MAT 542/540: Algebraic Topology, Fall 2016
Course Information

MAT542 Course Instructor

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Office Hours: Tu 9-10 in Math P-143, 10-12 in Math 3-111 (or catch me at tea)

MAT540 Course Instructor

Name: Dennis Sullivan *Office:* Math Tower 5-114 *E-mail:* dennis@math.stonybrook.edu
Office Hours: upon request or random encounter

Course Website

All updates, including schedule and, homework assignments, will be posted on the course website,

`http://math.stonybrook.edu/~azinger/mat542`.

Please visit this website regularly.

Prerequisites

This course is limited to the PhD students in mathematics who have passed their comps. All others must obtain permission from the instructor and the Director of Graduate Studies before registering for this course. Familiarity with MAT 530/531 (Geometry&Topology I/II) and 534/535 (Algebra I/II) is required.

Grading

Your grade will be based on class participation in all possible forms, including in discussions in class on MW/F, in office hours, and at other times with your classmates, and by handing in some written homework. You may hand in solutions to at *most* two problems every two weeks and no more than two weeks after these problems are assigned or the corresponding material is covered in class (see more on next page).

Readings

The main textbook will be *Elements of Algebraic Topology* by James Munkres; you should acquire this book. It thoroughly covers the foundations of algebraic topology, including the relevant homological algebra; it will be followed closely in MW lectures. You may also want to obtain a copy of *Algebraic Topology* by Allen Hatcher (available for download from his website). It provides a more informal and intuitive perspective and could serve as a great source of questions for discussions on Fridays.

About the Course

Algebraic topology is fundamental to much of geometry today. This course will cover the foundations of algebraic topology, such as simplicial and singular homology and cohomology, some homological algebra and its applications (Mayer-Vietoris, universal coefficient theorems, Kunneth formula for products of spaces), and Poincare Duality for manifolds (time-permitting). Like with much of mathematics, it is desirable to develop

(1) a solid grasp of algebraic topology and to be able to formulate the statements precisely,

(2) an intuitive understanding of the subject and to be able to communicate the key ideas informally.

The MW lectures (2:30-3:50 in Physics P-128) by Aleksey will focus on the former; the discussions with Dennis (and/or Chandrika) on Fridays (12:30-2:30 in Math 5-127) will focus on the latter. You are encouraged to attend and to participate in both. In particular, do not hesitate to bring up questions related to MW lectures or related homework problems in Friday's discussions.

Each section in the book is followed by a few exercises. These are generally directly related to the section and are thus (usually) not very hard. Some of these exercises will be suggested in class. However, you should try to figure out all (or at least most) of the exercises for yourself. If you write solutions to any of the exercises in order to hand them in, you should take the statements of all preceding exercises as given. You should also read (and study in detail) every section of the book (as well as additional readings) covered in class.

This is an intermediate grad course, and the formal requirements are fairly light. However, the more effort you put into this course, the more you are likely to benefit from it. If you are interested in geometry of some sort, at the minimum you should have a firm grasp of singular (co)homology, including the ability to compute and use it. If you are interested in algebraic topology, you should try to master the entire course, including homological algebra, and make the most of the opportunity offered to you by Dennis to learn about this subject beyond the course textbook.