Course syllabus for Math 231br
Advanced Algebraic Topology
Spring 2014

Instructor: Gereon Quick

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Office: Science Center 341 (in the back of the library)

Office Hours: Wednesdays, 1.30-2.30pm or by appointment

Please do not hesitate to contact me with whatever question or problem you might have. Either stop by at my office or send me an email.

The course:

Our aim: After learning about the fundamental objects in algebraic topology in Math 231a we start to discuss more advanced questions, e.g., the classification of vector bundles and K-theory, and learn about more sophisticated and powerful techniques, e.g. characteristic classes, cohomology operations and K-theory. The ideas we will come across are not only important in topology but turn out to be very useful in many different areas, e.g., in algebraic geometry.

Location: Science Center 411

Time: MWF 2.30-3.30pm

Prerequisites: Math 231a or the equivalent.

Homework, and grading: Grades will be based on problem sets, and a 4-10 page paper to be completed by the end of reading period. I will try to hand out a problem set every week. Feel free to work together on problem sets, but hand in your own write-up. And please indicate with whom you collaborated.

I will provide a list of potential topics for the final paper half way through the course, but you are very welcome to chose another topic which interests you more.

A list of topics we plan to discuss:

- vector bundles

- characteristic classes

- complex K-theory

- Bott periodicity

- Adams operations

- Hopf invariant one problem

- Chern character

- e-invariant

- J-homomorphism

- Adams Conjecture

Books and papers that you may want to have a look at:

- M. F. Atiyah, *K-Theory*, W. A. Benjamin, New York, 1967.

- A. Hatcher, *Vector Bundles and K-Theory*, online draft of a book.

- J. P. May, *A Concise Course in Algebraic Topology*, The University of Chicago Press, Chicago, 1999, p. ix+243.

- J. W. Milnor and J. D. Stasheff, *Characteristic classes*, Annals of Mathematics Studies 76, Princeton University Press, Princeton, 1974, p. v+330.

- R. Mosher and M. Tangora, *Cohomology Operations and Applications in Homotopy Theory*, Harper & Row Publishers, New York, 1968, p. x+214.