B.Sc. Engg. CSE 1st Semester

09 October 2023 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2022-2023**

DURATION: 1 HOUR 30 MINUTES — **FULL MARKS: 100**

Math 4141: Geometry and Differential Calculus

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

Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) Through what angle must the axes be rotated to remove the term containing xy in $11x^2 + 4xy + 14y^2 = 5$? What is the transformed equation? — 15 (CO1) (PO1)

   b) Transform the equation $3x^2 + 2xy + 3y^2 - 18x - 22y + 50 = 0$ to one in which there is no term involving x, y, and xy. — 18 (CO1) (PO1)

2. a) Given $2x^2 + 7xy + 3y^2 + 8x + 14y + 8 = 0$, answer the following questions: — 7×3 (CO1) (PO1)
   i. Show that the given equation represents a pair of straight lines.
   ii. Find the equations of the lines.
   iii. Find the point of intersection and the angle made by the lines.

   b) Under which condition the pair of straight lines joining the origin to the points of intersections of the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by the line $lx + my + n = 0$ are coincident? — 13 (CO1) (PO1)

3. a) Define and discuss direction cosines and direction ratios for a line. Find conditions for which the lines whose direction cosines are given by the equations $l + m + n = 0$ and $al^2 + bm^2 + cn^2 = 0$ are perpendicular and parallel. — 13 (CO1) (PO1)

   b) If (l_1, m_1, n_1) and (l_2, m_2, n_2) are the direction cosines of two mutually perpendicular lines, find the direction cosines of the line perpendicular to them. — 10 (CO1) (PO1)

   c) A line makes angles $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube. Find the value of : — 10 (CO1) (PO1)

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta$$