

Geometry and Topology
Qualifier Examination Syllabi
MAT 501-502*

1 First semester: Geometry & Topology of Manifolds I

Topics: The first class covers the basics of algebraic and geometric topology, including:

- Basics of general topology (connectedness, compactness, quotient spaces)
- Cell complexes
- Euler characteristic
- Topological manifolds
- Classification of surfaces
- Fundamental groups
- Covering spaces
- Basics of simplicial and singular homology

References:

- A. Hatcher, *Algebraic Topology, Chapters 0, 1, 2 and Appendix*. Available at:
<http://www.math.cornell.edu/~hatcher/AT/ATpage.html>.
- *Other sources as appropriate.*

2 Second semester: Geometry & Topology of Manifolds II

Topics: The second class covers the basics of differential geometry and topology with an introduction to Riemannian geometry, including:

- Differentiable manifolds
- Vector and tensor fields
- Differential forms
- Flows and foliations
- Lie groups, homogeneous spaces
- de Rham cohomology

*Run as MAT 598 in 2012-2013 and 2014-2015.

- Vector bundles and affine connections
- Introduction to Riemannian metrics and curvature.

References:

- John M. Lee; *Introduction to Smooth Manifolds, second edition. GTM 218, Springer.*
- M. do Carmo; *Riemannian Geometry. Birkhäuser.*
- *Other sources as appropriate.*