

MATH 8803 Syllabus

Haken manifolds and algorithms in 3-manifold topology, Section ETN, 3 credit hours

Fall 2026

Instructor Information

Instructor: Dr. John Etnyre

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General Course Information

Description

This course will introduce the use of incompressible surfaces in the study of the topology of 3-manifolds. Haken manifolds are, among other things, 3-manifolds that admit interesting incompressible surfaces. Given this, we will show that their study reduces largely to algebraic topology. We will also discuss normal surfaces, which are a way to study incompressible surfaces via triangulations of a 3-manifold. This allows one to algorithmically study 3-manifolds. For example, we will show that there is an algorithm to detect if a 3-manifold is the 3-sphere.

Course Learning Outcomes

By enrolling in this course, a student will

- Understand the uses of incompressible surfaces in the study of 3-manifolds.
- Understand the topology of Haken manifolds.
- Be able to create algorithms to study various phenomena in 3-manifold topology.

Required Course Materials

There is no required text for the class, but there are texts that might be a helpful supplement to the course lectures:

- *Homotopy Equivalences of 3-Manifolds with Boundaries* by Klaus Johannson.
- *Lectures on Three-Manifold Topology* by William Jaco.
- *3-manifolds* by John Hempel.
- *Algorithmic Topology and the Classification of 3-Manifolds* by Sergei Matveev

Grading Policy

Your grade will be based on class participation and some class assignments. For the class assignments, in each of the months of August, September, October, and November, by the end of the month, you need to either

- turn in 4 problems mentioned in class or in one of the textbooks (related to the material being covered in class), or
- give a talk in the Wednesday student geometry/topology seminar that month.

To receive a passing grade you must complete and pass the monthly assignments. For an A you must also attend at least 90% of the classes (or have an excused absence), for a B you must attend at least 80% of the classes (or have an excused absence), for a C, 70%, and for a D, 60%. **I realize that some people might have difficulty participating in class as much as they would like (and to meet the cut-offs for the given grades). If you need to miss classes, please just contact me and explain the situation and verify that you are keeping up with the class (though notes from other students or the above text books).**

Description of Graded Components

The written assignments must be turned in by the end of the month on Canvas. The assignments will be graded on a pass/fail basis. A reasonable attempt will receive a pass. By reasonable attempt, I mean that the attempts for solutions to 3 out of 4 of the problems are essentially correct, even if there might be some minor errors. If you give a talk, that will count as a completed assignment for that month, but **you will still need to turn in a PDF to Canvas saying that you gave a talk and give the date and title of the talk.**

For solving the written problems, you are welcome to consult with me or work with other students. **But the problems must be written up by you, in your own words.**

Course Policies

Attendance and Participation

Students must attend a certain percentage of lectures for various grad cut-offs as indicated above.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.