

CAAM-MATH 423, Fall 2010, Partial Differential Equations

Meets: Tuesday-Thursday, 9:25-10:40 PM, George R. Brown Hall W212

Description: A *partial differential equation* is an equation involving an unknown function of several variables and finitely many of its partial derivatives. The study of these began with the invention of calculus by Newton and Leibniz and the historic development of the subject has paralleled the numerous applications in science and engineering, especially continuum mechanics. These have continually provided more equations and many questions concerning the nature and accessibility of solutions. In this course we will address many of the mathematical issues. A brief outline of topics to be covered is as follows:

- Brief survey of various PDE's and associated problems
- Some basic ODE theorems.
- The Laplace equation: Maximum Principle, potential theory, the Dirichlet problem, eigenvalues
- The heat equation: Maximum Principle, fundamental solution, regularity and similarity properties
- The wave equation: existence, Huygen's Principle, energy results
- An introduction to 1st order equations and the method of characteristics
- Distribution and fundamental solutions of linear equations
- Hilbert Space and Sobolev spaces
- Very brief introduction to the calculus of variations- Euler-Lagrange equations

Course Text: Lawrence C. Evans, *Partial Differential Equations*, AMS Graduate Studies in Mathematics 19, Providence RI, 1998. ISBN: 1065-7339. See the errata at <http://math.berkeley.edu/~evans/>

Another **useful reference**, with less detail, is:

R. McOwen, *Partial Differential Equations*, Methods and Applications, Prentice Hall, 1995.

For a **quick introduction** and other references, see http://en.wikipedia.org/wiki/Partial_differential_equation

Homework will be given and collected weekly and communicated via owlspace.rice.edu . First click on *Collaboration and Course Management* and then login with your NetID.

Grades are to be determined by the following: Homework 40% , Midterm: 25% , Final: 35%

Midterm Exam This take-home exam will be distributed (tentatively) Thursday Oct.21, and collected by Tuesday Oct.26. It should be taken over a continuous 3 hour period with textbooks and notes allowed.

Final Exam will similarly be a take-home exam that will be distributed Friday, Dec.3, and collected by Wednesday, Dec.15. It should be taken over a continuous 4 hour period with textbooks and notes allowed.

Prerequisites: (CAAM 401 and 402) or (Math 222) or (Math 212 and 321) or equivalent.

Instructor: Robert Hardt : Office: Herman Brown 430; Office hours: 11-12 MWF (and others by appt.),
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Disabilities: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services in the Allen Center.