Math 4152B/9052 Course Outline

1. Course Information

Course Information

Math 4152B/9052: Algebraic Topology (Winter 2022/2023)

Class hours: Tuesdays 9:30-11:30am, Thursdays 9:30-10:30am in MC 108 (in person)

Prerequisites (Math 4152): Math 3120A/B and Math 4121A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Matthias Franz, Associate Professor
email: mfranz att uwo dott ca
office: MC 103D, phone ext: 86538

Students must use their Western (@uwo.ca) email addresses when contacting their instructor.

Office hours: in person in MC 103D, times TBA

3. Course Syllabus, Schedule, Delivery Mode

Algebraic topology is one of the major mathematical achievments of the last century, and it continues to be a field of active research. Its basic idea is to study topological spaces by assigning algebraic object (for example groups or vector spaces) to them. Continuous maps between spaces induce morphisms between the corresponding algebraic objects in such a way that home
omorphic (or just "homotopy equivalent") spaces lead to isomorphic algbraic objects. This often allows to distinguish topological spaces.
In this course we will study the fundamental group of a topological space (which is a possibly non-commutative group) and its homology (a commutative group or

vector space) and cohomology (which is similar to homology, but carries a multiplicative structure).

Course contents: Homotopy, fundamental group, Van Kampen's theorem, covering spaces, simplicial and singular homology, homotopy invariance, long exact sequence of a pair, excision, Mayer-Vietoris sequence, degree, Euler characteristic, cell complexes, projective spaces. Applications may include the fundamental theorem of algebra, the Brouwer fixed point theorem, division algebras, and invariance of domain.

As with any other advanced course in mathematics, there will be an emphasis on mathematical reasoning and proof-writing, which will be practiced through in-class discussion and homework exercises, for instance. Additionally, I want to focus on the ability to read (and understand!) mathematical texts. To practice this, we will regularly read parts of the textbook together in class. The goal is to increase the students' ability to learn mathematics on their own, outside of the classroom.

At a successful completion of the course, a student will be able to
  • give a high-level overview of the main ideas and constructions for the covered topics
  • state the relevant definitions and results from the course in a precise way
  • give proofs or proof ideas of these results in a well-structured way
  • apply them to solve problems (that he/she may or may not have encountered in the course) and present the solutions in a well-structured way
  • read and understand relevant mathematical texts and fill in steps omitted in these texts
  • give a presentation about a mathematical topic related to the course material

Students are expected to attend all classes and to prepare for them by reviewing the material from previous classes, to do the assigned homework and to thoroughly read in advance the sections of the textbook that we are going to read together in class.

Contingency plan for an in-person class pivoting to 100% online learning
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Course Materials

We will mostly follow the book

A. Hatcher, Algebraic Topology, Cambridge University Press 2002
An updated version is freely available at
http://pi.math.cornell.edu/~hatcher/AT/ATpage.html

There are many other excellent books, see Dan Christensen's list at
https://jdc.math.uwo.ca/M9052/reading.pdf.

When we read a text together in class, students may be required you to bring a
printout of the relevant pages or a laptop/tablet (not a smartphone!) for electronic
reading.

Students are responsible for checking the course OWL site (http://owl.uwo.ca) on a
regular basis for news and updates. This is the primary method by which
information will be disseminated to all students in the class.

All course material will be posted to OWL: http://owl.uwo.ca.

If students need assistance with the course OWL site, they can seek support on the
OWL Help page. Alternatively, they can contact the Western Technology Services
Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

In case the course is delivered online, students need a stable internet connection,
computer with working microphone and webcam.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:
Participation   10%
Assignments   20%
Presentation   30%
Final Exam   40%

Participation: participation in class. This in particular includes the times when we
read texts together and there also whether you bring the text in one of the
desrcibed formats.

Assignments: at least one assignment every two weeks. The lowest homework
score will be dropped. You can discuss the problem with your classmates, but you
must write it up yourself and not share your writeup with other students. You must
not use online tools (for example, search engines, forums, solution databases)
when working on the problems. Consulting textbooks is fine. You must give credit
to the sources or classmates that contributed to your solution.

Presentation: Every student has to give a presentation in class (50min including questions from the audience) towards the end of the course on a topic assigned by the instructor. After the class the instructor will meet with the student one on one for about 15min to asks detailed questions about the material presented to better assess the understanding. Both the mathematical understanding and the way of presentation enter into the presentation mark.

Final exam: 3h written exam

6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth less than 10% of the overall course grade:

If you miss such an assessment for a valid reason, the weight of the assessment will be transferred to the final exam.

Assessments worth 10% or more of the overall course grade:

For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

In case of a midterm missed for a valid reason, a make-up exam will be offered. If the make-up exam is again missed for a valid reason, the weight of the midterm exam will be transferred to the final exam.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

7. Accommodation and Accessibility

Religious Accommodation
When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

8. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

No electronic devices will be permitted on tests and exams,

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/ scholastic_discipline_undergrad.pdf.

In the event of a health lock-down, tests and examinations in this course may be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

https://remoteproctoring.uwo.ca.

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for victims, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.