



BRAC University  
Department of Mathematics and Natural Sciences  
**MAT215: Complex Variables & Laplace Transform**  
**Assignment-01**

Section: 12

**Name: URNISHA CHAKMA**

**ID: 24321046**

Submission Date:

Summer 2025

Total Marks: 15

---

**Use this page as the cover page of your assignment**

1. Using the definition **5×5=25**
- Find the derivative of  $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$  at  $z = i$ .
  - Find the derivative of  $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$  at  $z = z_0$ .
  - Show that  $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$  is differentiable at all points.
  - Show that  $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$  is not differentiable at  $z = 0$ .
  - Find the derivative of  $f(z) = \frac{\partial Q1e - k@}{z^2}$  at  $z = \partial Q1e - a@ + \partial Q1e - b@i$ .
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
  - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
  - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
  - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
  - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function  $U$  (or  $V$ ) is harmonic. Determine the harmonic conjugate  $V$  (or  $U$ ) such that  $\mathbf{U} + \mathbf{i}V$  becomes analytic. **5×10=50**
- Given  $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$ , show that  $V$  is harmonic and find  $U$ .
  - Given  $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$ , show that  $U$  is harmonic and find  $V$ .
  - Given  $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$ , show that  $V$  is harmonic and find  $U$ .
  - Given  $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$ , show that  $U$  is harmonic and find  $V$ .
  - Given  $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$ , show that  $V$  is harmonic and find  $U$ .