Ordinary Differential Equations

MATH-UA 262-003&4 Spring 2021

Zoom:	(access via NYU classes>Zoom, classes recorded)
Instructor:	Silvia Espinosa (se1557@nyu.edu)
Class:	Mon & Wed 2:00-3:15pm
Office Hours:	Provisionally Mon 3:15-5:15pm (2h), with changes announced by Sunday
Assistant:	Ondrej Maxian (om759@nyu.edu)
Recitation:	Fri 2:00-3:15pm
Office Hours:	Wed 8:00-9:00am and Th 5:00-6:00pm
Start:	Office hours, recitations and homework will start on Feb 5th.

1. Course description, goals, class notes and references

By the end of the course, students will be able to solve ordinary differential equations with the techniques covered, model the world with them and analyze the predictions of the models. Table 1 lists the subject main topics and where they are covered on the following references, which are not required:

- Braun, 'Differential Equations and Their Applications, 1993
  Free at https://link.springer.com/book/10.1007%2F978-1-4612-4360-1

- Boyce and DiPrima: 'Elementary Differential Equations and Boundary Value Problems', 2005

Material will be covered from other references as well. In my view, a successful classroom consists of eager students focused on understanding and ready to participate. To promote that, **classnotes will be posted** for you online on **NYU Classes>Resources>Class Notes** for you to print. I plan to leave blank space for problems, so you can participate since I welcome better approaches than the one I have in mind and copy the best solution. **The theory will all be there**, so you do not have to focus on copying but rather understanding, asking questions and participating in problem solving.

2. Assessment plan

2.1 Homework

There will be problems to write up on paper approximately each week. They will appear on **NYU classes>Resources>Homework** on Fridays after the recitation approximately each week. You will have a week to solve them, being **due by the beginning of the next recitation via Gradescope**. **Late homework will not be accepted**, in fairness to fellow students and to graders, so I can post the **solutions online afterwards under Resources > Homework**. However, because sometimes things more important than math homework come up, your **lowest problem set score will be dropped**.

Collaboration: Although each student must write his/her own solutions in his/her own words, collaboration between students is accepted for homework. Indeed, office hours can used both to ask me conceptual questions, to solve a problem yourself but with my feedback and also as a group problem solving session with your colleges if there is enough demand.

Topics	Partially contained in references
First-order ODE's ◦ Types and solution methods: - Separable and homogeneous equations - First-order ODE's, Bernoulli and Ricatti equations - Exact equations - Integrating factors ◦ Modeling with 1st order equations: population dynamics	Boyce&DiPrima Chapter 1&2 Braun Chapter 1
First order linear systems of differential equations ◦ With constant coefficients - Homogeneous: fundamental matrix solutions - Non-homogeneous: variation of parameters ◦ With variable coefficients ◦ Phase space: stability and trajectories	Boyce&DiPrima Chapter 7 Braun Chapter 3
n-order linear ODE's ◦ With constant coefficients - The method of undetermined coefficients - The method of variation of parameters ◦ With variable coefficients - Euler equations	Boyce&DiPrima Chapter 3,4&5 Braun Chapter 2
Non-linear differential equations ◦ Phase space: stability and trajectories ◦ Evolution in time: existence, uniqueness, periodicity ◦ Stability - Linearization: Hartman-Grossman's theorem - Liapunov's method ◦ Periodic solutions: Pointcaré-Bendixson ◦ Conservative mechanical systems	Boyce&DiPrima Chapter 9 Braun Chapter 4
Laplace Transform	Boyce&DiPrima Chapter 6

Table 1: Subject main topics and chapter where they are covered on the course references.

2.2 Exams

There will be an open-book midterm and a final exam via Gradescope. The midterm will be during class and **you will vote the exact day**. The final will take place at a time to be posted by NYU on Albert. The midterm will cover first-order ODE and linear systems, while the final everything in Table 1. Some questions will resemble problems solved in class, recitations and homework, while some will be brand new to you. **Partial credit will be obtainable in all the questions.**

Policy on missed exams: I will be offering one out-of-sequence exam before the actual exam for students in incompatible timezones. Since I will ask you for religious holidays/athletic tournaments/preferences before setting those, no make-up exam will be offered for students who miss both dates. If the reason was a documented last-minute medical emergency, the midterm weight will be transfer to the final. If you require additional accommodations as determined by the Center for Student Disabilities, please let your instructor know as soon as possible.

Academic Integrity: Students are expected to adhere to NYU's Academic Integrity Policy: https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/academic-integrity-

for-students-at-nyu.html

2.3 Grading and grades

You can always get partial credit, so please elaborate your answers. Your grader, TA and I care about whether you understand the **concepts** and have basic common sense (e.g. a population cannot be negative)*. **Algebraic mistakes will barely affect a perfect score** if you have proved the former.

Your course score will be determined as the following weighted average:

Item	**Weight**
Homework	20%
Midterm	30%
Final	50%

We will convert this score to a letter grade beginning with these values as cutoffs:

Letter grade	A	A-	B+	B	B-	C+	C	D
Maximum cutoff	93	90	87	83	80	75	65	50

These cutoffs might be adjusted to make letter grades higher. Although I will not curve each particular homework or exam, the total grade for the class will be curved in such a way that students with similar scores will get the same grade.

Regrade: Although in my homework solutions (NYU classes>Resources>Homework) or midterm solutions (NYU classes>Resources>Exams) you will find a way to solve the problem, there are other ways or even solutions that are also correct. Please tell me during office hours if you think yours is also correct so I can post an announcement. Feel free to get points back by pointing to my announcement to the grader, TA or me when you appeal them via Gradescope.

*If you get a non-sensical answer, please write a note explaining that this cannot happen and why, because if the mistake is just algebraic you will get an almost perfect score with the note.