Math 3331-13641 (Spring 2012): Ordinary Differential Equations *

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Texts

Differential Equations, Second Edition, by J. Polking, A. Boggess and D. Arnold. Prentice Hall, 2006.

Course outline

Ordinary differential equations (ODE's) and systems of ODE's. Existence, uniqueness and stability of solutions; first and second order ODE's; applications; the Laplace transform; numerical methods; systems of ODE's; solutions of linear equations with constant coefficients; qualitative results.
The computer software Matlab will be used to compute numerical solutions and represent them graphically.

Prerequisites

- Math 2431 and Math 2433.
- I do not check the prerequisites. If you did not successfully complete the above courses or their equivalents, then you can take this course at your own risk. The instructor is not responsible for your potential low course grade due to the lack of the prerequisites.

*This syllabus contains important information about this course to which you will need to refer from time to time.

Dropping Policies

- The instructor may drop a student for excessive absences (see Catalog/Student Handbook).
- Last day to drop a course or withdraw without receiving a grade: *Wednesday February 1, 2012*
- Last day to drop a course or withdraw with a 'W'. *Tuesday April 3, 2012*
- The instructor will take all questions concerning the academic honesty very seriously (see Catalog/Student Handbook).

Course Policies and Procedures

Grades: Homework (40 percent), Tests (20 percent), Exams (40 percent)

Exams: All Exams will be given in class (one hour and half). Students with a valid excuse for missing up to one exam must provide written documentation to that effect, e.g., a medical certificate. No make-up exams will be given.

Tests: All Tests will be given in class (half hour).

Homework: You may, with impunity, submit up to two assignments up to one class period (not one week) beyond their due date. Subsequent submissions will incur penalties in increments of 10%. Homework submitted later than one class period beyond its due date will not be accepted without a written excuse. Computer program source code must be turned in and must adhere to the programming standards. Homework scores can not be changed one week after they have been returned. You must staple your work sheets in the upper left hand corner, and make sure that all information (name, etc.) is provided on every page. Any deviation from these instructions will result in a grade of ZERO. Only a subset of the problems collected will be grade.

Honor Code Policy: You are encouraged to discuss homework with your classmates. However, you are expected to individually write up your solutions.

Course Outline, Homework, Reading, and Exam Dates[1]

- **Chapter 2 First-Order Equations**
  - Lecture 1 (Jan. 17) 1.1 Differential Equation Models, 2.1 Differential Equations and Solutions
  - Lecture 2 (Jan. 19) 2.2 Solutions to Separable Equations, 2.3 Models of Motion
- Assignment 1 (Jan. 24) 1.1 (1,2,3,4); 2.1 (4,13,19,25); 2.2 (1,3,9,11,15,19,29,33); 2.3 (3,9,15,19)
  - Lecture 3 (Jan. 24) 2.4 Linear Equations, 2.5 Mixing Problems
  - Lecture 4 (Jan. 26) 2.7 Existence and Uniqueness of Solutions, 2.8 Dependence of Solutions on Initial Conditions
- Assignment 2 (Jan. 31) 2.4 (1,2,3,4,5,6,15,18,23,36,37); 2.5 (1,5,12); 2.7 (1,2,9,11); 2.8 (5)
- Review and Test 1 (Jan. 31)
- **Chapter 3 Modeling and Applications**
  - Lecture 5 (Feb. 2) 2.9 Autonomous Equations and Stability, 3.1 Modeling Population Growth
  - Lecture 6 (Feb. 7) 3.2 Models and the Real World, 3.3 Personal Finance
- Assignment 3 (Feb. 9)
- **Chapter 4 Second-Order Equations**
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  - Lecture 7 (Feb. 9) 4.1 Definitions and Examples, 4.2 Second-Order Equations and Systems
  - Lecture 8 (Feb. 14) 4.3 Linear, Homogeneous Equations with Constant Coefficients, 4.4 Harmonic Motion
- Assignment 4 (Feb. 16)
- Review and Test 2 (Feb. 16)
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  - Lecture 9 (Feb. 21) 4.5 Inhomogeneous Equations; the Method of Undetermined Coefficients, 4.6 Variation of Parameters

[1]This schedule, including dates of exams, is subject to change. Changes will be announced in class.

  - Lecture 10 (Feb. 23) 4.7 Forced Harmonic Motion

- Assignment 5 (Feb. 28)

- **Chapter 5 The Laplace Transform**

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  - Lecture 11 (Feb. 28) 5.1 The Definition of the Laplace Transform, 5.2 Basic Properties of the Laplace Transform
  - Lecture 12 (Mar. 1) 5.3 The Inverse Laplace Transform, 5.4 Using the Laplace Transform to Solve Differential Equations

- Assignment 6 (Mar. 6)

- Review and Test 3 (Mar. 6)

- **EXAM I (Mar. 8)**

- **Chapter 6 Numerical Methods**

  - Lecture 13 (Mar. 20) 6.1 Euler's Method, 6.2 Runge-Kutta Methods
  - Lecture 14 (Mar. 22) 6.3 Numerical Error Comparisons, 8.1 Definitions and Examples

- Assignment 7 (Mar. 29)

- Review and Test 4 (Mar. 27)

- **Chapter 8 An Introduction to Systems**

  - Lecture 15 (Mar. 29) 8.2 Geometric Interpretation of Solutions, 8.3 Qualitative Analysis
  - Lecture 16 (Apr. 3) 8.4 Linear Systems, 8.5 Properties of Linear Systems

- **Chapter 9 Linear Systems with Constant Coefficients**

  - Lecture 17 (Apr. 5) 9.1 Overview of the Technique, 9.2 Planar Systems
  - Lecture 18 (Apr. 10) 9.3 Phase Plane Portraits, 9.5 Higher-Dimensional Systems

- Assignment 8 (Apr. 12)

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  - Lecture 19 (Apr. 12) 9.6 The Exponential of a Matrix, 9.7 Qualitative Analysis of Linear Systems

  - Lecture 20 (Apr. 17) 9.8 Higher-Order Linear Equations, 9.9 Inhomogeneous Linear Systems
  - Lecture 21 (Apr. 19) Chapter 10 Nonlinear Systems
- Assignment 9 (Apr. 24)
- Review and Test 5 (Apr. 24)
- **EXAM II (Apr. 26)**