BRAC University

Department of Mathematics and Natural Sciences

MAT215: Complex Variables & Laplace Transform

Assignment-01

Section: 12

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Submission Date: Summer 2025 Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**

   a) Find the derivative of $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) Find the derivative of $f(z) = \frac{@Q1e-k@}{z^2}$ at $z = @Q1e - a@ + @Q1e - b@i$.

2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) Given $U = @Q3b - 3a@x^2y - @Q3b - b@x^2 - @Q3b - a@y^3 + @Q3b - b@y^2$, show that U is harmonic and find V.

   c) Given $V = @Q3c-p@e^{-@Q3c-a@x}\cos(@Q3c - a@y) - @Q3c-q@e^{@Q3c-b@y}\sin(@Q3c - b@x)$, show that V is harmonic and find U.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, show that V is harmonic and find U.