Instructor: Ziwen Zhu
Office: JWB 107
Email: zzhu@math.utah.edu

Lectures: M,T,W,F 7:30am-8:20am, JWB 335

Office Hours: M 9:00am-10:00am, T 9:00am-10:00am, or after each day's class, also available by appointment

Course Web Page: http://www.math.utah.edu/∼zzhu/2250Fall2019.html

Textbook: *Differential Equations and Linear Algebra*, 4th Edition, ISBN 13: 978-0-13-449718-1.
You can get purchasing information at `http://www.math.utah.edu/schedule/bookInfo/`. You can also find purchasing information on Canvas.

Important Dates (Please schedule accordingly):

- **Midterm 1:** Friday, Sep. 27th (in class)

- **Midterm 2:** Friday, Nov. 8th (in class)

- **Final Exam:** Tuesday, December 10, 2019, 8:00 am - 10:00 am

Course Information: Math 2250 Differential Equations and Linear Algebra is a 4 credit course.

Lab TA: Jordan Saethre (saethre@math.utah.edu)

Lab Information: Every Thursday a Teaching Assistant- (TA) directed lab section will be held. These lab sections will have smaller class sizes, consisting of working on lab worksheet-reports. The lab worksheet-reports will tend to cover longer, more in-depth problems than that found in homeworks and exams, and will sometimes require use of instructor-supplied Maple or Matlab software to complete. The TA will be there to help guide students through the problems. Completion of worksheet-reports will require work outside of the lab hour. The lab work serves the the goal of learning complete problem solving fluency (see below), where students will develop skills to solve problems involving multiple coordinated skills, including interpretation and identification of relevant variables and unknowns, operationalization of the question into a series of executable methods, and interpretation and communication of results. The lab represents 20% of the class time every week, and worth 15% of your total grade.

Extra help: The TA will hold office hours in the Warnock Engineering Tutoring Lab (WEB 1705) and will be available for any questions, especially for helping complete lab assignments. TAs from other Math 2250 sections will also hold their office hours in the tutoring lab. These TAs will be familiar with your lab assignments and homework and should offer a broad time availability for any help you may need.

Prerequisites: Math 1210-1220 or 1310-1320 (or 1250-1260 or 1311-1321, i.e. single-variable calculus). You are also expected to have learned about vectors and parametric curves (Math 2210, or Physics 2210 or 3210). Practically speaking, you are better prepared for this course if you have had multivariable calculus (1320,1321, 2210, or equivalent), and if your grades in the prerequisite courses were above the C level.

Course Description: This is a hybrid course which teaches the allied subjects of linear algebra and differential equations. These topics underpin the mathematics required for most students in the Colleges of Science, Engineering, Mines and Earth Science.

Expected Learning Outcomes: The specific objectives are summarized as follows.
  The Basic Topics

1. 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.

2. 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.

3. 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.

4. Be able to use the basic concepts of linear algebra such as linear combinations, span, indepen- dence, basis and dimension, to understand the solution space to linear equations, linear differential equations, and linear systems of differential equations.

5. 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.

6. 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.

7. Learn how to use Laplace transform techniques to solve linear differential equations, with an em- phasis on the initial value problems of mechanical systems, electrical circuits, and related problems.

8. Be able to find eigenvalues and eigenvectors for square matrices. Apply these matrix algebra con- cepts 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.

9. 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.

10. 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

1. Students will be able to read and understand problem descriptions, then be able to formulate equations model- ing the problem usually by applying geometric or physical principles. Solving a problem often requires specific solution methods listed above. Students will be able to select the appropriate operations, execute them accu- rately, and interpret the results using numerical and graphical computational aids.

2. Students will also gain experience with problem solving in groups. Students should be able to effectively trans- form 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 convey how problem solutions meet the problem objectives.

Tutoring Lab: T. Benny Rushing Mathematics Student Center (adjacent to JWB and LCB), Rm 155
M - Th 8 am - 8 pm
F 8 am - 6 pm
(closed Saturdays, Sundays and holidays)
They are also offering group tutoring sessions.
If you're interested, inquire at the Tutoring Lab. `http://www.math.utah.edu/ugrad/tutoring.html`

Private Tutoring: University Tutoring Services, 330 SSB (they offer inexpensive tutoring). There is also a list of tutors at the Math Department office in JWB233.

