

# MATH 2250-001, Differential Equations and Linear Algebra, Fall 2020

**Instructor:** Nathan Willis (he/him/his)

**Class Meetings (over Zoom):** Monday, Tuesday, Wednesday, and Friday at 7:30-8:20

**Nathan's Email:** willis@math.utah.edu

**Nathan's Office:** JWB 118

**Nathan's Office Hours (held over Zoom):** TBA

**Lab Instructor:** Chong Wang

**Lab Meetings (over Zoom):** Thursday from 7:30-8:20 AM (Section 002) or 8:35-9:25 AM (Section 003)

**Chong's Email:** u0679435@utah.edu

**Chong's Office:** LCB Loft

**Chong's Office Hours:** TBA

**Text:** *Differential Equations and Linear Algebra*, 4th Edition, by C. Henry Edwards, David E. Penney, and David Calvis. ISBN-13: 978-0134497181. More information can be found at the link below:  
<http://www.math.utah.edu/schedule/bookInfo/M2250TextInclusiveAccess-1.pdf>

**Midterm 1:** Friday, October 2 during the regular scheduled class

**Midterm 2:** Friday, November 6 during the regular scheduled class

**Final Exam:** Wednesday, December 9, 2020 from 8:00 – 10:00 am

**Canvas:** Canvas will be used for posting course announcements, homework assignments, grades, section quizzes, files, and any relevant supplementary material. You are also welcome and encouraged to make use of 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](http://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.

**Attendance & Punctuality:** Attendance to the online lecture is strongly encouraged but not required. However, during both midterms and the final exam you are required to attend on time and online. Attendance to the online lab meeting is required.

**Learning Method:** The instruction will be delivered as a flipped classroom. For each section a short video, quiz, and worksheet will be posted prior to the Zoom lectures. During lecture, you will be able to ask questions on the work you've done at home, work on the day's assignment using the breakout rooms feature in Zoom and prepare for the next topic. For each lecture video, you will complete a short multiple choice quiz on Canvas. You will also turn in weekly homework electronically (via Gradescope). **There will be no in-person meetings in this course**, but live instruction will be provided over Zoom during the lecture.

**Lecture Videos:** The lecture videos for this course will be made in cooperation with Chee Han Tan who is the instructor this semester for Math 2250-013. Nathan and Chee Han will create the lecture notes together and alternate making the lecture videos by chapter.

**COVID-19 Considerations:** Students must self-report if they test positive for COVID-19 via [coronavirus.utah.edu](http://coronavirus.utah.edu).

**Syllabus subject to change:** This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you. I may also modify the Course Schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas

**Grading:** Following are the grade components and the percentage each contributes to a student's final grade:

- **Homework Assignments (20%) -**

- Roughly three to four textbook sections are due every Wednesday at midnight (Mountain Time). The homework will typically cover lectures through to the preceding Wednesday. If you click on a homework assignment, you will see listings of problems.
  - After the homework assignments are turned in three problems will be chosen to be graded, each out of 5 points. There will also be 5 points given for completing all problems. Making each homework out of 20 points.
  - Two of a student's lowest homework scores will be dropped.
  - Homework will be collected on Gradescope. No late homework will be accepted.
- **Quizzes (10%) -**
    - There will a short 2-4 problem quiz, taking roughly 10-15 minutes to complete, administered through Canvas for each lecture video.
    - Videos are assigned weekly and all quizzes for the week close Sunday at midnight. Therefore, for any section you will have 2-5 days to complete the quiz after the video is uploaded.
    - It is strongly recommended to complete the quiz immediately after watching the lecture video.
    - Late quizzes will be accepted, for partial credit. Each day it is late 20% will be deducted, therefore after 5 days a zero will be given.
- **Lab (15%) -**
    - 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 worksheets.
    - The lab worksheets 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 worksheets will require work outside of the lab hour.
    - The lab work serves 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.
    - Attendance to the lab and participation in the lab is mandatory and **attendance/participation will be taken each week by the TA**. Credit will be broken out into 3% lab attendance and 12% for well-written lab worksheet-reports.
    - Labs will be collected on Gradescope. No late lab assignments will be accepted.
    - The lowest lab score will be dropped.
- **Midterm Exams (30%, 15% each) -**
    - Two 50-minute midterm exams will be administered through Gradescope on select Fridays (**October 2nd** and **November 6**) during the regular class time.
    - A review sheet will be posted a week prior to the midterm that will cover the exam material. Review of the practice problems will occur in the lab before the exam.

