[06 – 4126]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

Elective – I : OPERATIONS RESEARCH

(Common with Dual Degree Programme in EEE)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) State the general linear programming problem (LPP) and put it in the standard form.

   (b) Distinguish between a slack variable and a surplus variable.

   (c) What is meant by an optimality test in a transportation problem?

   (d) Show that the assignment problem is a special case of the transportation problem.

(e) Explain the terms :

(i) Optimistic time and

(ii) Pessimistic time.

(f) Explain the significance of lead time and safety stock in inventory control.

(g) What is a two-person zero-sum game? Define the saddle point of such a game.

2. (a) A company manufactures desks and chairs. The sawing department cuts the lumber for both products and then sent to separate assembly departments, and finally to painting departments. The daily capacity of the sawing department is 200 chairs or 80 desks. 120 chairs and 60 desks can be assembled per day in the assembly department. The paint department has a daily capacity of either 150 chairs or 110 desks. The profit per chair is Rs.50 and that of desk is Rs.100, using graphical method determine the optimal production mix for the company.

(b) Solve the following LPP by simplex method.

Maximize $z = 5x_1 + 4x_2$

Subject to :

$$4x_1 + 5x_2 \leq 10$$
$$3x_1 + 2x_2 \leq 9$$
$$8x_1 + 3x_2 \leq 12$$
$$\text{and } x_1, x_2 \geq 0.$$

3. (a) Explain the importance of artificial variable in the LPP. Write the merits and demerits of a two phase simplex method over the simplex method.

(b) Solve the following LPP by two-phase simplex method.

Maximize $z = 5x_1 - 4x_2 + 3x_3$

Subject to

$$2x_1 + x_2 - 6x_3 = 20$$
$$6x_1 + 5x_2 + 10x_3 \leq 76$$
$$8x_1 - 3x_2 + 6x_3 \leq 50$$
$$\text{and } x_1, x_2, x_3 \geq 0.$$

4. Find an optimal solution to the following transportation problem, obtaining the basic feasible solution by the Vogel's approximation method.

		To				
		D_1	D_2	D_3	D_4	Available
From	O_1	23	27	16	18	30
	O_2	12	17	20	51	40
	O_3	22	28	12	32	53
Required		22	35	25	41	

5. (a) Does the optimal solution of an assignment problem change if some constant is added to or subtracted from the entries of any row or column of the cost matrix? Justify your answer.

(b) Solve the following assignment problem

Jobs	Operators			
	A	B	C	D
I	18	26	17	11
II	13	28	14	26
III	38	19	18	15
IV	19	26	24	10

6. State the rules for drawing a network diagram for a project and numbering the events on it.

A project is composed of the following activities whose time estimates are listed below :

Activity i – j	Estimated duration (weeks)		
	a	m	b
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(a) Draw the project network and calculate the early and late occurrence times for each event.

(b) Find the critical path and its standard deviation

(c) What is the probability that the project will be completed 4 weeks earlier than expected?

7. (a) Derive an Economic order quantity formula for the production inventory situation when demand is known with constant rate, shortages are not permitted and there is a lead time L allowed.

(b) Neon lights are replaced at the rate of 100 units per day in a corporation. The corporation orders for lights periodically. It cost Rs. 100th initiate a purchase order. Storage cost of a light is estimated as Rs. 0.20 per day. If the lead time between placing an order and receiving items is 12 days, determine an optimal inventory policy for ordering the lights.

8. (a) Explain the theory of dominance in the solution of rectangular games.

(b) Solve the following rectangular game using the theory (rules) of dominance :

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array} \begin{array}{c} \begin{array}{ccccc} B_1 & B_2 & B_3 & B_4 & B_5 \end{array} \\ \begin{pmatrix} 4 & 4 & 2 & -4 & -6 \\ 8 & 6 & 8 & -4 & 0 \\ 10 & 2 & 4 & 0 & 12 \end{pmatrix} \end{array}$$