Math 441 Analysis and Dynamics of Differential Equations (Spring 2017)

Time Tuesday and Thursday 11:00 a.m.- 12:15 p.m. **Location** Burruss 0034

Course Description This is an introductory course to nonlinear dynamics. Have you heard of chaos, fractals, Lorentz map, strange attractors, or butterfly effect? Have you ever wondered whether the planets are always going to stay in their orbits? Or why is that the weather is so unpredictable? Or whether instead, it is predictable, but so complex that we just haven't had the right way to describe it? Or why is it that if we eat two sandwiches, we feel twice as full, but, if we listen to two beautiful songs at the same time, we don't get twice the pleasure? In this course, we will address such questions, and as we formulate and analyze the mathematical theory, we may begin to get a sense of the complexity of *nature*, and at the same time really appreciate it. The emphasis will be on theory, proofs, and examples.

Nature of the Course Content (Directly from the course catalog)
MATH 441. Analysis and Dynamics of Differential Equations: Analysis of qualitative properties and dynamics of linear and non-linear ordinary differential equations, including topics such as existence, uniqueness, phase portraits, stability and chaos, with applications to the sciences. Prerequisites: MATH 238 or (MATH 300 and MATH 336); and MATH 245 or MATH 440 or permission of the instructor. - See more at: http://www.jmu.edu/catalog/15/courses/MATH.shtml - sthash.S1gcrHyu.dpuf

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Office Hours Wednesday 10:30 a.m. -12:30 p.m.

Course Webpage is on **my website (http://educ.jmu.edu/~alhajjhy/)**. Syllabus, handouts, homework assignments, announcements will all be found there.

Course Texts *Nonlinear Dynamics and Chaos, with applications to Physics, Biology, Chemistry, and Engineering- second edition (author: Steven H. Strogatz; publisher: Westview Press)*. We will follow the book, covering topics from all 12 chapters. Another reference that we will follow is: *Differential Equations, Dynamical Systems, and an Introduction to Chaos, Third Edition (authors: Morris Hirsch, Stephen Smale and Robert Devaney; publisher: Academic Press 2012) (there is a free pdf online version of the second edition of this book)*. Some material, especially the proofs for everything we discuss, will only be covered in class and will not be from the book. Homework problems will be a combination of book problems and outside problems, including some computer assignments. We will also pick examples from the book: *Dynamics Done with Your Bare Hands (authors: Diana Davis, Bryce Weaver, Roland Roeder, and Pablo Lessa; publisher: European Mathematical Society)*.

Grading Policy Homework assignments: 30%. In-class Midterm Exam: 30%. Comprehensive Final Exam: 30%. Final project: 10%. Please let me know in the first two weeks of classes about any documented condition that requires extra time to complete the exams.

Policy: 90 -100: A - to A range; 80 - 89: B- to B+ range; 70 - 79: C- to C+ range; 60 - 69: D to D+ range; 59 and below: F.

Attendance Policy You should attend class faithfully. Some material may only be covered in the classroom. You should contact me in case of any illness.

Exam Schedule In-class Midterm Exam: *Thurs, Mar 2, 2017*. In-class Final Exam: *Tues, May 2, 2017 from 8:00 a.m. till 10:00 a.m.* You *cannot* reschedule an exam. A makeup exam is possible only due to an (extreme) emergency situation.

Homework Assignments There will be weekly homework assignments and they will sometimes include computer projects. You can use Matlab, Maple or Mathematica, or any programming language you feel comfortable with, to complete your computer projects. The *homework will be assigned on Thurs of each week and is due the next Thurs*.

Honor Code Remember that JMU has a strict honor code. While you are strongly encouraged to work with others in this class, the work you submit must be your own. Copying someone else's work won't help you learn the material and might just get you expelled.

Material Covered We will mostly follow the following plan. We might be a bit faster or slower on few occasions.

Week 1: Chapters 1 and 2. *Week 2:* Chapter 2. *Week 3:* Chapter 3. *Week 4:* Chapter 4. *Week 5:* Chapter 5. *Week 6:* Chapter 6. *Week 7:* Chapter 7. ***Week 8:*** **Midterm exam** and Chapter 8. ***Week 9:*** **Spring Break.** *Week 10:* Chapter 9. *Week 11:* Chapter 9. *Week 12:* Chapter 10. *Week 13:* Chapter 11. *Week 14:* Chapter 11. *Week 15:* Chapter 12. *Week 16:* Chapter 12.