

[This question paper contains 3 printed pages.]

4686

Your Roll No. ....

B.Sc. (G) / I / NS

AS

MATHEMATICAL SCIENCES (Operational Research)

Paper II – Optimization – I

Time : 3 Hours

Maximum Marks : 55

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*Attempt any five questions.*

*All questions carry equal marks.*

1. (a) Comment on the statement : “OR advocates a systems approach and provides a quantitative analysis for decision-making”. (5)
- (b) Check the convexity of the following sets :
  - (i)  $X = \{x, x_2\} / x_1 x_2 \leq 1; x_1, x_2 \geq 0\}$
  - (ii)  $X = \{x_1, x_2\} / x_1^2 + x_2^2 \geq 4; x_1, x_2 \geq 0\}$  (6)
2. (a) Prove that the objective function of a Linear Programming Problem achieves its optimum value at one the extreme points of the convex set of the feasible solutions of the LPP. (7)
- (b) Find all possible basic feasible solutions for the following set of equations :

P.T.O.

$$2x_1 + 3x_2 + x_3 + 4x_4 = 8$$

$$x_1 - 2x_2 + 6x_3 - 7x_4 = -3$$

Is any bfs degenerate also? (4)

3. (a) State and prove strong duality theorem in duality theory. (7)

(b) Write the dual for the following LPP :

$$\text{Min } Z = 2x_1 + 3x_2 + 5x_3$$

s.t.

$$2x_1 + 5x_2 + 3x_3 \geq 2$$

$$3x_1 + 7x_2 - x_3 = 3$$

$$x_1 + 4x_2 - 6x_3 \leq 5$$

$$x_2, x_3 \geq 0; x_1 \text{ is unrestricted} \quad (4)$$

4. (a) Give the Mathematical formulation of an Assignment Problem. (4)

(b) Solve the following Transportation problem :

From \ To	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply
S <sub>1</sub>	8	5	6	120
S <sub>2</sub>	15	10	12	80
S <sub>3</sub>	3	9	10	80
Demand	150	80	40	

(7)

5. (a) Give the general form of an IPP. Name the methods available to solve an IPP. (3)

- (b) Solve the following all - IPP

$$\text{Max } Z = 3x_1 + 12x_2$$

s.t.

$$2x_1 + 4x_2 \leq 7$$

$$5x_1 + 3x_2 \leq 15$$

$$x_1, x_2 \geq 0 \text{ \& are integers} \quad (8)$$

6. (a) Write a short note on phenomenon of degeneracy in LPP. (5)

- (b) Solve the following LPP by 2-phase Simplex Method:

$$\text{Max } Z = 15x_1 + 25x_2$$

s.t.

$$7x_1 + 6x_2 \geq 20$$

$$8x_1 + 5x_2 \leq 30$$

$$3x_1 - 2x_2 = 18; x_1, x_2 \geq 0 \quad (6)$$

7. (a) Give the outline of Simplex Method. (5)

- (b) Discuss the effect of discrete changes in the requirement vector  $b$  on the optimal solution of a LPP. (6)