

**Course title:** *MA532 – Dynamical Systems and Ordinary Differential Equations 1*

**Instructor:** Patrick L. Combettes, [plc@math.ncsu.edu](mailto:plc@math.ncsu.edu)

**Term:** Spring 2024

**Time:** Tuesdays and Thursdays, from 15:00 to 16:15

**Office:** SAS 3276

**Office hours:** Tuesdays and Thursdays, from 16:30 to 17:30 (or anytime by appointment)

**Course objectives:** This course provides an introduction to the theory of dynamical systems and ordinary differential equations.

**Prerequisite:** MA425 or equivalent

**Content:** Introduction to abstract dynamical systems. Equilibria and stability, asymptotic behavior, Lyapunov functions. Discrete-time and continuous-time systems, autonomous linear systems, matrix functions, solutions methods. Dynamical systems associated with vector nonlinear differential equations, existence and uniqueness, sensitivity of Cauchy problems, flow, stability, gradient systems, Hamiltonian systems. Applications to mechanics, biology, population dynamics, electrical circuits, finance, and chemistry.

**Grading:** Homework 30%, midterm exams 30%, final exam 40%.

**Reference material (no purchase necessary):**

- M. W. Hirsch, S. Smale, and R. L. Devaney, *Differential Equations, Dynamical Systems, and an Introduction to Chaos*, 2nd ed. Elsevier, San Diego, CA, 2004.
- L. Perko, *Differential Equations and Dynamical Systems*, 3rd. ed. Springer, New York, 2001.
- G. Teschl, *Ordinary Differential Equations and Dynamical Systems*. American Mathematical Society, Providence, RI, 2012.