Question Paper
Operations Management - II (MB2E4): October 2008

- **Answer all 86 questions.**
- **Marks are indicated against each question.**

Total Marks : 100

1. Materials management is the detailed study of complete material flow process of a firm. Which of the following statements is **false** regarding materials management? <Answer>

(a) The responsibility of materials management is decentralized to departmental specialists like purchase managers or inventory managers
(b) The scope of materials management can be viewed in two contexts – trouble avoidance and opportunistic
(c) Irrespective of the industry, materials normally account for about 50% of the total capital invested
(d) Administrative expenses form the only major area for cost reduction in a firm
(e) Materials management executives are entrusted with the job of exploring new sources of supply and identifying the ways to environmental safety. **mark (1)**

2. ERP implementation is a long process that involves considerable investment in the form of time and money. To guarantee its success, organizations need to concentrate on issues like <Answer>

I. Functionality.
II. Intangibility.
III. Technology.
IV. Implementability.

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

3. Which of the following statements is/are **true** relating to the scheduling of service operations? <Answer>

I. Scheduling of service operations is same as the scheduling of manufacturing activities.
II. Services cannot be stored to meet the demand at peak hours.
III. Variation of demand is relatively low in service operations.

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

4. The implementation of JIT principles is difficult due to certain barriers, in spite of JIT being a powerful tool for reducing the firm's inventory and improving productivity. Which of the following is **not** one of those barriers? <Answer>

(a) Difficulty in accomplishing zero lead-time
(b) Difficulty in maintaining zero safety stock
(c) Difficulty in reducing the formal paper work
(d) Difficulty in ensuring zero idle time **mark**
(e) Worker's resistance to change. **(1)**

5. Which of the following is a process that estimates the requirement of materials starting with the date of requirement and working backward to estimate the date of receipt keeping in view production and waiting time, and estimating date of order, based on delivery lead-time? <Answer>

(a) Materials requirement planning
(b) Capacity requirements planning
(c) Facilities planning
(d) Master production scheduling **mark**
(e) Manufacturing resource planning. **(1)**

6. Supply chain management provides both tangible and intangible benefits to an organization. Which of the following is/are the intangible benefits to an organization? <Answer>

I. Enhanced customer and supplier relationships.
II. Optimized inventory management.
III. Improved facility utilization.
IV. Improvement in customer satisfaction.

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

mark (1)

7. Environ Furnishings, a manufacturer of carpets inspected 12 lots in its plant and identified the following number of defectives in the process. <Answer>

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Number of Defectives	3	2	1	4	2	1	3	3	5	4	2	6

Find the UCL, LCL and average of proportion of fraction defectives respectively, if the sample size is 18.

(a) 0.3415, 0 and 0.1615
(b) 0.3415, 0.0911 and 0.1615
(c) 0.4315, 0.0965 and 0.1675
(d) 0.4315, 0 and 0.1675
(e) 0.5314, 0.0965 and 0.1615.

mark (2 s)

8. Which of the following statements is **false** relating to the significance of maintenance management? <Answer>

(a) Machine failure can even lead to accidents in some cases
(b) Breakdown of a piece of equipment results in delaying of the production process
(c) Effective implementation of maintenance activities improves the economic lifetime of the equipment and reduces its salvage value
(d) Repairing a machine can be expensive once it breaks down
(e) Malfunctioning equipment result in an increase in the unit production costs.

mark (1)

9. Which of the following is **not** an advantage of network modeling? <Answer>

(a) The activities to be performed are visually represented
(b) Managers need to be trained on the statistical and mathematical calculations
(c) Networks provide an estimate of the duration of the projects at the given resource level
(d) They provide means for estimating the time and cost impact of changes in the project at the planning stage
(e) They help operations managers in identifying the critical or potentially troublesome activities.

mark (1)

10. Materials management that aims at preventing the problem of a shortage of material has several objectives. Which of the following is **not** an objective accomplished through materials management? <Answer>

(a) Purchase materials at the least possible prices
(b) Maintain low inventory turnover
(c) Maintain cordial relations with suppliers and supplying firms
(d) Maintain records along with well-planned administrative controls and periodic audits
(e) Search for new products and materials.

mark (1)

11. Competitive advantage is becoming a prime factor for an organization to attract and retain business in the competitive environment. Which of the following statements is **false** with respect to qualifiers and order-winners? <Answer>

(a) ISO standards are key order-winners for any organization operating in the global markets
(b) Using price reduction as an order-winner necessitates an organization to assess changes in lead-times
(c) Delivery reliability is one of the criteria on which customers judge an organization's competitiveness
(d) Quality, one of the order-winners refers to the match of the degree of a product manufactured to the agreed specification as conformance
(e) There is an increase in the cost and time of production due to an increase in the product range.

mark (1)

12. Electronic Data Interchange (EDI) is a system that helps in sharing and transmitting information electronically in between the departments within the same organization or between the customers and suppliers. Which of the following is **not** an advantage derived by firms through EDI? <Answer>

(a) It helps suppliers to track the sales or product usage rates of their customers
(b) It helps customers to track their orders within the vendor's system for status checking
(c) It helps organizations to maintain high levels of inventory
(d) It helps in reducing the paper work
(e) In services sector, it helps customers to do financial transactions through self service mode. **mark (1)**

13. Which of the following operational issues that demand the attention of strategy managers in the process of globalization relate to decisions concerned with the flow of materials from one facility to another or from one location to another, the cost of transportation, and the availability of distribution channel? <Answer>

(a) Capacity
(b) Facilities
(c) Integration
(d) Procedures and planning
(e) Management and organization. **mark (1)**

14. Which of the following is the maximum of the set of expected beginning times of an activity? <Answer>

(a) Optimistic time
(b) Pessimistic time
(c) Earliest start time
(d) Latest start time
(e) Expected start time. **mark (1)**

15. Materials Requirement Planning (MRP) system helps an organization achieve the objectives such as improved customer service, reduced investment in inventory, improved operating efficiency and faster response to market changes. Which of the following relate to improved operating efficiency? <Answer>

I. Reduced stock-out costs.
II. Delaying the outflow of materials.
III. Reduced inventory holding costs.
IV. Reduced idle time.

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

16. The probabilities of failure after maintenance for a machine in the spindles section of the Machine Tools division, Hyderabad of HMT Ltd., are given in the following table: <Answer>

Quarters after maintenance	1	2	3	4	5
Probabilities of break-down	0.2	0.3	0.1	0.2	0.2

If there are 8 identical machines in the plant, the average cost of preventive maintenance is Rs.895 and the cost of remedial maintenance per machine is Rs.7,800, calculate the expected number of breakdowns in the 4^{th} quarter and the average total cost of maintenance per month.

(a) 7.53 and Rs.11,651
(b) 9.08 and Rs. 6,499
(c) 9.08 and Rs. 5,829
(d) 10.61 and Rs. 6,645
(e) 10.61 and Rs. 5,928. **mark (3 s)**

17 Control charts are used to check whether the process related to a variable is in control. The variable(s) related to control chart for variables is/are

<Answer>

I. Length.
II. Weight.
III. Tensile strength.
IV. Queue waiting time.

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

mark (1)

18 The locations in the supply chain where the raw materials and finished goods are stored, and where work-in-progress materials are assembled or fabricated are known as

<Answer>

(a) Warehouses
(b) Facilities
(c) Inventory department
(d) Purchasing department
(e) Receiving department.

mark (1)

19 Proper equipment maintenance enables an organization to prevent equipment breakdowns. Which of the following is **not** one of the principles and actions that improve equipment maintenance?

<Answer>

(a) Design simple equipment and standardize replacement parts
(b) Collect information about the frequency and causes of failure of machines
(c) The number of machines used during the production should be maximized
(d) Replace worn parts of the equipment after periodic checks
(e) Purchase all spare parts that are necessary during repair work.

mark (1)

20 A firm engaged in manufacturing ceiling fans of three models A, B and C carries out three functions: setup work, fabrication and assembling. From the table given below, calculate the number of employees required for carrying out the setup work, fabrication and assembling functions respectively.

