

# International Islamic University Chittagong (IIUC)

## Department of Computer and Communication Engineering

### Final Examination

Program: **B.sc (Engg.)**  
 Course Code: **MATH-2401**  
 Total Marks: **50**

Semester: **Autumn 2022**  
 Course Title: **MATHEMATICS-IV**  
 Time: **2 Hours 30 Minutes**

- (i) Answer all the questions. The figures in the right-hand margin indicate full marks.  
 (ii) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

#### Course Learning Outcomes (CLOs) of the Questions

**CLO3** Use Fourier series, Laplace's Transforms, Fourier Transform in different scenario.

Letter Symbols Meaning	Bloom's Levels of the Questions					
	R	U	Ap	An	E	C
	Remember	Understand	Apply	Analyze	Evaluate	Create

#### Part A

#### Answer Two of the following Questions.

- Q1.** Define Fourier series in the interval  $(-L, L)$ . Sketch the following function for four cycles, **CLO3** **R** **10**  
&  
**U**

$$y = f(t) = \begin{cases} -t, & -\pi < t < 0 \\ t, & 0 < t < \pi \end{cases}$$

Also find the Fourier series for the function.

- Q2. a)** Find the half – range Cosine series of  $f(x) = x(\pi - x)$ , in the interval  $(0, \pi)$ . Hence deduce that, **CLO3** **U** **5**  
&  
**E**

$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$$

- b)** Find the Fourier integral representation of the function, **CLO3** **U** **5**  
&  
**E**

$$f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$$

Hence evaluate  $\int_0^\infty \frac{\sin \omega \cos \omega x}{\omega} d\omega$ .

**OR**

- Q2.** Derive the complex form of Fourier series. **CLO3** **E** **10**

**Part B**

**Answer Three of the following Questions.**

- Q3. a)** Find the Fourier Transformation of  $f(x) = \begin{cases} 1 - x^2, & |x| \leq 1 \\ 0, & |x| \geq 1 \end{cases}$  **CLO3 U 6**  
Hence evaluate,  $\int_0^\infty \left( \frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} dx$ . **& E**
- b)** Solve:  $Y'' + Y = t$        $Y(0) = 1$        $Y'(0) = -2$  **CLO3 E 4**
- Q4. a)** Define Laplace transform. Find the Laplace Transform of  $f(t) = t^n$  **CLO3 R& E 6**
- b)** State multiplication theorem. Using the theorem Find  $\mathcal{L}\{t \cdot e^{4t}\} = ?$  **CLO3 R& E 4**
- Q5.** Find the inverse Laplace transforms of the following: **CLO3 E 10**  
i)  $\frac{1}{s-2}$       ii)  $\frac{s}{s^2-16}$       iii)  $\frac{1}{(s+3)^2-4}$
- OR**
- Q5.** State convolution theorem for inverse Laplace transform and using this evaluate  $\mathcal{L}^{-1} \left\{ \frac{s}{(s^2+1)(s^2+4)(s^2+9)} \right\}$ . **CLO3 R& E 10**