**There will be no retakes of midterm exams for any reason.**

- **Final Exam (25%) -**
  - A two-hour comprehensive exam will be administered through Gradescope **Wednesday, December 9, 2020 from 8:00 – 10:00 am**.

- As with the midterms, a final exam review sheet will be posted a week prior.

**There will be no retakes of the final exam for any reason.**

Final course letter grades will be determined as follows: If  $X$  is your course percentage weighted according to the above, then  $\{X \geq 93\% \Rightarrow A, X \geq 90\% \Rightarrow A-, X \geq 87\% \Rightarrow B+, X \geq 83\% \Rightarrow B, X \geq 80\% \Rightarrow B-, X \geq 77\% \Rightarrow C+, X \geq 73\% \Rightarrow C, X \geq 70\% \Rightarrow C-, X \geq 67\% \Rightarrow D+, X \geq 63\% \Rightarrow D, X \geq 60\% \Rightarrow D-, X < 60\% \Rightarrow E\}$ . 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.

**Uploading to Gradescope:** Gradescope will be accessible through a link on Canvas. To submit an assignment or problem on an exam, take a picture or scan it and then upload it following the directions given online. The following rules apply:

- Unreadable problems or poorly scanned problems will not be graded;
- The orientation needs to be upright and not mirrored;
- Make sure there is no shadow when you take the picture of the problems;
- Pen is often easier to read than pencil, and certainly do not erase and then writeover text;
- Clearly separate your problems and make your solutions as neat and legible as possible;
- Show your work and use proper mathematical notation;
- Only use techniques discussed in the this class.
- Unless specifically asked for a numerical answer, keep constants like  $e$ ,  $\pi$ , and expressions involving roots and fractions as is in your answers.

**Conflict & Regrading:** Any grading questions, disputes, or concerns either with the instructor or the TA need to be addressed within a week of the graded work being returned to the student.

### Additional Resources

- **Tutoring Center & Computer Lab:** The T. Benny Rushing Mathematics Student Center offers free drop-in online tutoring. Click here for more information: <https://utah.instructure.com/courses/613503/>.
- **UofU Learning Center:** (formerly ASUU Tutoring; offers subsidised one-on-one tutoring) - The Learning Center offers 3 free tutoring sessions per student per semester. Additional hours can be purchased after that. Scholarship assistance is also available. Click here for more information: <https://learningcenter.utah.edu/>.
- **Equipment Help:** The UofU has a laptop and mobile hotspot loan program - laptops, mobile hotspots mailed to current U students on a first-come, first-served basis. Click here for more information: <https://union.utah.edu/covid-19/> or <https://lib.utah.edu/coronavirus/checkout-equipment.php>.
- **General Help, in particular in light of COVID-19:** Click this link for information from the University about logistics in light of COVID-19, financial assistance, counseling, the food pantry, and much more: <https://coronavirus.utah.edu/#students>.

**Technology:** Calculators should not be used 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. The

code will use the following programs: MATLAB, Maple, and Mathematica. These programs are great resources to check homework assignments prior to submitting them for evaluation. I encourage you to review your work before instructor evaluation.

**Remote learning technical requirements:** Knowledge and navigation of Canvas, Zoom (through Canvas) and Gradescope (through Canvas) is critical to access all features and resources of this course. When joining Zoom, you should turn off your microphone to minimize background noise. You might choose to turn on your camera or you might use a picture if keeping the camera off. Either having a picture or turning on the camera will help me matching a name and a face. You can ask questions either by using the microphone and the raise your hand button or by typing it in the chat box. A strong internet connection and adequate bandwidth are needed to join a live Zoom session. For technical assistance, review the Canvas and Gradescope Getting Started Guide for Students and/or contact TLT, Knowledge Commons, etc... If you anticipate any connectivity issues or if you plan to be in a vastly different time zone, you should let me know as soon as possible. It is your responsibility to maintain your computer and related equipment in order to participate in the online portion of the course. Equipment failures will not be an acceptable excuse for late or absent assignments.

### **Expected Learning Outcomes:**

- **Basic Topics**

- 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 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.
- 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.

