Syllabus

Math UN3027 Ordinary Differential Equations
Fall 2021

Instructor: Elena Giorgi (elena.giorgi@columbia.edu)

Course Hours and Location: Tuesdays and Thursdays, 11:40am-12:55pm, in room 312 Mathematics

Overview of the Course: This is a proof-oriented course in Ordinary Differential Equations (ODE) designed for students with a strong mathematics background. Emphasis will be given equally to theory and computations. Students who attend this class must be comfortable with proofs. Other students are encouraged to take UN2030.

Topics of the Course: We will focus mainly on first order and second order linear equations, and the various techniques used to solve them. We will present theoretical aspects, as well as applications from physics and population dynamics. Linear algebra is a recommended prerequisite.

A more detailed list of topics covered in the class is the following:

- First order linear differential equations, separable and autonomous equations
- The existence and uniqueness theorem
- Second order homogeneous equations, the Wronskian, method of undetermined coefficients
- Higher order linear equations
- Series solutions of second order linear equations, Euler equations
- System of first order linear equations
- The Laplace transform

Textbook: *"Elementary Differential Equations and Boundary Value Problems"* (10th Edition) by Wiley by Boyce/DiPrima.

Note: there are various editions circulating. Be sure to do the problems corresponding to the 10th edition textbook.

Structure of the course: The material of this course will roughly follow chapters 1,2,3,4,5,6,7 of the textbook by Boyce and DiPrima. The lectures will include some of the material from these chapters, as well as some additional material and examples.

In addition to the lectures, there will be about twelve weekly problem sets. These will be listed on the tentative schedule at the end of this syllabus and

should be uploaded on Gradescope in Canvas by the Saturday of the following week by 3pm (unless otherwise specified in the syllabus). Late homeworks will not be accepted.

It is very important to do all of the problem sets to the best of your ability, as this is the most effective way to absorb the material. While you are welcome to collaborate with your peers, you must attempt all problems on your own and your submitted solutions must be written out individually. Submissions which are copied or suspiciously similar may be rejected. A substantiated violation of the code of academic integrity may result to serious academic disciplinary action.

There will be one midterm exam and one final exam. The midterm will be a seventy-five minute exam which is scheduled on Thursday October 21st during normal class hours. The final exam will be a 2 hours and 50 minutes exam which is scheduled by the university registrar, and the projected schedule is Thursday December 16th from 4:10pm to 7pm.

The exams will generally follow the material from the problem sets but may include some additional conceptual problems to test your understanding. The midterm will cover roughly half of the course material, while the final exam will cover all the material from the course, with slightly more emphasis on the content covered after the midterm.

Grading scheme: The course grades will be computed as follows: 20% Homework, 30% Midterm exam, 50% Final exam. We will drop the lowest homework grade.

Office Hours

- The instructor will hold weekly office hours, 5:00-6:00pm on Tuesdays and Wednesdays, in room 606 Mathematics, or on Zoom.
- Each of the TAs will hold weekly hours in the Math Help Room in room 406 Mathematics (see the schedule here for their office hours) and you are encouraged to come to their hours with any questions or confusions you may have.

Tentative Schedule of Lectures: See table below.

Schedule of Lectures

This schedule is tentative and may be modified as the course progresses.

Week	Read	Homework
Sept. 9 only	**§1.1**, **§1.2**, **§1.3**	**Due Sep. 19** **§1.2**: 3, 5; **§1.3**: 17, 23; **§2.1**: 13, 20, 30, 32
Sept. 14–Sept. 16	**§2.1**, **§2.2**, **§2.4**, **§2.5**	**Due Sep. 25** **§2.2**: 5, 13, 17 (a,c), 29; **§2.4**: 3, 11, 13, 23; **§2.5**: 3, 11
Sept. 21–Sept. 23	**§2.6**, **§2.7**, **§2.8**	**Due Oct. 2** **§2.6**: 5, 13, 15, 23; **§2.7**: 20; **§2.8**: 13, 14
Sept. 28–Sept. 30	**§3.1**, **§3.2**, **§3.3**, **§3.4**	**Due Oct. 9** **§3.1**: 9, 15, 21; **§3.2**: 11, 15, 21; **§3.3**: 9, 13, 21; **§3.4**: 11, 19, 33
Oct. 5–Oct. 7	**§3.5**, **§3.6**, **§4.1**	**Due Oct. 16** **§3.5**: 7, 13, 30; **§3.6**: 9, 17, 31; **§4.1**: 3, 13, 19;
Oct. 12–Oct. 14	**§4.2**, **§4.3**, **§4.4**	**Due Oct. 30** **§4.2**: 15, 19, 41; **§4.3**: 5, 15, 20; **§4.4**: 3, 7, 17;
Oct. 19–Oct. 21	**Review** **Midterm Exam Oct. 21**	No Homework this week
Oct. 26–Oct. 28	**§5.2**, **§5.3**, **§5.4**	**Due Nov. 6** **§5.2**: 7, 11, 21; **§5.3**: 7, 10, 15; **§5.4**: 7, 19;
Nov. 4 only	**§5.5**, **§5.6**;	**Due Nov. 15** **§5.5**: 5, 11, 14; **§5.6**: 3, 13;
Nov. 9 – Nov. 11	**§6.1**, **§6.2**	**Due Nov. 21** **§6.1**: 12, 15, 16 ; **§6.2**: 5, 15, 22, 29;
Nov. 16– Nov. 18	**§6.3**, **§6.4**, **§6.5**, **§6.6**	**Due Nov. 29** **§6.3**: 7, 17, 21; **§6.4** 3(a), 11(a); **§6.5**: 5(a), 12(a); **§6.6**: 11, 17;
Nov. 23 only	**§7.4**, **§7.5**	**Due Dec. 6** **§7.4**: 3, 6; **§7.5**: 1(a), 4(a), 15, 29;
Nov. 30 – Dec. 2	**§6.3**, **§7.6**, **§7.8**, **§9.1**	**Due Dec. 13** **§7.6**: 6, 9; **§7.7** 5, 17; **§7.8**: 2, 7
Dec. 7–Dec. 9	**§7.7, §6.6; Review**	No homework this week
Dec. 16	**Final Exam 4:10pm - 7pm**	