

MATH 8230, FALL 2009
SYMPLECTIC GEOMETRY

Instructor: Mike Usher, usher@math.uga.edu

Office hours: Wednesday, 3:30-4:50, 321C Boyd

Required textbook: *Introduction to Symplectic Topology*, 2nd ed., by Dusa McDuff and Dietmar Salamon, Oxford, 1998.

Other (entirely optional) references for the subject include (parts of) *Mathematical Methods of Classical Mechanics* by V. I. Arnold and *Lectures on Symplectic Geometry* by Ana Cannas da Silva. A more advanced book is *J-holomorphic Curves and Symplectic Topology* by McDuff and Salamon.

Topics: First, I hope to cover most of Chapters 1–7 of the textbook, to include:

- Motivation and examples from physics and differential topology
- Symplectic linear algebra and symplectic vector bundles
- Basics about symplectic manifolds and symplectic diffeomorphisms (Darboux's theorem, Hamiltonian vector fields, Lagrangian and other special submanifolds)
- Group actions, moment maps, and toric manifolds from the point of view of symplectic geometry
- Topological constructions of symplectic manifolds (symplectic structures on fiber bundles, blow-ups, Gompf's symplectic sum)
- Basics about almost complex structures and pseudoholomorphic curves

Time permitting, we'll then proceed to more advanced topics involving pseudoholomorphic curves, Hamiltonian dynamics, and/or Floer homology.

Grading: Grading will be based on homework assignments, to be given approximately once every two weeks.

Prerequisites: A basic familiarity with smooth manifolds. The material in Chapters 1, 2, and 4 of Warner's *Foundations of Differentiable Manifolds and Lie Groups* (e.g., submanifolds, the calculus of vector fields and differential forms, and integration on manifolds) would suffice. I'll try to review the more subtle aspects of this material as it becomes necessary.

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

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.