Math 2250-013: Differential Equations and Linear Algebra
Fall 2017
MWF 11:50 - 13:10 in JTB 140
Laboratory Section 14: H 11:50 - 12:40 in LCB 225
Laboratory Section 15: H 12:55 - 13:45 in JWB 208
Syllabus Last Updated on August 14, 2017

Instructor: Todd Harry Reeb
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Please do not contact me via phone; I prefer to talk in person or via email or Canvas.
Office: JWB 129
Office Hours: TBA

Teaching assistant: TBA
Email: TBA
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Office hours: TBA

Course website: Course information and materials will be posted to the Canvas course page. In particular, I will use the calendar to list the sections that will be covered in each lecture, quiz, and exam, important administrative dates and holidays, etc. Expect announcements to be made via Canvas or email.


Course content: We will cover most of the material in the following sections of the textbook: 1.1-5, 2.1-6, 3.1-6, 4.1-4, 5.1-6, 10.1-5, 6.1-2, 7.1-4, 9.1-4.

Course information: Math 2250: Differential Equations and Linear Algebra is a four-credit semester course.

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)).

Expected learning outcomes: The goal of Math 2250 is to master the basic tools and problem solving techniques important in differential equations and linear algebra. These basic tools and problem solving skills are described below:
The tools and skills

- 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.
• Be able to use 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, and 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 use 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 non-linear 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 both the instructor and TA, and be able to effectively articulate how problem solutions meet the problem objectives.

Dropping and withdrawing from the course: The last day to drop this class is September 1, 2017 and the last day to withdraw from this class without approval from your dean’s office is October 20, 2017. After the latter date, approval from your dean’s office will be required in order to withdraw.

Lecture format: The lectures will focus on understanding the material conceptually and working through examples; they are meant to supplement the textbook, and not to be stand-alone. Consequently, you must read the relevant sections of the textbook before each lecture.
Grading: I reserve the right to modify the grading scheme, both for the course or individual assignments, as I deem necessary.

- Final: 25%
- Homework: 10%
- Laboratory: 20% (15% for written submissions + 5% for attendance)
- Midterm 1: 15%
- Midterm 2: 15%
- Quizzes: 15%

Grading scale: A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), E (0-59)

Homework (10%): Homework will be assigned regularly, but only a subset of the assigned problems will be graded (for both completeness and correctness). Completing and correcting the homework is essential to your understanding of the course material.

Laboratory (20%): There will be weekly lab assignments. During the lab, you will work in groups on the lab assignment; the TA will walk around the room and assist these groups with the lab, occasionally breaking to briefly lecture. The written lab assignments will be 15% of your total course grade, while attendance will be 5%. In order to receive the attendance credit, you must arrive on time, attend the entire lab, and participate as instructed; missed attendance credit may not be made up. Each lab assignment will be due in class the following Wednesday.

Quizzes (15%): After the first week, expect a quiz each Wednesday. The intent of these quizzes is to test students’ knowledge of recently discussed material and ensure that prior material is retained. Each quiz will be based on the problems from the corresponding homework.

Special note on the quiz grade: Extra credit will be given in each quiz so that you can atone for poor performance on a previous quiz by doing extremely well on another, but your quiz average will be capped at 15% of your final grade. Accordingly, your quiz average will be listed on Canvas as “Quiz Average” and the quiz average calculated by Canvas from your individual quiz scores (“Quizzes”) will be listed as contributing 0% to your final grade. Don’t panic; this ad hoc measure merely allows me to implement this extra credit system while preserving the grading scheme listed above.

Except in the case of university-excused absences, make-up quizzes will not be given, so please do not ask. Likewise, late lab assignments will not be accepted. However, the lowest two lab and quiz grades will be dropped. (Please don’t interpret this as an opportunity to not study or deliberately miss class during two of the weeks this semester. Rather, I drop quizzes so that missing a single class due to illness, for example, does not hurt your grade.)

