

COURSE TITLE	APPLIED LINEAR ALGEBRA
COURSE CODE	01AI0102
COURSE CREDITS	5

Objective:

- 1 This subject aims to provide computational proficiency involving procedures in Linear Algebra. This course will enable learners to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject. The topics delivered in this course are essential for the learners and it will prepare them for further courses of Artificial intelligence and Machine learning.
- 2 This subject aims to provide computational proficiency involving procedures in Linear Algebra. This course will enable learners to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject. The topics delivered in this course are essential for the learners and it will prepare them for further courses of Artificial intelligence and Machine learning.

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

- 1 Understand concepts of Basis and Dimensions of Vector Space
- 2 Identify the conversion of real-life problems into system of linear equations and solve them through several matrix methods
- 3 Apply the concepts of Eigen value and Eigen Vectors to Diagonalization and Quadratic form
- 4 Construct an orthonormal basis for an inner product space by using the Gram Schmidt process.

Pre-requisite of course: Basic matrix operations and Determinant.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	2	0	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Vector Space Vector space, Subspace, Linear Combination, Linear independence of vectors, Span, Basis and dimension of vector space, Row Space, Column Space, Null Space with the concept of Rank and Nullity	12

Contents : Unit	Topics	Contact Hours
2	Matrix Algebra and System of Linear Equations Types of matrices, 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, Cramer's Rule, Solution of a system through L-U Decomposition, Consistency of a system of Linear equations, Computing inverse of a matrix by Row operations	12
3	Eigen Values and Eigen Vectors 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, Positive definite Matrices, Singular Value Decomposition, Principal Component Analysis	13
4	Norms and Inner product space Vector Norms, Matrix Norms, Inner Product Spaces, Orthogonal Vectors, Gram-Schmidt Procedure, Orthogonal Decomposition	8
Total Hours		45

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Tutorial 1 Vector space	6
2	Tutorial 2 Matrix algebra, System of linear equations	8
3	Tutorial 3 Eigen value and Eigen vectros, Cayley Hamiltonian Theorem	6
4	Tutorial 4 Inner Product space	4
Total Hours		24

Textbook :

- 1 Linear Algebra and Its Application, David C. Lay, Tata Mac., 2010

References:

- 1 Linear Algebra and Its Application, Linear Algebra and Its Application, David C, -, -
- 2 Introduction to Linear Algebra with Application, Introduction to Linear Algebra with Application, Jim Defranza, Daniel Gagliardi, Tata McGraw-Hill, -
- 3 Elementary Linear Algebra, Applications version, Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley, -

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					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	40.00	40.00	0.00	0.00	0.00

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 directed toward the completion of semester for assessment of performance of understudies in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc21_ma03/preview
- 2 <https://www.coursera.org/learn/linear-algebra-machine-learning>
- 3 <https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/>