Winter 2022

Math 454: **Boundary Value Problems for PDE**

TR 11:30 – 12:50 PM, and TR 2:30-3:50 PM

Instructor: Zaher Hani, 5834 East Hall (EH)), *Email:* zhani@umich.edu,
*Website:*https://sites.lsa.umich.edu/zhani/. *Office hours:* Tuesday 4:00-5:00 PM in 1866 of East Hall, and Thursday 1:30–2:20 PM in my office, and by appointment.

Prerequisites: A solid knowledge of multi-variable calculus (including Green's, Stokes', and divergence theorems) is assumed. We will need some ideas from linear algebra (orthogonality, eigenvectors, eigenvalues) later in the course. You are responsible for reviewing such prerequisites on your own.

Course Coordinates: There are two sections of this course, both meet on Tuesdays and Thursdays. Section 1 meets TR 2:30-3:50 PM in Room 4088 of East Hall and Section 2 meets on TR 11:30-12:50 PM in Room 1084 of East Hall. The course format will be in-person lectures; which will NOT be recorded, so you are strongly encouraged to attend class in-person.

Textbook: No textbook is required for this course, as I will be providing my own notes in class (I will be posting a copy of the class notes on Canvas). That being said, you are very strongly encouraged to consult either of the first two references below for the material covered in this course. My lectures will most likely be more influenced by Strauss's book (the first reference), but Pinsky's book is just as good and comprehensive.

Textbook References Here are some textbook references for the topics covered in this course. You are strongly encouraged to read the treatment in either of the first two references to supplement my course notes. The remaining references (some of them might be a bit more advanced than the scope of this course) may be consulted for a more in-depth treatment or further reading.

1. Walter Strauss, *Partial Differential Equations: An Introduction 2nd Edition*.
2. Mark A. Pinskey, *Partial Differential Equations and Boundary Value Problems with Applications*, Third Edition. American Mathematical Society.
3. Richard Haberman, *Applied Partial Differential Equations*.
4. E. C. Zachmanoglou and D. W. Thoe, *Introduction to Partial Differential Equations with Applications*.
5. Peter Olver, *Introduction to Partial Differential Equations*.
6. M. J. Lighthill, *Introduction to Fourier Analysis*.
7. Sandro Salsa, *Partial Differential Equations in Action: From Modelling to Theory (Universitext)*. This might be a bit advanced.

8. Fritz John, *Partial Differential Equations.*

Homework: There will be weekly homework sets that are posted and due on Gradescope (see Canvas).

Grading: Homework 50%, midterm 25%, final exam 25%. A letter grade will then be assigned according to this grading scheme and the historical data for the course.

Course description and projected topics: This is an introductory undergraduate course on partial differential equations (PDE). We will attempt to cover most of the following topics:

- What are PDE.
- First order equations.
- The Wave equation.
- The Diffusion Equation.
- Laplace's Equation.
- Boundary value problems.
- Fourier Series.
- Green's identities and Green's functions.
- Some methods to compute explicit solutions.

Testing and Disability: If you think you need an accommodation for a disability, please let me know as soon as possible. In particular, a Verified Individualized Services and Accommo dations (VISA) form must be provided to me at least two weeks prior to the need for a test/quiz accommodation. The Services for Students with Disabilities (SSD) Office VISA forms.

Important Dates

January 6	First day of classes
January 25	Drop and Add deadline
Feb 26-March 7	Spring Break-No Class
March 10	Midterm (tentative)
April 19	Last day of classes.