MATH 567- RIEMANNIAN GEOMETRY- FALL 2008.

Alex Freire, office: Ayres 207A, 974-4313 e-mail: freire@math.utk.edu, web page: http://www.math.utk.edu/∼freire

Office hours: Tu+Th: 3:30-5:00, or by appointment (e-mail)

Goal and prerequisites. Basic definitions and foundational theorems of Riemannian geometry. The emphasis will be on concepts, examples and results which have proved useful in a wide range of fields: differential topology, general relativity, partial differential equations, applied mathematics...the only (formal) prerequisite is one year of advanced calculus.

Grading. Based on homework sets. Problems may be proposed in class, assigned from the text, or given in the course web page. Turn in 4 detailed solutions by Thursday, Sept. 4, and another four every two weeks after that.

References. 1. M.P. do Carmo, *Riemannian Geometry* (Birkhäuser 1992) (text for the course)

2. F. Warner, *Foundations of Differentiable manifolds and Lie groups* (Scott, Foresman and Co., 1971)

3. I. Chavel, *Riemannian Geometry: a Modern Introduction* (Cambridge U.P. 1993)

4. B. O'Neill, *Semi-Riemannian Geometry* (Academic Press 1983)

Main topics:

1. Differentiable manifolds
2. Affine connections, Riemannian metrics, curvature tensor
3. Exponential map, Jacobi fields, volume growth
4. Completeness, comparison theorems
5. Geometry of immersions (and of submersions)
6. Lie groups and isometry groups
7. Space forms, symmetric spaces and holonomy
8. Morse theory of geodesics
9. Curvature and the fundamental group