

# Math 206C: Algebra

## Spring 2021

### Course Information and Syllabus

**Professor:** Nathan Kaplan, [nkaplan@math.uci.edu](mailto:nkaplan@math.uci.edu)

**Zoom Office Hours:** Monday, Thursday, 2:00 - 2:50 PM.

If you would like to meet with me at a different time, send me an email and I am happy to find something that works.

**TAs:** Alex Sutherland, [asuther1@uci.edu](mailto:asuther1@uci.edu),

Office Hours: Tuesday 2:00-3:00PM and Friday 10:00-10:50AM.

**Discussion Sections:** Alex will lead Discussion sections on Zoom from 2:00-2:50 PM Wednesdays. Discussion is not required, but you are highly encouraged to attend!

**Course Website:** <https://canvas.eee.uci.edu/courses/36379>.

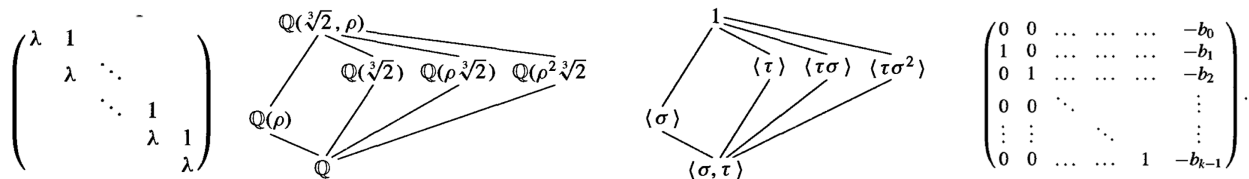
Please check your email address on file with <https://eee.uci.edu> regularly.

## Introduction

Welcome to Math 206C online! This course will follow the structure of Math 206A and Math 206B very closely. We now have about a year of experience with remote learning, so this is not so new anymore, but I continue to recognize that this format is not ideal and it is challenging to get as much out of a remote course than you would from an in-person course. I am going to continue to try my best to be really flexible and understanding about all the different stuff that people are dealing with right now. I am here to help you, so please let me know if any issues come up throughout the course that are making things difficult. I am happy to work with you to do what I can to help you have a successful Spring quarter.

## Course Goals

Algebra is one of the fundamental areas of mathematics and plays an important role in almost every area of modern mathematics. The goal of the Math 206 sequence is to provide a broad overview of algebra and to give you with a strong foundation that prepares you to pursue more advanced topics in the future. You will develop your algebraic intuition by working with many examples, solving lots of problems, and doing many proofs. Another key goal of this course, particularly for graduate students, is to prepare you for success on the Comprehensive Exam and Qualifying Exam in Algebra.



**Textbook:** *Abstract Algebra, Third Edition*, D. Dummit and R. Foote. ISBN: 978-0-471-4334-7

## Course Plan

Here is a description of how I would like this class to work:

1. **Lecture Videos:** My plan is to cover the same material that I would in a traditional lecture format, but to break it up into pieces– I know nobody wants to sit and watch 50 minutes of an online math lecture all at once! Each lecture will consist of several 5-25 minute videos. Most videos will be around 12 minutes and there will usually be 3 or 4 per ‘lecture’. There will typically be 3 or 4 ‘lectures’ posted per week, around 30 for the entire course.
2. **Office Hours:** On Mondays and Thursdays from 2:00 - 2:50 PM, I will host Office Hours using Zoom. If you have questions you would like me to talk about or problems you would like me to go over, please email them to me or post them on the course Discussion Board at least a few hours before our meeting. These sessions are not required and I am not planning to record them. Alex will also have weekly office hours that will run in a similar style.
3. **Discussion Sections:** Alex will run discussion sections on Zoom every Wednesday from 2:00-2:50PM. Discussion sessions are a very important part of this course. It is a good opportunity for you to practice working through problems on your own and in small groups.
4. **Exams:** There will be two midterm exams and one final exam. One of the big goals of this course is to prepare students for a high-stakes timed algebra exam (the Comprehensive and Qualifying Exams). I feel that the best way to prepare for this kind of exam is to take some timed algebra exams. Just like last quarter, exams will be given online as Canvas quizzes and will require Respondus LockDown Browser and Respondus Monitor.
5. **Canvas Discussion Board:** The Canvas Discussion Board is a good place for you to post questions related to material from this course. You can post questions about things that were covered in the lecture videos, about homework problems, about practice problems that are posted before exams, or about Comprehensive and Qualifying Exam problems from previous years. It is very helpful to me if you actively participate on the discussion board because it lets me know what kinds of questions people have and what topics I should cover in more detail in future lectures and in office hours.

