



Continuous Assessment Test (CAT)- II– October 2022

Programme	: B.Tech.	Semester	: Fall 2022-2023
Course Title	: Complex Variables and Linear Algebra	Code	: BMAT201L
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	Slot	: A1+TA1+TAA1
Duration	: 1 ½ Hours	Class Nbr	: CH2022231001157 60, 62, 64, 67, 70, 72, 74, 76, 80, 82

Answer all the Questions (50 marks)

Q.No.	Question Description	Marks
1.	a) A complex function $f(z)$ is defined as follows $f(z) = \begin{cases} Re(z), & x \geq 5 \\ Im(z+1), & x < 5 \end{cases}$	
	Evaluate $\int_C f(z) dz$, where C is the curve $y = \begin{cases} -x^2, & \text{from } -2 - 4i \text{ to } 0 \\ 0, & \text{from } 0 \text{ to } 5 \\ x, & \text{from } 5 \text{ to } 10 + 10i \end{cases}$	[5+5]
	b) Expand the function $f(z) = \frac{z-1}{z^2}$ in a Laurent series valid for i) $ z-1 >1$ ii) $ z-1 <1$.	
2.	a) Evaluate $\int_C \frac{z^2 e^{2z+1} dz}{(z+i)^2 (z^2-9)}$, where C is $ z+1 =3$. b) Classify the singularity $z=0$ for $f(z) = \frac{1}{1-e^{z^2}}$	[7+3]
3.	$\int_0^{2\pi} \frac{1}{1-2a\cos\theta+a^2} d\theta$ Evaluate $\int_0^{2\pi} \frac{1}{1-2a\cos\theta+a^2} d\theta$, $ a \neq 1$	[10]
4.	a) Check whether the given set of vectors $S = \left\{ \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \begin{pmatrix} -1 & 0 \\ 2 & 1 \end{pmatrix}, \begin{pmatrix} 5 & 4 \\ 0 & 5 \end{pmatrix} \right\}$ is linearly independent or not. b) Find a basis for the vector space $W = \{(x_1, x_2, x_3, x_4) \in R^4 x_1 + x_2 - 2x_3 + x_4 = 0, 2x_1 - x_2 + x_3 = 0, 4x_1 + x_2 - 3x_3 + 2x_4 = 0\}$. 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]

**Continuous Assessment Test (CAT)- II– June 2023**

Programme	: B.Tech.	Semester	: Fall Inter2022-23
Course Title	: Complex Variables and Linear Algebra	Code	: BMAT201L
Faculty	: Dr. V. Prabhakar, Dr. Pankaj Shukla, Dr. C. Rajivganthi, Dr. P. Dhivya	Slot	: D1+TD1+TDD1
Duration	: 1 ½ Hours	Class Nbr	: CII2022232500603, 601,602, 567

Max. Marks : 50

Answer all the Questions (50 marks)

Q.No.	Question Description	Marks
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1. a) A complex function $f(z)$ is defined as follows

$$f(z) = \begin{cases} \operatorname{Im}(z), & x \geq 4 \\ \operatorname{Re}(z+1), & x < 4 \end{cases}$$

Evaluate $\int_C f(z) dz$, where C is the curve

$$y = \begin{cases} -x^2, & \text{from } -2 - 3i \text{ to } 0 \\ 0, & \text{from } 0 \text{ to } 4 \\ x, & \text{from } 4 \text{ to } 8 + 8i \end{cases}$$

[7+3]

- b) Evaluate $\int_C \frac{1+z^2}{-1+z^2} dz$, where C is $|z+1|=1$.

2. a) Check whether the given set of vectors $S = \left\{ \begin{pmatrix} 1 & 5 \\ 2 & 3 \end{pmatrix}, \begin{pmatrix} -1 & 0 \\ -3 & 2 \end{pmatrix}, \begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix} \right\}$ is linearly independent or not?

[5+5]

- b) Find a basis for the vector space $W = \{(x_1, x_2, x_3, x_4) \in \mathbb{R}^4 | x_1 - 2x_2 + x_3 - x_4 = 0, x_2 - 3x_3 + 4x_4 = 0\}$. 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

$$N(A) \text{ of } A = \begin{bmatrix} 1 & 2 & -3 & -2 & -3 \\ 1 & 3 & -2 & 0 & -4 \\ 3 & 8 & -7 & -2 & -11 \\ 2 & 1 & -9 & -10 & -3 \end{bmatrix}$$

[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 ?

- b) Check whether $W = \{A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} : A = -A^T\}$ is a subspace of set of all 2×2 matrices.

[5+5]



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Continuous Assessment Test (CAT)- II– June 2023

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

Answer all the Questions (50 marks)

- | Q.No. | Question Description | Marks |
|-------|---|-------|
| 1. | Using the complex variables techniques, evaluate the integral
$\int_{-\infty}^{\infty} \frac{x dx}{(x^2 + 1)(x^2 + 2x + 2)}$ [7+7] | [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] | [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] | [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] | [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] | [10] |



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

Reg. No.:

22BCE135

Name :

Dinesh

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
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	Slot(s)	A2+TA2+TAA2
Duration	1 ½ Hours	Class Nbr(s)	CH2023240101009, 1010, 1011, 1012, 1013, 1014, 1015, 1017
		Max. Marks	50

Q.No.	Sub. Sec.	Question Description	Marks
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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

2 (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 5

$$p_1 = 2 + x + 4x^2; p_2 = 1 - x - 3x^2; p_3 = 3 + 2x + 5x^2$$

(b) Consider the set of functions 5

$W = \{f(x) = a + b\cos(x) + c\cos(2x), \text{ such that } a, b, c \in \mathbb{R}\}$. Prove that W is a subspace of $C(\mathbb{R})$. Where $C(\mathbb{R})$ is a vector space of all continuous functions on real line.

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

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