**Course Syllabus**
MATH 2250, Section 001, Summer 2020
Differential Equations and Linear Algebra

**Instructor:** Loren Santana
Pronouns: She/her/hers
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**Lecture Hours:**
Course is completely online. Lecture videos posted on weekly basis.

**Office Hours: Mondays and Wednesdays, 1:00 PM - 2:00 PM** or by appointment
**Location:** Online via Zoom.

**Email Communication:** I am happy to answer any questions through email. However, I don't always check my email on the weekends and I try not to check my email during the week after 6:00 PM. I will usually respond to your email within 24 hours.

**Text:** *Differential Equations and Linear Algebra* 4th Edition, by C. Henry Edwards, David E. Penney, and David Calvis. For information on purchasing the textbook, go to
http://www.math.utah.edu/schedule/bookInfo/M2250TextInclusiveAccess-1.pdf

- ISBN 13: 978-0134497181

The textbook is a custom edition designed for the University of Utah, and we will be using the textbook for homework. You can purchase the textbook at the bookstore or online. There is also an inclusive access option, which is the cheapest option. There is a 3rd edition of this textbook which *may* suffice for this course. However, it is the student's responsibility to ensure that the problem numbers are the same.

**Technology:** Calculators will not be allowed on exams. They may be used on homework, but you should still write out the details of your computation. It is in your best interest not to become too dependent on your calculator since they will not be allowed on exams. Students are not expected to have prior programming experience, but will be required to run portions of code that will be provided in lecture and lab.

**Prerequisites:** At least a "C-" or better in (MATH 2210 OR MATH 1260 OR MATH 1280 OR MATH 1321 OR MATH 1320 OR ((MATH 1220 OR MATH 1250 OR MATH 1270 OR MATH 1311 OR AP Calculus BC score of 5) AND PHYS 2210 OR PHYS 3210)).

**Canvas:** Canvas will be used for posting course announcements, homework assignments, grades, files and any relevant supplementary material. Class notes will also be posted on Canvas. You are also welcome to make use of the Canvas discussion board to discuss course problems or topics. You can access the Canvas page through CIS or by logging in at utah.instructure.com. Students should check the Canvas page regularly for course information and resources. Email notifications and correspondence will be sent to the student's UMail address ([u-number]@utah.edu); this email account must be checked regularly.

**Homework:** Weekly homework will be assigned but not collected. The assignments will be posted on Canvas and homework will cover material up to and including the previous Friday. It is in your best interest to complete these as quiz and exam questions will be similar to assigned problems.

**Quizzes:** There will be weekly quizzes except the first week and test weeks. Quizzes will be posted on Canvas by Friday morning and should be submitted via Canvas no later than 11:30 PM (MDT) . Although you will have the whole day to submit it, the quizzes should take no more than 15 - 20 minutes. Quizzes are **closed-book**. You should not use any resources, unless stated otherwise. The two lowest quiz scores will be dropped. There are no "make-up" quizzes. Students who miss a quiz will receive a "0" on the missed quiz.

**Weekly Labs:** Weekly labs will be posted and due on Fridays. You may collaborate with other students in the discussion section. There will be no "make-up" labs.

**Exams:** You will have two midterm exams (60 minutes each). There are no "make-up" exams. Students who miss an exam will receive a "0" on the exam. Absence from an exam will be excused only if you can provide verifiable and convincing evidence that you have a significant illness or serious family crisis that will prevent you from taking it. Except under extremely unusual circumstances, you must inform me in advance that you will miss an exam.

The midterms and final exams will open on Canvas by 7 AM and close at 11 PM. The exam is timed, so you need to be prepared (i.e study before hand). They will be closed-book, no calculators, or other resources allowed.

Any sort of cheating will result in filing a report with the department and Dean of Students, which will be included in your academic record.

**Final Exam:** The comprehensive final exam is on **Friday, July 31st**.

**Grading Policy:** Your grade will be based on:

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| Quizzes | 15% |
| Weekly Labs | 20% |
| Exam 1 | 20% |
| Exam 2 | 20% |
| Final Exam | 25% |

The instructor retains the right to modify this grading scheme during the course of the semester; students will, of course, be notified of any adjustments. **Do not expect extra credit, curving, or rounding to boost your grade.**

**Grades (Evaluation and criteria):** Final letter grades will be determined by overall percentage as follows:

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| A | 93% – 100% | B- | 80% – 82.9% | D+ | 68% – 69.9% |
| A- | 90% – 92.9% | C+ | 78% – 79.9% | D | 63% – 67.9% |
| B+ | 88% – 89.9% | C | 73% – 77.9% | D- | 60% – 62.9% |
| B | 83% – 87.9% | C- | 70% – 72.9% | E | below 60% |

