Western Science

Department of Mathematics

# Math 4121/9021 Course Outline

## 1. Course Information

**Course Information**
Course Name: Topology – Math4121A/9021
Academic Term – Fall

**List of Prerequisites**
Mathematics 3122A/B, Mathematics 2122A/B. An understanding of logic, proofs, sets and functions is required.

Unless students have either the prerequisites for this course or written special permission from the Department of Mathematics to enroll in it, they may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on their academic record. This decision may not be appealed.

## 2. Instructor Information

| Instructor | Email | Office | Office Hours |
|---|---|---|---|
| Dr. Yvon Verberne | yverber@uwo.ca | | |

Students must use their Western (@uwo.ca) email addresses when contacting their instructor. Please wait at least two business days for a reply.

Further office hours will be posted at the start of the semester. Office hours will be held in person.

## 3. Course Syllabus, Schedule, Delivery Mode

**Course Goals**

Topology is the field of mathematics which studies which properties are preserved through deformations, twistings, and stretchings of objects. Point-set topology lays down the groundwork for the field of topology. Point-set topology allows us to evaluate the structure a mathematical object has, and studies the general abstract nature of continuity, or the “closeness” of two different spaces. Topology is used in many branches of mathematics, such as differentiable equations, complex dynamics, and Riemann surfaces in complex analysis. Additionally, topology has applications in physics, for instance in string theory and fluid dynamics, and has recently been applied in statistics to analyze data sets.

The main goal of this course is to introduce point-set topology. In addition to understanding the main content presented in the course, I expect students to become more comfortable approaching a theoretical

math topic. In particular, students will learn to understand and manipulate mathematical definitions and other familiar objects, and be able to write a clear, correct mathematical proof. Writing clear mathematical proofs is key since they are one of the important ways we communicate mathematical results to other mathematicians and scientists.

This is a course where we will cover some deep concepts in topology. The course is likely to be challenging for many students and will likely become more difficult for you as the semester goes on. Due to this, please engage with the course material and to talk to your instructor regularly. By doing so, we can help you develop a deeper understanding of the course material.

**Topics**

This is a tentative list of topics we will cover in this course. The list of topics is quite ambitious, and the list is subject to change depending on time constraints. These topics are covered in Chapters 2-9 of the course textbook, "Topology through inquiry" by Su and Starbird.

- Open sets and topological spaces
- Limit points and closed sets
- Interior and boundary
- Bases and subases
- Order topology
- Product spaces
- Hausdorff, regular, and normal spaces
- Separation properties
- Heredity
- Separable spaces
- First and second countability
- Compactness
- Heine-Borel Theorem
- Continuous functions and homeomorphisms
- Urysohn's Lemma
- Connectedness
- Metric spaces and Metrizability

**Course Learning Outcomes**

Upon successful completion of the course, students will:

- Be able to define terms and restate theorems related to topology;
- Be able to apply terms and theorems to a range of examples of topological structures;
- Be able to draw figures to illustrate the meaning of the definitions and theorems;
- Be able to apply the theory from the course to solve problems and prove theorems in point-set topology;
- Be able to write a thorough, carefully written proof;
- Be able to present clear proofs to the class; and
- Be able to converse with peers on the course topics.

Classes begin: September 9, 2026

Fall Reading Week: October 10 – 18, 2026
Classes end: December 9, 2026
Study day: December 10, 2026
Exam period: December 11 – 22, 2026

# 4. Course Materials

***There is no required textbook for the course.*** All course material will be posted to OWL Brightspace: https://westernu.brightspace.com/

For students who would like a textbook, the following textbook will be our guide for the course:

- Topology through inquiry by Michael Starbird and Francis Su. An e-book version is available at the following link: https://bookstore.ams.org/text58/
    - A hardcopy or printing the e-book is a separate fee

*Supplementary resource:*

- *Counterexamples in Topology*, by Steen and Seebach. Think of this as a dictionary for topological spaces. It includes the almost all the definitions we will use in the course, and many more. It is not suitable for learning the material from scratch, and should be thought of as a supplementary resource.

Students are responsible for checking the course OWL Brightspace site regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL Brightspace site, they can seek support on the OWL Brightspace 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**
Should the course be required to move online, students will require access to a stable internet connection, a working microphone, and a webcam.

# 5. Methods of Evaluation

**Grading Scheme and Assessment Dates**
The final course grade will be determined by student performance on

*Participation [10%]:* Every student will receive a participation grade. This includes (but is not limited to) attendance, presenting solutions (or solutions attempts) to the class, asking questions, and making mistakes. This grade will be based on in-class participation throughout the semester. Graduate students must present to the class a minimum of two times to receive the full 10% participation grade. Students can miss up to 2 weeks of lectures and still receive a full participation grade.

*Midterm 1 [25%]:* Will take place on October 19, during class time. The grade will be max(Midterm 1 grade, Final Exam Grade)), which is a function which outputs your maximum grade between Midterm 1 and your final exam grade.

*Midterm 2 [25%]:* Will take place on November 23, during class time. The grade will be max(Midterm 2 grade, Final Exam Grade)), which is a function which outputs your maximum grade between Midterm 2 and your final exam grade.

*Final Exam [40%]:* The final exam will be scheduled by the Registrar during the Exam Period.

