

The Department of Mathematics

2019–20–B term

Course Name Homological Algebra

Course Number 201.2.2091

Course web page

https://www.math.bgu.ac.il/~amyekut/teaching/2019-20/homol-alg/course_page.html

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Office Hours <https://www.math.bgu.ac.il/en/teaching/hours>

Abstract

Description: This is a graduate level course. Undergraduate students can register with my permission.

The prerequisite course is “Commutative Algebra” that I gave in the fall semester (or an equivalent course). We will need the following topics from that course: categories and functors; additive and exact functors; free modules; products and coproducts; tensor products of modules and rings.

The pace of the course, and the amount of material covered, will be determined by the background and capability of the audience. There will be many examples and exercises. I will upload typed notes after every lecture.

Course Grade: pass/fail grade. Passing the course requires attending all lectures and submitting most of the homework.

Homework: To be assigned every week. Checking will be sporadic. See the first day handout for more administrative information.

Course Topics:

1. Adjoint functors.
2. Morita Theory.
3. Projective and Injective modules.
4. Complexes of modules.
5. Homotopies and homotopy equivalences.



6. The long exact cohomology sequence.
7. Projective, flat and injective resolutions.
8. Left and right derived functors.
9. Applications of derived functors to commutative algebra.
10. Further applications of derived functors and cohomology.

Requirements and grading¹

¹Information may change during the first two weeks of the term. Please consult the webpage for updates



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פרופ' אמנון יקותיאל
המחלקה למתמטיקה
אוניברסיטת בן גוריון
באר שבע 84105

22 February 2020

Course Announcement:
Homological Algebra
Spring Semester 2019-20

Catalog Number: 201.2.2091

Time: Wednesday 12:00 – 14:00

Place: Building 58 room 201

First meeting: 11 March 2020

Teaching Language: English

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Bibliography:

1. P.J. Hilton and U. Stammbach, "A Course in Homological Algebra", Springer, 1971.
2. S. MacLane, "Homology", Springer, 1994.
3. J. Rotman, "An Introduction to Homological Algebra", Academic Press, 1979.
4. L.R. Rowen, "Ring Theory" (Student Edition), Academic Press, 1991.
5. C. Weibel, "An introduction to homological algebra", Cambridge Univ. Press, 1994.
6. A. Yekutieli, "Derived Categories", Cambridge Univ. Press, 2019.
7. Course notes, to be uploaded every week to the [course web page](#).



Course topics

Course Topics:

1. Categories and functors: natural transformations, equivalence, adjoint functors, additive functors, exactness.
2. Derived functors: projective, injective and flat modules; resolutions, the functors Ext and Tor ; examples and applications.
3. Nonabelian cohomology and its applications.