JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

B. Tech-III Semester (CSE/IT/AIML/AIDS/CSECS/UXUI/FSSD)

COURSE CODE (CREDITS): 25B11MA314 (4) MAX. MARKS: 15

COURSE NAME: Mathematical Foundations for AI and DS

COURSE INSTRUCTOR: RSD, BKP* MAX. TIME: 1 Hour

Note:(a)All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculators is not allowed

Q.No.	Question	CO	Marks
Q1	Consider the vector space $M_{2x2}(R) = \left\{\begin{bmatrix} a & b \\ c & d \end{bmatrix} : a, b, c, d \in R\right\}$ over the field R. (a) Find the additive identity element **0** and the multiplicative identity element **1** of $M_{2x2}(R)$. (b) Is $W = \left\{\begin{bmatrix} a & b \\ c & d \end{bmatrix} \in M_{2x2}(\mathbb{R}) : ad - bc = 0\right\}$ a subspace of $M_{2x2}(R)$? Justify your answer.	CO-1	3
Q2	Consider the vectors $v_1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, $v_2 = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $v_3 = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$. (a) Show that v_1 and v_2 form a *basis* for R^2. (b) Do v_1, v_2, and v_3 form a *basis* for R^2? Give your reasoning.	CO-1	3
Q3	Let T : $\mathbb{R}^2 \to \mathbb{R}^3$ be a linear transformation such that $T(1,0) = (1,2,3)$, $T(0,1) = (2,-1,1)$. (a) Find T(x, y) for an arbitrary $(x, y) \in \mathbb{R}^2$. (b) Also find the image (range) of T.	CO-1	3
Q4	Let T: $R^3 \to R^2$ be the linear transformation defined by $T(x, y, z) = (x + y, y + z)$ Find the null space and nullity of T, and verify the Rank–Nullity Theorem.	CO-1	3
Q5	Let $V=\mathbb{R}^2$ with the standard inner product, Find the norm of the vector u=(3,4) and verify that u is orthogonal to v = (4,−3).	CO-1	3

JUIT EXAMINATION-NOV-2026