A–901

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MAMT–10

MATHEMATICAL PROGRAMMING

MA/M.Sc. Mathematics (MAMT/MSCMT–19)

2nd Year Examination, 2024 (June)

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 2×19=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 convex for $x > 0$ and strictly concave for $x < 0$.

2. Solve the following L.P.P. using revised simplex method :

   Max. :

$$Z = 3x_1 + 6x_2 + 2x_3$$

   s.t. :

$$3x_1 + 4x_2 + x_3 < 2$$

$$x_1 + 3x_2 + 2x_3 \leq 1$$

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

3. Using the bounded variable technique, solve the following L.P.P. :

   Max. :

$$Z = 3x_1 + 5x_2 + 2x_3$$

   s.t. :

$$x_1 + 2x_2 + 2x_3 < 14$$

$$2x_1 + 4x_2 + 3x_3 \leq 23$$

$$0 \leq x_1 \leq 4,\ 2 \leq x_2 \leq 5,\ 0 \leq x_3 \leq 3$$

4. What is the general non-linear programming problem ? Establish the relation between saddle point and the minimal point of the non-linear programming problem.

5. Solve the integer programming problem :

$$\text{Max } Z = x_1 + 4x_2$$

Subject to : $2x_1 + 4x_2 \leq 7$

$$5x_1 + 43 \leq 15$$

$x_1, x_2 \leq 0$ 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. Show that :

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

is convex function over R^2.

2. Show that :

$$f(x) = x^2$$

is convex function.

3. Obtain a set of necessary condition for the non-linear programming problem :

Max. : $Z = x_1^2 + 3x_2^2 + 3x_3^2$

Subject to :

$$5x_1 + 2x_2 + x_3 = 5$$

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

4. Define a general non-linear programming problem.

5. Solve by dynamic programming :

   Max :

$$Z = x_1 + 9x_2$$

   Subject to :

$$2x_1 + x_2 \leq 25$$

$$x_2 \leq 11$$

6. Prove that a hyperplane is a convex set.

7. If $F(X, \lambda)$ has a saddle point $(X_0, \lambda_0\})$ for each $\lambda \geq 0$, then prove that $G(X_0) \leq 0$ and $\lambda_0^T G(X_0) = 0$.

8. Define the following :

   (a) Separable Function

   (b) Convex Programming Problem

   (c) Separable Programming Problem

   (d) Convex Separable Programming Problem

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