

Winter 2023
Math 377: Differential Equations 2
10:00 - 10:50 MTTh, Samuelson 130
and occasional Tuesdays in Samuelson 138

Instructor: Dr. Jim Bisgard

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Office Hours: M-Th 1:00-1:50 pm and Friday 10:00-10:50 am (in-person and over Zoom) and by appointment. (Please feel free to knock if the door is closed!)

Course Outcomes: Upon successful completion of this course, the student will be able to:

- Formulate initial value problems involving systems of differential equations.
- Solve initial value problems involving systems of differential equations using standard techniques.
- Graphically describe solutions for two- dimensional autonomous systems of differential equations.
- Identify important properties of non- linear systems of differential equations.
- Analyze systems of differential equations using numerical software.
- Describe both analytic and approximate solutions clearly using appropriate mathematical notation and language.

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.

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. The first mid-term will be Thursday, February 2, and the second will be Thursday, February 22. The final exam will be cumulative, and will be Tuesday, March 14.

- Homework

We will have weekly homework assignments. They will be handed out on Thursdays, and be due Thursday of the following week at 4 pm. There will be a homework due during the last 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!** Because life can happen to any of us, your lowest homework score will be dropped.

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

1. Homework 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 scheduled time, 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 10 - Last Day for Add/Drop

February 2 - Mid-term Exam #1

February 17 - uncontested withdrawal deadline

February 22 - Mid-term Exam #2

March 14 - Final Exam (We will double-check this when CWU “confirms” final exam times!)

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: I strongly encourage you to wear a mask — 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!

Please note that if you wish to come to office hours or an appointment at my office, you **MUST** wear a face-covering. If this is not an option, we can instead meet virtually using Zoom.

Class Recordings: Attendance is considered mandatory, and you should plan to attend on an ongoing basis. Because of the ongoing pandemic, class will be recorded and posted on Canvas. It will not be edited, and I may point to portions of the board that aren’t in the view of the camera. (Everybody in class is able to see the entire board, unlike the restricted viewing angle of the camera.) 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 may have some period of class where you will work with your neighbor to solve problems. If you do not attend, you miss out on the substantial benefit these small group 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).

Academic Honesty: The integrity of students and their written and oral work is a critical component of the academic process. 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: If I (and/or a substantial proportion of class) need to quarantine during the quarter or if CWU decides that the safest way to conduct classes is completely online, class will be run as a **synchronous** online course, which will meet at the regularly scheduled days and time using Zoom. In this case, we will use the Zoom link posted in Canvas. Please let me know if something comes up that might affect your ability to attend or participate in class — you don't need to give me any details, but if you let me know, I can usually work with you to make sure you can turn assignments in and get information about class.

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