Syllabus **MAT 705** **Fall, 2014**

Instructor: Will Wylie, Carnegie 206C, 315-443-1469, email: wwylie@syr.edu

Lecture: Carnegie 119, TuTh 9:30-10:50.

Office Hours: Tu1:30-2:30, W 11-12, Th 1-2, or by appointment.

Text: *A comprehensive introduction to Differential Geometry, vol. 1*, by M. Spivak, Third edition.

There are many texts that cover part or all of the course material (see a partial list on the back). There are two reasons I choose this book. The first is that is has many good exercises. The second is that this text contains a flowing and in-depth exposition with a number of examples as opposed to a terse "theorem-proof" style. In other words, I picked this text because it is much more useful to read, so please read the book!

Prerequisites: MAT 602 (Functions of several variables), **MAT 661** (Point Set Topology), a strong background in linear algebra and multivariable calculus. I will assume you are familiar with the basic notions of point-set topology such as compactness, connectedness, continuous functions, and metric spaces. You should also be familiar with the basic notions of differentiation of maps between Euclidean spaces.

Course Summary: This will be an introductory course in the theory of smooth manifolds which are, roughly speaking, the spaces where it is possible to define derivatives and integrals. Developing a rigorous general theory of these spaces can sometimes be surprisingly difficult and counter-intuitive. It will involve ideas from analysis, algebra, topology and differential equations. I hope that one of the pay-offs will be a greater appreciation of the intersection of these fields which we usually learn as separate subjects.

Topics will include: Manifolds, C^∞-structures on manifolds, the tangent space, tensors, vector fields, differential forms, integration on manifolds, and the Frobenius theorem. This covers chapters 1-8 of the text, although we will have to leave out a lot of the material in the book along the way.

Homework: There will be homework assignments assigned bi-weekly. The homework problems will be discussed during regular problem sessions. Participation in the homework problem sessions will form the basis of the course grade. Alternatively, you can hand in written homework assignments.

Additional References:

- M. Spivak, *Calculus on Manifolds*, Addison-Wesley.
- V. Guillemin & A. Pollack, *Differential Topology*, First Edition, AMS Chelsea Publishing, 2010. (Reprint on original Prentice-Hall version, 1974).
- J. Milnor, *Topology from the differential viewpoint*, Princeton.
- F. Warner, *Foundations of Differentiable manifolds and Lie groups*, Springer.
- J. Lee, *Introduction to smooth manifolds*, Springer.
- W. Boothby, *An intro to differential manifolds and Riemannian geometry*, 2nd edition, Academic Press.