

Course Code	Course Title	L-P-T	Credits
MMATIC004T	Abstract Algebra	3-0-1	4
Objectives: The aim of this course is to introduce the students to the basic notions of group theory and ring theory. In group theory, we focus on the structure of finite groups and classify all infinite Abelian groups up to isomorphism. In the rings theory part, our focus will be on the ring's unique factorization into irreducible elements and polynomial rings with unique factorizations.			
CO 01	Understand fundamental concepts of group theory, including group actions, automorphisms, and isomorphism theorems, and apply them to solve related problems.		
CO 02	Analyze advanced group theoretical concepts such as class equations, Cauchy's theorem, Sylow theorems, and the simplicity of alternating groups.		
CO 03	Comprehend the structure of groups, including direct sums, composition series, Jordan-Hölder theorem, and solvable groups, with practical applications.		
CO 04	Gain a deep understanding of ring theory, covering subrings, ideals, quotient rings, homomorphisms, and the role of prime and maximal ideals.		
CO 05	Explore unique factorization in principal ideal domains, Euclidean domains, and polynomial rings, applying Gauss's lemma and Eisenstein's criterion.		

Course content

Unit-1

Group definition and examples, Matrix and Permutation groups, Subgroups, Normal subgroups, Quotient group, Group homomorphism, fundamental isomorphism theorems, Automorphism groups of Z_n , Z and S_3 , Examples and exercises based on these topics, Group action on a set, orbit Stabilizer formula, Conjugation, Automorphism, Computation of automorphism group of Z_n , Z and S_n examples and exercises based on these topics.

Unit-2

Class equations and its applications, Cauchy theorem, examples and exercise based on these topics. Sylow Theorems for finite groups, simple groups, Simplicity of the Alternating Group A_n ; $n \geq 5$, examples and exercises based on these topics

Unit-3

Direct sums, Structure theorem for finite Abelian groups and its applications, Examples and exercise based on these topics, Composition series Jordan Holder Theorem, Solvable group, example and exercise based on these topics

Unit-4

Rings, Sub rings, Ideals, Quotient rings, ring homomorphism. Isomorphism theorems, Matrix and Polynomials rings, prime and maximal ideals, examples and based on these topics, Integral domain, field of fractions of an integral domain, prime and irreducible elements, unique factorization domain, examples and exercises based on these topics

Unit-5

Principal ideals domains and Euclidean domains, Polynomial rings unique factorization domain: Gauss Lemma and Gauss theorem, Eisenstein criteria of irreducibility of polynomials, examples and exercises based on these topics

Reference Books:

1. N. Jacobson, Basics Algebra, Vol. I, second, Dover Publication, 2012.
2. I.N Herstein, Topics in Algebra, Wiley Eastern Ltd. Second Edition, New Delhi. 2011
3. W.A. Adkins and S.H. Weintraub, Algebra An approach by module theory, Springer, 1999.
4. M. Artin, Algebra Prentice Hall of India, Second Edition, 2011.
5. N.S Gopalakrishnan, University Algebra, New Age International (P) Ltd., publisher, second edition: 1986, (reprint: 2004)
6. L.S Luther and I.B.S Passi, Algebra, Vol I- groups, vol II- Rings, Narosa publishing house (vol. I-1996, vol-II 1999).

Shalabh




 

Kamlesh Kumar

R.K.

