[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 5188 **D** **Your Roll No.....**

Unique Paper Code : 236151

Name of the Course : **B.A. (Programme)**

Name of the Paper : Operational Research – I (Linear Programming)

Semester : I

Time : 3 Hours Maximum Marks : 75

Instructions for Candidates

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

1. (a) What is Operations Research ? What is a model in Operations Research ? What are the main characteristics that a good model for Operations Research should have ? (2+2+3)

   (b) Define a convex set. Examine whether the set $S = \{(x_1,x_2)|x_1^2 + x_2^2 \leq 4\}$ is convex or not. (3+5)

2. (a) Differentiate the following :

   (i) Linear dependence and independence of vectors

   (ii) Basic solution and basic feasible solution

   (iii) Degenerate and non-degenerate solution (3+3+3)

P.T.O.

(b) Obtain all the basic solutions to the following system of linear equation :

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

$$2x_1 + x_2 + 5x_3 = 5 \qquad (6)$$

3. (a) A firm manufactures two products A and B on which the profits earned per unit are Rs. 3 and Rs. 4 respectively. Each product is processed on two machines M1 and M2. Product A requires one minutes of processing time on M1 and two minutes on M2 while B requires one minute on M1 and one minute on M2. Machine M1 is available for not more than 7 hours and while Machine M2 is available for 10 hours during any working day. Find the number of units of products A and B to be manufactured to get maximum profit. (Use graphical method) (7+4)

(b) Give graphical representation of the following cases in LPP :

(i) Unbounded solution

(ii) Infeasible solution (2+2)

4. Use simplex method to solve the following LPP :

Maximize $z = 4x_1 + 10\ x_2$

Subject to the constraints :

$$2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90;\ x_1 \& x_2 \geq 0 \qquad (15)$$

5. (a) What is two phase method for solving a given linear programming problem ? Why is it used ? (4+1)

(b) Use the simplex method to solve the following simultaneous linear equations :

$$x_1 + x_2 = 1$$

$$2x_1 + x_2 = 3$$ (10)

6. (a) Solve the following assignment problem :

		Jobs			
		A	B	C	D
	I	1	4	6	3
Workers	II	9	7	10	9
	III	4	5	11	7
	IV	8	7	8	5

(7)

(b) The following is the initial basic feasible solution to a transportation problem. Find the optimal solution for the same.

						Supply
	20	***15*** 18	***85*** 18	21	19	**100**
	21	***20*** 22	23	***105*** 20	24	**125**
	60 18	***45*** 19	21	18	***70*** 19	**175**
Demand	**60**	**80**	**85**	**105**	**70**	

(8)

P.T.O.

7. (a) Write the dual of the following linear programming problem;

Max $Z = 6x_1 + 4x_2$

Subject to constraints;

$2x_1 + 3x_2 \leq 30$

$3x_1 + 2x_2 \leq 24$

$x_1 + x_2 \geq 3$, x_1 and x_2 are unrestricted in sign. (8)

(b) State and prove Weak duality theorem. (7)