

(FOR THE CANDIDATES ADMITTED

25UAI1A1

DURING THE ACADEMIC YEAR 2025 ONLY)

REG.NO. :

N.G.M. COLLEGE (AUTONOMOUS): POLLACHI

END-OF-SEMESTER EXAMINATIONS: NOVEMBER-2025

B.Sc. (Computer Science with AI & ML)
SEMESTERS: I

MAXIMUM MARKS: 75
TIME: 3 HOURS

PART - III

25UAI1A1-INTRODUCTION TO LINEAR ALGEBRA

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

- Homogeneous system of linear equation_____
(a) Is always consistent (b)is always inconsistent
(b) (c)has always infinite solution (d)none of these
- For singular matrix A of order $n \times n$ rank r of A is_____
(a) $r < n$ (b) $r > n$ (c) $r = n$ (d) $r = A$
- If A is orthogonal matrix, then the determinant of A is _____
(a)0 (b)1 (c)1 and -1 (d)-2
- The Caley-Hamilton theorem deals only with _____.
(a) unitary matrices (b)inverse matrices (c)square matrices (d)orthogonal matrices
- If the inner product between then vector vanishes then what will be the angle between them?
(a) 45 (b) 35 (c) 90 (d) 0

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

(K2)

- Write the condition for Homogeneous Equation.
- Define Transpose of a matrix.
- Define Singular and Non-Singular matrix with an example.
- Define Characteristic Equation.
- Define Vector Space.

SECTION – B

(5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

11. a) Solve the system of equation using a matrix

$$x + y + 3z = 0; x + 3y + 5z = 0; 2x + 4z = 1.$$

(OR)

- b) Determine whether the set S is linearly independent or linearly dependent for $S = \{(-3, 1, 4), (3, 8, -4), (3, 4, -4)\}$.

(CONTD 2)

12. a) Given $A = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 4 \\ 5 & 0 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 & -1 \\ 3 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$, Compute $3A - 4B$.

(OR)

- b) Verify that $A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ is Orthogonal
13. a) Solve the equation $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$

(OR)

- b) Find the Rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$
14. a) Find the Characteristic equation of the matrix $\begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(OR)

- b) Show that $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ satisfies $A^2 - 5A - 2I = 0$
15. a) Show that the set $\{(1, 0, 1), (1, -1, 1), (2, -1, 2), (0, 0, 1)\}$ is linearly independent over $\mathbb{R}$
- (OR)
- b) Find the area of the parallelogram that spanned by the vectors $u = (1, 2, 3)$ and $v = (-2, 1, 0)$.

SECTION – C**(5 X 8 = 40 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.**

16. a) Examine the consistency of the following equation
 $x + y + z = 6; 2x + y + 3z = 13; 5x + 2y + z = 12$,
 (OR)
 b) Find the value of λ such that the following equations have unique solution
 $\lambda x + 2y - 2z - 1 = 0, 4x + 2\lambda y - z - 2 = 0, 6x + 6y + \lambda z - 3 = 0$ and use matrix method to solve this equation when $\lambda = 2$.
17. a) If $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$ Show that $A^\theta A$ is Hermitian matrix.
 (OR)
 b) Express the following matrix as the sum of a Symmetric and a Skew-Symmetric matrix
 $\begin{bmatrix} -1 & 7 & 1 \\ 2 & 3 & 4 \\ 5 & 0 & 5 \end{bmatrix}$.
18. a) Find the Inverse of $\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$. (OR)
 b) Solve the given system of equation using Cramer's Rule
 $2x + 3y - z = 7; 4x - 2y + 3z = 8; x + y + 2z = 10$.
19. a) Find the Characteristic Value and Characteristic Vector of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$
 (OR)
 b) Find the Characteristic Equation of the matrix $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$ and hence determine its inverse.
20. a) Show that the set $S = \{(0, 1, 1), (1, 0, 1), (1, 1, 0)\}$ spans $\mathbb{R}^3$ and write the vector $(2, 4, 8)$ as a linear combination of vectors in S
 (OR)
 b) Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ is defined by $T(a_1, a_2, a_3) = (a_1, -1, a_2)$. Is T is a linear Transformation.