Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET-A

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY/JUNE 2024

Date : June 3, 2024
Time : 1:00 PM - 4:00PM

Semester : Semester VIII-2020

Course Code : ECE3017

Max Marks : 100

Course Name : - Linear Algebra for Communication Engineering

Weightage : 50%

Program : B.Tech.

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ANY THREE QUESTIONS **(3 Q X 5 M = 15 M)**

1. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, then show that α cannot be real for which $A^2 = B$.

(CO1) [Knowledge]

2. If $A + B = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and $A - B = 3I_2$, determine A and B.

(CO1) [Knowledge]

3.

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

Check whether the given matrix can be LU decomposed. Why? or, why not?

(CO1) [Knowledge]

4. If $\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_n$ are the eigen values of $A = \begin{bmatrix} 1 & 0 & 0 & \cdots & 0 \\ 0 & 2 & 0 & \cdots & 0 \\ 0 & 0 & 3 & \cdots & 0 \\ \vdots & \vdots & \vdots & & \vdots \\ 0 & 0 & 0 & \cdots & n \end{bmatrix}_{n\times n}$, determine $\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_n$ and hence find $\lambda_1 + \lambda_2 + \lambda_3 + \cdots \lambda_n$.

(CO3,CO2) [Knowledge]

5. What is the inverse of the identity matrix $I_{m\times m}$? What is the outcome of multiplying any matrix $A_{m\times n}$ with $I_{n\times n}$?

(CO4) [Knowledge]

PART B

ANSWER ANY TWO QUESTIONS **(2 Q X 20 M = 40 M)**

6. Check whether the following game has any saddle-point and, if not, solve it GRAPHICALLY.

		B		
A	1	0	4	-1
	-1	1	-2	5

(CO2) [Comprehension]

7. Using the method of dominance, solve the game whose pay-off matrix is given below

			B			
	0	0	0	0	0	0
A	4	2	0	2	1	1
	4	3	1	3	2	2
	4	3	7	-5	1	2
	4	3	4	-1	2	2
	4	3	3	-2	2	2

(CO3) [Comprehension]

8. Two players A and B play a game in which they toss a die each such that if the sum of the total of two dice is a mutiple of 3, A wins that amount. Else, A has to pay the same amount to B for any other combination that does not sum to a multiple of 3. Based on this data

- (a) write down the pay-off matrix of the game (for A)
- (b) determine row-min and col-max
- (c) check whether the game has any saddle-point.

(CO4) [Comprehension]

PART C

ANSWER ANY THREE QUESTIONS **(3 Q X 15 M = 45 M)**

9. Let λ and α be real. Find the set of all values of λ for which the system of linear equations has a non-trivial solution

$$\lambda x_1 + (\sin\alpha)\, x_2 + (\cos\alpha)\, x_3 = 0$$
$$x_1 + (\cos\alpha)\, x_2 + (\sin\alpha)\, x_3 = 0$$
$$-x_1 + (\sin\alpha)\, x_2 - (\cos\alpha)\, x_3 = 0$$

(CO1) [Application]

10. Find an *LU* decomposition of $A = \begin{bmatrix} 3 & 1 & 6 \\ -6 & 0 & -16 \\ 0 & 8 & -17 \end{bmatrix}$ and hence determine $X = \{x_1, x_2, x_3\}$ when $AX = \begin{bmatrix} 3 \\ 13 \\ 4 \end{bmatrix}$

(CO2) [Application]

11. For a given matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$, find the value of $A^3 - 4A^2 - 5A$ using the Cayley-Hamilton theorem.

(CO3) [Application]

12. Without expanding at any stage, show that the determinant $A = \begin{vmatrix} 1^2 & 2^2 & 3^2 & 4^2 \\ 2^2 & 3^2 & 4^2 & 5^2 \\ 3^2 & 4^2 & 5^2 & 6^2 \\ 4^2 & 5^2 & 6^2 & 7^2 \end{vmatrix}$ is equal to 0.

(CO4) [Application]