<Answer>

Product	Volume	Production Rate (units per hour)		
		Setup work	Fabrication	Assembling
A	120	3.75	2	2.5
B	180	2.5	3	3.75
C	240	3	2.5	5

(Assuming each employee works for 9 hours a day).

(a) 25, 23, 27
(b) 20, 24, 16
(c) 20, 25, 18
(d) 18, 24, 16
(e) 16, 25, 18.

mark (2 s)

21 The process of materials management is explained as an overlap of three functions – production control, inventory control and materials handling. In which of the following departments does an overlap exist in these three functions?

<Answer>

I. Purchasing department.
II. Raw materials inventory department.
III. Production department.
IV. Finished goods inventory department.

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

mark (1)

22 ERP implementation is done in a phased manner to ensure success. Who among the following should set the milestones to be achieved in the various phases of the ERP implementation process and review the progress continuously against the milestones? <Answer>

(a) Functional managers
(b) Project leaders
(c) Module leaders
(d) Implementation consultants
(e) External ERP consultants. **mark (1)**

23 Globalizing the activities of an organization is hindered by certain impediments. Which of the following serves as an economic impediment faced by the organizations? <Answer>

(a) Regulations relating to tariffs and duties
(b) Regulations relating to quantitative quotas and other similar restrictions
(c) Different performance requirements in different markets
(d) Corporate laws, tax laws, or other policies of the local government
(e) Rules and regulations relating to the preferential tax treatment and labor policies. **mark (1)**

24 Which of the following statements relates to expert systems? <Answer>

(a) They consist of an inference engine
(b) They are based on two related technologies – numerical control and teleoperators
(c) They manipulate symbols to solve problems
(d) They can be broadly classified into three categories
(e) They use sensors to determine whether or not a product being produced is consistent with the quality specifications. **mark (1)**

25 Which of the following statements is **false** relating to the Materials Requirement Planning (MRP) system inputs? <Answer>

(a) Information from the aggregate production plan is used by the MRP system to generate a replenishment plan
(b) The time horizon in the Master Production Schedule (MPS) is divided into time fences
(c) The Bills Of Material (BOM) contains information about the production of an item internally or its purchase from external sources
(d) Low-level coding refers to the restructuring of the BOM to ensure that a same component appears at the same level throughout
(e) Information relating to the spare parts is not included in the MPS. **mark (1)**

26 Which of the following is/are the condition(s) that need to be satisfied for crashing a selected activity to the possible extent? <Answer>

I. The activity time is at its minimum possible value.
II. The time reduced is equal to the smallest slack value of the critical activities.
III. The reduced time is equal to the desired project completion time.

(a) Only (III) 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. **mark (1)**

27 Pranathi Group of Industries Ltd. uses the 'bathtub curve' to predict when the probability of equipment failure will be highest. Which of the following is/are the stage(s) where the probability of failure is very high attributed to improper design and installation and where the functional defects in the product come to fore? <Answer>

I. Infant mortality.
II. Burn in stage.
III. Wear out stage.

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

28. The time estimates of five activities of a project on a critical path are: <Answer>

Activity	Time Estimates (in weeks)		
	Optimistic	Most likely	Pessimistic
1 – 3	6	5.5	8
3 – 4	9	7	11
4 – 6	7	11	9
6 – 7	8	7	12
7 – 8	7	6	11

The standard deviation of the duration of the critical path of this project is (in weeks)

(a) 0.88
(b) 1.10
(c) 1.22
(d) 1.64
(e) 1.86.

mark (2 s)

29. The principles of supply chain management enable an organization to attain a balance between customers' expectations and its growth and profitability objectives. Which of the following statements is **false**? <Answer>

(a) Segmenting the customers based on industry, product or trade channel does not help in serving the customers properly
(b) Designing the logistics system to meet the average service requirements of all the customers leads to poor resource utilization
(c) Every link in the supply chain should be involved in collaborative forecasting to enable provision of required capacity for all operations
(d) Approach to suppliers can be made based on the market positions and industry structure
(e) An IT system should help in planning and decision-making and effective resource allocation through a master production schedule in the long term.

mark (1)

30. Which of the following is **not true** regarding Acceptance Plans used in quality control? <Answer>

(a) They help to decide whether lots of raw materials, purchased parts and finished goods meet prescribed quality standards
(b) Acceptance Plans have large sample sizes
(c) Acceptance Plans protect an organization by limiting the percentage of defective products that are shipped to customers
(d) On the basis of Acceptance Plans, operations managers can either accept or reject a lot
(e) Average Outgoing Quality Curves and Operating Characteristics Curves are two important concepts of Acceptance Plans.

mark (1)

31. Quest Enterprises Ltd. has 5 jobs. The information relating to these jobs after the lapse of 22 days is given below. <Answer>

Particulars	**A**	**B**	**C**	**D**	**E**
Planned days	43	65	72	59	78
Work remaining in days	15	x	28	19	y

x = 1.8 times more than the work remaining to complete job A
y = 1.1 times more than the work remaining to complete job B.

The job that will be given 4th priority, and its critical ratio are

(a) C, 1.79
(b) E, 1.87
(c) C, 1.87
(d) E, 1.95
(e) C, 1.95.

mark (2 s)

32. The primary responsibility of the receiving department in an organization is to process the incoming shipments of materials. In the absence of a separate receiving department in an organization, its activities/functions are usually taken care of by <Answer>

(a) Purchasing department
(b) Raw materials inventory department
(c) Production department
(d) Finished goods inventory department
(e) Shipping department. **mark (1)**

33. The plan for effective ERP implementation includes various stages. Which of the following is performed after the customization and master data transfer stages? <Answer>

(a) Test run
(b) Parallel run
(c) Migration to the new system
(d) User documentation
(e) System monitoring and fine-tuning. **mark (1)**

34. Which of the following characteristics of the JIT systems can be enabled through the usage of procedures such as heating, cleaning and streamlining work? <Answer>

(a) Uniform workstation loads
(b) Maintenance of high quality
(c) Quick and economic setups
(d) Preventive maintenance
(e) Continuous improvement. **mark (1)**

35. MRP system uses information from product structure file and lead-time information to develop purchase and production schedule for the component using three steps. Which of the following statements represents Netting, one of the steps in the MRP system information processing? <Answer>

(a) It consolidates the material requirements to form a single master material requirements plan
(b) It starts with the time when the product is required and then proceeds backward to determine each production or purchasing activity
(c) It determines the planned order releases so that materials arrive just when they are needed
(d) It is to develop a materials requirement plan for each item in the BOM file for each time bucket
(e) It uses the information from MPS and BOM to generate the sequence followed to produce the end product. **mark (1)**

36. Which of the following statements relating to the automation in design and engineering support and controlling processing equipment is **true**? <Answer>

(a) CNC machines are one of the key elements of CAD
(b) Implementation of CAM results in high labor costs
(c) CAD packages eliminate the need for costly prototype testing at the initial stages of the product design
(d) FMS is useful in organizations producing a single product in large volumes
(e) CAM computers are used indirectly to control the processing equipment. **mark (1)**

37. Managing globalization requires changing the organization structure, managing the changing attitude of managers and developing core competencies for global learning. Which of the following statements relating to managing globalization is/are **false**? <Answer>

I. Most global organizations are characterized by the presence of authority in the lower levels of the hierarchy.
II. Designing an organizational structure for a global organization requires considering the objectives of sales personnel and engineers purchase agents.
III. Changing the attitude of managers involves conducting various training sessions at many levels.
IV. The approaches for managing core competencies are the same as the approaches used for managing capital base or strategic business units.

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

38 Operations manager has to make a trade-off between various types of maintenance that has implications on the overall performance of the organization by reducing the total maintenance cost. The total cost of maintenance includes components such as <Answer>

I. Preventive maintenance costs.
II. Predictive maintenance costs.
III. Remedial maintenance costs.
IV. Contract maintenance costs.

