

Math 380: Algebraic Topology

Description:

This course is an introduction to some topics in algebraic topology, including the fundamental group, homology, and cohomology. For these purposes, we will also discuss various algebraic topics including group presentations, free groups, free abelian groups, torsion groups. The course will allow students to see how algebraic concepts and techniques can be used to study topological spaces. This will help students see the interrelation between two main branches of mathematics, topology and abstract algebra.

Corequisites:

Math 330 (Students must have completed Math 330 or take it concurrently with this course.)

Purpose:

The purpose of this course is to give students the opportunity to see how one branch of mathematics, abstract algebra, can be used as a powerful tool within another branch of mathematics, topology. In using the algebraic concepts of groups, rings, and homomorphisms, we can gain a better understanding of topological spaces. The approach will allow students to understand many advanced topological concepts without any point-set topology prerequisite. This proof-based course will provide a chance for students to enhance their proof writing skills and visualization skills. In addition, it will deepen their understanding of essential algebraic concepts.

Topics:

- I. Groups and homomorphisms
- II. Topological spaces
- III. Fundamental group
- IV. Homology
- V. Cohomology

Learning Outcomes:

Upon successful completion of this course, students should be able to:

- Determine the fundamental group, homology, and cohomology of various topological spaces, and
- Use algebraic invariants to distinguish topological spaces up to homeomorphism and/or homotopy type.

Bibliography:

- F. Croom, [Basic Concepts of Algebraic Topology](#)
A. Hatcher, [Algebraic Topology](#)
J. Hocking and G. Young, [Topology](#)
W. Massey, [A Basic Course in Algebraic Topology](#)
R. Messer and P. Straffin, [Topology Now!](#)
J. Munkres, [Elements of Algebraic Topology](#)
J. Munkres, [Topology: A First Course](#)