

Winter 2021
Math 377: Differential Equations 2
2:00 - 2:50 MWTh

Instructor: Dr. Jim Bisgard
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Office Hours: M-F 9:30-10:30 am and by appointment.

Course Goals: The goal of the course is to introduce you to the ideas of systems of differential equations: how to use analytic, graphical and/or numerical methods to investigate the solutions of systems of differential equations, as well as how to derive systems differential equations to describe phenomena in different sciences. More precisely, we will study systems of linear first order equations, and how to describe the behavior of their solutions using the language of linear algebra. We investigate the bifurcation of linear systems. In addition, we will explain the behavior of nonlinear systems near their equilibria. Depending on timing, we may either introduce Laplace transforms, or investigate the method of separation of variables for partial differential equations.

Required Text: Noonburg, Virginia W.; Ordinary Differential Equations: From Calculus to Dynamical Systems 2nd edition; published by AMS

Software: Your homework assignments may have a few problems for which Mathematica will be very useful. CWU has a site license for Mathematica, and as a student you are entitled to your own license. If you do not have the bandwidth or a computer that can run Mathematica, you may also use CWU's virtual desktops at vdi.cwu.edu, and clicking on the COTS desktops.

1 Grades/Exams/Homework

- Grades

Grades will be calculated using the following weighting system:

Exams: 55% total, broken up as follows: 15% for each mid-term and 25% for the final;

Homework: 45%;

and the following scale:

	87 – 89.9 : B+	77 – 79.9 : C+	67 – 69.9 : D+	below 60 : F
93 – 100 : A	83 – 86.9 : B	73 – 76.9 : C	63 – 66.9 : D	
90 – 92.9 : A–	80 – 82.9 : B–	70 – 72.9 : C–	60 – 62.9 : D–	

I will use the following formula to calculate your overall score for the class:

$$(.45) * \frac{\text{HW points earned}}{\text{HW points possible}} + (.15) * \frac{\text{Exam 1 score}}{\text{points possible on Exam 1}} \\ + (.15) * \frac{\text{Exam 2 score}}{\text{points possible on Exam 2}} + (.25) * \frac{\text{Final Exam score}}{\text{points possible on Final Exam}}.$$

- Exams

There will be two mid-term exams during the course of the quarter, and a final exam. Each mid-terms will have a 24 hour window during which you must complete the exam. Once you begin the mid-term, you will have two hours. The first mid-term will be available between 2 pm Tuesday, February 2 and 2 pm Wednesday, February 3. The second mid-term will be

available between 2 pm Tuesday, February 23 and 2 pm Wednesday February 24. The final exam will have a similar 24 hour window, although you will have three hours to complete the final exam. The final exam will be cumulative, and will be available between 2 pm Thursday, March 18 and 2 pm Friday, March 19.

- Homework

We will have weekly homework assignments. They will be handed out on Wednesdays, and be due Thursday of the following week at 4 pm. There will be a homework due during the final week of class. To do some of the problems, you might need to use a computer. You may work with your classmates on homework (and in fact, I encourage you to do this!), but you should write your solutions using your own words. A really good way to make sure you are not copying is to only use scratch paper when working together, and then write your final solutions on the handout alone. Your homework must be neat and legible, and written using complete sentences where appropriate. Note also that notation is important: good notation can help you solve a problem, while poor notation can confuse you. As a result, use of poor or incorrect notation will result in failure to earn full credit on a problem! Finally, you may not be able to do every problem when the homework is assigned, but you should immediately attempt to do every problem that you can - **DO NOT PROCRASTINATE!**

- **Submitting Work Electronically:** All work for this course will be submitted electronically through Canvas.

1. Homework and Exams may only be submitted in .pdf format, and your submission must consist of a **SINGLE PDF FILE**. That is: you may **NOT submit a separate file for each page of your work! You must combine all parts of your submission into a single pdf prior to submission!** Your submission must be smaller than 20 MB and fewer than 15 pages.
2. If you choose to hand-write your homework, you have a couple of options for submission:
 - (a) You can scan it to a PDF document using a cell phone camera. Some apps that do this (there are many others if you don't like these): Adobe (free) or CamScanner (free version) for Android phones; the Notes App (built-in) or CamScanner (free version) for iPhone.
 - (b) You can take a well-lit, easy-to-read photograph, insert it into a Microsoft Word or OpenOffice Writer document, make sure that the photo is oriented correctly and easy to read, and then save the document as a .pdf file for upload to Canvas.

