MATH 526: Differential Geometry II

Course Material and Topics: This course covers the fundamental concepts of metrics, connections, and curvature. Riemannian manifolds are smooth manifolds equipped with Riemannian metrics, which allow one to measure geometric quantities such as distance and angles and study geometric properties of curved space. This course covers core material that would be useful for many areas of mathematics and physics.

Topics to be covered:

- Riemannian metrics
- Connections
- Riemann curvature tensor, sectional curvature, Ricci curvature, scalar curvature
- Basic theory of geodesics: the exponential map, Jacobi fields, completeness
- Riemannian submanifolds, second fundamental form, and the Gauss and Codazzi equations
- Spaces of constant curvature (canonical metrics)
- Classical applications: Hopf-Rinow and Hadamard theorems, Bonnet-Myers theorem, and Synge's theorem
- Other topics, like
  - -Relationships between curvature and topology, the sphere theorem
  - -Comparison theorems: Rauch, Laplacian, Hessian; Toponogov's theorem
  - -Topics in geometric analysis

Prerequisites: It will be assumed that the student has had the usual undergraduate training in analysis (for example, MATH 320), linear algebra, and basic ODE. Students should have some familiarity with differentiable manifolds (such as MATH 525 here at UBC).

Evaluation: The instructional format for the course will consist of lectures of 3 hours per week. There will be no final exam.

Possible references:

- M. do Carmo, *Riemannian geometry*
- J. Lee, *Riemannian Manifolds: An Introduction to Curvature*
- P. Petersen, *Riemannian Geometry*
- S. Gallot, D. Hulin, and J. Lafontaine, *Riemannian Geometry*
- D. Spivak, *A Comprehensive Introduction to Differential Geometry, 3rd Edition*