

MATH 6320, FALL 2018

THEORY OF FUNCTIONS OF A REAL VARIABLE

Class Website: www.math.uh.edu/~tomforde/Math6320F18.html

On the course website you will find reading assignments, practice problems, quizzes, and various deadlines as they are assigned, as well as a copy of this syllabus and announcements as they are made.

Course Description

This course is an introduction to Measure Theory and Integration. This two-semester sequence of classes provides an introduction to modern analysis. The core of the course will cover measure, Lebesgue integration, differentiation, absolute continuity, and L^p spaces. We will also study aspects of functional analysis, Radon measures, and Fourier analysis.

Instructor

Dr. Mark Tomforde
Office 601 PGH
www.math.uh.edu/~tomforde

Class Meetings

MWF Noon – 1PM
Agnes Arnold Hall, Room 301

Prerequisites

Math 4332 or a rigorous analysis course covering metric spaces

Office Hours

MW 11:00 – 11:50AM
Office 601 PGH

I encourage you to come by my office if you have questions, need help with homework problems, or want to talk about the material.

Objectives

Students will become comfortable with methods of modern analysis and be able to use results and techniques covered in the course to solve problems and prove results of their own. Great emphasis will be placed on effective writing and communication. Students will also be exposed to the notation, language, and methods used by professional mathematicians.

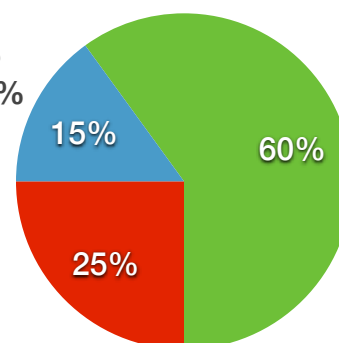
Textbook

Real Analysis: Modern Techniques and Their Applications, 2nd Ed., by Gerald B. Folland
supplemented by notes from instructor

Grading

Your final grade for the class will be determined as follows:

- Class Participation: 15%
- Quizzes (Best 5 of 6): 60%
- Final Exam: 25%



Class Participation

Class participation is based on attendance and how engaged you are in class meetings.

It is vital to attend every class meeting and pay attention, particularly since some lecture material does not appear in the text. If you have to miss class for school approved reasons (e.g., school sponsored events, major religious holidays) you need to let me know as soon as possible, and prior to the missed class, for it to not count against your grade. Please keep in mind that class participation is 15% of your final grade, which is significant.

Your grade for class participation is **not based on how much you talk** and also **not based on how many questions you ask or answer in class**. You are only asked to **be an active listener** (i.e., fully concentrating on the lecture, signaling understanding or confusion, and responding appropriately to questions asked of the entire class). You lose participation points for missing class or not paying attention (e.g., texting, reading non-class materials, talking). You also lose points by disturbing others, interrupting the lecture, or obstructing the learning process of others.

Quizzes and the Final Exam

There will be six quizzes throughout the semester and one Final Exam. Each quiz will be short; typically one or two questions, but possibly with multiple parts. All quizzes and the Final Exam will be take-home, open book, and open notes, but must be worked on independently. More specifically, the rules are as follows: **Quizzes and the Final Exam will be take-home with an assigned due date. You are allowed to use your class notes, the textbook, my notes, and any solutions to practice problems that you have written up. You are also allowed to talk to the instructor. You are not allowed to look at other books, use the internet to look up information related to the questions, or to talk to anyone else about the questions other than the instructor. Failure to follow these instructions will be considered a violation of the honor code.**

Quiz and Final Exam solutions are expected to contain carefully written proofs. **You should think of proofs as writing assignments.** When a problem asks you to prove (or show or verify) a proposition, you should write the proof up in “textbook style”. This should include a statement of the proposition you are proving, followed by a proof providing a clear and logically correct argument that explains to the reader why the result is true. Throughout the course you will get feedback on your proof writing, and see many examples of correctly written proofs in your textbook and in class, but you should be aware at the outset that **at a minimum, your proofs must contain complete sentences, proper spelling and grammar, and correct English usage.**

Out of the six quizzes during the semester, I will drop the lowest score of the six, and use the remaining five to calculate your final grade. These remaining five will constitute 60% of your final grade, which means each of the five counted quizzes contribute 12% toward your final grade. You cannot drop the Final Exam, and it constitutes 25% of your final grade. The dropping of one quiz serves many purposes, including to account for unexpected absences (e.g., illness or getting caught in traffic). So if you are unable to turn in quiz for some reason, it will count as your dropped quiz. The

Final Exam will use same format as the quizzes, but it will be a little longer (multiple questions instead of one or two).

