Fundamentals of Analysis II (MATH 322) – Spring 2011
Syllabus

Course Meetings: MW 12:30-1:45, Yost 101.

Instructor: Peter Thomas, Yost 209, 368-3623 (dept. office 368-2880), e-mail = `pjthomas(at)case.edu`.

Text: *Elementary Classical Analysis*, Second Edition, by Jerrold E. Marsden and Michael J. Hoffman, W.H. Freeman and Company, New York.

Website: `http://filer.case.edu/pjt9/m322s11/m322s11-index.html`

Prerequisites: MATH 321.

Description: Continuation of MATH 321. Point-set topology in metric spaces with attention to n-dimensional space; completeness, compactness, connectedness, and continuity of functions. Topics in sequences, series of functions, uniform convergence, Fourier series and polynomial approximation. Theoretical development of differentiation and Riemann integration. Required for all mathematics majors. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 322 and MATH 422.

Grading: There will be two midterm exams and a final exam. Each class will include a five minute quiz covering assigned reading. Each midterm will determine 20% of your grade, and the final will determine 40%. The remaining 20% of your grade will be based on daily homework assignments (15%) and daily quizzes (5%). The lowest quiz will be dropped from the final grade. The Midterms will be on 2/21/2011 and 4/4/2011. The final exam will be Wednesday 5/4 at 8:30 a.m. Please take exam dates into account when making your travel plans.

Office Hours: Wednesdays 2-4:45 p.m., and by appointment. If you know in advance that you plan to come to office hours at a particular time, please let me know via e-mail.

Homework: Homework be assigned regularly, either during lecture or via the course website. Homework is due at the beginning of class one week after the day on which it is assigned. If you miss a class please make arrangements with other members of the class to find out the assigned problems. Late homework will be penalized following a geometric series. If the homework would have scored x points, had it been on time, then if it is turned in n days late it will be receive a score of $\alpha^n x$ points, where $\alpha = e^{-1/5} \approx 0.818730753$. The "number of days late", n, will be rounded up to the nearest integer. Thus a homework assignment worth 100 points at the start of Monday's class would be worth about 82 points if turned in immediately after class (or any time in the following 22.75 hours), or 55 points on Wednesday or 37 points on Friday, *et cetera*. This is a Cauchy

sequence that converges (rapidly) to zero. It is in your best interest to keep up with the class and turn the homework in on time.
You are encouraged to discuss the problems with one another, but any work you turn in must be your own. If you find yourself having difficulty with the problems, please contact me to set up an appointment.

Additional References:

- Introduction to Real Analysis by William Trench covers many of the same topics as Marsden and Hoffman, in a somewhat less formal style that may appeal to some students in the course. It is available as a free download at

  `http://ramanujan.math.trinity.edu/wtrench/misc/index.shtml`

- Counterexamples in Analysis by Bernard R. Gelbaum and John M. H. Olmsted is a cheap (c. $15) Dover paperback containing many helpful examples of the concepts in the course.

Topics: The course will cover Chapter 4.8 (Integration) and most of Chapters 6-9 of Marsden and Hoffman, and selected sections of Chapter 10 as time permits. What follows is a rather optimistic time line; we will likely move somewhat slower and drop some topics. The schedule available through google docs (linked from the course page or the instructor's web page) will have an updated schedule.

Chapter 6: (Weeks 1-3) Differentiable Mappings.

Chapter 7: (Weeks 4-6) Inverse and Implicit Function Theorems and Related Topics.

Chapter 8: (Weeks 7-9) Integration (including Section 4.8, Integration of Functions of One Variable).

Chapter 9: (Weeks 10-12) Fubini's Theorem.

Chapter 10: (Weeks 13-15) Fourier Analysis (time permitting).

Advice: Analysis will challenge you to think more abstractly and carefully about mathematical objects (sets, sequences, functions) then is typically required in 200-level courses. Courses at this level (including Algebra, MATH 307-8, and Introduction to Advanced Mathematics, MATH 305) are essential for developing mathematical maturity. Here are some tips for making the transition.

- *Take careful notes in class, and review them the same day.* There is ample evidence that comprehension and retention are significantly improved if one takes careful notes and reviews one's course notes soon after class. Even waiting one day to review your notes can hamper your recall.

- *Start working on the homework problems the day they are assigned.* Solving the homework problems will be the best preparation for the exams, provided you start on them far enough in advance. Working on them shortly after class will lead you to review your notes the same day as well.
- *Study the proofs at the back of each chapter.* The textbook is organized so that the main results are stated in the text, along with heuristic or intuitive arguments for why they "should" be true. Intuition is notoriously unreliable once one is doing real analysis – in part the field developed historically through the invention of counterexamples to claims that previously seemed "obviously" true. The real action, and the mathematical toolkit, is displayed in proving (or disproving) the results. The back of each chapter contains the formal proofs of the theorems and other results stated throughout the chapter. You should study the proofs carefully, both as models of mathematical reasoning and also to see the way we expect you to write proofs in the homeworks and exams.