SYLLABUS

Honors Calculus III (Math 2411)
Spring 2006, Georgia Tech

Lecture	Section
T Th 12:05-13:25 Skiles 169	M W 12:05-12:55 Skiles 243

Instructor

Professor Mohammad Ghomi

- *Office:* Skiles 228
- *Office hours:* T-Th 2:30-3:30
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- *Course Web Page:* www.math.gatech.edu /~ghomi/Math2411

Teaching Assistant

Craig Sloan

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Course Description

We study calculus of vector valued functions. Main topics include Taylor's theorems, Lagrange multipliers and constrained optimization, parametrized curves and surfaces, change of variables formula and Jacobians, line and path integrals, surface integrals, theorems of Green, Gauss, Stokes, differential forms, and various applications to problems in Physics, Engineering, and Geometry.

Textbook

Vector Calculus, by Susan Colley, third edition.

Homeworks

There will be homework assignments due every Monday. *Late homeworks will not be accepted.*

Lecture and Reading Schedule

Dates			Lectures	
Jan	10	T	1.1	Intro to vectors
	12	Th	1.2,1.3	Dot products
	17	T	1.4, 1.5	Cross Products, Distance problems
	19	Th	1.7	Cylindrical and Spherical coordinates
	24	T	2.1, 2.2	Functions of several variables, Limits, Continuity
	26	Th	2.3, 2.4	Derivatives
	31	T	2.5	The Chain Rule, Gradient

Feb	2	Th	2.6	Directional derivatives
	7 9	T Th	3.1 3.2	Parametrized curves and Kepler's laws Arclength
	14 16	T Th	3.2 3.3	Frenet-Serret formulas Flow lines in vector fields
	21 23	T Th	3.4, 4.1 4.2	Divergence and Curl,Taylor's Theorem Extrema of functions
	28	T	4.3	Lagrange Multipliers
Mar	2	Th	5.1, 5.2	Areas and Volumes; Intro to Double Integrals
	7 9	T Th	5.3, 5.4, 5.5 5.6	Triple Integrals, Change of variables Averages and Centers of Mass
	14 16	T Th	6.1 6.2	Line Integrals Green's Theorem
	28 30	T Th	6.3 7.1	Conservative vector fields Parametrized surfaces
Apr	4 6	T Th	7.2 7.3	Surface integrals Stokes and Gauss's Theorems
	11 13	T Th	7.4 8.1	Maxwell's Equations Intro to Differential forms
	18 20	T Th	8.2 8.3	Integrals of k-forms General Stokes theorem
	25 27	T Th		

Assignments

#	Due Date	Problems
1	Jan 17	1.2) 14, 18, 24, 25, 28, 29, 37, 38; 1.3) 8, 10, 14, 16, 21, 24, 25, 26.
2	Jan 23	1.4) 10, 12, 16, 18, 20, 24, 25, 26, 27, 30, 32; 1.5) 5, 29, 33, 34, 35; 1.7) 6, 8, 12, 16, 18, 26, 32.
3	Jan 30	2.1) 12, 20, 35, 36, 46; 2.2) 14, 23, 28, 32, 46; 2.3) 8, 14, 20, 22, 24, 30, 36, 48; 2.4) 10, 20.
4	Feb 6	2.5) 3, 16, 20, 22, 26, 27, 30; 2.6) 6, 12, 16, 20, 22, 34, 36, 42.
5	Feb 13	3.1) 4, 6, 8, 16, 22, 25, 27, 29, 30, 32; 3.2) 4, 8, 9, 10, 12.
6	Feb 20	3.2) 16, 17, 18, 24, 29, 30, 32; 3.3) 18, 20, 24, 25.
7	Feb 27	3.4) 2, 8, 12, 14, 18, 29; 4.1) 10, 14, 18; 4.2) 4, 6, 28, 32, 33.
8	Mar 6	4.3) 2, 17, 19, 24, 28, 36, 37; 4.6) 20, 23; 5.1) 2, 4, 10, 16; 5.2) 4, 10, 12, 20, 23.

9	Mar 13	5.3) 2, 12; 5.4) 6, 9, 12; 5.5) 8, 14, 18, 24; 5.6) 3, 11, 12, 18, 22; 5.8) 11.
10	Mar 27	6.1) 2, 8, 16, 23, 24, 25, 27, 29; 6.2) 5, 10, 14, 17, 22, 25.
11	Apr 3	6.3) 4, 10, 18, 25; 6.5) 2, 23, 25, 27; 7.1) 2, 10, 20, 22, 26, 28.
12	Apr 10	7.2) 6, 7, 10, 23; 7.3) 2, 6, 12, 16, 20.
13	Apr 17	7.4) 5, 11, 13, 16; 7.6) 6, 8, 21, 38; 8.1) 2, 6, 8, 10.
14	Apr 24	8.2) 6, 7, 9; 8.3) 2, 4, 8, 11, 12; 8.5) 3.

Tests and Exams

There will be 2 midterms on Wednesdays Feb 15 and Mar 15. The Final Exam is on *Friday*, May 5 , 8-10:50.

Grading

Your final grade is comprised of the homeworks (20%), midterms (20% each) and the final exam (40%).

