

# International Islamic University Chittagong (IIUC)

## Department of Computer and Communication Engineering

### Midterm Examination

Program: **B.sc (Engg.)**  
 Course Code: **MATH-2401**  
 Total Marks: **30**

Semester: **Autumn 2022**  
 Course Title: **Mathematics-IV**  
 Time: **1 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 understanding of the basic principles and operations set theory, mathematical operations with complex numbers, geometrical interpretation and the related fundamental theories involving complex functions and the concept of transformation in a complex plane.  
**CLO2** Apply the concept of transformation of an object into complex space and different mathematical operation of complex functions.

#### Bloom's Levels of the Questions

Letter Symbols Meaning	Bloom's Levels of the Questions					
	R Remember	U Understand	Ap Apply	An Analyze	E Evaluate	C Create
<b>Q1. a)</b> Define complex number. If $z$ be the complex quantity $x + iy$ , then find the locus represented by $ z - 4  +  z + 4  = 16$ . Also find the cube roots of unity.	<b>CLO1</b>	<b>R/ U</b>	<b>1+3+ 2</b>			
<b>b)</b> Prove that, $\{ z_1 + z_2 ^2 +  z_1 - z_2 ^2 = 2\{ z_1 ^2 +  z_2 ^2\}$ , Hence deduce that, $\left z_1^2 + \sqrt{z_1^2 - z_2^2}\right  + \left z_1 - \sqrt{z_1^2 - z_2^2}\right  =  z_1 + z_2  +  z_1 - z_2 $ .	<b>CLO1</b>	<b>U</b>	<b>2+2</b>			
<b>Q2. a)</b> If $\alpha, \beta$ be the roots of $x^2 - 2x + 4 = 0$ , then prove that, $\alpha^n + \beta^n = 2^{n+1} \cos\left(\frac{n\pi}{3}\right)$ .	<b>CLO1</b>	<b>U</b>	<b>5</b>			
<b>b)</b> Map the points $A(z = -2 + i)$ and $B(z = 3 + 4i)$ on the $w$ -plane under the transformation $w = i2z + 3$ and illustrate the transformation on a diagram.	<b>CLO1</b>	<b>U</b>	<b>4+1</b>			
<b>Q3. a)</b> Define analytic function. Determine whether $w = f(z) = z\bar{z}$ is analytic or not.	<b>CLO2</b>	<b>R/ Ap</b>	<b>1+4</b>			
<b>b)</b> Find the value of $\int (x - y + ix^2) dz$ along a straight line from $z = 0$ to $z = 1 + i$ .	<b>CLO2</b>	<b>Ap</b>	<b>5</b>			
<b>OR</b>						
<b>Q3. a)</b> Prove that $u = x^2 - y^2$ and $v = \frac{y}{x^2 + y^2}$ are harmonic functions of $(x, y)$ .	<b>CLO2</b>	<b>Ap</b>	<b>5</b>			
<b>b)</b> Evaluate $\int_c \frac{2z+1}{z^2+z} dz$ , where $c$ is the circle $ z  = \frac{1}{2}$ .	<b>CLO2</b>	<b>Ap</b>	<b>5</b>			