Math 112A − Syllabus

Partially Differential Equations, but a whole lotta fun!

Friday, September 27, 2019

Welcome to Math 112A, a partial differential adventure awaits you! This is the survival manual for this course, where you can find all the administrative info you need to know, such as office hours, grading, and other goodies. Feel free to e-mail me if you have any other questions.

- **Instructor:** Peyam (Pie-Am) Ryan Tabrizian

- **E-mail:** drpeyam@gmail.com

- **Office:** 410N Rowland Hall

- **Class meeting times:** This course meets on MWF 4-4:50 PM in 1600 DBH. I do not take attendance, so whether you show up to class is entirely up to you. I will post lecture notes on my website, in case you want to know all the fun that you've missed

- **Office Hours:** W 12:30-1:30 PM and Th 2-3 PM, but feel free to show up whenever you want. That said, I do not take office hours by appointment.

- **TA information:**
  Name: Yang Yang
  E-mail: y.yang@uci.edu
  Office: 410T Rowland Hall

- **Discussion Section:** TuTh 4-4:50 PM in 2200 ALP. Attendance is optional, but remember that you have HW/Quizzes most Thursdays during discussion section. What is covered in the discussion section is entirely up to the TA's discretion.

- **Enrollment and Waitlists: I have no control over the waitlist.** For any administrative issues such as class enrollment, please contact Jezelle Rabbath. Her office is in 340B Rowland and her e-mail is younanj@uci.edu

- **Important Dates:**
  - ▶ Th 09/26: No discussion section/HW/quiz (section before lecture)
  - ▶ F 10/11: Last day to add/drop a course/change the grading option.
  - ▶ **W 10/30, 4-4:50 PM: Midterm Exam** (during lecture)
  - ▶ Th 10/31: No discussion section/HW/quiz (day after midterm)
  - ▶ M 11/11: No lecture (Veterans Day)
  - ▶ Th 11/28: No discussion section/HW/quiz (Thanksgiving)
  - ▶ F 11/29: No lecture (Thanksgiving)
  - ▶ **W 12/11, 4-6 PM, 1600 DBH: Final Exam**

- **Online resources you can use:**

  - ▶ Course website: This is the main course website, where you can find lecture notes, YouTube videos, suggested homework, as well as study guides and practice exams.
  - ▶ Canvas: Mainly use this to check your grades.
  - ▶ Dr Peyam: My YouTube channel; for PDE and other fun math videos. Feel free to subscribe to it if you want to! I will try to upload some PDE videos as the quarter progresses, but in the meantime, feel free to check out my PDE playlist

- **Textbook:**

  Required: *Partial Differential Equations: An Introduction* (Second Edition) by Walter A. Strauss, ISBN 978-0470054567. It's the same book I used when I took this class 12 years ago, and it's also the textbook that will be used in 112B and 112C.

  Beware: The book is very dense and some of the material is beyond the scope of this course. I will follow it very loosely, so you don't have to understand every single thing in every section. As long as you can follow the lectures and the homework problems, you should be fine.

  Note: Do **NOT** buy the Weinberger book, I will not use it at all!

  Recommended: *Partial Differential Equations* (Second Edition) by Lawrence C. Evans (my PhD advisor at UC Berkeley), ISBN 978-0821849743.

This is the Bible of PDEs, and it's the book they usually use in graduate PDE courses like Math 295A, so if you want to see how PDEs are *really* done, check it out!

- **Prerequisites:** Math 2E and Math 3D. You don't really need to know much from those courses, except for Green's Theorem, the Divergence Theorem, and how to solve simple ODEs like $y'' + 4y = 0$. Be very comfortable with the Chain Rule from Math 2D. You would appreciate this course even more if you've taken Math 121AB and Math 140AB, but it's not necessary.

