MATHEMATICS 6526

Real Analysis

MAT 6526 Textbooks: A Radical Approach to Lebesgue's Theory of Integration, David Bressoud, Cambridge University Press, ISBN 978-0-521-88474-7 (hardback); 978-0-521-71183-8 (paperback).

Author's website: http://www.macalester.edu/aratra/index.html

Prerequisites: Advanced Calculus.

Course Description: An undergraduate mathematics major spends a great deal of time studying the development and application of Riemann integration. This is sufficient for most application. However, in more general setting and in mathematical research, one find the need to consider the limits of sequences of functions and their integrals. Unfortunately, the Riemann integral does not perform well in such situations. To get around these problems, one must consider some generalization of the Riemann integral. In this class, we will develop the properties of the Lebesque integral and consider several general results using this new integral.

This course carries 3 hours of graduate academic credit.

Learning Objectives: We will discuss, time permitting:

- Measurable sets
- Construction of measures and in particular the Lebesque and Lebesque-Stieltjes Measure
- Metrics and Metric Spaces
- Measurable Functions and Simple Functions
- Integrals of Simple Functions and the definition of the Lebesque integral
- Normed Linear Spaces, Completeness and Banach Spaces
- L_p spaces and results
- Several Major Theorems of Functional Analysis will be discussed and proven. As time permits, we will investigate:
    - Lebesgue Bounded Convergence Theorem
    - Lebesgue Monotome Convergence Theorem
    - Fatou's Lemma
    - Holder's Inequality
    - Minkowski's Inequality
    - Fixed Point Theorem
    - Banach-Steinhaus Theorem (Principle of Uniform Boundedness)
    - Open-Mapping Theorem

- Closed-Graph Theorem
- Hahn-Banach Theorem

Meetings: The format of class meetings will consist of lectures by the instructor and presentation of problems by students. Students are expected to participate weekly.

This class meets as scheduled. You are expected to be in class on time. University policy states that a student cannot miss more than 25% of class meetings and receive credit for the course. Further, attendance will be necessary in order to understand the material and make a good grade. The student is responsible for work and material missed when absent. Cheating in any way will be properly rewarded according to University policy.

If you need special accommodations due to learning, physical, psychological, or other disabilities, please contact the Counseling and Career Development Center.

Grading: During the semester, there will be two examinations. Further, there will be library papers and homework. The semester grade will be based on an average where the exams comprise 75% and the library projects and homework counting the other 25%.

The grading scale is

A=80-100

B=60-79

C=40-59

D=30-39

F=0-29

Also, B+ and C+ grades can be awarded at the discretion of the instructor. Aim now for the desired grade. Finally, all graded work will be returned to the student for keeping. If there were any question later about your grade, you would be expected to show these papers.