Math 142: Mathematical Modeling

Syllabus

Winter 2016

General

- Lecture: MWF 1:00-1:50 PM, MS 5147
- Textbook: R. Haberman, Mathematical Models, SIAM Paperback
- Webpage: `http://hydra.math.ucla.edu/~craig/142.2.16w/`
- Discussion: T 1:00-1:50 PM, MS 5147

Instructor

- Craig Schroeder
- Office: MS 6310
- Hours: MWF 2:00-3:30 PM (after class), or by appointment
- Email: `craig@math.ucla.edu`

Goals

In this course, you will learn to

- Physical systems
  - Apply dimensional analysis as a tool
  - Construct a mathematical model that describes the motion of a physical system including such elements as masses, springs, gravity, friction, ropes, pulleys, beams, etc.
  - Analyze such a model including
    - Determining Equilibria and their stability
    - Interconverting with total/kinetic/potential energy, where these exist
    - Constructing and interpreting a phase plane diagram
  - Understanding connections between these
- Traffic flow
  - Solve problems using Eulerian and Lagrangian descriptions of the motion of objects in 1D
  - Solve the 1D conservation law by the method of characteristics, including ones with shocks or rarefactions
  - Quantitatively and qualitatively determine what will happen to traffic due to various stimuli, such as traffic lights or accidents.

Course elements

Lecture There are 25 regular lectures, in addition to a midterm, a midterm review, and a final review. Lectures are intended to introduce and motivate the core concepts of the course.

Homework Homework is assigned for each lecture and is posted on the website. You may work on the homework problems in groups or individually. Homework will not be collected or graded.

Group work During discussion (after the quiz, if there is one), students will break into groups of 2-4 to work through additional problems. These problems tend to be somewhat different in nature from the homework problems from the book.

Quizzes There will be eight quizzes, each given at the beginning of discussion (weeks 2-5, 7-10). No make-up quizzes will be given, but the two quizzes with lowest score will be dropped when computing your course grade. The schedule of Quizzes and their coverage is listed on the website. Each quiz will be 15 minutes and contain two problems of equal value. One problem will be taken from the homework (either verbatim or with limited modification). The other question will usually be taken from the previous group work exercise. When this is not feasible, another homework problem will be chosen. In the case of long problems, the quiz problem would be only a portion of the problem. Quiz 1 will contain two homework problems, since the first group work exercise is programming.

Projects There will be three projects. The first and third projects have a programming component. You may use any programming languages you like for these assignments, though MATLAB/octave is likely to be easiest. The difficulty and amount of programming that will be required is minimal. The projects will be posted on the website. Projects are due by the end of lecture on the day they are due. You may work on the projects alone or in pairs. If you work with a partner, submit one copy of the project with both names on it; both partners will receive the same grade for the project.

Examinations There will be one midterm on Monday, February 8, 2016, during class. The final will be Tuesday, March 15, 2016, 8:00-11:00 AM. Please bring your ID card to both exams. For both the midterm and the final exam no books, notes, smartphones, or calculators will be allowed.

Grading

Your grade will be computed according to the grading scheme below. The lowest two quizzes will be dropped when computing your grade.

Item	Contribution
Projects	15%
Quizzes	20%
Midterm	25%
Final	40%

Academic conduct

Your work and conduct in this course are governed by the UCLA student conduct code and can be found here. This code is designed to promote high standards of academic honesty and integrity as well as fairness. In particular, all work that you submit in this course must be your original work. Any cases of suspected academic misconduct will be addressed as defined by the conduct code.