Reg. No.:

Name :

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Mid-Term Examinations –October 2021					
Programme	: **B.Tech. [BCE, BCG,BCY,MEI,MIM]**		Semester	:	**Fall 2021-22**
Course	: **Applied Linear Algebra**		Code	:	**MAT3002**
Faculty	: **Dr.A.Manickam**		Slot/ Class No.	:	**F11+F12/ 0549**
Time	: **1 ½ hours**		Max. Marks	:	**50**

Answer all the Questions

Q.No.	Sub. Sec.	Question Description	Marks
1		The upward velocity of a rocket is given at three different times on the following table. Velocity vs. time data for a rocket	

Time, t (s)	Velocity, v (m/s)
5	106.8
8	177.2
12	279.2

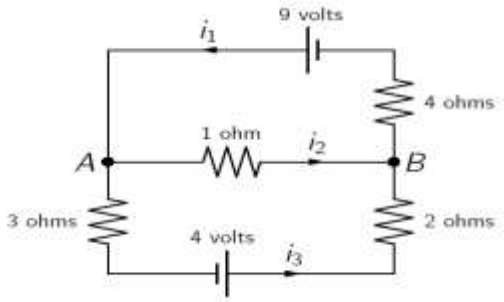
The velocity data is approximated by a polynomial as

$v(t) = at^2 + bt + c$, $5 \le t \le 12$.

Set up the equations in matrix form and find the coefficients a, b, c of the velocity profile by LDU Factorization method. **10**

2 (a) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 6 \\ -1 & -3 & 2 & -2 \\ 2 & 4 & -1 & 6 \end{bmatrix}$, by converting it into Echelon form **5**

(b) Determine the currents I_1, I_2, I_3 in the following network:



Node A: $i_1 = i_2 + i_3$

Node B: $i_2 + i_3 = i_1$ **5**

3 Find a basis for row space, column space, and null space for the following matrix:

$$M = \begin{bmatrix} 1 & 2 & 0 & 2 & 5 \\ -2 & -5 & 1 & -1 & 8 \\ 0 & -3 & 3 & 4 & 1 \\ 3 & 6 & 0 & -7 & 2 \end{bmatrix}$$

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4 Let $v_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}, v_2 = \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}, v_3 = \begin{bmatrix} -3 \\ 4 \\ 7 \end{bmatrix}$ and let $W = span\{v_1, v_2, v_3\}$

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Show that v_3 is linear combination of v_1 and v_2.

Show that $span\{v_1, v_2\} = W$

Show that v_1 and v_2 are linearly independent.

5 a)Prove that the function $T(v_1, v_2) = (v_1 - v_2, v_1 + 2v_2)$ is a linear transformation from R^2 into R^2.

(b)For any vector $\mathbf{v} = (v_1, v_2)$ in R^2, and let $T: R^2 \rightarrow R^2$ be defined by $T(v_1, v_2) = (4v_1 - v_2, 8v_1 + 2v_2)$ Find the image of $\mathbf{v} = (-4, 2)$ also Find the preimage of $\mathbf{w} = (-2, 10)$

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