

Math 106 Syllabus, Summer 2022

Course Information

This course will be a Zoom-based synchronous class with lecture time MWF from 9:00 AM to 11:30 AM (7/25/2022 - 8/26/2022). **Lecture attendance is required and will count as 15% of your course grade.** Attendance is taken sometime within the first hour of the class in the form of a keyword quiz. You will be instructed to go to Canvas Quiz to take it at an appropriate time. You access Zoom lectures/office hours from the Canvas **Zoom** tab. We use the **Gradescope** (see below) for submitting scanned homework assignments and exams, and we use Canvas **Discussions** for Q&A on homework problems and other questions. In Math 106, we will study systems of nonlinear differential equations that exhibit many interesting, unexpected nonlinear phenomena (phase portrait, limit cycles, chaos, etc). Knowledge from the basic theory of linear algebra (Math 21) and ordinary differential equations (Math 24) is assumed. Prerequisite(s): [MATH 21Links to an external site.](#) or [AM 10Links to an external site.](#); and either [MATH 24Links to an external site.](#) or [AM 20Links to an external site.](#); and either [MATH 100Links to an external site.](#) or [CSE 101Links to an external site.](#).

Learning Outcomes: By taking this course, you will learn the following.

1. You will understand the difference between linear and nonlinear systems of differential equations and understand their basic methods of approach.
2. You will be able to study the global qualitative properties of nonlinear systems of the first-order differential equations,
3. You will be able to model various biological, engineering, physical, and natural phenomena by differential equations and analyze their behavior.
4. You will understand chaos in deterministic systems.

Important Deadlines (Summer Session II, 2022):

Add - Thursday, July 28

- **Drop - Monday, August 1 (tuition reversed)**
- **Request "W" Grade - Sunday, August 14 (no tuition reversal)**
- **Change Grade Option - Sunday, August 21**
- **Grades Due - Thursday, September 1**

Summer is unique. You will not be dropped for non-attendance or non-payment. You must drop yourself. Dropping before the deadline results in a full-tuition reversal/refund. Withdraw posts a W for the grade, and full tuition is charged (no refund). For all dates and deadlines, here is the summer academic calendar: <https://summer.ucsc.edu/studentlife/index.html>. [Links to an external site.](#) For

questions about dropping, requesting a W grade for a course, or withdrawing from the summer quarter, email summer@ucsc.edu.

UC Santa Cruz Orientation Module for Summer 2022: Useful [official orientation information](#) from UCSC for summer session students can be found in the **Modules** tab.

Gradescope: We will use [Gradescope \(Links to an external site.\)](#) to grade your assignments/exams. Get familiar with this tool at [https://www.gradescope.com/get_started \(Links to an external site.\)](https://www.gradescope.com/get_started). Especially, check the video titled [For students: Submit PDF homework \(Links to an external site.\)](#) to review how to upload your scanned image files and PDF files to Gradescope. To submit your assignments/exams to Gradescope, you either (1) scan your work into multiple image files and upload them, or (2) make a **single** PDF file out of your scan and upload it. Gradescope cannot accept multiple PDF files for uploading at this time. If you do not have scanning technology, contact slug support: <https://deanofstudents.ucsc.edu/slug-support/program/contact.html>[Links to an external site.](#)

Time Zone: If you live in a different time zone, here is an instruction to set your time zone. [How do I set a time zone in my user account as a student? \(Links to an external site.\)](#) Especially, please be careful about the time and date for the final exam.

Instructor

Instructor and Zoom Office Hours

Professor Hirotaka Tamanoi (tamanoi@ucsc.edu)	Mondays, Wednesdays, and Fridays 11:30 AM to 12:30 PM zoom window, after lecture zoom window closes.)
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For my zoom office hours MWF from 11:30 AM to 12:30 PM, you will need UCSC email addresses to join, and zoom office hours will not be recorded. After the lecture Zoom window closes, we will take a short break and start the office-hour Zoom window.

Zoom Lectures, Videos, Notes

Synchronous Zoom Lectures, and Yuja: My course is hosted on [Canvas](#)[Links to an external site.](#). You do not need to sign up for an account, and you log in with your CruzID and Gold Password at canvas.ucsc.edu[Links to an external site.](#). See [Canvas Getting Started Student Guide \(Links to an external site.\)](#). See the Zoom item in the navigation menu on the left pane for schedule and information. Your UCSC email address will be required to participate in zoom lectures and zoom office hours.

Lecture dates: July 25 to August 26, Mondays, Wednesdays, and Fridays from 9 AM to 11:30 AM.

Lecture Videos: Zoom lectures will be recorded and is available in **Yuja** on the left navigation pane. In **Yuja**, look for "All Courses" in the "Shared" section. Math 106

channel should contain Zoom lecture recordings. These recordings come with the complete captioning of the video, which takes a few hours' of processing. So lecture videos will be available late in the afternoon.

