National University
Of Computer & Emerging Sciences-CFD Campus

Course Code: MT-1006

Course Title: Differential Equations

Fall 2023

Quiz#3

Maximum Marks: 10

Time: 20 minutes

Date: 06-10-2023

Roll No:

Name:

Q.1 Identify the type of differential equation $xy'+(1+x)y=e^{-x}\sin 2x$ and solve.

$x y' + (1+x)y = e^{-x}\sin 2x$ Linear equation in general Form.

or

$$\frac{dy}{dx} + \frac{(1+x)}{x}y = \frac{e^{-x}\sin 2x}{x}$$

$$\frac{dy}{dx} + \left(\frac{1}{x}+1\right)y = \frac{e^{-x}\sin 2x}{x} \quad \text{— (A)}$$

Here $P(x) = \frac{1}{x}+1$

Multiply eq (A) by I.F

$$x e^x \frac{dy}{dx} + \left(\frac{1}{x}+1\right)x e^x y = x e^x e^{-x}\sin 2x$$

or $x e^x \frac{dy}{dx} + (1+x)e^x y = \sin 2x$

$$\frac{d}{dx}\left(x e^x \cdot y\right) = \sin 2x$$

Apply integration

$$\Rightarrow (x e^x \cdot y) = \int \sin 2x \, dx$$

$$x e^x \cdot y = \frac{-\cos 2x}{2} + C$$

or $y = \frac{1}{x e^x}\left[-\frac{\cos 2x}{2} + C\right]$

$\int P(x)dx = \int \left(\frac{1}{x}+1\right)dx$

$= \ln x + x$

I.F $= e^{\int P(x)dx}$

$= e^{\ln x + x}$

$= e^{\ln x} \cdot e^x$

$\boxed{I.F = x e^x}$