APPLIED MATH II - Spring 1997

COURSE: MATH 5620
TIME: 10:25-11:20 MWF PLACE: Room 314 of Gilbreath Hall CALL # 12053
INSTRUCTOR: Dr. Robert Gardner OFFICE: Room 308L of Gilbreath Hall
OFFICE HOURS: 8:15-9:15 MWF PHONE: 439-6978 (Math Office 439-4349)

TEXT: *Partial Differential Equations An Introduction* by Walter Strauss. Although it is explicitly claimed in the preface that "this is an undergraduate textbook," I think this is appropriate, especially when combined with the outside references given below.

PREREQUISITES: You will need some knowledge of functions of several variables, line and surface integals, and vector calculus (along with, of course, partial differentiation). We will review this material as it is needed. You will also need a knowledge of techniques of integration and series. These topics will be only briefly reviewed and are mostly assumed to be very familiar to you.

ABOUT THE COURSE: As commented in the preface of the text, we will "motivate with physics, but then do mathematics." We will explore the three classical PDEs: the heat equation, the wave equation, and the potential equation. Each equation will be derived using physical arguments which may not be pleasing to the most pure among us. However, these will be standard derivations (and certainly up to the standards of a physics class) and are simply meant for motivational purposes. All analysis of the equations will be as rigorous as possible. The class will be more computational than most graduate-only level classes. The homework and tests will reflect the emphasis on problem solving, although there will be theory oriented questions.

I will occasionally assign problems and cover material not in the text. I will rely on the following sources:

1. *Boundary Value Problems* by David L. Powers. This is a nice introductory level text aimed at upper level undergraduates. It contains much relevant material, but isn't quite at an appropriate level for us.

2. *Partial Differential Equations of Mathematical Physics*, by S. L. Sobolev. This is a sophisticated text written by one of the big names in the field. The level of rigor is much higher in this book than in either Strauss or Powers. However, the level of sophistication might be a bit much for us (for example, it includes topics in Lebesgue integration of multiple integrals) and I will only use this reference as a supplement.

GRADING: Homework (H) will be assigned and collected regularly. We will have two tests (T_1 and T_2). Your average will be computed as follows:

$$AVERAGE = \frac{2H + T_1 + T_2}{4}.$$

Grades will be assigned based on a 10 point scale with "plus" and "minus" grades being assigned as appropriate.

The tests will cover:

Chapter 1 = Where PDEs Come From: introduction to PDEs and derivation of some classical equations.

Chapter 2 = Waves and Diffusions: more wave equation, energy, diffusion.

Chapter 4 = Boundary Problems: seperation of variables, Neumann condition, Robin condition.

Chapter 5 = Fourier Series: Fourier coefficients, orthogonality, completeness, bases for function spaces.

Chapter 6 = Harmonic Functions: Laplace's equation, brief discussion of complex variables.

Other Topics (time permitting): We will cover additional topics as time permits. If the class has some preference (such as fluid flow or quantum mechanics) we will follow that lead. Otherwise, we will choose topics which I prefer (probably from Chapters 9, 10 and 14).