Grading Scale for Quizzes and the Final Exam

Problems on quizzes and the Final Exam will be graded on a 4.0 scale similar to the GPA scale used in universities. You can easily convert this to a letter grade < <https://pages.collegeboard.org/how-to-convert-gpa-4.0-scale> >, and it mitigates the effect that low scores have on your average (it's much easier to come back from a zero on a 4.0 scale than a zero on a 100% scale). To help you interpret your performance on a 4.0 scale, you can use the following rough guide:

- 4.0 Mastery of Topics, no errors in work.
- 3.0 Basic Proficiency with Using the Material, may have small errors in work.
- 2.0 Borderline Competency, many small errors or a few large errors in work.
- 1.0 Not Competent, many large errors in work

With regards to preparing for preliminary exams: A student receiving a 4.0 on a problem should be able to currently complete a similar problem on the Analysis preliminary exam. A student with a 3.0 on that problem would not currently be able to complete such a problem, but should be able to do so with more study and practice. Students with 2.0 or lower on the problem would need significant improvement to deal with the topic, and they may have to fill in gaps from prior courses or perform substantial additional work.

Policies for Work that is Turned In

- **Quizzes are due at the beginning of class on their due date. Late quizzes will not be accepted for any reason. A quiz is late once I have started lecturing.**
- **Work without a name will not be accepted.**
- **Quizzes and the Final Exam will not be accepted by email.**
- **Solutions should be written legibly and on only the front side of the paper. Leave enough room for the grader (me) to make comments.**
- **If your work is more than one page, it should be stapled in the upper-left-hand corner.**
- **All work should be written on standard-sized paper (8.5" x 11"), with no "fringe" down the side as a result of the paper having been torn out of a spiral notebook**
- **Quizzes not picked up within one week of being returned in class will be discarded.**

Points will be deducted for each infraction of the above policies.

Reading Assignments from Folland

Every few days I will give you a reading assignment from the textbook by Folland, with a due date for the reading. You will be reading this material before it is presented in class, so that when you see it in lecture it will be your second exposure. As you read, you should take your own notes and think of comments and questions that you can raise in class. Folland's textbook is a very standard reference for a class in Measure Theory and Integration, but it also has a reputation for being difficult to read. It is written in a style that is dense, assumes a high level of mathematical maturity of the reader, and skips steps in arguments that the reader is expected to fill in. Be prepared to read with pencil and paper in hand, and if you have difficulty as you read, do not get discouraged — keep in mind that class and my own notes will give you additional opportunities to engage the material.

Lectures

In class we will cover the material from the reading assignment, and I will sometimes introduce additional topics not found in Folland. My emphasis will be on motivating the material and fitting it into a larger context, as well as focusing on some of the details in arguments to point out difficulties or subtleties in steps of proofs. Class will therefore be a mixture of the methods of Birds and Frogs.¹ You are welcome to ask questions or make comments in class, but remember that I have a schedule to keep to ensure that we cover all the material needed for the Analysis preliminary exam. Don't be afraid to ask questions in class, but please be responsive if I sometimes tell you I need to defer lengthy responses to office hours to keep on schedule. Also, to keep to the schedule, I will sometimes skip routine arguments or calculations in class, and provide you with detailed accounts in the notes I write up. I'll do my best to be judicious about this, going through those details in class that will benefit from my comments, and leaving other, more standard ones, for you to work through on your own. But, if you find you're having difficulty with the material I've left for you to cover on your own, you are welcome to give me feedback.

My Notes

After we complete a topic in class (which may take multiple lectures), I'll send you notes on the lecture material that I've written up. The notes will provide more explanations of what we covered in class, contain careful proofs, and sometimes reproduce terse arguments from Folland with more details filled in. Since these notes are created by me, I ask that you do not share them with anyone outside of the class. In particular **do not send the Notes to anyone by email** and **do not post the Notes on the internet**.

