Examination Confidential

বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি (বাইউস্ট), কুমিল্লা
BANGLADESH ARMY INTERNATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAIUST), CUMILLA

Mid Term Examination, Spring 2025

Department of Computer Science and Engineering (CSE)
Level- 1, Term-I
Course Code: MATH-111/141 (retake)
Course Title: MATH I (Differential Calculus, Integral Calculus and Matrix)
Credit Hour: 03

Notes:

a. Figure on the right of each question indicate marks for respective question. **Time : 1 hr 30 mins**
b. Answer any **three (03)** of the following **four (04)** questions **Full Marks: 90**

---

1. a. A function $f(x)$ is defined as follows- 10

$$f(x)=\begin{cases} 1+2x & \text{for } -1/2\le x\le 0 \\ 1-2x & \text{for } 0\le x<1/2 \\ -1+2x & \text{for } x\ge 1/2 \end{cases}$$

Discuss the continuity of the function at $x=0$.

b. **Determine** the value of $\lim\limits_{x\to-\infty}\dfrac{4x^2-x}{2x^3-5}$. 08

c. A function $f(x)$ is defined as follows- 12

$$f(x)=\begin{cases} 5x-4 & \text{when } 0<x\le 1 \\ 4x^2-3x & \text{when } 1<x<2 \\ 3x+4 & \text{when } x\ge 4 \end{cases},$$

Describe the differentiability of $f(x)$ at $x=1$.

2. a. If $y^{\frac{1}{m}}+y^{\frac{-1}{m}}=2x$, **show** that $\left(x^2-1\right)y_2+xy_1-m^2y=0$ 10

b. Compute the nth derivative of $y=\log(ax+b)$. 08

c. If $\log y=\tan^{-1}x$, then **show** that (i) $\left(1+x^2\right)y_2+(2x-1)y_1=0$ 12
(ii) $\left(1+x^2\right)y_{n+2}+(2nx+2x-1)y_{n+1}+n(n+1)y_n=0$

3. a. **Express** the two x-intercepts of the function $f(x)=x^2-5x+4$ and clarify that 08
$f'(c)=0$ at some point c between those intercepts.

b. **Explain** Mean Value theorem for the function $f(x)=(x-1)(x-2)(x-3)$ in the interval $(0,4)$. 10

c. **Find** the Maclaurin polynomials $p_0, p_1, p_2, p_3,$ and p_n for e^x. 12

4. a. **Extend** the Taylor's series for $f(x)=x^3+2x^2-1$ at $x=2$. 12

b. **Explain** the Maclaurin series for $\sec x$ up to x^4. 10

c. **Show** that $\log(1+x)^{1+x}=x+\frac{1}{2}x^2-\frac{1}{6}x^3+.....$ 08