MATH 454 – SPRING 2007 – GENERAL INFORMATION

Instructor. Tara S. Holm
Email: tsh@math.cornell.edu
Office: 589 Malott
Office phone: (607)255-2392
Office hours: W 13:00–15:00 and by appointment.
Web page: http://www.math.cornell.edu/∼tsh/454.html

TA. Tim Goldberg
Email: goldberg@math.cornell.edu
Office: 120 Malott
Office hours location: 218 Malott
Office hours: Tu 13:00–14:00, W 10:30–11:30, and by appointment.

Lectures. TuTh 14:55–16:10 in 207 Malott.

The Course. Geometry is the study of shapes and spatial relationships. Differential geometry is a core component of modern mathematics. It uses tools from calculus and linear algebra to describe and characterize geometric objects. This subject is an area of active research; indeed, *Science* magazine declared the celebrated proof of the Poincaré Conjecture the breakthrough of the year for 2006. Differential geometry also has important applications in science and engineering, including computer graphics, Einstein's theory of general relativity and quantum physics.

In this course, we focus on the geometry of curves and surfaces in Euclidean space. The fundamental concepts we will explore are **curvature** and **geodesics**. Topics we will cover include tangent bundles, orientability, the first and second fundamental forms, Gaussian and mean curvatures, the Gauss map, geodesics, minimal surfaces, and the Gauss-Bonnet Theorem. If time permits, we will discuss the basics of Morse theory.

Prerequisites. You must have some prior exposure to multivariable calculus and to linear algebra (Math 221-222, 223-224, or 293-294), as well as an upper level math class (Math 300 or higher) to enroll in this course. Math 453 is not a prerequisite.

Textbook. The course textbook is *Elementary Differential Geometry*, by Andrew Pressley. I expect we will spend about two to four lectures per chapter, covering most or all of the book as time permits. This textbook takes a very hands-on approach to curves and surfaces in $\mathbb{R}^3$. We will indicate how concepts and results generalize to higher dimensions.

There are many other good differential geoemtry books out there. Whenever you feel stuck or confused with our text, please feel free to consult alternative treatments. Reading multiple accounts of one topic is often helpful. Some other texts you might consult include

1. M.P. doCarmo, *Differential Geometry of Curves and Surfaces*, Prentice-Hall, 1976.
2. A. Gray, *Modern Differential Geometry of Curves and Surfaceswith Mathematica*, CRC, 1997.
3. D. Henderson, *Differential Geometry: A Geometric Introduction*, Prentice-Hall,1997.
4. B. O'Neill, *Elementary Differential Geometry*, 2nd Ed., AcademicPress, New York, 1997.

These books are on reserve at the Mathematics Library.

Academic integrity. As always, you are expected to abide by the Cornell Code of Academic Integrity. This states, "A Cornell student's submission of work for academic credit indicates that the work s the student's own. All outside assistance should be acknowledged, and the student's academic position truthfully reported at all times."

Homework. Problem sets will be handed out once every week or two, on Thursdays. They will be due the following Thursday. For the most part, these will consist of statements you will need to prove (or disprove). There will be between 6 and 10 problem sets throughout the semester. I will drop your lowest problem set grade when computing your final homework grade.

I do not accept late homework!

You may work together on your assignments, and you are encouraged to do so. However, you must write up your final solutions **by yourself**. Your work must be written neatly and legibly. Proofs should be written in complete English sentences. Your homework score will be determined not only by the correctness of the responses, but also by the correctness of the grammar.

Quizzes. There will be a couple of quizzes during the semester. These will be short in-class quizzes lasting 15–30 minutes, and will be announced a week in advance. The purpose will be to check that you know the basic definitions and can perform the basic computations similar to those in class and in the homework. You will not be allowed to use a calculator or any notes or books on the quizzes.

Exams. There will be at least one prelim during the semester. This will be a week-long take-home exam: you will be allowed to consult your text and your course notes, but you should **NOT** discuss the exam with your fellow students. Depending on the make-up of the class, there will be a take-home final exam or a final project.

Warning: There will be no make-up exams, except in extreme circumstances. In the rare case that a make-up exam is granted, it will be an oral examination.

Grading policy. The course components will be weighted as follows:

Problem sets – 30%
Quizzes – 15%
Prelim – 23%
Final – 32%

If you have any questions about homework, exams, or grades, please come talk to me during my office hours or send me email.