# MATH 6579 Syllabus

Measure Theory for Scientists and Engineers, Section A, 3 credit hours

Fall 2026

## Instructor Information

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Office Hours: TBA

## General Course Information

### Description

This course is an introduction to measure theory and related topics, with a focus on those topics in analysis that we believe are of the most utility in engineering and other sciences. The theory of Lebesgue measure is first developed in the one-dimensional setting and later extended to higher dimensions. The theory of the Lebesgue integral is developed, including fundamental results such as the Dominated Convergence Theorem and Fubini's and Tonelli's Theorems. Finally, abstract measure theory is developed, ending with the Radon–Nikodym theorem for positive measures.

- The course covers many of the topics that are presented in MATH 6337 (Real Analysis I). Some topics, such as bounded variation and differentiation, that are covered in detail in MATH 6337 are omitted from MATH 6579. Other topics, such as absolute continuity and the Fundamental Theorem of Calculus, are presented but not covered in detail. Some theorems whose full proofs are presented in MATH 6337 will be stated but not proved in MATH 6579. Abstract measure theory is covered in MATH 6579, but often is covered in MATH 6338 instead of MATH 6337.
- The appropriate course for Math Ph.D. students is MATH 6337 (Real Analysis I). In particular, students preparing to take the Comprehensive Exam in Analysis should take MATH 6337.
- A student who completes MATH 6579 should be prepared to take other classes for which MATH 6337 is a prerequisite.
- You cannot receive credit for both MATH 6337 and MATH 6579.
- Homeworks and exams in MATH 6579 will require rigorous proofs. All assignments in MATH 6579 allow collaboration (exams in MATH 6337 typically do not).

### Course Learning Outcomes

Upon successful completion of this course, you should be able to:

- Understand and prove theorems on Lebesgue measure,
- Understand and prove theorems on the Lebesgue integral,
- Understand and prove theorems on abstract measure theory.

**Prerequisites**

Prerequisites: Math 4317 (Analysis I)

This is a proof-based graduate-level course in mathematics that builds on the type of mathematical training that is presented in undergraduate mathematics courses. In particular, a student in this course must be fluent in the topics that are covered in a standard undergraduate real analysis course (such as MATH 4317) in order to be successful in this class.

**Required Course Materials**

**Lecture Notes**: C. Heil, *Measure Theory for Scientists, Engineers, and Mathematicians* (posted to Canvas).

Chapter 1: A Review of Real Analysis.

Chapter 2: Lebesgue Measure.

Chapter 3: Measurable Functions and Modes of Convergence.

Chapter 4: The Lebesgue Integral.

Chapter 5: The Dominated Convergence Theorem.

Chapter 6: Higher Dimensions and Repeated Integration.

Chapter 7: The Fundamental Theorem of Calculus.

Chapter 8: Abstract Measures.

Chapter 9: Measurable Functions and Integration.

Chapter 10: Absolute Continuity and the Radon–Nikodym Theorem

**Comparison Text**: The text that is used for MATH 6337 (Real Analysis I) is C. Heil, Introduction to Real Analysis.

Ebook available for free from SpringerLink:
`https://link.springer.com/book/10.1007/978-3-030-26903-6`

Additional resources related to this text are available at
`http://people.math.gatech.edu/~heil/real`

**These are copyrighted materials. Please be respectful of the author's intellectual property and do not re-post or distribute the Ebook or lecture notes without permission.**

Here are some other related books that may be useful as comparison texts.

- Stein and Shakarchi, Real Analysis
- Wheeden and Zygmund, Measure and Integral
- Folland, Real Analysis, 2nd Ed.

**Grading Policy**

We will have 7 homework assignments and one take-home final exam.

| | |
|---|---|
| 7 Homeworks | 30 points each |
| Final Exam (take home) | 40 points |
| TOTAL | 250 points |

Letter grades will be based on your accumulated points at the end of the semester, according to standard 90%, 80%, 70%, 60% cutoffs (although I may adjust the cutoffs downward at the end of the semester, depending on class distribution):

| | |
|---|---|
| 225–250 | A |
| 200–224 | B |
| 175–199 | C |
| 150–174 | D |
| 0–149 | F |

At the end of the course, I'll evaluate the class distribution and decide if a curve is needed. I'll only curve *down* from the above cutoffs, not up.

#### Description of Graded Components

All assessments will be electronic. Homework assignments will be posted on Canvas, and papers will be submitted electronically through Canvas. A subset of the problems on each assignment will be selected for grading.

Homeworks must be written in clear, complete sentences. You will not receive credit if the grader does not understand your writing.

I encourage you to type your homeworks using LaTeX or another mathematical typesetting system. I will provide sample LaTeX files that you can use as templates. Handwritten homeworks are acceptable, but be sure to write only on the *front side* of the page, otherwise bleed-through will be a problem. Use a good scanner to create a pdf file that you can submit through Canvas. Don't try to take pictures of the paper with a phone, it's just not readable.

#### Collaboration, Group Work, and Use of Generative AI

You are allowed (and encouraged) to work together with other students on the homework, as long as you each *independently* write up your own solutions. You are also allowed (and encouraged) to ask me questions, although you should try to think about the problems before asking.

The use of Generative AI is not allowed, either in research while attempting to solve homework problems, nor in writing solutions to homework.

#### Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Late homeworks will not be accepted without advance permission. Extensions may be granted on a case-by-case basis, depending on the reason given.

# Course Policies

## Attendance and Participation

Attendance is encouraged but not required.

## Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

## Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email me as soon as possible in order to set up a time to discuss your learning needs.

## Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

### Inclement Weather and Digital Learning Days

In case of inclement weather or declared digital learning days, I will record my lecture and post it to Canvas.

### Student Use of Mobile Devices in the Classroom

Mobile devices are allowed in the classroom as long as you do not cause distractions in the class.

## Campus Resources for Students

### Undergraduate Student Academic Success Resources

A list of resources for undergraduate students' academic success and information about advising can be found at Success at Tech

### Graduate Student Academic and Professional Success Resources:

A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- Professional Development such as the programming from the Career Center and other professional development resources and events

### Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being.