Math 4250/6250: Differential Geometry
Syllabus

Lecturer: **Dr. Jason Parsley**
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Course Time & Location: TuTh 11-12:15, Boyd 304

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). Time permitting, we will discuss non-Euclidean geometry and advanced topics. This is an excellent course for anyone planning graduate study in mathematics (or physics).

Text: Shifrin, *Differential Geometry: A First Course in Curves and Surfaces*, available freely online at `http://www.math.uga.edu/~shifrin/ShifrinDiffGeo.pdf`. A professionally bound copy of Shifrin's text may be purchased at Baxter Street Bookstore for a nominal price ($11.35).

Exams: There will be two midterm exams and a final exam. Dates for the midterms will be announced at least two weeks in advance. No makeup exams will occur, except under truly exceptional circumstances.

- 1st midterm: TBA, 6th or 7th week of semester (Feb. 14-23)
- 2nd midterm: TBA, 11th or 12th week of semester (March 27 - April 6)
- Final Exam: **Tu., May 9, 12-3 pm**

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. One component of the homework assignments will involve the software for the course. The assignments are due on **Thursdays, in class.** *No late work will be accepted.* If exceptional circumstances arise, please contact me, preferably in advance.

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. You should complete the computer portion of each assignment by yourself with little or no help from outside.

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.

Required disclaimer: All academic work must meet the standards contained in "A Culture of Honesty". Students are responsible for informing themselves about those standards before performing any academic work. See `www.uga.edu/ovpi/honesty/acadhon.htm` for more details, including the Academic Honesty Policy.

Course Evaluations: Student evaluations of this course will be conducted online around the end of classes. It is **mandatory** that you submit a confidential evaluation. Completing an evaluation is worth 1% of your final grade.

Grade Calculation:

Homework	29%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	30%
Course Evaluation	1%

Topics: We intend to cover chapter 1, chapter 2, and parts of chapter 3 from Shifrin's notes.

Disclaimer: This syllabus is a general plan for the course and is subject to change based on numerous factors. Any changes will be announced in class, and it is your responsiblity to adhere to them.

Chapter 1. Curves. (4-5 weeks)

- Examples, Arclength Paramaterization
- Frenet Frame
- Global Results, Crofton's Formula

Chapter 2. Local Theory of Surfaces (5-6 weeks)

- Parameterized Surfaces
- First and Second Fundamental Forms
- Gauss Map
- Codazzi Equation, Gauss Equation
- Covariant Derivatives
- Parallel Transport and Geodesics

Chapter 3. Surfaces: Further Topics (3-4 weeks)

- Gauss-Bonnet Theorem [definite]
- Hyperbolic Geometry [probable]
- Differential Forms for Surfaces [doubtful]
- Calculus of Variations [maybe]
- Surfaces of Constant Mean Curvature [maybe]