

Weekly Seminar Series on Group Theory

Advisor: Prof. Shiv Datt Kumar, MNNIT Allahabad

Speakers: Dr. Sumit Kumar Upadhyay, IIIT Allahabad and Dr. Mani Shankar Pandey, IIITDM Kurnool

Tutors: Mr. Amit Kumar, Mr. Deepak Pal, and Mr. Neeraj Kumar Maurya

Mode: Hybrid

Registration Fee: 1600/- + 18% GST (payable in two equal installment)

Number of Seats: 50

Duration: Every Saturday starting from August 2024 to November 2024 (except government holiday)

Number of Lectures: 17 (each of two hours)

Number of Tutorials: 17 (each of one hour)

Seminar Objective: The weekly Group Theory seminar series, starting August 03, 2024, aims to provide students with a comprehensive understanding of fundamental concepts, structures, and applications of group theory through a series of structured lectures, interactive discussions, and collaborative problem-solving sessions. We will focus on enhancing student's ability to construct and present rigorous mathematical proofs, use theoretical knowledge in problem-solving, foster a collaborative learning environment to encourage peer-to-peer learning, and prepare them for further studies or research in abstract algebra and related fields by gaining confidence and proficiency in group theory. The concept of group theory will also be illustrated by examples from geometry, linear algebra, and combinatorics point of view.

Student Learning Outcomes: By the end of the seminar series, participants should have a solid grasp of group theory concepts and the analytical skills necessary to pursue further studies or research in group theory and related fields. Students will be able to

- recognize groups and prove they are groups
- identify subgroups, normal subgroups, order of elements, and prove that the identification is correct
- find multiple examples of groups having specified properties (commutative, non-commutative, cyclic, non-cyclic, finite, finite exponent, etc.)
- find the number of group homomorphisms between two groups

- prove and apply the Fundamental Homomorphism Theorem, the isomorphism theorems, and Lagrange's theorem.
- classify finite groups as abelian, non-abelian, cyclic, direct products, etc.
- find the commutator subgroup of a given group
- identify solvable and nilpotent groups
- apply group theory
- take benefit for competitive exams also.

Syllabus: Definition of a group, Cyclic groups, Dihedral groups, Symmetric groups, Matrix groups, Group homomorphisms and examples, Subgroups, Cosets, Conjugacy classes, Normal subgroups, Quotient groups, Lagrange's theorem, Isomorphism theorems

Actions of groups on sets, Symmetric group, Alternating group, Cayley's theorem Direct products of groups, Group automorphisms, Sylow's theorem, Semi Direct products of groups, Applications: classification of groups of small order, The alternating group is a simple Classification of finite Abelian groups, Composition series, Jordan-Holder theorem Commutator subgroups, Solvable groups, Nilpotent groups.