Computer Lab: Also in the T. Benny Rushing Mathematics Student Center, Room 155C.
M - Th 8 am - 8 pm

F 8 am - 6 pm
Link to computer lab is `http://www.math.utah.edu/ugrad/lab.html`

Grading: The grades will be calculated as follows:

Weekly Homework	15%
Quizzes	10%
Lab	15%
Midterm 1	15%
Midterm 2	15%
Final Exam	30%
Total	100%

- Extra credits (5 points) are available via presenting example problems in class.

- The lab score consists of lab attendance (5%) and lab worksheet grade (10%).

- Each part of your grades will be posted on Canvas. I will do my best to update the grades in time and keep everything accurate. However, I would encourage you to check your own grades on a regular basis so that you can contact me immediately if there are questions or mistakes about your grades.

Homework:

- I will collect homework on Friday. All of the homework assigned in the previous week is due at that time. I will NOT accept any late homework due to unfairness to the grader. However, 2 lowest homework scores will be dropped for every student.

- Homework is picked from the textbook. One random problem will be graded for correctness and the rest is graded for completeness. There are keys to most of the problems in the textbook. I would recommend that you check yourself for correctedness on homework problems. If you have questions, try to utilize all the resources mentioned above such as tutoring center and office hours.

- Your final homework score will be the average of each week's homework score with the lowest two dropped.

Quizzes: : During the course we will have short (10-minute) quizzes every other Friday, starting from the second week, except the midterm weeks. They serve as quick reviews of the basic concepts learned over this period. Your lowest 2 quiz grades will be dropped.

Midterm: There will be 2 midterms. Each midterm will focus on material presented in class since the last midterm. You will not be allowed to use a calculator during the Midterm.

Final Exam: All students are expected to take the comprehensive final exam. You will fail the course automatically if you skip the final. It will occur on Tuesday, December 10, 2019, 8:00 am - 10:00 am. Unless in extreme cases, the time is NOT negotiable. It is your responsibility to schedule accordingly so that you can make the final. When there is an absolute emergency, please speak to me as soon as possible so that a fair plan can be worked out. The location is to be announced. The final will cover all topics presented in class and calculators are not allowed.

Grading Scales: The grade scale will be the usual: 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). Letter grade assignments can be changed uniformly for all students, at the discretion of the instructor.

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 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.

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).

Student Names and Personal Pronouns: 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). While CIS refers to this as merely a preference, 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, your name, and your pronoun will be respected. If you need assistance getting your preferred name on your UIDcard, please visit the LGBT Resource Center Room 409 in the Olpin Union Building, or email bpeacock@sa.utah.edu to schedule a time to drop by. The LGBT Resource Center hours are M-F 8am-5pm, and 8am-6pm on Tuesdays.

Wellness Statement: Personal concerns such as stress, anxiety, relationship difficulties, depression, crosscultural differences, etc., can interfere with a students ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at `www.wellness.utah.edu` or 801-581-7776.

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 ⟨`https://safeu.utah.edu/`⟩.

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

Other Class Policies:

- Please silence your technology during the class.

- You can use a scientific calculator, a programmable/graphing one or online resources to do your homework if you want. However since they won't be allowed on midterms or on the final, it might not be a good idea to rely heavily on these technologies.

- You need to have a valid email address registered with Campus Information System. I will send emails to the class and expect you to be responsible for receiving that information.

- Every student will be assigned a class number according to the order of the name list on Canvas for the convenience of updating grades on Canvas. Please do not forget to write your class number next to your name on all your assignments (including homework, lab worksheets, quizzes and exams).

- There will be no make-ups or retakes of quizzes and exams. Should it happen that you cannot make the test, please communicate with me IN ADVANCE and provide necessary justification of extenuating circumstances. In that case, I can work out a fair solution to your situation.

- If you have questions about any exam/quiz grade, or you want to appeal the grading of the exam/quiz, you must bring it to me within one week of the exam. After that, you will have to live with whatever grade you got.

- If you cheat on any homework, project, quiz or exam, I will automatically give you a zero for that assignment. Depending on the severity of the cheating, I may decide to fail you from the class. In all cases of cheating, I will also report the incident to the Dean of Students. Additionally, if an international student cheats, I will also report the incident to the International Students Office.

- I reserve the right to make any change in course policy mentioned above in the syllabus. If a change is needed, I will announce the change to the class and send a class-wide e-mail.