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Course Description: This course provides an introduction to ordinary differential equations and their applications to science and engineering. Topics include first order equations, separable and linear differential equations, second order differential equations, systems of linear differential equations, the Laplace transform and numerical methods. There is also a lab component that focuses on using Matlab to analyze and solve differential equations numerically.

Students enrolled in AMS 20A are not required (but are encouraged) to attend the lab sections and are not responsible for the Matlab component. They are also not responsible for the sections on systems of differential equations and the Laplace transform.

Reading: The reading assignments listed with the lecture schedule are meant to be completed at least once before the corresponding lecture.

Quizzes/Exams: There will be eight quizzes (in class), a midterm exam and a comprehensive final exam. The quiz/exam dates are listed in the lecture schedule that follows. Make-up quizzes will not be given. Your three lowest quiz scores will be dropped. AMS 20A students are responsible for the first 5 quizzes, and their lowest two scores will be dropped.

Homework: Assignments are listed in the lecture schedule. These assignments will not be collected or graded. However, the quiz problems and some of the exam problems will be similar, if not identical to homework problems.

Sections: The lab sections are mandatory for students enrolled in AMS 20.

Course grade: Your (five highest) quiz scores contribute 25 points to your overall score in the class, the midterm contributes 25 points and the final exam contributes the 40 points. There will also be several Matlab assignments in the lab sections, and these will contribute the final 10 points to your overall score. For students enrolled in 20A: your highest 3 quiz scores contribute 30 points, your midterm score contributes 30 points and your final exam contributes 40 points to your course grade. Letter grades will correspond (approximately) to the following ranges:

<table>
<thead>
<tr>
<th>Overall Score</th>
<th>Grade</th>
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<tbody>
<tr>
<td>90 – 100</td>
<td>A– to A+</td>
</tr>
<tr>
<td>79 – 89</td>
<td>B– to B+;</td>
</tr>
<tr>
<td>60 – 78</td>
<td>C to C+</td>
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<tr>
<td>50 – 59</td>
<td>D</td>
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<tr>
<td>0 – 49</td>
<td>F</td>
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To pass the class, your overall score must be 60 or above and you must score at least 50% on the final exam.
TIPS FOR SUCCESS

⋆ Come to all the lectures, and come prepared — read the assigned sections at least once before the lecture, so you have an idea of what we will be discussing in the lecture. You don’t have to read the material in depth the first time through.

⋆ Read the material again after the lecture, this time in more depth. Read actively: take notes, make a list of questions to ask. Try working the examples in the book/supplementary notes on your own before reading the solutions.

⋆ Work on the homework after the second reading. Make a note of the problems that you don’t understand so that you can ask about them.

⋆ Ask questions: the more specific your question, the better and more helpful the answer is likely to be. You can ask questions in class, in section and during office hours.

⋆ Attend sections regularly. You can prepare for section by making a list of the homework problems you find most challenging/confusing.

⋆ Study with friends for a few hours a week. Technical skills can be practiced alone, but concepts need to be discussed.

⋆ The standard for a 5-unit course at UCSC is 15 hours of studying a week. These 15 hours include the time for lectures and sections, but this still leaves close to 10 hours a week you should be spending with the material outside of class.

⋆ If you feel that you are getting lost, take action. Don’t wait and hope ‘it goes away’. Come to office hours or ask questions in class (or section) to clear up any confusion.

Students with disabilities: If you qualify for classroom/exam accommodations because of a disability, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me as soon as possible, preferably within the first week of the quarter. Contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu for more information.

CHEATING:

Cheating in any form (using notes on quizzes or exams, copying from someone else, etc.) will not be tolerated. Any student caught cheating will be reported to the AMS department and to his or her college provost. In almost all cases, students caught cheating will receive a failing grade. Students who help others cheat are also considered cheaters.

Cheating devalues everyone’s grades.
You should not tolerate it either.
Lecture Schedule with Homework and Quiz/Exam Dates.

Monday, 1-6: Introduction.
*Reading:* Sections 1.1 - 1.3.
*Homework.* 1.1: 15 - 21; 1.2: 3, 7, 15; 1.3: 1, 3, 5, 7, 11, 15, 19.

Wednesday, 1-8: First order linear equations
*Reading:* Section 2.1
*Homework.* 2.1: 1, 5, 8, 11, 13, 16, 19, 25, 30, 35.

Friday, 1-10: Separable equations
*Reading:* Section 2.2.
*Homework.* 2.2: 1, 3, 4, 7, 9, 15, 26.

*Reading:* Section 2.3.
*Homework.* 2.3: 1, 2, 3, 7, 13, 18, 20.

Wednesday, 1-15: Autonomous equations; Equilibria. **Quiz 1**
*Reading:* Section 2.5
*Homework.* 2.5: 1, 3, 5, 9, 13, 14.

Friday, 1-17: Population models.
*Reading:* Section 2.5
*Homework.* 2.5: 15, 16, 17, 20, 21.

