BENNETT
UNIVERSITY
TIMES OF INDIA GROUP

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Department/School: CSET

Mid-Semester Makeup 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.

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1. Let $S = \{(x, y, z) \in \mathbb{R}^3 : x + 2y = 0 \text{ and } y - 2z = 0\}$. 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. Determine the rank of the following matrix $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 6 & 7 & 8 \\ 3 & 6 & 9 & 12 & 15 \\ 4 & 8 & 12 & 14 & 16 \end{pmatrix}$ [2 marks]

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

$$x + y + z = 10, \quad x - y - 2z = 5, \quad 2x + \lambda y - z = \mu$$

4. Determine whether the subset $\{(1,1,0,0),(1,0,0,1),(0,0,-1,-1)\}$ of the vector space $\mathbb{R}^4$ are linearly dependent or linearly independent [2 marks]

5. Find the null space and the nullity of the linear transformation [2 marks]

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

6. Find a basis and the dimension of the vector space of all 2×2 symmetric matrices.

[1 mark]

7. Find the range space of the linear transformation [1 mark]

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

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

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

10. Consider a mapping $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by $T(x,y,z) = (x+y+z, x-y-z, x+y-1)$. Check if T is a Linear Transformation. Justify your answer. [1 mark]

Good Luck.

"Failure will never overtake me if my determination to succeed is strong enough."

—Dr. A.P.J. Abdul Kalam