

## SYLLABUS – MAT 569

This will be a continuation of MAT 568, taught by Mike Anderson in Fall, 2014. The textbook will be Petersen's *Riemannian Geometry*, Springer Graduate Texts in Mathematics, vol. 171 (as in MAT 568).

The first part of the course will concern differential operators on Manifolds. This will include Hodge theory, Dirac formalism, the Bochner method, etc., with applications to manifolds of positive curvature (of various sorts). I will then return to comparison theorems, and in particular, the Toponogov Triangle Theorem with its applications. Finally we will take up submanifold theory, and in particular, the theory of minimal submanifolds in riemannian spaces.

### RIEMANNIAN GEOMETRY Part II, Spring 2015

1. *The theory of connections on vector bundles*: direct sum and tensor product connections, curvature, parallel sections and the rough Laplacian, holonomy, reduction of structure groups.
2. *The Hodge Laplacian*: Definition and properties, Harmonic forms and The Hodge Decomposition Theorem.
3. *The Bochner Technique*: The basic idea and the basic case relating Ricci curvature to harmonic 1-forms.
4. *Clifford bundles, Dirac bundles and general Bochner-Weitzenböck-Lichnerowicz formulas*.
5. *Spin manifolds and the Dirac operator  $\not{D}$* .
6. *Manifolds of positive scalar curvature*. The Singer-Lichnerowicz Formula, Statement of the Atiyah-Singer Index Theorem for  $\not{D}$ .
7. *Ricci curvature comparison*.
8. *The Toponogov Triangle Comparison Theorem*. The Sphere Theorem, the Soul Theorem.
9. *Lie groups and symmetric spaces*.
10. *Submanifold Theory – minimal submanifolds*.

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