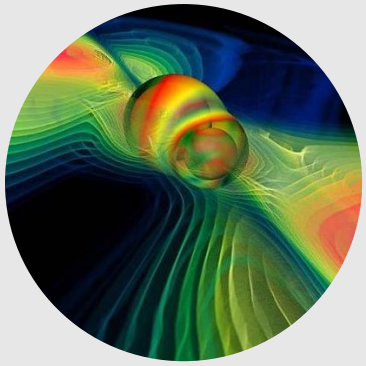

Computational Methods in Physics

PHYS 78100

Instructor Info

Professor Maller

Office Hr: Wednesday 12 - 1

https://www.citytech.cuny.edu/faculty/AMaller

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Course Info

Prereq:

Mon. & Wed.

10:00 - 11:40

TBD

About

This class focusses on the common techniques used to solve physics problems numerically. These techniques are common to all the sciences, but we will use examples from physics. The goal will be to gain an understanding of how continuous math problems are turned into discrete problems, an awareness of the limitations and difficulties associated with numerical techniques will be emphasized.

Syllabus - Spring 2022

Created on: 07/14/2022

Overview

This course provides a basic understanding of computer modeling in physics. Topics include basics of python programming language; scientific plotting; numerical evaluation of integrals; numerical solution of ordinary and partial differential equations; visual programming; basics of high performance and parallel computing; basics of graphics processing unit programming.

Materials

Recommended Text

Computational Physics, Mark Newman, 2012. ISBN-13: 978-1480145511.
Amazon Link

Online Resources

https://openlab.citytech.cuny.edu/phys4100/

Grading Scheme

20%	Class Work
40%	Midterm Exam
40%	Final Project

Grades will follow the standard scale: A = 93-100, A- = 90-93, B+ = 87 - 90, B = 83-87, B- = 80-83, C+ = 77-80,C = 70-77, D = 60-70, F < 60.

Final Project

Students will choose a problem from any area in physics that they can solve using the numerical techniques learned in the course. The problem should be complex enough that solving it requires a significant amount of effort. The code developed should be able to interact with an end user so that they can get a solution to the problem without much effort. Students will present their software project in a final presentation during the final week of class. The presentation should explain the problem, how it was solved numerically and demonstrate use of the code. Choices about which numerical techniques were used should be clearly explained.

Technology Statement

Computers will be used during class by students to work on exercises. Students should bring laptops to all class meetings. They will need to have python set up on their laptop.

FAQs

What programming language will we use?

The class will use Python as its programming language. While any computer language is capable of performing the tasks in this course, Python is designed for readability which makes it ideal for focussing on the concepts used in a code and not the syntax.

How do I turn in my work?

All assignments will be submitted using git. Git is a version control system often used in development of software. Sharing your git repository with the instructor will allow them to have a copy of all of your work.

Do I need to bring my own laptop?

Yes, you will need to bring your own laptop to use in class. Any operating system is fine as Python works on all systems.

How to I install Python on my computer?

Use conda to install python on your computer. Computers come with python as part of the operating system, but you do not want to use the system python for development. Conda will also install many of the packages useful for computational and data science with python.

Class/Assignment Rules

Students are encouraged to talk to each other in class and beyond, but assignments need to be the result of their own work. Identical or very similar assignments are not acceptable. This is valid also for longer assignments and reports. Using online sources as inspiration for assignments is allowed but sources should be cited. Using large chunks of text from outside sources in reports is not allowed and will be considered plagiarism.

Academic Integrity

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York (CUNY) and is punishable by penalties, including failing grades, suspension, and expulsion.

Diversity and Inclusivity Statement

The University respects individuals while acknowledging the differences among them. These differences include, but are not limited to, race, national-origin, ethnicity, religion, age, gender, sexual orientation, gender identity, disability, and socioeconomic status. However in order to create a vibrant academic, intellectual, and cultural environment for all, the University must move beyond representation to genuine participative membership. Thus, the University seeks to develop a community that is inclusive of all individuals and groups. Given CUNY's long history of proactive support for diversity and inclusion, it is uniquely positioned to build upon that strong foundation and serve as a national leader and model, exemplifying the benefits that accrue when diversity and inclusion are integral components of an institution' s educational philosophy and core mission.

Accessibility Statement

City Tech is committed to supporting the educational goals of enrolled students with disabilities in the areas of enrollment, academic advisement, tutoring, assistive technologies and testing accommodations. If a student has or thinks they may have a disability, they may be eligible for reasonable accommodations or academic adjustments as provided under applicable federal, state and city laws. They may also request services for temporary conditions or medical issues under certain circumstances.

Class Schedule

MODULE 1: Basic Numerical Techniques		
Week 1	Introduction to Python	Chapter 2
Week 2	Accuracy & Speed	Chapter 3
Week 3	Numerical Integration	Chapter 4
Week 4	Numerical Differentiation	Chapter 5
Week 5	Interpolation & Splines	Chapter 5
Week 6	Systems of Linear Equations	Chapter 6
Week 7	Nonlinear Equations and Optimization	Chapter 6
Week 8	Fourier Transforms & Exam	Chapters 1-7
MODULE 2: Advanced Numerical Techniques		
Week 9	Monte Carlo Techniques	Chapter 10
Week 10	Ordinary Differential Equations	Chapter 8
Week 11	Partial Differential Equations	Chapter 9
Week 12	N-body Problem	–
Week 13	Hydrodynamics	–
Week 14	High Performance Computing	–
MODULE 3: Final Project Presentation		
Week 15	Final Project Presentations	–