Course Title: Advance Mathematics- II [Algebra (Group Theory and Linear Algebra)]
Course Rating: 4 Cr. Hours

Groups
- Definition and examples of groups
- Subgroups lattice, Lagrange's theorem
- Cyclic groups
- Groups and symmetries, Cayley's theorem

Complexes in Groups
- Complexes and coset decomposition of groups
- Centre of a group
- Normalizer in a group
- Centralizer in a group
- Conjugacy classes and congruence relation in a group

Normal Subgroups
- Normal subgroups
- Proper and improper normal subgroups
- Factor groups
- Isomorphism theorems
- Automorphism group of a group
- Commutator subgroups of a group

Permutation Groups
- Symmetric or permutation group
- Transpositions
- Generators of the symmetric and alternating group
- Cyclic permutations and orbits, The alternating group
- Generators of the symmetric and alternating groups

Sylow Theorems
- Double cosets
- Cauchy's theorem for Abelian and non-Abelian group
- Sylow theorems (with proofs)
- Applications of Sylow theory
- Classification of groups with at most 7 elements

Ring Theory
- Definition and examples of rings
- Special classes of rings
- Fields
- Ideals and quotient rings
- Ring Homomorphisms

- Prime and maximal ideals
- Field of quotients

Linear Algebra
- Vector spaces, Subspaces
- Linear combinations, Linearly independent vectors
- Spanning set
- Bases and dimension of a vector space
- Homomorphism of vector spaces
- Quotient spaces

Linear Mappings
- Mappings, Linear mappings
- Rank and nullity
- Linear mappings and system of linear equations
- Algebra of linear operators
- Space L(X, Y) of all linear transformations

Matrices and Linear Operators
- Matrix representation of a linear operator
- Change of basis
- Similar matrices
- Matrix and linear transformations
- Orthogonal matrices and orthogonal transformations
- Orthonormal basis and Gram Schmidt process

Eigen Values and Eigen Vectors
- Polynomials of matrices and linear operators
- Characteristic polynomial
- Diagonalization of matrices

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Recommended Books
1. J. Rose, *A Course on Group Theory*, (Cambridge University Press, 1978)
2. I. N. Herstein, *Topics in Algebra*, (Xerox Publishing Company, 1964)
3. G. Birkhoff and S. Maclane, *A Survey of Modern Algebra*, (Macmillan, 1964)
4. Seymour Lipschutz, *Linear Algebra*, (McGraw Hill Book Company, 2001)
5. Humphreys, John F. *A Course on Group Theory*, (Oxford University Press, 2004)
6. P. M. Cohn, *Algebra*, (John Wiley and Sons, 1974)
7. J. B. Fraleigh, *A First Course in Abstract Algebra*, (Pearson Education, 2002)