PHYS 301 Computational Physics

Class Meetings:

- Tue. and Thurs. 10:00 AM-11:15 PM White Hall 105

Course Materials:

- *Computational Physics - Problem Solving with Python* - 3rd Ed. Landau, Paez, & Bordeiau
- Python 3 Programming Language
- GitHub Account

Welcome

This course is designed to introduce you to modern computational methods for physics data analysis and modeling. If you had some computational experience, then you will learn some numerical techniques, otherwise, we will not assume any familiarity with any computer language. The course is intended for upper-level undergraduates. The course was designed for physics students but should also be appropriate for students in mathematics and other physical sciences. Some programming experience will be useful but is not required. The course uses Python and looks at a variety of common problems and Scientific Python libraries. The aim of the course is to teach students how to solve problems and what to look for when searching for tools, rather than to teach all the details of specific methodologies. Common data manipulation and numerical analysis techniques will be investigated, with a strong focus on visualizing the results.

1.1 Course Goals

By the end of the course students will

- be able to use tools such as Github and Jupyter Notebooks
- be able to perform basic computational tasks such as if-then statements, for loops, while loops.
- be able to perform basic calculations such as finding zeros and doing numerical integration.
- use computation to fit data to defined functions

- use computation to solve differential equations
- create simulations of random processes
- use compution to do finite-difference calculations
- complete an advanced project using the computational tools discussed and learned in this course.

1.2 Your Learning Facilitator

Dr. Jason E. Ybarra (he/they)
Office: White Hall, Room G65.
Email: jason.ybarra@mail.wvu.edu

1.3 Lectures

The class will be interactive; students are expected to either use the computers in White Hall 103 or their personal devices. Most lectures are designed as notebook that students can follow along with during the class. If you do not want to install python in your own computer, you can always use Google colab.

2. Grading

Grading - 40% Homework Sets, 40% Term Project 10% Contribution to your learning community.

2.1 Homework

Weekly problem (or 10 days, depending on topic) sets. EACH ONE OF THESE WEEKLY problems should have the following sections:

- Set up of the problem.
- Demonstration that your solution is correct (by comparing with an analytic prediction or by using provided data or checking with respect to a provided solution.
- Discussion of the results. Here you need to address why it fails or how you can improve it.

This should be in a single repository in GitHub. The code and written discussion should be in a Jupyter notebook file. For each homework you will get a link where you will upload your code, your report and any data that you will use to execute your implementation. Github will record the time of upload and I will be able to see if the homework was handed in on time.

2.2 Term Project

The term project is a heavily weighted component of the course. It will consist of a project proposal, a written progress report, an oral presentation, and a written final report.

- Project Proposal 10%
- Progress Report 10%
- Oral Presentation 40%
- Final Written Report 40%

2.3 Attendance

You are expected to attend each class. All materials should be turned in promptly before the set deadlines - please contact me if you need an extension **before** a deadline is passed.

2.4 Letter Grade Definitions

The following definitions will serve as guidance during the assessment and discussion of your final grade.

- **A** indicates excellent performance in all areas of the course. Demonstrated exceptional understanding, application, analysis, and insight. Outstanding contributions to the learning community.

- **A-** indicates strong overall performance. Demonstrated understanding, application, and analysis. Analysis includes evaluation of scientific content and rigor.

- **B** indicates benchmark performance. Course objectives met with full participation. Demonstrated understanding and basic application. Application includes solving routine problems. Demonstrated interpretation of data, graphs, and diagrams.

- **C** indicates satisfactory performance. Only 70% of course objectives were met. Demonstrated minimal understanding of the material.

- **D** indicates unsatisfactory performance. Few course objectives were met and understanding of material is limited. *The instructor rarely ever assigns this grade; students demonstrating unsatisfactory performance are typically assigned an F.* [^1]

- **F** indicates unsatisfactory performance; little to no evidence of meeting course objectives; lack of participation.

3. Conduct

The University Rules, including the Student Code of Conduct, are applicable and should be followed in this class. For example, any material based heavily on outside sources should be attributed in a code comment or a similar manor. Any violation will be dealt with on an individual basis according to the severity of the misconduct.

3.1 Inclusive and Respectful Classroom

It is the intent of the instructor that students from all diverse backgrounds and perspectives be well served by this course, that the learning needs of students be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. Therefore, all members of the class are expected to avoid statements that disparage or threaten, or that oversimplify individuals based on membership in groups to which they may belong or identify with. Every member of the class, including the instructor, are expected to do their utmost to contribute to an inclusive and respectful classroom culture.

If there are any time conflicts between the schedule in this syllabus and major religious holidays or events for your faith, please let the instructor know. They will make every effort to provide reasonable accommodations.