Department of Mathematics and Statistics, IIT Kanpur
MTH 204A (Abstract Algebra),
Winter Semester 2018-19
Instructor: Somnath Jha, jhasom@iitk.ac.in
Office hours - Thursday 15:00-16:00

Objective: This course is aimed as an introduction to basic Group Theory. Some elementary topics in Ring Theory and Field Theory will also be covered.

Prerequisites: Instructor's consent; However it will be assumed that the students are familiar with basic Linear algebra.

Contents:

I. Groups, various examples of groups, subgroups, homomorphism, normal subgroups, cosets, Lagrange's theorem, quotient groups, first, second and third isomorphism theorems, matrix groups, symmetric groups and dihedral groups.

II. Group action, orbits and stabilizers, Cayley's theorem, Sylow's theorems, class equation, direct product and semi direct product, groups of small order.

III. Abelian groups, finite abelian groups, finitely generated abelian groups, direct sum, structure theorem of finitely generated abelian groups.

IV. Rings, ideals, quotient rings, commutative rings, unit group of a ring, polynomial rings, fields, finite fields, Fermat's 'little' theorem, Wilson's theorem, Chinese remainder theorem, UFD, PID, ED, the ring *Z[i]*, Quadratic fields.

V. If time permits: Solvable groups, nilpotent groups, ring of integer in quadratic fields, free groups.

Evaluation: There will be
1. one mid-semester exam of 30 points.
2. (one) end-semester exam of 40 points.
3. Two quizzes of 15 points and 15 points respectively; one before the mid-semester exam and one after the mid semester exam. One of the quiz may be a surprise quiz.
4. In addition, periodically assignment problems will be given. Students are strongly recommended to solve all of them at home, but it is not required to submit them for correction to the instructor.

Course Policies:

A. Attendance: It is strongly recommended that the students attend all the classes but there is no formal attendance requirement.

B. Honesty Practices: Any dishonest practice will be reported to the competent authority for appropriate action.

C. Withdrawal: As per guidelines.

References:

1. *Abstract Algebra,* D. S. Dummit & R. M. Foote, John Wiley
2. *Topics in Algebra,* I. N. Herstein, John Wiley.
3. *Algebra,* M. Artin, Prentice Hall.
4. *Linear Algebra,* K. Holfman, R. Kunze, Prentice Hall.
5. *Basic Algebra Vol. I,* N. Jacobson, W.H. Freeman and Co.
6. *Algebra,* S. Lang, Springer GTM 211.