

University of Sargodha
Department of Mechanical Engineering
Assignment

Program: BSc Mechanical Engineering
Course: Complex Variable and Transform
Maximum Marks: 30
Semester: 4th (Fall-19)

Teacher Name: Ms. Farhat Imtiaz
Course Code: BScMEF18
Late of Submission: 19/04/2020
Student ID: _____

Question No. 1

- (a) Evaluate i^{-2i}
- (b) Show that $\log(1+i)^2 = 2\log(1+i)$
- (c) Prove that $e^{z_1 z_2} = e^{z_1 + z_2}$
- (d) Find $f^{vi}(z), f(z) = \frac{(1+z^2)^4}{z^2}$.
- (e) Determine the principal value of argument $7 \pm 7i$ and find the all roots of $\sqrt[5]{-1}$

Question No. 2

Let u and v denote the real and imaginary components of the function f defined by means of the equations

$$f(x) = \begin{cases} \bar{z}^2/z & \text{when } z = 0, \\ 0 & \text{when } z \neq 0. \end{cases}$$

Verify that the Cauchy-Riemann equations are satisfied at the origin $z = (0,0)$. Compare with differential formula, where it is shown that $f'(0)$ nevertheless fails to exist.

Question No. 3

Show that $u(x, y)$ is harmonic in some domain and find a harmonic conjugate $v(x, y)$ when

$$u(x, y) = \frac{y}{x^2 + y^2}.$$

Question No. 4

- (a) Define analytic function, limit, continuity and differentiation with example.
- (b) Write the Cauchy-Riemann equations in Cartesian and Polar form,
- (c) Find $f''(z), f(z) = e^{-\theta} \cos(\ln r) + i \sin(\ln r)$,
- (d) Find the value of z such that $\exp(2z-1) = 1$
- (e) Solve that $e^{2+\pi i} = -e^z$