

MATH 439/839

2026-2027

Partial Differential Equations T1

Instructor:

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Course Details

Math 439 CRN 83147
Math 839 CRN 84016

Schedule:

Term 1
Times TBD

Tentative Topics:

Some of the topics covered will include:

- Linear and nonlinear PDEs
- Linear problems and their solution by eigenfunction expansion and integral transforms
- Method of characteristics for linear and nonlinear PDEs.
- Green's functions and their applications.
- Nonlinear waves
- Asymptotic analysis
- Symmetry methods for finding exact solutions of nonlinear PDEs
- Numerical methods and conservation laws.

Course Objective:

The goal of this course is to learn to work with the most powerful modern mathematical tools, both analytical and numerical, for solving problems involving linear and nonlinear partial differential equations.

Students Who May Be Interested:

This course will be of interest to students from a broad variety of disciplines and backgrounds; the main requirement is introductory exposure to ordinary and partial differential equations.

Other Information:

This course provides essential tools in the field of partial differential equations (PDE). By the end of the course, students will be familiar with origins and 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 choose an appropriate solution approach. 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 science and applied research. The course will use as examples multiple mathematical models from various disciplines, including gas, fluid and plasma dynamics; heat transfer; mechanics of elastic solids, biological, and composite materials; cell biology; ecology; traffic flows; and more. No special background in any area will be required.
