Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU
SCHOOL OF ENGINEERING

Test 1

Winter Semester: 2021-22
Course Code: ECE 314
Course Name: Linear Algebra for Communication Engineering
Program & Sem: B.Tech, & VI Semester

Date: 26th April 2022
Time: 1.30 PM to 2.30 PM
Max Marks: 40
Weightage: 15%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks. (8Qx2M=16M)

1. A solution for a linear system satisfies the set of linear equations which represent the system. An inconsistent linear system has --------------- no. of solutions.

[C.O.1][Knowledge]

2. Finding the solution for a system of two linear equations in two variables amounts to finding the ------------ of two straight lines. [C.O.1][Comprehension]

3. Pivot position is the position of the leading element of a non-zero row in a row reduced matrix. The entry in a pivot position of a reduced echelon matrix is -----[C.O.1][Knowledge]

4. A linear system can have one, infinite or no solutions, but not two solutions. (True/False) [C.O.1][Comprehension]

5. If the solution of a linear system Ax = b happens to be a vector from the null space of the matrix A then the system is said to be a -------------------system. [C.O.1][Knowledge]

6. Given 3 non-zero matrices A, B, and C it is found that A X B = A X C. This implies, in general B = C (True/False) [C.O.1][Comprehension]

7. Inverse of a matrix A, A^{-1} satisfies A X A^{-1} = I = A^{-1} X A, where I is the identity matrix. To check the invertibility of a matrix it is enough to verify the ------------of the matrix.

[C.O.1][Knowledge]

8. Any vector in a subspace can be written as a linear combination of the vectors in its basis. An important property of a basis is ---------------------------- [C.O.1][Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries FIVE marks. (3Qx5M=15M)

9) In an electrical circuit the voltage drop V measured across a time varying resistor at two different time instants is related to the current I as per the following equations.

$2V - 3I = 2, \quad 7V + 9I = 46$

For a certain value of I, the voltage drops at both the time instants are found to be equal. Find out for which values of V & I this happens. [C.O.1][Comprehension]

10) Column space of a matrix is the set of all linear combinations of the columns of the matrix. Let us define a matrix A and a vector b as follows.

$$A = \begin{bmatrix} 0 & 1 & -4 \\ 2 & -3 & 2 \\ 5 & -8 & 7 \end{bmatrix}, \quad b = \begin{bmatrix} 8 \\ 1 \\ 1 \end{bmatrix}$$

Determine whether b is in the column space of A. [C.O.1][Comprehension]

11) A set of vectors is said to be linearly independent if each of the vectors cannot be represented as a linear combination of the other vectors in the set. Determine if the columns of the following matrix A are linearly independent.

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

[C.O.1][Comprehension]

Part C [Problem Solving Questions]

Answer the following Question. The question carries NINE marks. (1Qx9M=9M)

12) Factorizing row reducible matrices into a unit lower triangular matrix (the L matrix) and an upper triangular row reduced matrix (the U matrix) greatly reduces the number of computations required to solve a linear system, especially for a case of a sequence of matrix equations to be solved. Construct the L and U matrices for the matrix A given below.

$$A = \begin{bmatrix} 1 & 4 & -1 & 5 \\ 3 & 7 & -2 & 9 \\ -2 & -3 & 1 & -4 \\ -1 & 6 & -1 & 7 \end{bmatrix}$$

[C.O.1][Comprehension]

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TEST 2 EXAMINATION

Odd Semester: 2021 - 22

Course Code: ECE 314

Course Name: Linear Algebra for Communication Engineering

Program & Sem: B. Tech & VI Sem

Date: 1st June 2022

Time: 1:30 pm to 2:30 pm

Max Marks: 30 Marks

Weightage: 15%

Instructions:

(iv) Read all questions carefully and answer accordingly.

(v) Non-Programmable and Scientific Calculators permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries two marks. (5Qx 2M= 10M)

1. A vector-space is a collection of vectors which is closed under __________. A subspace is a vector space contained inside a vector space, __________of two subspaces S and T is a subspace, where Sand T are closed under linear combinations.
   [C.O.No.1] [Knowledge Level]

2. Ax=b is solvable exactly when b is a vector in the __________ of A. [C.O.No.1] [Knowledge Level]

3. Basis is a linearly independent set that span a vector space V. The number of elements in a basis is called _______ of the vector space V. [C.O.No.1] [Knowledge Level]

4. The system of equations x+2y+z=9 and 2x+y+3z=7 can be expressed as______. Also represent it in the matrix form __________. [C.O.No.1] [Knowledge Level]

5. Null of a matrix A is the collection of all solutions to the equation Ax=0.Null space
   N(A-λI) is called the eigen space of A corresponding to _________.
   [C.O.No.2]

   [Knowledge Level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries five marks.

(2Qx5M=10M)

6. i) If the system of equations 2x+y=5, x-3y= -1 and 3x+4y=k is consistent, then find the value of K.

   ii) If the set of all $A \in R$ for which the vectors (2,A,0), (0,A^2,2) and (2,0,A) are linearly dependent, then find A^2 .

