Outline. This cross-listed 4th-year undergraduate/1st-year graduate course will give an introduction to measure theory and advanced integration. The topics covered will include $\sigma$-algebras, Lebesgue measure, Borel measures, measurable functions, integration, convergence theorems, $L^p$ spaces, Hölder and Minkowski inequalities, and Radon-Nikodym differentiation.

This is core material which, together with the function space theory covered in Math 421/510, provides the foundation for much of mathematical analysis. This material is useful in many areas of pure and applied mathematics, including harmonic analysis, differential equations, probability theory, information theory, differential geometry, and mathematical physics. The course will be based on Chapters 1-3 of the textbook.

Topics.

1. $\sigma$-algebras, measures and outer measures.
2. Borel and Lebesgue measure.
4. Convergence theorems, including monotone convergence, dominated convergence and Fatou’s Lemma.
5. Product measures and Fubini’s theorem.

Prerequisites: Math 420/507 or equivalent.

Grading: Homeworks (35%), midterm (25%), final exam 40%.