MATH 4330/8336

INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS

Course Description:

This course introduces the basic methods of PDEs guided by applications in physics and engineering. The main topics to be covered include The Linear First order PDEs, Transport equations, Characteristics, Classification of PDEs, Separation of variables, Heat conduction, vibrating membranes, boundary value problems, Maximum principle, Sturm-Liouville problems, Fourier series, Fourier integrals, Harmonic functions, Legendre polynomials, Distributions, Green's functions. **3 credits**

Prerequisites:

MATH 1970 with a C- or better and MATH 2350 with a C- or better, or permission of instructor; MATH 2050 recommended, not required.

Overview of Content and Purpose of the Course:

This course represents a collection of topics in modern mathematics not covered in other courses.

Anticipated Audience/Demand:

Graduates and undergraduates (third or fourth year majors in mathematics, engineering or computer science or) needing a basic familiarity with techniques for solving PDEs.

Major Topics:

1. Where PDEs come from: elliptic, parabolic and hyperbolic equations.

2. Linear first order PDEs: Characteristics method.

3. Physics and engineering problems giving partial differential equations which may be solved by the techniques of Fourier series.

4. Waves and Diffusions: d'Alembert formula, maximum principle.

5. Refection Method and Sources.

6. Boundary value problems, physical problems, solution techniques, uniqueness results.

7. Solution to heat and wave by separation of variables.

8. Fourier Series: Basic properties, convergence, differentiation.

9. Harmonic Functions : 2-D PDEs: separation of variables.

10. Computation of solutions: Numerical methods for PDEs.

11. Special functions (scope will vary with background of the students).

Methods:

This is a hybrid course, half classroom and half online. It will meet once a week for classroom instruction with additional course activities being satisfied online. This course is similar to an online course except that students are required to come to class on campus once each week. These meetings will be primarily to see the student progress, question/answer session, lectures and examinations.

Textbook:

Strauss, Walter A. *Partial Differential Equations, 2nd ed*. Hoboken: John Wiley & Sons, 2007.

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