This question paper contains **4** printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **6672**

Unique Paper Code : **62361101** **FC**

Name of the Paper : **Introduction to Operational Research and Linear Programming**

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

Semester : **I**

Duration : **3 Hours** Maximum Marks : **75**

(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*) Discuss the origin and development of O.R. Explain briefly application of O.R. 7

   (*b*) Define the convex set. Prove that the set :

$$S = \{(x_1, x_2) : 3x_1^2 + 2x_2^2 \leq 6\}$$

   is convex set. 2+6

2. (*a*) Explain the concept of duality in linear programming problem. Prove that dual of the dual is primal. 7

   (*b*) Obtain the dual of the following primal problem : 8

   Maximize $Z = 2x_1 + x_2 + x_3$

   Subject to $x_1 + x_2 + x_3 \geq 6,$

   $3x_1 - 2x_2 + 3x_3 = 3,$

   $-4x_1 + 3x_2 - 6x_3 = 1,$

   $x_1, x_2 \geq 0,$ x_3 is unrestricted.

3. (*a*) Define basic feasible solution to a system of linear equations. Find all the basic feasible solutions to the following system of linear equations : 2+5

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

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

P.T.O.

(*b*) The following is the optimum table to the linear programming problem :

Maximize $Z = 3x_1 + 4x_2$

Subject to $x_1 \leq 4$,

$x_2 \leq 6$,

$3x_1 + 2x_2 \leq 18$,

$x_1, x_2 \geq 0$.

		C_j	3	5	0	0	0
C_B	Y_B	X_B	Y_1	Y_2	Y_3	Y_4	Y_5
0	x_3	2	0	0	1	2/3	–1/3
5	x_2	6	0	1	0	1	0
3	x_1	2	1	0	0	–2/3	1/3
	$C_j - Z_j$	$Z = 36$	0	0	0	3	1

Discuss the effect on the optimality of the solution, when the objective function is change to $3x_1 + x_2$. 8

4. (*a*) What conditions must exist in a simplex table to establish the existence of infeasible solution ? Find the solution of the following L.P.P. : 2+5

Maximize $Z = -x_1 - x_2$

Subject to $3x_1 + 2x_2 \geq 30$,

$-2x_1 + 3x_2 \leq -30$,

$x_1 + x_2 \leq 5$,

$x_1, x_2 \geq 0$.

(*b*) An electronic company is engaged in the production of two components C_1 and C_2 used in TV sets. Each unit of C_1 costs the company Rs. 25 in wages and Rs. 25 in material, while each unit of C_2 costs the company Rs. 125 in wages and Rs. 75 in material. The company sells both products on one-period credit terms, but the company's labour and material expenses must be paid in cash. The selling price of C_1 is Rs. 150 per unit and of C_2 is Rs. 350 per unit. Because of the strong monopoly of the company for these components, it is assumed that the company can sell at the prevailing prices as many units as it produces. The company's production capacity is, however, limited by two considerations. First, at the beginning of period 1, the company has an initial balance of Rs. 20,000 (cash plus bank credit plus collections from past credit sales). Second, the company has available in each period 4,000 hours of machine time and 2,800 hours of assembly time. The production of each C_1 requires 6 hours of machine time and 4 hours of assembly time, whereas the production of each C_2 requires 4 hours of machine time and 6 hours of assembly time. Formulate this problem as a linear programming problem so as to maximize the total profit to the company. 8

5. (*a*) Use dual simplex method to solve the following L.P.P : 7

Minimize $Z = 3x_1 + x_2$

Subject to $x_1 + x_2 \geq 1$,

$2x_1 + 3x_2 \geq 2$,

$x_1, x_2 \geq 0$.

(*b*) (*i*) What is degeneracy ? Discuss a method to resolve degeneracy in L.P.P.

(*ii*) Use graphical method to solve the following L.P.P : 4+4

Maximize $Z = 2x_1 + 4x_2$

Subject to $x_1 + 2x_2 \leq 5$,

$x_1 + x_2 \leq 4$,

$x_1, x_2 \geq 0$.

6. (*a*) Solve the following linear programming problem by two-phase method : 8

Minimize $Z = x_1 + x_2$

Subject to $2x_1 + x_2 \geq 4,$

$x_1 + 7x_2 \geq 7,$

$x_1, x_2 \geq 0.$

(*b*) Solve the following linear programming problem by simplex method : 7

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430,$

$3x_1 + 2x_3 \leq 460,$

$x_1 + 4x_2 \leq 420,$

$x_1, x_2, x_3 \geq 0.$

7. Write short notes on any *three* of the following : 3×5=15

(*i*) Sensitivity analysis

(*ii*) Economic interpretation of duality

(*iii*) Complementary slackness

(*iv*) Simplex method *Vs*. Dual simplex method.