

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. Meets General Education Experiential Learning requirement.

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

Intended Audience: Students majoring in Quantitative Sciences or minoring in Quantitative Sciences and majoring in science, engineering, or economics.

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

Textbooks: *Discovering Discrete Dynamical Systems*, by Aimee S. A. Johnson, Kathleen M. Madden, and Ayse A. Sahin; MAA / AMS Press, 1st Edition.

Technology: This will be a technology intensive course; platform is student's choice.

Topic	Weeks
Introduction and Orbits	2
Examples, objectives, iteration, types of orbits, first numerical experiments.	
Graphical Analysis	0.5
Graphs, orbits, and phase portraits.	
Fixed and Periodic Points	1
Attractors, repellers, theory and experiment.	
Bifurcations	1
Finding and classifying bifurcations, and numerical analysis.	
The Quadratic Family	1
Chaotic behavior and Cantor sets.	
Transition to Chaos	1
Orbit diagrams and period-doubling.	
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

Written Problem Sets	20%
Discussion Boards	10%
Problem Solving Demonstrations	20%
Group Numerical Experiments	25%
Final Portfolio	15%
Final Presentation	10%

- 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.