A–1033

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

MT-503

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

Differential Equation and Calculus of Variation

Examination, 2026 (Feb.)

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 $2\times19=38$

***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. Solve :

$$2x^2 \cos y \frac{d^2y}{dx^2} - 2x^2 \sin y \left(\frac{dy}{dx}\right)^2 + x \cos y \frac{dy}{dx} - \sin y = \log x$$

2. Solve :

$$5r + 6s + 3t + 2(rt - s^2) + 3 = 0$$

3. Reduce the equation :

$$xyr - (x^2 - y^2)s - xyt + py - qx = 2(x^2 - y^2)$$

to canonical form and hence solve it.

4. Find the curve, the time taken along which the least, when velocity at any point of it is $v = x$.

5. Determine the curve of prescribed length $2l$ which joins the points $(-a, b)$ and (a, b) and has its centre of gravity as low as possible.

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 :

$$y(1 - \log y)\frac{d^2y}{dx^2} + (1 + \log y)\left(\frac{dy}{dx}\right)^2 = 0$$

2. Solve :

$$(mz - ny)dx + (nx - iz)dy + (ly - mx)dz = 0$$

3. Solve :

$$r = a^2t$$

by Monge's method.

4. Find the characteristics of :

$$x^2r + 2xys + y^2t + 0$$

5. Find eigenvalues and eigen function for the boundary value problem :

$$y'' - 2y + \mu y = 0; y(0) = 0, y(\pi) = 0$$

6. Find the curve with fixed boundary revolves such that its rotation about x-axis generates minimal surface area.

7. Obtain the Euler-Lagrange equation for the extremals of the functional :

$$\int_{x_1}^{x_2} [y^2 - yy' + y'^2]dx$$

8. Find the extremal of the functional :

$$I[y(x)] = \int_a^b (y^2 + y'^2 + 2ye^x)dx$$

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