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

mark (1)

39 Select the right formula from the options given below for arriving at an activity slack time (EST: Earliest Start Time; LST: Latest Start Time; EFT: Earliest Finish Time; LFT: Latest Finish Time) <Answer>

(a) Difference between EFT and EST
(b) Difference between LFT and LST
(c) Difference between LST and EST
(d) Difference between LFT and EST
(e) Difference between EST and LFT.

mark (1)

40 Which of the following forces shaping the supply chain focuses on finding a balance between cost and quality, and customization and availability without compromising on any one of them? <Answer>

(a) Consumer demand
(b) Globalization
(c) Competition
(d) Information and communication
(e) Environment.

mark (1)

41 The cost of quality can be divided into three categories. Which of the following relate to the cost of prevention? <Answer>

I. Investments made in machinery.
II. Costs of vendor certification.
III. Costs of equipment maintenance.
IV. Costs related to disposition of defective items.

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

mark (1)

42 Queuing analysis involves the study of waiting lines and queuing systems. Which of the following statements is **not true** with respect to queuing analysis? <Answer>

(a) Poisson distribution cannot effectively represent real life situations
(b) Arrivals are assumed from an infinite population
(c) The effects of short queues on new arrivals not being considered is a limitation of this analysis
(d) The waiting space available for the population arriving at the service facility is considered infinite
(e) Increasing the capacity of service facilities can reduce the queue but facilities become idle when the customer arrival rate slows down.

mark (1)

43. Which of the following statements relating to the functions of materials management is/are **true**? <Answer>

I. The tasks of inventory control in the raw materials storage and production departments are the same as that in the production control department.
II. The focus of inventory control is on materials availability, whereas production control focuses on cost minimization.
III. The finished goods inventory of a firm is planned on the basis of marketing strategy and market demand.
IV. Physical distribution, a sub-function of the materials management function deals with obtaining, producing and distributing materials and products at/to the desired place, at the right time.

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

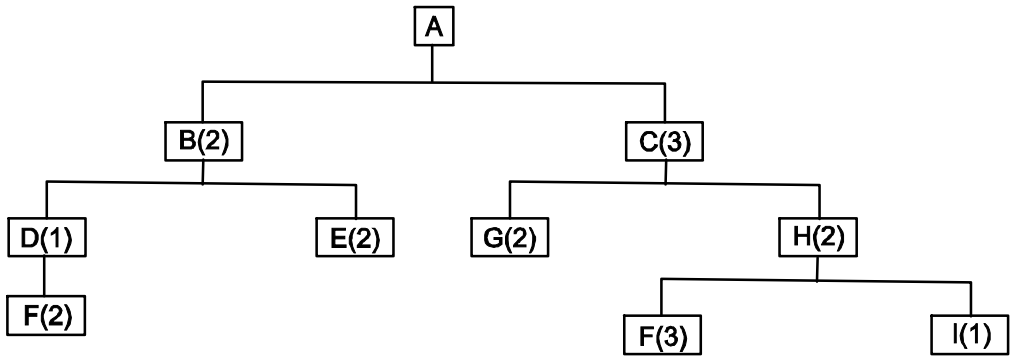
mark (1)

44. In the implementation of the ERP package, teams are formed consisting of members from various functions and implementation consultants. The key activity of monitoring the implementation process continuously in order to identify deviations, cost overruns, resource requirements, etc. during implementation is the responsibility of <Answer>

(a) Project managers
(b) Module leaders
(c) Implementation consultants
(d) Steering committee
(e) Top management.

mark (1)

45. From the product structure tree given below, calculate the number of units of F required to manufacture 240 units of A. The on-hand inventory available is 120 units of subassembly B and 80 units of subassembly C. <Answer>



(a) 2,760 units
(b) 3,890 units
(c) 4,560 units
(d) 4,890 units
(e) 5,290 units.

mark (3 s)

46. Flexible Manufacturing Systems (FMS) were introduced in the production lines to overcome the inefficiencies of the early automation systems. Which of the following does **not** represent the components of FMS? <Answer>

(a) A fixed-path conveyor
(b) An automated loading system
(c) Machining centers
(d) An unloading system
(e) A central computer.

mark (1)

47 Which of the following is advisable for firms in the maintenance of non-critical equipment, also referred to as breakdown maintenance? <Answer>

(a) Preventive maintenance
(b) Remedial maintenance
(c) Predictive maintenance
(d) Periodic maintenance
(e) Contract maintenance.

mark (1)

48 Which of the following is **not true** for the Program Evaluation and Review Technique (PERT) of project management? <Answer>

(a) PERT provides a graphical display of projects that help the users understand the relationships among the activities
(b) PERT can be used in situations where two or more projects have to be planned together to share the available resources
(c) The PERT network always begins with a single node and ends with a single node, with at least a single continuous path in between the two nodes
(d) The slack time for an activity is the time by which that activity can be delayed without delaying the total project
(e) The slack time for critical activities is zero.

mark (1)

49 JIT systems offer various benefits to organizations as well as suppliers. Which of the following is **not** an operational benefit derived by firms from the use of JIT systems? <Answer>

(a) Reduction in space requirements of the firm
(b) Closer relationship with suppliers
(c) Reduced investment in inventory
(d) Less expenditure on promotional activities
(e) Reduction in formal paper work.

mark (1)

50 Lyke Spares Ltd. has two job orders, J_1 to produce 380 nuts of 1.2 mm and J_2 to produce 290 screws of 1 inch. Both these orders have to be processed on two machines A and B. The route sheets for the jobs which should be ready in the next nine hours with the machines starting processing from now are given below. <Answer>

Job J Route sheet			**Job K Route sheet**		
Routing sequence	**Machine**	**Processing time (Hours)**	**Routing sequence**	**Machine**	**Processing time (Hours)**
1	A	3	1	B	3
2	B	1	2	A	1
3	A	2	3	A	1
Total		**6**	**Total**		**5**

Using forward scheduling, the two jobs can be completed earliest by the end of

(a) 7^{th} hour for Job J, 7^{th} hour for Job K
(b) 8^{th} hour for Job J, 6^{th} hour for Job K
(c) 6^{th} hour for Job J, 7^{th} hour for Job K
(d) 6^{th} hour for Job J, 8^{th} hour for Job K
(e) 4^{th} hour for both Job J and Job K.

mark (2 s)

51 Supply Chain Management (SCM) components represent business processes and practices. Which of the following SCM components focuses on how different entities of the supply chain perform as a group? <Answer>

(a) SCM leadership
(b) SCM strategy
(c) Operational planning
(d) Business relationship management
(e) Human resources management.

mark (1)

52. Many organizations implementing ERP may not prefer to purchase a complete package at one instance. Which of the following is to be examined in such a scenario? <Answer>

(a) Global presence
(b) Target market
(c) Ease and cost of implementation
(d) Modularity
(e) Price.

mark (1)

53. Following are the means ($\overline{X}$) and range (R) of 15 samples, each sample containing 8 items. <Answer>

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$\overline{X}$	28	31	29	34	23	30	33	27	24	26	30	25	22	27	21
R	7	5	8	9	6	8	5	4	6	7	9	4	6	8	7

(Conversion factors for sample size 8 are given as $A_2 = 0.373$, $D_3 = 0.136$, $D_4 = 1.864$)

The upper control limit, lower control limit and the central line respectively for the X-chart are

(a) 27.97, 22.78 and 25.47
(b) 29.79, 22.78 and 25.47
(c) 29.79, 24.87 and 27.33
(d) 31.27, 26.38 and 24.73
(e) 31.79, 24.87 and 26.33.

mark (2 s)

54. Robots are versatile, computer-controlled machines programmed to perform various tasks independently. Which of the following statements is/are **true** relating to robots? <Answer>

I. The work envelope of a robot is the physical movement capability of the robot's arms and hands.
II. The sequence of actions of variable–sequence robots is usually triggered by electronic sensors.
III. Intelligent robots are used to perform manufacturing operations where high precision is required.
IV. Playback robots can store a sequence of operations in memory.

