

This is a second course in real analysis which builds upon the groundwork set in MAT 544. The prerequisites consist essentially of a working knowledge of Lebesgue measure theory and someone with such knowledge should have no difficulty following the course. A detailed syllabus can be seen following the link below.

Instructor: André de Carvalho
Math Tower 4-103
tel. 632-8266
E-mail: andre@math.sunysb.edu

Office hours: Wed 3:30-4:30pm, Thu 11am-12pm or by appointment.

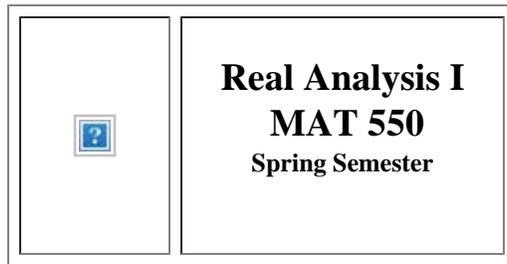
Course Syllabus

Homework: Homework will be assigned approximately weekly and collected one week after having been assigned. Click [here](#) for the assignment. Doing the homework is *fundamental* part of the course work. In particular, it will count for 30% of the overall course grade.

Midterm Exam: Friday, March 8th, in class, including all the material we manage to cover until then.

Final Exam: The final exam is on Monday, May 13th, 8am - 10:30am, in the usual room, P-124.

Final Grade: 30% MT + 30% HW + 40% Final



1. Brief discussion of the measure theory
 - Riesz Representation Theorem
 - Tonelli's and Fubini's Theorems
 - The dual of L^1
 - Radon-Nykodim Theorem
 - Lebesgue's Theorem
 - Hahn Decomposition Theorem
2. L^p spaces, convergence in measure, the dual of L^p
3. Fourier series
 - Riemann-Lebesgue lemma
 - Convergence of Fourier series for differentiable functions
 - Parseval's formula
4. Functional analysis
 - Open mapping and closed graph theorems
 - Uniform boundedness principle
 - Hahn-Banach theorem
 - Existence of orthonormal bases for Hilbert spaces
 - Maximal operator controlling sequences of operators between Banach spaces
5. More measure theory
 - Maximal operators controlling almost everywhere convergence
 - The fundamental theorems of calculus for the Lebesgue integral
 - Change of variables of integration
 - Polar coordinates
6. Partial Differential Equations
 - Separation of variables
 - The heat equation
 - Laplace's equation, the fundamental solution
 - The strong maximum principle and the Liouville theorem
 - The mean-value theorem
 - The Poisson kernel
 - Approximate identities and the Weierstrass theorem on approximation by polynomials
 - The wave equation, d'Alembert's solution
7. Additional Topics
 - Introduction to ergodic theory
 - Birkhoff's Ergodic Theorem

References:

- Daryl Geller, *A first graduate course in real analysis. Part II*, Solutions Custom Publishing (can be ordered from the campus bookstore);
- Walter Rudin, *Principles of mathematical analysis*, 3rd ed., McGraw-Hill, New York 1976;
- Walter Rudin, *Real and complex analysis*, 3rd ed., McGraw-Hill, New York 1987;

- Michael Taylor, *Partial differential equations*, Springer Verlag, 1996.



**MAT 550
Real Analysis I**

Spring 2002

Homework Sets:

1) Chapters 1 and 2 of *Rudin* - Due Friday, Feb. 8th.

Chapter 1: 7, 8

Chapter 2: 8, 10, 11, 15, 17, 25

2) Chapters 3 and 4 of *Rudin* - Due Friday, Mar. 1st.

Chapter 3: 4, 5, 10, 14, 17, 20

Chapter 4: 2, 3, 6, 9, 10, 13, 14

3) Chapter 5 of *Rudin* - Due Friday, Apr. 5th.

Chapter 5: 3, 6, 8, 9, 12, 22

4) Chapters 6 and 7 of *Rudin* - Due, Friday, May 3rd.

Chapter 6: 3, 4, 7, 9

Chapter 7: 2, 5, 7, 14, 22