A–1045

Total Pages : 4 **Roll No. ....**

MT-605

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Mathematical Programming-I

Examination, 2026 (Feb.)

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 $2\times19=38$

***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. Every supporting hyperplane of a closed convex set which is bounded from below contains at least one extreme point of the set.

2. Solve the following linear programming problem by revised simplex method :

Max :

$$Z = 2x_1 + x_2$$

s.t. :

$$2x_1 + x_2 \leq 6$$

$$6x_1 + x_2 \leq 3$$

$$x_1, x_2 \geq 0$$

3. Solve the following non-linear programming problem using the method of Lagrangian multipliers :

Minimize :

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

Subject to :

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

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

4. Define the following :

(i) Saddle point

(ii) Convexity of quadratic forms

5. Solve the integer programming problem :

Max. :

$$Z = 7x_1 + 9x_2$$

S.t. :

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

$$7x_1 + x_2 \leq 35$$

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

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 closed set.
2. Explain Lagrange's multiplier's method.
3. Show that $f(x) = x^2$ is a convex function.
4. Determine the properties of sign definiteness for the following quadratic form :

$$z = x_1^2 - 4x_1x_2 + 6x_1x_3 + 5x_2^2 - 10x_2x_3 + 8x_3^2$$

5. Write a short note on general non- linear programming problem.
6. Distinguish between pure and mixed integer programming.

7. Show that a linear function is convex as well as concave.

8. Obtain the necessary conditions for the optimum solution of the following non-linear Pro-gramming problem:

Min. :

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

Subject to the constraints :

$$x_1 + x_2 = 7 \text{ and } x_1, x_1 \geq 0$$

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