PHYS 220 Introduction to Computational Physics

Spring 2020

Dates and Location:
Tuesday & Thursday 10:00AM - 11:15AM Sherman Hall 150

INSTRUCTOR: Dr. Adriana Rocha Lima
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OFFICE HOURS: Physics Building – Room 425: Fridays, 11:00AM-12:00PM

Recommended TEXTS:
"**A Survey of Computational Physics: *introductory computational science*** " By R. H. Landau et al.
Python Multimodal eTextBook publically available from
http://www.compadre.org/psrc/items/detail.cfm?ID=11578

EQUIPMENT:
Computer access (and the possibility of installing software) is required. If at all possible, students should bring a laptop to every class.

GRADING:
Homework: 40%, Midterm: 30%, Final Project: 30%.
Final Project grade will consist of three parts: Proposal 10%, Presentation 10%, and Final Report 10%.

A: 100 – 85+; B: 84 -70; C: 69-60; D: 59-50; F: Below 50.

Late homework policy:
I do NOT accept late homework. However, at the end of the semester I will automatically waive **one** of your homework with the **lowest** grade in the calculation of your final grade. This policy only applies to homework, not midterm or final projects. Use this policy wisely.

Class Attendance and Missed Work
Absences from class and missed work are accommodated (excused) in five circumstances: 1) significant illness, 2) personal instances of distress or emergency, 3) religious observance, and 4) varsity athletic participation and 5) required court or legal appearances. For each circumstance, you will need to present to the instructor supporting evidence (e.g., doctor note).

Coarse Description:

An introduction to the computational software packages MATLAB and Mathematica, with particular emphasis on their use in solving physics problems and analyzing experimental data taken in physics laboratory experiments. Applications to problems in mechanics, electromagnetics and wave propagation will be stressed. The course will end with a comparison of the strengths and limitations of these languages and a compiled language such as C.

Learning Goals:

- Use a software package (e.g., Mathematica or Matlab) and high-level programming language (e.g., Python) to write modularized program and plot simple figures, such as scatter plot, time series, histogram, and 2D contour.
- Use Monte Carlo method to simulate and understand random walk problem, such as photon transport in isotropic-scattering medium.
- Write programs to solve physics problems involving Ordinary-Differential-Equations (ODE), such as projectile motion with drag and nonlinear oscillation.
- Write programs to solve physics problems involving Partial-Differential-Equations (PDE), such as finding electrostatic potential and simulating heat diffusion.
- Have a good mastery of basic data analysis methods, such as linear regression, uncertainty analysis, null hypothesis testing, and Fourier analysis.