(6 pages)

MAY 2016

P/ID 77508/ PMBH/PMB1H/ PMBSJ

Time : Three hours Maximum : 100 marks

PART A — (5 × 6 = 30 marks)

Answer any FIVE questions.

1. Define operations research. Highlight its scope.

2. Compare and contrast PERT and CPM. Give examples.

3. Explain the structure of a queuing system. Give real time examples.

4. Determine the age at which the following type of machine be replaced :

   Cost price = Rs. 8,000.

   Operating costs = Rs. 1,000 for the first year, increasing by Rs.500 every year

   Resale value = Rs. 4,000 for the first year, decreasing by Rs.500 every year.

5. Find the saddle point in the game $\begin{pmatrix} 3 & 7 \\ -5 & 5 \end{pmatrix}$.

6. Explain duality in LPP. Illustrate with examples.

7. Briefly describe the terms 'time-cost trade off', 'free float' and 'resource levelling' in relation to PERT/CPM.

8. Highlight the use of models for solving the inventory problems with examples.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Minimize : $Z = 4x + y$

Subject to $3x + y = 2, 4x + 3y \geq 6 ; x + 2y \leq 3 ; x, y \geq 0$.

(a) Write the dual problem for this linear program.

(b) Solve it for optimal values of x and y.

10. A project consists of the following activities :

Activity	Immediate predecessors	Time (weeks)
A	–	6
B	–	9

Activity	Immediate predecessors	Time (weeks)
C	A	9
D	B, C	3
E	B, C	12
F	D	6
G	E, F	3

(a) Draw a Network diagram

(b) Compute ES, EF, LS and LF of each activity.

(c) What is the project completion time?

(d) Which of the activities must be completed in time so that project may be completed in time?

11. Using suitable illustrations, compare the process of solving queuing problem with simulation method and application of standard formulations.

12. Explain, using examples, how the techniques of quantitative methods are applied in marketing and production?

13. Explain the principle of dominance in game theory and solve the following game :

$$\begin{bmatrix} 8 & 10 & 9 & 14 \\ 10 & 11 & 8 & 12 \\ 13 & 12 & 14 & 13 \end{bmatrix}.$$

14. The goods are distributed from warehouse X, Y, Z to customers A, B and C. the monthly requirements of customer A, B and C are 70, 30, 50 units respectively while the warehouse X, Y and Z can supply 65, 42, 43 units. The unit shipping cost are as follows :

Shipping cost		(Rs. / unit)		
		X	*Y*	*Z*
Customer	A	5	7	8
	B	4	4	6
	C	6	7	7

Determine optimal shipping schedule to minimize the total cost.

15. The data on the running costs per year and resale price of equipment A whose purchase price is Rs. 2,00,000 are as follows :

Year	1	2	3	4
Running cost (Rs)	30,000	38,000	46,000	58,000
Resale value (Rs)	1,00,000	50,000	25,000	12,000

Year	5	6	7
Running cost (Rs)	72,000	90,000	1,10,000
Resale value (Rs)	8,000	8,000	8,000

(a) What is the optimum period of replacement?

(b) When equipment A is two years old, equipment B which is a new model for the same usage is available. The optimum period for replacement is 4 years with an average cost of Rs. 72,000. Should equipment A changed with equipment B? If so, when?

16. "Game theory provides a systematic approach for analyzing competitive situations to determine an optimal strategy for winning" — comment.

PART C — (1 × 20 = 20 marks)

Compulsory.

17. A Departmental store has a single cashier. During the rush hours, customers arrive at the rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour. Assume that the conditions for use of single-channel queuing model apply. What is the

(a) Probability that the cashier is idle.

(b) Average number of customers in the queuing system.

(c) Average time a customer spends in the system.

(d) Average number of customers in the queue.

(e) Average time a customer spends in the queue Waiting for service.
