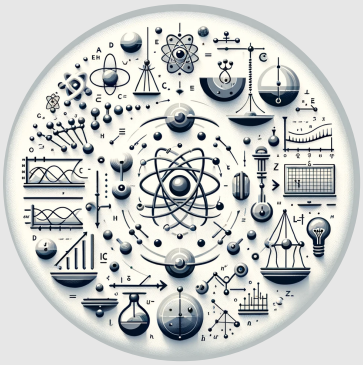

Computational Physics I

PHYS 3500K – Spring 2024

Instructor Info

Dr. Andreas Papaefstathiou

Office Hrs: M & W 1:00-3:00 PM or by appointment

Academic Building 260i, (Marietta Campus)

470-578-2702

http://facultyweb.kennesaw.edu/apapaefs

apapaefs@kennesaw.edu

Course Info

Prereq: Grade "C" or higher in PHYS 2212 and PHYS 2212L

Mon & Wed

3:30-4:45 PM & 5:00-6:15 PM

Academic Building 250 (Marietta Campus)

Course Overview

We will use introductory computer programming to analyze situations that are unique to physics. You will enhance your computational thinking by using these methods and learn to obtain high-accuracy approximate solutions to physics problems that are not solvable by analytic means. No prior programming knowledge will be assumed, and the basics of one or more of the Python programming language will be introduced.

Learning Objectives

At the completion of this course, you will:

- be able demonstrate knowledge of computer language syntax and the ability to structure code.
- be able solve physics problems involving linear equations using numerical methods.
- will learn basic numerical techniques to solve integral and differential equations in physics.
- be able to perform numerical integration and discuss the accuracy of the result for applications in physics.

Required Text and Material

Main Textbook:
Computational Physics - Rubin H. Landau, Manuel J. Páez and Christian C. Bordeianu.

Supplemental material will be provided during the lectures.

D2L

I will use D2L for course information and announcements. You can access D2L via: http://d2l.kennesaw.edu/. To sign on, use your KSU username and password. Please check D2L for announcements at least once or twice a day!

If you haven't already, I suggest that you download the Pulse app on your phones (links for: iOS or Android), which connects to D2L for instant notifications!

Gitlab Repository

The Gitlab repository https://gitlab.com/apapaefs/compphys will be used in conjunction with D2L to share lecture notes and computer code. Instructions will be given during class on how to access and use the repository.

Homework Assignments

Homework will be assigned during the lectures and posted on D2L. We will discuss solutions to problems class and these will also be posted on D2L following the deadline.

Repositories in the "Homework" section in D2L will be created for each assignment.

Please only ask for extensions if you have a valid emergency reason. If you believe you do have a valid reason, contact me via e-mail.

Please attempt the problems early, so that if you have any questions we can discuss them with sufficient time.

Important: Your code has to be your code entirely. Cheating of any form will not be tolerated. Your code should be appropriately commented to describe what is being done, line-by-line. Homework assignments should be returned in the form of a short "report", in the form of a jupyter notebook, with an introduction, main part and conclusions. An example will be given at the start of the course.

Communication

Only use e-mail to contact me (i.e. not D2L) at apapaefs@kennesaw.edu.

Please make sure that the subject line starts with "PHYS 3500K". Please also use your KSU e-mail address.

I will return all emails in 36-hours during the week and within 48 hours over the weekends.

Evaluation and Grading Policies

To be successful in this course, continuous effort is required. There will be no tests or final exam in this course. Weekly homework assignments plus a final project comprise the grading scheme.

60%	Homework
40%	Final Project

Grades will follow the scale: A = 89.5-100%; B = 79.5-89.4%; C = 69.5-79.4%; D = 60-69.4%; F $<$60%. Curving is at the discretion of the instructor.

The *two* lowest-scoring homework assignments will be dropped.

Extra Credit: There will be extra credit in the assigned homework in the form of bonus questions, constituting 10% of each assignment.

Final Project

The final project is important for the successful completion of this course, comprising 40% of the total grade.

A list of possible projects will be given at the start of the course. It is also possible to recommend projects yourselves, on which we will have to agree on.

Progress report: A progress report (1-2 pages) will be due on March 6$^{\text{th}}$, 3:30pm. This should summarize your progress towards this project. I will provide feedback on this report.

The grading of the final project will be based on the following three components:

1. A project report (10-15 pages, including an abstract, introduction, main part, results and conclusions).
2. The associated computer code produced. The code should be entirely reproducible, e.g. in a jupyter notebook, with appropriate commenting within the code, line-by-line.
3. A final project presentation to the rest of the class (10 minutes + 5 minutes for questions). This should describe the problem, your approach, and your conclusions. The presentations will take place on the day of the course's 'Final Exam', i.e. May 6$^{\text{th}}$ 3:30-5:30pm.

The grading scheme for the final project will be as follows:

10%	Progress Report (due on March 6$^{\text{th}}$, 3:30pm)
40%	Final Project Report (due on April 29$^{\text{th}}$, 3:30pm)
30%	Final Project Computer Code (due on April 29$^{\text{th}}$, 3:30pm)
20%	Presentation (on May 6$^{\text{th}}$ 3:30-5:30pm)

Course Dos and Don'ts

Please review these important points that will help you throughout the rest of your college career, and in your future careers.

