17HS039 LINEAR ALGEBRA

Course Description and Objectives:
This course to learn, how Linear Algebra is ubiquitous in Mathematics and therefore a strong foundation has to be laid in studying the abstract algebraic concepts intertwining geometric ideas. The fundamental notions of vector spaces viz linear dependence, basis and dimension and linear transformations on these spaces have to be studied thoroughly.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
2	Relate matrices and linear transformations, compute Eigen values and Eigen vectors of linear transformations.
3	Learn properties of inner product spaces and determine orthogonality in inner product spaces.
4	Obtain various variants of diagonalisation of linear transformations.
5	Realise importance of adjoint of a linear transformation and its canonical form.

Skills:

1. Realise that the subject evolves as a generalization of solving a system of linear equations.
2. Master the dimension formula and rank and nullity theorem which are often exploited.
3. Learn the theory of determinants and put them in practice.

UNIT – I (12 hrs) : Vector Spaces-I :
Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

UNIT –II (12 hrs) : Vector Spaces-II :
Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotientspace.

UNIT –III (12 hrs) : Linear Transformations :
Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

UNIT –IV (12 hrs) : Matrix :

Matrices, Elementary Properties of Matrices, Inverse Matrices, Rank of Matrix, Linear Equations, Characteristic Roots, Characteristic Values & Vectors of square Matrix, Cayley – Hamilton Theorem.

UNIT –V (12 hrs) : Inner product space :
Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle in Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

Reference Books :
1. Linear Algebra by J.N. Sharma and A.R. Vasista, Krishna Prakashan Mandir, Meerut
2. Matrices by Shanti Narayana, published by S. Chand Publications.
3. Linear Algebra by Kenneth Hoffman and Ray Kunze, Pearson Education
   (low priced edition), New Delhi.
4. Linear Algebra by Stephen H. Friedberg et al   Prentice Hall of India Pvt. Ltd. 4th Edition 2007.

Suggested Activities:
Seminar/ Quiz/ Assignments/ Project on "Applications of Linear algebra Through Computer Sciences"