Math 454 Principles of Real Analysis Fall 2020 Q2

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Class meets Quarter 2, Nov. 30 – Jan. 28, MWF 1:30-3:45 **online** or in **Olin 108.**

Office Hours: **ONLINE, times to be announced,** or email me to set up an appointment.

Textbook: **Abbott, *Understanding Analysis***, Springer, 2e, 2016
ISBN 9781493927111 or 9781493950263 (2nd printing) or 9781493927128 (eBook)

Grades: The course grade will be determined using the following weights:
four exams at 20% each, homework/attendance/participation 20%.

Prerequisites: Math 220: Mathematical Reasoning and Writing, Math 240: Linear Algebra.

Course Description: This course studies functions of a real variable and examines the foundations of calculus, with an emphasis on writing rigorous analytical proofs. It follows the historical development of analysis beginning with a rigorous axiomatic description of the real numbers and proceeding through the topology of the reals, sequences, series, limits, continuity, pointwise and uniform convergence, differentiation, Taylor series, and integration.

In Calculus I and II you learned the methods and computations of calculus. Now you will delve into the theory of why it works. Why are 220 and 240 required? Because these courses should have introduced you to the basic techniques of writing a mathematical proof.

Sources of Assistance:

● Discussing homework problems with **classmates** is encouraged, but standards of academic honesty apply to homework as well as exams: **what you turn in should be your own work.** Do not copy solutions from classmates or outside sources. Homework is only 20% of your grade, because *I want you to make mistakes on your homework* and learn from them; however, the time and effort you put into homework will prepare you for the exams.

● **Virtual office hours on Zoom.** See katie.luther.edu for a link to the recurring meeting.

● The **library**. If you don't understand something, see if another book provides a better explanation. See section **QA300**. Other texts I recommend include Gordon, Bressoud, Pugh, and Rudin's *Principles of Mathematical Analysis*.

● **Exams are measures of individual performance**. You may ask me for clarification, but do not refer to any outside sources or discuss exam problems with classmates.

Diversity statement: I try to foster an inclusive learning environment. Students with different learning styles and diverse backgrounds are welcome. Members of the Luther community are expected to act respectfully toward others, whatever our gender, sexuality, disability, religion, ethnicity, race, culture, or socioeconomic status. Please inform me at the start of the term if you have any accommodations from the Disability Services office.

Illness and conflicts: If you are ill, please inform me as soon as you are able, to request extensions on assignments or exams.

Class recordings: Students are expressly prohibited from recording any part of this course. Meetings of this course may be recorded by the instructor. Any recordings will be available to students registered for this course for educational purposes. Students may not reproduce or share these recordings with persons who are not in the course, nor may they upload them to other online environments. If the instructor plans any other uses for the recordings beyond this course, students identifiable in the recordings will be notified to request consent prior to such use.

Anticipated Schedule:

Week	**Date**	**Chapter**	**Topics**
1	M 11/30	1.1-1.6	Ch. 1 – Real Numbers, proof-writing rubric, sup, inf, Axiom of Completeness, Cantor's Theorem
	W 12/2	2.1-2.3	Ch. 2 – Sequences and Series
	F 12/4	2.4-2.5	Monotone Convergence Theorem, Bolzano-Weierstrass Theorem
2	M 12/7	2.6-2.9	Cauchy sequence, infinite series and convergence tests
	W 12/9		**Exam 1 – due M 12/14**
	F 12/11	3.1-3.2	Ch. 3 – Basic Topology of R, Cantor set, open and closed sets
3	M 12/14	3.3-3.4	Compact sets, Heine-Borel Theorem, perfect, connected
	W 12/16	4.1-4.3	Ch. 4 – Limits and Continuity, uniform continuity
	F 12/18	4.4-4.6	Intermediate Value Theorem
4	M 12/21		**Exam 2 – due W 1/6**
	W 12/23 – N 1/3		Holiday Break
5	M 1/4	5.1-5.3	Ch. 5 – Derivative, Darboux's Theorem, Mean Value Theorem
	W 1/6	5.4-5.5	Example
	F 1/8	6.1-6.4	Ch. 6 – Sequences and Series of Functions, pointwise and uniform convergence
6	M 1/11	6.5-6.7	Power series, Taylor series
	W 1/13		**Exam 3 – due M 1/18**
	F 1/15	7.1-7.4	Ch. 7 – Riemann Integral, definition of Riemann Integral, U(f), L(f)
7	M 1/18	7.5-7.7	Fundamental Theorem of Calculus, measure zero, Lebesgue's Theorem
	W 1/20	8.1	Ch. 8 – Generalized Riemann Integral
	F 1/22	8.1	tagged partition, gauge, Kurzweil-Henstock Integral
8	M 1/25		**Exam 4 – due W 1/27**
	W 1/27		evaluations