

## COURSE LEARNING OUTCOMES

DEPARTMENT: Mathematics

<b>COURSE #:</b> A4500 <b>COURSE TITLE:</b> Dynamical Systems <b>PRE-REQUISITES:</b> C or better in Math 32404 <b>CO-REQUISITES:</b> None <b>HOURS/CREDITS:</b> 4/4 <b>DATE EFFECTIVE:</b> 1/23/17	<b>CATALOG DESCRIPTION :</b> Dynamical systems arise naturally from connections to the sciences and many mathematical subjects both pure and applied. Students will be able to apply techniques learned in this course to these interrelated subjects. This course provides an introduction to important classes of dynamical systems and exposure to the most important phenomena which appear in the subject.  Required Text: <i>An Introduction To Chaotic Dynamical Systems</i> by Robert L. Devaney, 2nd edition.
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### COURSE LEARNING OUTCOMES

After taking this course, the student should be able to:

1. To rigorously prove results about specific dynamical systems in dimensions 1, 2 and 3.
2. To define and rigorously use terms used in the study of topological and differentiable dynamical systems.
3. To use methods and results from calculus and real analysis to analyze specific systems and to prove general results about dynamical systems.
4. To utilize shift spaces to understand dynamical systems via topological conjugacy and semi-conjugacy.
5. To prove that specific dynamical systems are chaotic.
6. To use Sharkovsky's theorem and ideas from its proof to find periodic orbits in continuous 1-dimensional dynamical systems.
7. To use the Schwarzian derivative to restrict the number of attracting periodic orbits of a 1-dimensional system.
8. To use Bifurcation Theory in 1-dimension to understand how dynamics of a family of maps varies under a continuous change of parameter.
9. To analyze the dynamical behavior of dynamical systems with hyperbolic attractors including Smale's horseshoe, toral attractors, and solenoids.
10. To state and use the stable and unstable manifold theorem.

### COURSE ASSESSMENT TOOLS

Please describe below all assessment tools that are used in the course.

You may also indicate the percentage that each assessment contributes to the final grade.

1. Term Grade (80%)
2. Final Project (20%)

### DEPARTMENTAL LEARNING OUTCOMES (to be filled out by departmental mentor)

**The mathematics department, in its varied courses, aims to teach students to**

- a. perform numeric and symbolic computations
- b. construct and apply symbolic and graphical representations of functions
- c. model real-life problems mathematically
- d. use technology appropriately to analyze mathematical problems
- e. state (e1) and apply (e2) mathematical definitions and theorems
- f. prove fundamental theorems
- g. construct and present (generally in writing, but, occasionally, orally) a rigorous mathematical argument.