



COMSATS University Islamabad (CUI)
Park Road, Tarlai Kalan, Islamabad, 45550, Pakistan
Department of Electrical & Computer Engineering
Terminal Exam, Fall 2024

Class: BEE-3B, BCE-3B
Subject: Differential Equations
Instructor: Dr. Nadia Wajid

Date: 10th Jan 2025
Time Allowed: 3 hours
Marks: 50

Instructions: -

- Answer all questions.
- Make sure the question numbers in your answer book align with those in the question paper.

Ques. 1:
Solve the initial value problem

$$\frac{dy}{dx} = \cos(x + y), \quad y(0) = \pi/4 \quad (07)$$

Ques. 2:

A 30-volt electromotive force is applied to an LR -series circuit in which the inductance is 0.1 henry and the resistance is 50 ohms. Find the current $i(t)$ if $i(0) = 0$. Also, determine current as $t \rightarrow \infty$.

Ques. 3:

Solve the given system of differential equations by systematic elimination.

$$\begin{aligned} \frac{dx}{dt} - 4y &= 1 \\ \frac{dy}{dt} + x &= 2 \end{aligned}$$

Ques. 4:

Find the charge on the capacitor in an LRC -series circuit when $L = \frac{1}{2}$ h, $R = 10 \Omega$, $C = 0.01$ f, $E(t) = 105$ V, $q(0) = 1$ C, and $i(0) = 0$ A. What is the charge on the capacitor after a long time?

Ques. 5:

Determine the ordinary and singular points of the given differential equation.

$$(x^2 - 1)y'' + xy' - y = 0$$

Also, find two power series solutions about the point $x = 0$.

Ques. 6:

(a): Classify the given partial differential equation $u_{xx} - u_{xy} - 3u_{yy} = 0$ as hyperbolic, parabolic, or elliptic.

(b): A rod of length L coincides with the interval $[0, L]$ on the x -axis. The left end is held at temperature zero, and the right end is insulated. The initial temperature is $f(x)$ throughout. Set up the boundary-value problem for the temperature $u(x, t)$.

Ques. 7:

Solve the Wave equation

$$\begin{aligned} \frac{\partial^2 u}{\partial x^2} &= \frac{\partial^2 u}{\partial t^2}, & 0 < x < \pi, t > 0, \\ u(0, t) &= 0, u(\pi, t) = 0, & t > 0, \\ u(x, 0) &= 0, & \frac{\partial u}{\partial t} \Big|_{t=0} = \sin x. \end{aligned}$$