

# Computational Methods in Physics

## PHYS 1321, Fall 2018

**Instructor:** Dr. David Nero  
**Office:** 221B Allen Hall  
**Office Hours:** Wednesday 1:30-3:00pm and 5:00-6:30pm  
Other times by appointment.  
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**Class Website:** CourseWeb ([courseweb.pitt.edu](http://courseweb.pitt.edu))

**Textbook:** *Computational Physics* by Mark Newman

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## 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 high-level syntax and popularity in the field. No prior programming experience is required, although additional self-study may be needed in that case.

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

## 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 programming 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 student(s) will have the potential to earn an A+. At the other extreme, no score below 50% will pass.

## Grading

	%	Points
10 Portfolio Checkpoints	20%	200 (20 ea.)
13 Weekly Homework	39%	390 (30 ea.)
Final Project	21%	210
Final Portfolio	20%	200
<b>Total:</b>	<b>100%</b>	<b>1000</b>

### Portfolio Checkpoints

After each major topic covered in the course, there will be a class period dedicated to solving a programming challenge. You can think of these like group quizzes. The idea is to collaborate on solving a “real world” problem using the skills you’ve just learned. You probably won’t completely finish during class—but you should be making progress! Checkpoints will formally be due with the following homework assignment. As described below, you are expected to correct any errors in these checkpoints to construct your final portfolio.

### Homework

The only way to really learn programming is to practice. For this reason, homework will be assigned weekly. Don’t be shy about asking me for help—just don’t wait until late at night to do it.

### 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. Your project should 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 minute presentation to the class of your project.

Due on the Monday of finals week, you will submit a final portfolio of all ten checkpoints from the semester. Unless these assignments were already perfect, you should revise these assignments so that they reflect your very best work. As this is the culmination of your work, grading will be at a higher standard than earlier in the semester.

The capstone of your portfolio will be your completed 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.