

Math 114: Algebraic topology

ORC syllabus

This course provides a foundation in algebraic topology, including both homotopy theory and homology theory. Topics may include: the fundamental group, covering spaces, calculation of the fundamental group, singular homology theory, Eilenberg-Steenrod axioms, Mayer-Vietoris sequence, computations, applications to fixed points and vector fields.

References.

[H] Allen Hatcher, *Algebraic topology*, Cambridge University Press, 2002.

Algebraic topology.

1. Operations on spaces, homotopy and homotopy equivalence. [H, 0]
2. Homotopy extension property. Paths and homotopy, the fundamental group of a circle. [H, 0, 1.1]
3. Van Kampen's theorem. Free products of groups and applications to cell complexes. [H, 1.2]
4. Covering spaces and fibration, lifting property. Long homotopy sequence of homotopy groups of a pair and of a fibration. Examples. [H, 1.2, 1.3]
5. Classification of covering spaces. Deck transformations and group actions. [H, 1.3]
6. Δ -complexes. Symplicial homology and singular homology. [H, 2.1]
7. Homotopy invariance and exact sequences. [H, 2.1]
8. Excision, degree. [H, 2.1, 2.2]
9. Mayer-Vietoris sequences and cellular homology. [H, 2.2]