

Roll No.: CS23TI029

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Indian Institute of Information Technology, Design and Manufacturing, Kancheeppuram
Mid-Semester Examination – March 2024

Course Code: MA1001

Course Title: Differential Equations

Date of Examination: 04.03.2024

Category: Core

Duration: 1 Hour 15 mins

Maximum Marks: 25

Answer All Questions

1. Find the family of orthogonal trajectories of the one-parameter family of curves $xy = c$ ($c \neq 0$). Also sketch both the families of curves. [5]
2. Prove that $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ is both a necessary and a sufficient condition for the exactness of the differential equation $M(x, y)dx + N(x, y)dy = 0$. [5]
3. If $\mu_1(x, y)$ and $\mu_2(x, y)$ are integrating factors of the differential equation $M(x, y)dx + N(x, y)dy = 0$ such that their ratio is not a constant, then prove that $\mu_1(x, y) = c\mu_2(x, y)$ is the general solution of the differential equation. [3]
4. Solve: $xy^2y' + y^3 = x \cos x$. [3]
5. State the existence and uniqueness theorem for second order linear differential equations. [2]
6. Solve: $x^2y'' + 2xy' - 2y = 0$. [2]
7. Prove that if $y_1(x)$ and $y_2(x)$ are solutions of the homogeneous equation $y'' + P(x)y' + Q(x)y = 0$ on an interval $[a, b]$, then their Wronskian is either identically zero or never zero on $[a, b]$. [5]