Physics 256 – Introduction to Computational Physics – Fall 2017

Instructor:

Dr. Juan M. Vanegas
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Office: W428, Discovery Hall (STEM west)
Office hours: W 1:30 pm – 3:30 pm, or by appointment
Learning assistant office hours: Tuesdays 12:00 – 1:00 pm, fourth floor lounge of Discovery Hall

Schedule:

Lectures: MWF 10:50 – 11:40 am, Lafayette L308
Midterm exam: Friday, October 13th, 10:50 – 11:40 am, Lafayette L308

Prerequisites:

Phys 152 or Phys 125 (or equivalent), and Math 121 (Vector Calculus)

Course textbook:

Computational Physics, 2nd edition (2005, Pearson).
Authors: Nicholas Giordano and Hisao Nakanishi.
ISBN: 978-0-1314-6990-7

Additional references (available as e-books from the UVM library):

Learning IPython for Interactive Computing and Data Visualization - Second Edition (2015, Packt Publishing)
Author: Cyrille Rossant
ISBN: 978-1-78398-698-9
http://proquest.safaribooksonline.com/9781783986989?uicode=uvermont

Shell Programming in Unix, Linux and OS X, Fourth Edition (2016, Addison-Wesley Professional)
Author: Stephen G. Kochan and Patrick Wood.
ISBN: 978-0-13-449600-9
http://proquest.safaribooksonline.com/9780134496696

Grading:

- Weekly homework assignments 35 %
- Midterm exam 10 %
- Term programming project 25 %

- Project oral presentation 25 %
- In-class attendance/participation 5 %

In-class work and homework:

This class has a large participatory programming component. You will learn by attacking problems in real-time in class, either in groups or by yourself. Please come prepared to lectures with a laptop or other suitable portable computing device. Students are encouraged to work together, but you must write and turn in your own code. Do NOT share your code with other students in the class. Academic dishonesty will not be tolerated! No credit will be given for late assignments.

Graduate Credit

Graduate students enrolled in the course will be required to answer additional homework problems as well as choose a more advanced topic for their final project.

Course plan (order and specific topics may change):

- Introduction to python and friends (numpy, scipy, matplotlib, ipython/jupyter, pandas, etc.)
- Errors and uncertainties in computation
- Finite difference methods (dissipation in classical mechanics, chaos, three-body problems and Laplace's equation in electricity and magnetism)
- Quadrature (1d integration and Monte Carlo methods for higher dimensional integrals)
- Interpolation, splines and Fourier Transforms (curve fitting and analysis of experimental or simulation data)
- Random systems (diffusion, percolation and fractals)
- Statistical mechanics (classical many body problem via Monte Carlo and molecular dynamics)
- Linear algebra (quantum mechanics and spin systems)
- Other advanced topics may be covered as time permits