The University of Chicago
CAAM/Stat 31440/1
Applied Analysis
Autumn 2022

Course Overview

Course description: This course provides an overview of fundamentals of mathematical analysis with an eye towards developing the toolkit of graduate students in applied mathematics. Topics covered include metric spaces and basic topological notions, aspects of mathematical analysis in several variables, and an introduction to measure and integration.

Prerequisites: The course will be self-contained. Familiarity with linear algebra at the level of STAT 243 or MATH 20250 (or equivalent) helpful.

Textbooks:
J. Hunter and B. Nachtergaele, Applied Analysis,
`https://www.math.ucdavis.edu/~hunter/book/pdfbook.html`

F.-C. Liu, Real Analysis, Oxford Univ. Press 2017,
(available online via UChicago library; `https://catalog.lib.uchicago.edu/vufind/Record/12380837`).

Learning Objectives

After successfully completing the course, students will be familiar with and able to reason about:

- ideas related to real analysis, metric spaces, normed linear spaces, and topological spaces,
- the inverse and implicit function theorems, contraction mapping (and more general fixed point) methods and applications to applied mathematics, and
- foundational material related to measure theory and Lebesgue integration.

Students will also refine their skills in developing and expressing their arguments in writing.

Selected bibliography/additional references (not required)

In addition to our assigned textbook, there are many good texts which cover the topics we will be discussing at a variety of levels. A short selection is listed below. Many of them are available in Eckhart Library (some may also be available as online texts through the UChicago library catalog).

- H. Rosenlicht. Introduction to Analysis.
- B.R. Gelbaum and J.M.H. Olmsted. Counterexamples in Analysis.
- M. Adams and V. Guillemin. Measure Theory and Probability.
- R. Wheeden and A. Zygmund. Measure and Integral.
- E.M. Stein and S. Shakarchi. Real Analysis: Measure Theory, Integration, and Hilbert Spaces.
- E.H. Lieb and M. Loss, Analysis, 2nd ed.

From time to time, we may draw on portions of material from the above references (as well as others) in preparing the lecture and problem sets.

Grading

Students are expected to attend and participate in classes, complete assignments and take exams. Your final grade in this course will consist of one midterm exam, one cumulative final, and homework assignments. The breakdown of points will be as follows:

Homework (40%): Approximately 6–8 assignments.
(The lowest homework score will be dropped.)
Midterm Exam (30%)
Final Exam (30%): Comprehensive.
Date and Location: To be determined by registrar's office.