

# Syllabus ODE MATHUN2030

Morena Porzio

Summer 2023

## General Information

**Instructor:** Morena Porzio. Email: mp3947@columbia.edu. Office: 408 Math Building.

**Office Hours:** Thursday 3pm - 7pm, 406 Math Building.

**Lectures:** Monday & Wednesday 5:30pm-8:40pm, 520 Math Building.

**Graduate student TA:** Qiyao Yu. Email: qy2266@columbia.edu.

**TA Office Hours:** Wednesday 2pm - 5pm, 406 Math Building.

## Course Description

The course is based on the book *Elementary Differential Equations and Boundary Value Problems, 9th Edition* by W. Boyce and R. DiPrima. In this course the material is split into qualitative methods, linear differential equations with constant and variable coefficients, systems of such equations, series solution techniques and Laplace transform. More precisely:

- Introduction to ODEs (Chapter 1)
- First order ODEs (Chapter 2)
- Second order linear equations (Chapter 3)
- Higher order linear equations (Chapter 4)
- Series solutions of second order linear equations (Chapter 5)
- Laplace transform method (Chapter 6)
- Systems of first order linear equations (Chapter 7)
- Nonlinear differential equations and stability (Chapter 9)

## Prerequisites

Calculus I and Calculus II (Math 1101/1102) or equivalent are essential prerequisites. Moreover, some familiarity with matrices, determinants, eigenvectors and eigenvalues from the Linear Algebra Curriculum is recommended (for example from MATH 2010 or equivalent courses).

However, I will try to review the recommended prerequisites during office hours if needed. If you are unsure about your prerequisites, please do not hesitate to reach out to me.

## Grading Scheme

**Homework:** 20%

**Midterm:** 30 %

**Final:** 50%

## Homework

There will be homework assignments (almost) twice a week that account for 20% of the grade. Assignments are posted on Courseworks and solutions to the problems need to be uploaded there as well. Each student should scan their homework and submit it to Gradescope. Solutions to the assignments will also be posted on Courseworks. The *lowest two grades on a homework* are automatically dropped.

## Late submissions and exam rescheduling

No late homework will be accepted. The only exception will be for those with an incapacitating illness, a serious family emergency, or situations of comparable gravity. If this is the case, students should contact the graduate TA of the class and arrange a workable solution with them.

## Academic Integrity

Students are encouraged to work together and use any resources available while solving the problems, but are advised to spend some time thinking about the problems individually. Everyone must write up their problem set in their own words and disclose all sources they have used including fellow students, office hours, other books etc.

Ça va sans dire that students are not allowed to cheat in any way during exams. Also students are not allowed to copy other students' work without citing them. A substantiated violation of the code of academic integrity can result to serious academic disciplinary action. For more on this, please consult the Columbia University Undergraduate Guide to Academic Integrity here <https://www.college.columbia.edu/academics/academicintegrity>.

Finally, phones and other electronic devices must be silenced and put away during class and exams.

## Disability services

Students requiring special accommodations should contact the Office of Disability Services (ODS) promptly to discuss appropriate arrangements. See <https://www.health.columbia.edu/content/disability-services>.

## Tentative Schedule of Lectures

- M, July 3 Course description, basics of ODEs, Classification of ODEs, method of integrating factors (Sections 1.1, 1.2, 1.3, 2.1)
- W, July 5 Separable equations, Linear vs Nonlinear equations, Exact equations and integrating factors (Sections 2.2, 2.4, 2.6)
- M, July 10 Modeling with first order equations, Second order homogeneous equations (Sections 2.3, 2.5, 3.1, 3.2)
- W, July 12 Roots of the characteristic equation, Methods of undetermined coefficients and variation of parameters (Sections 3.3, 3.4, 3.5, 3.6)
- M, July 17 Review of Linear Algebra (Section 7.2, 7.3)
- W, July 19 System of linear ODE (Sections 7.5, 7.6, 4.1, 4.2)
- M, July 24 Midterm
- W, July 26 Non-homogeneous linear systems (Sections 7.9, 4.3, 4.4)
- M, July 31 Power series solutions (Sections 5.1, 5.2, 5.3, 5.4)
- W, Aug 2 The phase plane: linear systems, Autonomous systems and stability (Sections 9.1, 9.2, 9.3)
- M, Aug 7 The Laplace transform method till convolutions (Sections 6.1, 6.2, 6.3, 6.4, 6.6)
- W, Aug 9 Reading Day
- F, Aug 11 Exam Day