

Math M522: Homology Theory

Spring 2025

MWF 10:25-11:15, RH 104

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Office hours: Friday 12:30-1:30 and by appointment

Texts: Chapter 2 of Hatcher, *Algebraic Topology*

Chapter 1 of Davis and Kirk, *Lecture Notes in Algebraic Topology, 2nd edition*, on Canvas/Files

Other decent books are Vick, *Homology Theory* and Massey, *A Basic Course in Algebraic Topology*.

Prerequisites: Basic point set topology: connectedness, compactness, Hausdorff spaces, and quotient spaces. Linear algebra: bases and matrices. Abelian groups: free abelian groups, the fundamental theorem of finitely generated abelian groups, and a good command of quotients and the Noether isomorphism theorems.

Topics: Singular homology theory, CW complexes, cellular homology theory and surfaces. The Eilenberg-Steenrod Axioms. Applications such as the Brouwer Fixed-Point Theorem, the Brouwer No Retraction Theorem, the Hairy Ball Theorem, the Borsuk-Ulam Theorem, the Jordan Curve Theorem, and Brouwer's Theorem on invariance of domain. At the end of the course we will either do covering spaces or cohomology.