

Course Outline for MATH 5542, Topology

MATH 5542 Topology (3 units)

Prerequisite: Graduate standing in Mathematics, MATH 440, or [MATH 4541](#).

General topological spaces with an emphasis on surfaces and manifolds. Concepts may include fundamental groups and covering spaces, simplicial and singular homology, and differential topology. 3 lectures. Formerly MATH 541.

Course Learning Objectives	
1	Prove theorems about general topological spaces, including surfaces and manifolds.
2	State fundamental definitions in the theory of fundamental groups and covering spaces, simplicial and singular homology, or differential topology.
3	Prove and apply theorems about fundamental groups and covering spaces, simplicial and singular homology, or differential topology.
4	Solve problems to illustrate important concepts in fundamental groups and covering spaces, simplicial and singular homology, or differential topology.
5	Apply the theory of fundamental groups and covering spaces, simplicial and singular homology, or differential topology to other disciplines.

Expanded Course Content

Textbooks, materials, and/or other resources
Topics may vary according to instructor. Some possible textbooks are: 1. Munkres, Elements of Algebraic Topology, Perseus Publishing. 2. Hatcher, Algebraic Topology, Cambridge University Press 3. Guillemin/Pollack, Differential Topology, Prentice-Hall, Inc. Below is a sample course based on the topic of singular homology using the book by Munkres.

Week	Readings	Topics of Discussion
1	Munkres Section 1	Simplices
2	Munkres Section 2	Simplicial complexes and simplicial maps
3	Munkres Section 3	Abstract simplicial complexes
4	Munkres Section 4	Review of abelian groups
5	Munkres Section 5	Homology groups
6	Munkres Section 5 (continued)	Homology groups (continued)
7	Munkres Section 6	Homology groups of surfaces
8	Munkres Section 6 (continued)	Homology groups of surfaces (continued)
9	Munkres Section 9	Relative homology
10	Munkres Section 9 (continued)	Relative homology (continued)
11	Munkres Section 19	Homomorphisms induced by homotopic maps
12	Munkres Section 23	The exact homology sequence
13	Munkres Section 23	The exact homology sequence (continued)
14	Munkres Section 24	The Zig-zag Lemma
15	Munkres Section 25	Mayer-Vietoris sequences

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets and presentations, projects, and homework. One or more midterms and a cumulative final exam are required.

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.