

**M617**  
**Syllabus**  
**Spring 2004**

1. **Riemann Integration Theory**
  - The Cauchy integral
  - The Riemann integral
  - The Riemann integral and limits
  - Characterization of Riemann integrable functions
2. **Introduction to Continuous Probability**
  - Discrete probability
  - Probability and sets of real numbers
  - Sets of measure zero
  - Bernoulli sequences
  - Lebesgue's characterization of Riemann integrability
  - The Law of Large Numbers
  - Random variables
3. **Measure Theory**
  - Some set theory
  - $\sigma$ -algebras and  $\sigma$ -rings
  - Measures
  - Outer measures
  - Borel measures
4. **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
5. **Decomposition of Measures**
  - Signed measures
  - The Radon-Nikodym theorem
6.  **$L^p$  spaces**
  - Basic theory
  - The dual space
  - Inequalities
7. **Probability Theory**
  - Review and basic theory
  - The Law of Large Numbers
  - The Central Limit Theorem
  - Sample Spaces
  - The Wiener Process