

SYLLABUS – MATH 6310 – FALL 2022

MODERN ALGEBRA

Description: Topics include:

Rings: ideals, quotient rings, group rings, matrix rings, division rings, commutative rings, prime and maximal ideals, group of units, principal ideal domains, unique factorization domains, structure theorem for modules over a principal ideal domain and its applications to Abelian groups and to linear algebra, rational and Jordan forms, eigenvectors, eigenvalues, minimal and characteristic polynomials, Cayley–Hamilton Theorem.

Modules: free modules, submodules, quotient modules, tensor, symmetric and exterior products of modules, projective and injective modules, exact sequences, complexes, homology, connecting homomorphisms, Tor and Ext functors.

Basic Commutative Algebra: polynomial rings, Gauss’ Lemma, Eisenstein’s criterion, localization, Noetherian rings, Hilbert’s Basis Theorem, integral extensions, algebraic sets, Hilbert’s Nullstellensatz.

- **Time:** Monday, Wednesday, Friday 12:55–1:45pm.
- **Instructor:** Aaron Bertram
- **Contact information:**
 - email: bertram@math.utah.edu
 - office: JWB 302
 - website: <http://www.math.utah.edu/~bertram/math6310>
- **Office hours:** TBD (most likely a hybrid of in person and virtual).
- There are multiple good options for textbooks. I will primarily follow.
 - “Algebra: Chapter 0”, *Paolo Aluffi*though good supplementary texts include:
 - “Abstract Algebra”, *Davis S. Dummit and Richard M. Foote*
 - “Basic Algebra I, II”, *Nathan Jacobson*
 - “Algebra”, *Serge Lang*

Grade: Your grade will be determined by the following formula.

- 40% Homework and worksheets (due about once every week or so – not every problem will be graded).
- 25% Midterm, tentatively Friday October 21st, in class.
- 35% Final.

A 92+ will be an A, 90-92 an A–, 88-90 a B+, etc. The final grading scheme may be more generous.

Pass/Highpass: For the Ph.D. students in the course, an A in the course counts as a high pass on the Algebra I qualifying exam. A grade of B+ or A– counts as a pass.

Assignments: If your homework will be late (or if you will miss an exam or quiz), for instance because you are sick or have tested positive for CoViD, or need to quarantine, you must contact me *prior* to missing the homework in order to receive credit. There will be no negative impact on the grade for late homework where an arrangement was made prior to the due-date. If there is an emergency that makes it difficult or impossible to contact me before the assignment is due, that will be handled on a case-by-case basis.

Students are allowed, and even encouraged to work together when solving homework problems (although each student is responsible for their own write-up).

Prerequisites: You should be familiar with groups, rings and fields at the undergraduate level.

Academic Integrity: All University of Utah policies regarding ethics and honorable behavior apply to this course.

Official matters

The following have been provided by the Department and University.

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS).

Campus safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu

University Counseling Center: The UCC staff is committed to supporting the mental health needs of our campus community, while mitigating COVID-19 risks in our department. While the pandemic is ongoing, the UCC is providing all services as telephone and secure video conference appointments. Their phone number is 801-581-6826, Monday-Friday, 8:00am-5:00pm. For after-hours emergencies, contact the 24/7 Crisis Line: 801-587-3000 . More information is at <https://counselingcenter.utah.edu/>

Office of the Dean of Students: The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. The Office of the Dean of Students is currently closed for in person meetings, but their staff are still available to help you. To contact the Office of the Dean of Students, please email deanofstudents@utah.edu or call 801-581-7066. There is more information at <https://deanofstudents.utah.edu/>

CoViD Matters

Students *must* self-report if they test positive for COVID-19 via this website:

<https://coronavirus.utah.edu/>

Follow the instructions at the website for your next steps.

Note: If you are unable to attend class in person due to a positive test, quarantine, etc., I will ensure that you are not penalized from the grade perspective and will do my best to make sure you don't fall behind.

Vaccination:

Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks. Visit <http://mychart.med.utah.edu/>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov/> to schedule your vaccination.

Masks: I encourage you to wear masks in indoor settings, but they are not now mandatory in my class, though that could change if University policy changes.