VIT

Vellore Institute of Technology

Continuous Assessment Test (CAT)- II– October 2022

Programme	:	B.Tech.	Semester	:	Fall 2022-2023
Course Title	:	Complex Variables and Linear Algebra	Code	:	BMAT201L
			Slot	:	A1+TA1+TAA1
Faculty	:	Dr. M. Dhivya, Dr. N. Durga, Dr. M. Prasannalakshmi, Dr. C. Rajivganthi, Dr. Ashish Kumar, Dr. Prosenjit, Dr. Ankit Kumar, Dr. Surath Ghosh, Dr. Sandip Saha, Dr. Kamalesh, Dr. P. Sushmitha, Dr. Amitkumar Rahul	Class Nbr	:	CH2022231001157 60, 62, 64,67, 70, 72, 74, 76, 80, 82
Duration	:	1 ½ Hours	Max. Marks	:	50

Answer all the Questions (50 marks)

Q.No.	Question Description	Marks
1.	a) A complex function $f(z)$ is defined as follows $$f(z) = \begin{cases} Re(z), & x \geq 5 \\ \mathrm{Im}(z+1), & x < 5 \end{cases}$$ Evaluate $\int_C f(z)\,dz$, where C is the curve $$y = \begin{cases} -x^2, & from\ -2-4i\ to\ 0 \\ 0, & from\ 0\ to\ 5 \\ x, & from\ 5\ to\ 10+10i \end{cases}$$ b) Expand the function $f(z) = \frac{z-1}{z^2}$ in a Laurent series valid for i) $\lvert z-1\rvert>1$ ii) $\lvert z-1\rvert<1$.	[5+5]
2.	a) Evaluate $\int_C \frac{z^2 e^{2z+1} dz}{(z+i)^2(z^2-9)}$, where C is $\lvert z+1\rvert=3$. b) Classify the singularity z=0 for $f(z) = \frac{1}{1-e^{z^2}}$	[7+3]
3.	Evaluate $\int_0^{2\pi} \frac{1}{1-2a\cos\theta+a^2} d\theta$, $\lvert a\rvert\neq 1$	[10]
4.	a) Check whether the given set of vectors S = $\{\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}, \begin{pmatrix}-1 & 0\\2 & 1\end{pmatrix}, \begin{pmatrix}5 & 4\\0 & 5\end{pmatrix}\}$ is linearly independent or not. b) Find a basis for the vector space $W = \{(x_1, x_2, x_3, x_4) \in R^4 \mid x_1 + x_2 - 2x_3 + x_4 = 0, 2x_1 - x_2 + x_3 = 0, 4x_1 + x_2 - 3x_3 + 2x_4 = 0\}$. What is the dimension of W?	[5+5]
5.	a) Let V be the set of all polynomials of degree at most 2. Is $W = \{p(x) \in V: p''(x) = 0\}$ a subspace of V? b) Check whether $W = \{A = \begin{pmatrix}a_{11} & a_{12}\\a_{21} & a_{22}\end{pmatrix}: A^2 = \alpha I\}$ is a subspace of set of all 2×2 matrices.	[5+5]

Reg. No.:

Name :

VIT

Vellore Institute of Technology

Continuous Assessment Test (CAT)- II– June 2023

Programme	: B.Tech.	Semester	: Fall Inter2022-23
Course Title	: Complex Variables and Linear Algebra	Code	: BMAT201L
		Slot	: D1+TD1+TDD1
Faculty	: Dr. V. Prabhakar, Dr. Pankaj Shukla, Dr. C. Rajivganthi, Dr. P. Dhivya	Class Nbr	: CH2022232500603, 601,602, 567
Duration	: 1 ½ Hours	Max. Marks	: 50

Answer all the Questions (50 marks)

Q.No.	Question Description	Marks
1.	a)A complex function $f(z)$ is defined as follows $$f(z) = \begin{cases} Im(z), & x \geq 4 \\ \mathrm{Re}(z+1), & x < 4 \end{cases}$$ Evaluate $\int_C f(z)\,dz$, where C is the curve $$y = \begin{cases} -x^2, & from\ -2-3i\ to\ 0 \\ 0, & from\ 0\ to\ 4 \\ x, & from\ 4\ to\ 8+8i \end{cases}$$	[7+3]
	b) Evaluate $\int_C \frac{1+z^2}{-1+z^2}\,dz$, where is C is $\lvert z+1\rvert=1$.	
2.	a). Check whether the given set of vectors S = $\{\begin{pmatrix}1 & 5\\ 2 & 3\end{pmatrix}, \begin{pmatrix}-1 & 0\\ -3 & 2\end{pmatrix}, \begin{pmatrix}1 & 3\\ 0 & 1\end{pmatrix}\}$ is linearly independent or not?	[5+5]
	b) Find a basis for the vector space $W = \{(x_1, x_2, x_3, x_4) \in R^4 \mid x_1 - 2x_2 + x_3 - x_4 = 0,\ x_2 - 3x_3 + 4x_4 = 0\}$. What is the dimension of W?	
3.	Evaluate $\int_0^{2\pi} \frac{sin\,2\theta}{4+3\cos\theta}\,d\theta$	[10]
4.	Find the basis and dimension of row space $R(A)$, column space $C(A)$ and null space $N(A)$ of $A = \begin{bmatrix} 1 & 2 & -3 & -2 & -3 \\ 1 & 3 & -2 & 0 & -4 \\ 3 & 8 & -7 & -2 & -11 \\ 2 & 1 & -9 & -10 & -3 \end{bmatrix}$.	[10]
5.	a) Let V be the set of all polynomials of degree at most 2. Is $W = \{p(x) \in V : p(x) + p''(x) = 0\}$ a subspace of V ?	[5+5]
	b) Check whether $W = \left\{A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} : A = -A^T\right\}$ is a subspace of set of all 2×2 matrices.	

