

MATH 2250: Differential Equations and Linear Algebra

Section 016 — Fall 2021

Instructor: Ann Dunham

Pronouns: She/her/hers

Office: LCB 305

Email: dunham@math.utah.edu

Lecture Hours: MWF 1:25 – 2:45PM in CSC 205

Lab Hours:

Section 017: Th 12:55 – 1:45PM in LCB 225

Section 018: Th 2 – 2:50PM in JTB 110

Office Hours: Mondays 10 – 11AM, Wednesdays 3 – 4PM in LCB 305 (or by appointment)

Textbook (Required)

Differential Equations and Linear Algebra, 4th Edition, by C. Henry Edwards, David E. Penny, and David Calvis (ISBN 13: 978-0134497181)

For information on purchasing the textbook, go to

<https://www.math.utah.edu/schedule/bookInfo/M2250TextInclusiveAccess-1.pdf>

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

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

It is important that you check the course Canvas page each day and set up your account so that you get notifications when I make an announcement. *You need to read all announcements.* All course materials and assignments will be delivered through the course Canvas page. Canvas will be where you go to get updates about the course, check the course schedule, and get homework and lab assignments. Lecture notes will also be posted on Canvas after class.

Course Components

Your grade will be based on:

Homework	15%
Labs	20%
Quizzes	15%
Midterm 1	12.5%
Midterm 2	12.5%
Final Exam	25%

Your two lowest homework scores, two lowest lab scores, and two lowest quiz scores will be dropped. I retain the right to modify this grading scheme during the course of the semester; students will, of course, be notified of any adjustments.

Final letter grades will be assigned as follows:

A	93 – 100	C+	77 – 79
A–	90 – 92	C	73 – 76
B+	87 – 89	C–	70 – 72
B	83 – 86	D	60 – 69
B–	80 – 82	E	0 – 59

Homework: Homework will be due on Wednesdays of each week. The assignments will be posted on Canvas and will cover material up to and including the previous Friday. Your lowest two homework scores will be dropped to create a buffer for any and all types of problems throughout the semester. No late homework will be accepted. There will be no exceptions to this rule! Homework must be stapled and is due at the beginning of class, no exceptions. Each homework section will be worth 10 points, with one problem chosen to be graded for correctness (out of 5 points) and 5 points for completion of the remaining problems. Each homework assignment will be comprised of multiple homework sections.

Labs: You will attend a weekly lab session run by a graduate TA. Attendance to the lab section is required, and will count for 5% of a student's total grade. The remaining 15% of the lab grade will be determined by the lab submissions that will be graded. The policies, grading criteria, and expectations of the lab will be communicated by the lab instructor during the first week. Questions about the content or grading of the lab should be directed toward the lab instructor.

Quizzes: There will be a quiz every week of classes except for exam weeks. The weekly quiz will be 15 – 20 minutes at the end on class on Fridays and cover the material presented that week in class. You must be in attendance to take the quiz, however 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, no exceptions.

Midterm Exams: You will have two midterm exams that take place during class. There are no make-up exams. Students who miss an exam will receive a "0" on the missed 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 attending. Except under extremely unusual circumstances, you must inform me in advance of the missed test.

Final Exam: There will be a comprehensive final exam on Monday, December 13th from 1 – 3PM in our classroom, CSC 205. This date and time is fixed by the University and cannot be changed.

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 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.
- 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.

Some Important Dates

- First day of class: Monday, August 23rd
- Last day to add course without a permission code: Friday, August 27th
- Last day to add, drop, elect CR/NC, or audit: Friday, September 3rd
- Labor Day (no class): Monday, September 6th
- **Midterm 1: Friday, October 1st (in class)**
- Fall Break (no class): Sunday October 10th – Sunday, October 17th
- Last day to withdraw: Friday, October 22th
- **Midterm 2: Friday, November 12th (in class)**
- Thanksgiving Break (no class): Thursday, November 25th – Sunday, November 28th
- Last day to reverse CR/NC option: Friday, December 3rd
- Last day of class: Thursday, December 9th
- **Final exam: December 13th, 1 – 3PM**

