6. Solve the following programming problem graphically :

Minimize :

$$f(x_1, x_2) = x_1^2 + x_2^2$$

$$x_1 + x_2 \geq 4$$

$$2x_1 + x_2 \geq 5$$

$$x_1, x_2 \geq 0$$

7. Solve the following quadratic programming problem by Wolfe's method :

Minimize :

$$f(x_1, x_2) = -4x_1 + x_1^2 - 2x_1x_2 + 2x_2^2$$

$$2x_1 + x_2 \leq 6$$

$$x_1 - 4x_2 \leq 0$$

$$x_1, x_2 \geq 0$$

8. Derive the dual of the quadratic programming problem :

Minimize :

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

$$AX \geq b$$

9. Solve by Dynamic Programming :

Maximize :

$$Z = 8x_1 + 7x_2$$

$$2x_1 + x_2 \leq 8$$

$$2x_1 + 2x_2 \leq 15$$

$$x_1, x_2 \geq 0$$



# MAMT–10/MSCMT–10

## June – Examination 2022

## M.A./M.Sc. (Final) Examination

### MATHEMATICS

### (Mathematical Programming)

### Paper : MAMT–10/MSCMT-10

*Time : 1½ Hours* ] [ *Maximum Marks :* ***80***

***Note*** :– The question paper is divided into two Sections A and B. Write answers as per the given instructions. Use of non-programmable Scientific Calculator is allowed in this paper.

**Section–A** **4×4=16**

**(Very Short Answer Type Questions)**

***Note*** :– Answer any *four* 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 4 marks.

1. (i) Define Quadratic Form.

   (ii) What are Artificial Variables ?

   (iii) Define a standard Integer Programming Problem.

(iv) What is a Fractional Cut ?

(v) Write the following quadratic form in matrix vector notation :

$$\begin{pmatrix} 1 & 2 & 4 \\ 2 & 6 & -2 \\ 4 & -1 & 14 \end{pmatrix}$$

(vi) Define Saddle Point.

(vii) Write standard form for Quadratic Programming Problem.

(viii) The dual of the quadratic programming problem is the quadratic program itself. True or False ?

**Section–B** **4×16=64**

**(Short Answer Type Questions)**

***Note*** :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 16 marks.

2. Solve the following L.P.P. by standard form II of revised simplex method :

$$2x_1 + 5x_2 \geq 6$$
$$x_1 + x_2 \geq 2$$
$$x_1, x_2 \geq 0$$

Minimize :

$$Z = x_1 + 2x_2$$



3. Solve the following integer programming problem using branch and bound technique :

Maximize :

$$Z = x_1 + x_2$$
$$3x_1 + 2x_2 \leq 12$$
$$x_2 \leq 12$$

$x_1$ and $x_2$ are integers.

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

Maximize :

$$f(X) = -3x_1^2 - 4x_2^2 - 5x_3^2$$
$$x_1 + x_2 + x_3 = 10$$
$$x_1, x_2, x_3 \geq 0$$

5. Write the Kuhn–Tucker necessary and sufficient conditions for the following non-linear programming problem to have an optimal solution :

$$f(x_1, x_2) = x_1^2 - 2x_1 - x_2$$
$$2x_1 + 3x_2 \leq 6$$
$$2x_1 + x_2 \leq 4$$
$$x_1, x_2 \geq 0$$