18.901 - Introduction to topology - Fall 2023

Instructor: Alex Pieloch
Email: pieloch@mit.edu
Office Hours: See Canvas

Class meeting time: Tuesdays and Thursdays from 2:30-4:00 pm in room 2-105.

Course Webpage: math.mit.edu/~pieloch/18.901-fall-2023
The above course webpage will be used for releasing homework assignments, exam solutions, etc.. Canvas will be used for hosting grades on individual assignments and for mass emailing purposes.

Textbook: James Munkres *Topology*, 2nd edition (ISBN: 9780134689517)
Allen Hatcher *Algebraic Topology*, https://pi.math.cornell.edu/~hatcher/AT/AT.pdf

Prerequisite: The official prerequisite is real analysis (18.100A, 18.100B, 18.100P, or 18.100Q). The unofficial prerequisites are basic knowledge of set theory on the level of Chapter 1 in Munkres and experience with writing formal proofs.

Course Description: This course serves as an introduction to topology. The first part of the course will focus on point-set topology, covering topological spaces, continuous functions, connectedness, compactness, and separation properties. The second part will focus on manifolds, imbeddings in Euclidean space, and the classification of surfaces theorem. The third part of the course will focus on algebraic topology, covering fundamental groups, covering space, and additional topics as time permits.

Homework: There will be weekly homework assignments. Homeworks will be assigned Tuesdays after class on the course webpage. Homework will be due the following Tuesday at the start of class. Students will be required to hand-in their solutions at the beginning of class. Any exceptions to this homework schedule will be noted for students in class and on the course webpage.

Collaboration policy: Students are welcome to discuss and work on homework problems with fellow students. However, the solutions that a student submits should be their own and written up by themselves. If students collaborate with any other students, then they should note their collaborators on the top of their homework solutions.

Late homework policy: Students will be granted a one time 48 hour extension on any particular homework assignment. To utilize this extension, students simply need to email a pdf copy of their solutions to pieloch@mit.edu. Outside of this one exception, late homework will not be accepted and the late homework will be given a zero.

Exams: There will be two in-class midterm exams and a cumulative final exam. The dates for the midterm exams are given below. The date for the final has yet to be announced by the registrar.

- Midterm 1 - Thursday, October 5th at 2:30-4:00 pm
- Midterm 2 - Tuesday, November 14th at 2:30-4:00 pm

Make-up exam policy: If students find that they will have a conflict for an exam, then they

should reach out to pieloch@mit.edu as soon as they are aware of a potential conflict. If the reason for the conflict is sensitive, then students are also welcome to contact their academic advisors who can in turn communicate to me the need for accommodations. If accommodations can not be arranged for a make-up midterm exam, then the weighting of the student's final grade that is determined by the missed midterm exam will be absorbed into the weighting of the final exam.

Regrading policy: If a student feels that a problem on either a homework or an exam was incorrectly graded, then they may request a regrading of the assignment. Any regrading must be requested within a week of the assignment being returned. For example, if a homework or exam was returned on a Tuesday during class, then students would have till the following Tuesday at 2:30 pm (the start of class) to request a regrade. Note, if an assignment is regraded, the entire assignment will be regraded, not simply the problem in question. All regrading requests should be sent to pieloch@mit.edu. In the email, students should list the problems that they believe were incorrectly graded and provide some justification for why they believe this.

Grading: The final course grade will be determined by the following weighting:

- Homework: 40%
- Midterm 1: 15%
- Midterm 2: 15%
- Final: 30%

Academic Honesty: Copying your written assignments from somebody else's assignment or from any other source is considered cheating. Any cheating on assignments, midterm exams, or the final exam will be dealt with severely.

Schedule: The tentative schedule for the course is below. It will be updated and populated as the course progresses.

Week	Day	Topics Covered
Week 1	9/7	Introduction, topological spaces, bases
Week 2	9/12	Metric spaces, subspaces, product spaces, quotient spaces
	9/14	Continuity, connectedness
Week 3	9/19	Compactness
	9/21	Hausdorff spaces, separation properties
Week 4	9/26	Normal spaces I
	9/28	Normal space II
Week 5	10/3	Metrization theorems, paracompactness
	10/5	**Midterm 1**
Week 6	10/10	**No class** (student holiday)
	10/12	Manifolds, paracompactness
Week 7	10/17	Manifolds, paracompactness, covering dimension
	10/19	Baire's theorem, embeddings of compact metric spaces
Week 8	10/24	Homotopy
	10/26	CW complexes
Week 9	10/31	Group theory
	11/2	Group theory, fundamental groups
Week 10	11/7	Properties of fundamental groups
	11/9	Fundamental group of the circle, applications of fundamental groups
Week 11	11/14	**Midterm 2**
	11/16	Free groups, presentations
Week 12	11/21	van Kampen's theorem
	11/23	**No class** (Thanksgiving holiday)
Week 13	11/28	van Kampen's theorem and CW-complexes
	12/30	Covering spaces, homotopy lifting
Week 14	12/5	Covering spaces, classification theorem
	12/7	Covering spaces, universal covers
Week 15	12/12	Wrapping-up