Course Policies

- **Collaboration and Outside Resources:** You are highly encouraged to work with others on homework and lab assignments. Mathematics is a social activity! However, all final work must be your own; that is, despite a group deriving a solution, your work and/or explanations are expected to be unique. Quizzes and exams must be entirely your own work. Cheating is student misconduct and will be dealt with seriously. If you cheat on any homework, quiz, lab, or exam, I will automatically give you a zero for that grade. Depending on the severity of the cheating, I may decide to fail you from the class. Please note that the use (or even just pulling it out of your pocket) of a cell phone or any other electronic device during any in-class exam is considered cheating and cause for receiving an automatic zero.
- **Calculators:** Calculators will not be allowed on quizzes or exams. They may be used on homework and labs, 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.
- **Making-up or Re-taking Exams:** There will be no retakes or make-ups of exams or quizzes, for any reason. If you have an emergent, extenuating circumstance that makes it necessary to take an alternate exam, it is your responsibility to discuss that with me well before the exam occurs, or as soon as possible. I may allow exams to be taken early, but not late. Should an emergency occur during or just before an exam, contact me as soon as possible; with a valid written excuse from a physician or the Dean's Office, we may be able to arrange an alternate option.
- **Grades Online:** It is your responsibility to ensure the accuracy of all recorded assignment and exam grades. If you see any errors in your grades on Canvas, reach out to me as soon as possible.
- **Regrade Requests:** Regrade requests can only be made the class period after the homework/quiz/exam was returned and in writing with an explanation of why more credit is due.
- **Contacting Me Outside of Class:** The best way to reach me is either via Canvas message or via email (see above). I typically answer emails/messages once per day during the week, so please send your emails/messages with this in mind. For emails/messages sent over the weekend, I will do my best to respond in a timely manner, but do not expect a response until Monday. Please do reach out if you have any questions or concerns about the course. If you have crisis-level extenuating circumstances which affect your class performance and you need guidance/advice/flexibility, please communicate with me as soon as possible so I can help you in some manner, which I am truly happy to do. The longer you wait to communicate with me, the less I can and am willing to do to help.
- **I reserve the right to change my policies stated in this syllabus at any point in the semester. If I do make a change to a policy, I will announce it in class as well as communicate the change via email or an announcement in Canvas.**

Student Resources

If you find yourself struggling with any aspect of the course material, even if it is just one topic or

one homework problem, please utilize one of the resources below. It is best to resolve any confusion as early as possible, especially because as we progress in the course, new topics will assume a mastery of material we have already covered.

- **My office hours:** I will hold regular weekly office hours (see above). This is an excellent resource to utilize to make sure you understand the course content. Please drop by to ask questions about any assignments or the course content in general. If you have any questions, comments, and/or concerns and are either unable to attend office hours or do not feel comfortable speaking in front of others, please email me and we will figure something out.
- **Lab TAs:** There will be Teaching Assistants (TAs) assigned to help with this course. TAs are graduate students in mathematics working towards their PhD or Masters degree. They will run the weekly labs as well as hold weekly office hours. The names, contacts, and office hours of the TAs will be posted on Canvas.
- **The math tutoring center:** The [T. Benny Rushing Mathematics Student Center](#) offers free tutoring Mondays-Thursdays, 8:00AM–8:00PM and Fridays, 8:00AM–6:00PM in the west end of the LCB basement (LCB 115). They have tutors that specialize in most areas of undergraduate mathematics. Check their website for the most up-to-date information.
- **Work with other students:** You are welcome to use the Canvas discussion board to discuss course problems or topics. You may also want to set up in-person or Zoom study groups.
- **Private tutoring:** The [Learning Center](#) offers very inexpensive tutoring at just \$5 per hour. They also currently have funding that allows them to provide your first three tutoring session for free, and there are scholarships available if covering further costs is an issue. Check their website for the most up-to-date information, but they should currently be operating entirely online. I also know many excellent math tutors I can connect you with directly; feel free to email me if you would like a recommendation.

Classroom Social Equity

I strive to be ethical, kind, fair, inclusive, and respectful in my classroom. I expect my students to behave likewise. It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: age, disability, gender, gender identity, gender expression, sexual orientation, national origin, race, ethnicity, culture, religion, socioeconomic status, political affiliation, veteran status, and other unique identities. In this regard, I have these requests of you, my student:

- Please do tell me, discreetly, if you have any sort of anxiety disorder, TBI, PTSD, C-PTSD, or any other challenge that would cause psychological harm to you by me calling on you in class. I want students to feel a little uncomfortable and stretched during class, while working on problems as a large group, but I definitely do not want to cause anyone harm. So, please tell me, in a way you feel comfortable, if that is the case for you and I will confidentially accommodate your request.

- Class rosters are provided to the instructor with the students' legal name as well as preferred first name (if previously entered by you in the Student Profile section of your CIS account). I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and update CIS) so I can help create a learning environment in which you feel respected. If you need assistance getting your preferred name on your U-ID card, please visit the [LGBT Resource Center](#), Room 409 in the Olpin Union Building. If your preferred name is different than your legal first name (the preferred name you chose does show up in CIS on my roll sheet, but not yet in Canvas), please log into Canvas and go to Account (on the far left) → Settings and change your Display Name to be the name you prefer. This will help me greatly in knowing students' names and to address you correctly when responding to Canvas messages/comments/discussions.
- If you would like, please let me know through writing, or in person, your preferred name and/or pronouns. In return, if someone discloses their personal pronoun to you/the group, I expect you respect their identity and maintain a safe learning environment. You may not understand their personal preferences (and you do not have to), but you must respect them. I will not tolerate disrespectful behavior.
- If any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.
- Your suggestions are encouraged and appreciated. If there is ever a time that you feel this course or the curriculum is not equitable, please email me or meet with me to discuss your concerns so I have a chance to address them. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

COVID-19 Considerations

University leadership urges all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community. These include:

- **Vaccination:** Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks. Visit <http://mychart.med.utah.edu/>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov/> to schedule your vaccination.
- **Masking:** While masks are no longer required outside of Health Sciences facilities, UTA buses and campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.
- **Testing:** If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others. Saliva based testing is available at alert.utah.edu/covid/testing
- **Self-Reporting:** All of us, including faculty, students, and staff, must self-report if we test positive for COVID-19 via this website: <https://coronavirus.utah.edu/>.

