MATH 405 – Introduction to Iteration and Chaos

Course Description from Bulletin: Functional iteration and orbits, periodic points and Sharkovsky's cycle theorem, chaos and dynamical systems of dimensions one and two. Julia sets and fractals, physical implications.

Enrollment: Undergraduate and graduate students in mathematics, science, and engineering.

Textbook(s): R.L. Devaney, *A First Course in Chaotic Dynamical Systems*

Supplements: Notes and recent journal articles

Prerequisites: Math 251,252, and one of the following:
Math 332, 333, or consent of the instructor.

Objectives:

1. Students will investigate discrete dynamical systems analytically, graphically, and numerically.
2. Students will develop and use criteria for classifying fixed and periodic points.
3. Students will generate and analyze orbit diagrams of key families of functions.
4. Students will understand modern definitions of chaotic (and regular) behavior.
5. Students will apply the central ideas to a variety of theoretical and practical questions.

Lecture schedule: 3 50 minute lectures per week

Course Outline:

	Hours
1. Iteration of real functions; discrete dynamical systems	5
2. Analysis of fixed and periodic points	7
3. One-parameter families of functions: orbit diagrams of the quadratic, Tent, and related families, computer explorations.	12
4. The Li-Yorke and Sharkovsky theorems	4
5. Chaotic systems: criteria and examples, cantor sets, conjugacy Symbolic dynamics	7
6. Singer's Theorem and its relatives	2
7. Newton's (and Halley's) method	4
8. Additional topics as time permits	4

Assessment:	Problem sets	50-70 %
	Projects	30-50 %

Syllabus prepared by: Jerry Frank
Date: March 2, 2006