(4)

B.Sc.Engg. EEE/1st Sem. Date: 06/04/2026 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF NATURAL SCIENCES

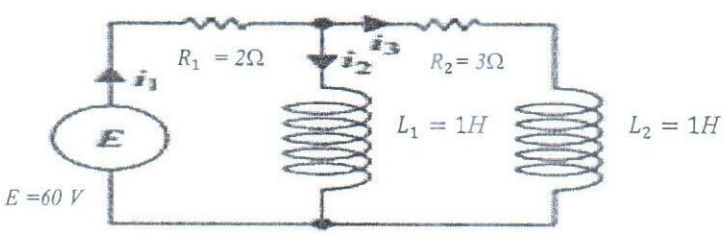
Final Semester Examination **Winter Semester**: 2024-2025
Course Code: MATH 4123 **Full Marks**: 120
Course Title: Matrix and Differential Equations **Time**: 2 Hours

Please answer according to the order of the questions. Answer all the **4 (FOUR)** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in the brackets. *Programmable calculators are not allowed. Do not write on this question paper.*

1.(a) Reduce the quadratic form $q = x_1^2 + 5x_3^2 + 4\,x_1x_2 + 6x_1\,x_3 + 8x_2\,x_3$ to the canonical form and find rank, index and signature of the form. **(18)** (CO1) (PO1)

(b) Find the LU factorization of the matrix $A = \begin{bmatrix} 3 & -6 & 3 \\ 6 & -7 & 2 \\ -3 & 1 & 0 \end{bmatrix}$ **(12)** (CO1) (PO1)

2.(a) Using the matrix method to find the currents $i_2(t)$ and $i_3(t)$ in an electrical network shown in figure given below **(20)** (CO3) (PO1)



The currents $i_2(t)$ and $i_3(t)$ are initially zero.

(b) Solve: $\left(D_x^3 - 4D_x^2D_y + 4D_xD_y^2\right)z = e^{2x+y} + sin(x+y)$. **(10)** (CO3) (PO1)

3.(a) Find the partial differential equation by eliminating the arbitrary function from the equation $\varphi(xy,\ x^4 - z^4 - 2xyz^2) = 0$. **(10)** (CO3) (PO1)

(b) Solve: $(1-x^2)(px - z) + (2x^3 - x^2y + y)q = 0$. **(10)** (CO3) (PO1)

(c) Solve: $(4x + y - z)p + (x + y - z)q = 3(z - y)$. **(10)** (CO3) (PO1)

4.(a) Solve the differential equation $[(x+2)D^2-(2x+5)D+2]y=(x+1)e^x$ by the method of factorize the operator. **(15)** (CO2) (PO1)

(b) Solve the boundary value problem $\frac{\partial^2 v}{\partial t^2}=c^2\frac{\partial^2 v}{\partial x^2}$ under the following conditions: **(15)** (CO3) (PO1)

$$v(0,t)=v(\pi,t)=0;$$

$$\left(\frac{\partial v}{\partial t}\right)_{t=0}=0,\quad v(x,0)=\sin x,\quad 0<x<\pi.$$

******THE END******