

MATH 5525: COURSE SYLLABUS

Class schedule and location: MWF 11:15-12:05, VinH 113

Instructor: M. Carme Calderer

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Office Hours: Tuesday, 3:30-5 pm; Friday, 1:30-3:00 pm.

Textbook: *Nonlinear Differential Equations and Dynamical Systems* by F.Verhulst, Springer.

It may be helpful to consult other reference books on differential equations, available in the University Library. For instance, *Differential Equations, Dynamical Systems and Introduction to Chaos*, by Hirsh, Smale and Devaney.

For issues related to Matlab, I highly recommend the book *Introduction to Matlab* by D.Higham and N.Higham. Students are also encouraged to work through Matlab tutorials (online and from YouTube).

Course Prerequisites: Math 2243 or 2373 (Linear Algebra and Differential Equations) or 2573 (Honors Calculus III), and Math 2263 or 2374 (Multivariable Calculus and Vector Analysis) or 2574 (Honors Calculus IV). Knowledge of Matlab or other programming resource will be needed to solve homework problems.

Course description: One of the main focus of the course is the application of the methods and principles of linear algebra to the study of linear systems of differential equations. Another part of the course deals with second order systems of nonlinear equations, and application of phase plane methods. For both, linear as well as nonlinear systems, we will develop the concepts of stability of fixed points and existence of periodic solutions . The course will also involve theorems and proofs, including , the theory of existence of solutions (sections 1.2 and 1.3) and the Poincare-Bendixon theory (section 4.3). We will study applications relevant to physics and biology. Matlab will be the computational software used in the course (in class, and also needed to complete the homework assignments.)

Course content: We will (approximately) cover the following sections of the book:

1.1, 1.2; 2.1–2.3; 3.1–3.4; 4.1–4.3; 5.1-5.5; 6.1-6.2; 7.1-7.2; 8.1-8.3.

Examples and applications from other bibliographic resources will also be presented in class.

Homework and Assignments: There will be a homework assignment every other week, two midterm and the final examinations. Students are encouraged to work in group for the homework assignments; however each student should individually submit the completed work. Some problems will require the use of Matlab. I strongly encourage to take notes during the class; the pace of the lecture should allow for it.

Class notes will be allowed during the tests.

The grade of the course will be based upon a weighted average of homeworks and examinations:

Homework: 25 % of the final grade.

Midterm Test 1 (Friday, February 21): 20 %.

Midterm Test 2 (Monday, March 30): 20 %.

Final examination (Comprehensive. Monday, May 11, 10:30-12:30; VinH 113): 35%.

Course policies.

- The final examination is compulsory. Failure to take it will automatically result in the grade 'F' in the course.
- Missing homework assignments and midterm tests will count as 0.
- Please, do not wait to the day before a test or assignment deadline to ask for help. Otherwise, I cannot guarantee to provide the appropriate individual assistance to students.
- All University of Minnesota policies regarding teaching and instruction apply to the course.