

Math 241, Introduction to Abstract Algebra — Fall 2019

<https://sites.aub.edu.lb/kmakdisi/>

Classes: MWF 1:00–1:50, in Nicely 416.

Instructor: Kamal Khuri-Makdisi (kmakdisi@aub.edu.lb), Bliss 311, phone 4234. E-mail is usually the easiest way to contact me.

Office hours: Monday 2–4 and Friday 2–4, or by appointment.

Required textbook: Fraleigh, *A First Course in Abstract Algebra*, 7th edition (available at the University Bookstore).

Optional, but useful, supplementary textbooks:

1) N. Jacobson, *Basic Algebra I* (especially chapters 0–2). Covers material at a higher level than Fraleigh, very elegantly. Essential reading for anyone wishing to go further into the subject. This book is on reserve at Jafet library (under the course Math 341).

2) M. Artin, *Algebra*. The order and choice of topics is slightly unconventional, but brilliant. The book makes a lot of the abstract algebra concrete, while also preparing for aspects of algebra one sees in modern advanced research topics. Take a look at the lectures of an introductory course at Harvard on abstract algebra using this book (which goes faster and covers more material than our 241):

<https://www.extension.harvard.edu/open-learning-initiative/abstract-algebra>

3) I. Herstein, *Topics in Algebra*. A beautiful older treatment, and a classic textbook.

4) G. Lee, *Abstract Algebra*. Available electronically from an AUB computer at <https://link.springer.com/book/10.1007%2F978-3-319-77649-1>

5) S. Lang, *Undergraduate Abstract Algebra*. Also available when at AUB from <https://link.springer.com/book/10.1007%2F0-387-27475-8>

Course requirements: The BETTER of **Option I:** 1) homework, 10%; 2) two quizzes, 25% each; 3) comprehensive final exam, 40%, and **Option II:** 1) homework, 10%; 2) quiz 1, 10%, and quiz 2, 20%; 3) comprehensive final exam, 60%. It is **very important** to keep up with the homework in this course, otherwise you will do badly on the quizzes and the final exam. You may collaborate with your classmates in finding out how to solve the homework problems, but **you MUST write your problem set in your own words, based on your own understanding of the solution. Also, you MUST include in your problem set the names of any people you consulted with, and full references to any books or websites you used in solving the problems.**

Prerequisites for this course: Mathematical maturity at a level equivalent to having taken Math 219; in particular, strong facility with sets, logic, and proofs, as well as with linear algebra. Students from all majors are welcome.

Topics to be covered: Here is a tentative list of the topics that we will cover, with the corresponding sections in Fraleigh.

1. Basics of set theory and binary operations. Definition of a group and its subgroups. First examples. Cyclic groups. (Sections 0–6; approximately 2.5 weeks.)

2. Groups of permutations and of linear transformations. Cosets, homomorphisms, and quotient groups (called “factor groups” by Fraleigh). Congruences. More examples. (Sections 8–15, with supplementary material; approximately 4.5 weeks.)

3. Groups acting on a set. Isomorphism theorems. Sylow theorems and applications. Finitely generated abelian groups. (Sections 16, 17, 34–38; approximately 2.5 weeks.)

4. Basic ring theory. Examples of integers, matrices and polynomials. Ideals and homomorphisms. Prime and maximal ideals. (Sections 18–23, 26, 27; approximately 3.5 weeks.)