Jaypee University of Information Technology, Waknaghat Test-1 Examinations, September 2023

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

Instructions: All questions are compulsory. Marks are indicated against each question.

Use of scientific calculators is allowed.

1. Which of the following is a group? Justify your answer.

(3 Marks) [CO-1]

- (a) $A = \{1, 2, 4, 8\}$ under multiplication
- (b) $\mathcal{B} = \{0, \pm 2, \pm 4, \pm 6, \ldots\}$ under addition
- 2. Consider the following set of vectors in \mathbb{R}^2 :

(3 Marks) [CO-1]

$$\mathbf{U} \ = \ \left\{ \left(\begin{array}{c} 1 \\ 2 \end{array} \right), \ \left(\begin{array}{c} 3 \\ 4 \end{array} \right) \right\}$$

- (a) Are these vectors linearly independent?
- (b) Describe the span of U.
- 3. Consider the subset **W** of \mathbb{R}^3 :

(3 Marks) [CO-1]

$$\mathbf{W} = \left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} \in \mathbb{R}^3 \mid x + 3y + z = 0 \right\}; \quad \text{let } \mathbf{B} = \left\{ \begin{pmatrix} -3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ -3 \end{pmatrix} \right\}.$$

- (a) Verify that **W** is a subspace.
- (b) Show that B is a basis for W.
- 4. Consider the following homogeneous system of equations:

(3 Marks) [CO-1]

- (a) Find the solution space for the system.
- (b) What is the dimension of the solution space?
- 5. Consider the matrix $\mathbf{C} = \begin{pmatrix} 1 & -9 \\ 1 & -5 \end{pmatrix}$. Calculate the following:

(3 Marks) [CO-2]

- (a) the eigenvalues of C.
- (b) a basis for the eigenspace E_{λ} of C corresponding to $\lambda = -2$.
- (c) dimension of $\mathbf{E}_{\lambda}(\mathbf{C})$.