CONTACT INFORMATION:

- Instructor James Taylor, office PHY256, x38115, taylor@uwaterloo.ca
- Office hours: Thursday 1-2, depending on need
- Please contact me first, not the TAs. Please email me rather than phoning. I will normally respond to email during work hours; I may not respond outside of work hours.

COURSE DESCRIPTION:

- Introduction to scientific programming techniques as applied to problem solving in Physics, with examples from first year mechanics. Basic programming techniques, procedural programming, control structures, functions, data storage. Numerical techniques, data analysis and visualization.

LEARNING OBJECTIVES:

- To understand the structure and use of computer programs in physics.
- Basic programming skills
- A basic knowledge of Python
- Basic ideas about computation – efficiency, complexity, accuracy etc.
- Basic computational techniques

RESOURCES:

- Textbook: *Computational Physics*, 2nd edition, Mark Newman; available at the bookstore or through Amazon; a copy will also be available at the Davis Library
- Lecture slides posted on-line, on the LEARN site: https://learn.uwaterloo.ca/d2l/
- Links and URLs posted on the LEARN site
TOPICS:

Introduction to Scientific Computing

I Basic Programming in Python:

Getting started with python - installing python, running programs; basic variables - variables and assignments; basic operations; I/O; control structures; functions; packages and modules, Numpy; programming theory: modularity, program structure; testing, debugging and the development cycle

II Numerical Techniques:

Representation of numbers, accuracy and errors; systems of equations and matrix inversion; differentiation; integration; solving differential equations versus integrating

III Physics applications & Data analysis (will cover a subset of this):

Basic mechanics (parabolic trajectory) problems & integration; data analysis, statistics & line fitting, interpolation; simulations, random number generation; classic algorithms, sorting and neighbor finding; image analysis, filtering; optimization and efficiency

ASSESSMENT:

- In-class weekly assignments: 50%
- In-class Midterm: 20%
- Final Exam: 30%
- Assignments will be due weekly – exact deadlines TBA. Any disruptions in the online learning environment will be handled on a case-by case basis; any modified submission deadlines will be posted on LEARN
- The lowest assignment mark of the term will be dropped from the final grade calculation; otherwise, all elements of the marking scheme must be completed to pass the course. In particular, in cases of illness tests may be deferred, but they will always generally be required to pass the course.
- Students may discuss work together, but are expected to submit their own work on assignments; details of what is and isn’t acceptable will be explained in detail on the first assignment.
- Assignment submission is timed; late assignments will not be accepted by the on-line system.
- Midterm date is provisionally Monday, October 20th; this will be confirmed in 1-2 weeks.
- Remember to check appropriate uWaterloo websites for details concerning various dates (e.g., final examination, drop deadlines)
COMMITMENT EXPECTATIONS:

• Students are expected to devote 8-9 hrs/week to the course; 4 hours for class time and the balance for reading and completing assignments, or reviewing material for tests and the exam
• Attendance is mandatory; students who miss class or tutorials are responsible for catching up the material they have missed

ACADEMIC INTEGRITY:

• Office of Academic Integrity provides relevant information for students, faculty and staff.
  o Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.
  o Grievance: Students, who believe that a decision affecting some aspect of their university life has been unfair or unreasonable, may have grounds for initiating a grievance. Students should read Policy #70, Student Petitions and Grievances, Section 4. When in doubt, students must contact the department’s/school’s administrative assistant who will provide further assistance.
  o Discipline: Students are expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Students who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism, cheating) or about ‘rules’ for group work/collaboration should seek guidance from the course instructor, academic advisor, or the Associate Dean of Science for Undergraduate Studies. For information on categories of offenses and types of penalties, students should refer to Policy #71, Student Discipline. For information on typical penalties, students should check Guidelines for the Assessment of Penalties.
  o Appeals: A decision or penalty imposed under Policy 33 (Ethical Behavior), Policy #70 (Student Petitions and Grievances) or Policy #71 (Student Discipline) may be appealed, if there is a ground. Students, who believe they have a ground for an appeal, should refer to Policy #72 (Student Appeals).
COURSE RULES/CONSIDERATIONS:

• Exam Period Travel:
  o The final exam will be scheduled during the normal F14 exam period; the exact date will be released by the faculty toward the end of October.
  o Student travel plans are not considered acceptable grounds for granting an alternative examination time.

• Students with Disabilities:
  o AccessAbility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If students require academic accommodations to lessen the impact of their disability, they should register with AccessAbility Services at the beginning of each academic term.

• Changes to Course Outlines
  o Revised course outlines will be posted/provided, if course details change (e.g., topics covered, emphasis on certain topics, etc.)
  o Course elements that will not change are the:
    ▪ Grading scheme*
    ▪ Course elements related to evaluation

*Note the grading scheme will not change in such a way as to lower the mark any student. Elements may be dropped or reweighted to reflect technical problems such as service disruption, but final mark will always be the minimum of the grade under the old scheme and the grade under any new scheme.*)