

**COURSE-V**  
**CBCS/ SEMESTER SYSTEM**  
**(w.e.f. 2020-21 Admitted Batch)**  
**B.A./B.Sc. MATHEMATICS**  
**LINEAR ALGEBRA**  
**SYLLABUS (75 Hours)**

**Course Outcomes:**

After successful completion of this course, the student will be able to;

1. understand the concepts of vector spaces, subspaces, bases, dimension and their properties
2. understand the concepts of linear transformations and their properties
3. apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
4. learn the properties of inner product spaces and determine orthogonality in inner product spaces.

**Course Syllabus:**

**UNIT – I (12 Hours)**

**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 Hours)**

**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 Quotient space.

**UNIT –III (12 Hours)**

**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 Hours)**

##### **Matrix :**

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

#### **UNIT –V (12 Hours)**

##### **Inner product space :**

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

##### **Co-Curricular Activities(15 Hours)**

Seminar/ Quiz/ Assignments/ Linear algebra and its applications / Problem Solving.

**Text Book:**

Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut- 250002.

**Reference Books :**

1. Matrices by Shanti Narayana, published by S.Chand Publications.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4<sup>th</sup> Edition, 2007.