SYLLABUS

MTH 311/411 – Real Analysis – Fall 2020

Instructor: Dr. Sofya Chepushtanova

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- Class webpage: `http://chepusht.mathcs.wilkes.edu/real-analysis-fall2020`

Class Meetings: MWF 09:00-09:50 am and R 01:00-01:50 pm in SLC 405.

Office Hours: MWF 10:00-11:00 am and TR 12:00-01:00 pm or by appointment. *Office hours will be held virtually.*

What is Real Analysis? Real analysis is an examination of the theory of calculus of a single variable. Topics include properties of the real numbers, topology of the real line, and a rigorous treatment of sequences, functions, series of functions, limits, continuity, differentiation and integration.

Prerequisites: MTH 302 or an equivalent course (or consent of the instructor).

Textbook: *Understanding Analysis* by Stephen Abbott, 2nd ed. (Springer).

Course Objectives: To help students

- develop a working knowledge of concepts and terms in Real Analysis;
- develop their ability to solve problems using that knowledge;
- enhance their appreciation for inner workings of Calculus;
- develop their ability to read and write concise, conventional proofs;
- generally sharpen their ability to solve problems and communicate clearly in mathematics.

COVID-19 Safety Rules: *Always wear a mask. Wash your hands or use hand sanitizer. Sanitize your desk before class. Use the same seat in the classroom (for contact tracing purposes). No eating or drinking allowed in the classroom. If you are sick, stay at home (and let me know).* Refer to the guidelines in *COLONELS COMBAT COVID*.

Attendance: You are expected to attend classes regularly. *Remember that poor attendance is a major contributor to poor performance!* If you miss a class, it is your responsibility to obtain notes from a classmate, find out any announcements made during the class, and make sure your homework turned in on time.

Homework and Quizzes: Homework problems will be assigned regularly. Start working on assigned problems as soon as the corresponding section(s) are covered. *It is a fact that doing*

problems is the way to learn mathematics. You may discuss homework problems with your classmates, but I insist that everybody writes up their own solutions demonstrating understanding. Problem sets will be due at the beginning of class. Homework submitted within 24 hours after class will be subject to 25% deduction from the total score of this problem set. Problem sets which are more than 24 hours late *will not be accepted for grading.*

Write your homework solutions neatly and legibly on 8.5" x 11" paper. You are also encouraged to type your solutions using TEXor LATEX, the standard in mathematical typesetting. There are versions available for you to use in the department labs. See our course webpage for tutorial and example links.

On occasion throughout the semester, you will be given short (5-10 minute) in-class quick response quizzes. These will be easy and are simply to encourage you to keep up with the class and reward your attention.

The lowest homework and quiz scores will be dropped.

Graduate (MTH 411) Students will receive extra homework and exam assignments and a project to be submitted by the end of the semester.

Exams and Grade Distribution: There will be two take-home midterm examinations and a comprehensive final take-home examination with a possible oral presentation part.

MTH 311 student's final score in this course will be calculated as follows:
Homework and Quizzes 20% + Midterm Exams (50%) + Final Exam (30%) = 100%.

MTH 411 student's final score in this course will be calculated as follows:
Homework and Quizzes 15% + Project 5% + Midterm Exams (50%) + Final Exam (30%) = 100%.

The final grade will be computed from the total percentage earned as follows:

Raw Score	0 to 59%	60 to 64%	65 to 69%	70 to 74%	75 to 79%	80 to 84%	85 to 89%	90 to 100%
Grade	0	1.0	1.5	2.0	2.5	3.0	3.5	4.0

Drop Policy: If you wish to drop from the course, I will give my permission during the first ten weeks of the semester. Thereafter you will need the permission of the Dean. Be aware that poor performance in the course will not be a sufficient reason for the Dean's permission to be granted.

Academic Honesty: By handing in homework, quizzes, and exams you certify that this is your own work. You may discuss homework solution strategies with fellow students but the final write-up must be your own. A violation will result in a grade of zero on that particular assignment; serious or repeated infractions of the Academic Honesty policy will result in failure of the course.

Cell Phones should be switched to silent mode (or turned off), and put out of sight during class time. **NOTE: THE USE OF CELL PHONES DURING EXAMS IS EXPRESSLY FORBIDDEN AND WILL RESULT IN A GRADE OF 0.**

Email Etiquette: Please refer to the following tutorial on how to communicate with your instructor via email: `https://www.math.uh.edu/~tomforde/Email-Etiquette.html`. View an email to a professor as a professional interaction. How you choose to interact conveys your level of seriousness and professionalism.

Outline of Topics

Although we may deviate from this, the tentative plan for the course is to cover the following topics.

1. Week of 8/23: Introduction. The Irrationality of $\sqrt{2}$. Preliminaries. The Axiom of Completeness.
2. Week of 8/30: More on Completeness. Cardinality. Cantor's Theorem.
3. Week of 9/6: Infinite Series. The Limit of a Sequence. The Algebraic and Order Limit Theorems.
4. Week of 9/13: The Monotone Convergence Theorem. Subsequences and The Bolzano-Weierstrass Theorem.
5. Week of 9/20: The Cauchy Criterion. Properties of Infinite Series.
6. Week of 9/27: Basic Topology of $\mathbb{R}$: The Cantor Set, Open and Closed sets, Compact and Connected sets.
7. Week of 10/4: Functional Limits. Continuous Functions.
8. Week of 10/11: Continuous Functions on Compact Sets. The Intermediate Value Theorem.
9. Week of 10/18: Derivatives and the Intermediate Value Property.
10. Week of 10/25: The Mean Value Theorems. A Continuous Nowhere-Differentiable Function.
11. Week of 11/1: Uniform Convergence of a Sequence of Functions. Uniform Convergence and Differentiation.
12. Week of 11/8: Series of Functions. Power Series. Taylor's Series.
13. Week of 11/15: The Riemann Integral.