PHY 3750: Applied Computational Methods
Course Syllabus: Fall 2019

Instructors:

- **Mr. Brendon Waters**
  E-mail: brendon.waters@wayne.edu
- **Prof. Prof. Alex Matos Abiague**
  Phone: (313) 577-2774
  E-mail: amatos@wayne.edu

Class Times and Location
Tu, 4:30 pm - 6:10 pm

Office Hours
Mr. Waters - TBD
Prof. Matos-Abiague – MW 12:25 pm – 1.25 pm (Room 391 Physics).

Course Synopsis
This course will provide an introduction to mathematical and computer applications to Physics, Biology, and other related sciences. Students will learn a variety of numerical techniques and computational methods and will employ them to model and solve interesting problems.
Many thanks to Prof. Peter Hoffmann and Prof. Christopher V. Kelly, who respectively assembled and modified much of the course content. Further course adjustments have been made by your instructors.

Learning Objectives
By the end of the course students will be able to:
1. Demonstrate a conceptual understanding of computer programming
2. Use Python programming to solve scientific problems and visualize the results
3. Demonstrate the capability to learn new programming skills through independent use of help menus and online resources
4. Develop computer models and simulations of real-world processes and physical systems
5. Interpret and present the results generated by computer models

Required Texts
A Student's Guide to Python for Physical Modeling (PPM), by Jesse M. Kinder & Philip Nelson
https://press.princeton.edu/titles/11349.html (Paperback at $24.95)
Google Play Store (eBook at $17.99; Rent at $9.98)
We will roughly follow this book. The 'updated' version of the book is preferred but older versions are also fine.

Online Resources
Canvas: https://canvas.wayne.edu/
Online tutorials: www.learnpython.org/; www.datacamp.com; www.tutorialspoint.com/python/ ; etc.
Software: https://www.anaconda.com/download/ (Python 3.6, Spyder, Jupyter)

Software

We will use Python throughout the course. All software is available to you in the Physics Computer Lab (377 Physics) from 8:30 am to 5 pm on work days via a key from the Physics Department office. Python is free and you can easily install it in your own computer if you would like to practice at home.

Pre-requisites
PHY 2130/2140 or PHY 2170/2180, MAT 2020, or consent of the instructors.

Add/Drop Dates
Please, refer to WSU's Academic and Registration Calendar (http://reg.wayne.edu/students) for the University add and drop dates. Note: Failing to drop a class by a deadline may hurt your GPA, financial aid status, and/or your tuition bill.

Exams
There will be no exams in this course. Exercises and a final Project with a presentation represent the largest contribution to the final grade.

Homework Assignments
Homework will be assigned and submitted every week. It will usually require the writing and submission of working Python code. Code should be properly commented and submitted as an easy-to-read HTML or PDF file that shows all your computations completed successfully. In addition, there will be reading assignments and short at-home quizzes to complete in Canvas.
Students are encouraged to work together on the homework via small study groups. However, each student is required to write their own code and answers without copying or plagiarizing others. Any copying or plagiarizing will be considered cheating, resulting in no credit and, possibly, university-level disciplinary actions (https://doso.wayne.edu/pdf/student-code-of-conduct.pdf). Your homework and project submissions may be checked for plagiarism with SafeAssign.

Type of Class Activities
There will be two types of class activities: Exercises and a Final Project

- **Exercises**: Are composed of a series of tasks designed to learn and practice programming skills. Each week students will complete the tasks in class and submit their solutions (as explained in Homework Assignments).
- **Final Project**: All students will be required to participate in a final project and present it to the rest of the class. Students will work on the final project individually or in a small group of no more than 3 students. Students are encouraged to propose their own topics for their final projects. However, each project must require a sophisticated use of Python to achieve something that would be nearly impossible to do without computer programming.

