MA-UY 4414 B / MATH-UA 263 003
Applied Partial Differential Equations

Spring 2023 syllabus

Instructor	Norman Cao (He/Him)	**Email**	norman.cao@cims.nyu.edu
Lecture	Tue/Thu 9:30-10:50am	**Classroom**	RGSH 331
Office Hours	(refer to NYU Brightspace)	**Office**	CIWW 704; 2 MTC room 872

Textbook(s)

We will make use of two texts throughout the course:

- (Required) *Applied Partial Differential Equations* (Third Edition) by J. David Logan, Springer. Available through NYU at https://link.springer.com/book/10.1007/978-3-319-12493-3
- (Optional) *Introduction to Partial Differential Equations* by Peter J. Olver, Springer. Available through NYU at https://link.springer.com/book/10.1007/978-3-319-02099-0

The course will mostly follow the material in Logan. Some topics may be taken from Olver, which takes a more mathematical approach to PDEs than Logan. Weekly readings will be posted on the homeworks.

Overview and Objectives

This course is an introduction to the mathematical theory of Partial Differential Equations (PDEs). PDEs find use and application in nearly every field of science, engineering, and mathematics. This course builds on topics from multivariable calculus and ordinary differential equations, and assumes familiarity with those subjects. Some familiarity with linear algebra is also very helpful.

The course will focus primarily on linear PDEs, although nonlinear problems will be covered in a few simple cases. Students will learn techniques and build intuition for both analyzing and solving PDEs. Topics covered will include:

- Basics: boundary conditions, initial value problem, well-posedness, linearity
- Major examples and classification of PDEs: first order hyperbolic equations, heat equation, wave equation, Laplace's equation. Parabolic, hyperbolic, and elliptic equations.
- Methods for solving PDEs: method of characteristics, fundamental solutions, Fourier and Laplace transforms, orthogonal expansions
- Eigenvalue problems: separation of variables, Sturm-Liouville problems, equilibria and stability
- Properties of PDEs: conservation laws, maximum principles
- Connection to relevant physical and applied problems

Communication and Course Components

Material such as homework/exam solutions, and updates/announcements for the course will be posted on NYU Brightspace. Homework will be posted weekly to Gradescope, where will also submit your solutions. Please email me if you do not have access to Gradescope.

There will be one midterm exam (on **Thursday, March 9th** in lecture) and a cumulative final exam (date/time TBA). The overall grade for the course will be computed as:

$$\text{homework } (35\%) + \text{midterm } (30\%) + \text{final } (35\%)$$

Additionally, the lowest homework grade will be dropped.

Course Policies

Sick and Late Policy

Extensions on homework will be granted if there is some circumstance which prevents you from working on the homework. Examples include sickness that extends over several days, family emergency, religious holiday, or qualified academically related activity. If you miss a homework or exam due to emergency circumstances, please contact me ASAP via email.

I will generally try to be flexible and understanding with late homework. If you are feeling overwhelmed think you need an extension to finish the homework properly, please reach out to me! However, **non-emergency extensions will only be granted if requested at least 24 hours prior to the homework due date**.

Other Policies

I expect students to contribute to our positive learning environment: try to attend live classes, pay attention for the duration of the class, and participate meaningfully during class by asking questions or answering them. Students who disrupt our learning environment will be asked to leave.

When collaborating on homeworks, each student is responsible for writing up their own solutions individually. **Direct copying of another student's homework, even if both students contributed, is considered a violation of academic integrity.**

If you have questions related to the course, please feel free to send me an email or drop by office hours. I will normally reply within 24 hours. If I do not, please send me a reminder.

This course will abide by NYU CAS academic policies and honor code.

Resources

I am available during **office hours and by appointment** to review course material or address any course related concerns. Peer tutoring is available at **University Learning Center** and **Undergraduate Mathematics Tutoring Center**. Students seeking accommodations must consult the **Moses Center for Student Accessibility**.