Course Outline

Math 676 Topics in Geometry I

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Objective: The course will provide an introduction to Riemannian geometry

Content:

1. Basic tools of Riemannian geometry: metrics, Levi-Cevità connection, curvature, hypersurfaces and shape operator.
2. Examples: Warped product metrics, Schwarzschild metric, Lie groups, Einstein metrics.
3. Tools: geodesics, the exponential map, Hopf-Rinow theorem, first and second variation of arclength and energy, conjugate points, minimal surfaces and variation of area, comparison geometry, Myers' theorem.
4. Topics in geometric analysis, chosen from: Harmonic maps and bosonic strings, Einstein's equations, conformally compactifiable Einstein metrics, curvature flows.

Grading: Assignments 60%, class presentation with written report 40%.

Prerequisites: Math 521 or equivalent or the permission of the instructor.

Recommended Texts: Any one of the following will suffice.

1. Isaac Chavel, *Riemannian Geometry: A Modern Introduction*, 2nd ed., Cambridge (2006), ISBN 521–61954–8 (978–0–521–61954–7).
2. Peter Petersen, *Riemannian Geometry*, 2nd ed., Springer (GTM 171), ISBN 0387982124 (978–0387982120).
3. Jürgen Jost, *Riemannian Geometry and Geometric Analysis*, Springer (Universitext), ISBN 3540259074 (978–3540259077).

Chavel is probably the clearest book for the course material. You might find Jost the most useful in future years. Petersen is a nice compromise.

Students potentially interested in taking this course are encouraged to contact the instructor.