National University of Computer and Emerging Sciences
Lahore Campus

Differential Equation (MT1006)

Sessional-II Exam

Date: April 4st 2024
Course Instructor(s)
Mr. Jawad Wazir

Total Time (Hrs):	1
Total Marks:	30
Total Questions:	3

Roll No   Section   Student Signature

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Attempt all the questions.

CLO #: 02 Introduce the basic concepts, notions, Formulation of the DEs with applications.

Q1: Solve the given initial-value problem. Use a graphing utility to graph the continuous function $y(x)$. **[10 marks]**

$$\frac{dy}{dx} + 2y = f(x), \qquad y(0) = 0 \text{ where,}$$

$$f(x) = \begin{cases} 1, & 0 \leq x \leq 1 \\ -1, & x > 1 \end{cases}.$$

CLO #: 03 Solution of some basic ODE's like Linear, Exact, Bernouli etc.

Q2: (a) Check that the given differential equation is exact. If yes, then by using the initial condition and following method find the value of "c". **[5 marks]**

$$(5y - 2x)y' - 2y = 0, \ y(0) = 2.$$

Q2: (b) In the study of population dynamics one of the most famous models for a growing but bounded population is the **Logistic equation,**

$$\frac{dP}{dt} = P(a - bP)$$

Where a and b are positive constants. Solve the DE this first time using the fact that it is a **Bernoulli equation.** **[5 marks]**

Q2: (c) A **100-volt** electromotive force is applied to an RC series circuit in which the resistance is **200** ohms and the capacitance is 10^{-4} farad. Find the charge $q(t)$ on the capacitor if $q(0) = 0$. Find the current $i(t)$. **[5 marks]**

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CLO #: 04 Existence/Independence of solutions of Initial/Boundary value problems for second & higher order ODE's through different techniques.

Q3: Find an interval centered about $x = 0$ for which the given initial-value problem has a unique solution. **[5 marks]**

$$(x - 2)y'' + 3y = x, \quad y(0) = 0 \text{ and } y'(0) = 1.$$

Good Luck!