

**A-0640**

Total Pages : 5

Roll No. ....

**MT-605**

**M.A./M.Sc. MATHEMATICS (MAMT/MSCMT)**

**(Mathematical Programming-I)**

3rd Semester Examination, Session December 2024

Time : 2:00 Hrs.

Max. Marks : 70

*Note :-* This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

**Section-A**

**Long Answer Type Questions**       $2 \times 19 = 38$

*Note :-* Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Use branch and bound method to solve following linear programming problem :

Max. :

$$z = 7x_1 + 9x_2$$

subject to :

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

$$7x_1 + x_2 \leq 35$$

$$x_2 \geq 7$$

2. Prove that the sum of convex functions is convex and if atleast one of the functions is strictly convex, then the sum is strictly convex.
3. Solve the following non-linear programming problem using method of Lagrangian's multipliers :

Min. :

$$f(x) = x_1^2 + x_2^2 + x_3^2$$

subject to :

$$4x_1 + x_2^2 + 2x_3 = 14$$

$$x_1, x_2, x_3 \geq 0$$

4. What is bounded variable problem ? Write down the procedure of bounded variable simplex method.
5. Solve the following all integer programming problem :

Max. :

$$z = 3x_1 + 4x_2$$

subject to :

$$3x_1 + 2x_2 \leq 8$$

$$x_1 + 4x_2 \leq 10$$

$$x_1, x_2 \geq 0 \text{ and are integers}$$

### Section–B

#### Short Answer Type Questions      4×8=32

**Note** :- Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Prove that a hyperplane is a convex set.
2. Give geometrical interpretation of branch and bound method.

3. Obtain the necessary condition for the optimum solution of the following non-linear programming problem :

Min. :

$$f(x_1, x_2) = 3e^{2x_1+1} + 2e^{x_2+5}$$

subject to :

$$x_1 + x_2 = 7$$

$$x_1, x_2 \geq 0$$

4. Write a short note on Gomory's all Integer programming problem method.
5. What is non-linear programming problem ? Establish the relation between saddle point and the minimal point of the non-linear programming problem.
6. Define :
- (i) Bounded variables
  - (ii) Slack and surplus variables
7. Define quadratic form. And write the quadratic form whose associated matrix is :

$$\begin{bmatrix} 1 & 3 & 5 \\ 3 & 6 & -3 \\ 5 & -3 & 14 \end{bmatrix}$$

8. Determine the properties of sign definiteness of the following quadratic form :

$$Q(x) = x_1^2 + 5x_2^2 + 8x_3^2 - 4x_1x_2 + 6x_1x_3 - 10x_2x_3$$

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