Math 3303
Butts

Fall 05
8/22/05

Introduction to Mathematical Modeling

Overview

Office: FN 3.308C
Office phone: 972-883-4007
Home phone: 214- 526- 9705
e-mail: tbutts@utdallas.edu
trbutts@earthlink.net

8/22/05A

Time: Mondays, Wednesdays 8:30 p.m. – 9:45 p.m.
Office Hours: MW 3:00 pm – 5:00 pm; 7:15 pm – 8:00 pm [in CB building] ,
T. 3:00 pm – 6:00 pm and by appt.

Prerequisites: Precalculus, Calculus I, Linear Algebra or Matrices rec; or permission

Textbook: A First Course in Mathematical Modeling, 3rd ed. Giordano, Weir, Fox. Brooks,Cole Publ. 2002. plus supplementary materials.

Technology/Calculator: You will need a TI-83^+/84^+ graphing calculator or other equivalent technology [e.g. Mathcad, Mathematica, etc.- please ask]. The TI-83^+/84^+ will be used for most class demonstrations. Feel free to see me in my office for help in learning to use the calculator.

Topics

1. Overview of modeling - getting acquainted with basic ideas of modeling.
2. Using proportionality / discrete dynamical systems
3. Using proportionality / geometric similarity
4. Using functions: polynomial, rational, trigonometric [periodic], exponential and logarithmic, logistic, etc. with sensitivity analysis
5. Using data: curve fitting
6. Using probability and simulation
7. Using dimensional analysis and graphing
8. Using calculus and simple differential equations.

In the textbook we will cover selected portions of chapters 1 – 6 and 8 –10. Handouts will also be distributed.

Assessment

- Quizzes [15%] in class / open book and notes 5 –7 quizzes, count best 5 of them.
- Tests [30%] Two tests [take-home] - Week 7 or 8, Week 12 or 13
- Projects [35%] : Several short projects, some individual and some team, and a team project for the 'final exam'. Week 15
- Homework / Attendance / Participation [20%] Homework will be assigned; some of it will be collected. Attendance, class participation, and a Monday Report are expected. .

Each **Monday [first reports 8/29 , 9/12, and each Monday thereafter]**, submit your answers to the following questions regarding this class:

1. What was the most important thing you learned during the last week?
2. What was the most confusing aspect of the work during the last week?
3 State any questions you have about the ideas and concepts in readings or class discussions of the last week.

Drop Date Info: http://www.utdallas.edu/calendar/index.php?search=withdraw

Academic Honesty: In this course students will conform to the University rules for academic honesty. For more information see http://www.utdallas.edu/judicialaffairs/index.html

Students with disabilities: Information from this course can be provided to students with disabilities through University services. For more information see http://www.utdallas.edu/student/slife/hcsvc.html

Course Objectives

Mathematical Modeling is an area of applied mathematics that uses mathematical tools for exploring and studying "real world" problems. The overall objective of this course is to provide an introduction to the process of mathematical modeling by giving students an opportunity to **construct, evaluate and compare appropriate models for various problem situations.**

Some more specific goals are: The student

- demonstrates understanding of the mathematical modeling process.
- applies the mathematical modeling process to a variety of situations from the real world.
- recognizes when different real-world situations may be represented by the same model.
- recognizes that some real world situations may be represented by several different models.
- knows the strengths and limitations of mathematical modeling as a method for solving real-world problems.
- is adept in using some technological tools, especially the TI-83^+ / 84^+ graphics calculator or equivalent technology
- uses a variety of mathematical techniques in modeling and problem solving.
- communicates mathematical ideas and approaches to problem solving both orally and in writing.
- critically evaluates mathematical models and comments on their strengths and limitations.

There are two basic types of models : **analytic and empirical.**

In modeling from theory [analytic models] , the student employs:

-linear, power, exponential, polynomial, exponential, logarithmic trigonometric, and logistic functions;
-matrices;
-probability simulations;
-difference, and / or differential, equations;
-graphs and diagrams;
-appropriate technology

In modeling from data [empirical modeling] , the student:

-models real phenomena with a variety of functions;
-represents and analyzes relationships using tables, rules, and graphs;
-translates among tabular, symbolic, and graphical representations of functions;
-analyzes the effects of parameter changes on the graphs of functions;
-uses curve fitting to predict from data;
-transforms data to aid in data interpretation and prediction;
-develops and employs criteria for "goodness of fit."