SYLLABUS FOR MATH 3150-03
Spring 2009

Instructor: Tommaso Centeleghe (Tommy)
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Office hours: Fridays 9:00 am - 11:00 am or by appointment


Course webpage: www.math.utah.edu/~centeleg/M3150.html

Class time and place: TH 6:00 pm - 6:50 pm - AEB 320.

**Prerequisites:** MATH 2250: ODE’s and Linear Algebra, Calculus III

**Contents of the course:** We will cover

- *CHAPTER 1*: sections 1.1 and 1.2;
- *CHAPTER 2*: sections 2.1 to 2.4;
- *CHAPTER 3*: sections 3.1 to 3.9;
- *CHAPTER 4*: (covered time permitting) sections 4.1 to 4.4;
- *CHAPTER 7*: sections 7.1 to 7.5.

A more detailed description of the course is attached.

**Mid Term Exams:** There will be two 50 minute long mid term exams (each worth 25% of your final grade). They are tentatively scheduled on Thursday, February 19th and on Thursday, April 2nd. They will take place in our classroom during our regular class time. The problems in the exams will be similar to the ones that you will have encountered on the homework. Any possible change in the exams schedule will be posted on the course webpage as well as announced in class.

**Homework:** I will assign homework weekly (they are worth 20% of your final grade). The homework will be posted on the course webpage and announced in class. They will be due every Thursday at the beginning of class, starting from January 22nd. LATE HOMEWORK WILL NOT BE ACCEPTED unless you have a serious reason. As a part of the homework, you are expected to read in depth each section of the book that I cover in class. If we run short on time, I might not cover some sections in class and leave them entirely to you. Homewor kes are graded by a grader who will first check that all the problems have been solved and then will grade only 2 or 3 problems per homework that I will have previously selected. Incomplete homework can be worth only up to half of the total credit. If you do not attend class on a day when homework is due, you either need to make sure that your homework makes it to class (e.g. hand it to a
class mate) or should drop it in my mail box before the beginning of class. Homework should be perfectly readable and accurate. Do not be afraid to use too much paper. Staple your homework please.

**Final exam:** The Final exam (worth 30% of your final grade) will be on Tuesday, May 5th from 6:00 pm to 8:00 pm in our regular classroom. In case of change of schedule you will find updates on the course webpage.

**Office Hours:** If you need to see me you can come to my office hours. If you know in advance that you are going to come to my OH, please drop me a line to make sure that I will be there. If my OH does not work well for you or you prefer to meet me at some other time, I am available basically every week day and I am happy to see students outside my OH. Just e-mail me. I usually reply to my e-mails within the day I received them on week days. Whenever something is not clear you are strongly encourage to come see me.

**ADA statement:** The American with Disabilities Act requires that reasonable accommodations be provided for students with physical, cognitive, systematic, learning and psychiatric disabilities. Please contact me at the beginning of the course to discuss any such accommodations you may require for the course.
Chapter 1

The first Chapter is a short introduction to PDE’s. In section 1.1, we obtain the general solution of a simple first order PDE, pointing out basic differences with the theory of ODE’s that are already visible. We will also discuss the method of characteristic curves and its relationship with ODE’s. In section 1.2 the main focus is the one dimensional wave equation. We will study a family of simple solutions (which describe simple motions of the stretched string) and discuss how the superposition principle leads to more complicated solutions and to Fourier series expansion. More examples of PDE’s will be provided by the exercises.

Chapter 2

In section 2.1 periodic functions and basic regularity conditions will be discussed, with a reference to the trigonometric system. Fourier series will be treated in 2.2, where the Euler formulas for the coefficients and a representation theorem will be explained together with examples. Section 2.3 deals with Fourier series with arbitrary periods and Fourier series of even and odd functions. The last section of the chapter that will be covered is about the half-range expansion of a function in cosine and sine series.

Chapter 3

Chapter 3 is the heart of the course and consists in the detailed study of some classical PDE’s. The method of separation of variables will play a fundamental role and will be used prominently. In 3.1 we will present the most classical PDE’s and we will introduce some notation. In 3.2 we derive the wave equation already encountered in 1.2 by modeling the vibration of a string. Section 3.3 gives a complete solution of the one dimensional wave equation which uses the method of separation of variables. The solution is described through its Fourier series expansion. In section 3.4 we will study D’Alembert method to solve the wave equation. Section 3.5 and 3.6 treat the one dimensional heat equation and they provide a complete solution of the problem of understanding the temperature distribution in a uniform bar with boundary conditions. In section 3.7 we will study the vibration of a rectangular, elastic membrane using the two dimensional wave equation. Again, the method of separation of variables will be used to solve the problem. Sections 3.8 and 3.9 will be covered time permitting. They respectively consist of the study of the Laplace’s and Poisson’s equations.

Chapter 7

Section 7.1 explains the Fourier integral representation theorem, the Fourier series of chapter 2 will be replaced by an integral. Section 7.2 illustrates the
basic features of the Fourier transform. Section 7.3 explains how to solve certain PDE’s using the Fourier transform. The last two sections 7.4 and 7.5 deal with finding explicit solutions of the heat problem over an unbounded region and of the Dirichlet problem on the upper half plane.

Further topics from chapter 4 may be added time permitting.