are the steps involved in time study:
- Job identification and division
- Observation
- Pace rating the workers
- Considerations of allowances

78. C   ≤

	JAN	FEB
Demand	7000	5000
Working Days	22	25
Production per month per worker	$22 \times 5 = 110$	$25 \times 5 = 125$
Workers available	50	64
Total production	$110 \times 50 = 5500$	$125 \times 64 = 8000$
Production Deficit	7000-5500=1500	0
Production Surplus	0	8000-5000=3000
Number of additional workers needed	$\frac{1500}{110} = 13.6 = 14$	Nil

Hiring costs	$200 \times 14 = 2800$	Nil
Number of workers to be laid off	Nil	$\dfrac{3000}{125} = 24$
Layoff costs	0	$300 \times 24 = 7200$
Total number of workers at the end of month	50+14=64	64-24=40
Total costs (Hiring/Layoff)	Rs.2800	Rs.7200

79. B Overtime costs are incurred when the strategy is to vary the utilization of the workforce. $\leq$

Very high Hiring costs and Lay-off costs are incurred when the strategy is to vary the workforce size in response to the output requirements.

Materials Handling costs are incurred when the strategy is to vary the size of inventory.

Stockout costs are incurred in case of a back-order strategy.

80. C In the decentralized purchasing system, the individual departments are flexible to alter their $\leq$
purchasing policies on the basis of their specific requirements.

All other options belong to centralized purchasing system.

81. E Predetermined Motion Time Study is a technique of setting work standards that uses the $\leq$
recorded standard time data for each of the basic motions associated with performing a task and summing them up to determine the time required to perform the whole task.

82. E All the statements are true regarding process charts. $\leq$

I.   These charts include information of steps involved, their frequency of occurrence, time for each step and the distance travelled etc.

II.   Both productive and non-productive activities are included in these charts.

III.   They show the material requirements, assembly operations and sub-assembly operations.

83. E In process charts, inverted triangle is used to represent the storage activity. $\leq$

Symbol	Activity
O	Operation
$\Rightarrow$	Transport
▯	Input
D	Delay
∇	Storage

84. A $\leq$

Period	Actual Demand (A)	Forecast Demand (F)	(A-F)	$\lvert A - F \rvert$
1	80	78	2	2
2	92	79	13	13
3	71	83	-12	12
4	83	79	4	4
5	90	80	10	10
6	102	83	19	19
		Totals	**36**	**60**

$$\text{MAD} = \frac{1}{n}\left(\sum_{t=1}^{n}\left|A_t - F_t\right|\right) = \frac{60}{6} = 10$$

Tracking Signal = $\displaystyle\sum_{i=1}^{n} \frac{(\text{Actual demand} - \text{Forecast demand})}{\text{MAD}} = \frac{36}{10} = 3.6$

Action limit of 4 is not exceeded. Therefore, corrective action is not required.

85. A   Vertical integration $\leq$

    I.   Relieves an organization of a part of its purchasing function.
    II.   Provides flexibility in manufacturing.
    III.   Helps in obtaining economies of scale.
    Increase in profits is not due to decentralized overheads, but through centralized overheads

< TOP OF THE DOCUMENT >