MATH 2250-001, Differential Equations and Linear Algebra, Summer 2020

Lecture: M T W Th at 12:30PM-1:30 PM via Zoom

Instructor: Lei Wu

Email: lwu@math.utah.edu

Office Hours: Mondays and Wednesdays, 10:00 AM - 11:00 AM or by appointment
Location: Online via Zoom.

Required Technology: Internet fast enough to participate in Zoom video conferencing, a webcam or a smartphone that has a camera that can run the Zoom application.
Course Lectures: The lectures of this course will be given live over zoom at the scheduled time from 12:30PM-1:30 PM. Students are expected to join the live zoom session and participate in class. The zoom sessions will be accessed through canvas.
Canvas: Canvas will be used for posting course announcements, lecture videos, homework assignments, grades, files and any relevant supplementary material. You are also welcome to make use if 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.

The university suggest that you use Firefox, Chrome, or Safari to login to Canvas, but not Internet Explorer. For any technical help with Canvas, you should contact the UOnline Helpdesk at (801) 581-6112.

Prerequisite Information: Prerequisites: "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)).

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.

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: Two 60-minute exams will be given during the semester. Midterm exams will be given through the computer. No textbook notes or calculators will be allowed. Exams will be proctored, either through ProctorU or Zoom, so a webcam will be required. Online resources and communication with others (either in person or electronically) will not be allowed during the exams. Violations of these rules will be considered academic misconduct; a zero will be given on the exam and a report will be sent to the College of Science.

One cumulative 120 minute exam will be given at the end of the semester. It will be the same format and follow the same rules as the midterm exams, only it will be longer.

- Exam 1: Friday, June 12
- Exam 2: Friday, July 10
- Final: Friday, July 31

Grading: The grades will be determined using the following weights:

- Quizzes: 15%
- Weekly Labs: 20%
- Exam 1 and 2: 20%×2
- Final: 25%
- Note: no scores will be dropped.

Grading Scale: Semester letter grades will be converted from numerical semester scores (N) as follows:

$100 \geq N \geq 93 : A$	$93 > N \geq 90 : A-$	$90 > N \geq 88 : B+$	$88 > N \geq 83 : B$
$83 > N \geq 80 : B-$	$80 > N \geq 78 : C+$	$78 > N \geq 73 : C$	$73 > N \geq 70 : C-$
$70 > N \geq 68 : D+$	$68 > N \geq 63 : D$	$63 > N \geq 60 : D-$	$60 > N : E$

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 encom- pass 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.

Math-Department Tutoring Lab: Room 155 of the T. Benny Rushing Mathematics Center (in the basement connector between the LCB and JWB math buildings). For more information, see http://www.math.utah.edu/undergrad/mathcenter.php

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, 162 Olpin Union Building, 581-5020 (V/TDD). 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 suspi- cious 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.

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Disclaimer: If I do any modification to this syllabus, I will let you know in class and update the webpage.