APPLIED MATH I - Fall 1996

COURSE: MATH 5610
TIME: 10:25-11:20 MWF PLACE: Room 477 of Brown Hall CALL # 11701
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: *Second Course in Elementary Differential Equations*, by Paul Waltman.

PREREQUISITES: The formal prerequisite for this class is an introductory differential equations class (MATH 3200 here at ETSU). However, a detailed recollection of the methods used in such a class are not necessary (they were mostly tricks, anyhow). It is assumed that each student has (or is currently getting) an introduction to analysis. We will see proofs which employ the methods developed in this type of class.

ABOUT THE COURSE: This class offers an introduction to both linear and nonlinear systems of ordinary differential equations. Although we may not be able to *solve* many nonlinear DEs, we can learn something about their long term behavior (What are the stable states of the system? To which stable state will the system be "attracted" given initial conditions?). We will work numerous examples and also give a rigorous development of the underlying theory. Applications will play a role in motivation for much of what we see.

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

1. *Elementary Differential Equations and Boundary Value Problems* by W. Boyce and R. DiPrima. A standard introductory level text. There is nothing special about this particular introductory text, it's just that I have taught out of it before.

2. *Differential Equations, Dynamical Systems, and Linear Algebra*, by M. Hirsch and S. Smale. A graduate level text which offers rigorous proofs of much of the material we will cover.

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

$$AVERAGE = \frac{3H + T_1 + T_2 + F}{6}.$$

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 = Systems of Linear Differential Equations: review of linear algebra, matrix exponentiation, eigenvalues, stability considerations.

Chapter 2 = Two-Dimensional Autonomous Systems: phase plane, critical points, nonlinear systems, Liapunov stability theory, limit cycles, Poincaré-Bendixson Theorem.

Chapter 3 = Existence Theory: Contraction Mapping Theorem, existence and uniqueness theorem for ordinary differential equations.

Chapter 4 = Boundary Value Problems (as time permits): Sturm-Liouville problems, integral equations, eigenfunction expansions.