

Government PG College, Ambala Cantt.

Course File (Session 2023-24)

Name of Assistant Professor: Dr. Hardish Kaur

Class: B.SC. /B.A. III Year/5th Semester

Course Code and Name: Groups & Rings (BM -352)

B.Sc. Theory: 40 /Sessional: 10

B.A Theory: 26 /Sessional: 7

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five or six parts distributed over all the four sections. Candidates are required to attempt five questions in all, selecting at least one question from each section and the compulsory question.

SECTION-I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem and its consequences, Normal subgroups, Quotient groups,

SECTION-II

Homomorphisms, isomorphisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

SECTION-III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principal, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

SECTION-IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, \mathbb{R} unique factorization domain implies so is $\mathbb{R}[X_1, X_2, \dots, X_n]$

Books Recommended:

1. I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal: Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist: Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi: Algebra, Vol.-II, Norsa Publishing House.

Lesson Plan: From August 2023 to November 2023:

1 Aug to 15 Aug	Groups and subgroups
16 Aug to 31 Aug	Cosets
1 to Sept. 15 Sept.	Homomorphisms and automorphisms
16 to Sept. 30 Sept.	Permutation groups , Rings and Fields
1 Oct to 15 Oct	Ideal and quotient rings
16 Oct to 31 Oct	Homomorphism of rings
1 Nov to 9 Nov	Euclidean Rings
10 Nov to 16 Nov	Diwali Break
17 Nov to 24 Nov.	Polynomial rings
Examinations	

Course Learning Outcomes:

1. After completing this course, students will be able to understand the importance of algebraic properties, group structures to finite permutation groups, group generators with specific conditions, Symmetry using group theory, group homomorphism, ring homomorphism, Euclidean

Domain, Unique Factorization Domain, principal Ideal domain, polynomial Rings. Enable to approach problems in analytical way, formulate theories and apply them to solve problems.

2. Enable to arrange things or actions in a certain order or pattern according to a specific rule or set of rules.

3. Improves the logical reasoning, enhances the critical thinking and investigating skills.

4. Provides basic knowledge to understand coding theory, image processing.

5. Explain the fundamental concepts of advanced algebra such as groups and rings and their role in modern mathematics and applied contexts

6. Demonstrate accurate and efficient use of advanced algebraic techniques

7. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra

8. Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts