BENNETT UNIVERSITY
TIMES OF INDIA GROUP

Name: ____________________

Enrollment No.: ____________________

Department/School: ____________________

# Mid-Semester Examination, Even Semester 2022-23

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

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

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

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

= a c b = 1

√c = IR

3. Find the values of $\lambda$ and $\mu$ such that the following system of linear equations have an infinite number of solutions. [2 marks]

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

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 $2\times 2$ skew symmetric matrices [1 marks]

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

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

rovT = 0

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]

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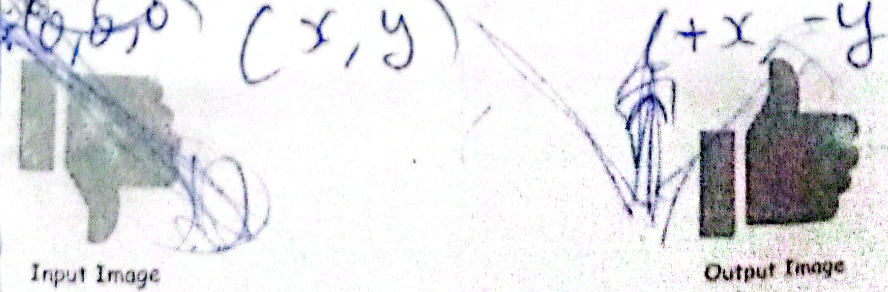
9. Let $S = \{(1,2,1),(1,0,1)\}$ be a set of vectors of the vector space $\mathbb{R}^3$. Determine whether the vector $(2,2,2)$ belongs to $\mathrm{Span}(S)$ or not. Justify your answer. [1 mark]

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]

(0,0,0) (x, y) (+x, -y)




+x, -y)

x, y