



# **MAT 215 Introduction to Group Theory**

**Winter 2024**

**Course Credits:** 4

**Contact Hours:** 56 hours

**Instructor:** TBA

**Email:**TBA

## **COURSE OBJECTIVES**

This course serves as an introduction to the fundamental concepts, structures, and applications of group theory in mathematics. Topics covered include permutation groups, cyclic groups, theory of finite groups, group homomorphisms, and abelian groups. Through the exploration of these topics, students will gain insight into the abstract algebraic structures that underlie various mathematical phenomena, with applications to number theory and geometry.

Upon Completion of this Course, students will be able to:

1. Understand the basic definitions and properties of groups;
2. Identify and classify different types of groups, including permutation groups, cyclic groups, and abelian groups;
3. Analyze the theory of finite groups, including subgroups and cosets;
4. Explore group homomorphisms and their applications;
5. Apply group theory concepts to problems in number theory and geometry;
6. Develop problem-solving skills through group theory problems and exercises.

## **PREREQUISITES**

None

## **GRADING**

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:



ITEM	POINTS
Participation	10 Points
Midterm 1	15 Points
Midterm 2	15 Points
2 Homework	20 Points
Term Essay	10 Points
Final Exam	30 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F.$$

We reserve the right to make adjustments to the overall grading policy.

## COURSE MATERIALS

### Required Texts:

David S. Dummit and Richard M. Foote, *Abstract Algebra*, 3rd Edition, John Wiley & Sons, 2003.

### Recommended (Optional) Texts or Other Materials:

None

## COURSE TOPICS

MODULE	TASKS
Module 1	<b>Topics:</b> Topic 1: Introduction to Groups: Definition and Basic Properties Topic 2: Permutation Groups: Cycles and Transpositions Topic 3: Group Operations: Closure, Associativity, Identity, and Inverses Topic 4: Subgroups and Cosets <b>Assessments:</b> Homework#1
Module 2	<b>Topics:</b> Topic 5: Lagrange's Theorem and Its Applications Topic 6: Cyclic Groups: Definitions and Examples Topic 7: Group Homomorphisms: Definitions and Properties Topic 8: Isomorphism Theorems



	<p><b>Assessments:</b> Homework#2 Quiz#1</p>
Module 3	<p><b>Topics:</b> Topic 9: Theory of Finite Groups: Order of Elements, Lagrange's Theorem Topic 10: Normal Subgroups and Quotient Groups Topic 11: Direct Products and Direct Sums of Groups Topic 12: Abelian Groups: Definitions and Properties</p> <p><b>Assessments:</b> Midterm#1</p>
Module 4	<p><b>Topics:</b> Topic 13: Classification of Finite Abelian Groups Topic 14: Applications of Group Theory in Number Theory: Fermat's Little Theorem, Euler's Theorem Topic 15: Applications of Group Theory in Geometry: Symmetry Groups, Crystallographic Groups Topic 16: Group Actions and Permutation Representations</p> <p><b>Assessments:</b> Midterm#2</p>
Module 5	<p><b>Topics:</b> Topic 17: Sylow Theorems and Their Applications Topic 18: Solvable and Nilpotent Groups Topic 19: Simple Groups and Classification Theorems Topic 20: Group Theory in Modern Mathematics: Advanced Topics and Current Research Directions</p> <p><b>Assessments:</b> Term Essay Final Exam</p>

## ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings



and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

## **LEARNING REQUIREMENTS**

- 1) Late assignments are not acceptable and are subjected to grade deductions.
- 2) Assignments submitted in the wrong format will be counted as not submitted.
- 3) Failure to submit or fulfill any required course component results in failure of the class.
- 4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
- 5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

## **TECHNOLOGY POLICY**

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

## **ACADEMIC INTEGRITY POLICY**

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

## **DISABILITY ACCOMMODATION**

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at



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Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.