T/K/TY

Reg. No:

Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: BMAT201L - Complex Variables and Linear Algebra

Class NBR(s): 2363 / 2364 / 2365 / 2367 / 2369 / 3472 / 3473

Slot: B2+TB2+TBB2

Time: Three Hours

Max. Marks: 100

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Construct analytic functions and find complex potential of fluid flow and electric fields.
CO2	Find the image of straight lines by elementary transformations and to express analytic functions in power series.
CO3	Evaluate real integrals using techniques of contour integration.
CO4	Use the power of inner product and norm for analysis.
CO5	Use matrices and transformations for solving engineering problems.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1.	If $f(z)=u+iv$ is an analytic function of z and $u-v=e^x(\cos y-\sin y)$, find $f(z)$ in terms of z.	CO1	BL2
2.	If $w=f(z)=\phi+i\psi$ represents the complex potential function for an electric field and $\psi(x,\ y)=x^2-y^2+\dfrac{x}{x^2+y^2}$, then find $\phi(x,\ y)$.	CO1	BL3
3.	Find the image of the region bounded by the lines $x=1,\ y=1$ and $x+y=1$ in the z-plane under the transformation $w=z^2$.	CO2	BL3
4.	Determine the bilinear transformation that maps the points $1,\ i,\ -1$ in z-plane into the points $i,\ 0,\ -i$ respectively in w-plane. Also find the invariant points of this bilinear transformation.	CO2	BL2
5.a)	Find the Laurent's series expansion of the function $f(z)=\frac{z+1}{z(z-1)(z-2)}$ in the regions (i) $0<\lvert z\rvert<1$ (ii) $1<\lvert z\rvert<2$.	CO3	BL3
	OR		
5.b)	Evaluate $\displaystyle\int_0^{2\pi}\frac{\cos 2\theta}{5+4\cos\theta}\,d\theta$ using contour integration.	CO3	BL3

6. (i) Find the basis and dimension of the subspace $W=\{(x, y, z, w) | x+y=0, z=2w\}$ of a vector space $R^4(R)$, where R is the set of all real numbers. [4] CO4 BL3

(ii) Find the basis and dimension of the row space of [6]

$$A=\begin{pmatrix} 1 & -2 & 5 & -3 \\ 2 & 3 & 1 & -4 \\ 3 & 8 & -3 & -5 \end{pmatrix}.$$ Also find the nullity (A).

7.a) Let $T:R^3(R) \to R^3(R)$ be a linear transformation defined by $T(x, y, z)=(2x, 4x-y, 2x+3y-z)$ for $x, y, z \in R$. Show that T is invertible and hence find T^{-1}. CO4 BL2

OR

7.b) Let $T:R^3(R) \to R^2(R)$ be a linear transformation defined by $T(x, y, z)=(3x+2y-4z, x-5y+3z)$ for all $x, y, z \in R$. Find the matrix of linear transformation T relative to the base $B_1=\{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$ and $B_2=\{(1, 3), (2, 5)\}$. CO4 BL2

8. Obtain an orthogonal basis for the subspace of $R^4(R)$ spanned by $\alpha_1=(1, 0, 1, 0)$, $\alpha_2=(1, 1, 1, 1)$, $\alpha_3=(-1, 2, 0, 1)$ using Gram Schmidt orthogonal process. CO4 BL2

9. Let $A=\begin{pmatrix} 3 & -2 & -1 \\ 2 & 3 & 4 \\ -2 & 0 & 5 \end{pmatrix}$. Apply Cayley-Hamilton theorem to find constants a, b and c such that $A^4=aA^2+bA+cI$, where $I=\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$. CO5 BL3

10. Solve the following system of linear equations using Gauss Jordan method. CO5 BL2

$$x+2y-3z+w=4,$$
$$2x-y+z+5w=11,$$
$$3x+y+2z-w=5,$$
$$x+y+3z-2w=2.$$

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