Section III

6. Solve the differential equation :

$$x^2\frac{d^2y}{dx^2}-\left(x^2+2x\right)\frac{dy}{dx}+\left(x+2\right)y=x^3e^x. \qquad \textbf{5}$$

7. Apply the method of variation of parameters to solve :

$$\frac{d^2y}{dx^2}+4y=\tan 2x. \qquad \textbf{5}$$

Section IV

8. Solve the simultaneous equations :

$$\frac{dx}{dt}+5x+y=e^t$$

and $$\frac{dy}{dt}-x+3y=e^{2t}. \qquad \textbf{5}$$

9. Solve the simultaneous equation :

$$\frac{dx}{xy}=\frac{dy}{y^2}=\frac{dz}{z\left(xy-2x^2\right)}. \qquad \textbf{5}$$

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B. A. & Hons. (Subsidiary)

EXAMINATION, 2025

(Second Semester)

(Re-appear Only)

MATHEMATICS

BM-122

Ordinary Differential Equations

Time : 3 Hours] [*Maximum Marks : 26*

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. **1** is compulsory.

(Compulsory Question)

1. (a) If $Mx + Ny \neq 0$ and the equation $Mdx + Ndy = 0$ is homogeneous, then what is the integrating factor ? **1**

(b) Define Orthogonal Trajectory. **1**

(c) What do you mean by the inverse operator $\frac{1}{f(D)}$? **1**

(d) Defne Homogeneous Linear differential equation. **1**

(e) Write the auxiliary equation of the simultaneous differential equations $\frac{dx}{dt} + y = \sin t$; $\frac{dy}{dt} + x = \cos t$. **2**

Section I

2. (a) Solve :

$$\left(x^2 + y^2 + 2x\right)dx + 2y\,dy = 0 . \quad \textbf{3}$$

(b) Solve the differential equation :

$$\sin px \cos y = \cos px \sin y + p . \quad \textbf{2}$$

3. (a) Solve the differential equation :

$$y = px + f(p) . \quad \textbf{2}$$

(b) Solve and find the complete primitive and singular solution of the equation :

$$3y = 2px - \frac{2p^2}{x} . \quad \textbf{3}$$

Section II

4. (a) Find the orthogonal trajectory for the family of curves $r = a(1 + \sin\theta)$. **3**

(b) Solve the differential equation :

$$\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = \sin 2x . \quad \textbf{2}$$

5. (a) Solve the differential equation :

$$x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4 . \quad \textbf{2½}$$

(b) Solve the differential equation :

$$(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y =$$

$$3x^2 + 4x + 1 . \quad \textbf{2½}$$