

Instructor: Harini Chandramouli

Office: Buttrick Hall Room 325

Office Hours:

M 02:00PM - 03:00PM Buttrick Hall Room 325

W 03:00PM - 04:00PM Buttrick Hall Room 325

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Please note that I do not often check my e-mail between the hours of 06:00PM and 08:00AM, or on the weekends. If you contact me during this time, please do not expect a response until the next business day. If none of the office hours above work for you, feel free to email me to make an appointment!

Class Title: MAT 311: Chaotic Dynamical Systems

Class Information: MWF 11:00AM - 11:50AM Bullock Science Center Room 304A

Credit Hours: 4

Note that you should expect to spend about 3-4 hours outside of class for every hour spent in class.

Textbook: Steven Strogatz., *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering*, 2nd Edition

A copy of this textbook and a solutions manual is on reserve in the library.

Course Learning Objectives:

During the semester, students will...

- understand differential equations as a way of encoding information about the evolution of a physical system, with the goal of identifying or constraining the long term behavior of a solution function to the equation;
 - distinguish between analytic solution methods for differential equations and qualitative or numerical methods that provide only an estimate of the solution function;
 - develop facility with geometrically-based qualitative solution techniques, including identifying critical points, assessing their stability, and using phase portraits to constrain our understanding of the long term behavior of a solution;
 - identify and describe the importance of bifurcations, by which we mean qualitative changes in system behavior that occur as a parameter is varied;
 - apply techniques, including nondimensionalization, linearization, and recurrence maps, to analyze a dynamical system;
 - describe the phenomenon of chaos and relate it to stretching and folding, as well as to example systems;
 - and justify the use of these methods as a valuable way to understand differential equations.
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Parts of the Course:

- Classes on MWF
- Assigned readings
- Weekly skill checks
- Weekly partner homework assignments
- Two take home exams
- One final project

Assigned Readings: Assigned readings will be done before class.

- **Philosophy:** Reading the assigned section before lecture allows you to familiarize yourself with what we are learning about. Everything is difficult the first time you see it, so coming to class with some notion of what is going on that day can help ease learning. It is not expected that you understand everything from reading the section, but it is expected that you do it.
- **Due Date:** Readings are due at the start of each class day for which they are assigned. See schedule for more details.

Skill Checks: Skill checks will be done on a weekly basis by yourself. Each week, you will complete the skill check on Canvas.

- **Philosophy:** To help student progress in building the fundamental factual and procedural skills of dynamical systems, there are regular short skill checks in the course.
- **Grading:** Skill checks will be graded as “satisfactory” (credit given) or “unsatisfactory” (no credit given).
- **Due Dates:** Skill checks will be due generally on Fridays at 11:00AM (the start of class) unless stated otherwise. They will mostly cover material from the previous Monday and Wednesday, unless otherwise stated. See schedule for more details.
- **Late Skill Check Policy:** Late skill checks can only be turned in with the express permission of the instructor in extreme circumstances with at least 24 hours notice to the instructor.

Homework: Homework will be done on a weekly basis with a partner who is assigned to you. Each week, you will turn in one homework amongst the pair and each of you will fill out a cover sheet to attach to the homework.

- **Philosophy:** Homework is an opportunity to learn math the best way possible – by doing it. Be sure to communicate with your partner about your homework assignment so that you *both* understand the assignment before turning it in. It is your responsibility to not only understand the homework, but make sure your partner does as well.
- **Grading:** On each homework, 2 randomly chosen problems will be graded on correctness (10 points) and then the rest of the problems and the cover sheets will be graded on completeness (5 points).
- **Due Dates:** Homework is due generally on Wednesdays at 11:00AM (the start of class) unless stated otherwise. They will mostly cover material from the previous Monday through Friday, unless otherwise stated. See schedule for more details.
- **Late HW Policy:** For each day that homework is turned in late, a deduction to the possible grade will be applied (see details below). The deduction will be applied to *both* partners in the group.

One Day Late	Can receive up to 75% of credit on the assignment
Two Days Late	Can receive up to 50% of credit on the assignment
Three or More Days Late	Can no longer receive credit on the assignment

Exams: There will be two take home exams. These three exams are tentatively scheduled for Friday, February 18th – Wednesday February 23rd and Friday, April 8th – Wednesday, April 13th. These exams will cover material from the class and in the textbook.

- **Late Exam Policy:** No late exams will be accepted. If there is an emergency and you cannot take the exam, you must inform the instructor before the exam is released. In the event that you cannot take the exam, your other exam grade will be substituted in for the missing exam.

Final Project: In the place of a final exam, a final project will be given. It will be due at the end of finals week. More details on the final project will be given as we get closer to the assignment.

Grading:

- **Philosophy:** Grades are a reflection of your mastery of the material and your ability to communicate through the graded assignments. Remember, grades are NOT a reflection of your self-worth.
- **Scheme:** Grades will be calculated as seen below.

Skill Checks	20%
Homework	30%
Exams	30% (15% each)
Final Project	20%

Class Expectations: You'll be expected to come to every class prepared to do mathematics. You should bring papers, pens, pencils, and any other equipment you may need. You should be prepared by doing assigned homework and reading ahead of time.

You're expected to be respectful and supportive of your classmates and the instructor. This extends to the use of electronic devices in class. Use them appropriately (to take notes, perform calculations, etc.), but using them for non-emergency social purposes during class is disrespectful of your time and everyone else's.

The instructor is expected to come to every class prepared to do mathematics. The instructor should bring the necessary materials for the day's activities, and should be prepared to cover the topics of the class by planning ahead of time.

