Course Title	Introduction to Topology
Course Code	MATH 4461
Semester	Summer 2026
Course Length	4 Weeks, 60 Contact Hours
Credits	4
Instructor	TBA
Office	TBA
Email	TBA
Prerequisite	MATH 3370 Introductory Real Analysis MATH 4162 Advanced Calculus

Course Description:

This course provides a rigorous introduction to the fundamental structures of continuity and shape. Starting from the axiomatic definition of topological spaces, students will explore how to generalize the concepts of limits and continuity from Euclidean space to abstract settings. The course covers the construction of new spaces via products and quotients, essential topological properties such as compactness and connectedness, and concludes with an introduction to algebraic topology through the fundamental group.

Course Goals:

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical Thinking Skills** – Students will engage in analytical thinking, demonstrating the ability to critically evaluate, synthesize, and apply knowledge to complex problems, and construct well-reasoned solutions and arguments.
- **Independent Research and Inquiry** – Students will conduct independent research, utilizing academic resources to explore relevant topics, formulating research questions, analyzing data, and presenting findings in a coherent, scholarly manner.
- **Problem-Solving and Application** – Students will apply theoretical concepts and methodologies learned in the course to real-world problems, demonstrating the ability to develop practical solutions informed by academic inquiry.
- **Global and Cultural Awareness** – Students will gain awareness of the global and cultural contexts relevant to the course, appreciating diverse perspectives and considering the implications of their studies in a broader, international context.

Student Learning Outcomes:

Upon completion of this course, students will be able to:

- Define and manipulate topological structures (bases, subspaces, and closures).
- Analyze and prove properties involving compactness, connectedness, and separation axioms.
- Construct new topological spaces using quotient and product topologies.
- Compute the fundamental group of basic surfaces and understand its role in classifying spaces.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:
Primary: *Topology (Classic Version), 2nd edition* by James Munkres. Pearson.
Secondary: *Introduction to Topological Manifolds* by John M. Lee. Springer.

Course Requirements:

Problem Sets (30%)
Assignments designed to reinforce theoretical concepts through rigorous proof-writing. These focus on the application of definitions and the construction of counterexamples in abstract spaces.

Midterm Exam (25%)
An in-class exam covering Point-Set Topology. It covers the foundational definitions of topologies, the construction of subspaces, products, and quotients, and the primary properties of connectedness and compactness.

Expository Paper (10%)
A short technical paper (3-5 pages) where students explore a specific application of topology (e.g., Topology in DNA folding) to demonstrate independent research skills.

Final Exam (35%)
A comprehensive final exam covering the entire course, with a significant emphasis on the Fundamental Group and its applications, covering spaces, and global topological properties.

Assessments: Activity	Percent Contribution
Problem Sets	30%
Midterm Exam	25%
Expository Paper	10%
Final Exam	35%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Grade	Percentage of available points
A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83

C+	77-79
C	74-76
C-	70-73
D	64-69
D-	60-63
F	0-59

Course Schedule:
The schedule of activities is subject to change at the reasonable discretion of the instructor.
Minor changes will be announced in class, major ones provided in writing.

MATH 4461 Schedule		
Lecture	Topic	Readings (Munkres)
L1	Foundations: Set Theory & Logic	Ch. 1
L2	Definitions: Topological Spaces	Ch. 2
L3	Bases and the Order Topology	Ch. 2;
	Problem Set 1 Assigned	
L4	The Subspace Topology	Ch. 2
L5	Continuity & Homeomorphisms	Ch. 2
L6	Product Topology: Finite & Arbitrary	Ch. 2
	Problem Set 2 Assigned	
L7	Metric Topology & Convergence	Ch. 2
L8	The Quotient Topology: Construction	Ch. 2
L9	Examples: Projective Space & Tori	Ch. 2
	Problem Set 3 Assigned	
L10	Connected Spaces & Path-Connectedness	Ch. 3
L11	Components & Local Connectedness	Ch. 3
L12	Compact Spaces & Heine-Borel	Ch. 3
L13	**Midterm Exam**	Lec 1-12
L14	Compact Subsets of $\mathbb{R}^n$	Ch. 3
	Problem Set 4 Assigned	
L15	Separation Axioms (T_1 through T_4)	Ch. 4
L16	The Urysohn Lemma	Ch. 4
L17	Tychonoff's Theorem	Ch. 5
L18	Homotopy and Path Homotopy	Ch. 9
L19	The Fundamental Group (π_1)	Ch. 9
	Problem Set 5 Assigned	
L20	π_1 of the Circle (S^1)	Ch. 9
L21	Retractions & Fixed Point Theorems	Ch. 9
L22	π_1 of Higher Spheres (S^n)	Ch. 9
	Paper Due	
L23	Deformation Retracts	Ch. 9
	Problem Set 6 Assigned	
L24	Intro to Covering Spaces	Ch. 13
L25	Classification of Surfaces	Ch. 12
/	**Final Exam**	All above

Accommodation Statement:

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or outside the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:

Attendance and Expectations

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

Assignment Due Dates

All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

Make-Up Work

The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for requesting any missed information from the instructor and setting up any necessary appointments outside of class.

Access, Special Needs, and Disabilities
Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.