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

mark (1)

55. Identify the critical path from the following information related to a project of Pioneer Infrastructures. <Answer>

Activity	A	B	C	D	E	F	G	H	I
Preceding Activity	–	–	A	A	B, C	D, E	D, E	F	G
Expected Time (weeks)	6	7	6	8	10	12	10	8	7

(a) A – D – F – H
(b) A – C – E – F – H
(c) A – D – G – I
(d) A – C – E – G – I
(e) B – E – F – H.

mark (2 s)

56. Which of the following system develops schedules for production equipment and coordinates the activities and flow of materials throughout the manufacturing unit and also tracks the movement of product in production units, monitors product quality and tool wear, and simultaneously stores the data for future analysis? <Answer>

(a) A computer aided design system
(b) A computer aided manufacturing system
(c) A flexible manufacturing system
(d) A computer integrated manufacturing system
(e) An indirect computer aided manufacturing system.

mark (1)

57 An MRP system generates many types of reports and planning information as outputs. Inventory forecasts, purchase commitment report etc., are examples of <Answer>

(a) Order releases
(b) Planned orders
(c) Planning reports
(d) Exception reports
(e) Performance reports.

mark (1)

58 Maintaining which of the following requires the identification and elimination of production bottlenecks, balance in the production system and reduction in setup time? <Answer>

(a) Trust
(b) Communication
(c) Linearity of production
(d) Organizational linkage
(e) Time to make changes.

mark (1)

59 Ms.Likitha, Sr.HR Manager of Pioneer Financial Services wishes to consider the opinions of the employees in scheduling their work times. The employees were given a choice to choose from the five personnel-related scheduling approaches, based on which the employees have chosen to work a specified number of hours per week provided they are given the choice of selecting their work times. Which of the following approaches did the employees of Pioneer Financial Services opt for? <Answer>

(a) Flextime
(b) Flextour
(c) Staggered times
(d) Compressed workweek
(e) Part time.

mark (1)

60 Maintenance in a firm is carried out in three major areas. Which of the following come under the purview of civil maintenance? <Answer>

I. Maintaining fire fighting equipment.
II. Maintenance of transport vehicles.
III. Waste disposal.
IV. Maintenance of materials handling equipment.

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

mark (1)

61 A well established supermarket chain group is considering to implement ERP in all its supermarkets. In which of the following stages of the ERP implementation program does the group require setting performance standards for each process by using benchmarking techniques? <Answer>

(a) Identify the needs for the ERP package
(b) Evaluating the “as-is” situation of the business
(c) Decisions about the desired “would be” situation for the business
(d) Reengineering of business processes to achieve the desired results
(e) Evaluation of available ERP packages.

mark (1)

62 Which of the following quality dimensions, influenced by individual preferences, can be used to cater to a niche market? <Answer>

(a) Reliability
(b) Conformance
(c) Aesthetics
(d) Serviceability
(e) Durability.

mark (1)

63 Enablers are responsible for the overall performance of the SCM. Which of the following SCM enablers is the comprehensive process that defines the overall requirements both external and internal to the organization, after considering the feedback from customers and suppliers? <Answer>

(a) Alignment
(b) Consumer-supplier focus
(c) Design
(d) Participation
(e) Periodic review.

mark (1)

64 Outsourcing of facilities management to external agencies is not always considered profitable due to the costs involved. With respect to outsourcing, costs related to which of the following would not result in benefits to the client? <Answer>

I. Control of facilities.
II. Flexibility in terms of time frame of the contracts.
III. Staffing quality.
IV. Operations.

(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) All (I), (II), (III) and (IV) above.

mark (1)

65 Materials managers use several techniques to carry out their tasks. Which of the following statements does **not** correctly represent the materials management techniques? <Answer>

(a) Just In Time systems enable zero defects to both buyers and sellers
(b) Kanban system uses three types of cards to initiate material transactions
(c) A conveyance authorization card specifies the product's name, its identification number and the delivery destination
(d) The dual-card Kanban system makes use of the production authorization card and the conveyance authorization card
(e) ABC system does not consider the aspect of importance of a material.

mark (1)

66 Production process in a firm involves a series of activities, which is formulated after detailed technical and engineering analysis. Which of the following activities are carried out as part of the production process? <Answer>

I. Equipment maintenance.
II. Raw material sourcing.
III. Inventory maintenance.
IV. Packaging.

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

mark (1)

67 MRP system implementation fails many times due to various reasons. Which of the following relate to inappropriate product environment, one of the reasons for the failure? <Answer>

I. Majority of components and parts as part of the purchase items results in an appropriate product environment.
II. The demand pattern of these items should be independent in nature.
III. The timing of these items should be irregular.

(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.

mark (1)

68 Operations are classified into various types for the effective preparation of schedules by the Operations managers. Which of the following statements represents repetitive operations? <Answer>

(a) They involve the production of products or services in low volume
(b) Methods like Gantt charts, job sequencing methods are used in scheduling these operations
(c) In these operations, the labor is trained and the equipment designed for a narrow range of activities
(d) Considerable variation exists in the materials used, set up time etc., in the performance of these operations
(e) Managers consider the opinions of employees while scheduling these operations. **mark (1)**

69 Which of the following statements relating to the implementation of JIT systems is **false**? <Answer>

(a) JIT firms use a concept known as 'immediate customer' wherein a worker views the next worker as a customer
(b) JIT firms maintain long-term business relationships with a few selected suppliers
(c) In suggestion programs, people working in similar types of operations meet at regular intervals and discuss ways of improving the quality of their processes
(d) JIT system requires an open management style to improve the performance of the firm **mark**
(e) JIT firm share their production plans and schedules with its suppliers. **(1)**

70 Medha Projects is contemplating to reduce the time taken by some of the activities of the ongoing project to complete the project on time. Identify the activity that can be crashed first. <Answer>

Activity	Normal Time	Crash Time	Normal Cost	Crash Cost
1 – 2	6	4	1200	1600
2 – 3	9	5	2400	3200
2 – 4	7	3	4200	4800
2 – 5	3	2	4500	5600
3 – 5	4	4	2200	2400
4 – 5	9	4	1900	2800
5 – 6	10	6	2300	3300

(a) 1 – 2
(b) 2 – 3
(c) 2 – 4
(d) 3 – 5 **mark**
(e) 4 – 5. **(2 s)**

71 Who among the following acts as change managers in situations where existing processes or infrastructure is modified or replaced with new ones to suit the organizational goals? <Answer>

(a) Human resource managers
(b) Finance executives
(c) Facilities managers
(d) Sales managers **mark**
(e) Purchase managers. **(1)**

72 WTO establishes the principles of trade between nations. Which of the following is/are the key aim(s) of WTO? <Answer>

I. To enable easy and quick repeal and modification of the trade rules and regulations.
II. To provide a forum for discussion among member countries with respect to trade related issues and concerns.
III. To act as a dispute settlement body for trade related disputes among member countries.

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

73. Which of the following statements represent a misconception about the customer focus in supply chain management? <Answer>

(a) In supply chain management, the focus of all the supply chain partners in a demand chain will be on end users
(b) Consumers provide both the push and pull in a process known as demand-chain management
(c) Every member of the demand chain needs to monitor consumer needs and wants
(d) In demand chains, business-to-business companies need to monitor only their customers
(e) Demand-chain management focuses on the supply of items that consumers are willing and able to purchase. **mark (1)**

74. Which of the following statements represents the integrated data model? <Answer>

(a) It transforms labor and machinery-based productivity to knowledge-and-information-based productivity
(b) It minimizes the data redundancy and ensures the availability of the right information to all concerned
(c) It implies a strong emphasis on how work is done within an organization
(d) It provides a general overview of the operations of a business
(e) It brings about transformation in the business process by rethinking the company's tasks in a holistic and process-oriented manner. **mark (1)**

75. Productivity can be increased either by increasing the output with the same number of inputs or by producing the same output using fewer inputs. This refers to <Answer>

(a) Price efficiency
(b) Allocative efficiency
(c) Product efficiency
(d) Technical efficiency
(e) Scale efficiency. **mark (1)**

76. Megha Industries Pvt. Ltd.'s Automated Storage and Retrieval Systems are computer–controlled and mechanically–operated materials handling systems that use automated guided vehicles and conveyance systems. Which of the following is/are the traditional materials handling equipment that are replaced by automated guided vehicles? <Answer>

I. Manually operated trucks.
II. Hydraulic.
III. Robots.
IV. Straddle trucks.

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

77. The small parts division of a manufacturing firm dealing in heavy machinery received 4 job orders – S1, S2, S3 and S4 to prepare nuts of varying sizes for 3 different machines of Leci Ltd. <Answer>

From the following information, calculate the average delay of a job using the dispatching rule – slack time remaining.

