Course Outline

PHYS/ACS-2112-001 Scientific Computing with Python

Contents

1   Course Information

- This course has two listings: PHYS-2112-001 and ACS-2112-001

- 2020 Fall Semester

- Instructor: Stuart Williams

- Email: stuw@swilliams.ca

- Class meeting times: Mon/Wed/Fri 8:30 a.m. - 9:20 a.m.

- Course Outline URL: https://uwcloud.uwinnipeg.ca/s/3aiKiFyPHZzoTAc

- Course Webpage and Schedule: On Nexus https://nexus.uwinnipeg.ca and/or https://uwcloud.uwinnipeg.ca/s/dazWxD6i5zsxN5b

- Office: Not available

- Course Format: Online-synchronous via video-conference

  - Lectures will not be recorded
  - Invitations will be sent to students' UWinnipeg email addresses
  - High-speed internet connection is required.
  - Students are expected to attend the online classes, for lectures, class activities and/or taking tests/exams. Students cannot be admitted to this course if they can't attend regularly due to having another course scheduled simultaneously.
  - Please disable notifications on your phon and computer during lectures.
  - For classes via video-conferencing, students are expected to be on time, raise hands when they have questions, and abide by the UW Respectful Working and Learning Environment Policy at http://www.uwinnipeg.ca/respect/
  - Students are strongly encouraged to have their video camera enabled.

- Office hours:

  Due to Remote Delivery of this course, there will be no in-person Office Hours. You can ask your questions via e-mail or other online means and I will do my best to answer them. However, to better answer your questions, a one-on-one conversation via video will be encouraged. Such sessions will be arranged by appointment only.

- Calendar Course Description from https://www.uwinnipeg.ca/academics/calendar/docs/all-course-descriptions.pdf

  PHYS-2112 (3) Scientific Computing with Python (3 hrs Lecture)

  This Python language course shows students how to create basic programming structures in Python including decisions, loops and more advanced topics such as object-oriented programming with classes and exceptions. Unique Python data structures such as tuples and dictionaries are introduced. Students learn how to create Python programs with graphic elements as well as data visualization and publication quality figures. Applications from a variety of scientific fields are discussed when appropriate.

  Note: Experience with elementary computer programming is recommended.

  Cross-listed: ACS-2112(3).

Experimental Course - This course is offered on a trial basis to gauge interest in the topic. Students who successfully complete this course receive credit as indicated.

Restrictions: Students may not hold credit for this course and ACS-2112.

2 Topics and Learning Outcomes

Upon the successful completion of this course, the student will have:

- A basic understanding of some basic computer science concepts:
  - Hardware and software in computing
  - Efficiency of computer algorithms
  - How variables are used in software, and two models of implementing them
- A basic understanding of computer programming:
  - Concept of data types
  - Specific data types: number, string, list, tuple, dictionary, set, file, np.array, pd.Series, pd.DataFrame
  - How computers represent numbers, characters, and pointers
  - How to write functions
  - Boolean expressions and if statements
  - Loops
  - Software testing strategies
  - Object oriented programming basics
- Some ability to code in Python using its basic features:
  - Objects
  - Names, namespaces, scopes and search order
  - Built-in data types and their most important operators and methods
  - Built-in functions
  - String formatting and f-strings
  - Sequence indexing and slicing
  - List comprehensions and generator expressions
  - Generators
  - Simple classes
  - Exceptions
  - Character encoding
  - Function locals, non-locals, globals
- Introduction for awareness to some advanced Python features
  - Class internals
  - Bound methods
  - Metaclasses
  - Decorators
  - Special methods of classes
  - Iterables, iterators, and the iterator protocol
- Basic ability to handle large amounts of data in Python efficiently with NumPy and Pandas
- Basic ability to visualize data with at least one Python visualization library
- Familiarity with techniques to measure and increase the performance of Python code
- Brief introduction to Machine Learning

Note that the details of the topics and learning outcomes above are tentative and some of them may not be achieved.

3 Course Material

The following free online books will be used in the course. Only parts of each book will be used.

- Think Python - How to Think Like a Computer Scientist 2nd Edition, Version 2.4.0 by Allen B. Downey (Green Tea Press). Copyright 2015 Allen Downey.

