C 58393 (Pages : 2) Name..............................

Reg. No..............................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2009

ME 04 605—OPERATIONS RESEARCH

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Test if the vectors (1, 2, 3), (1, –1, 1) and (1, 8, 7) are linearly independent or dependent.

(b) Find the rank of the matrix

$$\begin{pmatrix} 1 & 2 & 4 & -5 \\ 1 & 3 & 5 & -7 \\ 2 & -1 & 3 & 0 \end{pmatrix}$$

(5 marks)

(c) Find any two basic feasible solution of the LP problem Maximize $Z = 5x + 3y$, subject to $x + 2y \leq 10, 3x + y \leq 20, x, y, \geq 0$.

(d) Explain the difference between big M-method and two phase method.

(e) Explain the steps involved in stepping stone algorithm.

(f) Explain pure and mixed strategies game theory.

(g) Describe briefly different arrival processes and service mechanism in queues.

(h) Write down various assumptions of M/M/1 queue.

(8 × 5 = 40 marks)

II. (a) Find the value of λ and μ in the linear system of equation $2x + 3y + 5z = 9$ $7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ has (i) a unique solution ; (ii) no solution ; (iii) infinitely many solutions.

(15 marks)

Or

(b) Show that the vectors (1, 2, 3), (2, 3, 0) and (1, –1, 3) form a basis in $R^{(3)}$. Express (5, 3, 2) as a linear combination of the basis.

(15 marks)

III. (a) Find the optimum solution of the following LP problem by simplex method :

$$\text{Maximize } Z = 8x_1 + 10x_2 + 15x_3$$

$$\text{subject to } \quad x_1 + 2x_2 + 3x_3 \leq 15$$

$$x_1 + 4x_2 + x_3 \leq 10$$

$$x_1, x_2, x_3, \geq 0.$$

(15 marks)

Or

Turn over

(b) Solve the following LP problem by Charnes' M method or two phase method :

Minimize $Z = 7x_1 + 8x_2 + 5x_3$

subject to $x_1 + 2x_2 + x_3 \geq 15$

$2x_1 + x_2 + 3x_3 \geq 20$

$x_1, x_2, x_3 \geq 0.$

(15 marks)

IV. (a) Solve the following transportation problem by stepping-stone method or UV-method.

Plant	*Distribution Center (cost/unit)*				*Availability/month*
	1	2	3	4	
1	5	10	12	5	100
2	2	3	4	3	40
3	10	12	11	13	90
Requirement/month	50	40	100	40	

(15 marks)

Or

(b) Solve the following 2 × 6 game by graphical method :

Player B

$$\text{Player A} \begin{pmatrix} -5 & 1 & 5 & 0 & 1 & -2 \\ 8 & 6 & 4 & -1 & 5 & 3 \end{pmatrix}.$$

(15 marks)

V. (a) A retail shop has only one person at cash counter. Customers arrive in a Poisson process at rate of 10 per hour. The service times are exponential distributed with a mean duration of 4 minutes. Assuming that all customers purchase some items at the shop, find (i) the average number of customers in the waiting line ; (ii) mean duration a customer spent in waiting ; (iii) fraction of time the cash counter is free ; (iv) probability that a customer finds 5 customers in the cash counter.

(15 marks)

Or

(b) Solve the following dynamic programming problem :

Minimize $Z = x_1^2 + 2x_2^2 + x_3^2$

subject to $x_1 + x_2 + x_3 = 15$

$x_1, x_2, x_3 \geq 0.$

(15 marks)

[4 × 15 = 60 marks]