C 14745 (Pages : 2) Name..............................

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

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2010

ME 04 605—OPERATIONS RESEARCH

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Find the rank of the matrix $\begin{pmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 6 \end{pmatrix}$.

(b) Show that the vectors (1, 0, 4, 3) (3, 2, –6, –1) and (2, 1, –1, 1) are linearly dependent.

(c) Explain the followings with an example. Slack variable , surplus variable, artificial variable.

(d) State the method of determining the incoming variable and outgoing variation in simplex iteration process.

(e) Explain degeneracy in linear programming problems.

(f) State the steps in solving game theory problem using dominance strategy.

(g) Explain the characteristics of (i) Poisson arrival process ; (ii) Erlangian service times.

(h) Explain briefly Bellman's principle of optimality in dynamic programming.

(8 × 5 = 40 marks)

II. (a) Find the value of K for which the equations $x - 2ky + z = -2$, $kx - 2y + z = 1$ and $x - 2y + kz = 1$ have (i) unique solution ; (ii) no solution ; (iii) more than one solution.

Or

(b) Show that the set of vectors (1, 0, 4, 3) (2, 1, –1, 1) and (3, 2, –6,–1) are linearly dependent. Can you express (1, 2, –14, –11) as a linear combination of the above vectors ?

III. (a) Solve the following LP problem by simplex method

Maximize $Z = 5x_1 + 10x_2 - 5x_3$

$$\begin{aligned} \text{subject to } & x_1 + 2x_2 - x_3 \le 25 \\ & x_1 + 4x_2 + 3x_3 \le 20 \\ & x_1, x_2, x_3 \ge 0. \end{aligned}$$

Or

Turn over

(b) Solve the following LP problem by two-phase method.

Minimize $Z = 4x_1 + 8x_2$

subject to $x_1 + 2x_2 \geq 10$

$5x_1 + 5x_2 \geq 15$

$x_1, x_2 \geq 0.$

IV. (a) Solve the following transportation problem by stepping stone method on *uv*-method.

Source \ Destination	1	2	3	Availability/day
1	5	10	15	100
2	20	25	28	150
3	3	2	5	100
Requirement/day	90	140	120	

Or

(b) Solve the following two person zero sum game by graphical method :

Player B

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

V. (a) Customers arrive at a refalling station randomly according to Poisson process at a rate of 20 per hour. The service times are exponentially distributed with a mean time of 100 seconds. There is only one server in the station. Find the mean, number of customers in the refalling station, average waiting time of a customer, total time spent in the station and fraction of time the station is empty.

Or

(b) Solve the following dynamic programming problem :

Minimize $Z = x_1^2 + x_2^2 + 5x_3^2$

subject to $x_1 + 2x_2 + 3x_3 = 25$

$x_1, x_2, x_3 \geq 0.$

[4 × 15 = 60 marks]