International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Midterm Examination, Spring 2025

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 are mentioned in additional Columns.

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions		
CO	**CO Statements**	**PO**
CO1	Understanding (C2) the elementary concepts of differential and integral calculus.	**POa**
CO2	Apply (C3) the differential calculus in differentiability, partial differentiation, and general theorems.	**POa**
CO3	Apply (C3) the integral calculus to solve the problems of the gamma-beta function and reduction formula and determine the curve's length, area, and volume.	**POa**

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)	Differentiate x^x with respect to $sinx^{cosx}$	CO2	C3	3
		ii)	Using L'Hospital rule to determine $\lim_{x\to 0} \frac{x-tanx}{x^2}$	CO2	C3	2
1)	b)		A function $f(x)$ is defined in the following way: $$f(x) = \begin{cases} -x & when \quad x \leq 0, \\ x & when\ 0 < x < 1, \\ 2-x & when \quad x \geq 1. \end{cases}$$ Show that it is continuous at $x = 1$ and then justify its differentiability at $x = 1$.	CO1	C3	5
2)	a)		If $y = (ax+b)^m$, where m is any positive real number then prove that $y_n = \frac{m!}{(m-n)!} a^n (ax+b)^{m-n}$.	CO1	C3	5
2)	b)		State Leibnitz's theorem. If $y\sqrt{1-x^2} = sin^{-1}x$ then prove that $(1-x^2)y_{n+1} - (2n+1)xy_n - n^2 y_{n-1} = 0$	CO1	C3	5
3)	a)		State Maclaurin's Theorem. and using this theorem to expand $\ln(1+x)$	CO2	C3	5
3)	b)		State Mean Value theorem and verify this theorem for the function $f(x) = 3 + 2x - x^2$ in the interval $[0,1]$	CO2	C3	5

OR

)	a)	Define Rolle's theorem and if $f(x) = x(x+4)e^{-\frac{x}{3}}$, where $[-4,0]$ then verify Rolle's theorem.	CO2	C3	5
3)	b)	Define Taylors theorem and if $f(x) = x(x-1)(x-3);$ in the $\left(0,\frac{1}{3}\right)$, then verify Mean value theorem.	CO2	C3	5