[This question paper contains 2 printed pages.]

Sr. No. of Question Paper : 377 **C** **Roll No............**

Unique Paper Code : 236351

Name of the Paper : Operational Research : Mathematical Programming

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

Semester : III

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. Only simple calculators are allowed.

1. (a) Define Convex function.If f(x) is a convex function on a set S. Prove that the local minimum of f(x) on S is also global minimum of f(x) on S.

   (b) Show that the function $f(x) = 2x_1^2 + x_2^2$ is a convex function over all of $\mathbf{R}^2$. (9+6)

2. (a) Define Mixed Integer Programming problem and solve the following using fractional cut method :

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

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

   $-x_1 + 6x_2 \leq 5$

   $-x_1 + x_2 + x_3 \leq 5$

   $x_1, x_2, x_3 \geq 0$; x_1, x_2 are integers.

   (b) An exporter of ready- made garments makes two types of shirts: X and Y. He makes a profit of Rs. 10 and Rs. 40 per shirt on X and Y shirts respectively. He has two tailors, A and B, at his disposal to stitch these shirts. Tailors A and B can devote at most 1 hours and 15 hours per day respectively. Both these shirts are to be stitched by both the tailors. Tailors A and B spend two hours and five hours respectively in stitching a X shirt, and four hours and three hours respectively in stitching a Y shirts. How many shirts of both the types should be stitched in order to maximize daily profits ? Use Gomory's all integer linear programming method to find the solution. (9+6)

P.T.O.

3. Solve the following linear programming problem using branch and bound method :

Maximize $Z = 7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7$

$x_1, x_2 \geq 0$ and are integers. (15)

4. (a) Give the general form of a non-linear programming problem. What is the significance of Lagrange Multiplier ?

(b) Solve the following non-linear programming problem using the method of Lagrangian multipliers :

Minimize $Z = 2x_1^2 + x_2^2 + x_3^2$ subject to the constraints :

$4x_1 + x_2^2 + 2x_3 = 14, \; x_1, x_2, x_3 \geq 0$ (7+8)

5. (a) What is meant by Quadratic programming ? How does a quadratic programming problem differ from a linear programming problem ?

(b) Write the Kuhn–Tucker conditions for the following problem :

Minimize $Z = x_1^2 + x_2^2 + x_3^2$

Subject to $2x_1 + x_2 - x_3 \leq 0$

$1 - x_1 \leq 0$

$-x_3 \leq 0$

Also solve this problem. (7+8)

6. (a) Obtain the Kuhn-Tucker conditions for a solution of the problem :

Maximize $Z = cx + \frac{1}{2} x^T dx$

Subject to $Ax \leq b$

$x \geq 0$

(b) Solve graphically the following non-linear programming problem :

Maximize $Z = 8x_1 - x_1^2 + 8x_2 - x_2^2$

Subject to the constraints

$x_1 + x_2 \leq 12$

$x_1 - x_2 \geq 4$

$x_1, x_2 \geq 0$ (6+9)

7. Use Wolfe's method to solve the following quadratic programming 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)