Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022

TELECOMMUNICATION ENGINEERING

(2021 Scheme)

Course Code : **21TE101**

Course Name: **Applied Linear Algebra**

Max. Marks : 60 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Find the basis and dimension of the vectors space generated by S = {(1,2) (1,1) (3,1)}.

2. Express the vector V= (1, -2, 5) in 3D vector space on a linear combination of the vector v1 = (1,1,1) v2 = (1, 2, 3) v3 = (2, -1, 1).

3. Explain the system of homogenous linear equation.

4. Find the inverse of matrix A = $\begin{bmatrix} -2 & -1 \\ 3 & 3 \end{bmatrix}$.

5. Explain Inner product, Norm and Distance in vector space

6. Show that given vectors are orthogonal and orthonormal basis.

   $V_1 = \begin{bmatrix} 3/\sqrt{11} \\ 1/\sqrt{11} \\ 1/\sqrt{11} \end{bmatrix}$ $V_2 = \begin{bmatrix} -1/\sqrt{6} \\ 2/\sqrt{6} \\ 1/\sqrt{6} \end{bmatrix}$ $V_3 = \begin{bmatrix} -1/\sqrt{66} \\ -4/\sqrt{66} \\ 7/\sqrt{66} \end{bmatrix}$

7. Let A = $\begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, Find the eigen values and their algebraic multiplicities.

8. Find the rank of AA^T.

   A= $\begin{bmatrix} 3 & 2 & 0 \\ 1 & 1 & 1 \end{bmatrix}$.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Check whether the vectors V_1= (2,1,3) V_2= (5,0,3) V_3= (3, -1,0) are linearly independent or not. (6)

OR

10. Explain the Algebraic system and its general properties (6)

MODULE II

11. Find the solution of the given linear system using Gauss elimination method. (6)

$$x + 4y - z = -5$$
$$x + y - 6z = -12$$
$$3x - y - z = 4$$

OR

12. Check whether the given linear system is Trivial or not. (6)

$$x + 3y + 2z = 0$$
$$2x - y + 3z = 0$$
$$3x - 5y + 4z = 0$$
$$x + 17y + 4z = 0$$

MODULE III

13. Find all the fundamental subspace of the matrix given below. (6)

$$A = \begin{bmatrix} 1 & -2 & -1 & 3 & 2 \\ 2 & -2 & -3 & 6 & 1 \\ -1 & -4 & 4 & -3 & 7 \end{bmatrix}$$

OR

14. Find the change of basis of a given matrix from S_1 to S_2 and S_2 to S_1. (6)
$S_1 = \{u_1 = (1,2), u_2 = (1,3)\}$, $S_2 = \{v_1 = (3,1), v_2 = (0,1)\}$

MODULE IV

15. Find orthonormal basis of given vectors using Gram Schmidt orthonormalization. (6)
$V_1 = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $V_2 = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$

OR

16. Check whether the following orthogonal set obeys the Pythagoras theorem. (6)
$u = (1, 2, -3, 4)$, $v = (3, 4, 1, -2)$, $w = (3, -2, 1, 1)$

MODULE V

17. Diagonalize the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ (6)

OR

18. Check whether the given matrix is Hermitian or not. (6)
$A = \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$

MODULE VI

19. Find the SVD of the matrix A= $\begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 2 & -2 \end{bmatrix}$ (6)

OR

20. Find the least square solution to the matrix equation using pseudo inverse method.

$$\begin{bmatrix} 2 & -2 \\ -2 & 2 \\ 5 & 3 \end{bmatrix} X = \begin{bmatrix} -1 \\ 7 \\ -26 \end{bmatrix}$$ (6)

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