The instructor is expected to be respectful and supportive of their students.

Participation: You'll be expected to talk about math in class. This might be in small groups, in discussions with the whole class, or information presentations at the board. Other activities in which you may participate include worksheets or computer exploration.

Attendance: While attendance is not taken as part of your grade, you are expected to attend the class as much as you can. It is understood that exceptional circumstances may arise and other things may occupy your time during class but it is your responsibility to learn the material.

Technology:

- **Canvas:** Course organization (assignments, handouts, etc.) will be on Canvas. You will also be able to find things like information on office hours and learning assistant run workshops.
- **Computational Software:** Wolfram Alpha, Desmos, Geogebra, etc. are all wonderful online resources to use while doing your homework. These programs are great tools for visualizing functions and for checking your work.
- **Other:** Some students find it helpful to take photos of the board as a supplement to or instead of taking notes. This is allowed but *you may not post these photos publicly online*. Students also sometimes like to share materials with their friends from this course. While you should feel comfortable sharing material from this course with another friend, *you may not post any materials from this course to any websites. Please do not record any video in class. No audio recording without the express permission of your instructor.*

Extra Help: Learning math is hard and often frustrating! There is no need to despair – everyone goes through this. These are places to access more help:

- Ask classmates
- Form a study group
- Office hours with your instructor

Important Dates:

- January 14 – last day to add or drop using AscAgnes
- January 21 – last day to add a spring class or change to audit
- January 31 – last day to drop without a W
- March 30 – last day to drop with a W or change to pass/fail

Title IX Statement: Agnes Scott is here to help you if you have experienced any form of sexual harassment or violence, dating or domestic violence, or stalking. Please talk to any faculty or staff member with whom you feel comfortable. Faculty and staff members want to support you and have been trained to help. They will also inform the Title IX office so that you learn about options available to you. If you do not want college administrators to know what you have experienced, you may talk to the chaplain, as well as nurses or counselors in the Wellness Center with complete confidentiality. They will not tell anyone what you share with them unless you give your express permission. You may contact the Title IX Coordinator directly at T9Coordinator agnesscott.edu.

Diversity and Inclusion Statement: As one of the most diverse colleges in the nation, ASC is ideally positioned to be the model of a diverse and inclusive community that society can aspire to be. Such diversity raises the intellectual quality of the classroom experience, creating a unique environment for learning to understand and navigate the challenges of our times. By studying and living together, Agnes Scott College's remarkably diverse student body hones the habits of mind, skills, and knowledge essential to ethical and innovative leadership in our increasingly heterogeneous and global society. As such, this course adheres to the principles of diversity and inclusion as integral to the Agnes Scott community and respects people from all backgrounds. As a first step, this course affirms people's decisions about gender expression and identity and will use each other's preferred names and gender pronouns at all times.

Course Accessibility and Academic Accommodations: Agnes Scott College views disabilities as an integral part of the rich diversity of our community and strives to make all learning experiences as accessible as possible. If you are a student who receives academic accommodations through the Office of Accessible Education, please schedule a meeting with me within the first two weeks of classes if you'd like to discuss how your accommodations will be implemented for this course. During this meeting, you are not expected to disclose any details concerning your disability, though you may discuss these details at your discretion.

If you are a student with a disability, physical, medical, psychological, or learning-specific, and have not connected with Accessible Education to discuss your accessibility needs, please visit their website to learn more about accommodations, helpful resources and support, available through the Office of Accessible Education. Students who register for accommodations during the semester should schedule a meeting with me after accommodations have been approved by the Office of Accessible Education.

Academic Honesty: The Agnes Scott College honor code embodies an ideal of character, conduct, and citizenship, and is an important part of the College's mission and core identity. This applies especially to academic honesty and integrity. Passing off someone else's work as your own represents intellectual fraud and theft and violates the core values of our academic community. To be honorable, you should understand not only what counts as academic dishonesty, but also how to avoid engaging in these practices. You should...

- review each course syllabus for the professor's expectations regarding course work and class attendance;
- attribute all ideas taken from other sources; this shows respect for other scholars. Plagiarism can include portraying another's work or ideas as your own, buying a paper online and turning it in as if it were your own work, or not citing or improperly citing references on a reference page or within the text of a paper;
- not falsify or create data and resources or alter a graded work without the prior consent of your professor. This includes making up a reference for a works cited page or making up statistics or facts for academic work;
- not allow another party to do your work/exam or submit the same or similar work in more than one course without permission from the course instructors. Cheating also includes taking an exam for another person, looking on another person's exam for answers, using exams from previous classes without permission, or bringing and using unauthorized notes or resources (i.e., electronic, written, or otherwise) during an exam;
- not facilitate cheating, which can happen when you help another student complete a take home exam, give answers to an exam, talk about an exam with a student who has not taken it, or collaborate with others on work that is supposed to be completed independently;
- be truthful about the submission of work, which includes the time of submission and the place of submission (e.g., email, online, in a mailbox, to an office, etc.).

You should understand that penalties resulting from dishonest conduct range from failure of the assignment to expulsion from the college. You should speak with me if you need clarification about any of these policies.

Course Evaluations: Near the end of the semester, you will be notified by email and provided with a link to follow to complete course evaluations on online outside of class. I want you to know that your feedback on the course is extremely valuable to me, the department, and the administration. In particular, I take your comments very seriously and use them to improve the course the next time I teach it. Please do fill out a course evaluation when you receive the emailed link at the end of the semester.

5 points of extra credit will be added to your homework grade for completion of the Course Evaluations.

This syllabus is subject to change at my discretion. Any changes will be announced in class and on Canvas.