MATH 442/842 - Algebraic Topology

Winter 2025

General information

Instructor:	Martin Frankland
Email:	Martin.Frankland@uregina.ca
Office:	CW 307.17
Office hours:	TBA. Office hours are held in my office and on Zoom. The link is posted on UR Courses.
Lectures:	MWF 12:30 - 1:20 PM in room CL 431 and livestreamed on Zoom. The link is posted on UR Courses.
Textbook:	Allen Hatcher, *Algebraic Topology.* Available for free on the author's website:
	`https://pi.math.cornell.edu/~hatcher/AT/ATpage.html`
	Secondary reference: J. Peter May, *A Concise Course in Algebraic Topology.* Available for free on the author's website:
	`https://www.math.uchicago.edu/~may/CONCISE/ConciseRevised.pdf`
Prerequisite:	MATH 441 or similar course in general topology.
	Strongly recommended: MATH 323 or 223 or similar course in group theory.
UR Courses:	`https://urcourses.uregina.ca/`
	This site will contain announcements and additional course material. The site is updated throughout the semester, so please check back regularly.

Course outline

The course is a first semester in algebraic topology. Broadly speaking, topology studies the shapes of spaces. Algebraic topology assigns algebraic invariants to spaces, such as homotopy groups or homology groups. Those invariants are in fact *homotopy* invariants. This leads to studying spaces up to *homotopy equivalence*, i.e., a continuous deformation of one space into another. For example, a disk is homotopy equivalent to a point, by gradually shrinking its radius.

The course covers roughly Chapters 1 and 2 of Hatcher. Here is the list of topics:

- The fundamental group.

- Covering spaces.

- CW complexes.

- Examples: surfaces, real projective space, complex projective space.

- Simplicial homology, singular homology, cellular homology.

- Applications of homology.

- Time permitting: Cohomology.

Grading scheme

- Homework: 40%

- Midterm: 15%

- Final Exam: 15%

- Project: 30%

Course delivery and computer requirements

The course is taught in a **hybrid** format. Lectures will be held in person and livestreamed on Zoom.

For those taking the course remotely, here are the technology requirements.

- A computer, laptop, or similar device, with a reliable internet connection.

- A way of submitting work online, e.g., a smartphone camera or a scanner. Typing up your homework is another option.

- A video camera and microphone for the oral presentation. The rest of the semester, a camera and microphone are strongly recommended, in order to facilitate participation. Note: Most laptops have a built-in camera and microphone, which work fine for our purposes.

The course has both synchronous and asynchronous components.

- **Synchronous**: Lectures / problem sessions during the designated schedule.

- **Asynchronous**: Selected readings from the textbook, notes posted after each lecture, additional notes and worked examples.

Exams

- Midterm: take-home exam in February. Date TBA.

- Final Exam: **Wednesday April 23**, take-home exam.

Details for both exams will be confirmed.

The final exam covers the entire semester, with heavy emphasis on material after the midterm.

All exams will be **open book**: the textbook, notes, and class material are allowed. More details will be provided as to which resources are allowed and which are not.

Homework

Homework will be assigned more or less weekly and submitted on UR Courses. Selected problems from each assignment will be graded.

Late homework will not be accepted.

The **lowest homework score** will be dropped.

For students registered in MATH 842: Each homework assignment will contain one designated graduate problem, which is part of the assignment for MATH 842 but not for MATH 442.

Project

You will work on a project on a topic of your choice related to the course. The project consists of two components:

- An expository written report, worth 20%.

- An oral presentation, worth 10%.

Missed course work

Information about missed course work can be found in the *Academic Regulations*, section "Deferral of Final Exams or Course Work", available at:

https://www.uregina.ca/student/registrar/resources-for-students/academic-calendars-and-schedule/undergraduate-calendar/sections.html

See in particular the sections "Grounds for Deferral" and "Supporting Documentation".

Schedule conflicts: If you have a schedule conflict between an exam and another course or university sponsored activity (e.g. conference, sports tournament), please contact me in advance, **no later than a week before the exam** in question.

Illness: If you are unable to meet a course requirement due to illness or other serious circumstances, please contact me as soon as possible.

Homework: An excused missed assignment will be dropped. There will be no make-up homework.

Exams: In case of excused absence from an exam, the exam will be dropped, with the course grade computed out of the remaining 85 course points. There will be no make-up exam.

For administrative purposes, the Final Exam plays the role of a second midterm. In particular, the section "Deferral of Final Exam" in the *Academic Regulations* does not apply here.

Academic integrity

Working on homework with your peers is allowed. However, each student must write **their own** solutions. Handing in suspiciously similar solutions will be considered an instance of cheating.

Handing in any material copied from the internet or another source will likewise be considered cheating. **Cite sources** that you consult, for instance Wikipedia, Math Stack Exchange, or online course notes.

Scholastic offences are taken seriously and will not be tolerated. For more information, please consult the *Student Code of Conduct and Right to Appeal*, section "Academic Misconduct", available at:

https://www.uregina.ca/student/registrar/resources-for-students/academic-calendars-and-schedule/undergraduate-calendar/sections.html

Accessibility

Any student with special needs who may need accommodation should contact the Centre for Student Accessibility at:

https://www.uregina.ca/student/accessibility/

After I receive the letter from the Centre for Student Accessibility, please contact me to discuss the accommodation.