  Available free in PDF at https://greenteapress.com/wp/think-python-2e/ (and Jupyter notebooks adapted from it at several locations).

  This book teaches programming using Python.

- The Python Data Science Handbook by Jake VanderPlas (O'Reilly). Copyright 2016 Jake VanderPlas, 978-1-491-91205-8.

  Available free in PDF or Jupyter Notebooks at https://jakevdp.github.io/PythonDataScienceHandbook/

  This books teaches NumPy and Pandas.

Most "pages" in this book have lots of small code samples so the number of words per page will be about half of a typical textbook.

This book will be used both as a textbook and a reference. In its role as a textbook it presents concepts you should understand and on which you will be tested. In its role as a reference it may help you complete assignments.

- A Whirlwind Tour of Python by Jake VanderPlas (O'Reilly). Copyright 2016 O'Reilly Media Inc, 978-1-491-96465-1.

  Available free in PDF or Jupyter Notebooks at https://github.com/jakevdp/WhirlwindTourOfPython

  This book teaches programming with Python and is an alternative to Think Python.

4 Important Dates

- Sep 9 - Dec 8, 2020 - course lectures
- Oct 11-17 - fall term reading week (no classes)
- Oct 12 - Thanksgiving - no classes
- Nov 11 - Remembrance Day - no classes
- Nov 17 - Final date to withdraw without academic penalty
- Dec 7 - Last Monday class
- Dec 8 - Last class - makes up for Remembrance day
- TBD - Final Exam

For all other important dates, see https://www.uwinnipeg.ca/academics/calendar/docs/dates.pdf

5 Grade Distribution

- 30% Assignments (about 1 per week, approximately 10)
- 20% Test 1
- 20% Test 2
- 30% Final Exam

6 Important Notes

- Assignments:

  - Assignments will be usually given at the beginning of the class and will be due the following week before class, or other dates as specified by the instructor.
  - Assignments will be posted on the course webpage.
  - Assignments must be submitted online (via Nexus) as either Python code files or Jupyter notebook files, depending on the assignment.
  - Assignment submissions are not accepted via e-mail.
  - Late assignments will not be accepted without prior consent of the instructor.

- Assistance: Students are encouraged to consult with the instructor or lab assistant when experiencing difficulties in the course. We will do our best to help and/or provide advice.

- Tests/Exams:

  - Tests and Exams are administered and/or submitted online via Nexus. The format and specific instructions will be communicated prior to the test/exam date.
  - Authorized course materials and devices will be communicated prior to each test/exam.
  - Please note that student's activities will be monitored on Nexus and/or via video during the Tests/Exams.

- Communication: Only your University of Winnipeg email address will be used for course related correspondence.

- Grading System: Below are the guidelines for conversion from numerical (percentage) grades to letter grades. The final grades are approved by the Department Review Committee.

  Letter Grade - Percentage:

```
A+    95-100
A     87-94
A-    80-86
B+    74-79
B     67-73
C+    61-66
```

```
C      53-60
D      50-52
F       0-49
```

7 Academic Integrity

You are expected to take academic integrity very seriously and be mindful of your own activities and the requests/offers you may receive from others.

In addition to the guidelines in the Academic Calendar (Regulations and Policies, Subsection 8a), for all assessment items in this course, the following are considered cheating, plagiarism, or academic misconduct:

- Copying from another student's work and submitting it as your own (group or collaborative work approved by the instructor is not considered cheating).
- Consulting or copying from any unauthorized sources, including, but not limited to: the Internet; online calculators and graphing tools; assignments or tests/exams from previous years or from other courses; solutions provided by a third party (purchased or otherwise).
- Asking questions from another student or any unauthorized person during the exams and tests.
- Using any unauthorized sources during the tests and exams.
- Soliciting and obtaining solutions to the assignments, tests, and exams via any means of communication (e.g., e-mail, text, phone call, social media chats, etc.).
- Providing test or exam questions and/or solutions to another student, uploading them to a filesharing website, or otherwise sharing them outside the course.

