University of Central Punjab
FOIT
Mid Term Exam

Course Title: Differential Equations - (All Sections)

Course Instructors: Dr. Zain-al-Abadin, Rohsha Tahir, Mahnoor Akram, Muhammad Abdullah			
Course Code: CSSS2763	**Marks: 30**	**Time: 1.5 hr.**	**Semester: Spring 2022**

Name: **Registration Number:**

INSTRUCTIONS
1. Write your name and registration number on the Question Paper and Answer Sheet.
2. Write with blue/black permanent ink pen.
3. All your rough work and calculations should also be available on the answer sheet.
4. Make sure your calculator is in radian mode. Exchange of calculators is not allowed.
   - **No cheat sheet, notes, handbooks or any kind of sharing allowed.**

Q1. Marks: [3+3+4]

a. State the order, degree, dependent variable, and independent variable of the following differential equation. Also check its linearity.

$$[e^{w}\sin(w)]dy - [5y^{2}\sin(y)]dw = 0$$

b. Construct a first order separable ordinary differential equation with t and y as the independent and dependent variable respectively. And find its solution.

c. Find the value of A so that the following differential equation is exact.

$$(6xy^{3} + \cos(y))dx + (2Ax^{2}y^{2} - x\sin(y))dy = 0$$

Q2. Marks: [4+6]

a. Check whether the following differential equation is exact or not.

$$\left(\frac{1}{t} + \frac{1}{t^{2}} - \frac{y}{t^{2}+y^{2}}\right)dt + \left(ye^{y} + \frac{t}{t^{2}+y^{2}}\right)dy = 0$$

b. Solve the following linear initial value problem.

$$(1+x)y' - y = \frac{x+1}{x} \quad ; \quad y(2) = 2$$

Q3. Marks: [10]

A thermometer reading 70° F is placed in an oven preheated to a constant temperature. Through a glass window in the oven door, an observer records that the thermometer reads 110° F after 0.5 minute and 145° F after 1 minute.

a. Write the differential model and its solution for the given scenario.
b. How hot is the oven?
c. What will be the temperature on thermometer after 5 minutes?

Note:

Formula for Integration by Parts:

$$\int uv\,dx = u\int v\,dx - \int u'\left(\int v dx\right) dx$$