M361K (53825) **Introduction to Real Analysis**
Spring 2024

Class meets: PMA 5.124, TTH 930-11
Instructor: Francesco Maggi, maggi@math.utexas.edu
Office hours TTH 11-12, PMA 10.124.
Note: An additional office hour will be planned to accommodate possible schedule conflicts.

Course Description

Overview: Around the second half of the 17th century, the methods of "infinitesimal calculus" (derivatives, integrals, power series) were discovered by Newton and Leibnitz, leading to the solution a wealth of long-standing problems in Physics and Geometry. For about two centuries, infinitesimal calculus methods had been used with only an intuitive and informal understanding of the limit procedures behind their definition, this indeterminacy or confusion leading only to sporadic errors. This honeymoon period ended with Fourier's groundbreaking work on partial differential equations: indeed, Fourier's theory, which aims at expressing solutions to partial differential equations as trigonometric series, requires the systematic interchange of series and integrals operations, leading to paradoxical results whenever these two limit operations cannot actually be interchanged. By the end of the 19th century the best minds in Mathematics had started the systematic investigation of the foundations of infinitesimal calculus, and a course like "Introduction to Real Analysis" is a first account on these efforts.

This course is conceptually *very* different from other courses in Mathematics, like Calculus, Linear Algebra or Differential Equations, where emphasis is put on *computing quantities,* and one operates only with an *intuitive meaning* of the mathematical objects introduced. Rather, as a proof-based course, Introduction to Real Analysis requires understanding the language in which proofs are written, and how to translate intuition into rigorous, unambiguous terms. Do not underestimate the conceptual difference between previous Mathematics courses you have taken, and study for this class carefully from day one!

What will I learn?/Learning outcomes: A rigorous and self-consistent presentation of some basic topics in Real Analysis, including the construction of real numbers, the basic theorems about sequences and series of real numbers, the notions of pointwise limit, continuity, differentiability, and integrability of a function, the basic theorems relating integrals and derivatives. You will learn how to read and write proofs concerning these objects in an unambiguous and clear way.

How will I learn? By attending lectures (there are going to be two 75 minutes lecture per week) and by self-study. Lectures will be recorded, so that, for example, you will be able to complete your notes after class. You should plan to dedicate at least three hours per week to out-of-class, independent work, including studying the lectures, reading the textbook and working on homework assignments.

Course Requirements

Prerequisites Either consent of the Undergraduate Mathematics Faculty Advisor or two of the following courses with a grade of at least C- in each: Mathematics 325K or Philosophy 313K, Mathematics 328K, Mathematics 341. Students who have received a grade of C- or better in Mathematics 365C may not take Mathematics 361K.

Textbook: Bartle & Sherbert, Introduction to Real Analysis, Wiley, fourth edition. Any other edition will do. The textbook is required in the sense that the support of a good textbook is needed for succeeding in this class. Other textbooks may do, but please double-check with me if you want to use another one.

Assignments: Assessment is based on weekly homework assignments, three mid-term in-class exams, and a final exam. For organizational reasons **late homework will not be accepted** and there will be no make-up exams, so write down **immediately** the following dates:

First in-class exam Tuesday, February 20;
Second in-class exam Tuesday, April 9;
Final exam We will need to wait January 16, and check this website https://registrar.utexas.edu/schedules/242/finals to know when the Final Exam for this class will be scheduled by UT!

Absences: If a student is absent on the day of one (or more) midterm, the missing grade will be replaced by the grade of the final exam.

Attendance policy You are strongly suggested to be present to all in-class activities. This is a hard course. It requires a higher level of abstraction than other courses, and you will need to achieve a relevant maturation in your understanding and formal writing of Mathematics. All these objectives are hardly achieved by self-study alone. Attendance is not used in determining the course grade.

In class conduct: All computers, cell phones and other hand-held devices must be put away in SILENT mode and out of sight during class and during exams. Note-taking with ipads is permitted.