Attendance Policy

You are required to attend all lectures and sections.

Mathematics 2411 Honors Calculus III Course Description

Spring, 2000 (MWF 12:00 in the Skiles Building, with recitations TTh 12:00)

Instructor: Evans Harrell, Office Skiles 134, 894 4312, harrell@math.gatech.edu
Instructor's office periods: MF 2:30-3:30, Skiles 134
Assistant: Jorge Rebaza-Vasquez. Note to students continuing from Math 1502: This is a different Jorge. **Assistant's office periods**: MTh 11:00-12:00, Skiles 141

Class web page: http://www.math.gatech.edu/~harrell/2411/ It is your responsibility to consult the web page regularly for information about the class. The web page will contain the definitive information about the class, such as homework assignments. The web page will also give you e-mail contact with the instructor and the teaching assistant, and we will do our best to respond to your questions. Electronic mail has swollen to flood proportions, so please do not be upset if the response is delayed or brief. Information of use to the whole class may be posted on our faq list. The faq may be the quickest way to answer routine questions.

Required texts:
Hubbard and Hubbard, *Vector Calculus*, with some parts of Salas, Hille, and Etgen, *Calculus*, and on-line materials, for example the vector calculus page at mathphysics.com.

Description: Calculus is not only essential in engineering; it is one of mankind's greatest intellectual achievements. After thousands of years of confusion on the part of philosophers, Newton, Leibniz, and Euler created the tools for understanding the infinite and the infinitesimal. In the third term we learn about derivatives and integrals in three (or even more) dimensions and their uses. Since we are on the threshold of the new millennium, we can do all this with the aid of computers.

Grading and requirements: There will be in-term tests on Thursday, 27 January; Thursday, 24 February; and Thursday, 30 March; as well as a term paper due on 21 April (topic to be chosen by 24 March). There will also be a final exam, of course. Homework will not be systematically collected, but instead clones of the homework problems will appear on quizzes, given most Thursdays. Your quiz average will be based on the best ten quizzes. In addition, Prof. Harrell will announce occasional contests, and the winner of a contest will receive extra-credit points.

Students' grades will depend on the following quantity:

$$(T1^2 + T2^2 + T3^2 + Term^2 + Q^2 + F^2)^{1/2} + C + F\ ,$$

where the components of this formula correspond to the ingredients mentioned above, after scaling so that all of them except C = contest total have a common median. There will be no opportunities for make-up tests after the fact. As honor students can probably work out, the vector grade system largely compensates for a bad or missed test due to illness or other personal situations.

Since this is an honors class, only strong students can take it, and they are expected to perform well. Probably most will get A's and B's, but that will be just as hard as getting A's or B's in a class with a C median.

Mathematical software. The use of mathematical software will be a required element of the class, but advanced use of Maple will not be expected. Early in the term there will be a recitation devoted to Maple for those for whom it is new. If you are currently a user of Mathematica, Matlab or other software competing with Maple, you will not be compelled to switch, but the class will not systematically support these alternatives.

Calculators and tests. No restrictions will be placed on the use of calculators that do *elementary* mathematics on the tests. **Calculators that can do calculus symbolically shall not be brought to tests**. No credit will be given on tests for a correct answer without the intermediate steps.

Readings. The schedule of reading will be posted on the 2411 assignments page. The subject matter covered will be roughly the following:

Parametrized paths, velocity and acceleration, curvature and arclength

Continuity, etc. for functions of several variables. Graphs and contour plots

Partial derivatives and the chain rule. Tavlor's theorem in

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                              Partial derivatives and the chain rule. Taylor's theorem in
several variables
                              The gradient, tangent planes, best linear approximation and best
quadratic approximation
                              Optimization, types of critical points
                              Lagrange multipliers, Newton's method in several variables
                              Double integrals, iterated integrals. Applications: area, center
of mass, and volume by Pappus's Theorem
                              Area integrals in polar coordinates, general coordinates and the
Jacobian in the plane
                              Triple integrals, spherical and cylindrical coordinates
                              Jacobian in three variables. Improper multiple integrals and
applications
                              Vector fields and line integrals, work and flux
                              Green's theorem in the plane for both work and flux integrals.
Exact vector fields
                              Parameterized surfaces and surface integrals
                              Gauss's Theorem and Stokes's Theorem
                              Applications
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On-line materials

This course will benefit from many on-line materials, which you can access with the software in the student software suite, especially Netscape, Maple, and Acrobat. There is a home page for the class at http://www.math.gatech.edu/~harrell/2411/, and there are many other useful things at the School of Mathematics page for on-line resources: http://www.math.gatech.edu/~bourbaki/, as well as at the vector calculus page at mathphysics.com

Scientists and Engineers today do mathematics differently than in the past. Complicated calculations can be done with software such as Maple, and there are many powerful items on the World Wide Web to help you both to learn mathematics and to do it effectively. Georgia Tech is one of the leaders in incorporating these developments into our calculus classes, with Maple, Mathematica, Java, and other software. We hope that you will use software and the Internet to help with calculations and learning, but will always remember that real understanding requires you to exercise your mind as well as your fingers.

Return to the 2411 class web page