Monday, 1-20: *Martin Luther King Jr. day – Holiday*

Wednesday, 1-22: Exact equations. **Quiz 2**
*Reading:* Section 2.6
*Homework.* 2.6: 1, 3, 5, 6, 11.

Friday, 1-24: Numerical methods
*Reading:* Section 2.7 and 8.1.
*Homework.* 2.7: 1, 3, 11, 15; 8.1: 1, 3, 5, 22.

Monday, 1-27: Numerical methods (cont.)
*Reading:* Sections 8.2 and 8.3.
*Homework.* 8.2: 1, 3, 5; 8.3: 1, 3, 5.

Wednesday, 1-29: Existence and uniqueness theorems. **Quiz 3**
*Reading:* Sections 2.4 and 2.8
*Homework.* 2.4: 1, 3, 4, 7, 10, 21, 27, 28; 2.8: 1, 3, 8, 9.
Friday, 1-31: Second order linear homogeneous equations – characteristic equation.

*Reading*: Section 3.1

*Homework*. 3.1: 1, 4, 7, 8, 11, 14, 18, 20, 23, 27;

Monday, 2-3: Second order linear homogeneous equations – general theory.

*Reading*: Section 3.2.

*Homework*. 3.2: 7, 9, 12, 14, 21, 28, 38.

Wednesday, 2-5: Complex roots and repeated roots. *Quiz 4*

*Reading*: Sections 3.3 and 3.4.

*Homework*. 3.3: 1, 4, 5, 6, 8, 11, 15, 18, 21, 24, 28, 29, 34, 37; 3.4: 7, 12, 18, 38, 39.

Friday, 2-7: Nonhomogenous equations.

*Reading*: Sections 3.5 and 3.6.

*Homework*. 3.5: 1, 5, 8, 13, 15, 17, 19, 24, 31, 32; 3.6: 1, 4, 5, 9, 11, 15, 17.

Monday, 2-10: Applications

*Reading*: Sections 3.7 and 3.8.

*Homework*. 3.7: 1, 4, 6, 8, 11, 12, 15, 18, 19, 24; 3.8: 1, 3, 5, 7, 9, 11, 16, 21.

Wednesday, 2-12: Applications (cont.)

*Reading*: Sections 3.7 and 3.8.

Friday, 2-14: *Midterm Exam*

Monday, 2-17: *Presidents’ day – Holiday*

Wednesday, 2-19: Higher order linear homogeneous equations

*Reading*: Sections 4.1 and 4.2.

*Homework*. 4.1: 1, 3, 5, 7, 9, 11, 12, 17; 4.2: 1, 4, 5, 6, 7, 8, 9, 11, 14, 23, 37, 39.

Friday, 2-21: Nonhomogeneous equations – undetermined coefficients and variation of parameters.

*Reading*: Sections 4.3 and 4.4

*Homework*. 4.3: 2, 5, 9, 15, 18; 4.4: 1, 5, 7, 13.

Monday, 2-24: The Laplace transform. *Quiz 5*

*Reading*: Section 6.1

*Homework*. 6.1: 5, 6, 7, 10, 13, 15, 16, 19, 21, 22, 24, 26, 27.

Wednesday, 2-26: Solving initial value problems with the Laplace transform.

*Reading*: Section 6.2.

*Homework*. 6.2: 1, 3, 6, 9, 11, 15, 19, 21, 24.

Friday, 2-28: Equations with discontinuous forcing functions.
Reading: Sections 6.3 and 6.4.
Homework. 6.3: 1, 4, 6, 7, 12, 13, 15, 18, 21, 24, 30, 31, 33; 6.4: 1, 5, 7, 9, 11, 16.

Monday, 3-3: Systems of first order linear equations – basic theory.  Quiz 6
Reading: Sections 7.1 and 7.4.
Homework. 7.1: 2, 4, 5, 7, 11, 15, 17, 18, 19, 22.

Wednesday, 3-5: Systems of first order equations – homogeneous systems.
Reading: Sections 7.4 and 7.5
Homework. 7.4: 2, 5, 6; 7.5: 1, 3, 6, 8, 9, 11.

Friday, 3-7: Homogeneous systems with constant coefficients. Quiz 7
Reading: Sections 7.5 and 7.6.
Homework. 7.5: 15, 18, 24, 26, 30; 7.6: 2, 3, 6, 7, 9, 15, 25, 28.

Monday, 3-10: The fundamental matrix.
Reading: Section 7.7.
Homework. 7.7: 1, 3, 7, 9, 11.

Wednesday, 3-12: Repeated eigenvalues. Quiz 8
Reading: Section 7.8
Homework. 7.8: 1, 3, 5, 7, 10, 16.

Friday, 3-14: Nonhomogenous linear systems
Reading: Section 7.9
Homework. 7.9: 1, 3, 7, 11.

Monday, 3-17: Catch-up and review.

Thursday, 3-20: Final Exam: 12 – 3 pm