



MATH40121 - 2006/2007

General Information

- Title: Advanced Algebraic Topology
- Unit code: MATH40121
- Credits: 15
- Prerequisites:
- Co-requisite units:
- School responsible: Mathematics
- Member of staff responsible: Prof. Victor Buchstaber

Outline

Cobordism theory gives an extremely powerful tool for the solution of geometrical problems by the methods of algebraic topology. The main goal of this course is to base the construction of cobordism theory on the differential geometry of smooth manifolds and to show some important applications of the theory.

The introductory parts of the course will parallel those of Milnor's *Topology from the Differential Viewpoint* (see below), and the subsequent lectures will work through as many of the following topics as time permits.

Smooth manifolds.

- 1.1 Basic definitions.
- 1.2 Constructions on manifolds.
- 1.3 Important examples.

Bordism theory.

- 2.1 Bordism of manifolds.
- 2.2 Bordism groups of a space.
- 2.3 Axioms of a homology theory for bordism groups.

Vector bundles.

- 3.1 Basic definitions.
- 3.2 Constructions on vector bundles.
- 3.3 Vector bundles with additional structure.

Cobordism theory.

- 4.1 Orientation of maps.
- 4.2 Cobordism groups of a manifold.
- 4.3 Axioms of a cohomology theory for cobordism groups.
- 4.4 Poincare duality.

Thom spaces.

- 5.1 Basic definitions.
- 5.2 The Pontrjagin-Thom construction.
- 5.3 Cobordism groups from a homotopical point of view.
- 5.4 Atiyah duality.

Characteristic classes in cobordism theory.

- 6.1 Euler classes.
- 6.2 Transfer maps.
- 6.3 Stiefel-Whitney, Chern and Pontrjagin classes.

Cohomological operations in cobordism theory.

- 7.1 The Landweber-Novikov algebra.
- 7.2 tom Dieck-Steenrod operations.
- 7.3 Important examples.

Applications.

As time permits.

Bibliography

- John W. Milnor, *Topology from the differentiable viewpoint.*, The University Press of Virginia, Charlottesville, 1978.
- Allen Hatcher, *Vector bundles and K-theory.*, version 2.0, January 2003, see home page of A. Hatcher.

- P.E.Conner, E.E.Floyd, *Differentiable periodic maps.*, Springer-Verlag, 1964.
- Daniel Quillen, *Elementary proofs of some results of cobordism theory using Steenrod operations.*, Advances in Mathematics 7, 29-56,1971.

Arrangements

The first lecture is on Friday 29 September at 400pm in Newman G16, and the second on Monday 2 October at 1100AM in MSS B10. The first lecture is on Friday 29 September at 400pm in Newman G16, and the second on Monday 2 October at 1100AM in MSS B10.

[Full timetable](#)