

MATH 8210: TOPOLOGY OF MANIFOLDS SYLLABUS

Instructor: Mike Usher

Scheduled class meetings: MWF 12:20–1:10 in Boyd 326.

Office Hours: after class, or by appointment.

Textbook: *Differential Forms in Algebraic Topology* by Raoul Bott and Loring Tu. Springer Graduate Texts in Mathematics vol. 82, 1982, ISBN 0387906134

Other possibly-useful references:

- Some of the preliminaries for the course (to be covered in the first three or so weeks) aren't dealt with in detail in the textbook, but I'll put (somewhat informal) lecture notes for this part on my webpage, or you could consult the start of any of a number of differential topology books (for instance, Warner's *Foundations of Differentiable Manifolds and Lie Groups*, Springer GTM 94).
- *From Calculus to Cohomology* by Madsen and Tornehave (Cambridge U. Press 1997) contains a lot of the same material that we'll be covering in Bott and Tu, and perhaps slightly more accessibly in some cases.
- I hope to discuss Morse theory in some detail near the end of the course. This is briefly touched on in Bott and Tu, but the canonical reference for the topic is Milnor's *Morse Theory* (Princeton U. Press 1963).

Grading: Grades will be based on homework assignments, which will occur approximately every two weeks.

Topics: This course is an introduction to smooth manifolds, which are topological spaces on which one can do something resembling calculus. I intend to cover:

- Basic tools: constructions of smooth manifolds, partitions of unity, vector fields, differential forms.
- De Rham cohomology, including the Mayer-Vietoris sequence and Poincaré duality, vector bundles, and the Thom isomorphism.
- Other versions of cohomology for manifolds (Čech, singular) and their equivalence to the de Rham theory. Possibly also some basic spectral sequences, with applications to computing homotopy groups.
- Morse theory: how to study the topology of a manifold by looking at the critical points of a function on it.

Obligatory language: As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: www.uga.edu/honesty. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.