MAT 732 - Homological Algebra
Spring 2013

Instructor:	Professor Dan Zacharia
Office:	229C Physics
Phone:	443-1580
Email:	zacharia@syr.edu

Lecture:	MW 12:45–2:05, Carnegie 316.
Office hours:	MW 10:00–11:30.
	Also by appointment, and any time my door is open.
Text:	Rotman: *An Introduction to Homological Algebra, 2d ed.*, Springer, 2009.

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.

The plan is to cover the following topics:

- ✓ **Categories and functors** (Chapters 1 and 5). Definitions, examples, additive and abelian categories, adjoint functors. Limits, pushouts and pullbacks.
- ✓ **Hom and Tensor** (Chapter 2). Modules, tensor products, adjoint isomorphisms.
- ✓ **Special Modules** (Chapter 3). Projective, Injective and flat modules.
- ✓ **Homology** (Chapters 6 and 7). Homology functors, derived functors. Tor and Ext. Localization, Baer sums, the universal coefficients theorem.
- ✓ **Dimensions** (Chapter 8). Projective, injective, and global dimension.
- ✓ **Triangulated and Derived categories**[*]. Definitions, examples. The stable and the derived category. Derived categories are triangulated.

[*]Triangulated and derived categories are not covered in Rotman's book. We will use other sources for these topics. One of them is the book *Methods of Homological Algebra* by Gelfand and Manin.

Homework: Homework will be assigned in class. Some problems will be assigned to be turned in and graded. You are encouraged to work together to solve the problems, but each person must submit his/her own writeup.