(FOR THE CANDIDATES ADMITTED **22UDA3A1**

DURING THE ACADEMIC YEAR 20 ONLY) REG.NO. :

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

END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2023

B.Sc (CS) with Data Analytics **MAXIMUM MARKS: 50**

SEMESTER: III **TIME : 3 HOURS**

PART - III

22UDA3A1 – INTRODUCTION TO LINEAR ALGEBRA

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

1. The angle between $\begin{bmatrix}1\\0\end{bmatrix}$ *and* $\begin{bmatrix}1\\1\end{bmatrix}$ *has* $\theta =$

   a) 45 b) 30 c) 60 d) 90

2. The dimension of the whole n x n matrix space is

   a) n b) n^2 c) 2n d) n-2

3. The determinant of the n by n identity matrix is ____________

   a)1 b) n c) n-1 d) 0

4. The transformation reduces to T(v) =v is called __________ transformation.

   a) Linear b) Identity c) Bilinear d) Fourier

5. The absolute value of z=3+2i is__________

   a) $\sqrt{13}$ b) $\sqrt{14}$ c) $\sqrt{12}$ d) $\sqrt{15}$

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES (K2)

6. Define symmetric matrix.
7. Define subspace of a vector space.
8. State spectral theorem.
9. Define linear transformation.
10. Every real symmetric matrix is Hermitian. Is it true or not?.

SECTION – B **(5 X 3 = 15 MARKS)**

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. **(K3)**

11. a) Find A^{-1} by Gauss – Jordan elimination method if $A = \begin{bmatrix} 2 & 5 \\ 4 & 7 \end{bmatrix}$

(OR)

b) If $A = \begin{bmatrix} 1 & 5 \\ 2 & 3 \end{bmatrix}, B = \begin{bmatrix} 0 & 2 \\ 0 & 1 \end{bmatrix} and\ C = \begin{bmatrix} 3 & 1 \\ 0 & 0 \end{bmatrix}$ then find A(B+C), AB.

12. a) Describe the column space and row space of $A = \begin{bmatrix} 1 & 4 \\ 2 & 7 \\ 3 & 5 \end{bmatrix}$?

(OR)

b) Project $b = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} onto\, a = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ to find $p = \hat{x} a$.

13. a) Find the eigen values of A, A^2 and A^{-1} if $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$.

(OR)

b) Find A^{-1} if $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$.

14. a) If $A = \begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$ then find Q and S in polar decomposition A=QS.

(OR)

b) Find the pseudo inverse of $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$.

15. a) Find r and θ for z=1+i and its conjugate.

(OR)

b) Prove that every eigen value of a Hermitian matrix is real.

SECTION – C (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.(K4 (Or) K5)

16. a) Verify $(AB)^T = B^T A^T$ if $\begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} and\ B = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}$.

(OR)

b) Solve by Gauss – Elimination method

$$2x + 4y - 2z = 2, 4x + 9y - 3z = 8, -2x - 3y + 7z = 10$$

17. a) Find the rank of A and also $A^T A$ if $A = \begin{bmatrix} 1 & 4 & 0 \\ 2 & 11 & 5 \\ -1 & 2 & 10 \end{bmatrix}$

(OR)

b) Find the projection matrix P onto the line through $\alpha = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$.

18. a) Solve by Cramer's rule.

$$2x + 6y + z = 0,\ x + 4y + 2z = 0,\ 5x + 9y = 1.$$

(OR)

b) Test the symmetric matrix $S = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ for positive definite?

19. a) Show that $\sigma_1 \geq |\lambda|$. The largest singular value dominates all eigen values.

(OR)

b) Find L for A_1 and R for A_2 and also find A^+ for A_1, A_2, and A_3 if

$$A_1 = \begin{bmatrix} 2 \\ 2 \end{bmatrix} A_2 = \begin{bmatrix} 2 & 2 \end{bmatrix} and\ A_3 = \begin{bmatrix} 2 & 2 \\ 1 & 1 \end{bmatrix}.$$

20. a) Explain the full FFT Recursion.

(OR)

b) List out the applications of matrices in engineering.

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