Math 936, Spring 2010

Introduction to Geometric Analysis

Spring 2007
MWF 1:50 – 2:40.
Room A-304 Wells Hall
Course webpage:
math.msu.edu/∼parker/GA

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Office hours: Mon 3–4
Thurs 2–3
Friday 3–4

This course is an introduction to geometric analysis on Riemannian manifolds. It introduces some of the important geometric PDEs on manifolds, including examples of linear and non-linear elliptic equations and linear and non-linear parabolic (i.e. heat flow) equations. The emphasis is on quickly acquiring a working knowledge of the tools and ideas of the subject.

Prerequisites: Familiarity with manifolds (vector fields, differential forms, tangent and tensor bundles). It will be very useful, but not strictly necessary, to have an understanding of Hilbert and Banach spaces (e.g. Chapters 3-5 of Rudin's "Real and Complex Analysis") and some knowledge of PDEs.

Here is the tentative list of topics:

1. Connections and curvature on vector bundles.
2. A working man's introduction to elliptic theory.
3. Finding geodesics via Morse theory.
4. The Hodge Theorem and the Bochner technique.
5. Spinors and the Dirac equation.
6. The Seiberg-Witten equations.
7. The heat kernel on manifolds.
8. Time permitting: pseudo-holomorphic maps or harmonic map heat flow.

Text: There is no official text. Parts of the course will follow my notes *Lectures on Seiberg-Witten Theory*, which will be posted on the class webpage. Other parts will follow the (excellent!) book *Lectures on the Geometry of Manifolds* by Liviu Nicolaescu.

Grades: There will be homework assignments, collected every 1-2 weeks; the course grade will be based on these.