Introduction to scientific computer programming techniques as applied to problem solving in physics, with examples from first year mechanics. Procedural programs, control structures, functions, and data storage. Numerical differentiation, integration, and solution of linear equation systems. Data analysis and visualization. [Offered: F]
Prereq: PHYS 111 or 121; Not open to students in Mathematics.
Antireq: PHYS 139, CS 121, 122, 123, 125, 131, 132, 133, 135, CHE 121, CIVE 121, ECE 150, GENE 121, NE 113, SYDE 121

2012F Session

Instructor

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Teaching Assistants

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Course Web Site

This course will use the gnh.uwaterloo.ca web site for problem submission and course coordination.

Learning Objectives

This course is about using computers to manipulate and visualize data and to solve physics problems.
Students who successfully complete this course will be comfortable using Python in their subsequent courses to solve problems and present data graphically.

Because Python is also used for many purposes other than solving physics problems the student should also be comfortable applying their new knowledge to other endeavours.

Textbook & Online Resources

- Python Programming Language Official Website
- Scientific Tools for Python
- Think Python
- Think Stats
- Course Notes

Lectures & Tutorials

Three 50 minute lectures in B1-370, Mondays, Wednesdays and Fridays, 08:30-09:20.
One 50 minute tutorial in B1-370, Fridays, 09:30-10:20.
Note that the Friday lecture and tutorial are back-to-back and that start time of the tutorial may be earlier than scheduled.

Course Content

We will divide the term up into thirds, with a test at the end of each third.
In the first third of the term we will introduce the Python programming language with applications from probability and statistics and an emphasis on data analysis and visualization.
In the second third of the term we will apply our new programming skills to solving equation of motion problems (eg kinematics, Newton’s second law and central force motion).
In the third third of the term we will examine matrix methods with applications from circuits, fields, oscillations and waves.

Assignments

There will be weekly assignments. These problems are to be submitted to the gnh web site. Only a selection of the submitted problems may be marked.
In general, assignments will be posted on Monday, briefly discussed during the Wednesday class, help will be available in the Friday tutorial, and due on the Sunday.
The assignments (and tests) are cumulative and so it is imperative that students keep up with the class.
Late assignments will not be accepted without a medical note.
I expect the assignments to take from five to ten hours per week to complete. If you find that you are taking either much less of much more time to complete the assignments please come and talk with me.

Term Tests

There will be three 90 minute term tests which are tentatively scheduled for Oct 5, Nov 2 and Nov 30 (ie, at the ends of weeks 4, 8 and 12).

Exam

There will be a 150 minute exam to be scheduled by the registrar.

Assessment

Assignments 40%
Term Tests 3 × 10%
Exam 30%

In order to pass the course a mark of 50% or better must be achieved on the final exam, otherwise the final exam mark will be the final mark.

Important Dates

Sept 10 Lectures Begin
Sept 29 Drop, Penalty 1 Begins
Oct 5 test 1
Oct 8 Thanksgiving Holiday
Oct 26 50% tuition refund deadline
Nov 2 test 2
Nov 17 Drop, Penalty 2 Begins
Nov 30 test 3
Dec 3 Lectures End
Dec 6 Exam Period starts
Dec 20 Exam Period ends

Disclaimer

The course content and dates given below will be followed as closely as possible, but it is possible that changes may occur. Any changes will be discussed and announced in class and posted on the course webpage. The assessment will remain unchanged.

CS Minor

Those students interested in a CS minor should discuss their options with their undergraduate advisor.
Rules & Regulations

Illness
If you are ill and are unable to complete one or more course elements you must obtain a “Verification of Illness” form from Health Services, have it signed by your doctor and bring it to the Science Undergraduate Office (Earth Sciences and Chemistry Building Room 253).

Accommodation for Missed Course Elements
If an assignment is missed for legitimate academic reasons the remaining assignments will be re-weighted accordingly.

If a term test is missed for legitimate academic reasons the exam will be re-weighted accordingly.

If the exam is missed due to illness and you are in good academic standing (ie you have a passing mark on both the assignments and the tests) you will be assigned an INC and you will be required to write the exam during the following term. It is your responsibility to arrange a mutually convenient time to write the exam. If you are not in good academic standing you will be assigned a DNW for your final mark.

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. [Check http://www.uwaterloo.ca/academicintegrity/ for more information.]

Student Grievances
“A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy #70, Student Petitions and Grievances, Section 4. http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm When in doubt please be certain to contact the department’s administrative assistant who will provide further assistance.”

Discipline
“A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about ‘rules’ for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students should refer to Policy #71, Student Discipline, http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm For typical penalties check Guidelines for the Assessment of Penalties, http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm

Appeals
“A decision made under Policy #70 (Student Petitions and Grievances) (other than petitions) or Policy #71 (Student Discipline) a student may appeal the finding, the penalty, or both. A student who believes he/she has a ground for an appeal should refer to Policy #72 (Student Appeals) http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm

Students with Disabilities
“Note for students with disabilities: The Office for Persons with Disabilities (OPD), 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 you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.”

Travel and the Final Examination Period
“Student travel plans are not considered acceptable grounds for granting an alternative examination time. (see http://www.registrar.uwaterloo.ca/exams/finalexams.html)”

Assignment 1.1. Summary #1
Read chapters 1-3 of the textbook. (a) List the key concepts in each chapter in point form. (b) List the three concepts in each chapter which you found most difficult.

Assignment 1.2. Pythons!
Download and install Python, SciPy, NumPy and MatPlotLib on your personal computer. (a) Do Problem 1.3.1 from the course notes. (b) Do Problem 1.3.2 from the course notes.

Assignment 1.3. Vectors & Matrices
Read Chapter 1 of the course notes. (a) Do Problem 1.4.1 from the course notes. (b) Do Problem 1.4.2 from the course notes.