Integration and Measure Theory (Math 617)

Spring 2022

Technicalities

Instructor: Clayton Shonkwiler (clayton.shonkwiler@colostate.edu)
Office: Weber 206C
Course web page: https://www.math.colostate.edu/~clayton/teaching/m617s22/
Text: *Measure, Integration & Real Analysis*, by Sheldon Axler, which is available free online at https://measure.axler.net
Time/Location: 3:00–3:50 Monday, Wednesday, Friday, Engineering E205.
Office Hours: 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 applications of the theory to probability.

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.

The following books may be useful additional resources:

- *Topics in Real Analysis*, by Gerald Teschl (https://www.mat.univie.ac.at/~gerald/ftp/book-ra/index.html)
- *An Introduction to Measure Theory*, by Terence Tao
- *Real Analysis: Measure Theory, Integration, and Hilbert Spaces*, by Elias M. Stein and Rami Shakarchi
- *Real Analysis: Modern Techniques and Their Applications*, by Gerald B. Folland

1 Grading

This is an advanced graduate course, so your grade will be based on occasional homework assignments and on course participation. Homework will be collected semi-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 and Differentation	3
Product Measures	2
Banach Spaces	4
Decomposition Theorems	1
Probability Measures	2

4 Important information for students

Masks are required inside university buildings. You must also meet university vaccine or exemption requirements.

All students are expected and required to report to the COVID Reporter (https://covid.colostate.edu/reporter/) when:

- You suspect you have symptoms of COVID, regardless of whether or not you are vaccinated and even if your symptoms are mild
- You have tested positive for COVID through a non-CSU testing site, such as home test or test at a pharmacy
- You believe you may have been exposed to COVID go to the COVID Reporter and follow the guidance under "I believe I have been in close contact with someone who has COVID–19." This guidance will depend upon your individual circumstances

You will not be penalized in any way for reporting symptoms or concerns.

Do not ask me as your instructor to report for you. It is your responsibility to report through the COVID Reporter promptly.

As your instructor I may not ask you about vaccination status or if you have COVID but you may freely volunteer to send me information from a public health official if you have been asked to isolate or quarantine.

When you complete the COVID Reporter, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

If you do not have internet access to fill out the online COVID–19 Reporter, please call (970)491–4600.

For the latest information about the University's COVID resources and information, including FAQs about the spring semester, please visit the CSU COVID–19 site https://covid.colostate.edu.