PHYS 319/597, ASTR489, CSCI 319:
COMPUTATIONAL PHYSICS WITH PYTHON
COURSE SYLLABUS: FALL 2015

Instructor: Dr. Matt A. Wood
Office Location: Science Building 106
Office Hours: M-F 1:00–2:00 or by appointment
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Course Location and Time

Lectures: TR 11:00 a.m. – 12:15 p.m., STC 114
Note: Class will start promptly at the top of the hour, and end at scheduled time. Please don't be late

Materials – Textbooks, Readings, Supplementary Readings

Textbooks Required:

- Computational Physics with Python, by Mark Newman
  - ISBN-10: 1480145513
  - ISBN-13: 978-1480145511

Prerequisites: PHYS 2425 (programming experience will be helpful, but is not required)

Course Description

Today computational physics is a powerful approach to probing natural phenomena. In this course, you will learn first how to program in the Python language and to make plots with Matplotlib. T he remainder of the course will introduce you to several of the main computational tools, techniques, and methods of computational physics. This is a practical course, meaning you will be learning mostly by doing: writing programs, running them, debugging, etc., until you get answers that are physical and plausible. The knowledge of how to implement numerical solutions to problems, and the limits of these simulations, should be extrememely useful to you in your further courses and beyond.

Topics Covered:

- Introduction to Python Programming
- Making Plots with Matplotlib and VPython
- Accuracy and Speed
- Integrals and Derivatives
- Solution of Linear and Nonlinear Equations
- Fourier Transforms
- Ordinary Differential Equations
- Partial Differential Equations

- Random Processes and Monte Carlo Methods
- Advanced Topics (time permitting)

Student Learning Outcomes:

- To understand the basics of scientific, numerical simulation and modeling
- To learn to use to use the graphical capabilities of Matplotlib to visualize numerical solutions into highly interpretable forms
- To gain intuition for the quality of simulations results (just because a program runs without error does not guarantee the results are correct)

Additional Graduate Student Learning Outcomes (in addition to above)

- To learn to program efficiently using Python classes
- To understand how to fit experimental data using non-linear least squares
- To understand how to interpolate over gaps in data
- To understand how to employ Fourier filtering
- To implement additional or modified projects requiring higher mathematical and theoretical analysis (note: some exam problems may be at a higher level for graduate students)

Exams

There will be 2 midterm exams and the final exam. These may involve writing working code during the exam.

Homework / Projects

The way to learn computational physics is to write code and debug until it does what you want it to do. Therefore, the homework and project assignments account for 50% of your course grade. You are expected to write your own code – the instructor will be checking for originality.

Grading

The grading breakdown is as follows:

Homework / Projects	50%
Midterms (2)	30%
Final	20%

The nominal grading scale is:

90% to 100%	A
80% to 89.9%	B
70% to 79.9%	C
60% to 69.9%	D
Below 60%	F

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures:

Classroom behavior: I require you to follow some simple good manners that will make class time much more productive for you and your fellow students.

During lecture,

- Do not be disruptive or disrespectful.
- Turn off your cell phone ringer.
- Do not answer your phone in the classroom.
- Do not send or view texts, tweets, emails, photos, or any other communication.
- Do not use iPods, MP3 players, or any other type of noise-making device.

Academic integrity: A major goal of this and most every university course is for you to learn and appreciate subject material. Academic dishonesty ("cheating") actively prevents you from achieving this goal. Academic dishonesty is taken seriously by the University and by me, and will not be tolerated. (See the TAMU-C Code of Student Conduct and the TAMU-C Procedures A 13.04, 13.12, 13.31, and 13.32.)

This conduct is not only considered wrong in this course and at this University, but also in the real world. Engaging in these activities will get you fired from a job and prevent you from getting another job.

Unethical student conduct includes:

- **Plagiarism**, or copying the words of others with the intent of making it look like your own. Whether you use someone else's phrase word for word, or whether you try and change a few words, or even if you just borrow someone else's original idea and don't give them credit, that's unethical. Use your own words whenever possible, give credit to wherever you got an idea, and put direct quotes inside quotation marks.
- **Cheating** involves trying to trick me or others into thinking you did work that you really didn't do, or into thinking you know what you really don't know. This can include stealing exams, changing your answers on a graded exam or assignment and claiming it was graded wrongly, putting your name on someone else's homework, and so on. Searching the Internet for homework or exam solutions is considered cheating. Borrowing a previous student's homework, exams, or solution sets is considered cheating.
- **Collusion** is working with another person to cheat. This can include copying someone else's answers to an exam or assignment, doing work for another student, buying or otherwise obtaining homework/exam solutions from any source online or off-line, or any other instance of multiple people engaging in some form of cheating or dishonesty. Working with other students on an assignment is fine and encouraged as long as everyone contributes and each student does their own work.
- **Any other activity that, to a reasonable person, looks wrong.** If you have any doubt whatsoever whether a certain action is considered dishonest, please ask me *before* engaging in the activity. There is no need to be embarrassed about asking, and I won't penalize you for asking! In this class, if you follow the maxim "it's easier to beg forgiveness than to ask permission", don't expect forgiveness to be forthcoming.

If you engage in academic dishonesty during any graded activity, you will receive no credit for that activity. More than one instance of dishonesty by a student will result in automatic failure of the course and referral of the student for disciplinary action.

For further information, search the Texas A&M-Commerce website for "academic integrity policy".

University Specific Procedures:

ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
Texas A&M University-Commerce
Gee Library 132

Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148

StudentDisabilityServices@tamu-commerce.edu
Student Disability Resources & Services

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. (See *Code of Student Conduct from Student Guide Handbook).*

Nondiscrimination Statement

A&M-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.
