International Islamic University Chittagong (IIUC)
Department of Computer Science and Engineering (CSE)
Mid Term Examination

Program: B. Sc. in CSE | **Semester: Spring-2024**
Course Code: MATH-1107 | **Course Title: Mathematics-I**
Time: 1:30 hours | **Total Marks: 30**

(i)	Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii)	Please answer the several parts of a question sequentially.
(iii)	Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

CLO1:	Compute the functions, limit and continuity of a function, derivatives, integrals and extrema of single-variable and/or multivariable functions.
CLO2:	Understand the techniques of differentiation and integration.

Bloom's Taxonomy Domain Levels of the Questions

Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

			Marks	**CLOs**	**DLs**
1.	a)	Find the Maclaurin Series for the function $f(x) = \log(1+x)$	**2**	**CLO1**	**U**
	b)	Find the domain and range of the function, $f(x) = \lvert x+3 \rvert + \lvert x-3 \rvert$	**2**	**CLO1**	**U**
	c)	Test the differentiability of the following function at $x = \frac{3}{2}$	**3**	**CLO1**	**App**

$$f(x) = 3 + 2x; \quad -\frac{3}{2} \le x < 0$$

$$= 3 - 2x; \quad 0 \le x \le \frac{3}{2}$$

$$= -3 - 2x; \quad x \ge \frac{3}{2}$$

Or

Test the differentiability of the following function at $x = 0$

$$f(x) = 1; \quad x < 0$$

$$= 1 + \sin x; \quad 0 \le x < \frac{\pi}{2}$$

$$= 2 + (x - \frac{\pi}{2})^2; \quad x \ge \frac{\pi}{2}$$

d)	Evaluate the limit using L'Hospitals rules for $\lim_{x\to 0} \frac{\tan x - \sin x}{x^3}$	3	CLO1	U
	Or			
	Differentiate $\tan^{-1}\frac{2x}{1-x^2}$ with respect to $\sin^{-1}\frac{2x}{1+x^2}$.			
2. a)	Find the differential co-efficient of $\sin x$ by the first principle method.	3	CLO2	U
b)	If $y = \log\sec(ax+b)^3$, find $\frac{dy}{dx} = ?$	3	CLO2	U
c)	The radius of a circle increases at a rate of 3 cm/sec. Find the rate of change of the area when i) the radius is 5 cm ii) the area is 4π cm^2	4	CLO2	App
3. a)	If $y = x^n \log x$;Prove that $y_{n+1} = \frac{n!}{x}$	6	CLO2	App
b)	Suppose we are asked to determine whether Rolle 's Theorem can be applied to $f(x) = x^4 - 2x^2$ on the closed interval [-2, 2]. And if so, find all values of c in the interval that satisfies the theorem	4	CLO2	R&U
	Or			
	Verify the Mean Value Theorem for $f(x) = 2x^3 - 8x + 1$ when $a = 1$ and $b = 3$		CLO2	R&U