

MAT 732 - Homological Algebra Spring 2018

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Lecture: MW 8:00–9:20, Carnegie 120.

Office hours: TBA; also by appointment and any time my door is open.

Text: No specific text; your notes from lecture will be the main source. They can be supplemented by the following books (on reserve in the Math. Library):

- Rotman: *An Introduction to Homological Algebra*.
- Weibel: *An Introduction to Homological Algebra*.
- Gelfand-Manin: *Methods of Homological Algebra*.

Course Description: MAT 732 is an introduction to homological algebra. Homological algebra is an important tool for solving various problems in other areas of algebra, as well as geometry and topology. Prerequisites: MAT 631, 632 and 731.

The plan is to cover at least the following topics (not necessarily in this order):

- ✓ Quick review of homological concepts from MAT 731. Projective modules, injective modules. Tensor products, flatness.
- ✓ Categories and functors. Definitions, examples, additive and abelian categories, adjoint functors. Limits, pushouts and pullbacks.
- ✓ Chain complexes, homology and homotopy. Projective and injective resolutions. Derived functors.
- ✓ Double complexes. Mapping cones. Tor and Ext.
- ✓ Dimensions. Projective, injective, and global dimension.
- ✓ Triangulated categories.
- ✓ Derived categories.

Note that triangulated and derived categories are not covered in Rotman's book, but they are discussed in the books of Gelfand-Manin and Weibel.

Grading and homework: Your course grade will be based on the homework. You are encouraged to work together to solve the homework problems, but each person must submit his/her own writeup.

Academic Integrity: Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The university policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also

prohibits students from submitting the same written work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the university's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice. The Violation and Sanction Classification Rubric establishes recommended guidelines for the determination of grade penalties by faculty and instructors, while also giving them discretion to select the grade penalty they believe most suitable, including course failure, regardless of violation level. Any established violation in this course may result in course failure regardless of violation level. For more information and the complete policy, see <http://class.syr.edu/academic-integrity/policy/>

Students with Disabilities: If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS),

<http://disabilityservices.syr.edu>

located in Room 309 of 804 University Avenue, or call (315) 443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue students with documented disabilities Accommodation Authorization Letters, as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible. You are also welcome to contact your instructor privately to discuss your academic needs although I cannot arrange for disability-related accommodations. Making arrangements with ODS takes time. Do not wait until just before the first test.

Faith Tradition Observance: SU's religious observances policy can be found at

http://supolicies.syr.edu/emp_ben/religious.observance.htm

Under the policy, students are provided an opportunity to make up any examination, study, or work requirement that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes. There is an online notification process available on MySlice.