**Mandatory Online Instruction Periods:** All classes will be online the weeks of October 5-10 and November 30-December 3. As this course is already held fully online this will have no change on the structure of this course.

**Exam Dates:** October 2, November 6, December 9

### Important Dates:

Classes begin	Monday, August 24
Last day to add without a permission code	Friday, August 28
Last day to drop (delete) classes	Friday, September 4
Last day to add, elect CR/NC, or audit classes	Friday, September 4
Labor Day (No Class)	Monday, September 7
Instruction for all classes online	September 27- October 11
Midterm 1	Friday, October 2
Last day to withdraw from classes	Friday, October 16
Midterm 2	Friday, November 6
Conclusion of in person instruction	Wednesday, November 25
Thanksgiving Break (No Class)	Thu-Sun, November 26-29
Last day to reverse CR/NC option	Friday, November 27
Classes end	Thursday, December 3
Final Exam	Wednesday, December 9

Please check the academic calendar for more information pertaining to dropping and withdrawing from a course. Withdrawing from a course and other matters of registration are the student's responsibility.

**Student Code:** Students are encouraged to review the Student Code for the University of Utah. In order 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. All students are expected to maintain professional behavior in the classroom setting, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. 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>

**The Americans with Disabilities Act:** 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.

**Veterans Center:** If you are a student veteran, the U of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: <http://veteranscenter.utah.edu/>. Please also let me know if you need any additional support in this class for any reason.

**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 Student Bill of Rights, section E <http://regulations.utah.edu/academics/6-400.php>. I will listen and believe you if someone is threatening you.

**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, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to 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 police, contact the Department of Public Safety, 801-585-2677(COPS).

**Inclusivity Statement:** 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, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status, and other unique identities. gender, sexuality, disability, age, socioeconomic status, ethnicity, race, culture, and other unique identities. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that I can make arrangements for you.

**Incompletes:** According to university policy, to be considered for an incomplete, a student must have 20% or less of the course work remaining and be passing the course with a C or better. You must request an incomplete grade and I will consider giving that grade only under exceptional circumstances.

**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 at <https://wellness.utah.edu/> or 801-581-7776.

**University Counseling Center:** The University Counseling Center (UCC) provides developmental, preventive, and therapeutic services and programs that promote the intellectual, emotional, cultural, and social development of University of Utah students. They advocate a philosophy of acceptance, compassion, and support for those they serve, as well as for each other. They aspire to respect cultural, individual and role differences as they continually work toward creating a safe and affirming climate for individuals of all ages, cultures, ethnicities, genders, gender identities, languages, mental and physical abilities, national origins, races, religions, sexual orientations, sizes and socioeconomic statuses.

**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. 200 South Central Campus Dr., Suite 270. Monday-Friday 8 am-5 pm.

**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](http://safeu.utah.edu)

**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 U-ID card, please visit the LGBT Resource Center Room 409 in the Olpin Union Building, or email [bpeacock@sa.utah.edu](mailto: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.

**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](http://dream.utah.edu).

**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](http://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://asuu.utah.edu/displaced-students>).

**Extenuating Circumstances:** If you have crisis-level extenuating circumstances which require flexibility, it is completely your responsibility to communicate with me as soon as possible so I can help you in some manner. The longer you wait to communicate with me, the less I can and am willing to do to help.

**Academic Misconduct:** If you cheat on any homework, project, quiz, or exam, you will automatically get 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 internet device is considered cheating and cause for receiving an automatic zero on an exam. Also, if you exhibit any other behaviors that are unethical, like offering me a bribe to give you a better grade (even if you later claim you were joking), I will report your behavior to the Dean of Students.

**Classroom Social Equity:** I strive to be ethical, kind, fair, inclusive, and respectful in my classroom and expect students to behave likewise. In this regard, I have these requests of you, my student:

1. 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 don't want to cause anyone harm. So, please discreetly tell me if that is the case for you and I will confidentially accommodate your request.
2. If your preferred name is different than your legal first/last name (the preferred name you chose does indeed show up in CIS on my roll sheet, but not yet in Canvas), please let me know. It also helps if you log into Canvas and go to Account (on far left) → Settings and change your Display Name to be the name you prefer to be addressed by.
3. 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 that.

