

Math 3150-3: Partial Differential Equations for Engineers

Fall 2007

Instructor: Jingyi Zhu, LCB 335, 581-3236, zhu@math.utah.edu.

Course URL: <http://www.math.utah.edu/~zhu/3150.html>

Time and Place: T,H 6:00-6:50 pm, JWB 335.

Office Hours: Monday 2:00-3:00 pm, Tuesday 3:30-4:30 pm, Thursday 10:00-11:00 am, or by appointment.

Prerequisite: Math 2250 and either Math 1260 or Math 2210.

Text: *Partial Differential Equations with Fourier Series and Boundary Value Problems* by Nakhle Asmar, Prentice-Hall, 2005; Second Edition

Course Description: Partial differential equations (PDE) are traditionally the most relevant mathematics subject to many scientists and engineers, and they continue to be one of the most important branches in applied mathematics, as more and more challenging and exciting equations emerge from new scientific discoveries. In this first course on the subject, however, we will start from an old-fashioned approach, that is to try to find solutions by reducing the PDE to several solvable ODEs, via the techniques of **separation of variables** and **Fourier series/transforms**. In modern times these techniques have given their dominance to numerical solutions realized by computers. Nevertheless the principles still prevail and these fundamental solutions provide an important guide to our understanding of solutions in more general and practical problems. We will begin by giving examples to show the significance of PDEs in engineering problems (Chapter 1), and introduce the concept of Fourier series to represent a class of functions (Chapter 2), which will be used as candidates to solutions. Then we will discuss the separation of variables idea and apply it to problems in rectangular (Chapter 3) and circular (Chapter 4) regions. Finally we will introduce Fourier transform, which is a more general approach to reduce a PDE to ODEs, and also a fundamental tool in more theoretical studies of PDEs.

Grading: The course grade will be based on weekly homework (40%), three midterm exams (30%), and a final comprehensive exam (30%).

- Homework: weekly assignments will be posted on the web each Tuesday 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 on **Thursdays, September 13, October 18, and November 15**. Under special circumstances, arrangements can be made to take the exam at an earlier time, but no makeup exam will be given.
- Final Exam: **Tuesday, December 11, 2007**, 6:00-8:00 pm. The final exam is a comprehensive exam, covering all materials in the semester.
- Exam Policies: All the midterm and final exams will be closed books. You are allowed to bring an index card with your own handwritten notes. Laptops, PDAs, and wireless

devices are not allowed in exams.

Tutoring Center: Free tutoring is available in the T. Benny Rushing Mathematics Center, located between JWB and LCB. It opens M-Th 8:00 am - 8:00 pm, Fri 8:00 am - 6:00 pm.

ADA Statement: The American with Disabilities Act requires that reasonable accommodations be provided for students with physical, sensory, cognitive, systemic, learning, and psychiatric disabilities. Please contact me at the beginning of the semester to discuss any such accommodations for the course.

Syllabus

Week	Section	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, Midterm 1
5	3.2-3.3	One Dimensional Wave Equation
6	3.4	D'Alembert's Method
7	3.5-3.6	One Dimensional Heat Equation
8		Fall Break
9	3.7	Two Dimensional Equations, Midterm 2
10	3.8-3.9	Laplace's and Poisson's Equations
11	4.1-4.2	Circular Coordinate and Vibration
12	4.3-4.4	Laplace's Equation in Circular Regions
13	4.4	Laplace's Equation in Circular Regions, Midterm 3
14	7.1	Fourier Integral Representation
15	7.2-7.3	Fourier Transform
16	7.4-7.5	Heat Kernel and Poisson Integral Formula