Roll No: | | | | | | | | | | | |

PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi | Approved By BCI
Bengaluru

Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 09:30 AM - 11:00 AM

Course Code: ECE3206 **Course Name:** Linear Algebra for Communication Engineering

Semester: Fifth Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2
Marks	46	44

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Find the rank of the following matrix using elementary row transformations: $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 7 & 10 \\ 3 & 6 & 10 & 14 \\ 4 & 8 & 13 & 18 \end{bmatrix}$	2	CO1	BT1
2	Find whether the vectors $(1,2,-1,3)$, $(2,-1,3,2)$, and $(-1,8,-9,5)$ are linearly dependent.	2	CO1	BT1
3	Find the angle between the vectors $u = (1,3,-5)$ and $v = (2,-,3,4)$ in $\mathbb{R}^3$	2	CO1	BT1
4	Find the projection of $u = (1,1,1)$ on $v = (2,4,4)$.	2	CO2	BT1
5	Reduce the quadratic form $Q = 5x^2 + 5y^2 + 2z^2 - 4xy + 2xz - 2yz$ to its canonical form by an orthogonal transformation	2	CO2	BT1

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	Find a basis for the row space column space and null space of $\mathbf{A} = \begin{bmatrix} 1 & 3 & 1 & 3 \\ 0 & 1 & 1 & 0 \\ -3 & 0 & 6 & -1 \\ 3 & 4 & -2 & 1 \\ 2 & 0 & -4 & 2 \end{bmatrix}$	10	CO1	BT1

PTO (Please Turn Over)

7	**Find the LU and PLU factorization of the matrix** $$A = \begin{bmatrix} 3 & -7 & -2 & 2 \\ -3 & 5 & 1 & 0 \\ 6 & -4 & 0 & -5 \\ -9 & 5 & -5 & 12 \end{bmatrix}.$$	10	CO1	BT1

PART C: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
8	**Show that the equations** $$x + 2y + z = 0$$ $$3x + 2y + z = 2$$ $$2x - y + 2z = 5$$ $$5x + 6y + 3z = 2$$ $$x + 3y - z = -3$$ **are consistent and solve**	10	CO1	BT1
9	**i. Let a, b, c be fixed real numbers and $V = \mathbb{R}^3$. Prove that** $$W = \{(x, y, z) \in \mathbb{R}^3 \mid ax + by + cz = 0\}$$ **is a subspace of V.** **ii. Express the vector $v = (3, 8, 8)$ as a linear combination of the vectors** $u_1 = (1, 2, 1),\ u_2 = (2, 1, 3),\ u_3 = (1, 1, 1).$	10	CO1	BT1

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	**Find the characteristic roots and characteristic vectors of the matrix** $$A = \begin{bmatrix} 3 & -2 & 0 \\ -2 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$ **and hence reduce it to diagonal form.**	10	CO2	BT1

11	**Find the least squares solution of the system** $$AX = b,$$ **where** $$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix},\ b = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}.$$ **Also find the least square error.**	10	CO2	BT1

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	**Using the Gram-Schmidt Orthogonalization Process (GSOP), obtain an orthonormal basis for the subspace of $\mathbb{R}^4$spanned by the vectors** $$u_1 = (1,1,0,0),\ u_2 = (1,0,1,0),\ u_3 = (1,0,0,1).$$	10	CO2	BT1
13	**Let $P(t)$be the vector space of real polynomials of degree at most 2with inner product** $$\langle f, g \rangle = \int_0^1 f(t)\, g(t)\, dt.$$ **Find the angle between the polynomials** $$f(t) = 2t^2 + t - 1$$ **and** $$g(t) = t^2 - 2t + 2.$$	10	CO2	BT1