# PRESIDENCY UNIVERSITY **BENGALURU**

SET-A

Time: 1:00 PM - 4:00 PM

# SCHOOL OF ENGINEERING **END TERM EXAMINATION – MAY/JUNE 2024**

Semester : Semester VIII-2020

Course Code : ECE3017

Course Name : - Linear Algebra for Communication Engineering 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**

- **1.** If  $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ , then show that  $\alpha$  cannot be real for which  $A^2 = B$ .
- If  $A + B = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$  and  $A B = 3I_2$ , determine A and B. 2.

3.

Check whether the given matrix

can be LU decomposed. Why? or, why not?

(CO1) [Knowledge]

4.

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

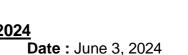
 $A = \begin{bmatrix} 1 & 0 & 0 & \cdots & 0 \\ 0 & 2 & 0 & \cdots & 0 \\ 0 & 0 & 3 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix}$ 

(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]





Max Marks: 100

Weightage: 50%

(3 Q X 5 M = 15 M)(CO1) [Knowledge]

(CO1) [Knowledge]

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

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.

		В			
Α	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

		В			
0	0	0	0	0	0
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.

Α

(CO4) [Comprehension]

(3 Q X 15 M = 45 M)

#### PART C

#### **ANSWER ANY THREE QUESTIONS**

**9.** Let  $\lambda$  and  $\alpha$  be real. Find the set of all values of  $\lambda$  for which the system of linear equations has a nontrivial 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.

12.

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  $AX = \begin{bmatrix} 3 \\ 13 \end{bmatrix}$ (CO2) [Application]

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. 11.

(CO3) [Application]

$$A = \begin{vmatrix} 1^2 & 2^2 & 3^2 & 4^2 \\ 2^2 & 3^2 & 4^2 & 5^2 \\ 3^2 & 4^2 & 5^2 & 6^2 \\ 4^2 & 5^2 & 6^2 & 7^2 \end{vmatrix}$$
 is equal to **O**.

Without expanding at any stage, show that the determinant

(CO4) [Application]