In Math 206C we plan to follow Dummit and Foote pretty closely, with some supplementary material from the Field and Galois Theory blurbs of Keith Conrad posted here: <https://kconrad.math.uconn.edu/blurbs/>

## Major Topics

1. Rational Canonical Form and Jordan Canonical Form (Sections 12.2 and 12.3)).
  - We will start the course by applying the material that we learned about Classification of Modules over a PID in Math 206B to the particular setting of  $F[x]$ -modules. This leads to a discussion of canonical forms for matrices. This topic comes up on almost every Algebra Comprehensive and Qualifying Exam, so I would like to solve lots of problems. This topic will be our focus for the first 5 lectures of the course.
2. Field Theory (Chapter 13).
  - We will give an overview of the theory of fields and field extensions. We plan to follow Chapter 13 of Dummit and Foote pretty closely. We will only briefly discuss Section 13.3, and Section 13.6 is quite short, but the other four sections of this chapter are pretty dense. We will also include some material from Conrad's notes. This topic will be our focus for approximately the next 10 lectures of the course.
3. Galois Theory (Chapter 14).
  - The biggest topic of this course will be an introduction to Galois Theory. We plan to follow most of Chapter 14 of Dummit and Foote pretty closely, ending with Section 14.7. We will also include some material and examples from Conrad's notes. This topic will be our focus for approximately the last 12-15 lectures of the course.

## Important Dates

- Friday, April 23, 2:00-3:30PM: Midterm Exam 1.
- Friday, May 21, 2:00-3:30PM: Midterm Exam 2.
- Thursday, June 10th, 1:30-3:30PM: Final Exam.

## Grading

- Weekly Homework: 30%
- Midterm 1: 20%
- Midterm 2: 20%
- Final Exam: 30%

**Makeup Exams: Only in extreme circumstances will make-up exams be offered.** If an emergency causes you to miss an exam, let me know as soon as possible. In such cases, I will most likely re-weight the other exams rather than offering a make-up exam.

**If you would like to take an exam at a different time, please send me an email as soon as possible. For example, if the exam is at a time that does not work well for the time zone that you are in, I am happy to work with you to find a time that works better.**

## Homework

Weekly homework will be a big part of this course. The best way to become comfortable with a new and challenging subject is to do lots of problems. In particular, we will do many of the problems from recent UCI Comprehensive Exams and Qualifying Exams. You can find a large number of these exams here: <https://www.math.uci.edu/graduate/current-students/examinations>

I have always found that I think better about mathematics when I can discuss it with others and that I only really understand a problem when I can explain its solution to somebody else. You are strongly encouraged to work together on problem sets. I know that it may be harder to develop these kinds of study groups with the remote format, but I definitely recommend that you find a way to work together with others. I highly encourage you to solve problems together with others, but you should **write up your solutions individually**.

Dummit and Foote has a ton of great exercises and most of the homework will come from the textbook. I know that there are lots of documents online giving solutions to problems from the book. I'm not saying that you are not allowed to look at these, but if you use outside sources (other textbooks, websites, etc.) for your homework, you **must acknowledge them**. If you do not take the homework seriously (if you just copy solutions from a website), then you won't learn anything from it, and it will be much more difficult to do well on the exams.

Homework will be due Fridays at 12PM. We will have approximately 6 homework assignments total. It will be posted at least one week in advance. Homework will be submitted via the course website and is required to be typed in LaTeX.

## Additional Information

**Academic Honesty:** Cases of academic dishonesty can have very serious consequences. We will adhere to the university's academic honesty policy. For more information see: <https://aisc.uci.edu/students/academic-integrity/index.php>.

**Accommodation Policies:** If you need an accommodation to participate in this course, please email me no later than the end of the second week of class. Review the policies on accommodation at: <http://disability.uci.edu/>.

**Resources for Remote Learning:** The UCI Division of Teaching and Learning has set up a helpful website *Learn Anywhere*: <https://sites.uci.edu/learnanywhere>. This site has resources to help you get started with issues related to online courses. Please check out the UCI Remote Student Success Guide on that page.