

<b>INSTITUTE</b>	<b>FACULTY OF ENGINEERING AND TECHNOLOGY</b>
<b>PROGRAM</b>	<b>BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING -CYBER SECURITY)</b>
<b>SEMESTER</b>	<b>2</b>
<b>COURSE TITLE</b>	<b>LINEAR ALGEBRA</b>
<b>COURSE CODE</b>	<b>01MA1104</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 This subject aims to provide fundamentals of Linear Algebra using matrix operations and Vector Space. The topics delivered in this course are essential for the learners of Computer Engineering

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Identify the conversion of real life problems into system of linear equations and solve them through several matrix methods
- 2 Understand the concept of basis and dimension of Vector Space
- 3 Solve the real-world problem using Linear Transformation
- 4 Understand the concepts of Eigen value and Eigen Vectors to Diagonalization and Quadratic form
- 5 Apply the concepts of Inner Product Space, Gram Schmidt Procedure and QR decomposition

**Pre-requisite of course:**NA

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	1	0	50	30	20	0	0

  

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Matrix and System of Linear Equations</b> Matrix, Determinant, Cramer's Rule, , System of Linear Equation, , Row Echelon Form and Row Reduced Echelon Form of a matrix,, Rank and Nullity of a matrix, Homogeneous and Non-homogeneous system of Linear equations, Methodology of Gauss- elimination and Gauss-Jordan-elimination, , Solution of a system through L-U Decomposition.	9
2	<b>Vector Space</b> Vector Space: Vector space & Subspace,, Linear Combination, Span Set, Linearly independent and Linearly dependent set, Basis and Dimension of the vector space,, Rank and Nullity Theorem	8

Contents : Unit	Topics	Contact Hours
3	<b>Linear Transformation</b> Definition of linear transformation,, Standard linear transformations, , Matrix of Linear transformations,, Range and Kernel of Linear Transformation, Dimension Theorem, Inverse Linear Transformation, Similarity Transformation	8
4	<b>Eigen Values and Eigen Vectors</b> Eigen values and Eigen vectors of a matrix, Algebraic Multiplicity and Geometric Multiplicity, Similarity of two matrices and Diagonalization, , Cayley - Hamilton theorem, Quadratic and Canonical forms,, Applications of Eigen Value.	12
5	<b>Inner Product Space</b> Dot products and Inner products,, the lengths and angles of vectors,, Matrix representations of Inner products,, Orthogonality, , Normality, Gram-Schmidt orthogonalization, QR decomposition	8
<b>Total Hours</b>		<b>45</b>

#### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	<b>practical 1</b> Rank by Row echelon form and Reduced row echelon form	2
2	<b>practical 2</b> System of Linear equation by Gauss Elimination and Gauss Jordan Method	2
3	<b>practical 3</b> LU – decomposition	2
4	<b>practical 4</b> Eigen value by its properties	2
5	<b>practical– 5</b> Eigen Value, Eigen Vector, AM and GM	2
6	<b>practical– 6</b> Cayley-Hamilton Theorem	2
7	<b>practical 7</b> Diagonalization and Orthogonally Diagonalization	2
8	<b>practical 8</b> Inner Product Space, Orthogonality, Normality	2
9	<b>practical 9</b> Gram Schmidt Procedure, QR Decomposition	2
10	<b>practical 10</b> Vector Space and Subspace	2
11	<b>practical 11</b> Linear Dependent and independent, Span and Basis	2
12	<b>practical 12</b> Rank – Nullity Theorem	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
13	<b>practical 13</b> Divergence, Tangent Plane, Normal Line, Directional Derivatives	2
14	<b>practical 14</b> Curl of a vector field and Irrotational Vector.	2
<b>Total Hours</b>		<b>28</b>

### Textbook :

- 1 Introduction to Linear Algebra with Applications, Jim DeFranza, Daniel Gagliardi, Waveland Press, 2015

### References:

- 1 ELEMENTARY LINEAR ALGEBRA APPLICATIONS VERSION, 9TH ED, ELEMENTARY LINEAR ALGEBRA APPLICATIONS VERSION, 9TH ED, Howard Anton, Chris Rorres, Wiley India Pvt. Limited, 2008
- 2 Elementary Linear Algebra, Elementary Linear Algebra, Ron Larson, David C. Falvo, Brooks/Cole Cengage Learning, 2009
- 3 Linear Algebra and Its Applications, Linear Algebra and Its Applications, David C. Lay , Pearson Education, 2003

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	40.00	10.00	10.00	10.00

### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

- 1 <https://mathworld.wolfram.com/LinearSystemofEquations.html>
- 2 <https://matrixcalc.org/slu.html>
- 3 <https://math.libretexts.org/Bookshelves>