

# Syllabus for Math 2280-001

## Introduction to Differential Equations

### Summer 2021

#### General Course Information:

**Course:** Math 2280 - Introduction to Differential Equations.

**Instructor:** Keyvan Yaghmayi.

**Email:** yaghmayi@math.utah.edu.

**Office:** JWB 104.

**Course Website:** We use Canvas: <https://gate.acs.utah.edu/>. To log in, use the same student ID and password that you use for Campus Information System.

**Class Time:** Mondays, Tuesdays, Wednesdays, and Thursdays 10:00am - 11:00am.

**Class Location:** Online lectures in Canvas via Zoom. Links are available in Canvas.

**Course Type:** The class type is listed as an “IVC” in the university catalog, which stands for “Interactive Video Conferencing”. This means that the class will be delivered synchronously, i.e. live and at the time listed but entirely online.

**Office Hours:** I will hold online office hours via Zoom in Canvas. Every Monday 11:20am - 12:20pm and every Thursday 8:45am - 9:45am, or by appointment. The Zoom link is available in Canvas.

**Textbook:** Differential Equations and Boundary Value Problems: Computing and Modeling, By Edwards, Penney, and Calvis, 5<sup>th</sup> Edition. ISBN-13: 978-0-321-79698-1 and ISBN-10: 0-321-79698-5.

**The Inclusive Access Program:** The e-textbook will be accessed/viewed within the Canvas course page (click on Bookshelf tab). This is least expensive option to acquire a digital e-textbook. You get an email prior to the first day of class with information on what Inclusive Access is and if you don't want the instant access to the e-book you will have the option to OPT OUT and will be refunded accordingly.

**Important Dates:** Classes begin Monday, May 17. The last day to add, drop, or audit classes is Wednesday, May 26. The last day to withdraw is Friday, June 25. Last day to reverse CR/NC option is Friday, July 30. *Final Exam* is on Thursday, August 5, 10:00am - 12:00pm, in Canvas.

**Technical requirements:** For both quality learning and proctored testing, students are required to have access to the following equipment:

- A strong internet connection with sufficient bandwidth (in order to participate in online classes, access course materials, and take exams)
- A webcam on your computer or camera on your phone (this is required for taking exams in Zoom; it is recommended for IVC lecture classes)
- A scanning device (smartphones can be used as scanning devices)
- a microphone (used for online meetings)

**Note:** The Marriott library is loaning laptops to students. They are also offering off-campus internet access. Please visit <https://lib.utah.edu/coronavirus/checkout-equipment.php>

## Essential Course Information:

**Prerequisites:** A grade of at least a “C” in Math 2270, Linear Algebra.

**Course Description:** Linear and non-linear differential equations and systems of equations, with applications. Matrix exponential, fundamental solution matrix, phase-space and portraits, stability, initial- and boundary-value problems, introduction to partial differential equations. Requires familiarity with linear algebra. Includes theoretical and computer lab components.

**Course Content:** This is an introductory course in differential equations, together with some applications in the sciences (particularly physics and biology). We will start off with first order equations, slope fields, analytic and numerical solutions. We then study higher order linear equations, with applications to mechanical vibrations. This will use linear algebra developed in 2270.

Next will be a study of linear systems of differential equations with more applications to vibrations. This involves the use of eigenvalues and eigenvectors of certain matrices. After this, we will study the qualitative behavior of nonlinear first order systems in the plane, together with applications to biological models of competing species, and predator/prey. Finally, there will an introduction to PDE’s (partial differential equations) and the topic of Fourier series used to study them. If there is time, we will study Laplace transforms.

**Modules:** To be organized, I will create “Modules” in Canvas for every week. The module is going to have four parts: (1) class notes (2) lecture videos (3) announcements and discussions (4) homework assignments and quizzes (and exams).

**Week-by-Week Course Roadmap:** Below is an outline and rough schedule of the sections and topics that we will cover in this course:

*Week 1:* 1.1 Differential Equations and Mathematical Models, 1.2 Integrals as General and Particular Solutions, 1.3 Slope Fields and Solution Curves, 1.4 Separable Equations and Applications.

*Week 2:* 1.5 Linear First-Order Equations, 2.1 Population Models, 2.2 Equilibrium Solutions and Stability. **Note: Wednesday, May 26 is the last day to drop.**

*Week 3:* Continue Stability, 2.3 Acceleration-Velocity Models, 2.4 Numerical Approximation: Euler's Method. **Monday, May 31 is Memorial Day Holiday.**

*Week 4:* 3.1 Introduction to Second-Order Linear Equations, 3.2 General Solutions of Linear Equations, 3.3 Homogeneous Equations with Constant Coefficients.

