Jaypee University of Information Technology, Waknaghat

TEST-1 Examination - August 2026

B.Tech - VII Semester (ALL)

Course Code/Credits: 22B1WMA731/3 Max. Marks: 15
Course Title: Linear Algebra for Data Science & Machine Learning
Course Instructor: RAD Max. Time: 1 Hour

Note: (a) ALL questions are compulsory; Scientific calculators are allowed.

(b) The candidate is allowed to make suitable numeric assumptions wherever required.

Q.No	Question	CO	Marks
Q1	Answer the following: (a) Let $*$ be a binary operation on $\mathbb{R}$ defined by $x * y = x + y - xy$, where $x, y \in \mathbb{R}$. Determine whether the operation is commutative. Justify your answer. (b) Let $*$ be a binary operation on $\mathbb{R}$ defined by $x*y = x+y+xy$. Determine the inverse of 2, if the identity element is 0.	CO-1	3
Q2	Determine whether each of the following sets is a vector subspace of the indicated vector space. Justify your answer. (a) $\mathcal{S}_1 = \left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \in \mathbb{R}^3 : x + y + z = 0 \right\}$. (b) $\mathcal{S}_2 = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a + d = 1,\ a, b, c, d \in \mathbb{R} \right\}$.	CO-1	3
Q3	(a) Determine whether the vector $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ belongs to the span of the vectors $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ Justify your answer. (b) Is the following set of vectors linearly independent in $\mathbb{R}^3$? $\mathcal{B} = \left\{ \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 3 \\ 3 \\ 1 \end{pmatrix} \right\}$.	CO-1	3
Q4	Consider the subspace of the 4-dimensional vector space $\mathbb{R}^4$: $\mathbf{W} = \left\{ (x_1, x_2, x_3, x_4) \in \mathbb{R}^4 \;\middle|\; x_1 + 2x_2 - x_3 + x_4 = 0 \right\}$. Determine a basis and the dimension of $\mathbf{W}$.	CO-1	3
Q5	Let $\mathbf{T} : \mathbb{R}^3 \longrightarrow \mathbb{R}^3$ be the linear transformation defined by $\mathbf{T}(x_1, x_2, x_3) = (x_1 + x_2,\ x_2 + x_3,\ x_1 + x_3)$. Find the **kernel** of $\mathbf{T}$ and hence determine its dimension.	CO-1	3

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