Grading
The course grade has the following components:

- **Participation: 10%** - attendance, in-class activities, discussions
- **Homework: 20%** - weekly set of homework problems
- **Exercises: 40%** - weekly sets of in-class exercises
- **Final Project: 30%** - Grade based on project completion, final presentation, and ability to answer detailed questions about the project

The course grade will be assigned according to the total number of percentage points with the following cutoffs:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
90	86	82	78	74	70	66	62	58	54	50	< 50

Undergraduate vs. Graduate Students

University regulations require that course work and grading be independent for undergraduate and graduate students. Graduate students will complete exercises, homework, and projects that require a higher proficiency in Mathematics and Physics. As there are no grades lower than C for graduate students, graduate students will receive a fail grade if they garner less than 66% of the total score of the course

Policy on Missed Work

There will be no make-up quizzes. We will drop the lowest quiz grade from the grade calculations. The same applies to exercises. However, the final project and its presentation are mandatory and failing to complete them will result in a fail grade for the course.

Incompletes

The mark of 'I' for Incomplete is given to either an undergraduate or a graduate student when he/she has not completed all of the course work as planned for the term and when there is, in the judgment of the instructors, a reasonable probability that the student can complete the course successfully without again attending regular class sessions. A grade of incomplete 'I' will be given only in exceptional cases (to accommodate illness or emergency) after consultation with the instructors **before** the end of term. The student should be passing at the time the grade of 'I' is given. A written contract specifying the work to be completed should be signed by the student and instructor. Responsibility for completing all course work rests with the student (see WSU Undergraduate Bulletin).

Student Disability Services

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. The SDS telephone number is 313-577-1851 or 313-202-4216 for videophone use. Once you have met with your disability specialist, I will be glad to meet with you privately during my office hours to discuss your accommodations. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. You can learn more about the disability office at www.studentdisability.wayne.edu.

To register with Student Disability Services, complete the online registration form at:
https://wayne-accommodate.symplicity.com/public_accommodation/

Syllabus Modifications

We will be trying a number of teaching techniques throughout this semester. As we learn what is working and what is not, we will be modifying the policies of this course. The course schedule may also be modified if needed. Hence, this syllabus is a dynamic document that may be updated as the semester progresses.

Academic Misconduct

Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at WSU, as outlined in the Student Code of Conduct (https://doso.wayne.edu/pdf/student-code-of-conduct.pdf). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct. Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student's test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam. (d) unauthorized access to a test from a previous semester also constitutes cheating. Fabrication: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper. Plagiarism: To take and use another's words or ideas as one's own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons. (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own. Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student's access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

WSU Resources for Students

- Student Disability Services (SDS) http://studentdisability.wayne.edu/
- Academic Success Center http://www.success.wayne.edu/
- Counseling and Psychological Services (CAPS) http://www.caps.wayne.edu
- Dean of Students' Office http://www.doso.wayne.edu
- College of Liberal Arts & Sciences: https://clas.wayne.edu/students
- Departmental Website: http://physics.clas.wayne.edu//

Course Outline

(It may be adjusted as needed throughout the semester)

DATES	TOPICS	Readings	Assignments
T 09/03	Introduction to the Course, Python environment, simple calculations in Python; Algorithmic thinking	1-10	Quiz 1 Exercise 1
T 09/10	Python modules, functions and expressions, objects, methods	11-19	Quiz 2 Exercise 2
T 09/17	Lists, Tuples and arrays; Slicing and manipulation of arrays, Strings, Formatting	19-30	Quiz 3 Exercise 3
T 10/24	Loops, Vectorizing math, array operations, writing scripts	30-43	Quiz 4 Exercise 4
T 10/01	Branching and Conditionals, Importing and Exporting data	43-52	Quiz 5 Exercise 5
T 10/08	Visualizing data, 2D graphs, 3D graphs, Advanced plotting	52-60	Quiz 6 Exercise 6
T 10/15	First computer lab	61-64	Quiz 7 Exercise 7
T 10/22	Writing your own functions, Random numbers, computer simulations, histograms, contour plots, surfaces	65-75 +additional readings	Quiz 8 Exercise 8
T 10/29	Numerical solutions to equations, Numerical integration	75-80 + additional readings	Quiz 9 Exercise 8
T 11/05	Solving differential equations	80-85 + additional readings	Quiz 10 Exercise 10
T 11/12	Second Computer Lab	86-90	Quiz 11 Exercise 11
T 11/19	Image Processing, analytical calculations	91-97	Quiz 12 Exercise 12
T 11/26	Final Projects Proposals		N/A
T 12/03	Work on Final Projects		N/A
TBD	Presentation of Final Projects		Final Project