| Course No | Course Name | L-T-P-Credits |
|---|---|---|
| **MA 403** | **Linear Algebra** | **3-1-0: 4** |

Prerequisite: nil

**Course Objectives**: The objective of this course is to introduce students to the theory, techniques and applications of linear algebra in various real-world situations.

**Course Outcomes**: After successful completion of the course, students will be able to:

1. Understand the concepts and methods of linear algebra
2. Demonstrate understanding of the concepts of vector space and dimension.
3. Apply principles of matrix algebra to linear transformations
4. Develop the concept of linear transformation and its matrix representation.
5. Determine eigenvalues and eigenvectors and solve eigenvalue problems.
6. Demonstrate understanding of inner products and associated norms.
7. Solve problems that apply Linear Algebra to Chemistry, Economics and Engineering.

## SYLLABUS

| Module | Contents | Hours |
|---|---|---|
| I | Vector spaces, subspaces, linear independence and dependence, bases, dimension, coordinates, row-echelon form, reduced row-echelon form. | 7 |
| II | Linear transformations, kernel and range of a linear transformation, rank-nullity theorem, algebra of linear transformations, isomorphism, representation of transformations by matrices, linear functionals, dual and double dual of a space, annihilator of a subset, transpose of a linear transformation. | 9 |
| III | Eigenvalues and eigenvectors, characteristic polynomial, diagonalization of matrices and linear transformation, annihilating polynomials, Cayley-Hamilton theorem, minimal polynomial, invariant subspaces, invariant direct sums, Jordan canonical form. | 10 |
| IV | Inner products, inner product spaces, orthogonality, orthonormal sets, Bessel's inequality, Gram-Schmidt process, Schur theorem, spectral theorem for Hermitian and normal matrices. | 10 |

**Essential Readings:**


1. K. Hoffman and R. Kunze, "Linear Algebra", Pearson, 2nd edition, 2019.
2. S.H. Friedberg, A. J. Insel and L. E. Spence, "Linear Algebra", Pearson Education India, 4th edition, 2015.


**Supplementary Readings:**


1. S. Axler, "Linear Algebra Done Right", Springer, 2nd edition, 1997.
2. S. Lang, "Linear Algebra", Springer, 3rd edition, 2010.