University of Information Technology & Sciences (UITS)
Faculty of Science and Engineering
Department Computer Science and Engineering
Program: B.Sc. in CSE
Mid Term Examination, Autumn 2025
Course Title: Ordinary and Partial Differential Equations
Course Code: MATH 0541121

Marks: 20   **Time: 1(One) hour**

(Answer all questions)

Q. No.	Questions	Marks

1. a) **Define** order and degree of a differential equation. Find the order and degree of the following differential equations: **[04]**

$$\text{(i)} \frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^{\frac{1}{2}} = 0 \quad \text{(ii)} \left[1 + \frac{d^2y}{dx^2}\right]^{\frac{1}{2}} = a\frac{d^2y}{dx^2} \quad \text{(iii)} \frac{d^3y}{dx^3} = \sqrt{y}$$

b) **Construct** a differential equation of the family of curve $xy = ae^{2x} + be^{-2x} + sinx$, where a and b are arbitrary constants. **[03]**

Or,

Show that the function f defined by $f(x) = 3e^{2x} - 2xe^{2x} - cos2x$ satisfies the differential equations $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = -8sinx$.

c) **Solve** the differential equation by variable separation method. **[03]**

$$(e^y + 1)cosxdx + e^y(sinx + 1)dy = 0.$$

Or

$$(x + y)^2 \frac{dy}{dx} = a^2.$$

2. a) **Define** homogeneous differential equation. Solve the IVP: **[06]**

$$\left(y + \sqrt{x^2 + y^2}\right)dx - xdy = 0, \; y(3) = 4.$$

Or

$$\left(ycos\left(\frac{y}{x}\right) + ysin\left(\frac{y}{x}\right)\right)y - \left(ysin\left(\frac{y}{x}\right) - xcos\left(\frac{y}{x}\right)\right)x\frac{dy}{dx} = 0, \; y(1) = 4.$$

b) **Verify** $ysin2x \, dx - (1 + y^2 + cos^2x)dy = 0$, is an exact differential equation and solve it. **[04]**