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-II
Course Code: MATH 121
Course Title: MATH-II
Credit Hour: 03

Notes:

Time : 1 hr 30 mins
Full Marks: 90

a. Figure on the right of each question indicate marks for respective question.
b. Answer any **three (03)** out of the following **four (04)** questions including **question No.1**

1. a. **Express** the Fourier series for $f(x)$ in the interval $(-\pi,\pi)$ where **12**

$$f(x)=\begin{cases}\pi+x, & -\pi<x<0\\ \pi-x, & 0<x<\pi\end{cases}.$$

and **show** that $\frac{\pi^2}{8}=1+\frac{1}{3^2}+\frac{1}{5^2}+\ldots$

b. **Estimate** the Fourier series for $f(x)=x^2$ within the interval $-\pi<x<\pi$. **08**

c. **Illustrate** the complex form of Fourier series for the function $f(x)=e^x$ when $-\pi<x<\pi$. **10**

2. a. Suppose two vectors are $\vec{A}=3\vec{i}-3\vec{j}+2\vec{k}$ and $\vec{B}=5\vec{i}-2\vec{j}+4\vec{k}$. **Determine** **10**

(a) The angle between $\vec{A}$ and $\vec{B}$.

(b) The projection of $\vec{B}$ on $\vec{A}$.

b. A particle moves along the curve whose parametric equations are $x=40t^2+8t$, **12**
$y=2\cos 3t$, $z=2\sin 3t$ where t is the time. **Calculate**

(a) the magnitude of $\vec{v}$ and $\vec{a}$ at any time t.

(b) the velocity and acceleration at $t=\pi/2$.

c. Suppose $\varphi(x,y,z)=xy^2z$ and $\vec{A}=x\vec{i}+\vec{j}+xy\vec{k}$. **Find** $\frac{\partial^2}{\partial x\,\partial y}(\varphi\vec{A})$ at the point **8**
$P(1,0,1)$.

3. a. **Examine** Green's theorem $\oint_C \{(3x^2-8y^2)\,dx+(4y-6xy)dy\}$ in the plane where C is the closed boundary of the region bounded by $x=0$, $y=0$ and $x+y=1$. 15

b. **Prove that** $(y^2-z^2+3yz-2x)\vec{i}+(3xz+2xy)\vec{j}+(3xy-2xz+2z)\vec{k}$ is both solenoidal and irrorational. If irrotational, then **determine** its gradient scalar potential. 15

4. a. Suppose $\vec{A}=-3\vec{i}+7\vec{j}+\vec{k}$, $\vec{B}=5\vec{i}-7\vec{j}+3\vec{k}$, $\vec{C}=2\vec{i}+3\vec{k}-7\vec{j}$. Then **show** that $(\vec{A}+\vec{B})+\vec{C}=\vec{A}+(\vec{B}+\vec{C})$. 08

b. Suppose, $\vec{A}=xy\vec{i}+7x\vec{j}+x^2yz\vec{k}$, $\vec{B}=x^2y\vec{i}-yz\vec{j}+3x^3\vec{k}$. **Prove** that $\frac{\partial^2}{\partial x\,\partial y}(\vec{A}.\vec{B})=\frac{\partial^2}{\partial y\,\partial x}(\vec{A}.\vec{B})$. 10

c. If $\vec{A}=(x^2+y-4)\vec{i}+3xy\vec{j}+(2xz+z^2)\vec{k}$ then by using Stoke's theorem **calculate** the value of $\iint_S(\vec{\nabla}\times\vec{F}).\vec{n}\,ds$ where S is the closed boundary of a sphere $x^2+y^2+z^2=4$ bounded by its projection on the $xy-$plane. 12