MATH-UA.263: Partial Differential Equations
Fall 2021

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Teaching assistant. Xuenan Li, xl2643@nyu.edu.

Lectures. Lectures will be given in person, at **7 East 12th Street, room LL23**. They will be **Tuesdays and Thursdays 9:30–10:45 a.m.**, starting September 2 and finishing December 14 (excluding October 12 and November 25, making 28 classes in total).

Recitation classes. It is recommended that you also participate in the recitation classes, held by Xuenan Li at the **Silver Center, room 414**, each **Friday 9:30–10:45 a.m.**.

Office hours. Two hours per week. Date and time to be decided with a poll.

Textbook. We will follow the early chapters of L. C. Evans' book *Partial Differential Equations (2nd ed.)*; however, since the class is very introductory, the topics are covered by most books on the subject, and you are free to use another book. In order to pass the exam, understanding what we do in class will be enough (no required additional readings).

Homework. Homework will be assigned every second week (excluding the first two weeks) and is due in 14 days. Late submissions are not accepted except for sickness or emergency situations (you must provide documentation). For each student, their two worst homeworks will be dropped when computing the final grade. You are encouraged to collaborate, but each of you must write down their own solution.

Exams. There will be a midterm and a final exam, which you have to take in person. The final grade will have the following breakdown: homework (35%) + midterm (30%) + final (35%). Exams cannot be rescheduled except for sickness and emergencies.

Contents of the course. A tentative schedule is the following, where numbers refer to the lecture (from 1 to 28).

- 1: review of calculus in several dimensions
- 2: rough classification of PDEs and physical derivation of some of them
- 3–6: first order PDEs and the method of characteristics; possibly, something about nonlinear first order PDEs and shocks
- 7–10: Laplace and Poisson equations (on $\mathbb{R}^n$ via fundamental solution and on special domains via separation of variables, including a short review of Fourier series)
- 11–13: maximum principle for harmonic functions and Perron's mehod
- 14: midterm
- 15–17: heat equation (on $\mathbb{R}^n$, on bounded domains, and Duhamel's principle)
- 18–19: wave equation
- 20–22: revisiting the topics with the Fourier transform
- 23–28: numerical approximation using software and further topics (depending on the audience's taste)