Reg. No.:

Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test I (CAT - I) - September 2023

Programme	:	**B.Tech**	Semester	:	**FALL 2023-2024**
Course Title	:	**Complex Variables and Linear Algebra**	Code	:	**BMAT201L**
			Slot(s)	:	**A1+TA1+TAA1**
Faculty	:	**Dr. S. Balaji, Dr. Ashish Kumar Nandi, M Dhivya, Dr.Mohana N, Dr. G. Hannah Grace, Dr. Abhishek Kumar Singh, Dr. Sudip Debnath**	Class Nbr(s)	:	CH2023240101002, 03,04,05,06,07,08.
Duration	:	**1 ½ Hours**	Max. Marks	:	**50**

Answer all the Questions
(5x10 = 50 marks)

Q.No.	Sub. Sec.	Question Description	Marks
1		Find the constant $'a'$ so that $u(x,y) = ax^2 - y^2 + xy$ is harmonic. Find an analytic function $f(z)$ for which u is the real part. Also find its harmonic conjugate.	10
2		(a) In a two-dimensional fluid flow, the velocity potential $\phi(x,y)$ is given as $4x(3y-4)$. Find the complex potential w= $\phi(x,y) + i\,\psi(x,y)$ where ψ is the stream function. (b) Verify whether $f(z) = \frac{1}{z-1}$ is analytic at $z = 1+i$.	10 [5 +5]
3		Determine the bilinear transformation which maps the points $z = 1, -1, \infty$ into the points $w = 1+i, 1-i, 1$ respectively. Find the image of the unit circle $\|z\| = 1$ under this transformation and sketch the image.	10
4		(a) Find the points where $w = e^{\cos hz}$ is not conformal. (b) Find the image of the circle $\|z-1\| = 1$ under the transformation $w = (\frac{1}{2}e^{i\frac{\pi}{2}})z$.	10 [5 +5]
5		(a) Find the Taylor series expansion of the given function $f(z) = \frac{z^3+1}{(z-3)(z-5)}$ about $z = 2$. Also, discuss the radius of convergence. (b) Find the poles and residues of the given function $f(z) = \frac{1}{z^4+5z^2+6}$.	10 [5 +5]