

ADMISSION NUMBER									

School of Basic Sciences

Master of Science in Mathematics
Mid Term Examination - Nov 2023

Duration : 90 Minutes
Max Marks : 50

Sem I - C1PM102T - Theory of Differential Equations

General Instructions

Answer to the specific question asked

Draw neat, labelled diagrams wherever necessary

Approved data hand books are allowed subject to verification by the Invigilator

- 1) Identify whether $x=0, y=0$ is an ordinary point or singular point of the differential equation K2 (2)
 $(x^2 - 1)\left(\frac{d^2y}{dx^2}\right) + x\left(\frac{dy}{dx}\right) - y = 0.$
- 2) State the Sturm's separation and Sturm's comparison theorem. K1 (3)
- 3) State the Lipschitz theorem and discuss the uniqueness of solution of K2 (4)
the initial value problem, $\frac{dy}{dx} = x^2 + y^3, y(0) = 1.$
- 4) Define Bessel's equation and find its solution. K2 (6)
- 5) Developed the formula for successive approximation for first order K3 (6)
initial value problem.
- 6) Apply the series solution method and find the solution of K3 (9)
 $4xy'' + 2y' + y = 0.$
- 7) State regular singular points, irregular singular points and examine the K4 (8)
singularities of the given differential equations $(x^2 + 1)y'' + xy' + xy = 0,$
- 8) Examine the successive approximations (up to three) for the problem K4 (12)
 $y' = y^2, y(0) = 1.$

OR

Analyze the solution of the given homogenous differential equations by using matrix method, K4 (12)
 $\frac{dx}{dt} = \begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix} x,$ where $x = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$