It is your responsibility to know the policies and guidelines, and to be aware of the academic misconduct procedures. Anybody involved in the process could be charged with academic misconduct. For more information, please see the Academic Calendar, Regulations and Policies, Subsection 8a. https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf

8 Important Information from the Department and the Dean of Science

1. A permitted or necessary change in mode of delivery may require adjustments to important aspects of this course outline, like class schedule and the number, nature, and weighting of assignments and/or exams.

2. Students can find answers to frequently ask questions (FAQ) related to remote learning here: https://www.uwinnipeg.ca/covid-19/remote-learning-faq.html.

3. The first day of class is Sep 8, 2020. Last class will be held on Dec 8, 2020. Make-up classes, if required, to be determined.

4. When it is necessary to cancel a class due to exceptional circumstances, every effort will be made to inform students via UWinnipeg email, or on Nexus, via Course News.

5. Students have the responsibility to regularly check their UWinnipeg e-mail addresses to ensure timely receipt of correspondence from the University and/or their course instructors. Only your University of Winnipeg email address (Name@webmail.uwinnipeg.ca) will be used for course related correspondence.

6. Please note that withdrawing before the VW date does not necessarily result in a fee refund. A minimum of 20% of the work on which the final grade is based will be evaluated and available to the student before the voluntary withdrawal date. Please contact the instructor before withdrawing in case they can help in any way.

   VW date: Tuesday, Nov. 17, 2020

7. The dates the University is closed for holidays, irrespective of campus closure related to COVID-19: September 7 (Labour Day), Thanksgiving Day (October 12), November 11 (Remembrance Day).

   Fall mid-term reading week is October 11 - 17.

8. Regulations, Policies, and Academic Integrity. Students are encouraged to familiarize themselves with the "Regulations and Policies" found in the University Academic Calendar at: https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf. Particular attention should be given to subsections 8 ("Student Discipline"), 9 ("Senate Appeals"), and 10 ("Grade Appeals").

   Please note the importance of maintaining academic integrity, and the potential consequences of engaging in plagiarism, cheating, and other forms of academic misconduct.

   Even "unintentional" plagiarism, as described in the UW Library video tutorial "Avoiding Plagiarism" (https://www.youtube.com/watch?v=UvFdxRU9a8g) is a form of academic misconduct.

Similarly, uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) is a form of misconduct, as it involves "aiding and abetting" plagiarism. More detailed information can be found here: Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf.

9. Respectful Learning Environment. Students are expected to conduct themselves in a respectful manner on campus and in the learning environment irrespective of platform being used. Behaviour, communication, or acts that are inconsistent with a number of UW policies (e.g. Respectful Working and Learning Environment Policy https://www.uwinnipeg.ca/respect/respect-policy.html, Acceptable Use of Information Technology Policy https://www.uwinnipeg.ca/institutional-analysis/docs/policies/acceptable-use-of-information-technology-policy.pdf) could be considered "non-academic" misconduct. More detailed information can be found here: Non-Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf.

10. Copyright and Intellectual Property. Course materials are the property of the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides—irrespective of format. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy.

   Students must also seek prior permission of the instructor/presenter before, for example, photographing, recording, or taking screenshots of slides, presentations, lectures, and notes on the board (or computer). Students found to be in violation of an instructor's intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy.

11. Privacy. Students are reminded to know their rights in relation to the collecting of personal data by the University (https://www.uwinnipeg.ca/privacy/admissions-privacy-notice.html), especially if Zoom is being used for remote teaching (https://www.uwinnipeg.ca/privacy/zoom-privacy-notice.html) and testing/proctoring (https://www.uwinnipeg.ca/privacy/zoom-test-and-exam-proctoring.html).

12. Research Ethics. Students conducting research interviews, focus groups, surveys, or any other method of collecting data from any person, including a family member, must obtain research ethics approval before commencing data collection. Exceptions are research activities done in class as a learning exercise. For submission requirements and deadlines, see http://www.uwinnipeg.ca/research/human-ethics.html

13. Religious Holidays: Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work or examinations without penalty. A list of religious holidays can be found in the 2020-21 Undergraduate Academic Calendar.

14. Service for Students with Disabilities: Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams or during lectures/laboratories are encouraged to contact Accessibility Services (AS) at 204.786.9771 or https://www.uwinnipeg.ca/accessibility-services/ to discuss appropriate options. All information about a student's disability or medical condition remains confidential.