Lecture notes will be posted in the Lecture Notes folder in the **Modules** item on the left navigation pane right after the class.

Textbooks: We have one required textbook and several reference textbooks. All books are available in the ebook version at [ZLibrary \(Links to an external site.\)](#).

(1) (Required) **Nonlinear Dynamics and Chaos, With Applications to Physics, Biology, Chemistry, and Engineering**, 2nd edition, by Steven Strogatz: CRC Press. (This textbook has many very interesting applications in physics, biology, and engineering in the substantial exercise section at the end of each chapter. Some mathematical details and proofs are briefly explained or skipped to maintain the flow of the discussion. Whenever this is done, references are mentioned with details.)

(2) (Reference) **Elementary Differential Equations and Boundary Value Problems**, Eleventh (11th) edition, by William E. Boyce and Richard C. DiPrima, Publisher: John Wiley & Sons. (This is a textbook for Math 24. You can find a lot of details on the basics of differential equations and systems.)

(3) (Reference) **Differential Equations, Dynamical Systems, and an Introduction to Chaos**, by M.W. Hirsch, S. Smale, and R.L. Devaney. (This textbook is also used as the main textbook for Math 106. This book has many proofs and mathematical details which were skipped in Strogatz's book.)

(4) (Reference) **Dynamics: The Geometry of Behavior**, by Ralph Abrams and Christopher Shaw. (Many pictures of chaos.)

(5) (Reference) **Chaos: Making A New Science**, by James Gleick. (A popular science book.)

Lecture Schedule: We plan to cover materials in chapters 2 to 12. Please read Chapter 1 before the class as an introduction. Here is a tentative plan.

Week	Monday	Wednesday	Friday
Week 1	Chapter 2	Chapters 2,3	Chapter 3
Week 2	Chapter 5	Chapters 5,6	Chapter 6
Week 3	Chapter 6	Chapter 6	Chapter 7
Week 4	Chapter 7	Chapter 8	Chapter 8
Week 5	Chapter 9	Chapter 12	Final Exam

Resources: In the **Module** section, you can find a folder containing the following apps.

- [Phase Portraits](#)
- [Direction Fields](#)
- [WolframAlpha](#)

- [Desmos Graphing Calculator](#)
- [dfield and pplane](#)

Homework Assignments

Homework Problems (Gradescope): After each lecture, a homework assignment will be given and posted in the Assignments tab as well as on the Gradescope. Due dates will be three days later, at midnight at the Gradescope. You go to the Gradescope tab to upload your assignments. You are encouraged to use LaTeX to write your solutions, but it is not required. **However, if your solution is not clearly written, your homework will not be read and will not receive credits.**

Collaboration: It is allowed to collaborate with other students to work on homework problems. However, you have to write your own solutions. Copying from other sources is not allowed, and the identical solutions will receive no credits (both students who copied and students who allowed).

No Late Homework: Since the summer session goes very fast, it is important to submit your homework assignments on time to keep up with the class. So no late homework assignments will be accepted unless you have a documented family/medical emergency.

Canvas Discussions (Q&A): You can ask various questions at Canvas **Discussions**, and the teaching staff (TA and I) and your fellow students can answer your questions. (Piazza is no longer used.)

LaTeX

You will be preparing midterm solutions using LaTeX. In the Modules tab, you will see some [LaTeX Resources](#) LaTeX resources. Among them, I find the "Short Math Guide" most useful.

Take-Home Midterm (covers up to Section 6.7)

(Take-Home) Midterm (Due 8/15) with Gradescope: There will be one take-home midterm available at 12 noon on Friday 8/12, and due at midnight on Monday 8/15. You are **required to write solutions in LaTeX** and upload PDF file of your solution to Gradescope. These exams are meant to review and master materials covered in the previous three weeks.

Final Exam (Closed-Book, Zoom Proctored)

8/26, 9 AM, 3.5 hours

Course Grades

Here is a tentative scheme for the course grade.

Homework 35%	Attendance 15%	Take-Home Midterm 25%	Final Exam 25%
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At the end of the course, class averages for the above categories will be calculated, and raw scores will be rescaled so that the above percentage distribution is reflected. Then the total scores of individual students will be calculated, and the course grades will be determined.

Academic Resources

DRC Remote Accommodations: The Disability Resources Center reduces barriers to inclusion and full participation for students with disabilities by providing support to individually determine reasonable academic accommodations. Operations continue via remote appointments. If you have questions or concerns about exam accommodations or any other disability-related matter, email the DRC Schedulers at drc@ucsc.edu for an appointment. You can also contact DRC by phone at 831-459-2089.

