COURSE TITLE	**LINEAR ALGEBRA**
COURSE CODE	**01MA0104**
COURSE CREDITS	**5**

Objective:

1 This subject aims to provide fundamentals of Linear Algebra using matrix operations and applications of Linear Algebra through Python . The topics delivered in this course are essential for the learners of Computer Engineering, Information Technology and Artificial Intelligence.

2 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 Bioinformatics Engineering

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 Apply Linear Algebra in Image Processing and Cryptography through Python

5 This subject aims to provide fundamentals of Linear Algebra using matrix operations and applications of Linear Algebra through Python . The topics delivered in this course are essential for the learners of Computer Engineering, Information Technology and Artificial Intelligence.

Pre-requisite of course: Determinant , Basics of matrices

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, Raw Space, Column Space, Null Space with the concept of Rank and Nullity	12

DR. SEJAL SAHILKRISHNA SHAH
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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	10
4	**Applications of Linear Algebra through Python** Basic Syntax of Python, Representation and operations on different types of Matrices through Python, Basics of Computer graphics and Image processing using matrix algebra, Basics of Cryptography (Coding-Decoding) through inverse of a matrix	8
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorial 1** Types of Matrices, Row Echelon Form, Rank by REF, RREF and Determinant, System of Linear equation by Gauss Elimination and Gauss Jordan Method, System of Linear equation by Cramer's Method, Inverse of Matrix by Gauss Jordan and Adjoint Method	2
2	**Tutorial 2** LU – decomposition, Eigen value by its Properties, Eigen Value, Eigen Vector, AM and GM, Cayley-Hamilton Th., Diagonalization and Orthogonally Diagonalization, Quadratic form, Index, Signature and Nature, Canonical form	2
3	**Tutorial 3** Vector Space and Subspace, Linear Combination, LD/LI, Span and Basis, Row space, Column space and Null space, Rank and Nullity Th.	2
4	**Tutorial 4** Eigen value and Eigen vector by Python, Inverse of matrix by Python, Cryptography and image processing by Python	2
5	**Tutorial 5** LUD composition	2
6	**Tutorial 6** Eigen values	2
7	**Tutorial 7** Cayley Hamilton theorem	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
8	**Tutorial 8** Quadratic forms	2
9	**Tutorial 9** vector space	2
10	**Tutorial 10** LI,LD and basis	2
11	**Tutorial 11** row space, column space	2
12	**Tutorial 12** commands of Python	2
Total Hours		**24**

Textbook :

1 Introduction to Linear Algebra with Application , Jim Defranza, Daniel Gagliardi,, Tata McGraw-Hill, 2015

References:

1 Linear Algebra, Linear Algebra, Ron Larson, Cengage Learning, 2016

2 Linear Algebra and its Applications, Linear Algebra and its Applications, David C. Lay, Pearson Education, 2003

3 Elementary Linear Algebra, Applications version, Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition, 2013

4 Numerical Python, Numerical Python, Robert Johansson, Apress Publications, 2019

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**
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.

DR. SEJAL SAHILKRISHNA SHAH
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Instructional Method:

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 https://en.wikipedia.org/wiki/Linear_algebra

2 https://onlinecourses.nptel.ac.in/noc20_ma21/preview

3 https://archive.nptel.ac.in/courses/111/104/111104137/

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Digitally signed by (Name of HOD)

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