Job (In order of arrival)	Processing Time (days)	Due date (Days hence)
S1	4	6
S2	5	8
S3	3	5
S4	6	9

(a) S1 – S2 – S3 – S4, 3.0 days
(b) S3 – S1 – S2 – S4, 3.5 days
(c) S1 – S2 – S4 – S3, 5.0 days
(d) S3 – S4 – S2 – S1, 5.5 days
(e) S3 – S1 – S2 – S4, 6.0 days. **mark (2 s)**

78. Just-In-Time (JIT) systems can be successful through achievement and maintenance of high performance levels in all their operational areas. JIT manufacturing, based on the concept of continuous improvement includes certain mutually supporting component(s) such as <Answer>

I. People involvement.
II. Machine utilization.
III. Total quality control.

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

mark (1)

79. Organizations using automation to control and manage their operations gain a considerable economic advantage. Which of the following is **not** an area of advantage derived by organizations from automation? <Answer>

(a) Productivity
(b) Use of materials
(c) Quality of the product
(d) Feedback from employees
(e) Factory lead-time.

mark (1)

80. Which of the following, considered as an integrated system by the operations managers is used to analyze complete product cycles, from corporate production plans to finished goods distribution? <Answer>

(a) Materials requirement planning system
(b) Manufacturing resource planning system
(c) Capacity requirement planning system
(d) Aggregate production planning
(e) Master production scheduling.

mark (1)

81. Trash removal, hazardous waste removal and management, energy management, disaster recovery planning and management, and energy management are the activities covered under the function of <Answer>

(a) Facilities planning and forecasting
(b) Operations, maintenance and repair
(c) Workplace planning, allocation and management
(d) Communication management
(e) Space planning and management.

mark (1)

82. Which of the following statements are **true** with respect to performance? <Answer>

I. Performance can be split into qualitative and quantitative performance.
II. Qualitative performance provides a good measure of performance at the national, industry or individual business level.
III. Quantitative performance is measured in terms of the ratio of the outputs to inputs.
IV. Quantitative performance can be used as a controlling tool to ensure that all the resources are utilized judiciously and efficiently.

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

mark (1)

83. Implementation of ESCM can be made effective through adoption of certain activities. Which of the following is **false** relating to those activities? <Answer>

(a) Understand and evaluate the level of integration within the organization
(b) Determine the number of suppliers who have direct influence over the products or services delivered to the customers
(c) Define the customer base in terms of first tier, second tier etc.
(d) Improve the information infrastructure within the organization to accommodate ESCM requirements
(e) Identify leaders who are capable of guiding the implementation process competently.

mark (1)

84. A structured and measured set of activities designed to produce a specified output for a particular customer or market is referred to as <Answer>

(a) Business process
(b) Business reengineering
(c) Business model
(d) Business restructuring
(e) Integrated data model.

mark (1)

85. Scheduling of operations within a firm is done with the main objective of providing best service to the customers through efficient use of the firm's resources. Which of the following statements is/are **true** regarding scheduling? <Answer>

I. Scheduling too much capacity results in incomplete jobs.
II. It is a short-range planning activity.
III. It is a medium-range planning activity.
IV. Backward scheduling is used in fabrication operations.

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

mark (1)

86. Following is the information related to a project. <Answer>

Activity	Duration (hours)
1 – 2	2
1 – 3	2
1 – 4	1
2 – 5	4
3 – 6	8
3 – 7	5
4 – 6	3
5 – 8	1
6 – 9	5
7 – 8	4
8 – 9	3

Calculate the earliest and latest times of the activity 2 – 5.

(a) 1, 7 and 10, 10
(b) 2, 7 and 6, 11
(c) 2, 7 and 11, 12
(d) 7, 8 and 10, 10
(e) 7, 8 and 11, 12.

mark (2 s)

END OF QUESTION PAPER

Suggested Answers
Operations Management - II (MB2E4): October 2008

	Answer	Reason	
1.	D	Management of materials is very significant in a firm as a reduction in expenditure on materials can improve the profits of a firm. Since, overheads other than material costs like labor costs and administration expenses are relatively fixed and do not offer much scope for reduction, material is only the major area for cost reduction. Hence, option (d) is the answer.	≤
2.	C	The success of an ERP implementation methodology depends on three issues like – functionality, technology and implementability. Intangibility is not one of those issues. An ERP package cannot be intangible.	≤
3.	B	Scheduling of service operations is different from the scheduling of manufacturing activities. Variation of demand is relatively high in service operations. Hence, statements (I) and (III) are false. Option (b) is the answer.	≤
4.	C	The implementation of JIT principles is difficult as it has to overcome the following barriers: • Workers' resistance to change • Difficulty in accomplishing zero lead-time • Difficulty in accomplishing zero safety stock • Difficulty in accomplishing zero idle time. Difficulty in reducing the paper work is **not** a barrier of JIT implementation. Adopting a JIT system will automatically reduce the formal paper work of the firm. It is one of the operational benefits derived by firms through a JIT system.	≤
5.	A	Materials requirement planning is a backward scheduling process that estimates the requirement of materials starting with the date of requirement and working backward to estimate the date of receipt keeping in view production and waiting time, and estimating date of order, based on delivery lead-time.	≤
6.	C	Enhanced customer and supplier relationships and improvement in customer satisfaction are the intangible benefits derived by organizations through supply chain management.	≤

	Answer	Reason

7. D n = Sample size = 18, N = Number of samples = 12 ≤

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Number of defectives	3	2	1	4	2	1	3	3	5	4	2	6
Fraction defective (p)	0.17	0.11	0.06	0.22	0.11	0.06	0.17	0.17	0.28	0.22	0.11	0.33

Fraction defective (p) = $\frac{c}{n} = \frac{\text{Number of defectives}}{\text{Sample size}}$

$\bar{P} = \frac{\sum p}{N} = \frac{2.01}{12} = 0.1675$

Control limits for the P-chart or the fraction defective chart for the given data are

$UCL = \bar{P} + 3\sqrt{\frac{\bar{P}(1-\bar{P})}{n}} = 0.1675 + 3\sqrt{\frac{0.1675(1-0.1675)}{18}}$

$= 0.1675 + 3\sqrt{\frac{0.13944375}{18}} = 0.1675 + 3\sqrt{0.007746875}$

$= 0.1675 + 3\ (0.088) = 0.1675 + 0.264 = 0.4315$

$LCL = \bar{P} - 3\sqrt{\frac{\bar{P}(1-\bar{P})}{n}} = 0.1675 - 3\sqrt{\frac{0.1675(1-0.1675)}{18}}$

$= 0.1675 - 3\sqrt{\frac{0.13944375}{18}} = 0.1675 - 3\sqrt{0.007746875}$

$= 0.1675 - 3\ (0.088) = 0.1675 - 0.264 = -0.0965$

LCL cannot be negative (-ve), so it should be taken as zero.