Academic Integrity: All members of the UCSC community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship. Academic integrity includes:

- Following exam rules
- Using only permitted materials during an exam
- Viewing exam materials only when permitted by your instructor
- Keeping what you know about an exam to yourself
- Incorporating proper citation of all sources of information
- Submitting your own original work

Academic misconduct includes, but is not limited to, the following:

- Disclosing exam content during or after you have taken an exam
- Accessing exam materials without permission
- Copying/purchasing any material from another student, or from another source, that is submitted for grading as your own
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.

- Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the [Academic Misconduct page Links to an external site.](#) at the [Division of Undergraduate Education Links to an external site.](#)

Religious Accommodation: UC Santa Cruz welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request reasonable accommodation for religious practices. The instructor will review the situation in an effort to provide a reasonable accommodation without penalty. You should first discuss the conflict and your requested accommodation with your instructor early in the term. You or your instructor may also seek assistance from the [Dean of Students' office Links to an external site.](#)

Principle of Community: The University of California, Santa Cruz expressly prohibits students from engaging in conduct constituting unlawful discrimination, harassment, or bias... [More here Links to an external site.](#) I am committed to providing an atmosphere for learning that respects diversity and supports inclusivity. We need to work together to build this community of learning. I ask all members of this class to:

- be open to and interested in the views of others
- consider the possibility that your views may change over the course of the term
- be aware that this course asks you to reconsider some "common sense" notions you may hold
- honor the unique life experiences of your colleagues
- appreciate the opportunity that we have to learn from each other
- listen to each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- ground your comments in the texts we are studying. Refer frequently to the texts and make them the focus of your questions, comments, and arguments. This is the single most effective way to ensure respectful discussion and to create a space where we are all learning together.

Title IX/Care Advisory: The [Title IX Office Links to an external site.](#) is committed to fostering a campus climate in which members of our community are protected from all forms of sex discrimination, including sexual harassment, sexual violence, and gender-based harassment and discrimination. Title IX is a neutral office committed to safety, fairness, trauma-informed practices, and due process. Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the Campus Advocacy Resources & Education (CARE) Office by calling (831) 502-2273. In addition, Counseling & Psychological Services (CAPS) can provide confidential, counseling support, (831) 459-2628. You can also report gender discrimination directly to the University's Title IX

Office, (831) 459-2462. Reports to law enforcement can be made to UCPD, (831) 459-2231 ext. 1. For emergencies call 911.

Difficult Conversations: In our in-class and online discussions and dialogues, we will have the opportunity to explore challenging, high-stakes issues and increase our understanding of different perspectives. Our conversations may not always be easy. We sometimes will make mistakes in our speaking and our listening. Sometimes we will need patience or courage or imagination or any number of qualities in combination to engage our texts, our classmates, and our own ideas and experiences. We will always need respect for others. Thus, an important aim of our classroom interactions will be for us to increase our facility with difficult conversations that arise inside issues of social justice, politics, economics, morality, religion, and other issues where reasonable people often hold diverse perspectives. This effort will ultimately deepen our understanding and allow us to make the most of being in a community with people of many backgrounds, experiences, and positions.

Student Services: [Counseling and Psychological Services Links to an external site.](#) Many students at UCSC face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity, and sexual orientation.

Student Success and Engagement Hub [Links to an external site.](#) The Division of Student Success provides campus-wide coordination and leadership for student success programs and activities across departments, divisions, colleges, and administrative units.

Tutoring[Links to an external site.](#) **and Learning Support:** At Learning Support Services (LSS), undergraduate students build a strong foundation for success and cultivate a sense of belonging in our Community of Learners. LSS partners with faculty and staff to advance educational equity by designing inclusive learning environments in Modified Supplemental Instruction, Small Group Tutoring, and Writing Support. When students fully engage in our programs, they gain transformative experiences that empower them at the university and beyond.

Slug Support Program [Links to an external site.](#)[Links to an external site.](#) College can be a challenging time for students and during times of stress, it is not always easy to find the help you need. Slug Support can give help with everything from basic needs (housing, food, or financial insecurity) to getting the technology you need during remote instruction. To get started with SLUG Support, please contact the [Dean of Students](#)[Links to an external site.](#) Office at 831-459-4446 or you may send us an email at deanofstudents@ucsc.edu.

Slug Help/Technology[Links to an external site.](#) The ITS Support Center is your single point of contact for all issues, problems, or questions related to technology services and computing at UC Santa Cruz. To get technological help, simply email help@ucsc.edu.

On-Campus Emergency Contacts: Slug Help/[Emergency Services](#)[Links to an external site.](#) For all other help and support, including the health center and emergency services, start [here](#) [Links to an external site.](#) Always dial 9-1-1 in the case of an emergency.