Computational Methods in Physics
PHYS 1321, Fall 2017

Instructor:	Dr. David Nero
Office:	221B Allen Hall
Office Hours:	Monday and Wednesday 5:30–6:30pm, Friday 12:30–1:30pm Other times by appointment.
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Meeting Times:	Monday, Wednesday, Friday 10:00am–10:50am in 210 Thaw Hall
Class Website:	CourseWeb (courseweb.pitt.edu)
Textbook:	*Computational Physics* by Mark Newman

Course Description

This course covers the most commonly used computational techniques used in physics and astronomy. We will use the Python programming language, owing to its popularity in the field and quick development time. No prior programming experience is required.

Topics covered include graphing, curve-fitting, Monte Carlo methods, numerical integration, the solution of linear and nonlinear equations, Fourier transforms, ordinary differential equations, and partial differential equations.

Course Learning Objectives

- Translate a written problem statement into executable computer code
- Demonstrate knowledge of the most commonly used computer algorithms used to solve physics problems
- Employ good programing practice while writing and debugging code
- Understand the limitations of finite precision calculations, and how to work around those limitations
- Create visualizations of data using graphs and animations
- Explain the functionality of code that you have written to your peers, and critique code written by others

Requirements

1. **Cell phones and all other electronic devices must be silenced.** In addition, students are expected to refrain from excessive electronic communication during class. Watching videos, playing games, and/or browsing the Internet is not appropriate during lecture.

2. **Be courteous to your neighbors.** Carrying on a conversation, habitually coming in late or leaving early, or misusing technology (as detailed above), are all disruptive to the class. Students who fail to show common courtesy will be asked to leave the classroom.

Policies

Late Assignments: Late assignments will be accepted at a penalty of 20% per day. This penalty will be waived in cases of documented emergency.

Academic Integrity: All students are expected to adhere to the standards of academic integrity. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty will be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be subject to the process outlined in the University Guidelines on Academic Integrity (http://www.cfo.pitt.edu/policies/policy/02/02-03-02.html).

To be completely clear, it is reasonable (and encouraged) to search online and/or work with your classmates to **develop ideas** for approaching each assignment. However, you should never **copy code** from another source. Put another way, each assignment you submit for credit must show that **you** understand how to solve the problem. In group assignments, these standards apply to the group as a whole.

Disability Services: If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 (Voice or TTD) to schedule an appointment. The Disability Resources and Services office is located in 140 William Pitt Union on the Oakland campus.

Statement on Classroom Recording: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Grade Scale

I do not anticipate the need to curve grades. If I do curve, it will be up, never down. If you achieve the following final grade percentages in the course, you will receive at least:

Percentage	Minimum Grade
90%	A-
80%	B-
70%	C-
60%	D-

Regardless of the scale, only the top one or two students will have the potential to earn an A+. At the other extreme, no score below 50% will pass.

Grading

	%	Points
13* In Class Exercises	24%	240 (20 ea.)
13* Homework	48%	480 (40 ea.)
Final Project + Portfolio Review	28%	280
Total:	**100%**	**1000**

*The week with the lowest homework+exercise total is dropped from grading.

In Class Exercises (20 points each week)

Many classes will end with a group programming assignment. The exercises for the week are all turned in together when the next homework assignment is collected. You will work in groups of 2–3 while in class (and having the same or similar code as your group members is expected, and not a violation of academic integrity). I will be available to answer questions during this time. Whatever portion you don't finish in class should be completed as part of your weekly homework. You may continue working with your group at home or finish the assignment on your own. Even though you work together, you will be graded individually on this assignment.

Homework (40 points each week)

Homework will be assigned weekly, and will be due the following Monday (or Wednesday in the case of the Labor Day holiday). There is no homework due the week of Thanksgiving. The code you submit for your homework should be your own work.

Homework Submissions Homework (including finalized in class exercises) must be submitted in two forms, both due at the **beginning** of class:

1. Printed on paper so that I can write feedback on the assignment. Outputs should be shown.
2. Digitally in a zip file uploaded to CourseWeb so that I can verify that your code runs. Put all files for the week in a single zip file.

Assignments will be considered late until they are submitted in both formats.

Final Project + Portfolio Review

In place of a final exam, you will submit a collection of your best work, with the capstone being a final group project.

Before the end of October, you should form a group of 3 or 4 and meet with me at office hours at least once to discuss what you'd like to do for your final project. The scope of the project should be roughly equivalent to two homework assignments, and showcase mastery of skills from at least two major topics in this course (i.e. from at least two topics listed in the course description at the beginning of this syllabus). Furthermore, the projects should be chosen so that each group member is able to make a meaningful contribution to the overall project. During the last week of the course, your group will make a 10–15 minute presentation to the class showcasing your project, followed by a question and answer period.

Due on the Monday of finals week, you will submit a final portfolio of your best work. Your portfolio should include your choice of any 6 previous homework assignments. Unless these assignments were already perfect, you should revise these programs so that they reflect your very best work. The capstone of your portfolio will be your group project, with an additional writeup describing the implementation of the project. Your writeup should be detailed enough that one of your classmates could, in principle, follow it to create a working version of your project without seeing your code.

I expect everyone in the group to submit the same code for their project, but the writeup should be written individually. It is important that everyone in the group fully understands how the overall project works.

Portfolio Grading

- Presentation: 40 points (group grade)
- Final project code: 80 points (group grade)
- Final project writeup: 40 points
- Selection of your best work: 120 points

Schedule

Learning Python (2 weeks)
Graphics, Curve-fitting, Interaction (2 weeks)
Random Numbers and Monte Carlo (1 week)
Integration and Differentiation (2 weeks)
Linear and Nonlinear Equations (2 weeks)
Fourier Transforms (1 week)
Ordinary Differential Equations (2 weeks)
Partial Differential Equations (1 week)
Final Project Presentations (1 week)