

Instructor: Prof. Boaz Ilan
Office: Science & Engineering 334, (209) 228-4178
bilan@ucmerced.edu

Lecture Time & Location: MW, 11:00 am – 12:15 pm, S&E 390

Discussion Time & Location: Friday 1:00 pm – 1:50 pm, COB 209

Office hours: By appointment.

Course Goals and Objectives: Partial Differential Equations (PDEs) are at the heart of applied mathematics and many other scientific disciplines. My goals are that by the end of this course you will have learned:

- Where and how PDEs arise in applications.
- Fundamental ideas in PDE theory.
- Analytical methods for solving PDEs.

Graduates of MATH 221 should be able to fulfill the following learning objectives:

1. Solve first order PDEs using the Method of Characteristics.
2. Determine the well-posedness of PDEs with initial/boundary data.
3. Solve linear second order PDEs using canonical variables for initial-value problems, Separation of Variables and Fourier series for boundary value problems.
4. Describe basic physical systems in terms of PDEs using modeling and analytic methods.

Prerequisites: Multi-variable calculus; Ordinary differential equations, Linear Algebra.

Tentative Outline:

- Introduction: PDEs and their solutions; initial and boundary value problems; existence, uniqueness, and well posedness; derivation of PDEs from conservation laws.
- First order PDEs: method of characteristics, linear and quasi-linear PDEs, examples from physics.
- Second order linear PDEs: classification; d'Alembert's solution to the wave equation and propagation of discontinuities; Separation of Variables: homogeneous equations, examples from the heat, wave, and Laplace equations; Fourier series and their convergence; the energy and maximum principles; elements of Sturm-Liouville (spectral) theory; PDEs in higher dimensions.

Course webpage: MATH 221's website is part of the UCMCROPS course management system.

Textbooks:

- *Partial Differential Equations: An Introduction*, W. A. Strauss.
- *An Introduction to Partial Differential Equations*, Y. Pinchover and J. Rubinstein.

Discussion Meetings: Discussions will convene as necessary and serve for any of the following purposes: working out examples, solving homework problems, supplementary lecture material.

Grade determination: Your final grade in the course will be based on the following approximate scheme: 60–70% by homework and the rest by the final exam.

Homework: Homework will be given approximately every week and collected every other week. You are encouraged to work in groups, but all work turned in must be your own. *It is essential that you comprehend the work that you submit.*

Final Exam: The final exam will be given during the last week of the course (date and time to be coordinated during the course). The exam will be 3 hours and focus on the learning objectives 1–3 outlined above. *There will be not make-up exam.*