*Week 5:* 3.4 Mechanical Vibrations, 3.5 Non-homogeneous Equations and Undetermined Coefficients, Review for Midterm 1. **Note: Midterm 1 is on Thursday, June 17, on Materials covered in Weeks 1-4.**

*Week 6:* 3.6 Forced Oscillations and Resonance, 4.1 First-Order Systems and Applications, 5.1 Matrices and Linear Systems. **Note: Friday, June 25 is the last day to withdraw.**

*Week 7:* 5.2 The Eigenvalue Method for Homogeneous Systems, 5.3 A Gallery of Solution Curves of Linear Systems, 5.4 Second-Order Systems and Mechanical Applications.

*Week 8:* 5.7 Non-homogeneous Linear Systems, 6.1 Stability and the Phase Plane, 6.2 Linear and Almost Linear Systems. **Monday, July 5 is Independence Day Holiday (observed)**

*Week 9:* 6.3 Ecological Models: Predators and Competitors, 6.4 Nonlinear Mechanical Systems, Review for Midterm 2. **Note: Midterm 2 is on Thursday, July 15, on Materials covered in Weeks 5-8.**

*Week 10:* General Fourier Series, and Convergence, Fourier Sine and Cosine Series, Separation of Variables and Heat Equation (Sections 9.2, 9.3, and 9.5; we may not cover all the details), 9.6 Vibrating Strings and the One-Dimensional Wave Equation.

*Week 11:* 9.7 Steady-State Temperature and Laplace's Equation (We may not cover all the details), 7.1 Laplace Transforms and Inverse Transforms, 7.2 Laplace Transformation of Initial Value Problems.

*Week 12:* 7.3 Translation and Partial Fractions, 7.4 Derivatives, Integrals, and Products of Transforms, on Wednesday we Review for the Final Exam. **Note: Final Exam is on Thursday, August 5, 10:00am - 12:00pm, Comprehensive.**

## Homework:

Homework problems and due dates will be posted on Canvas regularly. The problems will be taken from the book. You should write them on paper, scan and create a single PDF file of your work, then upload it into the Canvas. Please scan and don't take photo. You don't need a scanner; there are directions in Canvas for using your smart phone as scanner. Scanning is easier and faster than taking pictures. The quality is higher than pictures too.

I encourage you to discuss your homework problems with one another, ask help from tutors in the *online math center* (see below), or talk to me during online office hours. The other way that you can get help with homework assignments (and quizzes) is posting discussions in Canvas. In homework assignments please show work.

I will drop your lowest homework score at the end of the semester. Your homework assignments will be graded in Canvas.

## Quizzes:

We will have take-home (group) quizzes on the material that already has been taught and covered by homework assignments. I will make quizzes available by Wednesdays 11:59pm and they are due Fridays at 11:59pm. You print, answer questions, scan and upload the PDF file into Canvas (there are directions on Canvas for those who don't have access to printer and/or scanner). There will be 2-3 questions in every quiz. Your quizzes will be graded in Gradescope.

You are encouraged to work on quizzes within small groups of 3 or 4. You would discuss your possible solutions within the group and then write your answer based on your own understanding. Working in groups is encouraged, but it is "individual responsibility" to complete and submit quizzes. Everyone writes only his/her name on the quiz paper. At the end of the semester, I will drop your lowest quiz score.

## Tests:

There will be two midterms along with a "comprehensive" final exam. All exams are during class time. I will provide you exam file in Canvas and proctor you through the Zoom.

**Exam One:** Thursday, June 17<sup>th</sup>, 10:00am - 11:00am, on Materials covered in Weeks 1-4

**Exam Two:** Thursday, July 15<sup>th</sup>, 10:00am - 11:00am, on Materials covered in Weeks 5-8

**Final Exam:** Thursday, August 5<sup>th</sup>, 10:00am - 12:00pm, comprehensive

It is essential that you show all your work. Credit will not be given without the proper work and partial credit will be awarded if you show correct steps even if you do not obtain the final correct number.

## Grading:

The grades will be calculated as follows:

Homework 20%

Midterm 20%

Final Exam 20%

Quizzes 20%

Midterm 20%

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). If I do need to curve the grades, I will simply shift your overall percentage up by a few points (whatever is necessary).