**Use of Generative AI Tools**

Generative AI tools are prohibited for each graded course assessment, and may not be used during lectures. However, these tools may be used to complete homework. A word of warning to students attempting to use these tools for the homework: Although these tools are becoming more reliable, they are still known to make mistakes when used for courses which contain mathematical proofs. This leads students to misunderstand the course information, which can have long term consequences. Please use caution when choosing to use generative AI tools, and please consider attending office hours or reaching out to the course instructors or one of your TAs for help.

**Information about Missed Coursework**

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs,* posted on the Academic Calendar: https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage: https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

**Midterms**

This course has 2 midterm tests and a **cumulative** final exam. There is no makeup test for a missed midterm. If a student misses a midterm, its weight will shift automatically to their final exam grade. If their final exam grade is higher than their midterm grade, their final exam grade will replace the midterm's weight in their overall grade. They do not need to request Academic Consideration for a missed midterm; the reweighing will be done automatically.

The only exception is an early sitting, offered solely for a university-sanctioned schedule conflict (e.g., conflict of two midterms, Varsity competitions) or a religious accommodation that prevents a student from writing the midterm at its scheduled time. If a student requires this accommodation, they must notify their instructor in writing no later than one week before the test. No other circumstance, including illness, qualifies for an early sitting or makeup; these are addressed through the automatic reweighting described above.

**Special Examination**
Per university policy, Academic Consideration requests with supporting documentation are required for the final examinations scheduled during official examination periods by the Registrar's Office.

If the student has been approved by the Academic Advising Office to write a Special Examination (SPC) and the final exam is their only outstanding course component, an SPC will be assigned to them and scheduled by the instructor per university policy.

If the student misses their SPC exam and is approved for Academic Consideration, they will be withdrawn from the course without academic penalty. If they experienced extenuating circumstances such as prolonged illness, they may appeal to the Associate Dean (Academic), on a case-by-case basis, for the opportunity to write the final exam the next time the course is offered. An outstanding SPC will reduce their course load for the term in which the exam is deferred, as outlined in the Definitions of Types of Examinations policy.

If the student misses their SPC exam and Academic Consideration is not approved, or was not requested, they will receive a grade of zero on the exam.

# 6. Additional Statements

**6.1 Religious Accommodation**
When a recognized religious holiday either requires a student to be absent from the University, or requires or prohibits an activity that makes it impossible for them to complete an academic requirement scheduled that day, they are entitled to accommodation. No student will be penalized for an absence for religious reasons, and an alternative means of satisfying the requirement will be arranged. This accommodation is provided in accordance with the University's policy on Accommodation for Religious Holidays:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

The student should submit their requests through the Student Absence Portal (SAP), identifying the conflict and the specific course component(s) affected (e.g., test, midterm, exam).

> **Midterms and Tests**: If a religious observance conflicts with a midterm test, they must submit their request no later than **one week** before the test. Their instructor will arrange an early sitting of the test. As set out above, no makeup test is offered for any other reason; this early sitting is available specifically for this accommodation.
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> **Final Examinations**: If a religious observance conflicts with the final exam, the student must submit their request no later than **two weeks** before the exam. Their instructor will arrange a Special Examination to take place no later than one month after the end of the examination period.

Students are responsible for finding out what was covered in any class they miss due to a religious observance, and for taking the appropriate steps to keep up with the course.

If a suitable arrangement cannot be reached between a student and their instructor, they should consult the Undergraduate Chair of the department offering the course, and if necessary, the Associate Dean (Academic) of the Faculty of Science.

For a list of recognized religious observances, please visit the calendars posted on the Equity, Diversity & Inclusion website - https://www.edi.uwo.ca (About Us – Resources – Additional Resources – Calendars).

### 6.2 Academic 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.

### 6.3 General Academic Policies

The website for Registrar Services is https://www.registrar.uwo.ca/.

**Use of @uwo.ca email:** 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 email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

**Requests for Relief** (formally known as "appeals")

Policy on Request for Relief from Academic Decision:
https://uwo.ca/univsec/pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):
https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

Procedures on Request for Relief from Academic Decision (Graduate):
https://uwo.ca/univsec/pdf/academic_policies/appeals/graduate_requests_for_relief_procedure.pdf

### 6.4 Scholastic Offences

Policy on Scholastic Offences:
https://uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):
https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Procedures on Scholastic Offences (Graduate):
https://uwo.ca/univsec/pdf/academic_policies/appeals/graduate_scholastic_offence_procedure.pdf

### Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the **possession** of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, hidden cameras and wireless earbuds.

Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at a student's desk, on their person, or within reach during an assessment will be treated as a scholastic offence, **even if the device is not in use**.

Effective September 2026, the typical penalty for this offence is a failing grade in the course AND a 12-month prohibition on retaking the course.

Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is their responsibility to review and comply with these expectations.

**Use of Generative AI Tools**

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations.

Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**.

If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is the student's responsibility to seek clarification before using any AI tools in academic work.

### 6.5 Support Services

**Academic Advising.** Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/advising/.

**Mental Health Support.** 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.

**Gender-Based and Sexual Violence.** Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If a student has experienced GBSV (either recently or in the past), they can 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.

**Accessibility for Coursework.** A student may contact the course instructor if they require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to them. If they have any questions regarding accommodations, they may also contact Accessible Education at http://academicsupport.uwo.ca/accessible_education/index.html

**Learning Development and Success.** Learning-skills counsellors at Learning Development and Success (https://learning.uwo.ca) are ready to help students improve their learning skills. The facility offers 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.

**Student Councils.**
Student-run support services are offered by the University Students' Council (https://westernusc.ca) and the Science Students' Council (https://www.westernssc.ca).