Assessment and grading policy Assessment is based on homework, two mid-term in-class exams, and a final exam, which are scheduled according to the Course Plan. Homework will count for 20% of the final grade. Each mid-term will count for 25% of the final grade. The final will count for 30% of the final grade. There will be 13 homework assignments, each graded on the scale 0-10. Each mid-term will then be graded on the scale 0-162, and the final will be graded on the scale 0-196. Your total score will be expressed in the scale 0-650. Your final grade will be determined as follows:

A **604-650** (that is, 93% of available points or more)
A- **585-604** (90%)
B+ **565-584** (87%)
B **539-564** (83%)
B- **520-539** (80%)
C+ **500-519** (77%)
C **474-499** (73%)
C- **455-473** (70%)
D+ **435-454** (67%)
D **409-434** (63%)
D- **390-408** (60%)
F **0-389**

Homework rules: Thirteen assignments are posted on Canvas as detailed in the Course Plan. **Each**

assignment is graded 0-**10** points. In order to receive credit for an assignment you **must**: write your name and UT eid at the top of the first page of your turned assignment, **staple** further pages carefully, **write clearly**, label your exercises in a neat way, show all of your work, return it before lecture begins.

In-class exams: Two in-class exams are scheduled during class hours, the first on Tuesday, February 23, the second on Tuesday, April 12. **Each** in-class exam is graded 0-**175** points. In order to receive credit for an in-class exam you **must**: write your name and UT eid at the top of the first page of your turned solutions, label your exercises in a neat way, and show all of your work. As per all other in-class activities, the use of computers, tablets, smartphones, or mobiles is not allowed during in-class exams. Moreover, you cannot use notes or consult books during the exam. Calculators not needed.

Final exam: It is scheduled on Thursday, May 17, 9-12, and graded 0-**210** points. All the rules valid for in-class exams apply to the final exam as well.

Office hours: I am planning to have two office hours right after class (so TTH 11-12). I will also send out a request to each student with a scheduling conflict on those hours to send me their schedules, so that I can add additional office hours to accommodate everyone. Please **come to office hours!** They are a very effective tool to learn!

University Policies

DEADLINES FOR DROPPING A COURSE. If a student drops a class on or before the 12th Class Day, **Jan 31st**, the class will not show up on the transcript. If the student drops a class after that date, the course will show up on the transcript with a "Q" grade. After **March 26th**, it is not possible to drop a course except for extenuating (usually non-academic) circumstances.

University policy on observance of religious holidays. By UT Austin policy, student must notify the instructor of any pending absence prior to the date of observance of a religious holy day. If a student misses a class, an examination, a work assignment, or a project in order to observe a religious holyday, the student will be given an opportunity to complete the missed work within a reasonable time after the absence.

Academic integrity code. Each student in the course is expected to abide by the University of Texas Honor Code: "As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity." Plagiarism is taken very seriously. If one uses use words or ideas that are not their own, one must cite sources. Otherwise the student will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. The student is responsible for understanding UT's Academic Honesty and the University Honor Code:
https://deanofstudents.utexas.edu/conduct/standardsofconduct.php

For details and complete code, see: https://www.utexas.edu/about/mission-and-values

Disability Support Services (DSS): Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement (DDCE), Services for Students with Disabilities (SSD) at http://ddce.utexas.edu/disability.

CALENDAR FOR M361K

H=Homework	**T 11-12.30 RLM 5.124**	**TH 11-12.30 RLM 5.124**
Week1 **16-18 Jan**		H1 assigned
Week 2 **23-25 Jan**		H1 due. H2 assigned
Week 3 **30 Jan-1 Feb**		H2 due. H3 assigned
Week 4 **6-8 Feb**		H3 due. H4 assigned
Week 5 **13-15 Feb**		H4 due. H5 assigned
Week 6 **20-22 Feb**	**First midterm**	H5 due. H6 assigned
Week 7 **27-29 Feb**		H6 due. H7 assigned
Week 8 **5-7 Mar**		H7 due. H8 assigned
Week 9	**Spring break**	**Spring break**
Week 10 **19-21 Mar**		H8 due. H9 assigned
Week 11 **26-28 Mar**		H9 due. H10 assigned
Week 12 **2-4 Apr**		H10 due. H11 assigned
Week 13 **9-11 Apr**	**Second midterm**	H11 due. H12 assigned
Week 14 **16-18 Apr**		H12 due. H13 assigned
Week 15 **23-25 Apr**		H13 due. Final Review assigned.

This said... let's learn some Real Analysis!!!