清華大學數學系
實變函數論一 Real Analysis (I)

Math 5130 Fall 2006

Chapter 1. Preliminaries on Set Theory (1 week)
1.1. Set operations
1.2. Algebra of sets
1.3. Orderings

Chapter 2. Lebesgue Measure and Outer Measure (2 weeks)
2.1. Lebesgue outer measure
2.2. Lebesgue measurable sets
2.3. Characterizations of measurability
2.4. Lipschitz transformations of R^n
2.5. A nonmeasurable set

Chapter 3. Lebesgue Measurable Functions (2 weeks)
3.1. Elementary properties of measurable functions
3.2. Semicontinuous functions
3.3. Egorov's theorem and Lusin's theorem
3.4. Convergence in measure

Chapter 4. The Lebesgue Integral (4 weeks)
4.1. The Riemann-Stieltjes integral
4.2. The integral of nonnegative functions
4.3. The integral of measurable functions
4.4. L^p spaces
4.5. Riemann versus Lebesgue integral

Chapter 5. Repeated Integration (2 weeks)
5.1. Fubini's theorem
5.2. Tonelli's theorem
5.3. Some applications

Chapter 6. Differentiation (4 weeks)
6.1. The Vitali covering lemma
6.2. Lebesgue differentiation theorem
6.3. Differentiation of monotone functions
6.4. Functions of bounded variation
6.5. Absolutely continuous functions
6.6. Convex functions

Midterm Exam 1: Chapter 1 ~ 3
Midterm Exam 2: Chapter 4 ~ 5
Final Exam (Tuesday, Jan 9): Chapter 2 ~ Chapter 6