- Regular attendance is essential for success in this class. If you miss a class, it is your responsibility to get the notes for missed lectures from another student. And please be on time!
- Occasionally, it may be necessary to make corrections, updates or changes to this syllabus. Corrections or changes to the syllabus will be announced on D2L and in class: you are expected to check D2L for announcements regularly (i.e. at least once or twice a day.)
- Cellular telephones, pagers, and similar devices must be turned off or placed in silent mode during lectures. Use of cell phones should be restricted to emergencies.
- In class, please avoid conversations and other disruptions that may distract other students during the lecture. If you have questions or comments, direct them to me.
- Rude and disrespectful student behavior will not be tolerated and administrative actions will be taken.
- Deadlines are deadlines for a reason. As a college student, you must plan accordingly and use your time wisely. In the "real world" you are expected to submit work on time to your boss so that you keep your job. I expect the same.
- If you have asked for an extension on your work and do not meet the guidelines for getting an extension, and are told "no", do not continue to email. No means no, and this is grounds for a referral to student conduct.
- Do not tell your professors or employers how to do their jobs. While you may not like your professor or employer, remember that they have more experience in and knowledge about the field than you. They are also your means for networking and finding gainful employment.
- Remember that your professional aptitude not only reflects on you as a student and employee, but as a person in general. Please be sure you understand these guidelines, and if you have any questions about appropriate communication or college-level problem-solving skills, let me know.

Withdrawal Policy

Students are solely responsible for managing their enrollment status in a class.

Non-attendance does not constitute a withdrawal.

The last day to withdraw without academic penalty is Tuesday, March 5$^{\text{th}}$ 2024, 11:45 p.m..

Additional information on the withdrawal policy can be found at: `http://catalog.kennesaw.edu/content.php?catoid=51&navoid=3701#withdrawalfromclasses`.

The Academic Standing Appeal policy is explained at: `https://appeals.kennesaw.edu/withdrawal_appeal.php`.

Academic Integrity

Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.

All students are responsible for knowing the information, policies and procedures outlined in the Kennesaw State University Codes of Conduct. The Code is available online at `http://scai.kennesaw.edu/`.

Accommodations for Students with Disabilities

Any student with a documented disability or medical condition needing academic accommodations of class-related activities or schedules must contact the instructor as early in the semester as possible. This applies to accommodations for medical conditions related to COVID-19. Written verification from the KSU Student Disability Services (`https://sds.kennesaw.edu/`) is required. No requirements exist that accommodations be made prior to completion of this approved University documentation. All discussions will remain confidential.

Campus Sexual Misconduct Policy

For information about how to report sexual misconduct or how to obtain assistance, please go the following page: https://scai.kennesaw.edu/procedures/sexual-misconduct.php.

Other Policies

See the Student Handbook (http://catalog.kennesaw.edu/) for other policies and information.

KSU SMART Center

If you require tutoring assistance, the Science and Math Academic Resource and Tutoring (SMART) Center at KSU provides tutoring for all current KSU students in Math, Science, Engineering, Humanities, and Social Science courses. See https://academicaffairs.kennesaw.edu/smart/index.php for further details.

Course Delivery

KSU may shift the method of course delivery at any time during the semester in compliance with University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

Face Coverings and Illness

Based on guidance from the University System of Georgia (USG), masks are encouraged based on individual preference and assessment of personal risk.

If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness.

Class Schedule (Tentative)

Week 1	Jan 8	*Chapter 1: Hello Whimsical World of Pythonic Physics!* Introduction to the course, programming, and programming in Python.
	Jan 10	Chapter 1.
Week 2	Jan 15	BREAK
	Jan 17	Chapter 1.
Week 3	Jan 22	*Chapter 2: To err is human, to really foul things up requires a computer!* Computer number representations, machine precision, types of errors, subtractive cancellations and error assessment.
	Jan 24	Chapter 2.
Week 4	Jan 29	*Chapter 3: Randomness, Walks and Decays.* Random sequences, Random number generation, Random walks.
	Jan 31	Chapter 3.
Week 5	Feb 5	*Chapter 4: Differentiation and Integration.* Differentiation algorithms, Integration algorithms.
	Feb 7	Chapter 4.
Week 6	Feb 12	Chapter 4.
	Feb 14	Chapter 4.
Week 7	Feb 19	*Chapter 5: Monte Carlo Methods.* Monte Carlo Simulations, Monte Carlo Integration.
	Feb 21	Chapter 5.
Week 8	Feb 26	*Chapter 6: Matrix Computing, Trial-and-Error Searching and Data Fitting.* Linear equations, Bisection, Newton-Raphson Method, Least-Squares Fitting.
	Feb 28	Chapter 6.
Week 9	Mar 4	Chapter 6.
	Mar 6	Chapter 6. PROJECT PROGRESS REPORT DUE
Week 10	Mar 11	BREAK
	Mar 13	BREAK
Week 11	Mar 18	*Chapter 7: Differential Equations* Euler's Method, Euler-Cromer Method, Runge-Kutta Methods, Chaos.
	Mar 20	Chapter 7.
Week 12	Mar 25	Chapter 7.

	Mar 27	Chapter 7.
Week 13	Apr 1	
	Apr 3	Chapter 7.
Week 14	Apr 8	*Chapter 8: An Introduction to Nonlinear Dynamics and Chaos.* Flows on the Line, Linear Stability Analysis, Two-Dimensional Systems, Fixed Points and Linearization, The Lorenz Equations
	Apr 10	Chapter 8.
Week 15	Apr 15	*Chapter 9: More Monte Carlo.* Markov chains, the Metropolis Algorithm.
	Apr 17	Chapter 9.
Week 16	Apr 22	*Chapter 10: Interdisciplinary Topics.*
	Apr 24	Chapter 10.
Week 17	Apr 29	LAST DAY OF CLASSES: FINAL PROJECT DUE
	May 1	NO CLASS
Week 17	May 6 (3:30 – 5:30 PM)	FINAL PROJECT PRESENTATIONS