

SYLLABUS: MATH 551 ELEMENTARY TOPOLOGY (FALL 2024)

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1. INSTRUCTOR INFORMATION

- **Name:** Ruobing Zhang
- **Affiliation:** Department of Mathematics, University of Wisconsin-Madison
- **Office:** Van Vleck 811
- **Email address:** rzhang573@wisc.edu

Date: August 2024.

2. MEETING TIME AND LOCATION

- **Time to meet:** Tuesday and Thursday, 9:30AM - 10:45AM
- **Location:** Van Vleck Hall B139
- **Instructor's office hours:** Every Tuesday 2:00PM-4:00PM at Van Vleck 811

3. OFFICIAL COURSE DESCRIPTION

3.1. Brief description. This course is an introduction to the basic ideas and methods of point-set topology with a focus on topological spaces, connectedness, compactness, separation axioms, metric spaces.

In addition to the **fast-paced nature**, this course has a **main feature**: the whole course is based on rigorous definitions, proofs and arguments. You are **required** to have good understandings on how to effectively write math proofs before taking this course.

3.2. Course designation.

- Breadth - Natural Science
- Level - Advanced
- L & S Credit - Counts as Liberal Arts and Science credit in L & S
- Grad 50% - Counts toward 50% graduate coursework requirement

3.3. Prerequisites. Necessary prerequisites for this course include (*MATH 234 or 375*), (*MATH 320, 340, 341, or 375*), and (*MATH 341, 375, 421, 467, or 521*), or graduate/professional standing or member of the *Pre-Masters Mathematics (Visiting International) Program*.

3.4. Learning outcomes. The learning outcomes include the following.

- (1) Recall and state the formal definitions of the mathematical objects and their properties used in elementary point set topology (e.g., abstract topological spaces, metric spaces, Hausdorff spaces, compact spaces, etc.).
Audience: Both Grad & Undergrad
- (2) Use such definitions to argue that a mathematical object does or does not have the condition of being a particular type or having a particular property (e.g., connected, compact Hausdorff).
Audience: Both Grad & Undergrad
- (3) Recall and state the standard theorems of point set topology (e.g., Extension theorems, Tychonoff Theorem, etc.) and recall the arguments for these theorems and the underlying logic of their proofs.
Audience: Both Grad & Undergrad
- (4) Use such theorems in the context of longer arguments by examining their premises (e.g., proving a map is a homeomorphism).

Audience: Both Grad & Undergrad

- (5) Prove or disprove statements related to the above definitions, properties, and theorems using techniques of mathematical argument (direct methods, indirect methods, constructing examples and counterexamples, induction, etc.).

Audience: Both Grad & Undergrad

- (6) Convey arguments using English and appropriate mathematical terminology, notation and grammar.

Audience: Both Grad & Undergrad

- (7) Identify applications of course content in areas of modern research.

Audience: Graduate

4. A BRIEF INTRODUCTION TO THE COURSE

- 4.1. **Textbook.** The textbook we will use in the course is

James R. Munkres, *Topology (second edition)*.

The following books are also recommended to read:

- M. A. Armstrong, *Basic topology*.
- T. Apostol, *Mathematical analysis*.

- 4.2. **Main materials.** This course will focus on the following ingredients:

- Set theory and logic
- Basic topology in \mathbb{R}^n ;
- Topology of a metric space;
- Basics in topological spaces;
- Elementary topological properties: connectedness, compactness, countability, separation axioms, etc;
- Continuous functions
- Operations of topological spaces: product, quotient, etc;
- Examples: metric spaces, graphs, construction of closed surfaces, etc.

5. HOMEWORK AND EXAMS

Makeup exams will be scheduled only with the instructor's consent, and only in cases of illness or family emergency

- 5.1. **Homework rules and deadlines.** Weekly problem sets will be posted on **Canvas** every Thursday. You will have a week to complete your homework and must submit it on **Gradescope** by **Thursday 11:59pm**. Late submissions will, in principle, **not be accepted**. Late submission of homework will be accepted in **only two cases**: serious illness with a note from doctor or some legitimate reason/emergency approved by the instructor.

We understand that everyone may have a bad or busy week. We will drop the lowest homework grade for each student.

You are encouraged to work together with your classmates on the problem sets, but *you must write up your own solutions*. You may lose points for unclear work. Keep in mind that simply copying solutions from another student or from the solution manual is a waste of everyone's time, as well as a violation of the expected standard of academic integrity.

Please also note the additional rules regarding homework described in the section on academic integrity below; see Sections 6.1 and 6.4.

**Homework due dates & time are (11 assignments in total):
strictly before 12:00am on**

September: 20, 27

October: 4, 11, 18, 25

November: 1, 8, 15, 22

December: 6

5.2. Midterm exam. We will have one in-class midterm exam. No books, notes, or electronic devices will be allowed during the final exam. The time has been fixed as follows:

17 October 2024, Thursday, 9:30AM - 10:45AM

5.3. Final exam. There will be one final exam for the course. No books, notes, or electronic devices will be allowed during the final exam. The time has been fixed as follows:

17 December 2024, Tuesday, 12:25PM - 2:25PM

5.4. Grading. The total grades are determined by the three factors:

- Homework: 40%,
- Midterm Exam: 20%,
- Final Exam: 40%.

6. MORE RULES AND GUIDANCES

6.1. Rules, rights & responsibilities. To see the Guide's Rules, Rights and Responsibilities information, refer to [this link](#).

6.2. Honors optional. This course can be taken by undergraduate students for honors, and it can be also taken by graduate students. As for grading, we have the same standard for undergraduate students and graduate students.

Students will earn the honors credit if they are signed up with honors and accomplish the following.

- Complete extra assignments honors optional;

- Obtain “A-” or above in both midterm and final exams with at least one “A” in the both exams, namely there are three cases:
 - A- in midterm and A in final;
 - A in midterm and A- in final;
 - A in midterm and A in final.

6.3. Academic calendar & religious Observances. Establishment of the academic calendar for the University of Wisconsin-Madison falls within the authority of the faculty as set forth in Faculty Policies and Procedures. Construction of the academic calendar is subject to various rules and laws prescribed by the Board of Regents, the Faculty Senate, State of Wisconsin and the federal government. For additional dates and deadlines for students, see the [Office of the Registrar’s pages](#). Students are responsible for notifying instructors within the first two weeks of classes about any need for flexibility due to [religious observances](#).

6.4. Academic integrity. By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison’s community of scholars in which everyone’s academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to [this link](#).

6.5. Accommodations for students with disabilities. McBurney Disability Resource Center syllabus statement: “The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student’s educational record, is confidential and protected under FERPA.” See [this page](#) for more information.

6.6. Diversity and Inclusion. Institutional statement on diversity: “Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each

person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.” See [this page](#) for more information.