Syllabus for Math 2280-001
Introduction to Differential Equations
Summer 2020

General Course Information:

Course: Math-2280: Introduction to Differential Equations.
Instructor: Keyvan Yaghmayi.
Email: yaghmayi@math.utah.edu.
Course Website: I will 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: Monday - Thursday 10:00am - 11:00am.
Class Location: Online lectures in Canvas via Zoom. Please log into Canvas and click on Zoom. If it asks for meeting ID enter: 969-450-42441.
Online Office Hours: After class Monday - Thursday 11:00am - 12:00pm or by appointment.
Textbook: Differential Equations and Boundary Value Problems: Computing and Modeling, By Edwards, Penney, and Calvis, 5th Edition. ISBN-13: 978-0-321-79698-1 and ISBN-10: 0-321-79698-5.
Important Dates: Classes begin Monday, May 11. The last day to add, drop (delete), or audit the class is Wednesday, May 20. The last day to withdraw is Friday, June 19. *Final Exam* is on Friday, July 31, 10:00am - 12:00pm.

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.

Course Roadmap Week-by-Week: 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 20 is the last day to drop**.

Week 3: Continue Stability, 2.3 Acceleration-Velocity Models, 2.4 Numerical Approximation: Euler's Method. Monday, May 25 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 11**.

Week 6: 3.6 Forced Oscillations and Resonance, 4.1 First-Order Systems and Applications, 5.1 Matrices and Linear Systems. **Note: Friday, June 19 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.

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 9**.

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 Friday, July 31, 10:00am - 12:00pm**.

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, make a single PDF file of your solution, then upload into Canvas. You don't need a scanner; there are directions on Canvas for using your smart phone as scanner.

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. Late assignments won't be accepted but I will drop your lowest HW 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 on Fridays at 11:59pm. You print, answer to questions, scan and upload it into Canvas (there are directions on Canvas for those who don't have access to printer). 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 via Zoom. You would discuss your possible solutions within the group and then write your answer based on your own understanding. We talk about this during the first week of classes.

Tests:

There will be two midterms along with a comprehensive final exam.

Midterm One: Thursday, June 11, 10:00am - 11:00am
Midterm Two: Thursday, July 9, 10:00am - 11:00am
Final Exam: Friday, July 31, 10:00am - 12:00pm

Exams open in Canvas at 10:00am. You print, answer to questions, scan and upload your work into Canvas. You are allowed to use your textbook, class notes, past assignments, and a scientific calculator. You are not allowed to talk with classmates, friends, tutors, or use online resources. The detailed policies will be announced when we get close to exam dates.

Grading:

The grades will be calculated as follows:

Homework 15%
Quizzes 15%
Midterm One 20%
Midterm Two 20%
Final Exam 30%

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

Some Policies/Comments:

- Please check Canvas regularly (every day or every other day). I will use the following features of Canvas frequently: Announcements, Assignments, Zoom, Pages, Modules, Discussions, Files, and Grades.

- Past semester, with 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: yaghmayi@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.

Tutoring and Extra Help:

- **Tutoring Lab:** 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/ugrad/tutoring.html`

- **ASUU Tutoring Center:** University Tutoring Services, 330 SSB. They offer inexpensive online tutoring, please see their website: `http://tutoringcenter.utah.edu`

- **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/`

Summer Warning: This class is pretty intense, meaning over a shortened schedule of 11-12 weeks, rather than 15. We still have to cover all the same material. That being said, we have to perform accordingly. I recommend you to spend 2-3 hours per day (or 5-6 hours every other day) outside of class time to succeed in the class.

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).

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 to schedule a time to drop by. The LGBT Resource Center hours are M-F 8am-5pm, and 8am-6pm on Tuesdays.

LGBT Resource Center: The LGBT Resource Center provides a comprehensive range of education, information and advocacy services, and works to create and maintain an open, safe, and supportive environment for LGBT students, staff, faculty, alumni, and the entire

campus community. Here is their website: `https://lgbt.utah.edu/`

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.

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 `https://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.

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/`

Women's Resource Center: The Womens Resource Center (WRC) at the University of Utah serves as the central resource for educational and support services for women. Honoring the complexities of womens 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: 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 send the change in email.