

640:252:03 Elementary Differential Equations

Spring 2022

TF2 12:10-1:30 pm, TIL-116

Instructor: Hongbin Sun

Email: hongbin.sun@rutgers.edu

Office hour: M 1:00 - 2:30 on zoom, F 2:30 - 3:30 in person (Hill 236)

Textbook: Blanchard, Devaney & Hall, Differential Equations, Fourth Edition

Prerequisites: 01:640:250 and CALC3.

Course Description: This course is mainly aimed for solving ordinary differential equations. In particular, it covers: first- and second-order ordinary differential equations, systems of ordinary differential equations.

A differential equation is an equation that relates one or more functions and their derivatives. It is usually used to describe physical quantities that change over time and predict the future of physical systems. Note that most differential equations can not be solved by closed formulas. This course will focus on studying both quantitative and qualitative aspects of differential equations, instead of using various tricks to find closed formulas of solutions of differential equations.

Course meeting platform: We will do online meetings in January (the first two weeks of Spring 2022), and (hopefully) switch back to in-person mode in February. We will have a zoom link for all lectures, in case of emergency. The Monday office hour will also be a zoom meeting. The zoom links of these weekly recurring meetings are posted at the “announcement” of Canvas (the course website, see below).

Homework: There will be assignments every week, except midterm weeks. The instructor will post the problems on Canvas at least one week before the due date. Assignments are due on Tuesdays, by the end of the lecture (1:30 pm), either submitted physically during the lecture or online (Canvas). Not all homework problems will be graded. **No late homework will be collected.** The lowest two homework grades will be withdrawn.

In addition to usual homework, there might be extra (up to three) matlab assignments during the semester, depending on the availability of graders.

Students can discuss with each other on homework problems, but should write his/her own solution. Directly copying solutions from online sources or printed solutions is prohibited.

Quizzes: There will be 20-minute in-class quizzes every two weeks, in the following dates: 2/1, 2/15, 3/8, 3/29, 4/19. The quiz problem will be one of the homework problems due in the previous two weeks. **No make-up quizzes will be offered.** The lowest quiz grade will be withdrawn.

Exams: There will be two in-class midterm exams (2/22 and 4/5) and a cumulative final exam. All exams will be closed book exams. **No make-up exams of midterms will be offered.** You must

have a (documented) illness or major emergency or major outside commitment (with permission in advance) to miss a midterm, **otherwise you will get zero grade**. Make-up exam of the final will be offered.

Marking System:

If you take both midterms, then Final grade= 35% final exam + 20% higher midterm + 15% lower midterm + 15% homework + 15% quiz.

If you miss one midterm, then Final grade= 45% final exam + 25% midterm + 15% homework + 15% quiz.

If you miss both midterms, then Final grade= 70% final exam + 15% homework + 15% quiz.

Academic integrity: All students in the course are expected to be familiar with and abide by the academic integrity policy (<http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers/>). Violations of the policy are taken very seriously.

Special accommodations: Rutgers is fully committed to compliance with the Americans with Disabilities Act; policies and procedures are indicated at <https://ods.rutgers.edu/>.

Students who wish to request special accommodations must present a Letter of Accommodations to the instructor as early in the term as possible, and at least two days before the exam (<https://ods.rutgers.edu/my-accommodations/letter-of-accommodations>).

We will roughly follow the following schedule (may subject to change).

Week	Lecture dates	Sections	Topics
1	1/18, 1/21	1.1, 1.2	Modeling via differential equations, separation of variables
2	1/25, 1/28	1.3 - 1.5	Slope fields, Euler's method, existence and uniqueness of solution
3	2/1, 2/4	1.6, 1.7	Equilibria and phase line, bifurcations
4	2/8, 2/11	1.8, 1.9	Linear equations, integrating factors
5	2/15, 2/18	2.1, 2.2	Modeling via systems, the geometry of systems
6	2/22, 2/25	2.4 - 2.5	Midterm 1, Analytic methods for special systems, Euler's method
7	3/1, 3/4	2.6, 2.7, 3.1	Existence and uniqueness, SIR model, property of linear systems
8	3/8, 3/11	3.2, 3.3	Straight line solutions, systems with real eigenvalues
9	Spring break!		
10	3/22, 3/25	3.4, 3.5, 3.7	Systems with complex, repeated, zero eigenvalues, the trace-determinant plane
11	3/29, 4/1	3.6, 4.1	Second-order equations, forced harmonic oscillators

12	4/5, 4/8	4.2,4.3	Midterm 2, sinusoidal forcing, undamped forcing and resonance
13	4/12, 4/15	4.4, 5.1	Steady state, equilibrium point analysis
14	4/19, 4/22	5.2, 5.3	Qualitative analysis, Hamiltonian systems
15	4/26, 4/29	5.4	Dissipative systems, review

STUDENT WELLNESS SERVICES:

Just In Case Web App

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS).

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ www.rhscaps.rutgers.edu/.

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932- 1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>.

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation:

<https://ods.rutgers.edu/students/documentation-guidelines> If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at:

<https://ods.rutgers.edu/students/getting-registered>

Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>.

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.