- **What people make you believe this course is about:** The official description includes "Introduction to partial differential equations. Basic methods for classical PDEs (Laplace, heat, and wave equations). Classification of PDEs, separation of variables and (Fourier) series expansions, eigenvalue problems." In particular, we will cover the following sections of the textbook (but **NOT** necessarily in that order):

  Chapter 1: Where PDEs Come from

        1.1: What is a Partial Differential Equation?
        1.2: First-Order Linear Equations
        1.3: Flows, Vibrations, and Diffusions
        1.4: Initial and Boundary Conditions
        1.5: Well-Posed Problems
        1.6: Types of Second-Order Equations

  Chapter 2: Waves and Diffusions

        2.1: The Wave Equation
        2.2 Causality and Energy
        2.3: The Diffusion Equation
        2.4: Diffusion on the Whole Line
        2.5: Comparison of Waves and Diffusions

  Chapter 3: Reflections and Sources

        3.1: Diffusion on the Half-Line
        3.2: Reflections of Waves (first part)

  Chapter 4: Boundary Problems

4.1: Separation of Variables, The Dirichlet Condition
4.2: The Neumann Condition

Chapter 5: Fourier Series

5.1: The Coefficients
5.2: Even, Odd, Periodic, and Complex Functions
5.4: Completeness (just the basic results)
5.6: Inhomogeneous Boundary Conditions (second part)

Chapter 6: Harmonic Functions

6.1: Laplace's Equation
6.2: Rectangles and Cubes
6.3: Poisson's Formula (if time permits)

- **What this course is *really* about:** I highly doubt that you'll forget the techniques you'll learn in this course because they are essential to human surival. That said, as Steve Krantz puts it in his book *"How to teach Mathematics,"* there is another goal of teaching this course. Namely, *real* purpose of this course is to teach you about *mathematical discourse* and critical thought. Just like in rhetoric, philosophy or politics, mathematics has its own language and way of thinking. How do mathematicians deal with an unknown problem? What methods do they use? What do they do when a given method doesn't work? Getting acquainted with those different types of discourses is what your college education is really about.

  Note: Hamid Hezari is scheduled to teach Math 112B in Winter 2020 and Xiaolong Li will teach Math 112C in Spring 2020.

  Reading Course: In Spring 2020, I might teach a Math 199C reading course on PDEs, where we would study PDEs, but from a more advanced perspective. We will read Chapter 2 of Evans' textbook, and the prerequisites will be Math 140B (which you can take concurrently). Be on the lookout for an e-mail in the spring!

- **Grading:**

  ▶ 15 % Homework, due on Thursdays during discussion section. One problem will be graded (for correctness) at random. The lowest

homework is dropped. No homework is due on Thursday, September 26 (Week 0), on Thursday, October 31 (day after the midterm), and on Thursday, November 28 (Thanksgiving)

► 15 % Quizzes, given on Thursdays during discussion section. They are based on the homework assignments. The lowest quiz is dropped. No quiz on Thursday, September 26 (Week 0), Thursday, October 31 (day after the midterm) and on Thursday, November 28 (Thanksgiving)

► 25 % Midterm, Wednesday, October 31, 4-4:50 PM in 1600 DBH.

► 45 % Final Exam, Wednesday, December 11, 4-6 PM in 1600 DBH.

Note: Your final score can replace your midterm score if it is higher than your midterm score.

I will follow the standard curve suggested by the math department, which is 20 % A, 25 % B, 30 % C, 15 % D, and 10 % F, but I will try to be as generous as I can. This course will probably be curved. If I curve, then the way I'll curve is that I'll take all your raw scores and add them up to get a raw total score, and *then* I'll curve that total score.

- **Homework:** Homework is due on **Thursdays** during discussion section, and are mostly problems in the book (although I might sometimes add my own problems). One problem will be graded at random, and that will constitute your homework score, so make sure to attempt all the homework. **No late homework is accepted, but your lowest homework will be dropped**. No homework due on September 26 (Week 0), October 31 (day after the midterm), and November 28 (Thanksgiving). Collaboration is neither encouraged nor disencouraged (feel free to work the way you're comfortable with), but the assignment you submit has to be your own. **Please staple your assignment**

- **Quizzes:** Quizzes are given on **Thursdays** during discussion section, and roughly cover the material from the homework. They are written by your TA, who has complete control over them, and who can give you more information about them. **No make-up quizzes will be given, but your lowest quiz will be dropped**. I highly recommend you to save the dropped quiz for the time when you'll get sick or have a personal emergency. No quizzes on September 26 (Week 0), October 31 (day after the midterm), and November 28 (Thanksgiving)

Important: Your TA reserves the right to change the content and/or date of the quizzes, so make sure to keep in touch with your TA for any announcements.