In the case of a university-excused absence, make-up quizzes and exams must be taken before the test date and homework and labs must be submitted before the due date.

Midterm exams (15% each) and final exam (25%): Two in-class midterm exams and a comprehensive final will be given on the following dates:
- Midterm 1 Wednesday, September 27, 2017
- Midterm 2 Wednesday, November 8, 2017
- Final Exam Wednesday, December 13, 2017 at 10:30 to 12:30 in JTB 140

A current University of Utah ID will be required in order to take each exam. The ID must be an exact match in name and it must be obvious that you are the pictured individual, otherwise you will not be able to take the exam. Short of extraordinary circumstances and corroborating documentation, make-up exams will only be given before the relevant date for university-excused absences. I will not give make-up exams
for students who leave for home early, have work scheduled during the exam, etc. Make-up exams will be
different than the original exam and possibly more difficult.

**Grade adjustments:** Any requests for grade adjustments due to error or perceived unfairness on the part
of the grader must be made in the first week after I return the assignment in question. After that time, the
grade is finalized and will not be changed. *Extra credit or retakes will not be given on an individual basis. Please do not ask. Likewise, please do not ask me to increase any grades on the basis of effort, extenuating circumstances outside of class, etc.*

**Attendance:** While laboratory attendance is part of your grade, you will not receive a grade for attending
the lectures. That being said, you are responsible for all topics covered in class regardless of whether or not
you attend. I generally do not give copies of my notes to students, so please do not ask.

**Showing your work:** You will lose points if you do not neatly write down the work leading to your answer.
This work should make the correctness of your answers indisputable and convince me that you have mastered
the material. (Please note that this also means that your handwriting must be legible and the order of steps
must be obvious.) Additionally, neatly written solutions are helpful for studying, whereas the bare answers
often are not.

**Calculators:** You will need a scientific calculator for this course for lab participation and the homework,
but you will not be allowed to use calculators on quizzes or exams.

**Office hours:** My office hours are listed above. This is a time to come for extra help, ask questions,
discuss grades, etc. During this time, an appointment is not required, though preference will be given to
those who both make an appointment and are on time. If necessary, I may receive visitors outside of office
hours who schedule an appointment. Outside of office hours, I will generally not receive visitors without an
appointment.

**Tutoring center:** Free tutoring is available in the T. Benny Rushing Mathematics Center, located in the
basement between LCB and JWB. The center is generally open 8:00 a.m. to 8:00 p.m. Monday through
Thursday and 8:00 a.m. to 6:00 p.m. on Fridays. Private tutoring is offered at University Tutoring Services
(330 SSB). The Mathematics Department Office (JWB 233) maintains a list of tutors as well.

**Academic dishonesty:** For the first offense, you will receive a zero for the assignment on which you
cheated, at the very least. For the second offense, you will receive a zero for the course. To stifle cheating, I
may require students to change their seating during quizzes and exams. This is not to be interpreted as an
accusation of cheating.

**Disruptive behavior:** Disruptive or otherwise disrespectful behavior will not be tolerated in lecture, office
hours, or any interaction with me. You will be asked to leave and not be allowed to make-up any quizzes
or exams that are missed as a result. If you do not turn in your assignment before being kicked out, you
will no longer be able to turn it in. In particular, I will not tolerate ringing or beeping phones; silence your
phones or be prepared to be asked to leave.

**Student responsibilities:** All students are expected to maintain professional behavior in the classroom
setting, according to the Student Code, spelled out in the Student Handbook. You have specific rights in
the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article
XI) that involves cheating on tests, collusion, fraud, theft, etc. Students should read the Code carefully
and know 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](http://regulations.utah.edu/academics/6-400.php)
**ADA:** 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 Services (CDS), 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and me to make arrangements for accommodations. All information in this course can be made available in alternative format with prior notification to CDS.

**Syllabus:** I reserve the right to modify the syllabus as I deem necessary. I will announce any updates and the newest version will be posted to Canvas.