Math 930, Fall 2016

Riemannian Geometry

Class meets: 11:30 – 12:20 MWF in C-304 Wells Hall.

Professor: T. Parker
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Office hours: Monday: 1:30-2:30
Wednesday 3-4
Friday 2-3

Class Web page: math.msu.edu/~parker/RG. Bookmark this!

This course is an introduction to Riemannian geometry and geometric analysis. The emphasis is on quickly acquiring a working knowledge of the tools and ideas of the subject.

Prerequisites: Math 868 or a familiarity with manifolds (vector fields, differential forms, tangent and tensor bundles).

Course Content: The course will begin will the "classical differential geometry" of surfaces in $\mathbf{R}^n$. We will then start anew, casting things in the modern, more abstract language of manifolds, differential forms and connections. We will then introduce some of the basic ideas of geometric analysis, bringing in PDE methods and exploring how curvature interacts with analysis.

1. The geometry of surfaces in $\mathbf{R}^3$ and Riemann's thesis.
2. Riemannian metrics, length, and geodesics.
3. Connections, parallel transport, and curvature on vector bundles.
4. Jacobi fields and normal coordinates.
5. A working man's introduction to elliptic theory.
6. Finding geodesics via Morse theory.
7. The Hodge Theorem and the Bochner technique.

Textbook: *Riemannian Geometry and Geometric Analysis*, by Jurgen Jost.

Additional books: The following books are cover the same topics, with varying styles.

1. John M. Lee, *Riemannian Manifolds, an introduction to curvature.*
2. M. do Carmo, *Riemannian Geometry.*
3. M. Spivak, *A Comprehensive Introduction to Differeintial Geometry*, Vols. 1,2,3.
4. S. Gallot, D. Hulin, and J. Lafontaine, *Riemannian Geometry.*
5. J. Cheeger and D. Ebin, *Comparison Theorems in Riemannian Geometry.*

Grades: Homework assignments will be assigned and collected every 1-2 weeks; the course grade will be based on these.