- **Midterm:** The Midterm exam will be given on Wednesday, October 30, 4-4:50 PM in 1600 DBH (our usual lecture room), and will cover the material up to and including Friday, October 25. **No make-up midterm will be given,** but your final exam replaces your midterm score if you do better on the final.

- **Final Exam:** The Final exam is cumulative and will cover the whole course. It is set for Friday, December 11, 4-6 PM in 1600 DBH. **No make-up final will be given,** so if you cannot make it to the final, please switch to the other Math 112A lecture. Your final exam score replaces your midterm score if you do better on the final.

- **Cheating: DO NOT CHEAT!** Any form of cheating, no matter how small (e.g. even looking at your neighbor's quiz) will result in an automatic F in the course, and will be pursuant to further disciplinary sanctions. In particular, by taking this course, you agree to abide by the following academic integrity policy:

- **Academic Integrity Policy:** All students are expected to complete a course in compliance with the Instructor's standards. No student shall engage in any activity involving any Academic Integrity Policy Violations. No student shall engage in any activity that involves attempting to receive a grade by means other than honest effort, and shall not aid another student who is attempting to do so.

- **Accommodations:** Students who may need disability-related accommodations are encouraged to talk to me and the deans as soon as possible.

- **Finally:** Sit back, relax, and enjoy the show! Remember that this course is fun and enlightening! I'm really looking forward to an exciting quarter together! :) For your convenience, on the next page, you will find a schedule of lectures/due dates.

#		Date	Lecture	Comment
	Th	Sep 26	No Discussion	No HW/Quiz
1	F	Sep 27	Lecture 1	
2	M	Sep 30	Lecture 2	
3	W	Oct 2	Lecture 3	
	Th	Oct 3		HW/Quiz 1
4	F	Oct 4	Lecture 4	
5	M	Oct 7	Lecture 5	
6	W	Oct 9	Lecture 6	
	Th	Oct 10		HW/Quiz 2
7	F	Oct 11	Lecture 7	
8	M	Oct 14	Lecture 8	
9	W	Oct 16	Lecture 9	
	Th	Oct 17		HW/Quiz 3
10	F	Oct 18	Lecture 10	
11	M	Oct 21	Lecture 11	
12	W	Oct 23	Lecture 12	
	Th	Oct 24		HW/Quiz 4
13	F	Oct 25	Lecture 13	
14	M	Oct 28	Lecture 14	(Review)
15	**W**	**Oct 30**	**Midterm**	**(covers Lectures 1-14)**
	Th	Oct 31	No Discussion	No HW/Quiz
16	F	Nov 1	Lecture 16	
17	M	Nov 4	Lecture 17	
18	W	Nov 6	Lecture 18	
	Th	Nov 7		HW/Quiz 5
19	F	Nov 8	Lecture 19	
	M	Nov 11	No Lecture	(Veterans Day)
20	W	Nov 13	Lecture 20	
	Th	Nov 14		HW/Quiz 6
21	F	Nov 15	Lecture 21	
22	M	Nov 18	Lecture 22	
23	W	Nov 20	Lecture 23	
	Th	Nov 21		HW/Quiz 7
24	F	Nov 22	Lecture 24	
25	M	Nov 25	Lecture 25	
26	W	Nov 27	Lecture 26	
	Th	Nov 28	No Discussion	No HW/Quiz
	F	Nov 29	No Lecture	(Thanksgiving)
27	M	Dec 2	Lecture 27	
28	W	Dec 4	Lecture 28	
	Th	Dec 5		HW/Quiz 8
29	F	Dec 7	Lecture 29	(Review)
	W	**Dec 11**	**Final Exam**	**(covers Lectures 1-29)**