[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 286 **C** **Roll No.....**

Unique Paper Code : 236162

Name of the Paper : OR-1 – Operational Research (Linear Programming)

Name of the Course : B.Sc. (Mathematical Sciences)

Semester : I

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** Questions.
3. **All** questions carry equal marks.
4. Simple Calculators are allowed.
5. Graph paper can be used.

1. (a) Discuss the significance and scope of Operations Research in decision making. Also give the limitations if any of O.R approach. (6)

   (b) For a Linear Programming problem

   Max $Z = Cx$

   s.t $A x \leq b$

   $X \geq 0$

   Show that the feasible region is a closed convex set. (7)

   (c) Define

   (i) Convex Polyhedron

   (ii) Extreme point (2)

P.T.O.

2. (a) Define a convex set and examine the Convexity of the set

$$S = \{(x_1, x_2) \setminus x_1 x_2 \leq 1, x_1, x_2 \geq 0\}$$ (7)

(b) Formulate this as a linear programming problem and solve it graphically.

A firm plans to purchase at least 200 quintals of scrap containing high quality metal X and low quality metal Y. It decides that the scrap to be purchased must contain at least 100 quintals of metal X and not more than 35 quintals of metal Y. The firm can purchase the scrap from two suppliers (A and B) in unlimited quantities. The percentage of X and Y metals in terms of weight in the scrap supplied to A and B is given below.

Metals	Supplies A	Suppliers B
X	25%	75%
Y	10%	20%

The price of A's scrap is Rs. 200 per quintal and that of B is Rs. 400 per quintal. The firm wants to determine the optimal quantities so as to minimize the total purchasing cost. (8)

3. (a) Determine two basic feasible solutions of

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5$$

Do all the basic solutions exist ? (6)

(b) Obtain the inverse of $A = \begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix}$ using

Simplex method. (7)

(c) When is a LPP said to be unbounded. (2)

4. (a) State and prove strong duality theorem. (7)

(b) Use Two phase method to solve the following LPP

Max $Z = 5x_1 - 4x_2 + 3x_3$

s t

$2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

$x_1, x_2, x_3 \geq 0$ (8)

5. (a) Write the dual of

Minimize $z = 2x_1 + 3x_2 - 5x_3$

s t

$x_1 + x_2 - x_3 + x_4 \geq 5$

$2x_1 + x_3 \leq 4$

$x_2 + x_3 + x_4 = 6$

$x_1, x_2, x_3 \geq 0$, x_4 unrestricted in sign. (7)

(b) Use dual Simplex Method to solve the following LPP.

Minimize $z = 3x_1 + x_2$

s.t $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

$x_1, x_2 \geq 0$ (8)

6. (a) A company has factories at F1, F2 and F3 which supply to warehouses at W1, W2 and W3.

	Warehouse			
Factory	W1	W2	W3	Supply
F1	16	20	12	200
F2	14	8	18	160
F3	26	24	16	90
Demand	180	120	150	450

Using Vogel's approximation method, Determine the optimum distribution for this company to minimize the total transportation cost. (10)

P.T.O.

(b) Explain degeneracy in transportation problems and how can it be resolved. (5)

7. (a) Write short notes on any **three** :

(i) Supporting Hyperplane

(ii) Charnes - M – method

(iii) Alternate optimal solution

(iv) Economic Interpretation of duality

(v) Classification of O. R. Models (5)

(b) Use Hungarian method to make the following optimal assignments for the marketing manager who has five salesman and five districts. The profit maximize table is given below

		Districts				
		A	B	C	D	E
Salesman	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

in order to maximize the sale. (10)