syllabus – new plan
7 June 2021
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Homological Algebra

Fall Semester 2021-22

Catalog Number: 201.2.2091

Prerequities:

1. Algebraic Structures
2. Introduction to Topology

Recommended:

1. Introduction to Commutative Algebra
2. Introduction to Algebraic Geometry
3. Basic Concepts in Topology and Geometry

Course Topics: (as much as time permits)

1. **Review of prior material.** On rings, ideals and modules (including noncommutative rings).
2. **Categories and functors.** Emphasis on linear categories. (This topic will be introduced gradually, as we go along.)
3. **Universal constructions.** Free modules, products, direct sums, polynomial rings.
4. **Tensor products.** Definition, construction and properties.
5. **Exactness.** Exact sequences and functors.
6. **Special modules.** Projective, injective and flat modules.
7. **Complexes of modules.** Operations on complexes, homotopies, the long exact cohomology sequence.
8. **Resolutions.** Projective, flat and injective resolutions.
9. **Left and right derived functors.** Applications to commutative algebra.
10. **Further applications of derived functors.** Classification problems, extensions.
11. **Morita Theory.**

(Some of the material might move to the subsequenct course "Commutative Algebra")