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MAMT–10

M.A./M.Sc. Mathematics IInd Year Examination Dec., 2023

MATHEMATICAL PROGRAMMING

Time : 2 Hours] [**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 there in. ***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) 2×19=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. Prove that :

$$f(x) = \frac{1}{x}$$

is strictly for $x > 0$ and strictly concave for $x < 0$.

2. Solve the following LPP by revised simplex method :

$$\text{Max.} \quad Z = 2x_1 + x_2$$

$$\text{st.} \quad 3x_1 + 4x_2 \le 6$$

$$6x_1 + x_2 \le 3$$

$$x_1, x_2 \ge 0$$

3. Solve the following IPP :

$$\text{Max.} \quad Z = 2x_1 + 3x_2$$

$$\text{st.} \quad -3x_1 + 7x_2 \le 14$$

$$7x_1 - 3x_2 \le 14$$

and $x_1, x_2 \ge 0$ and all integers.

4. State and prove Lagrange's multipler method.

5. Find the dimension of the rectangular parallopiped with largest volume whose sides are to the coordinate planets, to be inscribed in the ellipsoid :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

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. Define a general non-linear programming problem.

2. Solve by Wolf's method :

$$\text{Max. } f(x_1, x_2) = 2x_1 + x_2 - x_1^2$$

$$\text{st. } 2x_1 + 3x_2 \leq 6$$

$$62 + x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

3. Prove that the set of all optimum solutions (global maximum) of general convex programming problem is a convex set.

4. Explain Bellman's principal of optimality.

5. Prove that a linear function Z = CX – $f(x)$ say X $\in$ R^n.

6. Show that $f(x) = x^2$ is a convex function.

7. Solve by dynamic programming :

$$\text{Max.} \quad Z = x_1 + 9x_2$$

$$\text{st.} \quad 2x_1 + x_2 \leq 25$$

$$x_2 \leq 11$$

$$x_1, x_2 \geq 0$$

8. Define the following :

   (a) Line and line segment

   (b) Artificial objective function

   (c) Fractional cut

   (d) Pure and mixed integer programming

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