Math 306U: Introduction to Differential Equations

Instructor(s)

Lecturer: Mark Sullivan
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    Office hours: Mondays and Wednesdays, 9:00 AM ET to 11:00 AM ET
Teaching assistant: Mark Sullivan

Prerequisites

MTH 141 and MTH 142.

Textbook

The textbook for this course is free and open source. It can be found at the following address:

$$\texttt{https://tinyurl.com/306text}$$

Meeting times

Monday, February 1st, 2021 - Friday, May 7th, 2021

Lectures: Tuesdays and Thursdays, 11:10 AM ET to 12:25 PM ET
Recitations:
    Section U1: Tuesdays, 12:45 PM ET to 1:35 PM ET
    Section U2: Thursdays, 12:45 PM ET to 1:35 PM ET

The lectures and recitations for this course will be held live over Zoom (see **Online resources** for more information). The lectures and recitations will be recorded and made available for later viewing.

Course description

From the Mathematics Department: "Analytic solutions, qualitative behavior of solutions to differential equations. First-order and higher-order ordinary differential equations, including nonlinear equations. Covers analytic, geometric, and numerical perspectives as well as an interplay between methods and model problems. Discusses necessary matrix theory and explores differential equation models of phenomena from various disciplines. Uses a mathematical software system designed to aid in the numerical and qualitative study of solutions, and in the geometric interpretation of solutions."

From me: This class has four topics:
1. First order ODEs (Chapter 1)
2. Higher order linear ODEs with constant coefficients (Chapters 2 and 6)
3. Power series methods for solving ODEs (Chapter 7)
4. Systems of ODEs (Chapters 3 and 8)

For each of these topics, we'll have three goals:
   i. Finding general solutions
   ii. Finding solutions to initial value problems
   iii. Creating and studying diagrams of solutions

Assignments and grades

Homework will be assigned weekly throughout the course. Each homework assignment will consist of at most five problems. The assignments will always be given on Wednesday, to be due on the following Wednesday at 9:00 PM ET. Homework will account for 40% of your final grade.

There will be **two midterm tests** throughout the semester. These tests will not be cumulative; no question that could have been asked on Test 1 will appear on Test 2. Your lowest test will account for 10% of your final grade. The other test will account for 30% of your final grade.

There will be a **cumulative final exam** for the course. See **Final exam information** for more details. It will account for 20% of your final grade.

To summarize:

Homework:	40%
Your lowest midterm test:	10%
The other midterm test:	30%
Cumulative final:	20%

The following system will be used to assign letter grades:

94-100	A
90-93	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
65-67	D
0-64	F

If I deem it necessary, I will make adjustments to the scale at the end of the course. At that time, I will assign grades that are better than or equal to the grades prescribed above. (Thus, any "curving" will be done at the end of the course. If you ask me about this during the semester, I will not be able to give you a complete answer.)

Final exam information

There will be a cumulative final exam for the course, scheduled for the following time:

Tuesday, May 11th, 2021, 11:45 PM - 2:45 PM

(If you have a conflict or some other legitimate reason for which you cannot attend the final exam at this time, you **must** inform me immediately.)

Expectations

Despite the pandemic, this is a serious university mathematics course, and it comes with the usual kinds of expectations, even if certain adjustments to our literal behavior must be made. The following technologies are **essential**, not suggested:

1. Stable Internet access throughout the course.

2. A second device with a camera and Internet access, such as a tablet or smartphone.

If you do not have access to these types of devices, then you must inform me immediately.

Additionally, if, during the course of the semester, you are unable to fulfill what would otherwise be expected of you (example: a power outage causes you to be unable to access or submit a test), then you **must** inform me immediately. For this reason, I have provided my cell phone number at the beginning of this syllabus. If your excuse is legitimate, and you inform me of the problem with appropriate haste, then I will be willing to discuss accommodations. If you fail to do so, then there won't be much that I'll be able to do to help.

Controlled enrollment

This is a Controlled Enrollment Course. If you need to repeat this course in the future (because you failed it, resigned from it etc. at the first attempt) you may be forced to do it in a UB summer or winter session. Registering to repeat this course in a Fall or Spring semester may be difficult or impossible. For more information see the Repeat Policy in the UB Undergraduate Catalog: `https://catalog.buffalo.edu/policies/repeat.html`.

Accessibility

Reasonable accommodations for equal access to this course because of disability should be requested through Accessibility Resources located at 60 Capen Hall, (716) 645-2608.

Academic honesty

The University at Buffalo's policy on academic honesty can be found here:

`https://catalog.buffalo.edu/policies/integrity.html`

I really don't want to have to deal with this. If, during the course of the semester, I discover that you have not closely adhered to the university's policies, then you will get no sympathy from me. I will pursue the most severe punishment possible in that case. In short, **I assure you that it would be far better for you to fail the class honestly than to disobey the rules.**

Advice

This class is hard. I have worked with many students in this class before, and not one of them has ever expressed to me that they found this course easier than Math 141 or Math 142. It would therefore be reasonable to expect that it will be harder than either of the previous courses. Of course, my job is to teach you, so I have some pieces of advice for handling the class.

1. There is exactly one way to improve your skill in mathematics, and it's to practice doing the types of problems that you're studying. For some reason, we humans simply cannot learn how to do an activity well just by being told how to do it, or by watching someone else do it. To believe that you can become better at mathematics by watching someone else do it is equally absurd as believing that you can become a pianist by watching someone else play the piano.

2. Confidence comes from familiarity. As a psychological corollary to the previous point, the only way to get over any anxiety that you might feel (especially in preparation for a test) is to become so familiar with the material that nothing could possibly surprise you. Think of any task that you feel you could easily do. Surely you didn't always think you could do it. So, how did you overcome your self-doubt?

3. Budget your time. This is important in general, but especially so for tests. The standard amount of time you'll get for exams in this class is seventy-five minutes. Take the first sixty (or so) of those minutes. Divide sixty (or so) by the number of problems on the test. This tells you how much time you should spend on each problem. The remaining time (fifteen minutes, or so) is dedicated to possible difficulties that you may face during the test.

4. Check your e-mail daily. This is pretty much the only way I can make announcements to the entire class. If you miss my e-mails, there won't be much that I can do for you.

5. Don't hesitate to ask me for help. Educating you is my job, and I happen to love my job. If there's ever anything I can do to help you learn, let me know. Additionally, if you have any suggestions for how I should run the course, I'd be open to those, as well.

Online resources

Seeing that this course will be (by necessity) completely online, there will be quite a few online resources that you will need to reference from time to time. All of these resources will be linked on UB Learns.

Course webpage:

https://tinyurl.com/5743w2tq

All homework assignments and lecture notes will be posted here. This webpage also contains links to everything below and more.

Link to the Zoom meeting for lectures:

https://tinyurl.com/36hffom9

This is the link we'll be using for our lectures. Meeting ID: 940 9384 4927, Passcode: 194666

Link to the Zoom meeting for recitations:

https://tinyurl.com/yubcczwt

This is the link we'll be using for our recitations. Meeting ID: 959 1260 8844, Passcode: 162432

Course calendar:

https://tinyurl.com/11cc9ybo

This calendar will document every major event in the course. This calendar is subject to change, and I will be updating it throughout the semester.

My YouTube channel:

https://tinyurl.com/247wx5jo

Here I will be uploading the recordings of every lecture and recitation.

Gradescope:

https://tinyurl.com/ydx74wyf

You'll need to use this site in order to access all of your assignments and tests, and also to view your grades.