

## FIRST COURSE HANDOUT

**MTH 204: Abstract Algebra**

**Spring Semester, 2023.**

**Credits: 3-0-0-1 [11]**

**Instructor: Santosha Pattanayak**

**Pre-requisite: MTH102/Instructor's consent.**

**Course Objectives :** This course introduces the basic concepts of Groups, Rings and Fields. The main objectives of the course are to learn basic terminology, concepts and results concerning Groups, Rings and Fields as a basis for further study of more advanced mathematics.

### **Contents:**

**Group theory:** Binary operation, and its properties, Definition of a group, Groups as symmetries, Examples: cyclic, dihedral, symmetric, matrix groups, Subgroups, Cosets, normal subgroups and quotient groups, Conjugacy classes, Lagrange's theorem, The isomorphism theorems, Direct and semi-direct products, Group automorphisms, Symmetric group and alternating group, Actions of groups on sets, Cayley's theorem, orbit and stabilizers, Class equations, p-groups, Sylow's theorem and applications: simplicity of groups, Classification of finite abelian groups. **(Time permitting:** Finitely-generated abelian groups, Free groups, Composition series, Jordan-Hölder theorem, Nilpotent and solvable groups).

**Ring Theory:** Definition and examples, Ring homomorphism, Ideals and Quotient rings, Chinese Remainder Theorem, Integral Domain and quotient fields, Unique factorization domain, Principal Ideal domain, Euclidean domain, Gauss lemma, Polynomial Rings, Irreducibility of Polynomials, Ring of Gaussian Integers.

### **Reference materials:**

- I. N. Herstein: Topics in Algebra, Wiley.
- D. S. Dummit and R.M. Foote, Abstract Algebra, Wiley.
- M. Artin, Algebra, PHI.
- J. P. Serre, Finite groups, an introduction, International Press.

**Evaluation[Tentative] :** There will be two quizzes, a mid-semester and an end-semester exam. The weightage are 15-15-30-40.

- Students who fail to appear in end-semester examination, due to bonafide reasons, are allowed to appear in the Make-up Examination on the permission of SUGC/SPGC and as per the schedule mentioned in Academic Calendar. If a student fails to appear in mid-semester examination, no makeup opportunity will be provided. This rule applies even if the student was on sanctioned leave or unwell.
- Attendance: It is strongly recommended that the students attend all the classes/tutorial sessions but there is no formal attendance requirement.
- Honesty Practices: Any dishonest practice will be dealt with strictly and reported to competent authority for appropriate action.