

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

Program: **B.sc in ETE**

Course Code: **Math-2407**

Total Marks: **50**

Semester: **Autumn 2023**

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 Outcomes (COs) and Bloom's Levels are mentioned in additional Columns.						
Course Outcomes (COs) of the Questions						
CLO1	Demonstrate the basic idea of analyse 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 $\int_{1-i}^{3+i} (4x + 2iy = 1)dz$ along the paths i) $x=t+1, y=2t^2-1$ ii) The straight line joining $1-i$ and $3+i$	CLO2	E	8
Q2	a)	State Cauchy's integral theorem.	CLO2	U	2
	b)	Evaluate $\oint \frac{4-3z}{z(z-1)(z-2)} dz$ where c is the circle $ z = \frac{3}{2}$	CLO2	Ap	8
OR					
Q2	a)	Show that a random process which is stationary of order n is also stationary of all order lower than n	CLO2	U/ R	5
	b)	Show that if $\{X(t), t \in T\}$ is a Strict Sense Stationary (SSS) random process, then it is also WSS.	CLO2	E	5
PART B					
Q3	a)	State Cauchy's integral formula.	CLO2	Un	2
	b)	Evaluate $\oint \frac{z-1}{(z+1)^2(z-1)} dz$ where c is the circle $ z-i = 2$	CLO2	E	8
Q4	a)	Define random process with example. Discuss different types of random variable.	CLO2	Un /R	2

	b)	On January 1, 2022, Bakery A had 50% of its local market share while the other two Bakeries B and C had 30% and 20% respectively of the market share. Based upon a study by a market research firm the following facts were compiled: Bakery A retains 90% of its customers while gaining 6% of competitor B's customers and 8% of C's customers. Bakery B retains 80% of its customers while gaining 5% of A's customers and 10% of C's customer. Bakery C retains 70% of its customers and gain 2% of A's customers as well as 4% of B's customers. a) What will each firm's share be on January 1, 2023? b) What will each firm's market share be at equilibrium?	CLO2	An	8
Q5	a)	What do you mean by Markov Analysis?	CLO2	Un	2
	b)	A manages has developed the following transition matrix for a firm's accounts receivable: - $ \begin{array}{c} p \quad \begin{array}{c} 1 \quad 2 \quad b \\ \begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0.3 & 0.2 \\ 0.3 & 0 & 0.4 \\ 0 & 0 & 0 \end{bmatrix} \end{array} \\ 1 \quad \begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0.3 & 0.2 \\ 0.3 & 0 & 0.4 \\ 0 & 0 & 0 \end{bmatrix} \\ 2 \quad \begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0.3 & 0.2 \\ 0.3 & 0 & 0.4 \\ 0 & 0 & 0 \end{bmatrix} \\ b \quad \begin{bmatrix} 1 & 0 & 0 \\ 0.5 & 0.3 & 0.2 \\ 0.3 & 0 & 0.4 \\ 0 & 0 & 0 \end{bmatrix} \end{array} $ Where, p=paid, 1= 1 to 30 days overdue, 2= 1 to 30 days overdue, B= 31 to days overdue Requirements:- - Obtain the fundamental matrix. - If there is currently 30,000 in accounts in the 1 Category and 18,000 in the 2 Category, determine the expected amount of bad debt and paid amount.	CLO2	E	8
CR					
Q5	a)	Let $\{X_n, n \geq 0\}$ be a sequence of iid r.v.s with mean 0 and variance 1, show that $\{X_n, n \geq 0\}$ is a WSS.	CLO1 /CLO 2	Un /R	2
	b)	Consider a two-state Markov chain with the transition probability matrix $P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix} \quad 0 < a < 1 \quad 0 < b < 1$ - Show that the n step transition probability matrix P^n is given by $P^n = \frac{1}{a+b} \left\{ \begin{bmatrix} b & a \\ b & a \end{bmatrix} + (1-a-b)^n \begin{bmatrix} -a & a \\ -b & b \end{bmatrix} \right\}$ - Find P^n when $n \rightarrow \infty$	CLO2	E	8