

# UNIVERSITY OF CENTRAL FLORIDA

FALL 2017

## MAP 6108: INTRODUCTION TO NONLINEAR DYNAMICS

**Class Meets:** MSB 407, 3.30 - 4:50 p.m., T R  
**Instructor:** Dr. Roy Choudhury  
**Office:** MAP 421  
**Contact options:** 407-823-2635  
choudhur@cs.ucf.edu/roy.choudhury141@gmail.com

**COURSE CONTENT:** In order to provide a self-contained course, we shall start with a brief introduction to ODEs, followed by the standard material on phase-plane analysis and the geometrical viewpoint, various attractors of increasing complexity, and analytical and numerical methods for their analysis. In order to provide a path into modern research areas in the currently very active areas of coupled nonlinear oscillator ensembles and networks, asymptotic methods (primarily averaging and multiple scales, but also harmonic balance) will be integrated into the course. Thus students would be well-positioned to tackle nonlinear problems in a variety of applications areas (including research levels problems, with perhaps a moderate amount of additional study).

**PRE-REQUISITES:** Mastery of a first course in Linear Algebra (such as MAS 3105) is ESSENTIAL. Prior exposure to phase-plane analysis, or perturbation theory, would be VERY helpful, but is not essential. Similarly, a second course in ODEs (such as MAP5336 or MAP 4303) would be very helpful, but is not mandatory (given serious effort on the first long homework).

**COURSE AND GRADING POLICIES:** There will be 3 long homeworks assigned for the course to test your mastery of the material. Select portions will be graded. The list of problems for each homework will be assigned approximately three weeks before they are due, to, and will count for 65% of the course grade. The submission date may be modified by a few days, depending on student requests, but subject to leaving a minimum of four weeks for either a. a fourth long problem set, or b. a project and project report. Whichever of these is chosen will count towards the balance 35% of the course grade.

Computer algebra systems such as MATHEMATICA (although you may use any one of your choice), will be helpful on some homework problems. You are STRONGLY encouraged to discuss homework problems with each other to the extent possible. However, the actual final write-ups should be your own, and based on your eventual individual understanding of the problems. For students choosing the project option, the following paragraph provides some details.

**PROJECTS:** Project presentations or an Oral Final examination on problem set 4 will be scheduled during the last class and/or the time allotted for the course final as per the UCF Final Examinations schedule. Project topics may be chosen from topics discussed in class, or after discussing them briefly with me. Topics for projects will come up throughout the class, and will also be specifically discussed from time to time. Many of the areas we discuss are currently very useful in applications (as we shall indicate), and offer rich classes of problems at both Masters and doctoral levels. On the last two occasions when this course was offered, three published research papers eventually resulted from the course projects (not counting later theses). In one exceptional case, a student went on to later write two additional papers based on the course material. The project will constitute 35% of the course grade.

**Course Policies:** If needed, course policies may be modified at the discretion of the instructor.

**Class Meets:** TR 3.30 - 4.50 pm in BA1 0213

**Instructor:** Dr. Roy Choudhury

**Office:** MSB 421

**E-mail:** choudhur@cs.ucf.edu

**Office Hours:** TR 12 noon - 2.30 pm

**Course Materials and Syllabus:**

a. **Textbook** Nonlinear Ordinary Differential Equations, D. Jordan and P. Smith (Oxford U. Press, Oxford)

**Withdrawal deadline:** October 30 2017

**Holidays:** September 4, November 10, and November 23-25 2017