**Expectations for online learning environment (Netiquette):** Respectful participation in all aspects of the course will make our time together productive and engaging. Zoom lectures, discussion threads, emails and Canvas are all considered equivalent to classrooms. Specifically:

- Posting photos or comments that would be off-topic in a classroom are still off-topic in an online posting.
- Disrespectful language and photos are never appropriate.
- Using angry or abusive language is not acceptable, and will be dealt with according to the Student Code. I may remove online postings that are inappropriate.
- Do not use ALL CAPS, except for titles, or overuse certain punctuation marks such as exclamation points and question marks.

#### **Additional Policies:**

- All correspondence for this class will be done through UMail or Canvas. You need to be checking your UMail daily during the week, and also checking for Canvas updates and announcements. If you do not check your UMail or Canvas regularly, you should have your messages forwarded to an email address that you do check. It is your responsibility to stay caught up on announcements, schedule changes, etc., and not seeing an email with the information is not an excuse.
- You should always feel free to email me at willis@math.utah.edu or contact me through Canvas with questions about course material, your grade, course policies, other concerns, or to set up a meeting outside of office hours. I will respond to all student emails in a timely fashion (within 24 hours, but more quickly if it is a time sensitive situation) between 8am and 5pm on weekdays. If you email me after 5pm I may not get back to you until the next day. If you email me over a weekend, I may not get back to you until the following Monday. (But I will do my best to respond to time-sensitive emails as soon as possible). Also, if you are emailing with a question regarding a math problem: It helps me immensely if you include the problem statement (either typed out or attached as a photo or scanned image) and also a brief summary of steps you have taken so far (again, either typed out or attached in an image). This will allow me to give you the best feedback possible.
- If you have concerns of your success in this class it is your responsibility to raise these issues with me and it is prudent to do so early in the semester.



- Under no circumstances will I make individual adjustments to student's final grades. Any adjustments to final grades will be consistent throughout the entire class, but you should not expect or rely on such adjustments to get the grade you desire. The only changes to your final grade can come from retrieving your final exam and checking for any grading errors, again these will be handled to be consistent with the entire class.
- There will be no cursing or negative ranting (for example, "math sucks") either verbally or on any written work turned in. The penalty for such things on written work will be a zero on that assignment or test.

**Course Roadmap Week-by-Week:**

Week	Dates	Sections	Material
1	8/24-8/28	1.1, 1.2, 1.3, 1.4	Differential equations Mathematical models Integral as general and particular solutions Slope fields Seperable differential equations
2	8/31-9/4	1.5, 2.1, 2.2, 2.3	Linear differential equations Circuits, mixture models, and population models Equilibrium solutions and stability Acceleration-velocity models
3	9/8-9/11	2.4, 2.5, 2.6	<b>No class Monday</b> Numerical solutions
4	9/14-9/18	3.1, 3.2, 3.3	Linear systems Gaussian Elimination Reduced Row Echelon Form
5	9/21-9/25	3.4, 3.5, 3.6	Matrix operations Matrix inverses Determinants
6	9/28-10/2	4.1, 4.2	Vector spaces Linear combinations in $\mathbb{R}^n$ Subspaces <b>Midterm 1 on Friday</b>
7	10/5-10/9	4.3, 4.4	Span and linear independence Subspaces, bases, and dimension
8	10/12-10/16	5.1, 5.2, 5.3	2nd-order linear differential equations General solutions Superposition, homogeneity, and constant coeeficients
9	10/19-1/23	5.4, 5.5, 5.6	Mechanical vibrations and pendulum model Particular solutions to non-homogeneous problems Forcing and resonance
10	10/26-10/30	10.1, 10.2, 10.3	Laplace transforms Solving IVPs with transforms Partial fractions and translations
11	11/2-11/6	10.4, 10.5	Unit step functions Convolutions <b>Midterm 2 on Friday</b>
12	11/9-11/13	6.1, 6.2	Eigenvalues and eigenvectors Diagonalization
13	11/16-11/20	7.1, 7.2	1st-order systems of ODE Matrix systems
14	11/23-11/25	7.3, 7.4	Eigenanalysis Phase portraits of linear systems Spring systems and forced undamped systems <b>No class Thursday and Friday</b>
15	11/30-12/3	7.5	Second order systems Mechanical applications Practical resonance