

Math 676, Fall 2020

Modules, Linear Algebra, and Groups

Credit hours: 3

Department: Mathematics

Time/location: MWF, 4pm–5pm in Zoom 986 6076 8707

Instructor: David Rose

Office hours: 5pm–6pm Monday in Zoom 986 6076 8707

Phone: (919) 962-1294

Email: davidrose@unc.edu

Website: <https://davidew.web.unc.edu/math-676/>

Teaching Assistant:

- Marc Besson
email: marmarc@email.unc.edu
Office hours: 11am–12pm Wednesday in Zoom 986 6076 8707

Target audience: First-year mathematics graduate students, and others with similar background in undergraduate linear and abstract algebra.

Course prerequisites: An undergraduate degree in mathematics, or equivalent background in algebra. More specifically, I expect everyone to be comfortable with advanced undergraduate abstract and linear algebra, including the basics of group/ring/field theory, matrices, and coordinate-free linear algebra.

A note for undergraduates: This is a graduate course, and I will assume that undergraduate students in the audience have the same background and mathematical maturity as that of students in our incoming graduate class. These students will typically have taken six (or more) senior level classes, and most of them will have earned straight A's in these classes. This is the target audience. Consequently, this class will be more difficult than the most challenging undergraduate classes at UNC, and you should think carefully about whether you are ready for this challenge. (If you've already talked to me, we've decided you are!)

Course goals and learning objectives: To develop a working knowledge of rings, modules, and group actions, and to apply this material to concrete problems in linear algebra and group theory.

Course requirements To demonstrate knowledge of the above, via homework assignments and examinations.

Zoom lectures/etiquette: Due to the COVID-19 pandemic, this course will be taught virtually via zoom. The lectures will be given synchronously, and you are expected to

attend. (Prof. Rose may record/distribute lectures if possible, but you will get much more out of this course if you attend the lectures live and participate.)

Please keep your camera on (whenever possible) and your microphone muted during lecture. Feel free to unmute if you'd like to ask a question, or answer one posed by Prof. Rose. Lastly, the zoom "lecture room" is password protected, for our security; please do not distribute the password.

Textbook: We are using the 3rd edition of *Abstract Algebra* by Dummit and Foote.

Course content: We aim to cover the material in Chapters 7-12 and 4 of Dummit and Foote (plus select additional topics). Here is a preliminary schedule:

	Dates	Topics
Week 1	8/10, 8/12, 8/14	Review of rings, homomorphisms, and ideals (7.1-7.4)
Week 2	8/17, 8/19, 8/21	Euclidean domains, PID's, UFD's (8.1-8.3)
Week 3	8/24, 8/26, 8/28	Polynomial rings (9.1-9.5)
Week 4	8/31, 9/2, 9/4	Vector spaces (11.1, 11.3, 10.4)
Week 5	9/9, 9/11	Introduction to modules (10.1, 10.2)
Week 6	9/14, 9/16, 9/18	More on modules (10.3, 10.4)
Week 7	9/21, 9/23, 9/25	Modules over a PID (12.1, 12.2)
Week 8	9/28, 9/30, 10/2	Jordan canonical form (12.3) and Midterm
Week 9	10/5, 10/7, 10/9	Wrap up material on modules
Week 10	10/12, 10/14, 10/16	Bilinear and quadratic forms
Week 11	10/19, 10/21, 10/23	More on bilinear forms
Week 12	10/26, 10/28, 10/30	Group actions (4.1, 4.2)
Week 13	11/2, 11/4, 11/6	The class equation and Sylow theory (4.3-4.5)
Week 14	11/9, 11/11, 11/13	More on Sylow theory (4.5)
Week 15	11/16	Wrap up and review
Final Exam	TBD at TBD	

Professor Rose reserves the right to deviate from the posted schedule as needed.

Grades: Your grade will be based on the following:

- Homework (30%)
- Mid-term examination (30%): tentatively scheduled for **October 2nd**. There may also be a take-home component assigned that day, and due on **October 5th**.
- Cumulative final examination (40%) on **TBD**.

Although not a formal component of the grading scheme, students are expected to regularly attend and actively participate in lectures.

Missed midterm exams will be treated on a case-by-case basis. If the absence is excused, the final exam grade will be substituted in place of the missed midterm. **No** make-up midterm will be given.

Homework: In order to properly learn the course material, it is crucial to develop the necessary problem-solving skills. As such, homework will be assigned weekly (typically on Friday, to be collected the following Friday). Students are allowed to work on homework collaboratively, but everyone should write up their own solutions. No late homework will be accepted. I encourage people to start working on the homework over the weekend, and to come to Monday morning office hours with questions. I'm also happy to discuss quick questions concerning the homework immediately before/after lecture.

Submission will be via Gradescope:

<https://www.gradescope.com/courses/156664>

and you will need the passcode: MZXNY3 to get things up and running. As is the case with many standard textbooks, you may be tempted to search for homework solutions online; I urge you **not** to do so, as 1) you will learn best by struggling with the problems, and eventually fighting through your confusion (which won't happen if you look up solutions), and 2) it is a violation of the UNC Honor Code.

Academic integrity: Don't cheat. Don't act dishonestly.

Syllabus changes: Professor Rose reserves the right to make changes to the syllabus, including test dates, should any unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.