MATH 614, Section 600

Dynamical Systems and Chaos

Spring 2014

Instructor: Yaroslav Vorobets
Time: TR 9:35 – 10:50 a.m.
Location: BLOC 161
Web page: `http://www.math.tamu.edu/~yvorobet/MATH614/`

Office: MILN 004 (e-mail: `yvorobet@math.tamu.edu`)

Office hours: Tuesday 1:00–3:00 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, Poincare 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/`

Students with disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Room B118 of Cain Hall or call 845–1637. For additional information, visit `http://disability.tamu.edu/`

MATH 614, Section 600
Dynamical Systems and Chaos
Spring 2014

Course outline

Part I ($\approx$ 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 ($\approx$ 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 ($\approx$ 3 weeks): *Complex analytic dynamics*

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

Devaney's book: Part Three

Part IV ($\approx$ 1.5 weeks): *Brief introduction to ergodic theory*

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