B.Sc. Eng. EEE/1st Sem. Date: 10 April 2026 (Afternoon)

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

Semester Final Examination — Winter Semester, A. Y. 2024-2025
Course Code: Math 4121 — Time: 2 hours
Course Title: Mathematics I (Calculus and Geometry) — Full Marks: 120

There are 4 (**four**) questions. Answer all 4 (**four**) questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets

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1.a) Find the centre of curvature and radius of curvature of the curve $x = a(cost + tsint), y = a(sint - tcost)$ at $t = \frac{\pi}{2}$. **(10+10)** (CO3) (PO1)

b) Evaluate $\int_0^1 \frac{ln(1+x)}{1+x^2} dx$ **(10)** (CO3) (PO1)

2.a) For a given curved surface of a right circular cone when the volume is maximum, show that the semi-vertical angle is $sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$. **(10)** (CO2) (PO1

b) Explain different tests for the point of inflection of the curve y=f(x). Test the function $y = x^5 - 5x^4 + 5x^3 - 1$ for point of inflection at x=0 using first derivative test and higher derivative test. **(10+10)** (CO2) (PO1)

3.a) Find the formula for the length of the curve $r = f(\theta)$. Find the perimeter of the hypocycloid **(5+10)** (CO2) (PO1)

$\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$

b) The curve $y^2(2a - x) = a^2x$ revolves about its asymptotes, find the volume. **(15)** (CO2) (PO1)

4.a) Derive Simpson's formula of integration. Evaluate $\int_1^2 e^{-2x}\sqrt{sin2x}$ dx using this formula taking 12 subintervals. **(10+10)** (CO1) (PO1)

b) Define Beta and Gamma function.
Evaluate $\int_0^\infty e^{-x^2}\sqrt{x}dx$. **(10)** (CO3) (PO1)