MATH 2250-10, Differential Equations and Linear Algebra, Spring 2019

Class Meetings: MWF 8:05–9:25 AM in WEB 1230
Instructor: Dr. Dong Wang (dwang@math.utah.edu)
Office Hours: Wednesday 9:30 – 11:30 AM in JWB 312, or by appointment
Lab section: Section 11: Th/08:35AM–09:25AM and Section 12: Th/09:40AM–10:30AM in AEB 340
Lab LA: Mr. Zhiwen Zhu (zzhu@math.utah.edu)
Course Information: Math 2250 Differential Equations and Linear Algebra is a 4 credit course.
Prerequisite Information: 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: Math 2250 is an introduction to differential equations and linear algebra, two important mathematical subjects that are particularly essential in engineering problem solving, and how they are used to model problems arising in engineering and science. The specific objectives are summarized as follows.

- Use general principles to model a phenomenon and derive the relevant governing differential equations;
- Learn solution techniques and visualization tools for first order separable and linear differential equations;
- Learn matrix algebra techniques, in order to be able to compute the solution space to linear systems and understand its structure;
- 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;
- Learn how to use Laplace transform techniques to solve linear differential equations;
- Understand the concepts of eigenvalues and eigenvectors and be able to compute them. Apply them to find the general solution space for first and second order constant coefficient homogeneous linear systems of differential equations;
- Understand and be able to use linearization as a technique to study the behavior of nonlinear autonomous dynamical systems near equilibrium solutions;
- 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.

Canvas: Canvas will be used for posting course announcements, 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.

**Grading:** The following are the grade components and the percentage each contributes to a student’s final grade:

- **Homework Assignments (15%)** - Weekly homework will be assigned each Friday and collected on the following Friday before class, and a large proportion of the problems will be graded by a grader. It is encouraged for you to form study groups for discussing and working on homework, although you will each hand in your own papers. The Math tutoring center is in the Rushing Student Center, in the basement between LCB and JWB on Presidents Circle. You will be able to find tutors there who can help with Math 2250 homework (8 am - 8 pm Monday-Thursday and 8 am - 4 pm on Fridays). The page www.math.utah.edu/ugrad/mathcenter.html has more information.

- **Lab work and projects (15%)** - The subject of differential equations is driven by its applications, and computers allow you to study interesting problems which are conceptually clear but computationally difficult. An important component of the course is to develop quantitative feelings for the solutions, and experimenting computer generated solutions is an effective way to achieve this goal. In the lab sessions, 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. Students will be able to select the appropriate operations, execute them accurately, and interpret the results using numerical and graphical computational aids.

- **Midterm Exams (30%, 15% each)** - Two 80-minute midterm exams will be given on select Fridays. You will have the whole class period to complete the exam. A practice exam will be posted a week prior to the midterm that will cover the same material. Dates of the midterm exams will be Friday Feb. 15th and Friday Mar. 29th.

- **Biweekly quizzes (10%)** - A 10-minute quiz will be given every other Friday unless there is a midterm exam scheduled. They serve as quick reviews of the basic concepts learned over this period.

- **Final Exam (30%)** - A two-hour comprehensive exam will be given. As with the midterms, a practice final will be posted a week prior. Our final exam is scheduled for Tuesday, April 30, 2019, 8:00–10:00 am in WEB 1230.

Final course letter grades will be determined as follows: If \( X \) is your course percentage weighted according to the above, then \( \{ X \geq 90\% \Rightarrow A, X \geq 85\% \Rightarrow A-, X \geq 80\% \Rightarrow B+, X \geq 75\% \Rightarrow B, X \geq 70\% \Rightarrow B-, X \geq 65\% \Rightarrow C+, X \geq 60\% \Rightarrow C, X \geq 55\% \Rightarrow C-, X \geq 50\% \Rightarrow D+, X \geq 45\% \Rightarrow D, X \geq 40\% \Rightarrow D-, X < 40\% \Rightarrow E \} \).

The instructor retains the right to modify this grading scheme during the course of the semester; students will, of course, be well notified of any adjustments.

**Additional Resources**

- **Tutoring Center & Computer Lab** - There is free tutoring in the T. Benny Rushing Mathematics Student Center (room 155, the lower level between JWB and LCB), as well as a computer lab. For more information see http://www.math.utah.edu/undergrad/mathcenter.php

- **Private Tutoring** - University Tutoring Services, 330 SSB. There is also a list of tutors at the math department office JWB 233.

- **Departmental Videos** - The math department has a full set of lecture videos which you are welcome to use to supplement our course material. These can be found at http://www.math.utah.edu/lectures/
Calculators: 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.

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. Students 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, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from and 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 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, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

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, cross-cultural 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.

Course Roadmap Week-by-Week: Below is an outline and rough schedule of the sections and topic covered in this course.

Week 1 1.1–1.4, Jan 7 - 11
Week 2 1.5, 2.1 (quiz), Jan 14 - 18
Week 3 2.2, 2.3, 2.4, Jan 21 - 25
Week 4 2.5, 2.6, 3.1, 3.2 (quiz), Jan 28 - Feb 1
Week 5 3.3, 3.4, 3.5, Feb 4 - Feb 8
Week 6 3.5, review, Midterm exam, Feb 15

Week 7 4.1, 4.2, 4.3, Feb 18 - Feb 22

Week 8 4.4, 5.1, 5.2 (quiz), Feb 25 - Mar 1

Week 9 5.3, 5.4, 5.5, Mar 4 - Mar 8

Week 10 Spring break

Week 11 5.6, 10.1, 10.2, 10.3 (quiz), Mar 18 - 22

Week 12 10.4, 10.5, review, Exam 2, Mar 25 - 29

Week 13 6.1, 6.2, 7.1 (quiz), Apr 1 - 5

Week 14 7.2, 7.3, 7.4, Apr 8 - 12

Week 15 9.1, 9.2, 9.3, 9.4 (quiz), Apr 15 - 19

Week 16 Review

Week 17 Final exam, Tuesday, April 30, 2019, 8:00–10:00 am in WEB 1230.