MATH 8446: PARTIAL DIFFERENTIAL EQUATIONS II
SPRING 2024

This course will a survey of a number of advanced topics in partial differential equations. An emphasis will be placed on covering material that is typically not seen in the standard second semester course on PDEs, but is nonetheless fundamental to active areas of current research. In particular, we plan to cover the following:

- **Elliptic equations**: the method of continuity and solvability in spaces of Hölder continuous functions; general maximum principles (including the Hopf edge point lemma and Serrin corner point lemma); symmetry and the moving planes method.

- **Parabolic equations**: solvability via energy methods; connections to semigroup theory and evolution equations.

- **Variational methods**: Euler–Lagrange equations; mountain pass lemma and Palais–Smale compactness; polyconvexity.

Time permitting, I hope to touch on some topics in mathematical fluid mechanics.

Textbook. We will draw on a number of books for the course. For the variational theory and parabolic equations, we will follow the relevant chapters in *Partial Differential Equations* by Evans. The elliptic theory will use parts of *Elliptic Partial Differential Equations of Second Order* by Gilbarg and Trudinger, *Lectures on Elliptic and Parabolic Equations in Hölder Spaces* by Krylov, and *Maximum Principles in Differential Equations* by Protter and Weinberger.

Prerequisites. MATH 8445: PDE I. A year of graduate-level analysis (equivalent to 8420 and 8421) will be helpful but not required.

Structure of the course. This is an advanced graduate course, so much of the responsibility for learning the material will rest on you. There will be semi-regular homework assignments. You are free — and encouraged — to collaborate on them, but each students must submit their own work.

In the first two weeks of the semester, you will be given a list of important modern papers touching on some of the topics of the course. You will be asked to (individually) select one of those papers, which you will then present the end of the semester during lecture. As your final exam, you will submit a brief summary of its contents and the main ideas of the argument. Your grade will be determined according to the following weights: 60% homework, 20% final presentation, and 20% final summary.

Office hours. I will hold regular office hours on Wednesday and Thursday, 3:00–4:00PM, and by appointment, in MSB 307.

Disabilities. The goal of the University of Missouri is to ensure an inclusive learning environment for all students. The University of Missouri Disability Center (`https://disabilitycenter.missouri.edu/`) provides services and accommodations for students to participate fully in the learning experience and to experience equitable evaluation of their performance.

Students (including online students) with a documented disability can contact the Disability Center to establish an accommodation plan; see Documented disabilities include hearing, vision, mobility, learning and attention, psychological health, and physical health. Students' accommodations are implemented with the input of students to maximize the learning experiences. The MU Disability Center keeps information about a student's disability confidential.

Please notify me of your eligibility for accommodations as soon as possible. Additionally, if there are aspects of the course that present as barriers, such as inaccessible course content or if you need an immediate accommodation due to an injury, please contact me or contact the Disability Center as soon as possible.

Academic Honesty. Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

Academic Dishonesty includes but is not necessarily limited to the following: Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty. Plagiarism which includes but is not necessarily limited to submitting examinations, themes, reports, drawings, laboratory notes, or other material as one's own work when such work has been prepared by another person or copied from another person. Unauthorized possession of examinations or reserve library materials, or laboratory materials or experiments, or any other similar actions. Unauthorized changing of grades or markings on an examination or in an instructor's grade book or such change of any grade report.

Complaints. If you have communication (or other problems) with your instructor, you can report them to Professor Calin Chindris (Director of Graduate Studies) either by phone (882-4540) or by e-mail (`muasmathdgs@missouri.edu`).

For statements on University policy regarding Academic Integrity, Intellectual Pluralism, Mental Health, and COVID-19, see the full syllabus on Canvas.