

Math 340-007 Introduction to Ordinary Differential Equations

A. Course Information

Classroom: MWF in Chemistry B202, T in Wager 132

Class time: 11:00-11:50 am

Course Coordinator: Dr. David Aristoff, Email: aristoff@rams.colostate.edu

Course Instructor: Dr. Baohua Chen, Email: baohua.chen@colostate.edu

Common Office hours: Held in Calculus center in the Great Hall of the TILT Building.

B. Course Description

Mathematical modeling to address real-world problems has been one of the most important aspects of each branch of science. These models are formulated in terms of equations involving functions as well as their derivatives. Such equations are called differential equations. If only one independent variable is involved, the equations are called ordinary differential equations. The course will demonstrate the usefulness of ordinary differential equations for modeling physical and other phenomena. Complementary mathematical approaches for their solution will be presented, including analytical methods and graphical analysis. The basic content of the course includes:

- First order linear ordinary differential equations (ODEs)
- Mathematical models
- Second order linear ODEs with constant coefficients
- Linear Algebra reviews; Systems of first order ODEs
- Laplace transform
- Linear systems of arbitrary order and matrices
- Nonlinear systems and phase plane analysis

Prerequisite: Math255 or Math261

C. Textbook

William E. Boyce, Richard C. Diprima, Douglas B. Meade, Elementary Differential Equations and Boundary Value Problems, Wiley, 11th edition, ISBN-13: 978-1-119-25600-7 (or ISBN-10: 1119256003)

D. Grading

Quizzes: 25%, Midterm Exam1: 25%, Midterm Exam2: 25%, and Final Exam: 25%

Quizzes will consist of 1 problem similar to the suggested exercises and will be given during the last 20 minutes of class on Wednesday biweekly.

Letter Grades: A (100-90), B (89-80), C (79-70), D (69-60), F (< 60)

Plus/minus grades may be awarded at the margins.

E. Important Dates

Midterm Exam1: 5:00-6:50 pm, Feb 22;

Midterm Exam2: 5:00-6:50 pm, Apr 4;

Final exam: 7:30-9:30 am, May 6

F. Weekly schedule

Week	Sections	HW exercises
Week 1 1/15-1/19	1.1-1.3: Direction fields, Solutions and classification of ODEs	1.1: 11, 12, 15, 18, 19, 20, 21 1.2: 1c, 3, 7, 8, 10, 12 1.3: 1-4, 6, 8, 13, 19
Week 2 1/22 – 1/26	2.1, 2.2: 1 st order linear ODE and integrating factors; Separable ODEs;	2.1: 3, 7, 9, 11, 17, 23 2.2: 2, 4, 6, 10, 12, 17, 27
Week 3 1/29 – 2/2	2.6, 2.3, 2.5: Exact ODEs and integrating factors; Modeling with 1 st order ODEs (population dynamics, etc.); plotting direction fields (sketching and/or MATLAB)	2.3: 2, 10, 12, 13, 20 2.5: 3, 7, 9, 15a, 16ab, 25 2.6: 2, 3, 6, 11
Week 4 2/5 – 2/9	3.1, 3.2, 3.3, 3.4: Solution of 2 nd order linear homogeneous ODEs w/constant coefficients; Solution of 2 nd order linear non-homogeneous ODEs w/constant coefficients;	3.1: 1, 4, 5, 8, 15, 19 3.2: 3, 10, 19, 20 3.3: 5, 7, 12, 13, 15, 23 3.4: 1, 2, 5, 7, 9,12
Week 5 2/12 – 2/16	3.5, 3.6, 3.7, 3.8: Method of undetermined coefficients; mechanical vibrations (undamped/damped free vibrations), forced periodic vibrations (beat, resonance); Wronskian; Linear combination and superposition	3.5: 1, 2, 4, 5, 10, 12 3.6: 1, 4, 6 3.7: 1, 4, 11a, 17, 20ac 3.8: 1, 4, 5a, 6, 13, 14
Week 6 2/19 – 2/23	4.2-4.3: High order linear ODEs Review and Midterm Exam 1	4.2: 8, 9, 10, 11, 13, 20 4.3: 1, 2, 4
Week 7 2/26 – 3/1	7.2, 7/3: Linear Algebra, eigenvalues, eigenvectors	7.2: 1cd, 2cd, 7, 8, 10, 16cd, 17, 18; 7.3: 1, 2, 3, 6, 7, 11, 12, 14, 15, 18
Week 8 3/4 – 3/8	7.5, 7.6: Linear Algebra, System of 1 st order ODEs	7.5: 1, 2, 4, 11, 17, 18 7.6: 1, 2, 3, 7, 9ab
Week 9 3/11 – 3/15	Spring Break, No Classes	
Week 10 3/18 – 3/22	7.8: Systems of 1 st order ODEs	7.8: 1, 2, 6a, 8a, 6b, 8b 7.5: 7, 8, 9, 12 7.6: 5, 18a, 19a, 25abc 7.8: 4, 5, 9, 10
Week 11 3/25 – 3/29	7.1, 7.4, 7.7: Systems of 1 st order ODEs	7.1: 4, 12, 15, 19a 7.4: 1ae, 3ae, 4ae, 12ab 7.7: 1a, 3a, 4a, 9
Week 12 4/1 – 4/5	7.9: Systems of 1 st order ODEs Review and Midterm Exam 2	7.9: 1, 2
Week 13 4-8 – 4/12	6.1: Laplace Transform: review of improper integrals, definition & examples of Laplace transforms; Properties of Laplace transform; Inverse Laplace transforms	6.1: 4ab, 5, 8, 9, 10 6.1: 11, 12, 14 6.1: 23ab, 24ab
Week 14 4/15 – 4/19	6.2: Solving 1 st and 2 nd order ODEs with Laplace transforms	6.2: 1, 2, 3, 4, 6, 7 6.2: 8, 9, 10, 12, 15, 16 6.2: 13, 14
Week 15 4/22 – 4/26	9.1-9.2: Planar linear systems and classification; Autonomous systems and stability	9.1: 1, 2, 4, 5, 6, 17, 18 9.2: 5abc, 10abc, 11abc, 19abc, 20ab
Week 16 4/29 – 5/3	9.3: Local linear systems; Review for Final Exam	8abcd, 10abcd, 12abcd

G. Exams/Quizzes Makeups

We follow university policies but require legitimate excuses and documents.

-- For quizzes, no makeup for any reason, but the lowest quiz will be dropped at the end of semester.

-- For midterm & final exams, contact course coordinator.