¹ This is a reference to a quote by Freeman Dyson, who said "Some mathematicians are birds, others are frogs. Birds fly high in the air and survey broad vistas of mathematics out to the far horizon. They delight in concepts that unify our thinking and bring together diverse problems from different parts of the landscape. Frogs live in the mud below and see only the flowers that grow nearby. They delight in the details of particular objects, and they solve problems one at a time." Mathematics needs both birds and frogs, and individual mathematicians often have to use the methods of each.

Practice Problems

I will assign a wide variety of Practice Problems for you to do. It's up to you to complete these, although none of them will be turned in or graded. It is a great idea to work on these problems through a careful combination of group work with other students balanced with individual work and write-ups that you undertake on your own. The Practice Problems are provided so you have the opportunity to actually use the material (not just enjoy it as a passive spectator), develop skills with measure theory and integration, and gauge your understanding of the topics we are covering. The problems will help you to identify those topics or concepts on which you need more work, and hopefully also expose material that you thought you understood but suddenly discover that you don't. At this point in your academic career, you should be prepared to take responsibility for your own learning. Part of this responsibility entails making sure you know how to do problems, and monitoring your own understanding of the material. In addition to selecting practice problems that cover appropriate topics, my role is to help you to become an independent learner by providing guidance and support (as well as an occasional hint) when you get stuck. Office hours are a good time to talk through difficult problems, ask for hints to solutions, or discuss the content material related to the exercises.

Some Advice

The main thing you should focus on is learning the material. Everything else (including your grades, passing preliminary exams, and having your TA fellowship renewed) will take care of itself if you learn the material in your courses well. Don't get caught up in counting points or trying to "game the system" for grades. Focus on understanding.

Makeup Policy

Turning in any quiz or the Final Exam late results in a score of zero, and you will not be allowed to make up the work. Exceptions may be made in the case of extreme circumstances, such as a documented, serious illness. You are always welcome to turn in work early, and in the event you need to do this, you should talk to me about the logistics of getting your solutions to me.

Blocks on UH Email and Policy on Missed Emails

Many email providers, including Yahoo, Google, Comcast, AOL / Verizon, and Hotmail have been blocking or filtering emails from uh.edu accounts on and off since last October. This has created problems with communication between students and professors. It is in your best interest to communicate with me using your math.uh.edu account if you have one, or your uh.edu account otherwise. Also, keep in mind that **UH policy states the following:**

"All required written notices from faculty shall be addressed to students via their UH email. Notices properly addressed and so sent shall be presumed to have been received by the students. Thus, students are responsible for the content in emails sent to their UH account, regardless if their external (non-UH) email provider filters or blocks them. Emails lost to external providers shall not be used as a justification to claim faculty are unresponsive, to appeal grades, etc."

Honor Principle

University of Houston students are expected to adhere to the Academic Honesty Policy as described in the Student Handbook. In this course this shall mean the following: **Quizzes and the Final Exam shall be worked on independently and the write-up must be done on the student's own, without the help of other people or outside sources. If you are aware of anyone who is cheating or receiving unfair outside assistance, you are honor bound to inform the professor of what is occurring, and you will be considered an accomplice if you do not.** Anyone caught cheating will receive a failing grade in the course and be reported to the department chair and dean for further disciplinary action.

Classroom Environment

As your professor, I hold the fundamental belief that everyone has a right to learn and deserves unrestricted access to education. I also believe that everyone in this class is fully capable of mastering the material. I value diversity, social justice, inclusion, and equality. I am therefore committed to creating a classroom environment that welcomes all students, regardless of race, gender, social class, religious beliefs, etc. If there is anything causing barriers to your inclusion or achievement, please come talk to me. Likewise, any student with a disability or chronic health problem should talk to me about the types of assistance that might be offered.

CAPS Statement

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless.

You can reach CAPS < www.uh.edu/caps > by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the "Let's Talk" program, a drop-in consultation service at convenient locations and hours around campus. < http://www.uh.edu/caps/outreach/lets_talk.html >

Important Dates

August 20, First Day of Class

August 24, Quiz #1 due

September 3, Labor Day (No Class)

September 5, Official Reporting Day (ORD), Last day to add or drop without receiving a grade

September 7, Quiz #2 due

September 28, Quiz #3 due

October 12, Quiz #4 due

November 1, Last Day to Withdraw with a W

November 2, Quiz #5 due

November 16, Quiz #6 due

November 21-25, Thanksgiving Break (No Class)

November 30, Last Day of Class and Final Exam due