אוניברסיטת
בן-גוריון בנגב

המחלקה למתמטיקה

סמסטר ב–2019–20

שם הקורס אלגברה הומולוגית

מספר קורס 201.2.2091

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

מרצה אחראי פרופ׳ אמנון יקותיאלי, <amyekut@bgu.ac.il>, חדר 202

שעות קבלה https://www.math.bgu.ac.il/he/teaching/hours

תקציר

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

Course Topics:

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

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

דרישות והרכב ציון הקורס[1]

[1] דרישות הקורס יכולות להשתנות במהלך השבועיים הראשונים של הסמסטר, ויש לשים לב להודעות באתר הקורס

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פרופ' אמנון יקותיאלי
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
Web Page: https://www.math.bgu.ac.il/~amyekut/teaching/2019-20/homol-alg/course_page.html

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 capabilty 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.

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.

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נושאי לימוד

1. Recalling material. prior Rings (including modules ideals, noncommutative), sequences, exact bimodules, and tensor products, and sums direct infinite rings. and modules of products

2. Categories and functors, Morphisms of categories, equivalences. Linear functors. and functors. of Exactness functors. linear and

3. Special modules, Projective modules. flat and injective

4. Morita Theory. Equivalences module of categories as realized products. tensor

5. Complexes of modules. Operations on complexes, homotopies, long the sequence. cohomology exact

6. Resolutions, Projective modules. flat and injective – resolutions uniqueness. and existence

7. Left and right derived functors. The general theory. Ext and Tor functors

8. Applications to commutative algebra. Some theorems, global and local involving functors. torsion and completion Derived functors. Ext and Tor

9. Sheaf cohomology. The role of homological algebra in geometry.

10. Nonabelian cohomology. Galois cohomology, theorems: classfiication of vector bundles.

Bibliography

1. Hartshorne, R. "Algebraic Geometry", Springer-Verlag, New-York, 1977.

2. Hilton P.J. and Stammbach, U. "A Course in Homological Algebra", Springer, 1971.

3. Maclane, S. "Homology", Springer, 1994.

4. Rotman, J. "An Introduction to Homological Algebra", Academic Press, 1979.

5. Rowen, L.R. "Ring Theory" (Student Edition), Academic Press, 1991.

6. Weibel, C. "An introduction to homological algebra", Univ. Cambridge Press, 1994.

7. Schapira, P. and Kashiwara M. Sheaves on Manfiolds, Springer, 1990.

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[2]http://stacks.math.columbia.edu
[3]https://arxiv.org/abs/1610.09640v4