

Elementary Number Theory & Algebra

1.1 Course Number: MA 212

1.2 Contact Hours: 40 Credits: 11 [LTP: 3-1-0]

1.3 Semester-offered: Odd (Sem 3)

1.4 Prerequisite: Linear Algebra

1.5 Syllabus Committee Member: Dr. C. Kundu, Dr. M.K. Rajpoot, Dr. A. Kumar,
Dr. G. Rakshit (Convener)

2. Objective:

Elementary Number Theory is the study of the basic structure and properties of integers. Learning Number Theory helps improving one's ability of mathematical thinking. To achieve knowledge and understanding of finite abelian groups, their various properties and capabilities to solve wide range of problems in science and technology. To understand Euclidean domains and their applications in mathematical sciences. To learn basic concepts of Unique factorization domain and field Extensions.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Number Theory	Integers and equivalence relations, Divisibility: basic definition, properties, prime numbers, some results on distribution of primes; Congruences: basic definitions and properties, complete and reduced residue systems, theorems of Fermat, Euler & Wilson, linear congruences and Chinese Remainder theorem	14
2	Group Theory	Groups, subgroups: Cyclic groups, Permutation group, Isomorphism, Cosets and Lagrange theorem, External direct product, Normal subgroups and factor groups, Fundamental Theorem of finite abelian groups, Sylow theorems and applications.	13
3	Ring and Field Theory	Introduction to rings and subrings, integral domains, Fields. Ideals and factor rings, Ring homomorphism, Polynomial rings, Factorization of Polynomials, Divisibility in integral domain. Finite Fields.	13
		Total	40

4. Readings

4.1 Textbook:

- *Topics in Algebra* by I. N. Herstein
- *Elementary Number Theory* by David M. Burton

4.2 Reference books:

- *Contemporary Abstract Algebra* by Joseph A. Gallian.
- *A Classical Introduction to Modern Number Theory* by Michael Rosen

5 Outcome of the Course:

- To classify numbers into number sets.
- Prove results involving divisibility and greatest common divisors.
- To combine polynomial by addition or subtraction.
- To solve problems of simple Inequalities.
- To simplify algebraic expressions, using the commutative, associative and Distributive properties.