

# Course Information Sheet: Math A4500, Section PR, Spring 2017

**Course Title:** Dynamical Systems

**Pre-requisite:** C or better in Math 32404.

**Catalog Description:** 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.

**Meeting time and place:** Tuesdays and Thursdays 2-3:40pm in Shepard 20.

## Instructor Information:

- **Name:** Prof. Hooper
- **Office hours:** Will be posted on course website. Appointments are also accepted.
- **Office:** NAC 6/282
- **Email:** whooper@ccny.cuny.edu
- **Office Phone:** (212) 650-5149

**Course Textbook:** *An Introduction To Chaotic Dynamical Systems* by Robert L. Devaney, 2nd edition.

**Topics covered:** We will complete most of the first two chapters of the course textbook. Exactly what we will cover will depend on time constraints. For reference, the table of contents of the course textbook has been reproduced at the end of this document.

**Grades:** Grades will be computed from the following:

- Attendance
- Homework (20%)
- Midterm Grade (60%)
- Final project (20%).

Your final score will be tabulated out of 100% as indicated by the percentages above, with attendance taken into account. (See the attendance section below.) A letter grade will be assigned to you according to the table below.

A+	97-100	B+	87-89	C+	77-79	F	below 70
A	95-96	B	84-86	C	70-76		
A-	90-94	B-	80-83				

**Course website:** Course information, homework assignments, and documents can be found on the website:

<http://wphooper.com/teaching/2017-spring-dynamics/>

**Blackboard:** You will be able to access your grades on Blackboard, which can be accessed at <http://bbhosted.cuny.edu/>. I also use blackboard to send out emails to students. You will be held responsible if you miss an important email, so make sure your email address is up to date. To change or update your email address go to <http://portal.cuny.edu>, click “Portal login” from the bottom left menu, then login, and select “My profile” on the top right.

**General expectations:** For each hour spent in the classroom, I expect you to spend at least three hours reading and understanding the book, understanding lecture notes, and doing homework. Practice (doing problems and proofs) is an important part of understanding mathematics. Only adequate practice will guarantee that you can complete midterm and exam problems in a timely manner.

**Expectations of written work:** Mathematical computations and proofs will be graded partially on presentation. In order to receive full credit, a student who reads your answer should be able to easily understand how you solved the problem. Written work is expected to be legible and arguments are expected to be well articulated.

**Midterms:** You will be given the full class to complete each midterm. If a midterm is missed under well documented and sufficiently compelling circumstances, then a makeup can be taken. Notify me ahead of a midterm you expect to miss to be sure your circumstances are sufficiently compelling. The makeup must be taken within one week of the originally scheduled midterm. A grade of zero will be assigned to anyone who does not take a midterm or a makeup.

**Midterm dates:** Midterms are scheduled for Feb. 28, Apr. 4 and May 5.

**Homework assignments:** Homework will be assigned approximately once a week and will have a due date. Homework assignments will be made available on the course website at least one week before the assignment is due. I encourage you to work in groups on the homework problems, especially if this best suits your learning style. Nonetheless, you should be confident that you understand how to do each problem, and should be able to solve similar problems independently.

**Homework goals:** I assign homework to encourage you to work on your problem solving skills, improve your proof writing, and to give me feedback on how you are doing with the material. Hopefully experience in solving homework problems will prepare you to solve test problems.

**Homework and plagiarism:** Copying homework answers from the back of the book, from

answers found online, or from friends is plagiarism and subverts the goals listed above! It is okay to work with other students, and to use the book and external sources to help with your homework problems, but you might write your answers in your own words. On each problem, you must acknowledge other students you worked with and any sources you used.

**Late homework:** Late homework will not be accepted for any reason. If you need to miss class, please scan it and email your assignment to me as a PDF document before the start of class on the day it is due.

**Final project:** This course touches on a few of the myriad of different dynamical systems of interest. One the date of the final (which will become available on <https://www.ccny.cuny.edu/registrar> in the future), I will have each member of the class give a presentation on a dynamical system or dynamical phenomenon not discussed in the course. You will be asked to write something or create slides documenting your work. Precise detail will come before Spring Break.

**Attendance Policy:** As students, class time is extremely important for learning. For this reason, attendance is mandatory. **Three or more unexcused absences will likely result in the reduction of your final grade by 5% (or half a letter grade).** Excused absences include illness with a doctor's note and many religious observations.

**Lateness:** Lateness to class is unacceptable because it disrupts the learning process of the whole class. For this reason, any student who arrives more than 5 minutes after class begins will be considered late. Three late attendances are considered the equivalent of one absence. Thus, sufficiently many late attendances will result in actions as described in the Attendance Policy. In addition, any student who arrives 15 minutes after a class begins will be considered absent from that class period.

**Departmental website:** The departmental website is <http://math.sci.ccny.cuny.edu/>. Almost anything else you could want to know about the department can be found here.

**Academic integrity:** You are expected to adhere to the CUNY Policy on Academic Integrity. This policy is posted at <http://www.ccny.cuny.edu/about/integrity>

**Accommodations for Students with Disabilities:** Qualified students with disabilities will be provided reasonable academic accommodations if determined eligible by the AccessAbility Center (AAC). Prior to granting disability accommodations in this course, the instructor must receive written verification of a student's eligibility from the AAC, which is located in NAC 1/218. It is the student's responsibility to initiate contact with the AAC and to follow the established procedures for having the accommodation notice sent to the instructor.

**An Introduction to Chaotic Dynamical Systems,  
by Robert Devaney, 2nd edition.**

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- 1.6: Symbolic Dynamics
- 1.7: Topological Conjugacy
- 1.8: Chaos
- 1.9: Structural Stability
- 1.10: Sarlovskii's Theorem
- 1.11: The Schwarzian Derivative
- 1.12: Bifurcation Theory
- 1.13: Another View of Period Three
- 1.14: Maps of the Circle
- 1.15: Morse-Smale Diffeomorphisms
- 1.16: Homoclinic Points and Bifurcations
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**Part Two: Higher Dimensional Dynamics**

- 2.1: Preliminaries from Linear Algebra and Advanced Calculus
- 2.2: The Dynamics of Linear Maps: Two and Three Dimensions
- 2.3: The Horseshoe Map
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- 2.8: The Hopf Bifurcation
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**Part Three: Complex Analytic Dynamics**

- 3.1: Preliminaries from Complex Analysis
- 3.2: Quadratic Maps Revisited
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