PHYS 340: Computational Physics Spring 2016

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Class: Tuesday 1:10 – 4:00 PM, Room SCI 71. If you wish, you will be issued a key, so that you can access the lab independently. Obviously, use this access responsibly. If you are issued a key, you are required to turn in the key at the end of the semester to pass the course.

Office Hours: Office hours are To Be Announced. That said, if my door is open, I am usually happy to answer your questions. If you have any concern about finding me, please email and we can fix a meeting time.

Course Materials: Assignments will be distributed and collected through DropBox.

Goal: The overall goal for this course is to provide you with the basic tools you need to carry out computational research, be it academic or applied. Primarily this means understanding the use of programming languages and algorithmic methods. Note that these skills are not exclusive to theoretical work; often, basic computational methods are just as critical for the analysis of experimental data.

Interdisciplinary Programs: This course is fulfills part of the requirements for the linked major in the College of Integrative Sciences (if you are a non-physics major), and for the Certificate in Informatics and Modeling.

Course Text: There is no one book that covers the material we will discuss. Some of the material is simply not in any books. However, I list a collection of books that I will reference during the class. When relevant, I will provide handouts.

1. *Numerical Methods for Physics*, by A. Garcia, Prentice Hall.
2. *Computational Physics*, by N.J. Giordano and H. Nakanishi, Prentice Hall.
3. *An Introduction to Computer Simulation Methods: Applications to Physical Systems*, by H. Gould, J. Tobochnik, W. Christian, Addison Wesley.
4. The "Bible" of numerical algorithms: *Numerical Recipes in C (or Fortran): The Art of Scientific Computing*, by W.H. Press, B.P. Flannery, S.A. Teukolsky, and W.T. Vetterling. Unfortunately, this book is not extremely user-friendly.
5. For basic programming reference: *A Book on C* by A. Kelley and I. Pohl,

Class Structure: The course will run more like a lab course than a lecture course. As such, we will complete nearly all the work for the course during class time. The one major exception will be the end-of-class project, which will require outside effort.

Participation/Attendance: I expect all students to actively engage in class. Since this is more like a lab course, this should be unavoidable. Similarly, attendance is **mandatory!** If you must miss class, discuss it with me as soon as possible.

Background: I am assuming relatively little prior knowledge, other than basic computer skills (web-browsing, etc). The lab computers are set up with Windows and Pelles C and I will be teaching based on this configuration. However, if you wish to use some other set of tools (including installing Linux on a machine or bringing in your own computer), you may. However, you're on your own for "IT support" in that case.

Final Project: Each student will complete a final project at the end of the semester.

Grading: Grading will be split into 2 components: (i) in-class assignments (65%) and (ii) final project (35%). Success on assignments is very well defined, do the work and you should do well. Obviously, the final project will be important to your grade.

While most work is done in-class, should you need additional time, each assignment is due the following Monday at 10 PM. Late assignments will be penalized.

Schedule: The schedule below will be altered if needed. If there are special topics the class wants to cover, these can potentially be included.

Week 1: The C programming language
Week 2: Numerical differentiation and integration; application to radioactive decay
Week 3: Root finding
Week 4: Integrating equations of motion: Oscillator motion
Week 5-6: Integrating equations of motion: N-body molecular dynamics
Week 7: Boundary Value problems: Quantum mechanical applications
Week 8: Monte Carlo methods: The Potts model
Week 9: Minimization methods
Week 10: To Be Decided
Week 11:] TBD/Final Project
Week 12: Final Project
Week 13: Final Project

Finally: I will not give an incomplete for the course, except under the most extraordinary of circumstances.