

Integration and Measure Theory (Math 617)

Spring 2016

Technicalities

Instructor: Dr. Clayton Shonkwiler (clayton@math.colostate.edu)

Office: Weber 216

Course web page: <http://www.math.colostate.edu/~clayton/teaching/m617s16/>

Text: *Real Analysis: Modern Techniques and Their Applications*, 2nd ed., by Gerald B. Folland

Time/Location: 1:00–1:50 MTWF, Weber 008.

Office Hours: Monday 2:00–3:00, Wednesday 2:00–3:00 and 4:00–5:00, and by appointment.

Summary of the Course

Measure theory provides the theoretical underpinnings of modern definitions of the integral and serves as the foundation for current approaches to functional analysis and distribution theory – and hence in particular to solving partial differential equations – as well as to probability theory, fractals, and dynamical systems.

The main goal of the course is to develop the basic theory: definitions and examples of σ -algebras and measures, the definition of measurable functions and of the Lebesgue integral, and the Lebesgue–Radon–Nikodym theorem. That groundwork will then allow us to develop two applications of the theory: to Fourier analysis (by way of functional analysis), and to probability theory. If time permits, we will conclude with some connections to random walks and polymer models.

A background in classical real analysis (i.e., MATH 517 material) and some familiarity with the basic concepts of point-set topology and vector spaces are essential prerequisites.

Some other texts that may be useful supplements:

- *Real Analysis: Measure Theory, Integration, and Hilbert Spaces*, by Elias M. Stein and Rami Shakarchi
- *Real and Complex Analysis*, by Walter Rudin
- *Measure and Integral: An Introduction to Real Analysis*, by Richard L. Wheeden and Antoni Zygmund
- *An Introduction to Lebesgue Integration and Fourier Series*, by Howard J. Wilcox and David L. Myers
- *An Introduction to Measure Theory*, by Terence Tao

1 Grading

This is an advanced graduate course, so your grade will be based on homework and class participation. Homework will be collected regularly throughout the semester.

2 Disclaimer

The course syllabus is a general plan for the course; deviations announced in class may be necessary.

3 Anticipated Schedule

Topic	Weeks
Measures	3
Integration	3
The Radon–Nikodym Derivative	2
Functional and Fourier Analysis	4
Probability Theory	2