Ahsanullah Univertsity of Science and Technology **Date: 09/03/2020**

Department of Arts and Sciences

Programme: B.Sc. in Computer Science and Engineering

Quiz#1 Year: 2019 Semester: Fall

Course Name: Mathematics III, Course Code: Math 2101, Sec-A **Set –A**

Time: 30 **Marks:20**

Answer all the questions

1. For any two complex numbers z, w ; prove that $|z-w| \geq ||z|-|w|| \geq |z|-|w|$.

2. Find all values of $(8)^{\frac{1}{6}}$.

3. Prove that the $\lim_{z \to 0} f(z) = \frac{z}{\bar{z}}$ does not exist. Is $f(z) = \sin z$ analytic? why or why not?

4. Evaluate the integral $\oint_c \frac{z dz}{(9-z^2)(z+i)}$ where c is positively oriented circle $|z| = 2$.

5. Expand $f(z) = \frac{1}{1-z}$ in the Taylor series about $z_0 = -1$. For what values of z must the series converges to $f(z)$?

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Course Name: Mathematics III, Course Code: Math 2101, Sec-A **Set –B**

Marks:20

Time: 30

Answer all the questions

1. Find all values of $\left(-8-8\sqrt{3}i\right)^{\frac{1}{4}}$.

2. Test the differentiability of $f(z)=|z|^2$.

3. prove that, if $u=x^2-y^2$, $v=\dfrac{-y}{x^2+y^2}$, both u and v satisfy Laplace's equation, but $u+iv$ is not an analytic function of z.

4. Evaluate the integral $\oint_c \dfrac{dz}{(z^2+4)^2}$ where c is positively oriented circle $|z-1|=2$.

5. Expand $f(z)=\dfrac{1}{z^2+1}$ in the Taylor series about $z_0=2$. For what values of z must the series converges to $f(z)$?

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Time: 30 **Marks:20**

Answer all the questions

1. For any two complex numbers z and w, prove that $|z+w| \le |z|+|w|$. Hence show that

   $\left|\frac{z_1}{z_2+z_3}\right| \le \frac{|z_1|}{||z_2|-|z_3||}$, $|z_2| \ne |z_3|$, where $z_1, z_2, z_3, z_4 \in \mathbb{C}$.

2. Prove that for $f(z) = \frac{x^3(1+i) - y^3(1-i)}{x^2+y^2}, (z \ne 0)$, $f(0) = 0$, Cauchy-Riemann equations are satisfied at the origin, yet $f'(z)$ does not exist there.

3. Prove that $u = y^3 - 3x^2y$ is a harmonic function. Determine its harmonic conjugate, hence find the corresponding analytic function $f(z)$ in terms of z.

4. Show that $\oint_c \frac{dz}{(z-a)^n} = 0$, $n = 2,3,4,...$where $z = a$ is inside the simple closed curve c.

5. Expand $f(z) = \sin z$ in the Taylor series about $z_0 = \frac{\pi}{4}$. For what values of z must the series converges to $f(z)$?

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1. Find all values of $(8i)^{\frac{1}{3}}$. Sketch the graph of $f(z)=z^2$.
2. Show that $f(z)=\bar{z}$ is non-analytic anywhere.
3. If the potential function is $\log\sqrt{x^2+y^2}$, then find the flux function and the complex potential function.
4. Evaluate $\oint_c \frac{dz}{z-a}$ where c is any simple closed curve and $z=a$ is i) outside c, ii) inside c
5. Expand $f(z)=\ln(1+z)$ in the Taylor series about $z_0=0$. For what values of z must th series converges to $f(z)$?