**Course Objective:** Linear Algebra is the most important branch of mathematics and is extremely useful in physics, economics and social sciences. This course is intended to emphasized topics useful in matrix theory and advanced linear algebra. Due to its broad range of applications, the main objective is to develop the ability to solve various types of problems using linear algebra and matrix theory.

| Advanced Linear Algebra (BSM601) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme | | | | | Examination Scheme | | | | | |
| L | T | P | C | Hrs/Week | Theory | | | Practical | | Total Marks |
| | | | | | MS | ES | IA | LW | LE/Viva | |
| 3 | 1 | -- | 4 | 4 | 25 | 50 | 25 | -- | -- | 100 |

**UNIT I** **9 Hours**

Introduction of vector space, Euclidean n-space, Subspaces; Linear dependence/Independence, Basis and Dimension of a vector space; Coordinates with respect to a basis; symmetric and positive definite matrices, Linear Transformation and change of basis, Least square solutions.

**UNIT II** **10 hours**

Image of a basis identifies the linear transformation, Range Space and Rank, Null Space and Nullity: Rank-Nullity theorem, Matrix Representation of a linear transformation, Linear Operators on Rn and their representation as square matrices, Eigenvalues and eigenvectors of a matrix,

**UNIT III** **12 hours**

Diagonalization, Eigenvalues and eigenvectors of a linear operator, Characteristic Equation, Diagonalizability of a linear operator; Properties of eigenvalues and eigenvectors of Hermitian, skew-Hermitian, Unitary, and Normal matrices (including symmetric, skew-symmetric, and orthogonal matrices),

**UNIT IV** **8 hours**

Inner Products, Orthogonal Matrices, Angle and Orthogonality in Inner Product Spaces, Orthogonal Basis and Orthogonal Projection, Orthonormal Basis, Gram Schmidt Process. QR-decomposition

**APPROXIMATE TOTAL 39 Hours**

**Text and Reference books**


1. H. Anton and C Rorres, Elementary linear algebra with applications (11th ed.), John Wiley (2016)
2. G.Strang, Linear algebra and its applications (4th ed.), Cengage Learning (2014)


**Course Outcomes:**

On completion of this course students will be expected to have a good understanding of the following topics and their applications:

- Systems of linear equations
- Row reduction and echelon forms

- Matrix operations, including inverses
- Linear dependence and independence
- Subspaces and bases and dimensions
- Orthogonal bases and orthogonal projections
- Gram-Schmidt process
- Linear models and least-squares problems
- Determinants and their properties
- Cramer's Rule
- Eigenvalues and eigenvectors
- Diagonalization of a matrix
- Symmetric matrices
- Similar matrices
- Linear transformations