

Computational Physics / PHYS-UA 210

This course teaches computational physics at a level appropriate for undergraduate physics majors. Classes meet Tuesday and Thursday 12:30pm to 1:45pm, in Room 1045 of 726 Broadway. The textbook is *Computational Physics*, by Mark Newman. I will also ask you sometimes to look online at the Python Data Science Handbook (PDSH) by Jake Van Der Plas.

If you have never programmed in Python before then Chapter 2 of the book will require your special attention. There are also many online resources for learning the basics of Python. I can recommend Software Carpentry and also Prof. David Pine's *Introduction to Python for science and engineering*, available online through Bobst Library.

Prof. Blanton's office is Room 941 of 726 Broadway, and his email is blanton@nyu.edu. You can come to ask questions about computational physics (or any other subject!) on Tuesdays 11:00am to 12:15pm, or by appointment.

The teaching assistant is Jatin Abacousnac (ja3067@nyu.edu) Recitation is Thursday, 5pm–6:15pm, in Room 1067 of 726 Broadway. This time will primarily consist of working on homework assignments.

The class will be participatory. Please read the assignments *before* attending class; you will be expected at certain points to follow along with calculations on your computer.

There will be no exams in this course, but there will be a pretty heavy load of assignments:

- *Weekly homeworks*: You may consult with each other about the homeworks, but you must write your own individual code and report. These are due on the *Fridays* of the indicated weeks for PS#5 and later.
- *Semester project*: Performed in groups of two or three students each. I have deadlines for two intermediate drafts of this project; the projects are designed such that you will be able to complete them in stages over the semester based on material previously covered in class. The project culminates in a written report and a presentation in December.

All material handed in will consist of reports written in L^AT_EX (the physics standard typesetting system) and as documented Python code which the TA and professor will be able to run to produce the data and plots. You will receive rather specific templates and instructions about code standards to follow!

Grades are based on problem sets (65%), the large project and presentation (25%), and class participation (10%).

The classes will proceed as follows (subject to revision!).

| <i>Date</i> | <i>Topic</i> | <i>Reading</i> | <i>Problem Sets</i> |
|----------------|---|-----------------|----------------------|
| 2023-09-05 (T) | Numbers on computers | Ch. 1, 2, 3 | PS#1 |
| 2023-09-07 (R) | Arrays | PDSH, Ch. 1 & 2 | |
| 2023-09-12 (T) | Numerics | Ch. 4 | |
| 2023-09-14 (R) | Random Numbers | Ch. 10.1–10.2 | PS#2 |
| 2023-09-19 (T) | Integration | Ch. 5.1.3 | |
| 2023-09-21 (R) | Integration | Ch. 5.4–5.6 | |
| 2023-09-26 (T) | Integration | Ch. 5.7–5.9 | PS#3 |
| 2023-09-28 (R) | <i>“Solving Riemann Problems Numerically” (Marcus DuPont guest lecture)</i> | — | PS#4 |
| 2023-10-03 (T) | Differentiation | Ch. 5.10–5.11 | |
| 2023-10-05 (R) | Linear Algebra | Ch. 6.1 | |
| 2023-10-10 (T) | Legislative Day, no class | | PS #5 |
| 2023-10-12 (R) | Linear Algebra | Ch. 6.1 | |
| 2023-10-17 (T) | Eigensystems | Ch. 6.2 | |
| 2023-10-19 (R) | Eigensystems | Ch. 6.2 | Project draft #1 due |
| 2023-10-24 (T) | Root-finding | Ch. 6.3 | |
| 2023-10-26 (R) | Minimization | Ch. 6.3 | |
| 2023-10-31 (T) | Minimization | Ch. 6.4 | PS#6 |
| 2023-11-02 (R) | Fourier Analysis | Ch. 7.1–7.3 | |
| 2023-11-07 (T) | Fourier Analysis | Ch. 7.4 | |
| 2023-11-09 (R) | Ordinary DEs | Ch. 8.1 | PS#7 |
| 2023-11-14 (T) | Ordinary DEs | Ch. 8.2 | |
| 2023-11-16 (R) | Ordinary DEs | Ch. 8.3 | |
| 2023-11-21 (T) | Ordinary DEs | Ch. 8.4–8.5 | Project draft #2 due |
| 2023-11-23 (R) | Thanksgiving, no class | Ch. 8.6 | |
| 2023-11-28 (T) | Partial DEs | Ch. 8.6 | |
| 2023-11-30 (R) | Partial DEs | Ch. 9.1–9.2 | PS#8 |
| 2023-12-05 (T) | Partial DEs | Ch. 9.3 | |
| 2023-12-07 (R) | Partial DEs | Ch. 9.3 | |
| 2023-12-12 (T) | Project presentations | — | Final project due |
| 2023-12-14 (R) | Project presentations | — | |
| | | | PS#9 |