

Jaypee University of Information Technology, Wagnaghat

Test-1 Examination, September 2024

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.

(b) Scientific calculators are allowed.

(c) Marks are indicated against each question in round brackets.

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

1. Which of the following is a *group*? Justify your answer. (3 Marks) [CO-1]

(a)  $\mathcal{A} = \{1, -1\}$  under addition

(b)  $\mathcal{B} = \{0, 1, 2, 3, 4\}$  under multiplication modulo 5

2. Which of the following two subsets is a *subspace* of  $\mathbb{R}^2$ ? (3 Marks) [CO-1]

(a) Set of all points on the line give by  $x + 2y = 0$

(b) Set of all points on the line give by  $x + 2y = 1$

3. Consider the following vectors of the vectors space  $(\mathcal{M}_{2 \times 2}, +, \times)$ : (3 Marks) [CO-1]

$$\mathcal{C} = \left\{ \begin{pmatrix} 2 & 1 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 3 & 0 \\ 2 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 2 & 0 \end{pmatrix} \right\}$$

Determine whether given set of vectors is linearly independent or linearly dependent?

4. Consider the following subspace of  $\mathbb{R}^3$ : (3 Marks) [CO-1]

$$\mathcal{S} = \{(x, y, z) \in \mathbb{R}^3 \mid x + 2y + 3z = 4x + 5y + 6z = 7x + 8y + 9z = 0\}$$

(a) Find the solution space for the system of equations in  $\mathcal{S}$ .

(b) What is the *dimension* of the subspace  $\mathcal{S}$  of  $\mathbb{R}^3$ ?

5. Consider the vectors  $\mathbf{u} = (1, 2, -1)$  and  $\mathbf{v} = (6, 4, 2)$  in  $\mathbb{R}^3$ . (3 Marks) [CO-1]

(a) Show that  $w = (9, 2, 7)$  is a linear combination of  $\mathbf{u}$  and  $\mathbf{v}$ .

(b) Show that  $w = (4, -1, 8)$  is not a linear combination of  $\mathbf{u}$  and  $\mathbf{v}$ .

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