

International Islamic University Chittagong (IIUC)
Department of Electronic and Telecommunication Engineering
Semester End Examination

Program: **B.sc in ETE**
Course Code: **Math-2407**
Total Marks: **50**

Semester: **Spring2025**
Course Title: **Complex Variable, Higher Trigonometry
& Random Process**
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 Outcomes(COs)of the Questions						
CLO1	Demonstrate the basic idea of analyzing complex variable, higher trigonometry & random process, complex functions.					
CLO2	The advancement of the knowledge of Complex variables, higher trigonometry & random process, complex functions, are implemented in engineering problem interpretation and applicability by using the mathematical formulations.					

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

PART A

Q1	a)	Discuss Complex Integral (line integral) with diagram.	CLO2	R	2
	b)	Evaluate $\int_{(0,0)}^{(1,1)} (3x^2 + 4x + 3y^2)dx + 2(x^2 + 3xy + 4y^2)dy$ (a) along $y^2=x$ (b) along $y=x^2$ (c) along $y=x$	CLO2	E	8
Q2	a)	State Cauchy's integral theorem.	CLO2	U	2
	b)	Evaluate the integral $\oint \frac{dz}{z^2+9}$ where c is the circle i) $ z+3i =2$ ii) $ z =3$ iii) $ z =5$	CLO2	E	8

OR

Q2	a)	Find the Fourier series corresponding to the function $f(x)$ defined in $(-2, 2)$ as follows: $f(x) = \begin{cases} 2 & \text{in } -2 \leq x \leq 0 \\ x & \text{in } 0 < x < 2 \end{cases}$	CLO2	U	5
	b)	Find the Fourier sine series for the function $f(x) = e^{ax}$ for $0 < x < \pi$ where a is constant.	CLO2	E	5

PART B

Q3	a)	Define Pole and Residue	CLO2	U	2
	b)	Evaluate the integral $\oint \frac{\sin \pi z^2 + \cos \pi z^2 dz}{(z-1)(z-2)}$ where c is the circle $ z =3$	CLO2	Ap	8
Q4	a)	Define random process with example. Discuss different types of random variable.	CLO2	U	2

	b)	On January 1, 2025, Mobile Company A had 40% of its local market share while the other two Companies B and C had 40% and 20% respectively of the market share. Based upon a study by a market research firm the following facts were compiled: - Mobile Company A retains 90% of its customers while gaining 10% of competitor B's customer and 5% of C's customers. Mobile Company B retains 80% of its customers while gaining 8% of A's customers and 4% of C's customers. Mobile Company C retains 70% of its customers and gain 4% of A's customers as well as 2% of B's customer. a) What will each mobile company's share be on January 1, 2026? b) What will each mobile company's market share be at equilibrium?	CLO2	An	8
Q5	a)	What do you mean by Markov Analysis?	CLO2	U	2
	b)	A manager has developed the following transition matrix for a firm's accounts receivable: - P 1 2 b P $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0.5 & 0.3 & 0.2 & 0 \\ 0.3 & 0 & 0.4 & 0.3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ 1 2 b Where, p=paid, 1= 1 to 30 days overdue, 2= 1 to 30 days overdue, B=31 to days Requirements: - i. Obtain the fundamental matrix. ii. If there is currently 280,000 in accounts in the 1 Category and 120,000 in the 2 Category, determine the expected amount of bad debt and paid amount.	CLO2	E	8
OR					
Q5	a)	Calls arrive at a telephone exchange according to a Poisson process with an average rate of $\lambda=5$ calls per minute. • What is the probability of receiving exactly 3 calls in 1 minute? • What is the probability that no calls arrive in 30 seconds?	CLO2	U	2
	b)	Using Laplace Transforms, find the solution of the initial value problem $y'' + 25y = 10\cos 5t$, $y(0) = 2$, $y'(0) = 0$	CLO2	E	8