MATH 8230: Elliptic PDE's in geometry
Fall 2016 Syllabus

Instructor: Mike Usher

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

Subject matter: This will be a course about various ways in which elliptic PDE's are used to study manifolds. Roughly speaking, I intend the first half of the course to be about Hodge theory on Riemannian and Kähler manifolds. This involves using a version of Laplace's equation for differential forms to describe (and learn about) the cohomology of such manifolds. The second half of the course will be about pseudoholomorphic curves in symplectic geometry, aiming for Gromov's non-squeezing theorem. While these subjects are different from each other, they share a theoretical framework that is also used other parts of geometry (e.g. gauge theory on four-manifolds), namely elliptic regularity and Sobolev spaces.

Texts: There is no official class textbook, but various resources may be useful. For at least some of the course I intend to write up my lecture notes and put them on my webpage. For the Hodge theory part of the course, two standard references are Chapter 6 of *Foundations of Differentiable Manifolds and Lie Groups* by Warner and parts of *Differential Analysis on Complex Manifolds* by Wells. The standard thick book on pseudoholomorphic curves is *J-holomorphic curves and Symplectic Topology* by McDuff and Salamon; other (and free) references include an earlier and much shorter edition of the same book that you can find at http://math.columbia.edu/~dusa, and the lecture notes from a course on pseudoholomorphic curves that I taught a few years ago, available at http://alpha.math.uga.edu/~usher/8230/notes-spring.pdf.

Grades: Grades will be based on homeworks, which will be given every few weeks. Alternatively, students who don't want to do the homeworks can replace them by giving a presentation on a topic related to the subject of the course during the last week of classes.

Prerequisites: Familiarity with smooth manifolds, specifically differential forms and partitions of unity.

Academic honesty: 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 http://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.

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