VIT

Vellore Institute of Technology

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

CHENNAI

Reg. Number:	22BAI1266

Continuous Assessment Test (CAT) – II - MARCH 2024

Programme	:	B. Tech.	Semester	:	Winter
Course Code & Course Title	:	BMAT201L & Complex Variables and Linear Algebra	Slot	:	A1+TA1+TAA1
Faculty	:	Dr. Amit Kumar Rahul, Dr. Ashish Kumar Nandi, Dr. Jaganathan B, Dr. Kalyan Manna, Dr. Manivannan A, Dr. Sagithya, Dr. Somnath Bera.	Class Number	:	CH2023240500810 CH2023240500806 CH2023240500801 CH2023240500798 CH2023240500816 CH2023240500804 CH2023240500812
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary.
- Use graph sheets supplied from the exam cell as necessary.
- Only non-programmable calculator without storage is permitted.

Answer all questions.

Q. No	Sub Sec.	Description	Marks
1.		Using the contour integration, evaluate $\int_{-\infty}^{\infty} \frac{x^2-x+2}{x^4+5x^2+4}\, dx$.	10
2.	(a)	Let the circle $\gamma = \{z \in \mathbb{C}: \lvert z \rvert = 1\}$ be positively oriented. Then, evaluate $\oint_{\gamma} z^2 \sin\left(\frac{1}{z}\right) e^{\frac{1}{z}}\, dz$.	5
	(b)	Using the Cauchy integral formula, evaluate the integral $\oint_C \frac{z\, e^{\frac{1}{z}}}{z^2-1} dz$ where C is the positively oriented circle $\lvert z-1 \rvert = \frac{1}{2}$.	5
3.	(a)	Determine the subspace of $\mathbb{R}^3$ spanned by the vectors $(1, 2, 3)$ and $(3, 1, 0)$. Examine whether $(2, 1, 3)$ and $(-1, 3, 6)$ are in the subspace or not with proper justifications.	5
	(b)	Check if the set of vectors $S = \{(1,2,3,0), (2,1,0,3), (1,1,1,1), (2,3,4,1)\}$ is a linearly dependent set in $\mathbb{R}^4$ or not. Find a linearly independent subset S_1 of S such that $LS(S_1) = LS(S)$.	5

4.		Find bases for row space and null space of the matrix A, where $$A = \begin{pmatrix} 0 & 0 & 2 & 2 & 0 \\ 1 & 3 & 2 & 4 & 1 \\ 2 & 6 & 2 & 6 & 2 \\ 3 & 9 & 1 & 10 & 6 \end{pmatrix}.$$ Also, verify the rank-nullity theorem.	10
5.	(a)	Construct the linear transformation from $P_3(\mathbb{R})$ to $M_{2\times 2}(\mathbb{R})$ which maps the standard basis of $P_3(\mathbb{R})$ onto the standard basis of $M_{2\times 2}(\mathbb{R})$.	6
	(b)	Let V be the vector space of polynomials in x over $\mathbb{R}$, and let $T: V \to V$ be the differential operator: $T(f(x)) = \frac{df(x)}{dx}$. Find the image and kernel of T.	4

**********All the best *************