MATH 530, REAL ANALYSIS, SPRING 2017

The course will cover most of the sections in this list.

1. Abstract Integration

(1) Set-theoretic notations and terminology (read ahead)
(2) The concept of measurability
(3) Simple functions
(4) Elementary properties of measures
(5) Arithmetic in $[0, \infty]$
(6) Integration of positive functions
(7) Integration of complex functions
(8) The role played by sets of measure zero

2. Positive Borel Measures

(1) Vector spaces
(2) Topological preliminaries
(3) The Riesz representation theorem
(4) Regularity properties of Borel measures
(5) Lebesgue measure
(6) Continuity properties of measurable functions

3. L^p-Spaces

(1) Convex functions and inequalities
(2) The L^p-spaces
(3) Approximation by continuous functions

4. Elementary Hilbert Space Theory

(1) Inner products and linear functionals
(2) Orthonormal sets
(3) Trigonometric series

5. Examples of Banach Space Techniques

(1) Banach spaces
(2) Consequences of Baire's theorem
(3) Fourier series of continuous functions
(4) Fourier coefficients of L^1-functions
(5) The Hahn-Banach theorem
(6) An abstract approach to the Poisson integral

6. Complex Measures

(1) Total variation
(2) Absolute continuity
(3) Consequences of the Radon-Nikodym theorem
(4) Bounded linear functionals on L^p
(5) The Riesz representation theorem

8. Integration on Product Spaces

(1) Measurability on cartesian products
(2) Product measures
(3) The Fubini theorem
(4) Completion of product measures
(5) Convolutions
(6) Distribution functions

18. Elementary Theory of Banach Algebras

(1) Vector spaces
(2) Topological preliminaries
(3) The Riesz representation theorem
(4) Regularity properties of Borel measures
(5) Lebesgue measure
(6) Continuity properties of measurable functions