

MATH 614, Section 600
Dynamical Systems and Chaos
Spring 2018

Instructor: Yaroslav Vorobets

Time: MWF 11:30 a.m. – 12:20 p.m.

Location: BLOC 161

Web page: <http://www.math.tamu.edu/~yvorobet/MATH614/>

Office: BLOC 223b (e-mail: yvorobet@math.tamu.edu)

Office hours: Monday and Friday 1:00–2:00 p.m., and by appointment.

Text: Robert L. Devaney, *An Introduction to Chaotic Dynamical Systems*, 2nd ed., Westview Press, 2003 (ISBN 978-081334085-2).

Prerequisites: MATH 308 (ordinary differential equations), MATH 601 or equivalent (linear algebra and complex analysis).

Course content: The course is an introduction to the theory of dynamical systems with emphasis on the chaos theory. The topics to be covered include: dynamical systems with discrete and continuous time, Poincaré maps, symbolic dynamics, chaos, attractors, fractals, computer simulation of dynamical systems.

Grading system: The grade will be determined by homework (40%) and a project (60%) according to the 90–80–70–60% scale.

Late homework will be accepted only for legitimate reasons and may be penalized if circumstances warrant.

Academic integrity: Copying another student's homework is forbidden (it is dishonest and academically worthless). Information about the Honor Council Rules and Procedures can be found at <http://aggiehonor.tamu.edu/>

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Course outline

Part I (≈ 5.5 weeks): *One-dimensional dynamics*

- Introduction and preliminaries
- Hyperbolicity
- Quadratic maps
- Symbolic dynamics
- Definition of chaos
- Structural stability
- Bifurcation theory
- Maps of the circle
- Period-doubling

Devaney's book: Part One

Part II (≈ 3 weeks): *Higher-dimensional dynamics*

- Dynamics of linear maps
- The horseshoe map
- Attractors
- Stable and unstable manifolds
- The Hopf bifurcation

Devaney's book: Part Two

Part III (≈ 3.5 weeks): *Complex analytic dynamics*

- Complex quadratic maps
- Classification of periodic points
- The Julia set
- The Mandelbrot set

Devaney's book: Part Three

Part IV (≈ 1.5 weeks): *Brief introduction to ergodic theory*

- Invariant measure
- Ergodic theorem
- Ergodicity and mixing
- Spectral properties of a dynamical system