International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B.Sc. Engineering in EEE

Midterm Examination, Spring 2024

Course Code: **MATH 1107** Course Title: **Mathematics- I**

Time: 1 hour 30 minutes Full Marks: 30

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.

(ii) Course Outcomes (COs) and Bloom's Levels (BL) are mentioned in additional Columns.

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions	
CO	**CO Statements**
CO1	For engineering problems, it is essential to get Knowledge of the limit, continuity, and differentiability, power series, Rolle's Theorem, Mean value theorem, Taylor, and McLaurin series.
CO2	By applying the method of partial differential (PD) to recognize the optimal value of the model equations.
CO3	Implementing the mathematical problems by applying the definite and indefinite along with the surface and volume integration expresses engineering problems.

Bloom's Levels (BL) of the Questions						
Letter Symbols	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

1) a) i). Define differentiability of a function.Test the differentiability of $f(x)$ at $x = 0$ where $f(x) = \begin{cases} x^2 sin\frac{1}{x}, & when\ x \neq 0 \\ 0, & when\ x = 0 \end{cases}$ CO1 C5 3

ii). Differentiate $cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ with respect to $sin^{-1}(\frac{2x}{1+x^2})$ CO1 C3 2

1) b) If $y = f(x) = \begin{cases} 2 & if\ x \leq 3 \\ ax + b & if\ 3 < x < 5 \\ 6 & if\ x \geq 5 \end{cases}$ CO1 C3 5

check the limit at $x = 3$ and the continuity at $x = 3$. Where a and b are any real constant.

2) a) If $y = \frac{x^2}{(x+1)(x+3)}$, then derive the nth derivative y_n. CO1 C3 5

2) b) State Leibnitz's theorem. If $y\sqrt{1-x^2} = sin^{-1}x$ then prove that $(1-x^2)y_{n+1} - (2n+1)xy_n - n^2y_{n-1} = 0$ CO1 C1 C3 5

3)	a)	Verify Rolle's theorem for the function $f(x) = x\left(x+\frac{1}{2}\right)e^{-\frac{x}{3}}$ in the interval $[-\frac{1}{2}, 0]$.	CO1	C3	5
3)	b)	Derive the Maclurin's theorem from the Taylors theorem, and thenderive the series of $f(x) = \tan(ax)$ by applying Maclurin's theorem. Where a is any real number.	CO1	C3	5

OR

3)	a)	State Rolle's theorem and verify this theorem for the function $f(x) = x^2 - 8x + 15$	CO1	C3	5
3)	b)	State Taylor's theorem and expand $sinx$ in powers of $\left(x-\frac{\pi}{2}\right)$ using this theorem.	CO1	C3	5