Catalogue Description

MAT 732 Homological Algebra 3 IR Projective and injective resolutions, Tor and Ext, flatness, homology, derived categories, spectral sequences. Prerequisites: MAT 631-632, 731.

More detailed description. Here we list sections from two books, An Introduction to Homological Algebra, second edition by Joseph J. Rotman and Methods of Homological Algebra, second edition by S. I. Gelfand and Yu. I. Manin. So as not to be accused of plagiarism we let it be known that we copy the titles of chapters and sections directly from these books. The number of lectures indicated is based on 55 minute MWF lectures.

Rotman

Chapters 1 and 2: 4 lectures
Chapter 1 Introduction
- 1.2 Categories and Functors

Chapter 2 Hom and Tensor
- 2.1 Modules
- 2.2 Tensor Products
- 2.2.1 Adjoint Isomorphisms

Chapter 3: 3 lectures
Chapter 3 Special Modules
- 3.1 Projective Modules
- 3.2 Injective Modules
- 3.3 Flat Modules

Chapter 5: 6 lectures
Chapter 5 Setting the Stage
- 5.2 Limits
- 5.3 Adjoint Functor Theorem for Modules

Chapter 6: 6 lectures
Chapter 6 Homology
- 6.1 Homology Functors
- 6.2 Derived Functors
- 6.2.1 Left Derived Functors
- 6.2.2 Axioms
- 6.2.3 Covariant Right Derived Functors
- 6.2.4 Contravariant Right Derived Functors

Chapter 7: 8 lectures
Chapter 7 Tor and Ext
- 7.1 Tor
- 7.1.1 Domains
- 7.1.2 Localization
- 7.2 Ext
- 7.2.1 Baer Sum
- 7.4 Universal Coefficients

Chapter 10: 5 lectures
Chapter 10 Spectral Sequences
- 10.1 Bicomplexes
- 10.2 Filtrations and Exact Couples
- 10.3 Convergence
- 10.4 Homology of the Total Complex

Gelfand and Manin

Chapters III and IV: 9 lectures
Chapter III Derived Categories and Derived Functors
- III.1 Complexes as Generalized Objects
- III.2 Derived Categories and Localization
- III.3 Triangles as Generalized Exact Triples
- III.4 Derived Category as the Localization of the Homotopic Category
- III.5 The Structure of the Derived Category

Chapter IV Triangulated Categories
- IV.1 Triangulated Categories
- IV.2 Derived Categories are Triangulated
- IV.3 An Example: The Triangulated Category of Λ-Modules