2016/ODD/08/23/MTM–305 (C)/489

PG Odd Semester (CBCS) Exam., December—2016

MATHEMATICS

(3rd Semester)

Course No. : MTM–305 (C)

(Operations Research and Optimization Techniques—I)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Solve :

$$\text{Max} \quad Z \quad x_2 \quad 3x_3 \quad 2x_5$$

subject to

$$\begin{array}{rrrrr} x_1 & 3x_2 & x_3 & 2x_5 & 7 \\ & 2x_2 & 4x_3 & x_4 & 12 \\ 4x_2 & 3x_3 & 8x_5 & x_6 & 10 \end{array}$$

$$x_j \quad 0, \; j \quad 1, 2, \ldots, 6$$

Find variations of costs C_1, C_2, C_3, C_4, C_5 and C_6 for which optimal solution remains optimal. 8

(b) For the LPP

$$\text{Max} \quad Z \quad x_1 \quad 2x_2 \quad x_3$$

such that

$$\begin{array}{rrrr} 3x_1 & x_2 & x_3 & 10 \\ x_1 & 4x_2 & x_3 & 6 \\ & x_2 & x_3 & 4 \end{array}$$

$$x_1, x_2, x_3 \quad 0$$

find the separate range of b_1, b_2 and b_3 consistent with the optimal solution. 7

2. *(a)* Six jobs go first over machine-*I* and then over machine-*II*. The order of completion of jobs has no significance. The following table gives time in hour for six jobs on the two machines :

Job No.	:	1	2	3	4	5	6
Time on Machine–I	:	5	9	4	7	8	6
Time on Machine–II	:	7	4	8	3	9	5

Find the sequence of jobs that minimizes the total elapsed time to complete the jobs. 9

(b) Discuss the graphical method of solving job sequencing problem. 6

UNIT—II

3. *(a)* Solve the game whose pay-off matrix is given by

		B: *I*	*II*	*III*	*IV*
A	*I*	3	2	4	0
	II	2	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

8

(b) Discuss the algebraic method for the solution of a general game. 7

4. *(a)* Obtain the necessary and sufficient condition for function $E(x, y)$ to posses a saddle point. 8

(b) Explain the theory of dominance in solution of rectangular games. 7

UNIT—III

5. *(a)* Solve

$$\text{Max } z \quad 3x_2$$

subject to

$$3x_1 \quad 2x_2 \quad 7$$
$$x_1 \quad x_2 \quad 2$$
$$x_1, \; x_2 \quad 0$$

and integer by Gomory technique. 8

(b) Discuss branch and bound technique. 7

6. *(a)* Discuss the computational procedure for solution of mixed-integer programming problem using Gomory's cutting plane. 7

(b) Solve

$$\text{Max } Z \quad x_1 \quad x_2$$

subject to

$$3x_1 \quad 2x_2 \quad 12$$
$$x_2 \quad 2$$
$$x_1, \; x_2 \quad 0$$

and integers by branch and bound technique. 8

UNIT—IV

7. *(a)* Develop economic lot-size model with uniform rate of demand, finite rate of production and having shortages which are to be fulfilled. 8

(b) A company uses annually 50000 units of an item each costing ₹ 1·20. Each order costs ₹ 45 and inventory carrying costs 15% of annual average value.

(i) Find EOQ.

(ii) If the company operates 250 days within a year, the procurement time is 10 days and safety stock is 500 units. Find order level, maximum, minimum and average inventory. 7

8. *(a)* Develop economic lot-size model with uniform rate of demand, infinite production rate and having no shortages. 8

(b) For the following data, determine approximately the economic order quantities when the total value of average of inventory levels of three products is ₹ 1,000 : 7

Cost of Products	:	*A* (in ₹)	*B* (in ₹)	*C* (in ₹)
Holding cost	:	20	20	20
Cost per unit	:	6	7	5
Setup cost	:	50	42	60
Yearly demand rate	:	10,000	12,000	7,500

UNIT—V

9. *(a)* Find the best replacement time of a machine when—

(i) its maintenance cost is given by a function of increasing time;

(ii) its scrap value is constant;

(iii) the money value is not considered. 8

(b) The cost of a truck is ₹ 3,000. The salvage value and running costs are given as under :

Year	:	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Running cost (in ₹)	:	600	700	800	900	1,000	1,200	1,500
Resale value (in ₹)	:	2,000	1,333	1,000	750	500	300	300

Find the most economical replacement age of the truck. 7

10. *(a)* Discuss the difference between CPM and PERT. 5

(b) Discuss the general procedure for construction of network diagram. 5

(c) Define total, free and independent floats and hence prove that total float free float independent float. 5

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