



Continuous Assessment Test (CAT) I - Aug 2024

Programme : B.Tech.	Semester : Fall 2024-25
Course : Complex Variables and Linear Algebra	Code : BMAT201L
	Slot : A2+TA2+TAA2
Faculty : Dr. B. Jaganathan, Dr. V. Parthiban Dr. Kriti Arya, Dr. A. Manivannan, Dr. M. Dhivya, Dr. Kalyan Manna, Dr. Abhishek Kumar Singh, Dr. T. Sagithya.	Class ID : CH2024250102037, 2038 2039, 2040, 2041, 2042, 2043, 2046.
Time : 90 Minutes	Max.Marks : 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted.

Part - A ($5 \times 10 = 50$)

Answer all the Questions

- (a) If n is real, then show that $r^n(\cos(n\theta) + i \sin(n\theta))$ is analytic except when $r = 0$. [6]
Also, find the derivative.
- (b) If $u = x \sinh(x) - y \cosh(y)$, then find a corresponding analytic function. [4]
- Prove that [10]

$$f(z) = f(x, y) = \begin{cases} \frac{x^3(1+i) - y^3(1-i)}{x^2 + y^2} & \text{when } (x, y) \neq (0, 0), \\ 0 & \text{when } (x, y) = (0, 0). \end{cases}$$

satisfies the C-R equations at the origin, but $f'(z)$ does not exist there. [5+5]
- (a) Determine and sketch the image of the region $R = \{(x, y) | 0 \leq x \leq 1, 0 \leq y \leq \frac{\pi}{4}\}$ [5]
under the complex mapping $w = e^z$ with $z = x + iy$.
- (b) Show that the complex mapping $w = z^2$ maps the circle $|z - 1| = 1$ onto a cardioid. [5]
- Find the bilinear mapping which maps the points $-i, 1, \infty$ onto the points $1, i, -1$. [10]
Then, determine and sketch the image of the region $|z| < 1$ under this mapping.
Also, list all the fixed points of this mapping. [4+5+1]
- Represent the function $f(z) = \frac{4z + 3}{z(z - 3)(z + 2)}$ in Laurent's series valid (i) within the [10]
region $0 < |z| < 1$, and (ii) in the annular region between $|z| = 2$ and $|z| = 3$. [5+5]