

Fall 2018, Course 18.706, Noncommutative algebra

MW 3–4:30, Room 2-151

Instructor: Roman Bezrukavnikov, office 2-470.

Contents. The beginning of the course will cover fundamental concepts forming the basic vocabulary of the algebraic language in today's math. These include:

Rings, modules. (Semi)simple rings, division rings. Wedderburn Theorem, Jordan-Hoelder and Krull-Schmidt Theorem. Prime radical, Jacobson radical. Artinian rings.

Categories: Yoneda Lemma, adjoint functors. Additive and abelian categories. Morita theory.

Basic homological algebra: δ -functors, Tor's, Ext's, group (co)homology, global dimension etc.

These will be followed by somewhat more specialized topics:

Koszul algebras.

Ore Localization and Goldie Theorem.

Central simple algebras and Brauer group.

PI algebras.

Growth of algebras

Some ideas of Noncommutative geometry.

Sources. Possible references include the book by P.M. Cohn "Further Algebra and Applications" (chapters 2, 4, 5, 7, 8; an earlier edition of basically the same text is volumes 2,3 of the series "Algebra" by the same author); C.A. Weibel "An introduction to homological algebra" and notes by Mike Artin and by Pavel Etingof available at the course website.

Class work and final grade. Biweekly homework assignments will be given.

The grade will be based on the homework.

Students are also invited to prepare an optional expository paper for extra credit. Suggested topics for will be posted on the class website. Please talk to the instructor before starting to work on the paper.

Class website. Course material including homeworks will be posted at:

[http : //math.mit.edu/ ~ bezrukav/706.html](http://math.mit.edu/~bezrukav/706.html)

Office hours. Are Thursday 3-4 or by appointment. Questions and discussion of the course material are most welcome, the students are encouraged to contact the instructor by e-mail and/or stop by his office.