



ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF NATURAL SCIENCES

Term: Midterm Examination
 Course Number: Math 4337
 Course Title: Engineering Mathematics I

Winter Semester: 2024-2025
 Full Marks: 120
 Time: 2 hours

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 4 (Four)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. a) Define the Ordinary Differential Equations (ODE) and Partial Differential Equations (PDE) with example. (5)
 (CO1)
 (PO1)
- b) Form the differential equation by eliminating arbitrary constants in the following cases. (5+8+12)
 (CO1)
 (PO1)
- a) $y = Ax + A^2$
 b) $y = A \cos x + B \sin x$
 c) $y = C_1 e^{2x} + e^{2x}(C_2 \cos x + C_3 \sin x)$

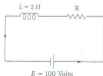
2. a) Define linear and non-linear Differential equations. (6)
 (CO1)
 (PO1)
- b) Write down the order and degree of the following differential equations, also mention if the differential equation is linear or non-linear. (9)
 (CO1)
 (PO1)
- (i) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3\frac{dy}{dx} + 2y = e^x$
 (ii) $(x^4 + 2x^3)\frac{d^2y}{dx^2} + (3x^2 - x)\frac{dy}{dx} + y = 0$
 (iii) $\left(\frac{dy}{dx}\right)^2 + y\frac{d^2y}{dx^2} = x^2$

- c) Solve the given linear differential equation $(x + 1)\frac{dy}{dx} - y = e^x(x + 1)^2$ (15)
 (CO1)
 (PO1)

3. a) Solve the given differential equation by using separation of variables: (10)
 (CO1)
 (PO1)

$$dx - dy + (\sin 2y + \cos 2y)dx - (\sin 2x + \cos 2x)dy = 0$$

- b) A series circuit is given in the picture. If the current is zero when $t = 0$, find the current at the end of 0.01 sec if $E = 100$ volts, and $R = 20$ ohms, using differential equation.



(10)
 (CO2)
 (PO1)

- c) Find the PDE by eliminating constants h and k from the given equation

$$(x - h)^2 + (y - k)^2 + z^2 = w^2$$

(10)
(CO1)
(PO1)

4. a) What is a vector quantity? Define the scalar product and the vector product of two vectors.

(6)
(CO1)
(PO1)

- b) If $\vec{a} = 6\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 4\hat{i} + \hat{j} - 8\hat{k}$, find the magnitudes of \vec{a} and \vec{b} . Also compute their dot product and the angle between them.

(10)
(CO2)
(PO1)

- c) Verify that

$$\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c}) \vec{b} - (\vec{a} \cdot \vec{b}) \vec{c},$$

(14)
(CO2)
(PO1)

when the given vectors are

$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} - \hat{j} + \hat{k}, \vec{c} = 3\hat{i} + 2\hat{j} - 5\hat{k}.$$

THE END