PROGRAME NAME: : B.Sc. (H) Mathematics
COURSE NAME : Ring Theory and Linear algebra
SEMESTER DURATION : January to May

Week	**Topic(s)**	**Teaching Methodology Adopted/ Continous Internal Evaluation**
1	Polynomial rings over commutative rings, Division algorithm and consequences, Principal ideal domains.	Lectures
2	Factorization of polynomials, Reducibility tests, Irreducibility tests	Discussions
3	Eisenstein's criterion, Unique factorization in Z[x]	Lectures
4	Divisibility in integral domains, Irreducibles, Primes	Presentations
5	Unique factorization domains, Euclidean domains.	Assignments
6	Dual spaces, Double dual, Dual basis, Transpose of a linear transformation and its matrix in the dual basis, Annihilators.	Lectures
7	Eigenvalues, Eigenvectors, Eigenspaces and characteristic polynomial of a linear operator; Diagonalizability	Discussions / Assignments
8	Invariant subspaces and Cayley-Hamilton theorem; The minimal polynomial for a linear operator.	Lectures
9	Inner product spaces and norms.	Tutorials
10	Orthonormal basis, Gram-Schmidt orthogonalization process	Presentation
11	Orthogonal complements, Bessel's inequality.	Lectures / Discussions
12	The adjoint of a linear operator and its properties, Least squares approximation, Minimal solutions to systems of linear equations	Lectures
13	Normal, Self-adjoint	Discussions
14	Unitary and orthogonal operators and their properties	Demonstrations

Course Objectives: This course introduces the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers, used in finite fields with applications in Cryptography. This course emphasizes the application of techniques using the adjoint of a linear operator and their properties to least squares approximation and minimal solutions to systems of linear equations.

Course Learning Outcomes: :

On completion of this course, the student will be able to:

i) Appreciate the significance of unique factorization in rings and integral domains.

ii) Compute with the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.

iii) Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization to obtain orthonormal basis.