

Course Outline for MATH 4541, Introduction to Topology

MATH 4541 Introduction to Topology (3 units)

Prerequisite: Graduate standing in Mathematics, MATH 412, or [MATH 4264](#). Corequisite: MATH 481 or [MATH 4201](#).

Introduction to topological spaces. Metric spaces, open and closed sets, continuity, compactness, connectedness. Quotient spaces. Covering spaces and the fundamental group. 3 lectures. Formerly MATH 440.

Course Learning Objectives	
1	Prove results about metric spaces and topological spaces.
2	Prove results related to the concepts of continuity, compactness and connectedness in topological spaces.
3	Construct topological spaces using the quotient topology.
4	Define and prove results about fundamental groups.
5	Define and prove results about covering spaces.
6	Compute fundamental groups using the theory of covering spaces.
7	Prove results about quotient spaces

Expanded Course Content

Textbooks, materials, and/or other resources
Gamelin and Green, Introduction to Topology, 2nd ed., Dover Publications

Week	Readings	Topics of Discussion
1	Gamelin and Green Sections 1.1 - 1.2	Metric spaces, open and closed sets, completeness
2	Gamelin and Green Sections 1.3 - 1.4	The real line, products of metric spaces
3	Gamelin and Green Section 1.5	Compact metrics spaces
4	Gamelin and Green Section 1.6	Continuous functions defined on metric spaces

Week	Readings	Topics of Discussion
5	Gamelin and Green Sections 2.1 - 2.3	Topological spaces, subspaces, continuous functions defined on topological spaces
6	Gamelin and Green Sections 2.4 - 2.5	Basis for a topology, separation axioms
7	Gamelin and Green Sections 2.6 - 2.7	Compact spaces, locally compact spaces
8	Gamelin and Green Sections 2.8 - 2.9	Connected spaces, path connected spaces
9	Gamelin and Green Section 2.10	Product topology
10	Gamelin and Green Section 2.13	Quotient maps, quotient spaces
11	Gamelin and Green Section 3.2	General homotopy theory
12	Gamelin and Green Sections 3.2 - 3.3	Path homotopy, definition of the fundamental group
13	Gamelin and Green Section 3.4	Properties of the fundamental group, induced homomorphisms
14	Gamelin and Green Section 3.5	Definition and examples of covering spaces, properties of covering spaces
15	Gamelin and Green Section 3.5	The lifting correspondence, compute fundamental groups using the theory of covering spaces

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.