Algebraic Topology (M24)

Professor I. Smith

Algebraic Topology studies topological spaces by associating to them algebraic invariants, primarily abelian groups and commutative rings. It permeates modern pure mathematics and theoretical physics. This course will focus on cohomology, with an emphasis on applications to the topology of smooth manifolds. Topics will include:

- basic theory of (co)chain complexes
- singular and cellular (co)homology
- cup-products
- vector bundles
- Thom isomorphism and the Euler class
- Poincaré duality
- and possibly cobordism.

The course will not strictly assume prior knowledge of algebraic topology, but will go quite fast in order to reach more interesting material, so some previous exposure to chain complexes and simplicial homology would definitely be helpful. Some material from the Differential Geometry course (including basics of smooth manifolds and tangent bundles) will also be used at certain points, and may need to be black-boxed by students not taking that course.

Prerequisites

Basic topology: topological spaces, compactness and connectedness, at the level of Sutherland's book. Some knowledge of the fundamental group would be helpful though not a requirement. The books by Bott and Tu and by Hatcher are especially recommended, but there are many other suitable texts and many online resources.

Literature

1. Bott, R. and Tu, L. *Differential forms in algebraic topology.* Springer, 1982.
2. Hatcher, A. *Algebraic Topology.* Cambridge Univ. Press, 2002.
3. May, P. *A concise course in algebraic topology.* Univ. of Chicago Press, 1999.
4. Sutherland, W. *Introduction to metric and topological spaces.* Oxford Univ. Press, 1999.

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a revision class in the Easter Term.