**Math 312: Partial Differential Equations**
**Spring 2011**
**Professor Justin Corvino**

**Introduction:** Welcome to Math 312! This course is an introduction to partial differential equations, a subject of intense interest to engineers, scientists and mathematicians. Partial differential equations provide a mathematical framework to model the behavior of many mathematical and physical situations. The subject comprises an enormous body of work, both applied and theoretical. Insights from physics often help to motivate the mathematics, and results from mathematics provide a rigorous framework to find or, more frequently, to deduce the behavior of solutions to the equations, all of which can then be interpreted physically.

**Prerequisites:** Math 263 or equivalent.

You will draw heavily on your calculus experience from Math 161, 162 and 263. Please keep a calculus book handy for reference.

**Schedule:** **Section 01**: WF 11-12:15 in Pardee 227.
**Section 02**: WF 12:45-2:00 in AEC 315.

**My contact information:** Office: Pardee Hall, Room 214A
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Email: corvinoj@lafayette.edu

**Office hours:** M 10-12, WF 10-11, after class, by email, and by appointment.

I will usually be available after class for questions-just ask! Also, a lot of students like to correspond with me by email. If you need to make an appointment, please let me know. It is crucial that you seek help if you need it. This includes your participation in class, and meeting with me outside of class as the need arises.

**Comments:** This course is neither theoretical nor applied: it's both! By this I mean several things: first, it is a math course, and as such the subject matter is mathematics. I will make no apologies for going over derivations and/or proofs in class, and I will do so to the extent that I feel they serve a definite role in aiding your understanding of the material. On the other hand, the course is not going to be too abstract, as the goal of the course to study the behavior of solutions to certain differential equations and how they arise in math and physics. The objective of the course, then, is to understand the mathematics and the physical models, not necessarily to teach you various proof techniques.

This is a 300-level course. You may find it to be substantially more demanding that Math 263 or 264, or even some other 300-level math courses. We will not have time to go over every bit of every example or idea in class---it is very important, then, that you make time to regularly read the text, study your notes, and work the problems.

**Feedback:** It is important for me to know how the course is going for you. This includes how the homework is going, and your opinions on class and on the material. It is useful to know these things as we go along, *before* the semester ends, since afterwards it is too late make adjustments.

**Course information on the web:** We will be using Lafayette's Moodle system to serve as the course webpage.

**Text:** *Partial Differential Equations: An Introduction* by Walter A. Strauss. Second Edition. The First Edition would be fine as well.

**Content:** The plan is to cover most of the first six chapters of the text. We will also covers topics from the later chapters, as time permits.

**Student Learning Outcomes**: Students should be able to

- Apply basic principles, such as conservation/balance laws or variational principles, to formulate initial and boundary value problems to model an array of physical phenomena
- Interpret the features of the solutions to PDE in terms of relevant models
- Utilize concepts such as energy, causality, and maximum principle to obtain qualitative and quantitative information about the solutions to PDE
- Solve elementary PDE by using characteristics, d'Alembert's solution, or integral kernel
- Explain the genesis of separation of variables and Fourier series solutions as applies to boundary value problems
- Understand the different modes of convergence of Fourier series
- Apply Fourier series to solve initial-boundary value problems in several contexts

**Grades:** There will be several components to your grade in this course. We will have homework, midterms and the final exam. There is no pre-determined distribution of grades (that is, no pre-set number of A's, B's, C's, etc.). Roughly, an **A** means you have done *excellent* work and have a strong command of concepts and applications, a **B** means you have done a *good* job but maybe did not get the hardest problems on the exams and quizzes, a **C** means you have done a *satisfactory* job in the course and understand the basic ideas, but you have some gaps in your understanding of deeper concepts and harder applications, and finally a **D** means you have done the bare minimum to warrant a *passing* grade.

There will be three components to your grade, each with the same weight:

- Homework
- Midterm Exams (2)
- Final exam

In other words, your final numerical grade will be computed by averaging the following three numbers: your homework average, your midterm average, and your final exam grade.

**Midterm Exam dates:** The midterm exams are scheduled as follows:

- Wednesday March 2 In class

- Wednesday April 20 In class

These dates are pretty firm, but if there be a need to move an exam date, I will give you plenty of advance notice. Unexcused absence from an exam will result in a grade of zero for that exam.

**Final Exam**: The ***three-hour*** final exam date is to be determined by the Registrar. Do not make any commitments before the end of exam period.

**Homework:** Homework will be assigned roughly each week. I consider this component of the course very important (it's worth as much as the final exam). *Reading* the assigned sections will be (implicitly or explicitly) part of the assignment, as will be studying the solutions that will be posted.

**Academic Honesty:** Work done for a grade must be your own. Cheating on exams, whether in the form of using the work of someone else (via collaboration or stealing answers) or using unauthorized materials will be dealt with to the full extent allowed by the College.

Students may work together to discuss the homework, ***unless specifically directed otherwise***; in fact some find it helpful to study in groups. However, you should write up the solutions you hand in ***on your own***. If you work with someone or with a group, then please ***cite*** that on your work. Failure to cite collaborations, or handing in solutions that are too identical to that of another student, will be cited for academic dishonesty and sent to the Dean.

**Attendance:** Attendance and participation in class is expected of each student. Within a couple of weeks I will know all of you by name, and so if I notice your attendance and/or participation is not satisfactory, I will approach you about it. If you miss class, you should see me so that you know what was covered. If you expect to miss class for an excusable reason, please let me know ahead of time.

**Calculators:** A calculator is not required for the course, and I do not anticipate allowing them on the exams.

**Tips for success:** There is a lot of material to cover in this course, so you have to stay on top of it. You should read the text and go over notes from class in addition to trying all the homework problems. As we go along I'll be updating you on where we are in the course and what sections will be covered in class, and you should make time to read the relevant text, and to go over your notes shortly after class. You also need to allot time for doing homework, and ***for going over previous homework problems and solutions***. When you have difficulties, you should let me know, since others probably are having the same problem. When you encounter trouble, try to pinpoint the difficulty and write out exactly where you are stuck.