MTCS1033 - Linear Algebra

Course Title:	Linear Algebra (MTCS1033)
Pre-requisite(s):	Calculus and Analytical Geometry (MTCS1013)
Credit Hours:	3
Instructor(s):	
Text Book(s):	Linear Algebra and its applications, 4th Edition by David C. Lay
Reference Book(s):	• H. Antone, C. Rorres, Elementary Linear Algebra and its applications
Web Reference:	

Course Introduction:

The principle aim of this course is to understand several important concepts in linear algebra, including systems of linear equations and their solutions; matrices and their properties; determinants and their properties; vector spaces; linear independence of vectors; subspaces, bases, and dimension of vector spaces; inner product spaces; linear transformations; and Eigen values and eigenvectors. These concepts are needed for advanced mathematics courses

Course Objectives:

This course teaches how to solve a system of linear equations that appears in circuit analysis, electromagnetic fields and waves, antenna theory, microwaves, etc. Interpret the vector equations and linear transformations which are used in image processing, Control theory, etc.

Apply the basic knowledge of vector spaces, Eigen value and Eigen vectors which are help full in image processing, control theory. Develop a solid understanding of the course by implementing the key concepts in MATLAB environment.

Course Learning Outcomes (CLOs):

At the end of this course, the students should be able to:

CLO:1 Describe the basic concepts of linear algebra. (C1)

CLO:2 Explain and describe the concept of vector algebra, vector spaces and linear transformations. (C2)

CLO:3 Apply their acquired knowledge to problems arising in real life (C3)

CLOs – PLOs Mapping

	CLO:1	**CLO:2**	**CLO:3**
PLO:1 (Academic Education)			
PLO:2 (Knowledge for Solving Computing Problems)	√	√	
PLO:3 (Problem Analysis)			√
PLO:4 (Design/ Development of Solutions)			
PLO:5 (Modern Tool Usage)			

Course Contents:

Week	**Contents**
1	**System of Linear Equations and Matrices-Four Lectures** • Introduction to system of linear equations • Matrix form of system of Linear Equations • Gaussian Elimination method • Gauss-Jorden Method • Consistent and inconsistent systems • Homogeneous system of equations

2	**System of Linear Equations and Matrices-Four Lectures** • Introduction to system of linear equations • Matrix form of system of Linear Equations • Gaussian Elimination method • Gauss-Jorden Method • Consistent and inconsistent systems • Homogeneous system of equations
3	**Vector Equations-Four Lectures** • Introduction to vector in plane • Vector in R^n • Vector form of straight line • Linear Combinations • Geometrical interpretation of solution of Homogeneous and Non-homogeneous equations
4	**Vector Equations-Four Lectures** • Introduction to vector in plane • Vector in R^n • Vector form of straight line • Linear Combinations • Geometrical interpretation of solution of Homogeneous and Non-homogeneous equations
5	**Applications of Linear Systems-Two Lectures** • Traffic Flow Problem • Electric circuit Problem • Economic Model
6	**Linear transformations-Four Lectures** • Introduction to linear transformations • Matrix transformations • Domain and range of linear transformations • Geometric interpretation of linear transformations • Matrix of linear transformations
7	**Linear transformations-Four Lectures** • Introduction to linear transformations • Matrix transformations • Domain and range of linear transformations • Geometric interpretation of linear transformations • Matrix of linear transformations

8	**Inverse of a matrix-Four Lectures** • Definition of inverse of a matrix • Algorithm to find the inverse of matrices • LU factorization
Mid-Term Exam	
9	**Inverse of a matrix-Four Lectures** • Definition of inverse of a matrix • Algorithm to find the inverse of matrices • LU factorization
10	**Determinants-Two Lectures** • Introduction to determinants • Geometric meaning of determinants • Properties of determinants • Crammer Rule • Cofactor method for finding the inverse of a matrix
11	**Vector Spaces-Three Lectures** • Definition of vector spaces • Subspaces • Spanning set • Null Spaces and column spaces of linear transformation • Linearly Independent sets and basis • Bases for Null space and Kernel space • Dimension of a vector space
12	**Vector Spaces-Three Lectures** • Definition of vector spaces • Subspaces • Spanning set • Null Spaces and column spaces of linear transformation • Linearly Independent sets and basis • Bases for Null space and Kernel space • Dimension of a vector space

13	**Eigen Values and Eigen Vectors-Three Lectures** • Introduction to eigen value and eigen vectors • Computing the eigen values • Properties of eigen values • Diagonalization • Applications of eigen values
14	**Eigen Values and Eigen vectors-Three Lectures** • Introduction to eigen value and eigen vectors • Computing the eigen values • Properties of eigen values • Diagonalization • Applications of eigen values
15	**Eigen Values and Eigen vectors-Three Lectures** • Introduction to eigen value and eigen vectors • Computing the eigen values • Properties of eigen values • Diagonalization • Applications of eigen values
16	Revision

Grading Policy

S.No	Grading	% of Total Marks
1	Assignments	15
2	Quizzes	15
3	Project	10
4	Mid-term Exam	20
5	Final Exam	40
	Total	**100**