

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

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination
Course No.: Math 4121
Course Title: Mathematics I

Winter Semester, A. Y. 2022-2023
Time: 90 minutes
Full Marks: 75

There are 3 (**three**) questions. Answer all 3 (**three**) 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

1. a) Identify the curve $16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$ and reduce it to standard form. (12)
(CO1)
(PO1)
- b) Differentiate $(x^2 - 1)y_2 + 2(1 - n)xy_1 - 2ny = 0$ n times by Leibnitz theorem to find the relation between y_{n+2} , y_{n+1} and y_n . (13)
(CO2)
(PO1)
2. a) If $u = (ax + by + cz)^2 - (x^2 + y^2 + z^2)$ and $a^2 + b^2 + c^2 = 10$ find the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} - 14$. (12)
(CO2)
(PO1)
- b) If the tangent at (x_1, y_1) to the curve $x^2 + y^2 = a^2$ meets the curve again in (x_2, y_2) , show that $\frac{y_2}{x_2} + \frac{y_1}{x_1} = -1$. (13)
(CO3)
(PO2)
3. a) Find the altitude of the right cone of maximum volume that can be inscribed in a sphere of radius a . (12)
(CO3)
(PO2)
- b) Find the radius of curvature of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ at any point (x, y) . (13)
(CO1)
(PO1)