Course Information

Professor: Gabriel Kerr
Office: CW 215,
Office Hours: T U 2:30 - 3:30 (unless there is a colloquium) and by appointment,
Office Phone: 532-0578
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Text: Notes for the course will be available on Canvas. The additional required text is:
   An Introduction to Homological Algebra, by Charles Weibel.
The following books are recommended supplementary reading:
   Methods of Homological Algebra by Gelfand and Manin.
   An Introduction to Homological Algebra by Joseph Rotman.

Prerequisites: Math 811 or equivalent is listed as a prerequisite. It is anticipated that the student is comfortable with algebraic structures such as groups, rings, modules and fields, their definition and basic properties. It is expected that the student can produce clear mathematical proofs.

Course Summary: This course aims to present a rigorous introduction to homological algebra. The approach for the first semester is to compute as much as possible, keep unnecessary abstraction to a minimum, and develop theory as needed.

Course Content:

Category Theory
   abelian categories; functors, adjoints and derived functors; DG categories; natural transformations; limits and colimits; universal properties.

Homological Algebra Fundamentals
   Snake Lemma; 5-lemma; projective and injective resolutions; long exact sequences; universal coefficients; double complexes; filtered complexes; spectral sequences.

Rings and modules
   Tensor review; Tor and Ext; interpretations of low dimensional cohomology; homological dimension; local cohomology.

Groups
   Group (co)homology; interpretations of low dimensional cohomology; restriction, inflation, transfer; central extensions; Galois cohomology

Other topics (time permitting)
   Lie algebra (co)homology; sheaf cohomology; Hochschild, Sullivan, and cyclic cohomology; Morita invariance

Homework: Homework will be assigned every week (one to three problems) and a student will work through one exercise at the beginning of each class.

Grading: Attendance and participation : 100%

* If you have any condition, such as a physical or learning disability, which will make it difficult for you to carry out the work as I have outlined it or which will require academic accommodations, please notify me in the first two weeks of classes. You may also wish to contact the Academic Assistance Center, in 101 Holton Hall.

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