BENNETT UNIVERSITY
TIMES OF INDIA GROUP

Enrollment No.: E22CSEU0827 Name: MADHAV

Department/School: SCSET

Mid-Semester Examination, Even Semester 2022-23

Course Code: EMAT102L **Maximum Time Duration:** 1 hour

Course Name: Linear Algebra and ODEs **Maximum Marks:** 15

GENERAL INSTRUCTIONS:

1. Do not write anything on the question paper except name, enrollment number and department/school.
2. Carrying mobile phone, smart watch and any other non-permissible materials in the examination hall is an act of UFM.

1. Let $S = \{(x, y, z) \in \mathbb{R}^3 : x + y = 0 \text{ or } y - z = 0\}$. Then check whether S forms a subspace of $\mathbb{R}^3$ with respect to the usual addition and scalar multiplication operations over $\mathbb{R}$. [2 marks]

2. Find all the values of a, b and c such that the matrix A (whose all entries are real) is in reduced row echelon form (RREF) [2 marks]

$$A = \begin{pmatrix} 0 & a & 0 & 2 & 0 \\ 0 & 0 & b & c & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}.$$

3. Find the values of λ and μ such that the following system of linear equations have an infinite number of solutions. [2 marks]

$$x + y + z = 6, \quad x + 2y + 3z = 10, \quad x + 2y + \lambda z = \mu$$

4. Determine whether the subset $\{(1,1,1,1),(1,-1,1,-1),(1,1,-1,-1)\}$ of the vector space $\mathbb{R}^4$ are linearly dependent or linearly independent. [2 marks]

5. Find the range space and the rank of the linear transformation [2 marks]

$$T : \mathbb{R}^3 \to \mathbb{R}^2 \text{ given by } T(x,y,z) = (x+y,0).$$

6. Find a basis and the dimension of the vector space of all 2×2 skew symmetric matrices. [1 marks]

7. Find the null space of the linear transformation [1 marks]

$$T : \mathbb{R}^2 \to \mathbb{R}^2 \text{ given by } T(x,y) = (x-y, 2x-2y).$$

8. Let $A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 0 & 1 \\ 4 & 5 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 0 & 1 \\ 6 & 9 & 12 \end{pmatrix}$. Find the elementary matrix E such that $EA = B$. [1 mark]

9. Let $S = \{(1,2,1),(1,0,1)\}$ be a set of vectors of the vector space $\mathbb{R}^3$. Determine whether the vector $(2,2,2)$ belongs to Span(S) or not. Justify your answer. [1 mark]

10. Find the linear transformation T from $\mathbb{R}^2$ to $\mathbb{R}^2$ which flips the below image vertically along the x-axis. [1 mark]

Input Image

Output Image

Good Luck.

"Self-belief and hard work will always earn you success." —Virat Kohli, Indian cricketer