Core II

Introduction to Algebra & Number Theory

Course Objectives:

To present a systematic introduction to number theory and a basic course on algebra.

Learning Outcomes:

After completing the course the student will be able to

- Understand the equivalence relations and concept of group with different examples.
- Understand the properties of cyclic groups, rings, and integral domain.
- Know divisibility and division algorithm and find *gcd* using Euclidean Algorithm.
- Solve linear Diophantine equations, find least common multiples,solve linear congruence applying the Chinese remainder theorem.

Unit I

Integers and equivalence relations**,** properties of integers, modular arithmetic, mathematical inductions, equivalence relations, Introduction to groups**,** symmetries of a square, the dihedral groups, definitions and examples of groups, elementary properties of groups, subgroups, examples of subgroups.

Unit II

Cyclic groups, properties of cyclic groups, classification of subgroups of cyclic groups, definitions and examples of normal subgroups, Introduction to rings, definition and examples of rings, properties of rings, subrings, definition and examples of integral domain and fields.

Unit III

Divisibility**,** division algorithms, prime and composite numbers, Fibonacci and Lucas numbers, Fermat numbers, greatest common divisor, Euclidean algorithm.

Unit IV

Fundamental theorem of arithmetic, least common multiple, linear Diophantine equations, congruence, linear congruence, Chinese remainder theorem, Wilson's theorem, Fermat little theorem, Euler's theorem.

Books Recommended:

- ✓ *Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.(IX Edition 2010).*
- ✓ *Thomas Koshy, Elementary Number Theory with Applications (2nd Edition), Academic Press, 2007.*

Books for Reference:

- ✓ *I. N. Herstein: Topics in Algebra, Wiley Eastern Limited, India, 1975.*
- ✓ *David M. Burton: Elementary Number Theory (6th Edition), Tata McGraw-Hill Edition, Indian Reprint, 2007.*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*
- ✓ *e-Learning Source http://ndl.iitkgp.ac.in ; http://ocw.mit.edu ; http://mathforum.org.*