אוניברסיטת
בן-גוריון בנגב

The Department of Mathematics

2017–18–B term

Course Name Homological Algebra

Course Number 201.2.2091

Course web page
`https://www.math.bgu.ac.il/~amyekut/teaching/2017-18/hom-alg/course_page.html`

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

Abstract

Requirements and grading[1]

Course topics

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

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

.3 Special modules. Projective, injective and flat modules.

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

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

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

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

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

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

.9 Sheaf cohomology. A survey of the role of homological algebra in geometry.

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

Bibliography

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

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

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

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

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

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

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

.8 The Stacks Project[2], an online reference, J.A. de Jong (Editor). (9) A. Yekutieli, "Derived Categories", Cambridge Univ. Press, .2019 Free prepublication version[3]. (10) Course notes, to be uploaded every week to the course web page

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