Western Science

Department of Mathematics

Math 4152B Course Outline

1. Course Information

Course Information

Algebraic Topology - Math 4152B - Winter 2024 - Tue & Thu 9:30 a.m. – 11:30 a.m MC 107

List of Prerequisites

Math 3120A/B and Math 4121A/B

Unless you have either the requisites for this course or special permission 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

Instructors	Email	Office	Phone	Office Hours
Anibal M. Medina Mardones	amaximil@uwo.ca	MC 112	88875	By appt

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

3. Course Syllabus, Schedule, Delivery Mode

Algebraic topology stands as a central achievement in mathematics over the past century and continues to be a vibrant area of active research. Its fundamental concept involves studying topological spaces by associating them with algebraic structures, such as groups or vector spaces. This association is done in a way that continuous maps between spaces induce corresponding morphisms between the algebraic structures. Consequently, spaces that are homeomorphic—or more generally, homotopy equivalent—yield isomorphic algebraic structures. This powerful approach often enables mathematicians to distinguish between different topological spaces effectively.

In this course, we will delve into the fundamental group of a topological space, which is a potentially non-commutative group, and explore its homology and cohomology. Homology refers to a series of commutative groups or vector spaces, while cohomology is akin to homology but is endowed with a multiplicative structure. These concepts are central to understanding the intricate relationship between algebra and topology and will serve as the foundation for more advanced studies in the field.

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 advanced mathematics course, there will be a strong emphasis on mathematical reasoning and proof-writing. These skills will be honed through in-class discussions and homework exercises. Additionally, a significant focus will be placed on developing the ability to read and comprehend mathematical texts. To facilitate this, we will regularly engage with sections of the textbook during class sessions. The overarching goal is to enhance students' capacity to independently learn and understand mathematics beyond the classroom environment.

Upon successful completion of the course, students will be able to:

1. Precisely articulate relevant definitions and results from the course.
2. Construct proofs or outline proof concepts for these results in a coherent manner.
3. Apply the learned concepts to solve problems, familiar or unfamiliar, and present the solutions clearly.

Students are expected to attend all classes and actively prepare by reviewing material from previous sessions. Completing assigned homework and thoroughly pre-reading the textbook sections to be discussed in class are also critical for success in this course.

Jan. 11 First Lecture
Jan. 16 Last day to add a second-term half course
Feb. 17–25 Spring Reading Week including Family Day (Saturday – following Sunday)
Mar. 7 Last day to withdraw from a second-term half course without academic penalty
Mar. 29 & 31 Good Friday and Easter Sunday.
Apr. 8 Last day of classes in the Winter Term
Apr. 9–10 Study Days
Apr. 11–30 April examination period.

4. Course Materials

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

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.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Monthly Assignments	20%
Participation	10%
Presentation	30%
Final Exam	40%

Please notice that nothing will be due during the reading break period

6. Student Absences

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

Homeworks or Presentation

If you miss a homework or the presentation for a valid reason, the weight of the assessment will be transferred to the final exam.

Final Examination

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).

6. 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. Please consult University's list of recognized religious holidays (updated annually) at

www.edi.uwo.ca

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.

7. 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 during the exam.

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.

8. 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.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, 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.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

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