MATHEMATICS 721 A1
Introduction to Differential Topology I
Fall Semester 2008

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Lectures: MWF 11-12 in MCS B29

Text: *Introduction to Smooth Manifolds*, by John M. Lee; Springer; ISBN 978-0-378-95448-6.

My Office Hours: M 2-4 W 2-3 (Tentatively)

Class Web Page: `http://math.bu.edu/people/kimura/Teaching/Fall08/721/`

Content: A smooth n-dimensional manifold is a space obtained by gluing together copies of $\mathbf{R}^n$ by using smooth maps. Standard examples of smooth n-manifolds are $\mathbf{R}^n$ itself, n-spheres, or n-dimensional real projective spaces.

Differential topology is the study of smooth manifolds which merges tools from calculus with ideas from topology. The key point in definition of a smooth manifold is that it provides a description of the space (and interesting equations on them) in a coordinate independent manner. This is a very powerful idea which has many applications to many other areas of mathematics. Differential topology also has many applications to modern theoretical physics particularly in relativity and quantum field theory since the fundamental equations of nature are coordinate invariant.

In this course, we will introduce smooth manifolds, smooth maps, tangent bundles and vector fields, cotangent bundles, vector bundles, immersions and submersions, tensors, Lie groups and Lie algebras, orientations, differential forms and integration, de Rham cohomology, integral curves and flows, Lie derivatives, and foliations.

Prerequisites: The prerequisites to this course are multivariate calculus and some basic linear algebra. Some knowledge of topology or analysis will also be helpful.

Homework: Homework will be assigned periodically. Late homework will not be accepted. Students may discuss homework with each other (and are encouraged to do so) but all written work must be prepared independently.

Exams: There will be a midterm exam and a final exam.

Grades: Your final grade is determined by three categories – the midterm, the homeworks, and the final. Grades are based upon the formula:

$$\text{Final Grade} = \frac{1}{3}(\text{Exam Average}) + \frac{1}{3}(\text{ Homework Average}) + \frac{1}{3}(\text{Final Exam})$$