MAMT-10/MSCMT-10

December - Examination 2025
M.A./M.Sc. (Final) Examination
MATHEMATICS
MATHEMATICAL PROGRAMMING
Paper : MAMT-10/MSCMT-10

[*Time: **3** Hours*] [*Maximum Marks: **80***]

Note :- The question paper is divided into three Sections A, B and C. Write answers as per the given instructions. Use of non-programmable scientific calculator is allowed in this paper.

Section-A **8×2=16**

(Very Short Answer Type Questions)

Note :- Answer **all** the questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries **2** marks.

1. (i) Define extreme point of a convex set and give an example.

(ii) Define bounded variable linear programming problem.

(iii) Write importance of Integer programming problem.

(iv) Write the difference between pure and mixed integer programming.

(v) Write the quadratic form in matrix form.

$$Q(X) = x_1^2 + 2x_2^2 - 7x_3^2 - 4x_1x_2 + 6x_1x_3 - 5x_2x_3$$

(vi) Define general non-linear programming problem.

(vii) State convex programming problem.

(viii) Define separable function.

Section-B **4×8=32**

(Short Answer Type Questions)

Note :- Answer **any four** questions. Each answer should not exceed **200** words. Each question carries **8** marks.

2. Prove that a hyperplane is a closed set.

3. Use branch and bound method to solve following L.P.P.

Max $Z = 2x_1 + 6x_2$

s.t. $3x_1 + x_2 \leq 5$

$4x_1 + 4x_2 \leq 9$

$x_1, x_2 \geq 0$ and are integers.

4. Obtain the necessary conditions for the optimum solution of the following non-linear programming problem -

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

subject to the constraints : $x_1 + x_2 = 7$ and $x_1, x_2 \geq 0$

5. Use Lagrangian function to find the optimal solution of the following non-linear programming problem :

Maximize $f(X) = -3x_1^2 - 4x_2^2 - 5x_3^2$

Subject to $x_1 + x_2 + x_3 = 10$

$x_1, x_2, x_3 \geq 0$

6. Solve the following programming problem graphically and verify the Kuhn-Tucker conditions for the same -

Maximize $f(x_1, x_2) = 2x_1 + 3x_2$

Subject to $x_1^2 + x_2^2 \leq 20$

$x_1x_2 = 8$

$x_1, x_2 \geq 0$

7. Derive the dual of the quadratic programming problem -

Min $f(X) = C^T X + \frac{1}{2} X^T GX$

Subject to $AX \geq b$

8. Use dynamic programming to solve the following problem -

Min $(x_1^2 + x_2^2 + \cdots + x_n^2)$

Subject to $x_1, x_2, ...x_n = b$

and $x_1, x_2, ...x_n \geq 0$

9. Use dynamic programming to solve -

Max. $z = 8x_1 + 7x_2$

Subject to $2x_1 + x_2 \leq 8$

$2x_1 + 2x_2 \leq 15$

and $x_1, x_2 \geq 0$

Section-C **2×16=32**

(Long Answer Type Questions)

Note :- Answer **any two** questions. You have to delimit your each answer maximum up to **500** words. Each question carries **16** marks.

10. Solve the following linear programming problem by revised simplex method -

Max $z = 3x_1 + x_2 + 2x_3 + 7x_4$

st. $2x_1 + 3x_2 - x_3 + 4x_4 \leq 40$

$-2x_1 + 2x_2 + 5x_3 - x_4 \leq 35$

$x_1 + x_2 - 2x_3 + 3x_4 \leq 100$

$x_1 \geq 2, x_2 \geq 1, x_3 \geq 3, x_4 \geq 4$

11. Solve the following mixed integer programming problem -

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

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

$-x_1 + 6x_2 \leq 5$

$-x_1 + x_2 + x_3 \leq 5$

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

12. Solve the following quadratic programming problem by Beale's method.

Min. $f(x_1, x_2) = 10x_1^2 + x_2^2 + 4x_1x_2 - 10x_1 - 25x_2$

Subject to $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 9$

$x_1, x_2 \geq 0$

13. Solve the following convex separable programming problem -

Min. $z = x_1^2 - 2x_1 - x_2$

Such that $2x_1^2 + 3x_2^2 \leq 6$

and $x_1, x_2 \geq 0$
