

Math 242 — Spring 2023

Topics in Algebra

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

Classes: TTh 8–9:15 in Nicely 318 (**note updated room**).

Professor: Kamal Khuri-Makdisi, Bliss 311, phone 4234. The best way to contact me is to send e-mail to kmakdisi@aub.edu.lb. My office hours are TTh 3–5. You can also contact me by e-mail or through the discussion forum in Moodle.

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

Optional, but useful, supplementary textbooks: These can be borrowed from Jafet Library.

- 1) N. Jacobson, *Basic Algebra I* (especially chapters 2 and 4); may also be in the AUB bookstore.
- 2) M. Artin, *Algebra* (especially chapters 11, 13, and 14)
- 3) E. Artin, *Galois Theory*
- 4) L. Gaal, *Classical Galois Theory, with Examples*

I will list a few other useful downloadable textbooks on Moodle.

Course requirements: The grade will be based on 15% weekly problem sets, 35% midterm, and 50% final. If needed, I may give brief quizzes at other points in the semester, or have two midterms instead of just one.

It is **very important** to keep up with the homework in this course, otherwise you will do badly on the midterm and the final exam. The problem sets will be challenging — it's the only way to really learn the mathematics. You may discuss homework problems with your classmates but you may **not** solve homework together. You must write your problem set **in your own words, based on your own understanding of the solution**. I encourage you to look up material in other books and articles, but if you use this resource in your solution of a problem, please give a reference to the text you used for each problem. **You MUST include in EACH problem set the names of any people you discussed the problem with, and full references to any books or websites you used in solving the problems.**

Prerequisites for this course: Math 241 or the equivalent. Specifically, you should be comfortable with groups and rings including subgroups, quotient groups, ideals, quotient rings, and prime and maximal ideals.

Topics to be covered: Here is a tentative list of the topics that we will cover, with the corresponding sections in Fraleigh. Each section will take one to two hours of lecture.

- Some background material:
 - Lecture, Unique factorization of integers; the Euclidean algorithm
 - Section 22, Rings of Polynomials
 - Section 23, Factorization of Polynomials over a Field
- More on polynomial rings and unique factorization:
 - Section 45, Unique Factorization Domains
 - Section 46, Euclidean Domains
 - Section 47, Gaussian Integers and Norms
- Field extensions:
 - Section 29, Introduction to Extension Fields
 - Section 30, Vector Spaces
 - Section 31, Algebraic Extensions
 - Section 32, Geometric Constructions
 - Section 33, Finite Fields

Midterm quiz

- Galois theory:
 - Section 48, Automorphisms of Fields
 - Section 49, The Isomorphism Extension Theorem
 - Section 50, Splitting Fields
 - Section 51, Separable Extensions
 - Section 52, Totally Inseparable Extensions
 - Section 53, Galois Theory
 - Section 54, Illustrations of Galois Theory
 - Section 55, Cyclotomic Extensions
 - Section 56, Insolvability of the Quintic
- Group theory as needed while we do Galois theory:
 - Section 16, Group Action on a Set (review)
 - Section 35, Series of Groups
 - Section 38, Free Abelian Groups

Final exam

Statement from the Accessible Education Office: AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you must also register with the Accessible Education Office, West Hall 304, Extension 3168, accessibility@aub.edu.lb

Other AUB Policies: By signing up for this course, you confirm that you have read and accepted the terms and provisions of AUB's **Privacy Statement** and policies on **Academic Integrity** and **Non-Discrimination**.