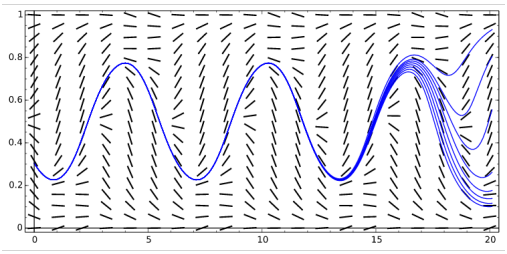
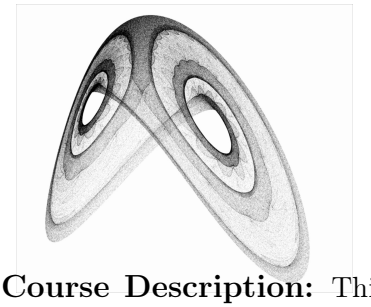


Math 2C - Section 2929 - Spring '18

Ordinary Differential Equations

MTWR 8:00-9:20AM, MSTC153



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Math 12
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Syllabus subject to time rate of change.

Course Description: This is an introductory course in differential equations and their applications in modeling dynamic phenomena. Topics include analysis of first, second and higher order differential equations; systems of first order equations, linear, homogeneous and nonhomogeneous differential equations; solutions by power series; numerical methods, LaPlace transforms; and applications.
Prerequisite: Math 1B. **Credit Hours:** 4

Text: *Elementary Differential Equations with Boundary Values*, by Boyce/Diprima/Moore.
e-book **ISBN-13:** 978-1-119-32063-0

Course Objectives:

At the completion of this course, students will be able to:

1. Solve first order linear differential equations using separation of variables and integrating factors.
2. Apply concepts to model dynamical systems in the sciences.
3. Synthesize the predictive value of differential equations and some of the limitations that imperfect data present in mathematical modeling including absolute and relative error.
4. Prove theorems regarding the existence and uniqueness of solutions for differential equations.
5. Understand how linearity (or lack of it) affects the nature of solutions of differential equations
6. Apply the superposition principle to methods of solving homogeneous and non-homogeneous linear second order differential equations with constant coefficients including resonant solutions.
7. Produce geometric interpretations for solutions using direction fields and phase portraits.
8. Develop numerical methods for solving ODEs including Euler's methods.
9. Use analytic methods for solving and interpreting solutions to linear 1st order systems with constant coefficients.
10. Use eigenvalues and eigenvectors in the analysis of systems of ODEs.
11. Analyse sensitivity of solutions to changes in initial conditions especially in relation to the eigensystem of the matrix that defines the system.
12. Create and analyse solutions to some nonlinear differential equations of contemporary interest including bifurcation and chaotic dynamics.
13. Use Laplace transforms to solve second order equations with discontinuous forcing functions.

Grade Distribution:

Projects	25%
Homework quizzes	5%
Chapter Tests	45%
Final Exam	25%

Letter Grade Distribution:

≥ 90.00	A	70.00 - 79.99	C
80.00 - 89.99	B	60.00 - 69.99	D
.	.	≤ 59.99	F

Course Policies:

- **Homework**
  - Homework will be assigned regularly. See class schedule.
- **Group Projects**
  - Projects will involve using ODEs in modeling.
  - Groups will involve 3 or 4 students, preferably 3.
  - Groups can be formed by students or imposed by the instructor.
  - Peer Review will be used as part of the grading procedure for projects.
  - Use CoCalc to collaborate in the cloud with sagemath.
- **Calculators and Computers**
  - The use of Computer algebra systems is essential to the course. There many flavors of CAS, including Mathematica, Maple, and MatLab. We'll use Sagemath via CoCalc.
  - You will need scientific calculator for some exams, but graphing calculators and calculators with CAS may be restricted when testing analytical methods that the calculator will do for you.
- **Grades**
  - Grades in the **C** range represent performance that **meets minimal expectations**; Grades in the **B** range represent performance that is **substantially better** than the expectations; Grades in the **A** range represent work that is **excellent**.
- **Attendance and Absences**
  - Attendance is expected and will be noted. If you're not there, you missed it. Excessive absences are cause for dismissal, as per the college catalog.
  - Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials and to learn what was missed.
  - It is the student's responsibility to drop all classes in which he/she is no longer participating or attending.

