

BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-II Computer Science & Business Systems : SUMMER : 2025
SUBJECT: LINEAR ALGEBRA

Day : Thursday
 Date : 22/05/2025

S-27707-2025

Time : 10:00 AM-01:00 PM
 Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data **WHEREVER** necessary.
- 4) Draw neat diagrams **WHEREVER** necessary.

Q.1 Solve the following equation by using Cramer's rule (10)
 $x + y + z = 6, 2x + y - 2z = -2, x + y - 3z = -6.$

OR

Q.1 Show that $\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2.$ (10)

Q.2 Find the rank of $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}.$ (10)

OR

Q.2 Solve $3x + y + 2z = 3, 2x - 3y - z = -3, x + 2y + z = 4.$ (10)

Q.3 Determine whether or not the following set S of vectors form a basis of R^3 . $S = \{v_1 = (1, 1, 2), v_2 = (1, 2, 5), v_3 = (5, 3, 4)\}.$ (10)

OR

Q.3 Let W be the subspace of R^5 spanned by $u_1 = (1, 2, -1, 3, 4), u_2 = (2, 4, -2, 6, 8), u_3 = (1, 3, 2, 2, 6), u_4 = (1, 4, 5, 1, 8), u_5 = (2, 7, 3, 3, 9).$ Find a subset of the vectors that form a basis of W. (10)

Q.4 Apply the Gram-Schmidt process to obtain an orthogonal basis. Then normalize this basis to obtain an orthonormal basis. $x_1 = (1, -1, -1), x_2 = (0, 3, 3), x_3 = (3, 2, 4)$ (10)

OR

Q.4 Find a QR factorization of $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \\ -1 & -1 \\ 0 & 1 \end{bmatrix}.$ (10)

Q.5 Find the Eigenvalues and Eigenvectors of $A = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}.$ (10)

OR

Q.5 Determine whether the given matrix is Hermitian or not $A = \begin{bmatrix} 3 & 2-i & 4+i \\ 2-i & 6 & i \\ 4+i & i & 7 \end{bmatrix}.$ (10)

Q.6 Find a singular value decomposition of $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$ (10)

OR

Q.6 Give the following data, use principal component analysis to reduce the dimension from 2 to 1. (10)

| Feature | Example1 | Example2 | Example3 | Example4 |
|---------|----------|----------|----------|----------|
| X | 4 | 8 | 13 | 7 |
| Y | 11 | 4 | 5 | 14 |
