Math 425: Partial Differential Equations

Spring 2020 Syllabus

Instructor: Eduardo García-Juárez
Email: edugar@math.upenn.edu
Lectures: Tuesday-Thursday 13:30-3pm in David Rittenhouse Lab. A2.
Office hours: M 10:30-12:30pm in DRL 3N4C.
Course Web Page: Canvas
First class, last class: January 16, April 28.

Grader: Pranav Trivedi (pranavt@sas.upenn.edu)

Prerequisites: Math 240 or its equivalent (basic linear algebra, including eigenvalue theory, some knowledge on ODEs and Fourier Series, familiarity with vector calculus).

Course Overview: Partial differential equations provide one of the fundamental tools to model and understand the real world processes. This course is an introduction to the basic PDEs and their properties. We will start with classic techniques to study the wave and heat equation, build off these techniques to deal with more complex problems (boundary conditions, uniqueness, etc.) and go on to analyze modern topics (Fourier transform, fluid mechanics equations, Black-Scholes in finance, Heisenberg uncertainty principle, etc.).

Topics to be covered: (conditional on time constraints and subject to change)

- From ODEs to PDEs
- Wave and heat equations
- Reflections and Sources (Duhamel's principle, Sturn-Liouville theory)
- Boundary problems: Separation of variables
- Fourier series (convergence, Gibbs Phenomenon)
- Harmonic functions: Laplace and Poisson equations
- Fourier transform and applications

Textbook: The textbook is *Partial Differential Equations, an introduction* (second edition) by Walter Strauss (pub. Wiley). You do not need to buy it, but I strongly recommend that you keep a copy of it.

Canvas: The class will make use of Canvas to post assignments, grades, announcements, etc. Students will be responsible for checking Canvas regularly during the semester.

Homework: Weekly, posted on the Canvas website. Homework will be assigned on Thursdays (starting on the first week), and it will be due the following Thursday at 1pm on Canvas. You will be allowed one week to complete each assignment. Collaboration

between students is encouraged, but you must write your own solutions, understand them, and list the names of your collaborators at the top of each assignment.

Late homework will not be accepted.

Your two lowest homework scores will be dropped.

Attendance and Course Notes: It is in your best interest to attend each lecture and take accurate notes. You will be tested on the material **as it is covered in class**. If you miss a lecture, make sure that you copy from a classmate and review the notes from that day.

Exams: There will be two in-class midterms and a final exam. Exam attendance is *mandatory*; please make sure you can attend the exams *before* enrolling in the course. You can take the make-up midterm only if you have a medical excuse or *prior* arrangement (you must inform me at least 24 hours prior). The final exam will be cumulative.

The first exam is on February 20. **Before drop deadline.**

The second exam is on March 26. **Before withdraw deadline.**

The final exam is on May 7, 9-11am.

Evaluation: Your final grade is based on the homework (25%), the midterms (25% each), and the final exam (25%).

Second opportunity policy: If your homework grade is higher than 80%, you can substitute the midterms grades by the final exam grade: that is, your final course grade would be $\max\{G_1, G_2\}$, where $G_1 = 0.25(H + M_1 + M_2 + F)$ and $G_2 = 0.25H + 0.75F$ (H, M_1, M_2, F are the scores of homework, midterm 1, midterm 2 and final exam).

Extra resources:

- "An Introduction to Partial Differential Equations" by Y. Pinchover and J. Rubinstein.
- **MIT Open Courseware** Prof. Jared Speck has a complete open course at `https://ocw.mit.edu/courses/mathematics`: *18.152 Introduction to Partial Differential Equations*.
- **Math Help** is available Monday through Thursday 4PM to 7PM in Education Commons 235. No appointment is necessary. This is a great place to work together on homework, with extra assistance available if need be (`https://www.math.upenn.edu/undergraduate/calculus-homepages/schedule-math-centers`).
- **CAPS**: Counseling & Psychological Services (`https://www.vpul.upenn.edu/caps/`) This is an excellent resource, not sufficiently known, that everybody should use whenever stress or any other personal issues arise.

- **The Tutoring Center** www.vpul.upenn.edu/tutoring/
- **Math Department Approved Private Tutors** www.math.upenn.edu/ugrad/tutors.html