Syllabus for PHY/CSC 200

Computational Physics

MWF, 9:30am-10:20am, Chambers 3130

Dr. Michelle P. Kuchera

Office: Dana 132
Email: mikuchera@davidson.edu
Office Phone: (704) 894-2322

Office Hours:

M	T	W	Th	F
3pm-5pm	2pm-4pm	3pm-5pm	9am-11am 2pm-4pm*	2pm-4pm

* PHY 200 **only**

Course Description: This is an introduction to computer programming and computational physics using Python. No prior programming experience is necessary. This course will provide students with the skills required to write code to solve physics problems in areas including quantum physics, electromagnetism, and mechanics. Structured programming methods will be covered as well as algorithms for numerical integration, solving differential equations, and more. This course satisfies the Mathematical and Quantitative Thought distribution requirement.

Text: *Computational Physics*, Mark Newman. *Revised and expanded.*
Course content: Moodle will be used to post and submit assignments, daily exercises, and other course content.

Grade Distribution:

Problem Sets & Daily Exercises	40%
2 Reviews	30%
Final Project	30%

Accommodations: Please look carefully at the syllabus, if any of the assignments or Reviews conflict with a major religious holiday for your faith, then please let me know. I will make every effort to make the necessary accommodations.

Course Policies:

- **Attendance**
  - It is one of the primary responsibilities of the student to attend every class.
  - Daily exercises will be completed in class in pairs and submitted on Moodle.
  - Each student is responsible for the material discussed in class and the announcements made in class. Absence from class does not relieve one from this responsibility.
- **Reviews**
  - There will be two Reviews. Each review has two portions: an in-class written portion and a take-home coding portion.
  - Problems on the quizzes, reviews, and final exam are similar to homework and lecture example problems.
- **Assignments**
  - There will be **daily** as well as **weekly** assignments (8 points per problem).
  - **Daily** assignments will be done in class with a partner. We will use the pair programming paradigm. Failure to follow the rules of pair programming will result in reduced credit for the daily assignment.
  - **Weekly** assignments will be posted and submitted on the course Moodle page.
  - **Weekly** assignments will be due on Friday before class. Problems with an * are group problems. For group problems you may collaborate with other students. Please indicate the name of all members of your group on each problem set. For individual problems, you will work alone.
  - **Copying another student's work from this class or any previous class is an honor code violation. In addition, using any solution, other than those found in your textbook or discussed during office hours, is an honor code violation.** Submission of your homework on Moodle signifies your compliance with this requirement.
  - Late homework may be turned in for a maximum of 70% credit for same-day submissions (by 5pm) and 50% credit at any point afterwards.
- **Final Project**
  - The final project will be broken up into five parts, due throughout the semester. The project will be graded out of 100 points and broken up as follows:

Proposal:	15 points
Code submission:	15 points
Poster session:	20 points
Presentation:	25 points
Final code:	25 points

Learning Objectives: By the end of this course, students will:

1. obtain a basic understanding of the fundamental concepts in physics;
2. develop critical thinking and analytical problem-solving skills;
3. learn to apply these concepts qualitatively as well as quantitatively;
4. gain an appreciation of how large a role physics plays in your daily life;
5. develop analytical, graphical, and reasoning skills;
6. gain experiences with experimental processes, including some experience designing investigations;
7. develop an array of basic skills and tools of experimental physics and data analysis.

Learning Outcomes: By the end of this course, students will be able to:

1. demonstrate knowledge of fundamental principles of physics;
2. solve qualitatively problems or situations involving the fundamental principles of physics;
3. solve a physical problem by determining the relevant concepts, parameters, and mathematics;
4. set up experiments to measure physical quantities, record data, analyze results, and fit the data with appropriate mathematical formulas;
5. demonstrate effective oral and written communication skills in the discussion and interpretation of data;
6. develop collaborative skills by working in groups on laboratory experiments.

Tentative **Spring Schedule:**

Week/Dates	*Reading/Lab*	*Concept(s)*
Week 1 1/18, 1/20	Ch. 1-2.1	intro to course getting started
Week 2 1/23, 1/25, 1/27	Ch. 2.2-2.4	`if/while` lists/arrays
Week 3 1/30, 2/1, 2/3	Ch. 2.5-2.7	`for` loops functions
Week 4 2/6, 2/8, 2/10	Ch. 3-4	graphics/visualization speed/accuracy
Week 5 2/13, 2/15, 2/17	**Review #1** given 2/15 due 2/20	work on project proposals
Week 6 2/20, 2/22, 2/24	Ch. 5.1-5.6	integration quadrature
Week 7 2/27, 3/1, 3/3	Ch. 5.7-5.11	integrals derivatives interpolation
No class	SPRING	BREAK!
Week 8 3/13, 3/15, 3/17	Ch. 6.1-6.4	linear algebra non-linear equations
Week 9 3/20, 3/22, 3/24	**Review #2** given 3/22 due 3/27	work on project code

Week/Dates	*Reading/Lab*	*Concept(s)*
Week 10 3/27, 3/29, 3/31	Ch. 7.1-7.4	Fourier transforms
Week 11 4/3, 4/5, 4/7	Ch. 8.1-8.4	ODEs
Week 12 4/10, 4/12, 4/14	Ch. 8.5-8.6	leapfrog method boundary-value problems
Week 13 4/19, 4/21	Ch. 9.1-9.3 posters due	PDEs spectral methods
Week 14 4/24, 4/26, 4/28	Chs. 10.1-10.2	Monte-Carlo
Week 15 5/1, 5/3, 5/4	Chs. 10.3-10.4	MC simulated annealing
Week 16 5/8, 5/10	**Final Project**	presentations