ENAS/APHY 151 - Multivariable Calculus for Engineers - Fall 2014

Time & place: Tue & Thu 1:00pm-2:15pm in Dunham 220 *Meets during reading period!*
Makeup lectures: 8:00pm-9:15pm on September 23 and November 18 in Dunham 220
Two midterms: 8:00pm-9:15pm on October 7 and November 11 in Dunham 220
Final exam: exam group 26 on Sunday December 14 at 2pm
TF & Instructor:
TFs: Eric Kittlaus eric.kittlaus@yale.edu, Linshu Li linshu.li@yale.edu
Instructor: Sohrab Ismail-Beigi sohrab.ismail-beigi@yale.edu, Becton 307
Study halls: Tue 8pm-10pm & Wed 9pm-11pm in Mason 107. A big room with tables, come & work with colleagues on problems; asks questions from TFs; instructor sometimes drops by as well.
Office hours: TFs: during study.
Sohrab: Wednesdays 8pm-9pm in Becton 307 (Sohrab's office)
Textbook: Anton, Bivens and Davis, Calculus Multivariable, 10th edition (in Yale bookstore). There are many editions, the 10th being what the bookstore orders for this course. You should be fine with the 9th edition as well since I will be providing full problem statements for the problem sets. I have put a number of copies on reserve in the CSSSI library (in Kline tower).
Online Q&A and discussions: through Piazza at piazza.com/yale/fall2014/aphyenas151/home

Homeworks, quizzes, exams, policies

There are 3 components to your numerical score for the course.
The higher your numerical score for the score, the better your letter grade for the course.

Weekly written problem sets (30%): are posted online a week before the due date. They are due by Fridays at 3pm. After this cutoff, the homework is late and will be graded out of a maximum of 50%. Once solutions are posted, the homework is not accepted and counted as a zero. At the end of the course, I will drop your lowest 2 problem set grades and average the remaining grades. Hand in to our administrative assistant Maria Rao in Becton 401 by 3pm on Fridays.

Pre-lecture online quizzes (10%): coming to lecture prepared is critical to getting something out of it (beyond copying what is said). Without preparation, you will not really follow what is going on or be able to ask deeper or more conceptual questions. To help you prepare, there will be a short online reading-based quizzes online on classesv2 that can be submitted until 11:00am sharp before lecture. The 2 hour delay allows us to look at results and discuss as needed. We will go over responses at the start of lecture. You have up to 6 tries on the online quiz. The point is not to stress you out but simply to ensure reading is done prior to arrival in class. At the end of the course, for each student I will sort quiz scores and only use the best 3/4 of the scores to compute this contribution to the grade. I will endeavor to make the quizzes as painless and simple as possible while still ensuring they test key basic facts. The first quiz that counts is due September 16.

Midterms and final exam (60% total): There will be two 75 minute evening midterm exams and one final exam (see above). Your three exam scores will be sorted in ascending order and weighed by 15%, 20%, and 25% respectively.

Excuses: The **only acceptable excuses** for missed work or exams are written Dean's excuses and the instructor's permission. Remember that it is your job to inform me in a timely way about: your excuse, whether you have a dean's excuse, that you handed in your homework in an unorthodox time and/or place, etc. Please communicate with me so I can help you!

Group work: We encourage you to work in groups, a proven and effective way to enhance learning (and it can be more fun). However, the final work that you hand in must be your own: your quizzes and problem sets must be your own work. Blind copying is both dishonest as well as detrimental to your learning: it will inevitably catch up with you during the exams.

Here is the hyperlink for the Yale college academic calendar with various deadlines.

Course philosophy, grading philosophy, how to study, etc.

Course philosophy: This class is meant to teach you the mathematics and applications, and that is the primary objective.

The class is designed to teach you in different mutually reinforcing ways: pre-lecture quizzes help you integrate the reading and come to class with a prepared mind; lectures hopefully clarify what you've read and help you solidify the knowledge and give you the chance to ask questions; office hours and review sessions allow you to come and ask more detailed questions or get help on particular problems you are having; problem sets allow you to practice the technical and computational skills necessary to solve problems; and the exams mix conceptual and technical aspects and allow you to integrate everything together in a coherent manner.

Learning, and not exam preparation, is the primary purpose of the problem sets.

Hence the exam questions are not guaranteed to look like the problem sets.

Like any serious intellectual endeavor, only **you** can learn and teach yourself the material.

This class helps prepare your mind, gives you the needed tools, gives the right context, provides the background material, organizes opportunities for getting help and questions answered, etc. But learning can only take place when you spend the time and effort to do it yourself. Real learning occurs when you teach yourself.

Fundamentally, you are expected to learn the material yourself and teach it to yourself.

The teaching staff and entire class structure is devoted to help you in this endeavor and to make it efficient, but we cannot "teach" you the material in any deep sense.

Grading philosophy: For introductory courses, this topic, more than any other, has lead to long discussions, unhelpful arguments, or dashed expectations based on implicit and incorrect assumptions. So I would like to explain this plainly and in some detail upfront.

My objective as instructor is for you to learn the mathematics and its applications.

If you demonstrate excellent learning, you get an A; good learning gets a B; passing knowledge is worth a C. This is my fundamental principle for converting numerical grades into letter grades. This is also the official Yale grading policy and meaning of the letter grades as per the Yale College Programs of Study (see the section on Academic Regulations about Grades).

There is no curve or *a priori* desired distribution for this course.

If every single student demonstrates excellent learning, then every single student will get an A.
If no student demonstrates excellent learning, no student gets an A (this has never happened to date).

I do not give out numerical boundaries that correspond to various letter grades because it is a meaningless exercise that depends primarily on the difficulty of the exams. Please do not be fixated on the actual numerical scores you receive as they do not mean anything by themselves. This might differ from your other courses or previous experience. For example, a very difficult exam may lead a median score of 48% and someone demonstrating excellent learning might score 64%.

My exams tend to be on the more challenging and conceptual side: this makes for lower numerical scores, wider score distributions, allows students to clearly demonstrate what they know and are capable of, and (most important for grading purposes) provides more discrimination power to make sure that higher scores do actually correspond clearly and significantly to better demonstrated understanding and learning.

How to study for a nontrivial exam: (i.e., not-just-crank or plug-and-chug)

Best is to solve many, many problems on your own!
This forces you to *apply* (and not just *know*) the concepts and forces their integration into problem solving; you gain facility in applying techniques and concepts to various problems; the process of translating the word problem into a mathematical set of equations becomes efficient and fluid.

Where to find problems?

The textbook has many problems as well as worked problems in the text itself; you can check out other multivariable calculus textbooks from the library and find new problems to solve.

A common error when studying for the exams is only to "review" for an exam: i.e., reread chapters, reread notes, go through the solved problem sets and quizzes, etc. And then stop when one feels comfortable that things make sense in the overall conceptual manner.

This is a valuable and a necessary preparation, **but it is not enough** (and can lull one into a false sense of confidence).

You need to solve, solve, solve!

Ideally, you should reach the stage so that when you find a new problem, you efficiently begin to break it into pieces, start solving it quickly, and can look at your answer to see if it makes sense or not. Then you have integrated the material very well.

In short, practice makes perfect.