[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 5223 **D** **Your Roll No.....**

Unique Paper Code : 236351

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

Name of the Paper : OPERATIONAL RESEARCH – III :

MATHEMATICAL PROGRAMMING

Semester : III

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. Attempt any **five** questions.
3. **All** questions carry equal marks.
4. Statistical Tables can be used.

1. (a) Describe Integer programming. Differentiate between All integer programming and Mixed integer programming. (7)

(b) The following is the non integral Optimum table to the IPP

Maximize $Z = 4x_1 + 6x_2 + 2x_3$

Subject to $4x_1 - 4x_2 \leq 5$

$-x_1 - 6x_2 \leq 5$

$-x_1 + x_2 + x_3 \leq 0$

$x_1, x_2, x_3;\quad x_1, x_2$ integer

P.T.O.

	c_j	4	6	2	0	0	0	
C_B	X_B	x_1	x_2	x_3	s_1	s_2	s_3	b
4	x_1	1	0	0	3/10	1/5	0	5/2
6	x_2	0	1	0	1/20	1/5	0	5/4
2	x_3	0	0	1	1/4	0	1	25/4
		Optimal feasible non-integer solution						

Find the integer solution by using Gomory's fractional cut algorithm for mixed integer programming. (8)

2. (a) A company manufactures two products if it charges a price p_i for the product i, it can sell q_i units of product i, where $q_1 = 60 - 3p_1 + p_2$ and $q_2 = 80 - 2p_2 + p_1$. It cost 25 rupees to produce one unit of product 1 and 72 rupees to produce a unit of product 2. How many units of each product should be produced to maximize profits ? (9)

   (b) What is meant by zero-one programming problem ? Explain it with the help of the fixed charge problem. (6)

3. (a) Define a convex function and prove that a positive linear combination of convex functions is convex. (6)

   (b) Use the Kuhn-Tucker conditions to solve the following non-linear programming problem :

   Maximize $Z = 2x_1 - x_1^2 + x_2$

   Subject to constraints

   $$2x_1 + 3x_2 \leq 6$$

   $$2x_1 + x_2 \leq 4$$

   $$x_1 \geq 0,\ x_2 \geq 0$$

   (9)

4. (a) Derive the Kuhn-Tucker Necessary and Sufficient conditions for Quadratic Programming problems. (9)

(b) A positive quantity b is to be divided into n parts in such a way that the product of n parts is to be a maximum. Use Lagrange multipliers method to obtain the optimal sub-division. (6)

5. Use the wolf's modified simplex method for solving the following quadratic problem

Maximize $Z = 2x_1 + 3x_2 - 2x_1^2$

Subject to $x_1 + 4x_2 \leq 4$

$x_1 + x_2 \leq 2$

$x_1, x_2 \geq 0$ (15)

6. (a) Solve the following non-linear programming problem, using the Lagrangian multipliers method.

Optimize $Z = 4x_1^2 + 2x_3^2 - 4x_1x_2$

Subject to $x_1 + x_2 + x_3 = 15$

$2x_1 - x_2 + 2x_3 = 20$

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

(b) Define concave and convex function. Use definition to show that

$f(x) = x^2$ is a convex function. (7)

P.T.O.

7. Write notes on :–

(a) Hessian matrix, positive definite and negative definite matrix

(b) Branch and Bound Algorithm for solving IPP (15)