   [C.O.No.2][Comprehension Level]

7. Geometrically, an eigen vector of a matrix A is a non-zero vector x in R^n such that the vector x and Ax are parallel. It can be determined by solving the homogeneous system of equations (A-λI)x=0 for each eigen value λ. Determine the eigen values and eigen vectors of $A = \begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$

   [C.O.No.2] [Comprehension Level]

Part C [Problem Solving Questions]

Answer the Question. The question carries ten marks.

(1Qx10M=10M)

8. Construct the L and U matrix by the method of factorization .What matrix E puts A into triangular form EA=U? Multiply by $E^{-1} = L$ to factor A into LU.

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

[C.O.No.1] [Application Level]

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

END TERM EXAMINATION

Even Semester: 2021 - 22
Course Code: ECE 314
Course Name: Linear Algebra for Communication Engineering
Program & Sem: B. Tech & VI Sem

Date: 30th June 2022
Time: 09:30 AM to 12:30 PM
Max Marks: 100 Marks
Weightage: 50%

Instructions:

(vi) Read all questions carefully and answer accordingly.
(vii) Non-Programmable and Scientific Calculators permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FIVE marks. (6Qx 5M= 30M)

9. Solving simple matrix equations is similar to solving real number equations but with two important differences:1)There is no operation of division for matrices 2)Matrix multiplication is not commutative. In solving matrix equations, list some of the properties of matrices, Assuming that all products and sums are defined for the indicated matrices A, B, C, I, and 0 [C.O.No.1] [Knowledge Level]
10. A system of linear equations is consistent if it has one or more solutions and inconsistent if no solutions exist. Furthermore, a consistent system is said to be independent if it has exactly one solution and dependent if it has more than one solution. Two systems of equations are equivalent if they have the same solution set. Solve each of the following systems by graphing and comment on the graph.

    (i) $x - 2y = 2$, $x + y = 5$

    (ii) $x + 2y = -4$, $2x + 4y = 8$

    (iii) $2x + 4y = 8$, $x + 2y = 4$ [C.O.No.1]

[Knowledge Level]

11. Using Row Reduced echelon form find the inverse of matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 3 \\ 1 & 4 & 6 \end{bmatrix}$ and check whether it is invertible. [C.O.No.1] [Knowledge Level]

12. The column space of matrix A, is the set of all linear combinations of the columns of matrix A and Rank is the dimension of column A which is given by the number of vectors in the basis of column A. Give the basis of the column space and the rank of the matrix $A = \begin{bmatrix} 1 & 0 & -6 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & -9 \end{bmatrix}$ [C.O.No.1] [Knowledge Level]

13. Consider the Vector space R^n . Prove that R^n is an inner product space with the inner product defined by $(u,v)=a_1b_1+a_2b_2+......+a_nb_n$ where $u=(a_1,a_2,......a_n)$ & $v=(b_1,b_2,....b_n)$

[C.O.No.3]

[Knowledge Level]

14. Let S be a set that contains vectors $v_1,v_2,.....v_n$. Define Orthogonal vectors, orthogonal
set, orthonormal set and basis of a vector space. [C.O.No.2]
[Knowledge Level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TEN marks.
(3Qx10M=30M)

15. i) The system of equation 2x+y=5, x-3y= -1 and 3x+4y=k is consistent, then find the value of K.

ii) The set of all $A \in R$ for which the vectors $(2,A,0)$, $(0,A^2,2)$ and $(2,0,A)$ are linearly dependent, then find A^2 .

[C.O.No.2][Comprehension Level]

16. i) Geometrically, an eigen vector of a matrix A is a non-zero vector x in R^n such that the vector x and Ax are parallel. It can be determined by solving the homogeneous system of equations (A-λI)x=0 for each eigen value λ. Determine the eigen values and eigen vectors of A=$\begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$

ii) Explain the properties of determinant. [C.O.No.2] [Comprehension Level]

17. Solve the following system of equations using cramer's rule.

$x + 2y + 3z = -5\ ,\ 3x + y - 3z = 4\ ,\ -3x + 4y + 7z = -7$

[C.O.No.2]

[Comprehension Level]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TEN marks.

(4Qx10M=40M)

18. Find a matrix P, which transforms the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to diagonal form. Hence calculate A^4. [C.O.No.2]

[Application Level]

19. Apply Gram-Schmidt orthogonalization process to the basis B={(1,0,1),(1,0,-1),(0,3,4)} of the inner product space R^3 to find an orthogonal basis of R^3.

[C.O.No.2]

[Application Level]

12. The message 46 84 85 28 47 46 45 10 30 48 72 29 57 38 38 57 95 was encoded with

the matrix A shown. $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 2 \\ 2 & 3 & 1 \end{bmatrix}$ Decode this message.

[C.O.No.3]

[Application Level]

13. Solve Ax=B by LU factorization method .Given the matrix $A = \begin{bmatrix} 1 & 3 & 6 \\ 2 & 8 & 16 \\ 5 & 21 & 45 \end{bmatrix}$.

Also verify

A=LU.

[C.O.No.2]

[Application Level]