SYLLABUS

PHY 6750 – Fall 2016
Applied Computational Methods

Instructor: Prof. Peter M. Hoffmann
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Office hours: M 12:05 – 1:05 pm
W 12:05-1:05 pm

Class times and locations:
Unless otherwise noted, we will meet in the computer lab, Room 377
M 10:40 am – 12:05 pm
W 10:40 am – 12:05 pm
Final presentations will take place in room 245.

Class Website: Blackboard

Method of Instruction: Hybrid course with online resources and in-class project coaching.

Required Books & Texts (note: both books are required):
None; Materials will be provided through Blackboard.

Course Content and course philosophy:
This course will cover mathematical and computer applications to physics, biology and other related sciences. The course assumes that students had exposure to programming in either MATLAB or Python. This course will combine online and in-class quizzes, exercises and projects to provide a hands-on learning environment. The instructor will coach students to find their own solutions to challenging projects. The reading of provided materials will be assessed through weekly quizzes. The course will be quite challenging and will require students to spend a significant time working on projects. Instructors will be available to help with projects during regular class hours and during the office hours. Additional help is available upon request.

Learning outcomes:
As a result of mastering the material in this course, you will be able to:

- Recognize the purpose and application of scientific programming.
- Demonstrate knowledge of programming syntax and apply common programming structures, including data structures, data manipulation, conditionals, loops and subroutines (functions).
- Use computer programming to visualize scientific data and computational results.
- Compose computer programs that solve moderately difficult (mathematically expressed) scientific problems.
- Develop computer models of real-world situations and systems in physics and the biomedical sciences.
- Interpret results generated by computer models and present results both orally and in written form.

Grading:

Participation: 10% - attendance, discussion boards, at-home quizzes
Exercises*:* 5% - exercises are designed to practice programming skills
In-class quizzes: 15% - quizzes will be weekly short quizzes on topics covered in class, reading materials or projects
Projects: 40% - Projects challenge students to develop a computational model of a scientific problem, program the model and interpret the results. Grade based on completion and the ability to explain project details. See Rubric.
Final project: 30% - Grade based on project completion, final presentation, and ability to answer detailed questions about project.

Cutoffs for grades:

"Excellent"		"Good"		"Fair"		"Poor"		"Fail"	
A	90	B+	82	C+	70	D+	58	F	<50
A-	86	B	78	C	66	D	54		
		B-	74	C-	62	D-	50		

Graduate students taking the course are expected to perform at a higher level. In particular, 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 for the course.

THE RULES

Please review these rules carefully.

1. **Make-up quizzes etc**: There will be no make-up quizzes. We will drop the lowest quiz grade from the grade calculations. The same applies to exercises and projects, except the final project and presentations. The final project and presentations are mandatory for the course and failing to complete the final project and present it will result in a fail grade for the course.
2. **Missing classes**: If you must miss a class for a legitimate reason, you must inform me at least 1 hour before the class, and, if requested, be able to produce documentation regarding the circumstances of the missed class (e.g. doctor's note).
3. **Incompletes are** given to a student when he/she has not completed all of the course work for the term and when there is, in the judgment of the instructor, a reasonable probability that the student can complete the course successfully without again attending regular class sessions or requiring instructor assistance. 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).
4. **Grades:** Grades are earned as detailed in this syllabus on a numerical basis only. I will not accept any special pleading at the end of the semester. You know what grade you want & need, so work for it!
5. **Bonus**: There will be no extra bonus or extra credit assignments.
6. **Mathematics**: This course expects that you are proficient in mathematics to the level of PHY 3700 and Calculus II.
7. **Cheating and other academic misconduct**: Any actual or attempted cheating will result in a Fail grade (F) either for a project, quiz or homework, or, depending on severity and for repeat offenses, for the entire course. In the latter case a report to the university will be filed for further disciplinary action.

Additional details:

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 Wayne State University, as outlined in the Student Code of Conduct (http://doso.wayne.edu/codeofconduct.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.

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.

8. **Course drop/withdrawal information**: In weeks one and two of the full term, students can drop this class and receive 100% tuition and course fee cancellation. In weeks three and four, students may drop but will not receive tuition cancellation. Courses dropped in weeks three and four will not appear on your academic record. Beginning with the fifth week of the term students who wish to drop the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the 10th week; students enrolled in the 10th week and beyond will receive a grade. More information on this can be found at: http://reg.wayne.edu/students/information.php#dropping
9. 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 in the Adamany Undergraduate Library. SDS telephone number is 313-577-1851 or 313-577-3365 (TTY only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours or at another agreed upon time to discuss your needs. 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.
10. **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: http://clas.wayne.edu/CurrentStudents
Departmental Website: http://physics.clas.wayne.edu/

Course Outline

Note: The required readings & video lectures will be posted on Friday for the week following

DATES	TOPICS	Assignments
08/31	Python environment, simple calculations, data sequence structures, Python modules	Exercise 1
09/07	Defining and manipulating lists, arrays, strings and dictionaries; defining function; writing simple programs; creating 2D plots	Exercise 2
09/12, 09/14	Reading and writing data; Loops and conditionals; Vectorizing calculations; planning multipart programs; Drawing; PROJECT: Fractals	Project 1
09/19, 09/21	Finding roots of functions; PROJECT: Michaelis-Menten Kinetics, Energy levels in atoms	Project 2
09/26, 09/28	Interpolation, approximations and derivatives; PROJECT: DNA stretching, TBD	Project 3
10/03, 10/05	Gaussian Elimination and Curve Fitting; PROJECT: Fitting data to a theory, Infectious disease, Kepler's law, TBD	Project 4
10/10, 10/12	Numerical integration, PROJECT: Infectious disease, TBD	Project 5
10/17, 10/19	Random numbers; Random walks; PROJECT: Bacterial motion versus random walk	Project 6
10/24, 10/26	Monte Carlo methods; Monte Carlo integration; PROJECT: Protein bond breaking	Project 7
10/31, 11/02	Differential equations; PROJECT: The Medawar Problem; Modeling epidemics	Project 8
11/07, 11/09	Nonlinear differential equations; PROJECT: Nerve conduction	Project 9
11/14, 11/16	Matrices, vectors and differential equations; PROJECT: Game theory and evolutionary dynamics.	Project 10
11/21	Partial differential equations; PROJECT: Pattern formation; diffusion-reaction; bacterial growth	Project 11
11/28, 11/30	FINAL PROJECTS: presentation of project plans	Final Project
12/05, 12/07	FINAL PROJECTS: Project Completion	Final Project
12/12	FINAL PROJECT: Project Presentations	Final Project

*During the two weeks that students work on final projects, I will be available in the computer room during regular class times to help.