

Under-Graduate Programme with MATHEMATICS; 5th Semester

MATHEMATICS

MMT526J1: ALGEBRA – I

Theory: 3 Credits (45 Hours)

MAJOR COURSE

Credits: 3 THEORY + 1 TUTORIAL

Tutorial: 1 Credits (15 Hours)

Course Objective: To introduce students the basic concepts of group theory and examples of groups and their properties. This course will lead to future basic courses in advanced mathematics, such as advanced abstract algebra and ring theory.

Course Outcomes: A student understands cyclic groups, permutation groups, normal subgroups and related results. After this course he can opt for courses in ring theory, field theory, commutative algebras, linear classical groups etc. and can be apply this knowledge to problems in physics, computer science, economics and engineering.

Theory: 3 Credits

Unit I

Binary composition, equivalence relation and equivalence class. Groups: Definition and examples, Finite & Infinite groups, abelian & non-abelian groups. Properties of groups: uniqueness of identity/ inverse and cancellation laws. Subgroups and Cosets. Criterion of subgroups, order of an element, Lagrange's theorem. Cyclic groups: Definition & examples, cyclic groups are abelian, order of a cyclic group is equal to the order of its generator.

Unit II

Normal subgroups: Definition & examples, criterion of normal subgroups, product of subgroups, Quotient groups. Homomorphism, kernel of a homomorphism, Fundamental theorem of homomorphism, Isomorphism theorems (statements only), Normalizer of an element, Centre of a group. Permutation groups and Cayley's theorem. Definitions and examples of symmetric groups and alternating groups.

Unit III

Rings: Definition & Examples, elementary properties of rings, rings with & without zero divisors, Integral domains & skew fields. Definitions & examples of Fields, Subrings, Ideals, Quotient rings and Boolean rings. A finite integral domain is a field. Ring homomorphism, fundamental theorem of homomorphism & ring isomorphism. Prime, Maximal and Principal ideals (Definitions & examples only).

Tutorial: 1 Credit

Unit IV

Examples of monoids, semigroups, abelian/non-abelian, cyclic/non-cyclic groups, computing generators in a cyclic group, Structure theorem for cyclic groups (statement only), concept of even and odd permutation. Examples of commutative & noncommutative rings, Left & right ideal of a ring, relation between ideals & subrings, sum & product of ideals.

Recommended Books:

1. M. Artin, Algebra, Prentice hall of India.
2. D. S. Dumit and R. M. Foote, Abstract Algebra, John Wiley.
3. Joseph Gallian, Abstract Algebra, Narosa Publishers, New Delhi.
4. I. N. Herstein, Topics in Algebra, John Wiley.
5. P.B. Bhattachariya, S.K. Jain, S. R. Nagpaul, Basic Abstract Algebra, Cambridge.
6. Surjeet singh and Qazi Zameeruddin, Modern Algebra, New age International.