## Tutoring and Extra Help:

- **Math Student Center:** The online math tutoring center is available free of charge to all university students. The tutoring center is open Monday-Thursday 8:00am-8:00pm, and Friday 8:00am-6:00pm. Please take advantage of the tutoring center as needed throughout the semester. Their website is: <http://www.math.utah.edu/undergraduate/mathcenter.php>
- **ASUU Learning Center:** Home of tutoring services here at the University of Utah. If you need help understanding course content or want to develop better strategies for academic success, then check out their website: <http://tutoringcenter.utah.edu>. They offer inexpensive (online) tutoring.
- **Khan Academy:** It is a non-profit, free, educational organization for anyone, anywhere. They have some amazing videos in the Youtube. If you're interested, check out: <https://www.khanacademy.org/>

## Some Policies and Comments:

- Please check Canvas regularly (every day or every other day). I will use the following features of Canvas frequently: Pages, Assignments, Zoom, Announcements, Modules, Discussions, Gradescope, Files, and Grades.
- Online attendance to live lectures is strongly encouraged but not required. **Class lectures will be recorded and posted in Canvas.**
- All materials for this course are copyrighted. Do not distribute or share course resources without instructor permission.

- **Late and Missing Assignments Policy:** The course is designed to provide flexibility in the case of a few times. But in general, you are expected to turn things in on time and take quizzes and exams at the times given. If there are extenuating circumstances, please contact me in a timely way to discuss alternatives. If the situation is one that can be documented, you may be asked to provide documentation. The University of Utah student code allows for making up quizzes or exams in advance for “officially sanctioned University activities, or government obligations, or religious obligations”. Please contact me at least one week in advance of any such obligations to arrange accommodation.
- For quizzes and exams, you are allowed to use a “scientific calculator”. You can use either a regular physical Texas Instruments scientific calculator or an online scientific calculator. If you search 2+3 in Google a scientific calculator pops up. Other types of calculators like programmable calculators or graphing calculators are not allowed. I will make tests and quizzes to evaluate your mathematical skills and not your calculator skills. For homework assignments, it is okay that you check your answer by advanced calculators or other preferred technology.
- Past semesters, with take-home quizzes and online exams, there was an increase in instances of cheating and other types of academic misconduct. Many online tutoring and video hosting sites, as part of their terms of service, are authorized to fully cooperate with investigations involving academic integrity. All cases involving cheating will be handled according to standard protocols in the Code of Student Rights and Responsibilities. See Policy 6-400 <http://regulations.utah.edu/academics/6-400.php>.
- If there is something that I want to inform you, I will reach out to you by emailing you through Canvas. That is usually your default UMail address (uNID@utah.edu) that you have in the CIS. If you are using other emails more frequently than your UMail, then you can set your UMail to forward to your preferred email address. Also the fastest way to reach me is my email: yaghamayi@math.utah.edu.
- If your preferred name is different than your legal first name (the preferred name you chose does indeed show up in CIS on my roll sheet, but not yet in Canvas), please log into Canvas and go to “Account” (on far left) then “Settings” and change your “Display Name” to be the name you prefer to be addressed by. This will help me greatly to know students’ names, and to address you correctly when responding to Canvas comments.
- If you have any thoughts, ideas, or suggestion, please feel free to contact me. I promise to do everything in my power to help.

## COVID-19 Considerations:

- Generally, on-campus, all of us should wear a face covering mask and we should also maintain a 6 ft. distance between ourselves while using community rooms and common areas in buildings.
- We must self-report if we test positive for COVID-19 via <https://coronavirus.utah.edu/>.

## University of Utah Resources and Policies:

- **Center for Disability & Access:** is dedicated to students with disabilities by providing the opportunity for success and equal access at the University of Utah. They are committed to providing reasonable accommodations as outlined by Federal and State law. The Center for Disability & Access (CDA) also strive to create an inclusive, safe and respectful environment. By promoting awareness, knowledge and equity, they aspire to impact positive change within individuals and the campus community. Please visit <http://disability.utah.edu/> for the latest information.
- **A.D.A. 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.
- **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 <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>

- **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).
- **Veterans Support Center:** The Center is staffed by student Veterans who are committed to providing their fellow Veterans with the most useful and current information available. The Mission of the Veteran Support Center is to improve and enhance the success of student Veterans; to help them receive the benefits they deserve; to serve as a liaison between the Veteran student community and the University; and to increase their academic success. Additionally to provide an opportunity to continue the relationships built through the service in civilian life. Please see <https://veteranscenter.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.
- **Women’s Resource Center:** The Women’s Resource Center (WRC) at the University of Utah serves as the central resource for educational and support services for women. Honoring the complexities of women’s identities, the WRC facilitates choices and changes through programs, counseling, and training grounded in a commitment to advance social justice and equality. <https://womenscenter.utah.edu/>

**Disclaimer:** This syllabus is meant to serve as an outline and guide for our course. All information on this syllabus is subject to change. If any changes on this syllabus, course policies or course outline arise throughout the semester, then I will announce it in class and post it on Canvas.