Student Code

Students are encouraged to review the [Student Code](#) for the University of Utah. You should read the Code carefully and know you are responsible for the content.

To ensure that the highest standards of academic conduct are promoted and supported at the University, students must adhere to generally accepted standards of academic honesty, including but not limited to refraining from cheating, plagiarizing, research misconduct, misrepresenting one's work, and/or inappropriately collaborating. A student who engages in academic misconduct as defined in Part I.B. may be subject to academic sanctions including but not limited to a grade reduction, failing grade, probation, suspension or dismissal from the program or the University, or revocation of the student's degree or certificate. Sanctions may also include community service, a written reprimand, and/or a written statement of misconduct that can be put into an appropriate record maintained for purposes of the profession or discipline for which the student is preparing. Incidents of academic misconduct will be subject to penalty per Section V of Policy 6-400, the Student Code. Incidents of academic dishonesty on regular assignments will result in a minimum penalty of a full letter-grade reduction and up to a failing grade (E) for the course. Incidents of academic dishonesty on exams will result in a minimum penalty of a failing grade (E) for the course, and the incident(s) will be referred to the dean of your major-department college for possible further sanction.

Furthermore, All students are expected to maintain professional behavior in the classroom setting. 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.

Office of the Dean of Students

The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. Please consider reaching out to the Office of Dean of Students for any questions, issues and concerns. To contact the Office of the Dean of Students, please email deanofstudents@utah.edu or call 801-581-7066. There is more information at <https://deanofstudents.utah.edu/> .

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 & Access](#) (CDA), 162 Olpin Union Building, 801-581-5020 (V/TDD). The CDA 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 CDA. As I am sure you are aware, if you need accommodations, it is your responsibility to give me the relevant paperwork and take initiative in telling me what you need.

English Language Learners

If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include the [Writing Center](#), the [Writing Program](#), and the [English Language Institute](#). Please let me know if there is any

additional support you would like to discuss for this class.

Undocumented Student Support

Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801-213-3697 or visit dream.utah.edu.

Veterans Center

If you are a student veteran, the University of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building, open Monday through Friday, 8:00AM – 5:00PM. Please visit their [website](#) for more information about what support they offer, a list of ongoing events and links to outside resources. Please also let me know if you need any additional support in this class for any reason.

Wellness Statement

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](#) (801-581-7776) or the [Counseling Center](#) (801-581-6826).

Student Success Advocates

The mission of [Student Success Advocates](#) is to support students in making the most of their University of Utah experience (ssa.utah.edu). They can assist with mentoring, resources, etc. Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact a [Student Success Advocate](#) for support (<https://asu.utah.edu/displaced-students>).

Addressing Sexual Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status, or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

Discrimination and Harassment

If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or Office of the Dean of Students, 270 Union Building, 801-581-7066. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS). Please see the [Student Bill of Rights, section E](#). I will listen and believe you if someone is threatening you.

Campus Safety

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

Lodging Complaints

If you feel that I have disrespected you, not accommodated you, made you feel unsafe, harassed you in any way, etc., *please* let me know. I will be more than happy to change my behavior and work with you to make the class more safe and/or accessible; I strive to create a safe learning environment for all students. Though you can reach out to me, I understand confronting someone who has disrespected/offended/harassed/upset/hurt you can be difficult. If you would like to lodge a formal complaint against me (for my teaching, behavior, class conduct, etc.), you may email my course coordinator, Will Nesse, at nesse@math.utah.edu.

Tentative Weekly Schedule

The daily coverage may change depending on the progress of the class.

	Textbook Sections Covered
Week 1	1.1 – 1.3
Week 2	1.4, 1.5, 2.1
Week 3	2.2, 2.3
Week 4	2.4 – 2.6, 3.1
Week 5	3.2 – 3.4
Week 6	3.5, 3.6; Midterm 1
Week 7	4.1 – 4.4
Week 8	Fall Break
Week 9	4.4, 5.1, 5.2
Week 10	5.3 – 5.6
Week 11	5.6, 10.1, 10.2
Week 12	10.3, 10.4; Midterm 2
Week 13	10.5, 6.1, 6.2, 7.1
Week 14	7.1 – 7.3
Week 15	7.4
Week 16	Review