Roll No. ------------------

**MAMT-10**

**Mathematical Programming**

MA/M.Sc. Mathematics (MAMT/MSCMT)

2ndYear Examination2024 (Dec.)

**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 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**

**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. (2×19=38)**

1. Show that a hyperplane is a closed set.
2. Explain the steps involved in Dynamic Programming with an example of a shortest path problem.
3. Solve the following Nonlinear Programming Problem using the Lagrange Multiplier Method:

$$Maximize: f\left(x,y\right)=x^{2}+y^{2}$$

$$Subject to: x+y=5$$

1. A company produces two products $P\_{1 }$and $P\_{2 }$. The profit per unit is $\$50$ and $\$40$ respectively. Each unit of $P\_{1 }$requires $2 $hours of labor and $1 $unit of raw material, while $P\_{2 }$ requires $1$ hour of labor and $2$ units of raw material. The company has $80$ labor hours and $90$ units of raw material available. Formulate this as a Linear Programming Problem and solve using the Simplex Method.
2. Solve the following Nonlinear Programming Problem using Lagrange Multipliers:

$$Maximize: f\left(x,y\right)=xy$$

$$ Subject to: x+2y=10$$

**SECTION – B**

**Short – answer – type questions**

**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.* (4×8=32)**

1. Show that a linear function is convex as well as concave.
2. Define Linear Programming Problem (LPP) and explain its assumptions.
3. Obtain the set of necessary condition for the non-linear programming problem:

$$Maximize: Z=x\_{1}^{2}+3x\_{2}^{2}+5x\_{3}^{2}$$

$$Subjectto: 5x\_{1}+2x\_{2}+x\_{3}=5$$

$$x\_{1},x\_{2},x\_{3}\geq 0$$

1. Explain the Kuhn-Tucker Conditions and their application in Nonlinear Programming.
2. Show that $f\left(x\right)=\left\{\begin{array}{c}a\left(x-α\right), a>0,x\geq α\\b\left(x-α\right), b<0, x\leq α\end{array}\right.$ is a convex function.
3. State the advantages and disadvantages of the Simplex Method.
4. Prove that the set of all optimum solutions (global maximum) of general convex programming problem is a convex set.
5. Define the following
6. Branch and Bound Method.
7. Dynamic Programming.
8. Simplex Method.
9. feasible solution, basic feasible solution, and optimal solution