

# MA 2431 Mathematical Modeling with ODEs B term 2006

Text: Paul Waltman, *A Second Course in Elementary Differential Equations*

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Office Hours: MWF 11-1, TR 9-11, or by appointment.

Web page: [http://www.math.wpi.edu/Course\\_Materials/MA2431B06/](http://www.math.wpi.edu/Course_Materials/MA2431B06/)

## Course Goals

The primary goal of this course is to provide students with the knowledge and skills needed to derive and analyze ODE models of physical, chemical, or biological systems. This requires some additional background on ODE's as well as some material on deriving models and making them non-dimensionless.

We will find that this process can become rather involved, even for relatively simple models, so a secondary goal for this course is for you to become familiar with some computer tools. The main one of these is the CAS Maple, which is useful for solving for steady states, plotting vector fields, and solving (analytically and numerically) differential equations.

Another secondary goal is for you to work in teams on extended problems and communicate your results orally and in writing. Analyzing a model on your own provides a valuable experience that is a lot different from following what I do in class!

## Course Structure

- Homework  
There will be weekly homework assignments that will be collected and graded. Some will be paper and pencil problems from the book, others will require the use of a computer. Homework scores will count as 35% of your final grade.
- Exams  
There will be two in-class exams. Each will count 20% of your final grade. Tentative exam dates are 11-16 and 12-8.
- Major Project  
You will work in teams on a major project, analyzing a particular model. Oral and written reports will be required. This project will be worth 25% of your final grade. Details will be provided in class later in the term.

## Topics to be covered

### Week 1

Introduction to Modeling, Systems of ODE's

Secs. 1.1, 1.2, 1.3, 1.4

**Week 2**

Constant Coefficient Linear Systems

Secs. 1.5, 1.6, 1.7, 1.8

**Week 3**

Non-homogeneous systems, periodic systems

Secs. 1.9, 1.10, 1.12, 2.1, 2.2

**Week 4**

Phase plane

Secs. 2.3, 2.4, 2.5, 2.7

**Week 5**

Non-dimensionalization

Class Notes

**Week 6**

Examples

**Week 7**

Project presentations

*William W. Farr*

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