The Johns Hopkins University

EN 553.391

Dynamical Systems

Fall 2018

Instructor: Felix Ye

Lectures: MWF 1:30-2:20pm, Th 12:00-12:50pm in Garland 97

Instructor Office Hours: W 10:00-10:50pm in Whitehead 302

TA: Yashil Sukurdeep, yashil.sukurdeep@jhu.edu

TA Office Hours: Th 11:00-11:50am in Whitehead 212

E-Mail Address: xye16@jhu.edu
Email will be a major line of communication between the student and the instructor. I will send urgent announcements and important information via email. Please check your university email regularly.

Web Page: Check the course page in blackboard regularly. Homework assignments, course announcements, and grades will be posted there.

Course Description: Mathematical concepts and methods for describing and analyzing linear and nonlinear systems that evolve over time. Topics include boundedness, stability of fixed points and attractors, feedback, optimality, Liapounov functions, bifurcation, chaos, and catastrophes. Examples drawn from population growth, economic behavior, physical and engineering systems. The main mathematical tools are linear algebra and basic differential equations. Prerequisite: EN.553.291 OR AS.110.201 OR AS.110.211

Learning Objects:

- Learn analytical methods for dynamical systems with concrete examples. The geometric intuition is stressed.
- Learn the theory with the following three parts: 1-Dimensional Flows (Fixed Points, Stability, Bifurcations), 2-Dimensional Flows (Phase Portraits, Limit Cycles, Bifurcations) and Chaos (Lorenz Equations, One-dimensional Maps, Fractals, Strange Attractors).
- Emphasis the dynamical system theory on applications. Learn how to understand the dynamical models developed in the research paper in the applied science.

Textbook: *Nonlinear Dynamics and Chaos With Applications to Physics, Biology, Chemistry, and Engineering*, 2nd Ed. by Strogatz.
The textbook is not required but is strongly recommended for use as a reference. Previous editions will suffice.

Grading Policy:

Homework	40%
Project	10%
Take-home Midterm	20%
Final Exam	30%

Letter Grade Distribution in %:

A-/A/A+	90-100%
B-/B/B+	80-89%
C-/C/C+	70-79%
D-/D/D+	60-69%
F	0-59%

Class Meetings: Monday, Wednesday and Friday classes will be lectures given by the instructor which cover theories and core materials. Thursday classes will be my office hours. I may cover relevant applications, numerical methods, and worked problem examples.

Exams: There will be two exams. The midterm will be take-home. **The tentative date is Oct 31st**, but that is subject to change. You will have one day to finish this exam. The final exam will be held at the University designated time. The final will be cumulative as the course material naturally builds on itself.

Make-ups for the Midterm and Final Exams may be available if exams are missed due to illness or family emergency. Make-up exams are only available if discussed with the instructor at least 1 day before the date of the exam. If an emergency arises after that time and there is a valid excuse, then the exam will be removed from the student's total grade for the course, and the remainder reweighted accordingly. Proper documentation of the emergency must be presented before either of these options can be offered.

Homework: Homework assignments will be assigned regularly. There are 10 sets of homework in total. Homework will be assigned at least one week ahead and due on the coming Friday(except on Oct 19th). The lowest score will **not** be dropped.

Unless discussed ahead of time with the instructor, the following rules apply to late homework: **75% credit if turned in after class but before 4pm on due day; no credit after 4pm on due day.**

If homework is not turned in during class, it MUST be delivered to my office in Krieger 411. If an emergency arises and there is a valid excuse, then this homework set will be removed from the student's total grade for the course, and the remainder reweighted accordingly.

Project: Please see separate document. More guideline will be given after Midterm.

Attendance: Although attendance will not be taken, I strongly encourage you attend and participate in every lecture. This is one of the best ways to ensure success in the course.

Computing Policy: Some computing will be done in this course. Demonstrations will be done in Matlab, but any programming language may be used. However, computing is not the main focus of this course so you will not be tested over writing code.

Academic Misconduct: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.

In addition, specific ethics guidelines for this course are as follows: Students may discuss homework. However, all solutions MUST be written up and submitted individually. The same rules apply to computer programs. Basic ideas may be discussed but detailed codes should not be copied or shared. Finally, exams must represent the result of individual effort and communication is permitted only with the instructor and TA.

Report any violations you witness to the instructor. You may consult the associate dean of student affairs and/or the chairman of the Ethics Board beforehand. See the guide on "Academic Ethics for Undergraduates" and the Ethics Board Web site (http://ethics.jhu.edu) for more information.