Math 732: Differential Topology
Syllabus, Spring 2008

Professor: **Dr. Jason Parsley**
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1. Course Time & Location: TuTh 12-1:15, Manchester 245

2. Text: Victor Guillemin and Alan Pollack, *Differential Topology*

Supplementary Text: John Milnor, *Topology from the Differentiable Viewpoint*

3. Course description: This course is a sophisticated look at a very basic question: what are the properties of the sets of solutions of a system of simultaneous equations? If the equations are linear, this question is exhaustively studied in linear algebra, and the answer is very simple: if we have k linearly independent (homogenous) equations on an n dimensional vector space, then the set of solutions is a subspace of dimension $n - k$.

In this class, we consider the situation where the equations are nonlinear. The solution sets are generally curved & much more interesting and can have interesting topological and geometric properties as well. But surprisingly, almost all of the time, the set of solutions is still locally identical to a subspace of dimension $n - k$. Much of the course will be devoted to putting a rigorous foundation under these simple ideas.

This course is essential for students interested in graduate study in geometry and topology and is useful for many other disciplines. Smooth manifolds are the n-dimensional analog of surfaces. This course introduces their most important properties: embeddings and immersions, transversality, intersection theory, and integration, forms, and DeRham cohomology. Prerequisites for the course are linear algebra and vector calculus. You do not need the point-set topology course (MTH 731) for this course; some knowledge of analysis (MTH 311/611) is helpful, but not required. In the spring of 2009, the MTH 732 class will (probably) explore a different topic in topology, i.e., this won't be offered again for awhile. The word differential need not scare you. We won't be performing intense calculus computations, as one might in MTH 334/634 studying surfaces. Rather this course examines the larger topological worldview of manifolds.

4. Homework. Homework will be assigned every 1-2 weeks and will be due at the start of class/problem session on the appropriate day. Each assignment, a few of the homework problems will be graded for correctness (5 pts each), while the rest will be graded for completeness (3 pts each).

Academic integrity is something I take quite seriously. You are bound to uphold the University Honor Code. For this course, here are my expectations: the assignments that you submit should be your original work. Assignments should be completed individually, not as a group. You are welcome to discuss any sticking points. However, the key ideas for the

problems should be yours; otherwise, you must reference how you came to understand it.

5. Problem Sessions: Every 1-2 weeks, we will hold a problem session. We need all of our lecture time, so as a class, we will select a separate meeting time for this session. A day or two in advance, I will post a sign-up sheet for volunteers. You should sign up for all problems that you are willing to present; it's okay for multiple people to sign-up for the same problem. Most students will be able to present one problem during a session.

Following the session, I would like you to formally write-up the problem you presented. This can either be typed or neatly handwritten (and scanned as a `.pdf` document. One person will be designated *session-editor*, a rotating duty; the editor will compile the class's solutions into one document and ensure all of the arguments are logical and understandable.

Your grade for the problem session will be based on

(i) attendance
(ii) participation – both in presenting and asking questions
(iii) number of problems volunteered for
(iv) quality of formally submitted problems
(v) editor duties.

Of these, (i) and (ii) are the most important.

6. Final Exams: There will be a cumulative, take-home final exam.

7. Grade Calculation:

Homework	35%
Problem Session	30%
Final Exam	35%

If you have a disability which may require an accomodation for taking this course, please contact the Learning Assistance Center (758 5929), then contact me, within the first 2 weeks of the semester.