Reg No.: ____________________ Name : ____________________

Jyothi Engineering College(Autonomous)

BTech Degree S1 (Challenge Course) Examination, January 2026 (2025 Scheme)

25MAT201- MATHEMATICS FOR INFORMATION SCIENCE - 2

Total Mark: 60 Total Time: 2hrs 30 min

CO MARK

PART A

(Answer All Questions. Each question carries 3 marks)

1. Find the rank of the matrix $\begin{bmatrix} 1 & 3 & 2 \\ 2 & -1 & 3 \\ 3 & -5 & 4 \\ 1 & 17 & 4 \end{bmatrix}$. CO1 (3)

2. Find the eigen values of $\begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$. CO1 (3)

3. Determine whether the subset $W = \{(x, y, 1) : x, y \in R\}$ is a subspace of R^3. CO2 (3)

4. Show that the set $\{(4, -3), (5, 2)\}$ is a basis for R^2. CO2 (3)

5. Find the distance between u and v if $u = (3, -1, 0, -3)$ and $v = (4, 0, 1, 2)$. CO3 (3)

6. Determine all vectors orthogonal to $u = (4, 2)$. CO3 (3)

7. Find the kernel of $T : R^3 \to R^3$ represented by $T(x, y, z) = (x, y, 0)$. CO4 (3)

8. Let T be a linear transformation from $R^2 \to R^2$ such that $T(1, 0) = (1, 1)$, $T(0, 1) = (-1, 1)$. Find $T(1, 4)$. CO4 (3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module - 1

9. Find the values of μ for which the system of equations $x + y + z = 1$, $x + 2y + 3z = \mu$, $x + 5y + 9z = \mu^2$ is consistent. For each value of μ obtained, find the solution of the system. CO1 (9)

OR

10. Diagonalize the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. CO1 (9)

Module - 2

11. a) Find the transition matrix from B to B' for the bases for R^2 given by $B = \{(-3, 2), (4, -2)\}$ and $B' = \{(-1, 2), (2, -2)\}$ CO2 (5)

b) Determine whether the set $S = \{(1, 5, 3), (0, 1, 2), (0, 0, 6)\}$ of vectors in R^3 is linearly independent. CO2 (4)

OR

12. a) Find the coordinate matrix of $x = (1, 2, -1)$ in R^3 relative to the basis $B' = \{u_1, u_2, u_3\} = \{(1, 0, 1), (0, -1, 2), (2, 3, -5)\}$. CO2 (5)

b) Find a basis and dimension of the subspace $W = \{(s + 4t, t, s, 2s - t) : s, t \in R\}$ of R^4. CO2 (4)

Module - 3

13. a) Find the least square regression line for the data points (1,1), (2,5), (3,3), (4,6), (5,9). CO3 (5)

b) Verify the Cauchy- Schwarz inequality for $\mathbf{u} = (1, -1, 3)$ and $\mathbf{v} = (2, 0, -1)$. CO3 (4)

OR

14. a) Apply Gram- Schmidt orthonormalization process to transform the given basis $B = \{(1,1), (0,1)\}$ into an orthonormal basis. CO3 (5)

b) Use the Euclidean inner product in R^3 to find the orthogonal projection of $\mathbf{u} = (6, 2, 4)$ onto $\mathbf{v} = (1, 2, 0)$. CO3 (4)

Module - 4

15. a) Let $T: R^5 \to R^4$ defined by $T(X) = AX$ where $A = \begin{bmatrix} 1 & 2 & 0 & 1 & -1 \\ 2 & 1 & 3 & 1 & 0 \\ -1 & 0 & -2 & 0 & 1 \\ 0 & 0 & 0 & 2 & 8 \end{bmatrix}$. Find a basis for Range of T. CO4 (5)

b) Determine whether the function $T: R^2 \to R^2$ defined by $T(x, y) = (x, 1)$ is a linear transformation. CO4 (4)

OR

16. a) Use the standard matrix for the linear transformation T defined by $T(x, y, z) = (2x + y, 3y - z)$ to find the image of the vector $\mathbf{v} = (0, 1, -1)$. CO4 (5)

b) Find the rank and nullity of $\begin{bmatrix} 1 & 3 \\ -1 & -3 \\ 2 & 2 \end{bmatrix}$. CO4 (4)

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