

Mathematical Models

MATH 303, MWF 11:00 - 11:50, Swords 302, Spring 2003

Dr. Gareth Roberts

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Office hours: Mon., Wed., 10:00 - 11:00, Tues. 10:00 - 12:00 or by appointment.

Required Text: *Mathematical Modeling, Third ed.*, Giordano, Weir and Fox.

Course Prerequisites: MATH 242 (Principles of Analysis) and MATH 244 (Linear Algebra)

Web page: <http://mathcs.holycross.edu/~groberts/Courses/MA303/homepage.html>
Homework assignments, lab and computer projects, schedule changes, exam materials, useful links and other important information will be posted at this site. Please bookmark it!

Syllabus: This is an applied mathematics course concerned with the construction, analysis and interpretation of mathematical models designed to investigate real world problems and phenomena. Part of the course will focus on developing the necessary mathematical tools often used in modeling. These include discrete dynamical systems, difference equations, the method of least squares (curve fitting), cubic splines, linear programming and differential equations. Some of this material may be familiar from previous courses. The applications we will explore come from various sources such as the natural sciences, engineering, economics and the social sciences.

One major goal for the course is, given a real world problem, to be able to construct a reasonable mathematical model, analyze the model for its effectiveness, refine your model as necessary and master the mathematical techniques needed to create and assess your model. Another goal is for you to develop your speaking skills by means of a couple of class presentations. You will also be asked to collaborate with other students on several group projects.

We will cover material from Chapters 1 - 4, 7, 10 and 11 of the text, with supplementary material provided as needed. We will also spend about a week on discrete dynamical systems. A rough outline of the semester is as follows:

- Modeling Change and Discrete Dynamical Systems (6-7 classes)
- The Modeling Process (5 classes)
- Model Fitting, Least Squares (4-5 classes)
- Midterm Exam
- Experimental Modeling, Cubic Splines (4-5 classes)
- Linear Programming (4 classes)
- Modeling with Differential Equations (4-5 classes)
- Modeling with Systems of Differential Equations (4-5 classes)
- Student Final Project Presentations (3-4 classes)
- Final Exam

Homework: Homework assignments will be posted on the course web page throughout the semester. There will be a list of problems for you to hand in, a nonempty subset of which will be graded. While you are allowed and encouraged to work on homework problems with your classmates, the solutions you turn in to be graded should be your own. Take care to write up solutions **in your own words**. Plagiarism will not be tolerated and will be treated as a violation of the Departmental Policy on Academic Integrity.

NOTE: LATE homework will NOT be accepted. The only excused homework which is late will be accompanied by a letter from the Class Dean. However, you will be allowed ONE “mulligan” over the course of the semester where you can turn in the assignment up to one week after the original due date.

Projects and Presentations: Several projects will be assigned over the course of the semester. These will often be collaborative efforts giving you the chance to apply some of the concepts learned in class. As most modeling problems are open ended, there will never be one correct solution. You will be given sufficient time to prepare your projects. The last and most important project will be on a topic of your choice and will involve a class presentation to display your findings. It is hoped that you will choose material which is related to other subjects you find interesting.

You will also be asked to do one 5-10 minute presentation at the start of a particular class on a topic I choose. These presentations are designed to give you practice at speaking in front of larger groups and to prepare you for your final project presentation. The material will usually come from an example in the textbook. Your presentation will begin the lecture for that section.

Exams: There will be one midterm exam on **Wednesday, February 26th, from 5:30 - 7:00 pm** and a comprehensive final at the end of the semester on **Monday, May 5th, from 8:30 - 11:30 am**. Please make a note of these dates and plan accordingly. Any conflicts must be legitimate and brought to my attention well before the exam is scheduled. If you have any specific learning disabilities or special needs and require accommodations, please let me know early in the semester so that your learning needs may be appropriately met. You will need to contact Dr. Matthew Toth of Disability Services in Hogan 207 (x 3693) to obtain documentation of your disability.

Academic Integrity: The Department of Mathematics and Computer Science has drafted a policy on academic integrity to precisely state our expectations of both students and faculty with regards to cheating, plagiarism, academic honesty, etc. You are required to read this policy and sign a pledge agreeing to uphold it. Anyone who violates the Departmental Policy on Academic Integrity will receive a 0 for that assignment as well as possible further disciplinary action involving your Class Dean.

Grade: Your course grade will be determined as follows: homework 20%, projects/presentations 40% midterm exam 15% and final exam 25% .

How to do well in this course: Attend class, participate and ask questions. Be an active learner. Do your homework regularly and learn to read the text.

WORK WITH YOUR CLASSMATES. Some of the best assets available to you are the knowledge and abilities of your peers. Mathematics can be fun and rewarding when there are people around you who enjoy figuring out problems as much as you do. Take advantage of this opportunity and organize study groups.