

**COURSE SYLLABUS**  
**MATH 80210**  
**TOPICS IN ALGEBRA: FREE RESOLUTIONS**

INSTRUCTOR: KELLER VANDEBOGERT

MY INFORMATION

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Office Hours: MWF, 10 : 30 – 11 : 30 am, in Hurley 279.

Schedule: MWF 9 : 25 – 10 : 15 am, Pasquerilla Center 116.

1. PREREQUISITES

All material of Chapters 1 and 2 of Eisenbud's "Commutative Algebra with A View Toward Algebraic Geometry" and Matsumura's "Commutative Ring Theory" will be assumed. *Some* familiarity with homological algebra will be necessary, but I will recall many standard definitions for sake of establishing conventions. Finally, an  $\epsilon > 0$  amount of familiarity with multilinear algebra and tensor/exterior/symmetric algebra constructions would be very helpful

Material Covered

I plan to start the course with an overview of free resolutions and to illustrate techniques of constructing resolutions with explicit examples. After this, depending on student interest and time, some subset of the following topics will be covered:

- a) Classical structure theorems on finite free resolutions of certain classes of modules/ideas) the Koszul complex, Eagon-Northcott, Gulliksen-Negard, Buchsbaum-Eisenbud,...)
- b) Computing homological information of a module based on its free resolution
- c) Free resolutions equipped with additional structure (i.e, equivariance, combinatorial support, DG/A infinite-algebra structure,...)
- d) Classical structure theorems for infinite free resolutions (the Priddy complex/Koszul duality, acyclic closures, the Massey complex, the Eisenbud- Shamash construction..)