Therefore, CL = $\bar{P}$ = 0.1675, UCL = 0.4315 and LCL = 0

8. C Effective implementation of maintenance activities improves the economic lifetime and salvage value of the equipment. ≤

9. B Managers need to be trained on the statistical and mathematical calculations to effectively use the tool. This is not considered as an advantage since the training to be imparted to the managers' results in an upward shift in the costs and delay in implementing the tool. ≤

10. B One of the objectives accomplished through materials management is to maintain high inventory turnover so that less capital is tied up in inventory. ≤

	Answer	Reason	
11.	A	With the increased focus on quality, ISO standards have become key qualifiers for any organization operating in the global markets.	≤
12.	C	EDI helps organizations to cut down their inventory levels and plan for better production and shipment schedules, but does not help in maintaining high levels of inventory.	≤
13.	C	Integration decisions are concerned with the flow of materials from one facility to another or from one location to another, the cost of transportation, and the availability of distribution channel.	≤
14.	C	Earliest start time is the maximum of the set of expected beginning times of an activity.	≤
15.	D	Based on the actual requirements, MRP systems can expedite or delay the inflow of materials. As a result, both stock-out costs and inventory holding costs can be reduced. Moreover, timely supply of needed materials reduces the idle time and improves the overall operating efficiency of organizations. Delaying the outflow of materials implies the delay in the flow of materials from the raw materials inventory department to the production department. This does not result in the improvement in operating efficiency as holding the inventory for long time increases the inventory holding costs.	≤

	Answer	Reason	
16.	B	B_t = Expected number of breakdowns. C_p = Average cost of preventive maintenance = Rs.895 C_R = Cost of remedial maintenance = Rs.7,800 N = Number of machines t = Time period $B_t = N(P_1 + P_2 + P_3 + \ldots + P_t) + B_{t-1} P_1 + B_{t-2} P_2 + \ldots + B_1 P_{t-1}$ N = 8 and t = 4 $B_1 = NP_1 = 8 \times 0.2 = 1.6$ $B_2 = N(P_1 + P_2) + B_1P_1 = 8(0.2 + 0.3) + 1.6(0.2) = 4.0 + 0.32 = 4.32$ $B_3 = N(P_1 + P_2 + P_3) + B_2P_1 + B_1P_2 = 8(0.2 + 0.3 + 0.1) + 4.32(0.2) + 1.6(0.3)$ $= 4.8 + 0.864 + 0.48 = 6.144$ $B_4 = N(P_1 + P_2 + P_3 + P_4) + B_3P_1 + B_2P_2 + B_1P_3$ $= 8(0.2 + 0.3 + 0.1 + 0.2) + 6.144(0.2) + 4.32(0.3) + 1.6(0.1)$ $= 8(0.8) + 6.144(0.2) + 4.32(0.3) + 1.6(0.1)$ $= 6.4 + 1.2288 + 1.296 + 0.16 = 9.0848 \approx 9.08$ Hence, expected number of breakdowns in the 4th quarter = 9.08 Total cost of maintenance for every 4 quarters = TC(4) $= C_p N + C_R B_t = (895 \times 8) + (7800 \times 9.08) = 7160 + 70824 =$ Rs. 77,984 Average total cost per period = TC(t) / t ∴ Average total cost per quarter = TC (4) / 4 = 77,984 / 4 = Rs. 19,496. ∴ Average total cost per month = Average total cost per quarter/number of months in a quarter = 19,496/3 = 6,498.67 ≈ Rs.6,499.	≤
17.	E	All the given variables are checked using control charts for variables.	≤
18.	B	Facilities are the locations in the supply chain where the raw materials and finished goods are stored, and where work-in-progress materials are assembled or fabricated.	≤
19.	C	According to the principles and actions that improve equipment maintenance, the number of machines used during the production should be minimized.	≤

	Answer	Reason
20.	B	Based on the information given, the time required for completing each function of all models of ceiling fans is calculated as follows: ≤

Product	Processing Times			Total Time
	Setup work	Fabrication	Assembling	
A	32	60	48	140
B	72	60	48	180
C	80	96	48	224
Total	**184**	**216**	**144**	**544**

The processing times for each function are calculated using the formula - $\frac{\text{Volume}}{\text{Production Rate}}$

The number of employees required can be obtained by dividing the total number of hours with 9, as the number of hours an employee works per day is assumed to be 9 hours.

$\therefore$ Number of employees required for setup work = $\frac{184}{9} = 20.44 \sim 20$

Number of employees required for fabricating work = $\frac{216}{9} = 24$

Number of employees required for fabricating work = $\frac{144}{9} = 16.$

21.	C	The raw materials inventory department and the production department are the two departments involved in all the three functions of materials management, i.e., which overlap in the three functions of materials management. ≤
22.	B	Project leaders should set the milestones to be achieved in the various phases of the implementation and review progress continuously against the milestones. ≤
23.	C	The performance requirements being different in different markets serve as an economic impediment faced by organizations. All other options relate to institutional impediments. ≤
24.	A	Expert systems consist of an inference engine, which is a program that enables the system to evaluate the rules in the knowledge base. It determines the set of rules that will be invoked based on the nature of the problem. ≤ Option (b) is related to robotics. Option (c) is related to systems with artificial intelligence. Option (d) is related to the categorization of manufacturing operations. Option (e) is related to robots. Robots use sensors to determine whether or not a product being produced is consistent with the quality specifications.

	Answer	Reason
25.	B	Time fences are the periods of time during which no change or very minor change is allowed in the MPS, whereas time buckets are the division of time horizon in the MPS into shorter time buckets such as a day or two to plan for short-term requirements and longer time buckets such as a fortnight or a month to plan for long-term requirements by the managers. Hence, option (b) is false.
26.	C	The time reduced should be equal to the smallest slack value of the non-critical activities. Hence, option (c) is correct.
27.	D	In the first stage of infant mortality, the probability of failure is very high but it decreases rapidly. The reason for these failures can be attributed to improper design and installation. This stage is also known as 'burn in' stage where the functional defects in the products come to fore.
28.	B	

Activity	t_o	t_m	t_p	t_e	$\left(\frac{t_p - t_o}{6}\right)^2$
1 – 3	6	5.5	8	6	$\left(\frac{8-6}{6}\right)^2 = \frac{4}{36}$
3 – 4	9	7	11	8	$\left(\frac{11-9}{6}\right)^2 = \frac{4}{36}$
4 – 6	7	11	9	10	$\left(\frac{9-7}{6}\right)^2 = \frac{4}{36}$
6 – 7	8	7	12	8	$\left(\frac{12-8}{6}\right)^2 = \frac{16}{36}$
7 – 8	7	6	11	7	$\left(\frac{11-7}{6}\right)^2 = \frac{16}{36}$

Standard deviation = $(\sigma) = \sqrt{\text{Variance}} = \sqrt{\sigma^2} = \sqrt{\left(\frac{t_p - t_o}{6}\right)^2}$

The critical path of this network is 1 – 3 – 4 – 6 – 7 – 8.

$\therefore$ Variance of the critical path $= \frac{4}{36} + \frac{4}{36} + \frac{4}{36} + \frac{16}{36} + \frac{16}{36} = \frac{44}{36} = 1.22$

$\therefore$ Standard deviation of the critical path = $\sqrt{1.22} = 1.10$ weeks.

29.	E	An IT system should help in planning and decision-making and effective resource allocation through a master production schedule in the medium term. In the long term, it should provide the top managers with tools for strategic analysis.

	Answer	Reason	
30.	B	Acceptance Plans help to decide whether lots of raw materials, purchased parts and finished goods meet prescribed quality standards. Acceptance Plans **do not** have large sample sizes because their inspection costs are higher. Hence, from above discussion, we can infer that option (b) is **not true** regarding Acceptance Plans used in quality control. Option (a) is true, as it is the definition of Acceptance Plans. Option (d) is true. Operations managers can either accept or reject a lot, on the basis of Acceptance Plans. Option (c) is true. Acceptance Plans protect an organization by limiting the percentage of defective products that are shipped to customers. Option (e) is true. Average Outgoing Quality Curves and Operating Characteristic Curves are two important concepts of Acceptance Plans.	≤
31.	B	Work remaining for job B = 1.8 times of work remaining for job A = 27 days Work remaining for job E = 1.1 times of work remaining for job B = 29.7 days ≃ 30 days.	≤

Particulars	A	B	C	D	E
Planned days	43	65	72	59	78
Work remaining in days	15	27	28	19	30

Critical Ratio = Planned time remaining / Actual work remaining

The critical ratios of the jobs are as follows:

Job	Critical Ratio	Priority Order
A	(43 – 22)/15 = 1.4	1
B	(65 – 22)/27 = 1.59	2
C	(72 – 22)/28 = 1.79	3
D	(59 – 22)/19 = 1.95	5
E	(78 – 22)/30 = 1.87	4

