Reg No.: ____________________ Name : ____________________

CREATING TECHNOLOGY LEADERS OF TOMORROW ESTD 2002

Jyothi Engineering College(Autonomous)

B. Tech Degree S2 (S) Examination, June 2026 (2025 Scheme)

25MAT201 - MATHEMATICS FOR INFORMATION SCIENCE - 2

Total Mark: 60 **Total Time: 2 Hr 30min**

CO MARK

PART A

(Answer all questions. Each question carries 3 marks.)

1. Find the rank of A = $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$. CO1 (3)

2. Examine whether the matrix $A = \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}$ is diagonalizable. CO1 (3)

3. Write $w = (1, -2, 2)$ as a linear combination of vectors $\{(1,2,3), (0,1,2), (-1,0,1)\}$ if possible. CO2 (3)

4. Find the dimension of the subspace $W = \{(d, c, -d, c) : c, d \in R\}$. CO2 (3)

5. Find the unit vector in the direction of $v = (3, -1, 2)$ and verify that this vector has length 1. CO3 (3)

6. Find the distance d(u, v) between u = (- 4, 2) and v = (1 ,- 2) for the inner product, $\langle u, v\rangle = u_1v_1 + 9u_2v_2$. CO3 (3)

7. Let $T : R^5 \to R^7$ be a linear transformation. Find Rank(T), if Nullity(T) = 4. CO4 (3)

8. For a Linear Transformation $T : R^2 \to R^2$ defined by $T(x, y) = (x - y, x + 3y)$, find preimage of $w = (-1, 3)$. CO4 (3)

PART B

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

Module - 1

9. a) Test for consistency and solve: CO1 (5)

$$\begin{aligned} x + y + z &= 3 \\ 2x + 3y + z &= 7 \\ 3x + 4y + 2z &= 10 \end{aligned}$$

b) If 1 is an eigen value of $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, without using characteristic equation, find the other eigen values. Also find the eigen values of A^2 and $A + 7I$. CO1 (4)

OR

10. a) Determine the values of **a** and **b** so that the system of equations CO1 (5)

$$\mathbf{x + y + z = 6}$$
$$\mathbf{x + 2y + 3z = 12}$$
$$\mathbf{x + 3y + az = b}$$

has (i) no solution

(ii) a unique solution

(iii) an infinite number of solutions.

b) Find the eigenvectors of the matrix $A = \begin{bmatrix} 1 & 4 \\ 0 & 5 \end{bmatrix}$. CO1 (4)

Module - 2

11. a) For which values of t is the set $S = \{(t,t,t),(t,1,0),(t,0,1)\}$ linearly independent? CO2 (5)

b) Determine whether $S = \{(1,2,3),(0,1,2),(-1,0,1)\}$ spans R^3. CO2 (4)

OR

12. a) Find the transition matrix from B to B' for the basis for R^3 if $B = \{(1,0,0),(0,1,0),(0,0,1)\}$ and $B' = \{(1,0,1),(0,-1,2),(2,3,-5)\}$. CO2 (5)

b) Given the coordinate matrix of **x** relative to a basis $B = \{(2,-1),(0,1)\}$ for R^2 is $\begin{bmatrix} 4 \\ 1 \end{bmatrix}$, find the coordinate matrix relative to the standard basis. CO2 (4)

Module - 3

13. a) Use the inner product $\langle u,v\rangle = u_1v_1 + u_2v_2 + u_3v_3$ to find the coordinate matrix of $w = (5,10,15)$ relative to the orthonormal basis $B = \left\{\left(\frac{3}{5},\frac{4}{5},0\right),\left(-\frac{4}{5},\frac{3}{5},0\right),(0,0,1)\right\}$ in $\mathbb{R}^3$. CO3 (5)

b) Find the angle between u = (- 4, 3) and v = (0, 5), using the inner product $\langle u,v\rangle = 3u_1v_1 + u_2v_2$. CO3 (4)

OR

14. a) Show that the function $\langle u,v\rangle = u_1v_1 + 2u_2v_2$ defines an inner product, where, $u = (u_1, v_1)$ and $v = (v_1, v_2)$. CO3 (5)

b) Show that the set $S = \left\{(1,1,0),(0,0,2),\left(-\frac{1}{2},\frac{1}{2},0\right)\right\}$ is a basis for $\mathbb{R}^3$. CO3 (4)

Module - 4

15. a) Find $T(v)$ by using the matrix relative to **B** and **B′** where $T: R^3 \to R^2$ given by $T(x,y,z) = (x-y, y-z)$, $v = (2,4,6)$, $B = \{(1,1,1),(1,1,0),(0,1,1)\}$ and $B^I = \{(1,1),(2,1)\}$. CO4 (5)

b) Find the Kernel of linear transformation $T: R^3 \to R^2$ defined by $T(x) = Ax$ where $A = \begin{bmatrix} 1 & -1 & -2 \\ -1 & 2 & 3 \end{bmatrix}$. CO4 (4)

OR

16. a) Find the Nullity, Rank and Range of $T: R^5 \to R^4$ defined by $T(X) = AX$ where $A = \begin{bmatrix} 2 & 2 & -3 & 1 & 13 \\ 1 & 1 & 1 & 1 & -1 \\ 3 & 3 & -5 & 0 & 14 \\ 6 & 6 & -2 & 4 & 13 \end{bmatrix}$. CO4 (5)

b) 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 (4)

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