National Forensic Sciences University

School of Cyber Security and Digital Forensics

Course Name: M.Tech Artificial Intelligence and Data Science (Batch: 2024-26)

Semester – III

Subject Code: CTMTAIDS SI P1 **Time:** 11:00-12.30 pm

Subject Name: Mathematical and Computational Foundation for Artificial Intelligence

Exam: Mid Semester Examination (October - 2024) **Date:** 7-10-2024

Q1. Find k so that u and v are orthogonal **5 marks**

(a) u = (1, k, 3) and v = (2, -5, 4)
(b) u = (2, 3k, -4, 1,5) and v = (6, -1, 3, 7, 2k)

Q2. Let $A = \begin{bmatrix} 1 & 2 & -3 \\ -3 & -4 & 13 \\ 2 & 1 & -5 \end{bmatrix}$. Perform LU decomposition on the matrix **7 marks**

Q3. Solve the following system of linear equations using Gaussian Elimination **8 marks**

$$-3x_1 + 2x_2 - x_3 = -1$$
$$6x_1 - 6x_2 + 7x_3 = -7$$
$$3x_1 - 4x_2 + 4x_3 = -6$$

Q4. Which of the following matrices are diagonalizable with reasons? Show the decomposition as well

(a) $B = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ (b) $C = \begin{bmatrix} 2 & 0 & 0 \\ 4 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ **10 marks**

Q5. Calculate the singular value decomposition of

$$D = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 1 \\ 3 & 2 & 1 \end{bmatrix}$$ **10 marks**

Q6. Perform Cholesky decomposition of the following system of equations

$$4x_1 + 2x_2 + 14x_3 = 14$$
$$2x_1 + 17x_2 - 5x_3 = -101$$
$$14x_1 - 5x_2 + 83x_3 = 155$$

10 marks