MATH 439/839 2024-2025

Partial Differential Equations T1

Instructor:

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Course Details

Math 439 CRN 83147
Math 839 CRN 84016

Schedule:

Term 1, Schedule will be based on availability of registered students

Tentative Topics:

- Linear and nonlinear partial differential equations of mathematical physics. Examples of mathematical models from various areas of science and applications.
- Types of linear second-order partial differential equations and their properties.
- Solution of linear equations by separation of variables: basic and advanced techniques and theory behind them.
- Method of characteristics for linear and nonlinear PDEs. Shock waves. Applications to fluid and solid wave dynamics and traffic flows.
- Method of Green's functions and its applications.
- Method of conformal mappings and its applications .
- Travelling wave solutions of time-dependent PDEs. Reductions of PDE problems to lower-dimensional and ODE problems.
- Asymptotic analysis: basic ideas, regular and singular perturbations, boundary layers.

Course Objective:

This course provides essential theoretical tools and classical examples in the field of Partial Differential Equations, at the advanced undergraduate level. By the end of the course, students will be familiar with techniques of derivation of partial differential equations (PDEs) that model a variety of physical phenomena, including heat transfer, diffusion, advection, wave propagation, static electric and gravity fields, equilibrium fluid flows, and more. Students will be able to formulate initial-boundary problems for different types of linear PDEs and solve such problems by choosing an appropriate method (see the list of topics below). Students will gain insights into important constituents of linear and nonlinear processes, including eigenmodes, traveling waves, shock waves, diffusion, instabilities, and phase space dynamics. These ideas and hands-on experience of working with mathematical models and software will form a basis to understand the building blocks of models of complex nonlinear phenomena that arise in modern theoretical physical sciences and applied research.

Students Who May Be Interested:

This course will be of interest and will be made accessible to students from a broad variety of disciplines and backgrounds; the main requirement is introductory exposure to PDEs.

Other Information:

Please contact the instructor directly by email for any further questions; feel free to register any time. Prerequisite overrides will be considered where appropriate