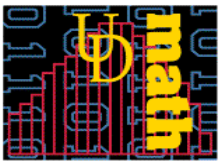

MATH 503 - 011 Advance Calculus for Applications
Fall 2009

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Course Web Site http://www.math.udel.edu/~cakoni/math503.html

Lectures Mondays – Wednesdays 3:30 – 4:45 pm, 208 Willard Hall

Office Hours Mondays and Wednesdays 11:00 – 12:00 or by appointment

Textbooks

- *Calculus of Variations* by Gelfand & Fomin
- *Nonlinear Dynamics and Chaos* by Strogatz

Course Outline

This is a course in *advanced calculus*. Over the last several years, you have taken multiple courses called "Calculus." For the most part, they have been concerned with the notion of a derivative and the notion of an integral. Almost all other topics were built upon these. In some sense, this course is an extension of that idea. However, there are so many topics that could fit into "advanced calculus" that we must use some discretion in our choice of topics. In this class, we will focus on three broad areas

- advanced integral calculus
- the calculus of variations
- nonlinear dynamics

You will find that the tools we develop in this course are of broad applicability. You should also be aware that we will rely upon material from many of your prior mathematics courses this semester. If you feel rusty on some topics, a review is necessary.

General Remarks

If you choose to take this class and develop your mathematical skills you should be prepared to:

• ***Read regularly and critically*** - You will have a text for this course, notes that I will prepare, and outside references to consult. In order to master the material it is necessary that you read these materials regularly and critically.

• ***Attend Class*** - If you choose to take this class, you'll need to attend. A good portion of the material we cover will not be in your text. Don't decide to take this class without committing yourself to attending each and every class. I will *not take attendance*.

• ***Complete Problem Sets*** - The heart of this course is the homework problems. It is in doing the homework that you will master the material. There will be several homework sets handed out during the course of the semester. The due date for each homework assignment is firm; *no late homework will be accepted*. You should write your answers clearly.

• ***Exams*** – The date and material for each exam will be announced at least 2 weeks in advance. *No make up exam will be given*. If you have an university valid excuse you must notify me before the exam. *Medical emergency* cases will be handled on individual bases. The tentative date for the **first exam is Monday, October 5.**

Grades

Your final grade will depend on each of the components in the course. In particular, **Assignments 25%, Three in class exams 25% each**

Letter grades will be awarded according to the following scale:

91-100% (A), 88-90% (A-),
86-87% (B+), 81-85%(B), 78-80% (B-),
76-77% (C+), 71-75% (C), 68-70% (C-),
66-67% (D+), 61-65% (D), 55-60% (D-),
0-55% (F).

Electronic Communication

Course related announcements and **all the assignments will be posted on SAKAI** https://sakai.udel.edu/portal
You may send me e-mail with questions regarding the course.

Academic Honesty

The University has explicit rules on academic honesty that will be strictly enforced in class. See for details
http://www.udel.edu/stuguide/09-10/code.html#honesty

A tentative list of topics to be covered

(the list of topics is subject to changes and adjustments as needed)

Vector Calculus

- Gradient, Divergence and Curl (review).
- Multiple integrals, change of variables (review).
- Surface and line integrals (review).
- Divergence theorem, Stokes' theorem, Green's theorem.
- Green's first and second identities and applications.

Calculus of Variations

- Overview, some basic variational problems, function spaces, notion of a functional.
- Euler's equation and examples.
- Variational derivatives, invariance of Euler's equation.
- Lagrange multipliers.
- Isoperimetric problems.
- General variation, second variation, Weierstruass-Edman conditions.
- Variational problems leading the PDE's, direct methods.

Nonlinear Dynamics

- Linear systems, phase plane analysis.
- Limit cycles and nonlinear oscillators.
- Introduction to bifurcation theory and stability.
- The Lorenz equations and chaos.