Salisbury University Department of Mathematical Sciences

MATH 475/575 : Introduction to Dynamics and Chaos
Syllabus (Tentative)

Description: Introduction to mathematical dynamics and chaos. Topics include orbits, bifurcations, Cantor sets and horseshoes, symbolic dynamics, fractal dimensions, notions of stability, flows and chaos. Includes motivation and historical perspectives, as well as examples of fundamental maps studied in dynamics and applications of dynamics. 4 Hours Credit: Meets four hours per week.

Prerequisites: C or better in MATH 202, MATH 210.

Intended Audience: Majors in Mathematics or strong minors in mathematics majoring in science, engineering or economics.

Objective: To learn the attributes, history, motivation, and applications of mathematical dynamics and chaos,

Textbooks: *A First Course in Chaotic Dynamical Systems: Theory & Experiment*, by Robert Devaney; Perseus Publishing (a division of HarperCollins), 1992.

Topic	Weeks
Introduction	1
Examples, objectives, first spreadsheet experiments.	
Orbits	1
Iteration, types of orbits, further spreadsheet experiments.	
Graphical Analysis	0.5
Graphs, orbits, and phase portraits using spreadsheets.	
Fixed and Periodic Points	1
Attractors, repellors, theory and experiment.	
Bifurcations	1
Finding and classifying bifurcations, and spreadsheet analysis.	
The Quadratic Family	1
Chaotic behavior and Cantor sets	
Transition to Chaos	1
Orbit diagrams and period doubling. Technology dependent.	
Symbolic Dynamics	1
Shifts on sequences and conjugate systems	
Chaos	1
Definition, examples, and experiments.	
Sarkovski's Theorem	0.5
Fractals	2
Definition and examples, including Iterated Function Systems	
Julia Set, Mandelbrot Set	1.5
Complex algebra, algorithms, theory, and experiments for J and M.	
Student Presentations	1
Tests	0.5
Total	**14**

Evaluation

Homework	30%
Project	20%
Midterm Exam	25%
Final Exam	25%

- Graduate students will be assigned special homework/test problems or projects.
- Clear descriptions of thought processes, evidence of critical thinking, and effective communication must be demonstrated in written work.
- **Writing Across the Curriculum:** Students will be expected to communicate mathematics and mathematical ideas effectively in speech and writing. At the University Writing Center, trained consultants are ready to help you at any stage of the writing process. In addition to the important writing instruction that occurs in the classroom and during professors' office hours, the Center offers another site for learning about writing. **All students are encouraged to make use of these important services.**
- **NOTE:** Once a student has received credit, including transfer credit, for a course, credit may not be received for any course with material that is equivalent to it or is a prerequisite for it.