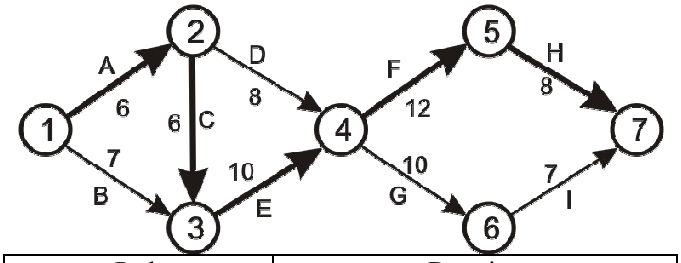
32.	A	The activities of the receiving department are taken care of by the purchasing department in some firms.	≤
33.	A	Test runs are conducted to see the performance of the system after customization and master data transfer.	≤
34.	C	The successful implementation of a JIT system is greatly dependent on its ability to reduce setup times. In reducing the setup times, firms adopt various procedures like converting internal setup activities into external setup activities, enabled through the procedures like heating, cleaning and streamlining work. This relates to the characteristic – Quick and economic setups.	≤
35.	D	Netting is the second step in the MRP system information processing that is to develop a materials requirement plan for each item in the BOM file for each time bucket.	≤

	Answer	Reason	
36.	C	• CAM computers are used directly to control the processing equipment or indirectly to support the manufacturing operations. • CAD packages eliminate the need for costly prototype testing at the initial stages of the product design. • FMS is useful in organizations producing different items with similar processing requirements. • CNC machines are one of the key elements of CAM. • Implementation of CAM results in reduced labor costs. Hence, option (c) is the answer.	≤
37.	C	The approaches for managing core competencies differ widely from the approaches that are used for managing capital base or strategic business units. All other statements are true.	≤
38.	D	The total cost of maintenance is the sum of preventive maintenance costs and remedial maintenance costs. Predictive maintenance costs also form a part of the total maintenance costs, as predictive maintenance is a part of preventive maintenance. The total cost of maintenance includes the cost of in-house maintenance that includes the preventive maintenance costs, remedial maintenance costs and predictive maintenance costs. Contract maintenance is the process of outsourcing the maintenance activities of a firm. This forms a part of their outsourcing costs.	≤
39.	C	The slack time for an activity is the time by which that activity can be delayed without delaying the total project. This is the difference of either the latest start time and earliest start time or the latest finish time and the earliest finish time.	≤
40.	A	Consumer demand is the force shaping the supply chain management that emphasizes that the key focus of an organization is to find a balance between cost and quality, and customization and availability without compromising on any one of them. The objective of supply chain management is to keep the customers satisfied by providing them with what they want, when they want it and at a price they can afford.	≤
41.	A	Investment made in machinery is a category of cost of prevention. Cost for vendor certification is included under cost of prevention. Costs of equipment maintenance relate to cost of detection. Costs related to disposition of defective items relate to cost of failure.	≤
42.	C	The effects of long queues on new arrivals not being considered is a limitation of the queuing analysis. Hence, option (c) is the answer. Option (e) relates to the queuing analysis. Options (a), (b) and (d) relate to the limitations of the queuing analysis.	≤

	Answer	Reason
43.	C	Statement (II) & (IV) are false. Statement II – Inventory control focuses on cost minimization, whereas the focus of production control is on materials availability. Statement IV – Logistics is the sub-function of the materials management function that deals with obtaining, producing and distributing materials and products at/to the desired place, at the right time. Statements (I) and (III) are true.
44.	D	The key activity of the steering committee is to monitor the implementation process continuously in order to identify deviations, cost overruns, resource requirements, etc. during implementation. The steering committee consists of project managers, project leaders and module leaders chosen from the implementation team.
45.	C	For every unit of A, 2 units of B and 3 units of C are required. Quantity of A to be produced = 240 units ∴ Quantity of B required to produce 240 units of A = 480 units Available inventory of B = 120 units Quantity of B to be produced = Quantity required – Available inventory = 360 units 2 units of F are required to produce one unit of D, and 1 unit of D to produce one unit of B. Hence, **720** units (360 × 2 × 1) of F are required to produce 360 units of B. Quantity of C required to produce 240 units of A = 720 units Available inventory of C = 80 units Quantity of C to be produced = Quantity required – Available inventory = 640 units 3 units of F are required to produce one unit of H. 2 units of H are required to produce one unit of C. Hence, **3**,**840** units (640 × 2 × 3) of F are required to produce 640 units of C. ∴ Total quantity of F required to produce 240 units of A = 720 + 3840 = **4**,**560** units.
46.	A	The components of a FMS include: • An automated loading system • Two or more machining centers • A system to move materials in between machining centers • An unloading system • A central computer A fixed-path conveyor is not one of the components of the FMS. It was used as a part of the early automation systems.
47.	B	Remedial maintenance is carried out when a machine or equipment breaks down or is malfunctioning. Remedial maintenance is also referred to as ‘breakdown maintenance’ or ‘corrective maintenance’.
48.	B	PERT cannot handle situations in which two or more projects have to be planned together to share the available resources.

	Answer	Reason
49.	D	Less expenditure on promotional activities is a benefit derived by suppliers to firms from JIT systems. Though organizations also benefit in the form of low promotional (marketing) expenses in the sale of their products, it is not an operational benefit derived through JIT systems.
50.	C	Forward Scheduling: Job J can be completed earliest by the end of six hours and Job K by the end of seven hours using forward scheduling.
51.	B	A firm's SCM strategy component focuses on how different entities of the supply chain perform as a group.
52.	D	Organizations not preferring to purchase a complete package at one instance may prefer implementing it in modules. In such cases, the modularity of the package i.e., the availability of the package in separate modules should be examined.
53.	C	$UCL = \bar{\bar{X}} + A_2\bar{R}$, $LCL = \bar{\bar{X}} - A_2\bar{R}$ $\bar{\bar{X}} = \frac{\sum \bar{X}}{n} = \frac{410}{15} = 27.33$ $\bar{R} = \frac{\sum R}{n} = \frac{99}{15} = 6.6$ $\therefore UCL = 27.33 + (0.373 \times 6.6) = 27.33 + 2.462 = 29.792 \sqcup 29.79$ $\therefore LCL = 27.33 - (0.373 \times 6.6) = 27.33 - 2.462 = 24.868 \sqcup 24.87$ $\therefore CL = 27.33$
54.	C	The sequence of actions of fixed sequence robots is usually triggered by electronic sensors. Numerical control robots are used to perform manufacturing operations where high precision is required. Therefore, Statement (II) and (III) are false. Statements (I) and (IV) are true.

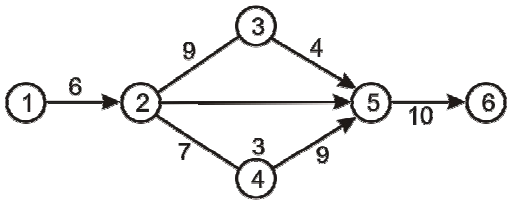
Time	1	2	3	4	5	6	7	8	9
Machine A	J_1	J_1	J_1	K_2	J_3	J_3	K_3		
Machine B	K_1	K_1	K_1	J_2					

	Answer	Reason
55.	B	 Critical path has the maximum time estimate. So, A – C – E – F – H is the critical path.

Path	Duration
A – D – F – H	6 + 8 + 12 + 8 = 34 weeks
A – D – G – I	6 + 8 + 10 + 7 = 31 weeks
B – E – F – H	7 + 10 + 12 + 8 = 37 weeks
B – E – G – I	7 + 10 + 10 + 7 = 34 weeks
A – C – E – F – H	6 + 6 + 10 + 12 + 8 = 42 weeks
A – C – E – G – I	6 + 6 + 10 + 10 + 7 = 39 weeks

56.	D	A typical CIM (Computer Integrated Manufacturing) system takes product design details from CAD system and other customer order information systems, and uses this information to create purchase orders (for producing necessary materials), work instructions, tooling requirements and so on. The system develops schedules for production equipment and coordinates the activities and flow of materials throughout the manufacturing unit. It also tracks the movement of product in production units, monitors product quality and tool wear, and simultaneously stores the data for future analysis.
57.	C	Examples of Planning reports are inventory forecasts, purchase commitment report and long-range materials requirement planning information.
58.	C	Linearity of production i.e., maintaining linear production schedules requires the identification and elimination of production bottlenecks, balance in the production system, and reduction in setup time.
59.	A	The choice of the employees of Pioneer Financial Services was to work a specified number of hours per week provided they are given the option to select their work times. This relates to the flextime approach used by operations managers as a personnel-related scheduling approach.
60.	A	Civil maintenance includes maintaining fire fighting equipment and waste disposal. Maintenance of transport vehicles and materials handling equipment come under mechanical maintenance.
61.	C	Performance standards set for each process by using benchmarking techniques in the third stage of the ERP implementation program i.e., in the process of deciding the desired would-be situation for the business.

