

BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-II CS&BS : WINTER: 2025
SUBJECT: LINEAR ALGEBRA

Day : Thursday
Date : 20/11/2025

W-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 with the help of matrices, the simultaneous equations. (10)
 $x + y + z = 1; x + 2y + 3z = 6; x + 3y + 4z = 6$

OR

- Q. 1** If $\begin{bmatrix} a & a^2 & a^3 - 1 \\ b & b^2 & b^3 - 1 \\ c & c^2 & c^3 - 1 \end{bmatrix} = 0$ in which a, b, c are different. Show that $abc = 1$. (10)

- Q. 2** Find the rank of $A = \begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$. (10)

OR

- Q. 2** Solve $x + y + z = 9; 2x - 3y + 4z = 13; 3x + 4y + 5z = 40$. (10)

- Q. 3** Find the basis and dimension of the subspace W of R^4 generated by the vectors : (10)
 $u_1 = (1, 2, 3, 5); u_2 = (2, 3, 5, 8); u_3 = (3, 4, 7, 11); u_4 = (1, 1, 2, 3)$

OR

- Q. 3** S consist of the following vectors in (10)
 $R^4 : u_1 = (1, 1, 0, -1); u_2 = (1, 2, 1, 3); u_3 = (1, 1, -9, 2); u_4 = (16, -13, 1, 3)$
Show that S is orthogonal and a basis of R^4 .

- Q. 4** Find the QR decomposition of $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 0 \\ 0 & -1 & 1 \end{bmatrix}$. (10)

OR

- Q. 4** Apply the Gram-Schmidt orthogonalization process to find an orthogonal basis and (10)
then an orthonormal basis for the subspace U of R^3 spanned by
 $u_1 = (1, -1, -1); u_2 = (0, 3, 3); u_3 = (3, 2, 4)$.

P.T.O.

Q. 5 Find the Eigen values and Eigen vectors of matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$. (10)

OR

Q. 5 Determine whether the given matrix is Hermitian or Not $A = \begin{bmatrix} 4 & 1-i & 7 \\ 1+i & 6 & -i \\ 7 & i & 5 \end{bmatrix}$. (10)

Q. 6 Find a singular value decomposition of $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$. (10)

OR

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

| Feature | Example 1 | Example 2 | Example 3 | Example 4 |
|---------|-----------|-----------|-----------|-----------|
| X | 4 | 8 | 13 | 7 |
| Y | 11 | 4 | 5 | 14 |

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