Chaos, Fractals, and Dynamical Systems (MATH 266)   Spring 2019

Time: T/TH 1:15-2:30pm   **Place**: Rowell 110

Info: Professor Chris Danforth
Office: Room 218 Farrell Hall, Trinity Campus
email: chris.danforth@uvm.edu
twitter: @chrisdanforth
course tweets: @nonperiodicflow please use #math266 also
course website: http://www.uvm.edu/~cdanfort/main/266.html

Office Hours: Typically Tuesday or Wednesday afternoon, or Thursday morning, see Twitter. You are **strongly** encouraged to attend.

Corequisites: See me if you have not taken (or are not taking) MATH122/124 (Linear Algebra). Matlab programming experience will prove helpful, but it is not required.

Textbook: *Chaos: An Introduction to Dynamical Systems* by Alligood, Sauer, and Yorke, published by Springer.

References: *Nonlinear Dynamics and Chaos* by Strogatz, published by Perseus.

Topics:

- One-Dimensional Maps: Orbits, Stability, and the Logistic Map ($\approx$ 4 lessons)

- Two-Dimensional Maps: Mathematical Models, Sources, and Sinks ($\approx$ 4 lessons)

- Chaos and Lyapunov Exponents ($\approx$ 4 lessons)

- Fractals: Cantor, Mandelbrot, and Julia Sets ($\approx$ 5 lessons)

- Chaos in Two-Dimensional Maps ($\approx$ 5 lessons)

- Chaotic Attractors and Stable Manifolds ($\approx$ 2 lessons)

- The Lorenz Attractor ($\approx$ 3 lessons)

- Excellent Experiments ($\approx$ 2 lessons)

Grades: There will be twelve homework assignments (5 questions at 3 points each), due weekly on Thursdays as you enter class. These HWs will total 50% of your grade. For undergraduate students, I will drop the lowest HW score. You will also have a take-home midterm exam worth 25% due March 8, and a take-home final exam worth 25% due May 10. In borderline situations, class participation will play a role in determining your course grade. Late homework will be marked off by 1 point for every calendar day past due.

Remarks:

- **Graduate Certificate in Complex Systems:** This course is applicable towards a 5-course graduate certificate in complex systems at UVM. If you are potentially interested in the Certificate you should

apply now, since at most 2 courses taken (at UVM or elsewhere) during or prior to the semester in which you are accepted into the Certificate are allowed towards the Certificate. Application is free for current UVM Graduate Students, info can be found here:
http://www.uvm.edu/~cmplxsys/teaching-learning/certificate-of-study-in-complex-systems

- If you are a graduate student, you are required to submit your HW solutions using a mathematical document preparation software (e.g. LATEX). If you are an undergraduate student planning on going to graduate school in the sciences, I strongly suggest you do so as well. Information about LATEX can be found on the course website.

- Some of the homework assignments will have a component which requires the aid of a computer simulation. You are encouraged to use Matlab for these problems, but are welcome to use another language if you prefer (e.g. Mathematica). To get started learning matlab, click on the 'how do I use matlab' link on the course website, it points to a comprehensive set of instructional demonstration videos.

- Please bring your questions about the course material to office hours (make sure the question is important and can not be answered by a google search if you are going to send an email about it).

- Each student is required to visit my office hours at least once during the semester.

- You are encouraged to work in groups on homework assignments. However, each student must turn in their own solutions and code.

- Whenever possible, will be using Twitter to communicate about the class. I strongly recommend that you obtain a twitter account if you do not have one. Alternatively, you can observe a subset of the conversation by visiting the course webpage.

- If you need to communicate with me privately, or don't want your question shared, please email me and include 266 in the subject line.

- Please silence and ignore your cellphone during class, unless you're professing your love for the material on Twitter (see above).

- Offenses against academic integrity are any acts which would have the effect of unfairly promoting or enhancing one's academic standing within the entire community of learners. Such acts are serious offenses, which insult the integrity of the entire academic community of the University. Any suspected violations of the policy will not be tolerated and all allegations will be forwarded to the Center for Student Ethics & Standards.

- In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact ACCESS, the office of Disability Services on campus. ACCESS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated in an accommodation letter to faculty. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. Contact ACCESS: A170 Living/Learning Center; 802-656-7753; access@uvm.edu; or www.uvm.edu/access.

- UVM Religious Holidays Policy: Please submit in writing by the end of the second full week of classes your documented religious holiday schedule for the semester. Students who miss work for the purpose of religious observance will be permitted make up this work.