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MAMT-03

Differential Equations, Calculus of Variations and Special Functions

M.Sc./M.A. Mathematics (MSCMT/MAMT-19)

Ist Year Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

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

(b) Solve $(mz-ny)dx+(nx-lz)dy+(ly-mx)dz=0.$

2. Find the real eigenvalues and eigenfunctions for the boundary value problem : $y'' + \mu y = 0$, $y(0) = 0$, $y'(1) = 0$.

3. Use the method of separation of variables to solve the partial differential equation $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$.

4. Solve in series $(2 - x^2)\frac{d^2 y}{dx^2} + 2x\frac{dy}{dx} - 2y = 0$.

5. (a) Show : $xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x)$.

(b) Expand x^n in a series of Hermite polynomial.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Solve : $y^3 \frac{d^2 y}{dx^2} = C$.

2. Solve : $xdy - ydx - 2x^2 zdz = 0$.

3. Solve : $r = 2y^2$.

4. Show that to every eigenvalue of a Sterm-Liouville system there corresponds only one linearly independent eigenfunction.

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

6. Find the representation of $(1 + z)^n$ in terms of Gauss hyper geometric function.

7. Show : $(2n + 1)xP_n(x) = (n + 1)P_{n+1}(x) + nP_{n-1}(x)$.

8. Show : $xL'_n(x) = nL_n(x) - nL_{n-1}(x)$.