BBA in TM, 3rd Sem. Date: December 22, 2023 (Morning)

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

DEPARTMENT OF BUSINESS AND TECHNOLOGY MANAGEMENT

Semester Final Examination
Course No. : Math 4361
Course Title : Mathematics II

Winter Semester, A. Y. 2022-2023
Time : 3 hours
Full Marks : 150

Answer **all 6 (six)** questions. All questions carry equal marks. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

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1. a) Evaluate the indefinite integral $\int e^x \sin x\, dx$ through repeated integration by parts. 09 (CO3) (PO2)

   b) Evaluate the integrals: (i) $\int x^2 \sqrt{x-1}\, dx$ (ii) $\int_{-3}^{0}\left(2+\sqrt{9-x^2}\right)dx$ 08 (CO3) (PO2)

   c) Sketch the region whose area is represented by the definite integral $\int_{0}^{4}\sqrt{16-x^2}\, dx$, and evaluate the integral using an appropriate formula from geometry. Also find the area by using calculus. 08 (CO3) (PO2)

2. a) Solve the initial (boundary) value problem $\frac{dy}{dt}=\frac{3}{\sqrt{1-t^2}};\ \ y\left(\frac{\sqrt{3}}{2}\right)=0.$ 12.5 (CO3) (PO3)

   b) Verify Mean Value theorem (MVT) for $f(x)=\sqrt{49-x^2}$ in the interval [-7, 3]. 12.5 (CO3) (PO4)

3. a) Find the area of the region enclosed by $x = 2 - y^2$ and $y = -x$. 12.5 (CO3) (PO4)

   b) Find the total area between the curve $y = 1 - x^2$ and the x-axis for the interval [0, 2]. 12.5 (CO3) (PO4)

4. a) Discuss the fixed-point iteration method for finding a real root of the equation $f(x)=0$. Use this method to find a real root of $f(x)=x^3+x^2-1=0$ correct up to 2-decimal points. 12.5 (CO4) (PO4)

   b) Discuss the Newton-Raphson's method for finding a real root of the equation $f(x)=0$. Use this method to find a real root of $f(x)=e^x-x^2+3x-2=0$ in [0, 1] correct upto 2-decimal places. 12.5 (CO4) (PO4)

5. Given points (x , $f(x)$) as (1, 1) , (2, 8) , (3, 27) , (4, 64) , (5, 125) , (6, 216) , (7, 343) and (8, 512). 25 (CO3) (PO4)

   (i) Use Newton's Forward difference interpolation formula to find $f(2.5)$.

   (ii) Use Newton's Backward difference interpolation formula to find $f(7.5)$.

6. a) Derive Euler's Method for solving 1st order differential equation. Use this method to solve $\frac{dy}{dx} = x + y, \quad y(0) = 1 \quad at \quad x = 0.05, \quad x = 0.1$ taking $h = 0.05$. 12.5 (CO4) (PO5)

b) Derive 2nd order Runge-Kutta Method for solving 1st order ordinary differential equation. Use this method to find $y(0.4)$ from the IVP $5\frac{dy}{dx} = x^2 + y^2, \; y(0) = 0$ and $h = 0.2$. 12.5 (CO4) (PO5)