## MATH 761-SYLLABUS- FALL 2011

- Course : Math 761. It meets TR at Van Vleck 129, 2:30-3:45 pm.
- **Text** : A comprehensive introduction to Differential Geometry, by Michael Spivak, V. I, Publish or Perish Inc. 2005.
- Lecturer : Prof. Gloria Marí Beffa, maribeff@math.wisc.edu
- Office: Van Vleck Hall 309, office phone #: 263-1634
- Office hours: I will be in my office most of Tuesdays and Thursdays. If you need to talk to me any other day you will need to make an appointment.

The following is a rough description of lectures. You will need to come to class if you want to know what we are covering. The dates of midterms are fixed, they will be in class (for some prelim practice) but you will be able to take them home and complete them before they get graded. I will assign regular homework every week and collect them every two weeks.

## Lectures

- 1. Manifolds: definition examples and review of the basics.
- 2. Non trivial examples. Manifolds with boundaries.
- 3. Differentiable structures on a manifold: differentiable maps, rank, regularity, diffeomorphisms.
- 4. Sard's Theorem. Immersions and imbeddings.
- 5. Submanifolds. Partitions of Unity.
- 6. Tangent vectors and the differential.
- 7. Vector bundles. The tangent bundle.
- 8. Properties of the tangent bundle. Vector fields.
- 9. Orientation of vectors, orientable manifolds and preservation of orientation.
- 10. The cotangent bundle. The differential map. Tensors and tensor bundles.
- 11. Covariant, contravariant and mixed tensors. Contractions.
- 12. Integration of vector fields: existence and uniqueness. Contraction maps.
- 13. Integration (cont.).
- 14. Lie derivative. Lie brackets.
- 15. Lie brackets (cont.). Conmuting vector fields.
- 16. Distributions and integral manifolds. Integrable distributions.
- 17. Frobenius Theorem. Foliations and global picture.
- 18. Alternating tensors and wedge products. Forms.
- 19. Differentials. A second version of Frobenius Theorem.
- 20. Closed and exact forms. Poincare's Lemma.
- 21. Introduction to integration: the integral of n-forms over n-cubes.
- 22. Chains and boundaries. Closed chains.
- 23. Stoke's Theorem (first version on chains).
- 24. Orientation of a manifold with boundary. Stoke's Theorem.
- 25. De Rham Cohomology, examples.
- 26. More examples and corollaries.

First miderm is October 13. Second midterm is November 17. Final exam is to be announced.