Whichever method you choose, please double-check that your images are oriented correctly. Images not oriented correctly or images that are not easy to read will lead to the assignment being returned without being graded.

- Late and Make-up Policy

Homework is due at 4 pm on its due date. Homework submitted after that time on its due date will have 5 points deducted from its score immediately, and 5 more points will be deducted for every 24 hours after. That means: if you hand in homework at 4:25 pm on Thursday, you can earn at most 20 out of 25 on your homework. If you submit your homework on Friday at 4:25 pm, you can earn at most 15 out of 25, since over 24 hours will have passed. If you are unable to take an exam during its window, you may be eligible for a make-up. To get a make-up, you must notify me before the exam (if possible) or within 24 hours after the exam. In addition, a make-up is only allowed if you have proof of a compelling reason for having missed the exam. Make-ups will not be given for circumstances you know about ahead of time! When a make-up exam cannot be taken

before I return the corrected exam, I reserve the right to instead replace that portion of your course grade with your final exam grade. These considerations also apply to the final: **IF YOU MISS THE FINAL BECAUSE YOU OVERSLEPT OR HAVE THE WRONG DATE, YOU DO NOT GET A MAKE-UP FINAL!**

2 Important Dates

January 11 - Last Day for Add/Drop

February 2 to February 3 (2 pm) - Mid-term Exam #1

February 18 - uncontested withdrawal deadline

February 23 to February 24 (2 pm) - Mid-term Exam #2

March 18 to March 19 (2 pm) - Final Exam

3 General Class Policies

Come to class. Do your own work. Work really hard; this class is likely to be quite difficult, but you will leave it with a useful set of tools that will be applicable in your future careers.

Face Coverings and Social Distancing: Due to COVID-19, and under the directive and mandate of public health officials and the president of Central Washington University, students must adopt face covering protocol before entering any classroom or building at CWU until further notice. Students must also follow the social distancing placement marks in buildings and classrooms. If you do not have a face covering Central Washington University can provide one for you. If you have not yet received your CWU-supplied facial covering, please go the SURC Information Desk. Please do so prior to the start of your first class. Face coverings must cover both the mouth and nose. Your mask protects me; my mask protects you. Masks with one-way valves for exhalation do not provide protective value for others — please don't use them as your face covering for any in-person interactions. Thank you for helping keep all of us safe!

Class Recordings: Lecture/discussion will be recorded and posted on Canvas for those who can't attend synchronously on a given day. However, you should plan on attending synchronously on an ongoing basis. We all benefit from the conversations in-class, and they will be richer for having you there! One of the points of attending classes is to have an expert in the content area provide you with guidance in that content area, and be able to respond to any questions you may have. In addition, we will often have some period of class where you work on an example — and have an opportunity to ask questions as you work through it. If you do not attend, you miss out on the substantial benefit these interactions provide.

When attending virtually, please turn on your camera if that is reasonable given your situation, bandwidth issues, etc. If you cannot turn on your camera, please use a profile picture on Zoom that matches your profile picture on Canvas (and please put one up on Canvas) so that we don't have to look at a sea of initials!

Academic Honesty: Consult university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and WAC 106-125-020) for student conduct, cheating, plagiarism, and other academic expectations. CWU's policies and recommendations for academic misconduct will be followed, leading to disciplinary action up to and including failing the course.

Inclusivity Statement: As a member of a peer learning community, a high degree of professionalism is necessary. **CWU expects every member of the university community to contribute to an inclusive and respectful classroom culture.**

Classroom Conduct: Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see definitions below from the Washington Administrative Code: WAC 106-125-020) will be referred to the Dean of Student Success.

Disability Support Services: Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu

Religious Obligations and Schedule Conflicts: In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor *within the first two weeks of class* listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

Communication: This is going to be an unusual quarter in many ways. Some of you are completely remote. Some of us may need to quarantine in the middle of the quarter. In all things, communication is going to be key. If you have something going on, please let me know (no details you don't feel comfortable sharing, of course, just a general heads-up). As things need to change during the quarter, I will do my best to let you know as soon as I can. In all things, please extend grace to me and your classmates, and I will do my best to do the same. I will try to respond to email sent between 9 am and 4 pm, Monday through Thursday within three hours. Emails sent later in the evening may not be responded to until the next day. In addition, beginning Friday afternoon and continuing on through Saturday and Sunday, I may only check my email once or twice a day.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.