Course Syllabus, M617, Spring 2005 – Daniel J. Rudolph

Instructor: Daniel J. Rudolph (Dan), 203 Weber, rudolphd@math.colostate.edu
Office Hours: MW 2-3 or e-mail for an appointment.
Class meetings: MTWF 12:10-1:00 in E202 ENGR.

Course Content:
The Real Numbers:
  Arithmetic
  Order
  Completeness

Riemann Integration Theory:
  The Cauchy integral
  The Riemann integral
  The Riemann integral and limits
  Characterization of Riemann integrable functions
  Sets of measure zero
  Lebesgue’s characterization of Riemann integrability

Measure Theory:
  Some set theory
  $\sigma$-algebras and $\sigma$-rings
  Measures
  Outer measures
  Borel measures

Lebesgue Integration Theory:
  Measurable functions
  Integration of nonnegative functions
  Integration of general functions
  Modes of convergence
  Product measures and Fubini theorems
  Lebesgue Integration on $\mathbb{R}^n$ and change of variables

Decomposition of Measures:
  Signed measures
  The Radon-Nikodym theorem
  The weak* topology and weak* convergence

$L^p$ spaces:
  Basic theory
  The dual space
  Inequalities

Advanced Topics:
  To be determined by our interests and progress.

Text: We will start with Chapter 6 of Elementary Analysis: The Theory of Calculus
by Ross. I will announce where we will go for text material after that.
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Grading:
Homework will be assigned, collected and graded. You will be expected to correct your homework and resubmit it. There will be two midterm exams, the first once we finish the Riemann theory and the second after we finish the Lebesgue theory. There will be a two hour cumulative final exam on Wednesday May 11, 9:10-11:10. Your grade will be based on a 500 point scale, 100 points from homework, 100 points each for the midterms and 200 points on the final.

Course Format:
I will lecture on new material on MTW. The Friday class will be devoted to problem solving and your questions. As with any advanced mathematics course, there are two goals to the course, to learn the basic material of integration and measure theory and also to learn how to understand, think about and solve problems with this material. As we will use ideas from a variety of texts and perhaps at times from my notes only, it will be extremely important that you participate actively in class as you may not have a text to refer to for some material. I will expect very active class participation on Fridays, students will be expected to present solutions at the board and certainly to ask questions.