National University of Sciences and Technology
NUST Institute of Civil Engineering

Course Title: Linear Algebra & ODE **Course Code: Math-121**
Instructor Name: Dr. Muhammad Israr **Assignment-3**
Class: UG CE-2023 **Date of Submission: 07- Mau, 2024**

Q1: Find a general solution. Show the steps of derivation. Check your answer by substitution.

i. $y' = (y + 4x)^2$ hint : set u = y/x

ii. $xy' = y + 2x^3 sin^2\left(\frac{y}{x}\right)$ hint : set u = y/x

iii. $xy' = y + 3x^4 cos^2\left(\frac{y}{x}\right)$ $subject\ to\ y(1) = 0,$ hint : set u = y/x

Q2: Solve the given differential equation by separation of variable.

i. $\sec y \frac{dy}{dx} + \sin(x - y) = \sin(x + y)$

ii. $\frac{dx}{dy} = 4(x^2 + 1),$ $x\left(\frac{\pi}{4}\right) = 1$

iii. $y' + 2y = 1,$ $y(0) = \frac{5}{2}$

Q3: Determine whether the given equation is exact. If it is exact, solve it.

i. $(x + y)(x - y)dx + x(x - 2y)dy = 0$

ii. $(y \ln y - e^{-xy})dx + \left(\frac{1}{y} + x \ln y\right)dy = 0$

iii. $(e^x + y)dx + (2 + x + ye^y)dy = 0,$ $y(0) = 1$

iv. $(y^2 \cos x - 3x^2 y - 2x)dx + (2y \sin x - x^3 + \ln y)dy = 0$ $y(0) = e$