

MATH 663- ALGEBRAIC TOPOLOGY I-FALL 2025-SYLLABUS

Instructor: Alex Freire, afreire@utk.edu, Ayres 325, <https://web.math.utk.edu/~freire>

Office Hours: Thursday 5PM-6PM or by appointment (email)

Lectures: Perkins Hall 218, Tu+Th 12:55—14:10 (fully in-person course)

Prerequisites: topology at the graduate or advanced UG level, or consent of instructor

Main Topics:

Homology: simplicial, singular, cellular

Singular and de Rham cohomology, change of coefficients, Čech cohomology

Poincaré and Lefschetz duality on manifolds (singular and de Rham approaches)

Morse theory, intro to Morse homology; duality via intersection theory

Connections with homotopy groups, Hurewicz theorem

Homotopy classes of maps (equidimensional maps to the sphere), obstruction theory

Special topics: Linking number and Hopf invariant, Steenrod squares

Main References:

Allen Hatcher, Algebraic Topology (Cambridge UP, 2001)

M. Greenberg and J. Harper: Algebraic Topology, A First Course

R. Bott and L. Tu, Differential Forms in Algebraic Topology

J. Rotman, An Introduction to Algebraic Topology (Springer 1988)

P. Hilton, S. Wylie, Homology Theory (Cambridge UP, 1960)

General Policies and Grading

Attendance to (almost) every lecture is expected, as well as participation (asking questions in class). Please mute cell phones; no laptop use during lecture.

Proposed problems will be posted on the course page (linked to my web page), 3-4 per week. Written solutions to 10 problems must be turned in by Finals Week, with 5 turned in by Fall Break. (Working with other students OK, but solutions written individually, in LaTeX.)