Course Title: Linear Algebra **Credit: 3**
Course CSIT.123
Nature of the Course: Theory **Total hours: 45**
Year: First, Semester: Second
Level: B.Sc. CSIT .

1. Course description

The course intends to enable the students to understand the basics of linear algebra. In this course students will be able to study linear equation and matrices, linear transformation, vector space. At the same time students get much idea about matrix algebra, Eigen values and Eigen vectors.

2. Course objectives

The general objectives of the course are as follows:

- To acquaint the students with basics of linear algebra.
- To enable the students, to understand the concept of linear equation, and its solution.
- To know the basic concept of Eigen values and Eigen vectors and its further application.

Specific objectives and contents

Specific Objectives	Unit 1: Linear equation & Matrices - 8 hou
• Define system of linear equations • Give the concept of row reduction and Echelon form and example. • Define the vector equation. • Discuss the matrix equation of the form Ax = b and its solution. • Explain the meaning of solution set of linear equation.	1.1 System of linear equations 1.2 Row reduction and Echelon form 1.3 vector equation 1.4 The matrix equations Ax = b 1.5 Solution set of linear system 1.6 Linear independence
	Unit 2: Matrix Algebra - 6 hou
• Define linear independence and Examples. • Discuss the inverse of a matrix. • Discuss the characterization of invertible matrix. • Explain partitioned matrices. • Discuss Leontief input output model and its application to computer graphics.	2.1 Matrix operation 2.2 The inverse of a matrix 2.3 Characterization of invertible matrices 2.4 Partitioned matrices 2.5 The Leontief input output model 2.6 Application to computer graphics
	Unit 3: Vector Spaces - 8 hou
• Define the meaning of vector spaces and its various examples. • Define vector subspace and examples. • Explain the term linear combination, linear dependence and independence. • Define Basis and dimension of vector space. • Compute the row rank and column rank of a matrix.	3.1 Definition and examples 3.2 Vector subspaces 3.3 Linear combination, linear dependence independence 3.4 Basis and dimension of a vector space. 3.5 Row and Column space of a matrix. 3.6 Row rank and column rank.

Unit 4: Linear Transformation - 8 hours

- Define linear transformation and how this concept used in matrix?
- Discuss the term Kernel and Image of linear transformation.
- Compute Kernel and Image of any function.
- State and prove Rank Nullity theorem and some examples related to this.
- Define linear isomorphism.
- State the meaning of L(V, N) how it is vector space?
- Discuss the matrix of linear transformation.

4.1 Linear transformation, representation by a matrix.
4.2 Kernel and image of linear transformation.
4.3 Rank nullity theorem
4.4 Linear isomorphism
4.5 L(V, W) is a vector space dimension of L(V, W) (statement only)
4.6 The matrix of liner transformation.

Unit 5: Inner Product Space - 7 hours

- Give the concept of Eucledian space and define dot product.
- Discuss the general inner product space.
- Define the term orthogonality, orthogonal projection and orthogonal basis.
- Discuss Gram-Schmidt orthogonalization process.
- Define orthogonal transformation.

5.1 The Eucledian space & dot product.
5.2 General Inner product spaces
5.3 Orthogonality, orthogonal projection onto a line, orthogonal basis.
5.4 Gram-schmidt orthogonalization.
5.5 Orthogonal transformation.

Unit 6: Eigen Values and Eigen Vectors - 8 hours

- Define Eigen values and Eigen vectors.
- Define characteristics equation.
- Discuss the term diagonalization.
- Obtain the relation between linear transformation and Eigen vectors.
- Define Complex Eigen values.
- State Caley Hamilton theorem

6.1 Eigen values and Eigen vectors
6.2 The characteristic equation,
6.3 Diagonalization
6.4 Eigen vectors and linear transformation.
6.5 Complex Eigen values
6.6 Caley Hammiton theorem (statement only)

Text Books and References

Text Books

i. David C. Lay: Linear Algebra and its applications. 3rd Edition, Pearson Edition
ii. S. Lang: Introduction to Linear Algebra, second Edition. Springer verlag, New York (1986)

Reference Books

i. I. Kolman, Bernard: Introductory Linear Algebra, with application, 7th Edition. Pearson Ed.
ii. G. Strang: Linear Algebra and its application 3rd Ed. Harcourt Brace Jovanovich Orlando (1986)