

**Mathematics Department**  
**Topics in Topology**  
**MATH 657, Fall 1997**  
**Stephan Stolz**

The topic of this course is the Atiyah-Singer Index Theorem, which calculates the index of certain differential operators in topological terms. The index theorem gives thus a basic relationship between analysis and topology, and it generalizes many classical results like the signature theorem. It also gives some relations between geometry and topology, e.g., an application of the index theorem shows that for a spin manifold with a metric of positive scalar curvature a certain characteristic number called the  $\hat{A}$ -genus, vanishes.

The goal of the course is to discuss the Index Theorem and applications thereof for a particular important class of first order differential operators known as “generalized Dirac operators”. Of the various proofs of the Index Theorem we plan to use the ‘heat kernel’ approach, following the book “Heat kernels and Dirac operators” by Berline, Getzler and Vergne, complemented by the book “Spin geometry” by Lawson and Michelsohn.

**Prerequisites:**

The level of the course will be determined by the prospective participants. I will try to determine in individual discussions with prospective participants what background material should be covered in the course.