Math 523 — Commutative algebra — Spring 2022

Instructor Contact Info: Brooke Ullery (bullery@emory.edu, MSC E416). I'll respond to your emails within 24 hours. Office hours are 9-11 AM on Tuesdays on Zoom.

Class meeting times: Mon/Wed 1-2:15 PM January 10 – April 25. We will be on Zoom through January 26 (link to Zoom room on canvas) and in MSC E406 thereafter.

Website: `http://www.math.emory.edu/~bullery/math523`. I'll post all of your assignments and lecture notes on the website. Canvas will be used for homework submission.

Prerequisites: Knowledge of the material in a yearlong abstract algebra class.

Course Overview: This is a graduate-level commutative algebra class. Topics will include Noetherian rings and modules, the Hilbert Basis Theorem, the spectrum of a ring, localization, Hilbert's Nullstellensatz, primary decomposition, Noether Normalization, systems of parameters, DVRs, dimension theory, Nakayama's Lemma, graded rings, and many more. I will be lecturing and posting notes on the website, but the only way to really learn the material is by doing lots of problems.

Text: We will not be following any one textbook, but our main sources will be Mel Hochster's notes at `http://www.math.lsa.umich.edu/~hochster/614F20/614Lx.pdf` as well as "Commutative algebra" by Atiyah and Macdonald. Time permitting, we may cover more advanced topics from Eisenbud's "Commutative algebra with a view towards algebraic geometry."

Homework: Problem sets will be assigned every one to two weeks. I encourage you to work on the problems together, but you must turn in your own solutions and list the names of your collaborators.

Final project: At the end of the semester, you will give a short presentation on a topic of your choice. Some examples of potential topics: free resolutions and syzygies, Gröbner bases, Macaulay2 basics, Cohen-Macaulay rings, local cohomology.

Grading: The final course grade will be calculated as follows: 85% homework/participation, 15% final project. The "participation" portion of your grade can only help you. For example, if you turn in perfect homework assignments but never participate in class or office hours, you may still receive an A on the homework/participation portion. However, if you struggle with the homework assignments, but prove to me that you are working hard and engaging with the material (as evidenced by discussions in class or office hours), your participation may boost your homework grade.

Masks: Please keep your mask on for the entire length of class. Refrain from eating/drinking in class so that you can keep your mask on the whole time.

ADA and students with disabilities: In compliance with the Americans with Disabilities Act of 1990 (ADA), no otherwise qualified person with a disability be excluded from participation in, be denied the benefits of, or be subject to discrimination under any educational program or activity in the university. Please contact the Office for Disability Services, located in the SAAC building on the Emory's Clairmont campus to coordinate reasonable accommodations for students with documented disabilities.