Math 3150-001: Partial Differential Equations for Engineers
Spring 2012

Instructor: Andrej Cherkaev, JWB 225, 581-6822, cherk@math.utah.edu.

Time and Place: M., W., 11:50-12:40, LCB 225

What is PDE?

Partial differential equations (PDEs) describe processes in continua that depend on time instances and spatial position. PDEs are, for example, used to describe the vibration of a string or a membrane, waves, propagation of sound or heat, electrostatics, electrodynamics, fluid flow, and elasticity. PDE is a type of differential equation, i.e., a relation involving an unknown function (or functions) of several independent variables and their partial derivatives with respect to those variables.

Course objectives: M3150 is a first course in PDEs intended for students from the sciences and engineering programs. On completion of the course the student should be competent in solving basic linear PDEs using classical solution methods, that is, be able to:

- Understand the derivation of the heat, wave and equilibrium (Laplace, Poisson) equations with various boundary conditions;
- Understand the classification of PDEs, and their geometric and physical meanings.
- Use Fourier series for functions representation;
- Use the method of separation of variables;
- Use Fourier Transform methods;
- Be able to solve boundary value problems (BVPs) of vibrating string and rectangular or circular membranes.
- Be able to solve BVPs for the one-dimensional homogeneous and inhomogeneous heat equation with different boundary conditions by using Fourier method.
- Be able to solve BVPs for the two-dimensional Laplace and Poission equations in rectangular and circular domains.
- Use Maple to visualize PDE solutions.

Table 1: Preliminary syllabus

Week	Text	Topic
1	1.1-1.2	Introduction
2	2.1-2.2	Periodic Functions and Fourier Series
3	2.3-2.4	More on Fourier Series
4	3.1	Examples in Physics and Engineering
5	3.2-3.3	One Dimensional Wave Equation. Midterm 1
6	3.4	D'Alembert Method
7	3.5-3.6	One Dimensional Heat Equation
8		Break
9	3.7	Two Dimensional Equations
10	3.8-3.9	Laplace and Poisson Equations
11	4.1-4.2	Circular Coordinate and Vibration, Midterm 2
12	4.3-4.4	Laplace Equation in Circular Regions
13	4.4	Laplace Equation in Circular Regions
14	7.1	Fourier Integral Representation
15	7.2-7.3	Fourier Transform, Midterm 3
16	7.4-7.5	Heat Kernel and Poisson Integral Formula

Text: Partial Differential Equations with Fourier Series and Boundary Value Problems by Nakhle Asmar, Prentice-Hall, 2005; Second Edition. Sections: 1.1, 1.2; 2.1 - 2.4; 3.1 - 2.9; 4.1 - 4.4; 7.1 - 7.4

Office Hours: W. 2:00-4:00 pm, or by appointment.

Tutoring Center: Free tutoring is available in the T. Benny Rushing Mathematics Center, located between JWB and LCB.

Prerequisite: Calculus series, ODE, Linear Algebra.

Homework Will be posted on the course website.

Grading: The course grade will be based on weekly homework (40%), three midterm exams (40%), and a final take-home exam (20%). The final exam will be given in the last day of classes and is due next day. Challenging problems for extra credit will be suggested.

The final score for the course will be calculated by adding two highest scores of three midterms (the lowest midterm score will be disregarded), of all but two homework assigments, and the final exam.

– Homework: weekly assignments usually will be posted on the web each Wednesday and they will be collected after one week. No late homework will be accepted, unless requested and approved in advance, in extreme circumstances.

– Midterms: there will be three 50 minute midterm exams. No makeup exam will be given.

– Final Exam: will be given in the last day of classes and collected next day. The final exam is a comprehensive exam, covering all materials in the semester.

– Exam Policies: The midterm exams will be closed books unless announced otherwise. You are allowed to bring an index card with your own handwritten notes. Laptops, PDAs, and wireless devices are not allowed in exams.

The entry quiz is posted on the course website. It is due August 27 2012.