[This question paper contains 4 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 2978 **L**

Unique Paper Code : 2353572006

Name of the Paper : DSE-2(iii) Linear Programming

Name of the Course : **B.Sc. (Prog.) Physical Sciences / Mathematical Sciences**

Semester : IV

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **all** questions by selecting any **two** parts from each question.
3. **All** questions carry equal marks.
4. Use of ordinary calculator is allowed.
5. Graph paper will be provided.

Q1 (a) Solve the following linear programming problem graphically.

Maximize $z = 3x_1 + 2x_2$

Subject to

$$x_1 + x_2 \geq 1$$
$$x_1 + x_2 \leq 7$$
$$x_1 + 2x_2 \geq 10$$
$$x_2 \leq 3$$
$$x_1, x_2 \geq 0.$$

(7.5)

(b) Find all basic feasible solutions of the following equations.

$$2x_1 + x_2 + x_3 = 6$$
$$x_1 + 2x_2 + x_3 + x_4 = 12.$$ **(7.5)**

(c) Test the convexity of the set $S = \{(x, y) \in R^2 : 3x^2 + 2y^2 \leq 6\}$. **(7.5)**

Q2(a) Use Simplex Method to solve the following Linear Programming Problem.
Minimize $z = -x_1 + 2x_2$
Subject to the constraints

$$-x_1 + 3x_2 \le 10$$
$$x_1 + x_2 \le 6$$
$$x_1 - x_2 \le 2$$
$$x_1, x_2 \ge 0.$$

(7.5)

(b) Use Simplex Method to solve the following Linear Programming Problem.
Maximize $z = 3x_1 + 2x_2 + x_3$
Subject to

$$2x_1 - 3x_2 + 2x_3 \le 3$$
$$x_1 - x_2 - x_3 \ge -5$$
$$x_1, x_2, x_3 \ge 0.$$

(7.5)

(c) Using Artificial variable technique Method, solve the following Linear Programming problem.
Maximize $z = x_1 - 4x_2 + 3x_3$
Subject to

$$2x_1 - x_2 + 5x_3 = 40$$
$$x_1 + 2x_2 - 3x_3 \ge 22$$
$$3x_1 + x_2 + 2x_3 = 30$$
$$x_1, x_2, x_3 \ge 0.$$

(7.5)

Q3 (a) Define a convex set.
Examine the convexity of the set $S = \{(x, y) \in R^2 : xy \le 1, x \ge 0, y \ge 0\}$. (7.5)

(b) Formulate the dual of the following Linear programming problem.
Minimize $z = x_1 + x_2 + 3x_3$
Subject to

$$4x_1 + 8x_2 \ge 3$$
$$7x_2 + 4x_3 \le 6$$
$$3x_1 - 2x_2 + 5x_3 = 7$$
$$x_1 \le 0, x_2 \ge 0, x_3 \text{ is unrestricted.}$$

(7.5)

(c) Determine the values of m and n that will make (A_2, B_2) a saddle point from the pay-off matrix of player A.

	B_1	B_2	B_3
A_1	1	n	6
A_2	m	5	10
A_3	6	2	3

(7.5)

Q4(a) Minimize cost in the following assignment problem.

	I	II	III	IV	V
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

(7.5)

(b) Find initial basic feasible solution by using North-West corner rule, Least Cost method and Vogel's approximation method. Compare the three solutions.

	A	B	C	D	Supply
I	19	14	23	11	**11**
II	15	16	12	21	**13**
III	30	25	16	39	**19**
Demand	**6**	**10**	**12**	**15**	

(7.5)

(c) Solve the following cost minimizing assignment problem:

	A	B	C	D	E	F
1	14	9	16	18	11	13
2	10	12	14	16	9	11
3	13	11	9	12	14	10
4	15	14	12	10	11	9
5	9	13	15	11	10	12
6	11	10	13	14	12	8

(7.5)

Q5(a) Staring with Initial Basic feasible solution obtained using Least Cost Method, find the optimum solution to following transportation problem:

Sources	D1	D2	D3	D4	D5	Supply
	Destinations					
S1	12	18	25	14	20	**15**
S2	16	22	18	20	15	**20**
S3	20	10	22	16	18	**25**
Demand	**10**	**10**	**15**	**10**	**15**	

(7.5)

(b) Find all basic feasible solutions of the following equations.

$$5x_1 + 4x_2 + x_3 + x_4 + 2x_5 = 8$$
$$x_1 + x_2 + 3x_3 + 2x_4 + 6x_5 = 12$$

(7.5)

(c) Solve the following Linear programming problem by using artificial variables.

Maximize $z = x_1 + 5x_2$

Subject to

$$3x_1 + 4x_2 \geq 6$$
$$x_1 + 3x_2 \leq 2$$
$$x_1, x_2 \geq 0.$$

(7.5)

Q6(a) Use principle of dominance to solve the following game:

$$\begin{bmatrix} 5 & -7 & -2 & 2 \\ -2 & 2 & -5 & 5 \\ -2 & 5 & -2 & 7 \end{bmatrix}$$

(7.5)

(b) Convert the following game problem, involving "two-person zero-sum game" into a linear programming problem for player A and player B:

Player B

$$\text{Player A} \begin{bmatrix} 1 & -1 & -1 \\ -1 & -1 & 3 \\ -1 & 2 & -1 \end{bmatrix}$$

(7.5)

(c) (i) Define the following terms in "Two person Zero-Sum" game:

(i) Maximin and minimax value for a fair game

(ii) Mixed strategy

(ii) Determine the saddle point(s) in the pay-off matrix given below.

$$\begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 4 & 6 & 7 \end{bmatrix}$$

(4+3.5)