MA/MSCMT-10

December - Examination 2018

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

Mathematical Programming

Paper - MA/ MSCMT-10

Time : 3 Hours] **[Max. Marks :- 80**

Note: The question paper is divided into three sections A, B and C. Use of non-programmable scientific calculator is allowed in this paper.

Section - A **$8 \times 2 = 16$**

(Contain eight (08) Very Short Answer Type Questions)

Note: Section 'A' contains Very short Answer Type Questions. Examinees have to attempt all questions. Each question is of 02 marks and maximum word limit may be thirty words.

1) (i) Write the relation between quadratic form and convex function.

(ii) What is difference between a slack and surplus variable?

(iii) Write the condition when a point will be saddle point in Lagrangian function.

(iv) If the given LPP has an optimal solution, then what about the solution of dual problem?

(v) Define quadratic programming problem.

(vi) Determine whether or not the quadratic forms $A^T AX$ is positive definite, where $A = \begin{bmatrix} 2 & 1 & 4 \\ 6 & 0 & 1 \\ 1 & -1 & 2 \end{bmatrix}$

(vii) Explain Bellman's principle of Optimality.

(viii)Define convex separable programming problem.

Section - B **$4 \times 8 = 32$**

(contain Eight Short Answer Type Questions)

Note: Section 'B' contain 08 short Answer Type Questions. Examinees will have to answer any four (4) question. Each question is of 08 marks. Examinees have to delimit each answer in maximum 200 words.

2) Prove that a hyperplane is a closed set.

3) Solve the following LPP with the help of revised simplex method without use of artificial variables:

Maximize $Z = 2x_1 - 6x_2$

Subject to $x_1 - 3x_2 \leq 6;$

$2x_1 + 4x_2 \geq 8;$

$-x_1 + 3x_2 \leq 6;$

$x_1 , x_2 \geq 0$

4) Find the dimension of a rectangular parallelepiped with largest volume whose sides are parallel to the coordinate planes, to be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$

5) Solve the following nonlinear programming problem graphically:

Max $f(x_1, x_2) = -x_1^2 - x_2^2 + 8x_1 + 8x_2$

Subject to $x_1 + x_2 \leq 12;$

$x_1 - x_2 \geq 4;$

$x_1, x_2 \geq 0.$

6) Write the Kuhn-Tucker necessary and sufficient conditions for the following nonlinear programming problem to have an optimal solution:

Max $f(x_1, x_2) = x_1^2 - 2x_1 - x_2$

Subject to $2x_1 + 3x_2 \leq 6;$

$2x_1 + x_2 \leq 4;$

$x_1, x_2 \geq 0.$

7) What are Primal function and Dual function in nonlinear programming?

8) Write separable programming algorithm.

9) Use dynamic programming to solve the following LPP;

Max $z = 2x_1 + 5x_2$

Subject to $2x_1 + x_2 \leq 43;$

$2x_2 \leq 46;$

$x_1, x_2 \geq 0.$

Section - C $\qquad 2 \times 16 = 32$

(Contain 4 Long Answer Type Questions)

Note: Section 'C' contains Four Long Answer Type Questions. Examinees will have to answer any two (02) questions. Each question is of 16 marks. Examinees have to answer in maximum 500 words.

10) Find the optimum integer solution to the integer programming problem.

Max $\quad Z = x_1 + 2x_2$

Subject to $\quad 2x_2 \leq 7,$

$x_1 + x_2 \leq 7,$

$2x_1 \leq 11,$

$x_1, x_2 \geq 0.$

11) Solve the following quadratic programming using Wolfe's method:

Minimize $\quad f(x_1, x_2) = 10x_1^2 + x_2^2 + 4x_1x_2 - 10x_1 - 25x_2$

Subject to $\quad x_1 + 2x_2 \leq 10;$

$x_1 + x_2 \leq 9;$

$x_1, x_2 \geq 0.$

12) Using bounded variation technique, solve the following LPP

Max $\quad z = x_1 + 3x_2$

Subject to $\quad x_1 + x_2 + x_3 \leq 10;$

$x_1 - 2x_3 \geq 0;$

$2x_2 - x_3 \leq 10;$

$0 \leq x_1 \leq 8, 0 \leq x_2 \leq 4, x_3 \geq 0.$

13) Solve the following convex separate programming problem.

Max $\quad f(x_1, x_2) = x_1^2 - 2x_1 - x_2$

Such that $\quad 2x_1^2 + 3x_1^2 \leq 6;$

$x_1 , x_2 \geq 0.$