	Answer	Reason	
62.	C	The aesthetics value of a product is influenced by individual preferences. Companies use this quality dimension to cater to a niche market.	≤
63.	C	Design is the comprehensive process that after considering the feedback from customers and suppliers defines the overall requirements both external and internal to the organization.	≤
64.	C	Costs associated with outsourcing are: • Loss of control – In terms of control of facilities, outsourcing results in a loss of control by the client, and hence is not considered a benefit. • Decrease in flexibility – In terms of flexibility relating to the time frame of the contracts, generally the vendor would require a long time to realize the profits from those operations and would desire a long-term contract. The client, on the other hand, would not like to go for a long-term outsourcing contract as this would result in the vendor gaining control on the operations of the client organization. Therefore, there is less flexibility to the client with respect to long-term contracts. • Decrease in staffing quality – The vendors may employ semi-skilled or unskilled personnel as the contract progresses, resulting in low quality staffing and high costs to the client. Cost of operations is an area where costs can be reduced, as outsourcing the management of facilities results in the management not requiring to pay salaries and wages to the employees regularly.	≤
65.	D	The dual-card Kanban system makes use of the conveyance authorization card and the vendor authorization card.	≤
66.	D	During the production process, activities like equipment maintenance, raw material sourcing, quality control and packaging are carried out, as and when required. As part of the production process, raw materials are sourced when they are required but they do not maintain inventory. Hence, inventory maintenance is not one of the activities carried out during the production process.	≤
67.	C	The product environment is considered to be appropriate only if the organization needs to purchase many items, a majority of which are components and parts. The demand pattern of these items should be dependent in nature and irregular in timing. Hence, statement (II) is false. The other statements relate to the inappropriate product environment.	≤
68.	C	In repetitive operations, the labor is trained and the equipment designed for a narrow range of activities. All other statements in options (a), (b) and (d) relate to job operations and option (e) relates to labor-intensive operations.	≤

	Answer	Reason
69.	C	In quality circles, people working in similar types of operations meet at regular intervals and discuss ways of improving the quality of their processes. In suggestion programs, employees are encouraged to make suggestions to improve a process.
70.	C	

$$\text{Time-Cost Slope} = \frac{\text{Crash cost - Normal cost}}{\text{Normal time - Crash time}}$$

Activity	Normal Time	Crash Time	Normal Cost	Crash Cost	Time-Cost Slope
1 – 2	6	4	1200	1600	$\frac{400}{2} = 200$
2 – 3	9	5	2400	3200	$\frac{800}{4} = 200$
2 – 4	7	3	4200	4800	$\frac{600}{4} = 150$
2 – 5	3	2	4500	5600	$\frac{1100}{1} = 1100$
3 – 5	4	4	2200	2400	$\frac{200}{0} = \infty$
4 – 5	9	4	1900	2800	$\frac{900}{5} = 180$
5 – 6	10	6	2300	3300	$\frac{1000}{4} = 250$

The critical path activity with the smallest time-cost ratio is selected and crashed first.

$\therefore$ From the above calculations, we can infer that activity (2 – 4) has the smallest time-cost slope, and needs to be crashed first.

71.	C	Facilities managers act as change managers in situations where existing processes or infrastructure is modified or replaced with new ones to suit the organizational goals.
72.	D	To enable easy and quick repeal and modification of the trade rules and regulations is not a key issue of WTO. One of the key issues of WTO is to increase awareness about the trade rules and regulations of different countries and ensure that these rules and regulations are not repealed or modified suddenly.

	Answer	Reason
73.	D	In demand chains, business-to-business companies need to monitor only their customers. This is a misconception about demand chains as the companies need to monitor not only their immediate customers but also their customer's customers'.
74.	B	An integrated data model minimizes the data redundancy and ensures the availability of the right information to all concerned. Options (a), (c) and (e) relate to business process reengineering. Option (d) relates to business modeling.
75.	D	Technical efficiency refers to gaining efficiency by modifying the existing production processes, introducing automation in production processes etc. Productivity can be increased either by increasing the output with the same number of inputs or by producing the same output using fewer inputs refers to technical efficiency, as it implies a modification in the existing production processes.
76.	E	The traditional materials handling equipment that are replaced by automated guided vehicles are: • Manually operated trucks • Hydraulic. • Hand pallet trucks • Straddle trucks.
77.	B	According to the rule of Slack Time Remaining, the jobs with the shortest slack time are dispatched first. Slack Time = Due Date (–) Processing Times.

Job (In order of arrival)	Processing Times (days)	Due date (Days hence)
S1	4	6
S2	5	8
S3	3	5
S4	6	9

Slack times for the four jobs are:

S1: 6 – 4 = 2

S2: 8 – 5 = 3

S3: 5 – 3 = 2

S4: 9 – 6 = 3

As the slack times for the jobs S1 and S3, and that for S2 and S4 are same, these jobs are dispatched based on their processing times i.e., the job with the smallest processing time is dispatched first.

So, the order of the jobs according to their slack time remaining is S3 – S1 – S2 – S4.

The average delay of a job is calculated as follows:

Job sequence	Processing Time	Due date	Time Flow	Delay
S3	3	5	0 + 3 = 3	0
S1	4	6	3 + 4 = 7	1
S2	5	8	7 + 5 = 12	4
S4	6	9	12 + 6 = 18	9

Average delay of a job

= (0 + 1 + 4 + 9)/4 = 14/4 = 3.5 days.

	Answer	Reason	
78.	D	JIT manufacturing is based on the concept of continuous improvement, which includes two important and mutually supporting components: • People involvement • Total quality control.	≤
79.	D	Organizations derive advantage from automation in the form of: • Improvement in productivity • Efficient use of materials • Improvement in the quality of the product • Improvement in work environment for the workers • Reduced factory lead-time. Feedback from employees is considered as an disadvantage of automation because usually employees resist automation for the fear of losing their jobs, as automation results in less requirement for employees.	≤
80.	B	Manufacturing resource planning system (MRP II) is the system considered as an integrated system by the operations managers, and is used to analyze complete product cycles, from corporate production plans to finished goods distribution.	≤
81.	B	Operations, maintenance and repair function includes activities like trash removal, hazardous waste removal and management, energy management, disaster recovery planning and management, and energy management.	≤
82.	D	Quantitative performance, also called productivity, provides a good measure of performance at the national, industry or individual business level. All other statements are true with respect to the measurement of performance.	≤
83.	C	The customer base is defined in terms of sales, profitability, size etc. The suppliers are divided into different categories such as: first tier, second tier etc.	≤
84.	A	Business process is a structured and measured set of activities designed to produce a specified output for a particular customer or market.	≤
85.	C	(I) – Scheduling too much capacity results in the facilities remaining idle, whereas scheduling low capacity results in incomplete jobs. (II) and (III) – Scheduling can be either a medium-range planning activity or a short-range planning activity. (IV) – Forward scheduling is used in fabrication operations where the products are so customized that customers specify the product specifications. Hence, statements (II) and (III) are true.	≤

	Answer	Reason	
86.	B	The earliest and latest event times of the activity 2 – 5 relate to the E_2, L_2 and E_5, L_5 $E_2 = E_1 + t_{1,2} = 0 + 2 = 2$ $L_2 = L_5 - t_{2,5} = 11 - 4 = 7$ $E_5 = E_2 + t_{2,5} = 2 + 4 = 6$ $L_5 = L_8 - t_{5,8} = 12 - 1 = 11.$	<

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