**Course information and expected outcomes:** Math 2250 is a 4-credit semester course where students will master the basic tools and problem solving techniques important in differential equations and linear algebra. Techniques and tools learned in class will be demonstrated in the weekly lab sections. Upon successful completion of this course, a student should be able to:

- Be able to model dynamical systems that arise in science and engineering, by using general principles to derive the governing differential equations or systems of differential equations. These principles include linearization, compartmental analysis, Newton's laws, conservation of energy, and Kirchoff's law.
- Learn solution techniques for first order separable and linear differential equations. Solve initial value problems in these cases, with applications to problems in science and engineering. Understand how to approximate solutions even when exact formulas do not exist. Visualize solution graphs and numerical approximations to initial value problems via slope fields.
- Become fluent in matrix algebra techniques, in order to be able to compute the solution space to linear systems and understand its structure; by hand for small problems, and with technology for large problems.
- Manage to utilize the basic concepts of linear algebra such as linear combinations, span, independence, basis and dimension, to understand the solution space to linear equations, linear differential equations, and linear systems of differential equations.
- Understand the natural initial value problems for first order systems of differential equations, how they encompass the natural initial value problems for higher order differential equations, and general systems of differential equations.
- Learn how to solve constant coefficient linear differential equations via superposition, particular solutions, and homogeneous solutions found via characteristic equation analysis. Apply these techniques to understand the solutions to the basic unforced and forced mechanical and electrical oscillation problems.

- Learn how to utilize Laplace transform techniques to solve linear differential equations, with an emphasis on the initial value problems of mechanical systems, electrical circuits, and related problems.
- Be able to find eigenvalues and eigenvectors for square matrices. Apply these matrix algebra concepts to find the general solution space to first and second order constant coefficient homogeneous linear systems of differential equations, especially those arising from compartmental analysis and mechanical systems.
- Understand and be able to use linearization as a technique to understand the behavior of nonlinear autonomous dynamical systems near equilibrium solutions. Apply these techniques to non-linear mechanical oscillation problems and other systems of two first order differential equations, including interacting populations. Relate the phase portraits of non-linear systems near equilibria to the linearized data, in particular to understand stability.
- Develop your ability to communicate modeling and mathematical explanations and solutions, using technology and software such as Maple, MATLAB or internet-based tools as appropriate.

**Problem solving fluency:**

- Students will be able to read and understand problem descriptions, then be able to formulate equations modeling the problem usually by applying geometric or physical principles. Solving a problem often requires a series of transformations that include utilizing the methods of calculus. Students will be able to select the appropriate calculus operations to apply to a given problem, execute them accurately, and interpret the results using numerical and graphical computational aids.
- Students will gain experience with problem solving in groups. Students should be able to effectively transform problem objectives into appropriate problem solving methods through collaborative discussion. Students will also learn how to articulate questions effectively with the instructor, and be able to effectively articulate how problem solutions meet the problem objectives.

**Some important dates for this class:**

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| Monday, May 11 | First day of classes |
| Wednesday, May 20 | Last day to add, drop (delete), or audit classes |
| Monday, May 25 | Memorial Day holiday (no class) |
| **Friday, June 12** | **First midterm exam** |
| Friday, June 19 | Last day to withdraw from classes |
| Friday, July 3 | Independence Day holiday (no class) |
| **Friday, July 10** | **Second midterm exam** |
| Wednesday, July 22 | Last day to elect CR/NC |
| Thursday, July 23 | Last day to reverse CR/NC option |
| Friday, July 24 | Pioneer Day holiday (no class) |
| Wednesday, July 29 | Last day of class |
| **Friday, July 31** | **Final exam** |

**ADA Statement:** The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability and Access, 200 S. Central Campus Dr., Rm. 162. CDA will work with you and the instructor to make arrangements for accommodations. All information in this course can be made available in alternative format with prior notification to the Center for Disability and Access.

**Safety Statement:** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

**Veterans' Center:** If you are a student veteran, the U of Utah has a Veterans Support Center. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: http://veteranscenter.utah.edu/. Please also let me know if you need any additional support in this class for any reason.

**Nondiscrimination & Accessibility Statement:** The University of Utah does not discriminate on the basis of race, color, religion, national origin, sex, age, status as a disabled individual, sexual orientation, gender identity/expression, genetic information or protected veteran?s status, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Additionally, the University endeavors to provide reasonable accommodations and to ensure equal access to qualified persons with disabilities. Inquiries concerning perceived discrimination or requests for disability accommodations may be referred to the University?s Title IX/ADA/Section 504 Coordinator at the Office of Equal Opportunity and Affirmative Action, 801-581-8365

**Student Wellness:** Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu

**Student responsibilities:** All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, indicated in the Student Handbook. You have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies prescribed conduct (Article XI) that involves cheating on tests, collusion, fraud, theft, etc. Students should read the Code carefully and understand you are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee. http://regulations.utah.edu/academics/6-400.php