22MT102 LINEAR ALGEBRA

Image Source: https://thumbs.dreamstime.com/z/linear-algebra-complex-like-puzzle-pictured-as-word-linear-algebra-puzzle-pieces-to-show-linear-algebra-can-be-164220956.jpg

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basics of matrices, Determinant, relations and functions.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of matrices and rank of a matrix using Echelon form, Normal forms. The methods for solving the system of linear equations using Cramer's rule, Gauss Elimination method and Gauss-Jordan method. To find the Eigen values and Eigen vectors of a square matrices and applications on it. To discuss vector space and its properties, Basis and Dimension and their applications.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

MATRICES:

Rank of a Matrix: Algebra of matrices, Types of matrices, Invertible matrices, Rank of a matrix, Echelon from, Normal form.

Solutions of Linear Equations: Consistency of System of linear equations, Cramer's Rule, Gauss Elimination method, Gauss-Jordan method.

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS OF MATRICES:

Eigen values and Eigen vectors: Introduction to Eigen values and Eigen vectors, Eigen values of diagonal matrix, Eigen values of triangular matrices, Properties of an Eigen values and Eigen vectors (without proofs).

Applications of Eigen Values and Eigen Vectors: Cayley-Hamilton theorem (without proof), Verification of Cayley-Hamilton theorem, Power of a square matrix, Spectral matrix, Diagonalization of a matrix.

PRACTICES:

- Determine the Rank of a matrix using the definition.
- Determine the rank of a matrix using Echelon form and Normal form.
- To find the solution of system of linear equations using Cramer's rule and Gauss Elimination method.
- To find the solution of system of linear equations (Homogeneous and Non-homogeneous) using Gauss-Jordan method.
- Determine the Eigen values and Eigen vectors of a square matrix which are either diagonal matrix or triangular matrix.
- Verification of Cayley-Hamilton theorem for square matrices.
- Examine the given square matrix is diagonalizable or not.
- Using Cayley-Hamilton theorem find the powers of a matrix.

SKILLS:

- ✓ *To discuss the solution of system of linear equations using other methods.*
- ✓ *Find Eigen Values and Eigen Vectors.*
- ✓ *Apply transformation to real world problems involving linear transformations.*
- ✓ *Analyze Quadratic forms and its applications.*

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

VECTOR SPACES:

Vector Spaces, Bases and Dimension: Vector space, Subspace, Linear independence and dependence of vectors, Bases and Dimension.

Linear Transformation: Linear transformations, Representation of linear transformations by matrices, Null space, Rank-nullity theorem.

UNIT-2 **12L+8T+0P=20 Hours**

INNER PRODUCT SPACES:

Inner Product Space: Inner product spaces, Cauchy-Schwarz's inequality, Orthogonal basis, Gram-Schmidt orthogonalization process.

Quadratic Forms: Introduction to Quadratic forms, Reduction of Quadratic form to symmetric matrix form and vice-versa, Positive, negative and semi definite matrices.

PRACTICES:

- Verify the given set of vectors is linearly dependent or not.
- Verify the given set of vectors is a basis or not.
- Examine the given transformation is a linear transformation or not.
- Verify Rank-Nullity theorem for given set problems.
- To discuss the applications of Orthogonal vectors and linearly independent.
- Find the Orthonormal basis to the given set of vectors using Gram-Schmidt Orthogonalization process.
- Discuss the Quadratic forms.
- Determine the nature of the Quadratic form.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of matrices and the methods to solve the system of equations.	Apply	1	1, 2, 4, 9, 10, 12
2	Apply the concepts of vector spaces, subspaces, bases, dimension.	Apply	2	1, 2, 4, 9, 10, 12
3	Evaluate inverse and power of a matrix by Caley Hamilton theorem.	Evaluate	1	1, 2, 4, 9, 10, 12
4	Determine orthogonality in inner product spaces.	Evaluate	2	1, 2, 4, 9, 10, 12

TEXT BOOKS:

1. Gilbert Strang, "Linear Algebra", 5th edition, Wellesley-Cambridge Press, 2016
2. V. Krishnamurthy, V. P. Mainra ,J.I. Arora, "An introduction to linear algebra", Chaukhamba Auriyantaliya, 2018.

REFERENCE BOOKS:

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018, 2nd Edition.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44 Edition, 2018.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, 2015.
4. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand and Co., Third revised edition, 2015.