Physics 440/740 - Spring 2022

SFSU Physics 440/740: Computational Physics

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Lecture, Computer Lab

Lecture: asynchronous online via iLearn
Computer Lab: F 9:30–12:15 online via Zoom

Quick note on e-mail contact

So that I can identify and respond to e-mails from you expeditiously, please put [PHYS440] or [PHYS740] at the beginning of the subject line. I will respond to emails within 48 hours.

Course Overview

Analysis and development of numerical algorithms with a focus on computer simulations of physical systems. Topics may include: finite difference methods for nonlinear ordinary differential equations and chaos theory, N-body gravitational systems, and molecular dynamics; numerical linear algebra; Fast Fourier Transforms, finite difference and spectral methods for partial differential equations; Monte Carlo methods for integration, Markov chains, statistical mechanics and spin systems; introduction to parallel programming. Lecture, 2 units; laboratory, 1 unit. (PHYS 740/PHYS 440 is a paired course offering. Students who complete the course at one level may not repeat the course at the other level.)

Course Objectives & Student Learning Outcomes

(1) To be able to analyze real-world systems in physics, and to make valid approximations and develop simplified models of such systems;
(2) To be able to translate models of physics phenomena into the language of mathematics;
(3) To be able to identify and implement the appropriate computational algorithms to solve the mathematical representations of models of physics phenomena;
(4) To be able to understand the limitations of any physics model, its mathematical representation, or its computational solution;
(5) To be able to communicate the results of computational investigations with both written expositions and appropriate visualizations.

Learning Resources

Required:

Optional:

Important Websites

(1) www.physics.sfsu.edu – Department of Physics & Astronomy
(2) ilearn.sfsu.edu (note: no www in web address) – Login to access course website. Please check frequently for new announcements, updates to the syllabus & schedule, tips & tricks on assignments, and links to additional learning resources.

Prerequisites & Corequisites

(1) Math: introductory courses in differential equations and linear algebra
(2) Computer Science: introductory course in programming in FORTRAN, C, C++, Java, or Python
(3) Physics: a complete introductory sequence in classical physics, some modern physics

Please see me if you have any concerns about your preparation.
Assignments & Grades
During the computer lab sessions, students will work on short, guided exercises to acquaint them with the computational algorithms discussed in lecture. These guided exercises will lead into more complex computational investigations that will be finished outside of class lab time. Students will be expected to produce visual representations (graphs, webpages, animations) summarizing their computational investigations of various physics phenomena. Graduate students enrolled in Physics 740 will be expected to have more detailed, sophisticated investigations. This course will have no in-class or final exams.

Policy on Collaboration & Academic Integrity
You are strongly encouraged to discuss the course material with your fellow classmates. When working on assignments, first try to solve the problems on your own. Struggle. Struggle some more. If you get stuck, feel free to discuss overall methods and approaches with your classmates, but not the details! Your written solutions should be solely your own and should be written-up in isolation from your fellow classmates. Copying is strictly prohibited. Cheating via any method on assignments will result in a grade of zero on that assignment and being reported to the department chair and/or college dean for possible discipline. Please see the official plagiarism and academic ethics policies for the Department of Physics & Astronomy at: http://www.physics.sfsu.edu/Academics/Policies.html.

Disability Access
Students with disabilities who need reasonable accommodations are encouraged to contact me early in the semester. The Disability Programs and Resource Center is available to facilitate the reasonable accommodations process. The DPRC, located in Student Services Building 110, can be reached by phone at 415-338-2472 (voice/TTY) or by e-mail at dprc@sfsu.edu.

Religious Holidays
The faculty of San Francisco State University shall accommodate students wishing to observe religious and cultural holidays when such observances require students to be absent from class activities. It is the responsibility of the student to inform the instructor, in writing, about such holidays during the first two weeks of the class each semester. If such holidays occur during the first two weeks of the semester, the student must notify the instructor, in writing, at least three days before the date that they will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed.

Student Disclosures of Sexual Violence
SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Dean of Students. To disclose any such violence confidentially, contact:

The SAFE Place - (415) 338-2208; http://www.sfsu.edu/~safe_plc/
Counseling and Psychological Services Center - (415) 338-2208; http://psyservs.sfsu.edu/
For more information on your rights and available resources - http://titleix.sfsu.edu
Health & Safety Commitments

Your health and safety are our paramount concern at SF State. We ask every member of our campus community to join a pledge to make and follow plans to keep fellow students, faculty, and staff safe and well. Feeling confident, safe, and well will help you focus on your academic success. To participate in this class, all students are expected to:

- stay informed on the most up-to-date information related to SF State’s COVID-19 response and Campus Comeback plan;
- plan ahead for possible class disruptions due to COVID-19 or other unexpected events, such as unhealthy air quality caused by smoke;
- take care of yourself and others by staying home when you aren’t feeling well or believe you have been exposed to COVID-19;
- follow all required health and safety guidelines, including verifying your proof of vaccination or exemption status before coming to class, wearing a multilayered mask over your nose and mouth at all times when indoors on campus, and washing your hands as often as possible with soap and water or hand sanitizer.

For more information about SF State’s response to COVID-19 and how you can keep yourself and others safe and well, visit the Campus Comeback Website. To plan for how you will maintain your academic success when unexpected events disrupt regular teaching and learning activities, follow the information on the course syllabus and consult the Keep Learning guide.

Recording of Lectures & Privacy

As the instructor of this course, I will be using Zoom to record our class sessions/lectures for the sole purpose of supporting student learning. To maintain privacy, I will post links to the recordings in our campus’s learning management system iLearn to limit access to the members of this course only. It is expected that students also refrain from sharing these recordings outside the context of this course. Students who have privacy concerns may turn off their video and/or change their user name for the duration of the session.

At the beginning of each recorded Zoom session, you will be prompted to acknowledge that the session is being recorded and that you would like to continue in the session. These recordings will be retained for one semester beyond the end of this course, to support students who may have received an incomplete grade, and will then be deleted. As always, any student who has concerns about these recordings may speak with me at any time during the semester to discuss your concerns.