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SCHOOL OF ADVANCED SCIENCES
DEPARTMENT OF MATHEMATICS
Continuous Assessment Test - I, AUGUST 2019

Course Code: MAT3003

Slot: C1+TC1+TCCI

Course Name: Complex Variables and Partial Differential Equations

Max. Marks : 50

Answer ALL the Questions

Duration: 90 Minutes.

1. Find the harmonic conjugate v of the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ and also show that the families of curves $u(x, y) = a$, $v(x, y) = b$, cut orthogonally where a and b are arbitrary constants.

2. In a two dimensional fluid flow, verify whether $\psi = x^2 - y^2 - 3x - 2y + 2xy$ can represent the stream function or not. If so, find the complex potential.

3. Find the image of the region bounded by the straight lines $x = 1$, $y = 0$, $y = x$ Under the transformation $w = z^2$, and also Sketch the area in the w -plane which Corresponds to the interior of the triangle in the z -plane.

4. Find the bilinear transformation that maps the points $z_1 = 1$, $z_2 = 0$ and $z_3 = -1$ in to the points $w_1 = \infty$, $w_2 = -1$ and $w_3 = 0$. find the Invariant points and show that this transformation maps the unit circle in the w -plane on to the imaginary axis in the z -plane.

$$\frac{(w-w_1)(w_2-w_3)}{(w_1-w_2)(w_3-w)}$$

5. (a) Expand the function $f(z) = \frac{z}{(z-1)(z-3)}$ in Laurent's series valid in $|z| > 3$.

- (b) Find the Taylor's series expansion of $f(z) = \frac{1}{(z-2)}$ about $z = 1$, also state

The region of convergence of the series.



$$\frac{z}{(z-1)(z-3)} = \frac{A}{(z-1)} + \frac{B}{(z-3)}$$

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