VIT

Vellore Institute of Technology

Continuous Assessment Test (CAT)- II– June 2023

Programme	:	B.Tech.	Semester	:	Fall Inter2022-23
Course Title	:	Complex Variables and Linear Algebra	Code	:	BMAT201L
			Slot	:	D2+TD2+TDD2
Faculty	:	Dr. P. Durgaprasad, Dr. Tharasi Dilleswar Rao, Dr. C. Rajivganthi, Dr. Pankaj Shukla, Dr. B. Jaganathan	Class Nbr	:	CH2022232500604, 05, 06, 07, 09
Duration	:	1 ½ Hours	Max. Marks	:	50

Answer all the Questions (50 marks)

Q.No.	Question Description	Marks
1.	Using the complex variables techniques, evaluate the integral $\int_{-\infty}^{\infty} \frac{x\,dx}{(x^2+1)(x^2+2x+2)}$	[10]
2.	a)A complex function $f(z)$ is defined as follows $f(z) = \begin{cases} z\bar{z}, & x \geq 0 \\ 2z, & x < 0 \end{cases}$ Evaluate $\int_C f(z)\,dz$, where C is the arc from $z = -1 - i$ to $z = 3 + 6i$ along the curve $y = x^3$.	[7+3]
	b)Find the residue for $f(z) = z^3 e^{\frac{1}{z}}$	
3.	Find the value of m such that the vectors $S = \{(m, 7, -4), (-2, 2, 1), (2, 1, -2)\}$ will form a basis for R^3. If so express any $(x, y, z) \in R$ as a linear combination of vectors in S.	[10]
4.	Let $P_3(\mathbb{R})$ be a vector space of polynomials of degree less than or equal to 3 then prove that W is a subspace of $P_3(\mathbb{R})$ containing polynomials whose root is 2. And find the basis of W.	[10]
5.	Consider the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 1 & 1 & 1 & 1 \\ 3 & 5 & 7 & 9 \end{bmatrix}$ i)Find the bases and dimension for the row space, column space of A ii)Is the row space equal to the column space? iii)Find the null space of the transpose of matrix A.	[10]

VIT

Vellore Institute of Technology

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

Reg. No.: 22BCE1351

Name : Satyaprakash Swain

Name of Examination	:	Continuous Assessment Test (CAT-II), Fall 2023-24 Semester, (Oct. 2023)		
Programme	:	B.Tech	Semester	: Fall 2023-24
Course Title	:	Complex Variables and Linear Algebra	Code	: BMAT201L
			Slot(s)	: A2+TA2+TAA2
Faculty	:	Dr. S. Balaji, Dr. Ashish Kumar Nandi, Dr. N. Mohana, Dr. G. Hannah Grace, Dr. Abhishek Kumar Singh, Dr. Prosenjit paul, Dr. P. Vijay Kumar, Dr. M Dhivya	Class Nbr(s)	: CH2023240101009, 1010, 1011, 1012, 1013, 1014, 1015, 1017
Duration	:	1 ½ Hours	Max. Marks	: 50

Q.No.	Sub. Sec.	Question Description	Marks
1	(a)	Evaluate $\int_C (y - x - i3x^2)dz$ along the curve 'C', where 'C' is a straight line joining the points (0,0) and (1,1).	5
	(b)	Using Cauchy Integral formula, evaluate $\int_C \frac{z^2}{(z^2+4)^2} dz$, where C is the circle $\|z - i\| = 2$.	5
2		Evaluate $\int_0^\infty \frac{x^2 dx}{x^4+1}$ using contour integration.	10
3	(a)	Express the polynomial $p = -9 - 7x - 15x^2$ as a linear combination of $p_1 = 2 + x + 4x^2; p_2 = 1 - x - 3x^2; p_3 = 3 + 2x + 5x^2$	5
	(b)	Consider the set of functions $W = \{f(x) = a + bcos(x) + c\cos(2x), such\ that\ a, b, c \in \mathcal{R}\}$. Prove that W is a subspace of $C(\mathcal{R})$. Where $C(\mathcal{R})$ is a vector space of all continuous functions on real line.	5
4		Find the value of 'k' for which the system of equations 2x+4y+4z=2, 3x+4y+2z=5, 5x+8y+kz=4 have (a) Unique Solution (b) Infinite Solution (c) No Solution	10
5		Suppose A= $\begin{pmatrix} -2 & 0 & 1 \\ -5 & 3 & a \\ 4 & -2 & -1 \end{pmatrix}$ where 'a' is real number. Given that, one Eigen value is zero, then find the value of 'a' and hence evaluate all other Eigen values and Eigen vectors.	10