B.Sc. Engg.(EE), 1st Sem. Date: 04 September, 2021
Time: 02:30 pm – 04:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination Winter Semester: 2020-2021
Course No.: Math 4121 Time: 90 Minutes
Course Title: Mathematics-I Full Marks: 75

There are **4 (four)** questions. Answer **any 3 (three)** questions. The symbols have their usual meanings. The examination is **Online**. Marks of each question and corresponding CO and PO are written in the brackets.

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1. a) Explain (i) translation of axes and (ii) rotation of axes to find the equations of transformations. (13) (CO1) (PO1)

   b) Identify the curve $64x^2 - 96xy + 36y^2 - 44x - 92y - 9 = 0$ and reduce it to its standard form. (12) (CO1) (PO1)

2. a) State L'Hospital's theorem and use it to evaluate $\underset{x\to 0}{Lt}\left[\frac{1}{x^2} - \frac{1}{\sin^2 x}\right]$ (13) (CO2) (PO2)

   b) If $y = \left(\sin^{-1}\sqrt{1-x}\right)^2$ then find the relationship between y_{n+2}, y_{n+1} *and* y_n. (12) (CO2) (PO2)

3. a) If $u = \cot^{-1}\frac{\sqrt[3]{x^5} + \sqrt[3]{y^5}}{\sqrt[3]{x^{10}} + \sqrt[3]{y^{10}}}$ then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ using Euler's theorem. (13) (CO1) (PO1)

   b) Find the sum of the intercepts of the tangents to the curve $\sqrt{x} + \sqrt{y} = \sqrt{5}$ upon the coordinate axes. (12) (CO2) (PO2)

4. a) Discuss the first derivative test for maximum and minimum of a function. Find the altitude of the right circular cone of maximum volume that can be inscribed in a sphere of radius 6 inches. (13) (CO3) (PO12)

   b) Find the formula for the radius of curvature of the curve whose parametric equations are x=x(t), y=y(t). Determine the centre of curvature of the curve $x = a(\theta - \sin\theta),\ y = a(1 - \cos\theta)$ *at* $\theta = \frac{\pi}{2}$. (12) (CO3) (PO12)