

Geometry 1, MTH G122.
Fall 2004. Professor Mikhail Shubin.

Textbook:

Foundations of Differentiable Manifolds and Lie groups, by Frank W. Warner. Springer-Verlag New York, Inc., 1983.

Office: 460 Lake Hall. **Phone:** (617)373-5676 **E-mail:** shubin@neu.edu

Class meetings: Tuesday and Thursday 7:30 – 9:00 p.m. 544 Nightingale Hall

This is an introductory course in geometry of manifolds, covering material which is “must know” for every mathematician. The topics included in the course:

1. Manifolds and submanifolds. Smooth maps of manifolds. Tangent vectors and differentials. Implicit function theorem. Vector fields. Distributions and Frobenius Theorem.
2. Tensors and differential forms. Lie derivative.
3. Lie groups and their Lie algebras. Subgroups, homomorphisms. Covering spaces and covering groups. Exponential maps. Adjoint representation. Homogeneous manifolds.
4. Integration of differential forms and Stokes’ theorem. De Rham cohomology.
- 5*. Riemannian manifolds. Elements of geometry of curves and surfaces in the 3-dimensional space.
- 6*. Sheafs, cohomology and de Rham theorem.
- 7*. Laplace-Beltrami operator and Hodge theory.

The items with stars will be covered as time allows. The topics in item 5* are not covered in the book but necessary printed or written materials will be provided when needed.

Some topics, in particular the ones which are contained in the items with stars above, may be offered for the students’ presentations in class.

The prerequisites include an analysis course with elements of topology. For example, Chapters 1-9 from “Principles of Mathematical Analysis” by W.Rudin are sufficient (but not all the material there is necessary).

Warner’s textbook is very well written and contains sufficiently many exercises which will be used for homework assignments. Usually homework will be assigned weekly, collected, and graded. It is recommended that you do as many of the exercises from the book as possible (whether assigned as homework or not). You shall profit greatly from this.

The grade will be based on homework assignments, and, possibly, presentations and the final exam.