- It is the instructor's discretion to drop a student for excessive absences or non-participation any time during the allowed drop/withdrawal period for the course.
- Student who remain enrolled in a class beyond the published withdrawal deadline, as stated in the class schedule, *must* receive an evaluative letter grade in the class. (A 'W' grade cannot be assigned during the final grading for students till appearing on the roster.)
- The final grade in this class will be affected by active participation, including attendance, as indicated in the in-class quiz scores.

- **Cell Phones**
  - Turn off your cell phone during class. You may not receive calls or messages in class.

Note: No makeup quizzes will be given. Only legitimate excuses (with a doctor's note, say) will allow a makeup exam.

Academic Honesty Policy

In addition to skills and knowledge, College of the Desert aims to teach students appropriate ethical and professional standards of conduct. The college catalog specifies that students are expected to "be honest and ethical at all times in the pursuit of academic goals. Students who are found to be in violation of the Student Conduct Standards and Procedures will receive a grade of zero on the assignment, quiz, or exam in question and may be referred for disciplinary action in accordance with Student Disciplinary Procedures." Any attempt to deceive a faculty member or to help another student to do so will be considered a violation of this standard.

Course Calendar:

Week	Content
Week 8 3/16	• Chapters 3 Test • hw for 3.7 and 8 • Chapter 3 Review Sheet
Week 7 3/12	• §3.6: Variation of Parameters: 2,4,8,10,12,14,16-22 • §3.7: Mechanical and Electrical Vibrations: 2,4,5,6,8,10,12,15,16,17,18,20,22 • §3.8: Forced Periodic Vibrations
Week 6 3/5	• §3.4: Repeated Roots & Reduction of Order: 4,8,10,12,13,15,16,17,20,23,24,26,28,29,30,32 • §3.5: Non-homogeneous Equns: 2,4,8,10,12,14,16,19,22,23,24,25,27,29
Week 5 2/23	• test and Solutions • §3.1: Homogeneous ODEs with constant coefficients: 3,5,9,11,14,17,21 • §3.2: Wronskian: 5,9,11,13,16,18,20,22,24,26,28,30 • §3.3: Complex Roots of Char. Equn: 3,7,11,13,16,18,22,24,25,28,31,32,34
Week 4 2/17	• Project 2: Single Neuron Equation • Review for Test 1. See first order equations among these.
Week 3 2/9	• §2.6: Exact Equations: 2,6,8,13,16,18,20,22 • §2.7: Euler's Method: 2,4,8,10,12,14,15,16 • §2.8: 2,4,6,8,10,11,12,13,14,15,16,17,18 • §2.9: 1,2,3,4,8,10,11,12,13,14,15 • Choose Project & Team
Week 2 2/5	• §2.4,2.5: Graphical Solutions, Linear 1st Order ODEs, E& U, and Autonomous ODEs and Population Mods. 2.3: 2,4,6,10,12,17,18,19,20,21,22,23,24 2.4: 2,4,8,12,16,18,20,22,24 2.5: 1,2,3,4,8,16,18,21,23,24,25
Week 1–1/29	• Introduction: Open a CoCalc account and start the first project: "M&M Population Dynamics". §1-2.3: First Order Linear Equations, Separable Equations and Modeling. 1.1: 4,10,11,12,13,14,15,16,20,22,25 1.2: 4,5,6,10,12,13 1.3: 4,8,10,12,20,22,23 2.1: 4,8,12,16,18,20,22-28 2.2: 1,3,5,9,13,15,18,20,24,25,28,31