

Math 334/634: Differential Geometry Syllabus, Spring 2007

Professor: **Dr. Jason Parsley**

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Office hours: M 12-1, Tu 2:15-4:00, W 2:30-3:30, and by appointment

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1. Course Time & Location: MWF 11-12, Manchester 124

2. Course Synopsis: This course will study, in detail, the geometrical properties of curves and surfaces. As we will discover, the subject is remarkably more difficult than your high school geometry class. We will utilize calculus and linear algebra to understand the basic idea of curvature, which is somewhat intuitive for a curve but less so for a surface. One highlight is the Gauss-Bonnet Theorem, which relates the total curvature of a surface to its topology (roughly, how many holes it has). We will talk about the shortest path between two points on a surface, that is a *geodesic*, and how to find geodesics. This is an excellent course for anyone planning graduate study in mathematics (or physics).

3. Text: Manfredo do Carmo, *Differential Geometry of Curves and Surfaces*

4. Secondary Texts: We will utilize

- Lecture notes written by Dr. Herman Gluck, University of Pennsylvania (available through Blackboard)
- Ted Shifrin, *Differential Geometry: A First Course in Curves and Surfaces* available freely online at <http://www.math.uga.edu/~shifrin/ShifrinDiffGeo.pdf>, which is also linked on Blackboard

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5. Exams: There will be two midterm exams and a final exam. The midterms will probably have a take-home component and possibly an in-class component.

- 1st midterm: **M., Feb. 26**
- 2nd midterm: **F., Mar. 30**
- Final Exam: **M., May 7, 2-5 pm**

6. Homework: Homework, which forms a significant component of your grade, will be assigned weekly. Students enrolled in the graduate version of the course will be responsible for additional problems. The assignments are due on **Wednesdays, in class**. *No late work will be accepted*. If exceptional circumstances arise, please contact me, preferably in advance.

Homework problems will generally be broken into three categories:

- ♣ computations
- ♥ easy/moderate problems
- ♦ challenging problems

You will have some choices regarding which problems you submit. Students enrolled in the graduate version of the course (Math 634) will be required to do more problems and to do more of the challenging ♦ problems.

Homework should be neatly written using proper English grammar, i.e., a list of calculations never forms a complete answer. This is an upper level course, and I expect that to be reflected in the quality of the writing.

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. The key ideas in the proofs should be yours; if you want to use an idea that is not yours, you must reference how you came to understand it. Having said all of this, I encourage you to discuss the course material with your classmates, just not the key ideas to a proof. You are free to look in other books on curves and surfaces; you should not use the internet to obtain homework answers.

7. Problem Sessions: On roughly a biweekly basis, we will find a time to meet as a class and discuss some of the more challenging problems in the course. You will be required to present your work. Students enrolled in the graduate version will be expected to present more frequently.

8. Grade Calculation:

Homework	30%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	30%

Of your homework grade, one-third (i.e., 10% of your overall grade) will be determined subjectively, based on your choice of problems and your participation in our problem sessions.

9. Course material: We intend to cover the following topics (sections reference do Carmo).

- Curves. § 1.1-1.6
- Isoperimetric Problem § 1.7A
- Four Vertex Theorem § 1.7B
- Regular Surfaces § 2.1-2.5 (possibly 2.6, 2.7, 2.8)
- Geometry of the Gauss Map § 3.1-3.4
- Minimal Surfaces § 3.5
- Intrinsic Geometry of Surfaces § 4.1-4.3
- Geodesics § 4.4
- Gauss-Bonnet Theorem § 4.5