

Bachelors with Mathematics as Major

5th Semester

MMT522J1: Mathematics/Applied Mathematics: Algebra-I

Credits: 3 THEORY + 1 TUTORIAL

Theory: 45 Hours & Tutorial: 15 Hours

Course Objective: To introduce students towards basic concepts of algebraic structures, viz groups and rings. (ii) to identify various properties associated with the groups and rings. (iii) to expose students towards advanced mathematics, such as advanced abstract algebra and commutative ring theory.

Course Outcomes: After the completion of this course, students shall be able to (i) understand symmetries in nature and identify patterns. (ii) shall be able to apply these concepts in linear classical groups, to the problems arising in physics, computer science, economics and engineering etc.

Theory: 3 Credits

Unit I

Relations & mappings, Equivalence relations & equivalence classes, Binary composition. Introduction to groups: Finite & Infinite groups, Semi-groups, various properties of groups, subgroups and Cosets. Criterion of subgroups, Cyclic groups, Generators & relations, Structure theorem, Lagrange's theorem. Examples of General linear groups, Symmetric and alternating groups. Dihedral groups and their applications.

Unit II

Normal subgroups, product of subgroups, counting principle, Quotient groups, homomorphism, kernel of a homomorphism, Fundamental theorem of homomorphism, Isomorphism theorems, Conjugate elements, Normalizer of an element, Centre of a group, theorems and relation between centre of a group and normalizer of an element.

Unit III

Rings: Definition & Examples, Elementary properties of rings, Rings with & without zero divisors, Integral domains & skew fields. Fields, Subrings & Subfields, Ideals & Quotient rings, Idempotent and Boolean rings, Homomorphism, fundamental theorem & ring isomorphism.

Tutorial: 1 Credit

Unit IV

Problems on equivalence relations and classes, Generators of a cyclic group, Order of an element, Binary operations, Commutative & non-commutative rings, Left & right ideal of a ring, Relation between ideals & subrings, Sum & product of ideals.

Recommended Books:

1. I. N. Herstein, Topics in Algebra, John Wiley, 1975.
2. Joseph Gallian, Abstract Algebra, Narosa Publishers, New Delhi, 1999.
3. M. Artin, Algebra, Pearson Education India, 2011.
4. D. S. Dumit and R. M. Foote, Abstract Algebra, John Wiley, 2003
5. P.B. Bhattachariya, S.K. Jain, S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press, 1994
6. Surjeet singh and Qazi Zameeruddin, Modern Algebra, S Chand And Company Ltd, 2021