Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – October 2025

Date: 07-10-2025 **Time:** 09.30am to 11.00am

School: SOE	**Program:** B. Tech. in ECE	
Course Code: ECE3017	**Course Name:** Linear Algebra for Communication Engineering	
Semester: V	**Max Marks**: 50	**Weightage**: 25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**24**			

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	Consider the following set of vectors in R^3: S = {(1, 0, 0), (0, 1, 0), (0, 0, 1)}. Classify whether S forms a basis for R^3. Defend your answer.	**2 Marks**	**L3**	**CO2**
2	A set of vectors in R^3 is provided: $\begin{bmatrix} 2 & 1 & 0 \\ 1 & -1 & 3 \\ 0 & 4 & -3 \end{bmatrix}$ Describe whether the given vectors are linearly dependent or linearly independent. The row echelon form of the above matrix is: $\begin{bmatrix} 1 & -1 & 4 \\ 0 & 3 & -8 \\ 0 & 0 & 5 \end{bmatrix}$	**2 Marks**	**L3**	**CO2**
3	A matrix C is provided for analysis: $C = \begin{bmatrix} 6 & 4 \\ 3 & 2 \end{bmatrix}$ a) Compute the determinant of C. b) Defend the claim that matrix C is singular without computing its	**2 Marks**	**L2**	**CO1**

	inverse.			
4	The following matrix B is in row reduced echelon form. $$B = \begin{bmatrix} 1 & 2 & 0 & 0 & 4 \\ 0 & 0 & 1 & 0 & -1 \\ 0 & 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$ a) Locate the pivot positions. b) Locate the pivot columns. **c)** Compute the rank of the matrix.	**2 Marks**	**L2**	**CO1**
5	Consider the following matrices: $$A = \begin{bmatrix} 4 & -1 & 5 \\ 2 & 3 & 0 \\ -2 & 1 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 3 \\ -2 & 0 \\ 4 & 2 \end{bmatrix}$$ a) Compute the matrix product AB. b) Compute the transpose of the resulting product matrix, denoted as $(AB)^T$.	**2 Marks**	**L2**	**CO1**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Consider the matrix $$A = \begin{bmatrix} 1 & 2 & -3 & 1 & 2 \\ 2 & 4 & -4 & 6 & 10 \\ 3 & 6 & -6 & 9 & 13 \end{bmatrix}$$ Solve for the row canonical form (reduced row echelon form) of matrix A.	**10 Marks**	**L3**	**CO 2**
	b.	Solve the following system of linear equations using LU factorization method: x+2y+3z+2w=1 4x+3y+z+w=2 x+2y+3z=3	**10 Marks**	**L3**	**CO 2**
		Or			
7.	**a.**	Consider the matrix $$B = \begin{bmatrix} 1 & -2 & 3 & 1 & 2 \\ 1 & 1 & 4 & -1 & 3 \\ 2 & 5 & 9 & -2 & 8 \end{bmatrix}$$ Solve for the row canonical form of matrix A using the Gauss-Jordan method.	**10 Marks**	**L3**	**CO 2**
	b.	Apply the LU factorization method to decompose the following matrix:	**10 Marks**	**L3**	**CO 2**

		$$A = \begin{bmatrix} 1 & 2 & 0 & 2 \\ 1 & 3 & 2 & 1 \\ 2 & 3 & 4 & 0 \end{bmatrix}$$			

8.	**a.**	Consider the matrix $$A = \begin{bmatrix} 1 & 2 & -3 & 1 & 2 \\ 2 & 4 & -4 & 6 & 10 \\ 3 & 6 & -6 & 9 & 13 \end{bmatrix}$$ Convert matrix A to an echelon form.	**10 Marks**	**L2**	**CO 1**
	b.	Determine whether the vector $$\mathbf{u} = \begin{bmatrix} 5 \\ 3 \\ 13 \end{bmatrix}$$ is in the column space of the matrix $$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 2 & 3 & 4 \end{bmatrix}$$ The row echelon form of the above matrix is $$\text{ref}(A) = \left[\begin{array}{ccc\|c} 1 & 2 & 1 & 5 \\ 0 & 1 & -1 & 3 \\ 0 & 0 & 1 & 6 \end{array}\right]$$	**10 Marks**	**L2**	**CO 1**
Or					
9.	**a.**	Consider the matrix $$B = \begin{bmatrix} 1 & -2 & 3 & 1 & 2 \\ 1 & 1 & 4 & -1 & 3 \\ 2 & 5 & 9 & -2 & 8 \end{bmatrix}$$ Convert matrix A to an echelon form.	**10 Marks**	**L2**	**CO 1**
	b.	Determine whether the vector $$\vec{x} = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$$ is in the null space of the matrix	**10 Marks**	**L2**	**CO 1**

		$E = \begin{bmatrix} 1 & 0 & -2 \\ 2 & 1 & -3 \\ 1 & 1 & -1 \end{bmatrix}$			