ABSTRACT ALGEBRA-I

Course Code: **MM24101CR** Total Credits: **04**
Semester: **MA/M.Sc. 1st Semester** Total Marks: **100**
Continuous Assessment: **Marks 20,** Theory: **Marks 80** Time Duration: **2½ hrs**

Course Objectives: To enable the student to understand group structures, symmetries and various results and properties associated with algebraic structures.

Course Outcomes: After the completion of this course, the students shall be able to understand group/ring structures, define and comprehend various algebraic structures, such as groups, rings, and fields, including their axioms and properties.

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UNIT-I

Criterion for a semi-group to be a group, Cyclic groups, Generators of finite/infinite cyclic groups, Structure theorem for cyclic groups, endomorphism, automorphism, Inner automorphism and outer automorphism, Cauchy's and Sylow's theorem for abelian groups, Groups of symmetries, alternating groups, simple groups, groups of order six, simplicity of the alternating group A_n.

UNIT-II

Conjugate classes, class equation of finite groups $(p, 2p, p^2, p^3)$ and its applications, Cauchy's and Sylow's theorems for finite groups, direct product of groups, finite abelian groups, normal and subnormal series, composition series, Jordan Holder theorem for finite groups, Zassenhaus lemma, Schreir's refinement theorem, Solvable groups, examples and theorems.

UNIT-III

Brief review of rings. Field of quotients of an integral domain, embedding of an Integral domain, Euclidean rings with examples such as $\mathbb{Z}[\sqrt{-1}], \mathbb{Z}[\sqrt{2}]$, Principal Ideal Rings (PIR), unique factorization domains (UFD) and Euclidean domains (ED), GCD and LCM in rings, factorization theorem, relationships between Euclidean rings, P.I.R.'s and U.F.D.

UNIT-IV

Polynomial rings, the division algorithm for polynomials, irreducible polynomials, polynomials and the rational field, primitive polynomials, contraction of polynomials, Gauss lemma, Integer monic polynomial, Eisenstein's irreducibility criterion, cyclotomic polynomials, polynomial rings and commutative rings.

Recommended Books

1. J. A. Gallian, Contemporary Abstract Algebra, Cengage Learning, USA, 9th Edition, 2015
2. I. N. Heristein, Topics in Algebra, John Wiley & Sons, 2nd Edition, 1975.
3. P. B. Bhatacharaya and S.K.Jain, Basic Abstract Algebra, Cambridge University Press, 4th Edition, Reprint 2009.
4. J. B. Fragleigh, A First Course in Abstract Algebra, Pearson New International, 2014.
5. K. S. Miller, Elements of Modern Abstract Algebra, Krieger Publishing, 1975.
6. Surjeet Singh and Qazi Zameer-ud-Din, Modern Algebra, Vikas Pub Hou. Pvt Ltd, 8th Edition, 2006