A–0707

Total Pages : 3 **Roll No. ....**

MT-503

MA/MSC Mathematics (MAMT/MSCMT)

(Differential Equation and Calculus of Variation)

Examination, June 2025

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. Show that cross ratio of any four particular integrals of a Riccati's equation is independent of x.

2. Solve :

$$y' = \cos x - y \sin x + y^2$$

3. Show that X. curl X = 0 is the necessary condition for integrability of the total differential equation :

$$X.dr = P dx + Q dy + R dz$$

4. A thin rectangular plate whose surface is impervious to heat flows has at $t = 0$ an arbitrary function $f(x, y)$. Its four edges $x = 0$, $x = a$, $y = 0$, $y = b$ are kept at zero temperature. Determine the temperature at a point of the plate as 't' increases.

5. Find the shape of the curve on which a bead is sliding from rest and accelerated by gravity will ship without friction in least time from one point to another.

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. Solve :

$$\sin^3 y \frac{d^2 y}{dx^2} = \cos y$$

2. Solve :

$$2\frac{d^2 y}{dx^2} - \left(\frac{dy}{dx}\right)^2 + 4 = 0$$

3. Solve :

$$z^2 dx + (z^2 - 2yz)dy + (2y^2 - yz - zx)dz = 0$$

4. Solve :

$$s - t = \frac{x}{y^2}$$

5. Solve :

$$t + s + q = 0$$

6. Classify partial differential equations of second order.

7. Discuss Sturm-Liouville Problem.

8. Show that $y'' - \lambda y = 0$ with $y(0) = 0 = y(\pi)$ is a Sturm-Liouville problem.

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