Course Outline

PHYS/ACS-2112-050 Scientific Computing with Python

Contents

1   Course Information

- This course has two listings: PHYS-2112-002 and ACS-2112-002

- 2021 Fall Term

- Instructor: Stuart Williams

- Email: st.williams@uwinnipeg.ca

- TA/Lab Assistant/Marker: phys-2112-ta@googlegroups.com

- Class meeting times: Tuesday evenings from 6:00 p.m. to 9:00 p.m.

- Course webpage, schedule, and outline: UW MS-Teams site

- Office: Not available

- Course Format: "LIVE ONLINE: Scheduled class times will take place using an online platform. Students must be available during the posted lecture times for live streaming and/or group interactions. High speed internet and access to an electronic device with a webcam (e.g., smart phone, laptop) is mandatory."

  - Lectures may be recorded and may be made available upon request.
  - Invitations to the video-call lectures will be sent to students' UWinnipeg email addresses.
  - Students will need to install Python and Jupyterlab on their personal computer to follow along with lectures and to complete assignments. If this is a problem, in theory https://colab.research.google.com or similar sites could be used instead with permission of the instructor.
  - Students are expected to attend all online classes for lectures, class activities, and tests and exams. Please disable notifications on your devices.
  - Students are expected to be on time, come prepared to ask questions, and abide by the UW Respectful Working and Learning Environment Policy at http://www.uwinnipeg.ca/respect/
  - Students are expected to have their video enabled. This helps everyone (you, other students, and the instructor) engage with the subject and others. If you have a concern with this, talk with the instructor.

- To minimize noise, students should stay muted except when asking or answering questions. You may also use the meeting chat function, but the instructor may not notice new questions for a few minutes when focused on the shared screen. Feel free to attract their attention via the meeting software's raise-hand function, or raise your hand or otherwise get their attention via video, or unmute.

- Office hours:

  Due to Remote Delivery of this course, there will be no in-person Office Hours. You can start by asking questions via e-mail to the TA/Lab Assistant/Marker address phys-2112-ta@googlegroups.com (which the instructor also monitors). The TA or instructor may decide to schedule a video meeting.

- 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.

  Cross-listed: ACS-2112

  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.

- Caution: Prior course-work or experience with computers and elementary computer programming is strongly recommended. Historically, students without any programming experience have rarely succeeded except by putting in extra work, especially in the first half of the course.

2 Topics and Learning Outcomes

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

- Basic understanding of some basic computer science and programming concepts:
  - How variables are used in software, and two models of implementing them
  - Concept of data types
  - Character encoding
  - Functions
  - Boolean expressions and if statements
  - Loops
- Basic ability to code in Python: - Names, namespaces, scopes and name 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 - 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.

  This book teaches programming, using Python as the example language.

Available free in PDF format at https://greenteapress.com/wp/think-python-2e/, HTML format at http://greenteapress.com/thinkpython2/html/index.html, and Jupyter notebooks adapted from it at several locations.

Other editions will be similar, but some exercises will be assigned from the book by exercise number, so be sure you have the correct version by checking it.

- 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, assuming you already know some Python.

  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 can be used as an alternative or supplement to the Think Python book.

4   Important Dates

- September 7 to November 30 2021: - course lectures
- October 10 - 16: - Reading Week (no classes)
- November 16 - Final date to withdraw without academic penalty
- TBD - Final Exam

- December 10 - 23: The Fall Term evaluation period. Note final assignments may be due before December 23rd.

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

5 Grade Distribution

- 45% Assignments (about 12, one per week, varying weights)
- 15% Test 1
- 15% Test 2
- 25% Final exam

6 Important Notes

- Assignments:

  - Assignments will usually be finalized and communicated on Tuesday or Wednesday and will be due the following Monday at 8 a.m. may change.
  - Assignments must be submitted online (details TBD) as either Python code files and/or Jupyter notebook files, depending on the assignment.
  - Late assignments will not be accepted without prior consent of the instructor.
  - You should try first to complete your assignments without any assistance. If you succeed, you'll learn the most. However, if you are stuck, you are allowed to receive help with assignments, but you are not allowed to copy code from a helper, the internet, or anywhere, to complete an assignment. A good rule of thumb is you can talk with others about how you might approach a solution, but you can't take any notes; then you have to do a different activity for at least an hour, for example studying for a different class, and then after that you should try to complete your assignment.

- Assistance: Students are encouraged to consult with the TA/lab assistant or instructor 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. 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 may be monitored during online quizzes/tests/exams, including via video.

- Communication: 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 Physics Department Review Committee.

  Letter Grade - Percentage:

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  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
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The following list contains the general items/notes provided by the Deans and the Senate for Course Outlines.

The section on Academic Integrity has been prepared by the Department of Physics Review Committee (DRC) in consultation with the Department's members for inclusion on the Course Outlines.

Details about COVID-19 Safety protocols, policies and rules are also included.

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 Department and Dean

The following list contains the general items/notes provided by the Deans and the Senate for Course Outlines.

The section on Academic Integrity has been prepared by the Department of Physics Review Committee (DRC) in consultation with the Department's members for inclusion on the Course Outlines.

Details about COVID-19 Safety protocols, policies and rules are also included.

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. Students can find answers to frequently asked questions (FAQ) related to University Services and

updates during the COVID-19 pandemic here: https://www.uwinnipeg.ca/covid-19/index.html

4. The method of delivery and submission of graded work should be specified, as well as the type of equipment/resources authorized for use in tests/exams.

5. When it is necessary to cancel a class due to exceptional circumstances, every effort will be made to inform students via UWinnipeg email, or via the class MS-Teams channel.

6. 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.

   Your University of Winnipeg email address (Name@webmail.uwinnipeg.ca) will be used for course related correspondence.

7. 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. I encourage you to contact me before withdrawing in case I can help in any way. VW dates: Fall courses - Tuesday, Nov. 16, 2021.

8. The dates the University is closed for holidays in the fall term, irrespective of campus closure related to COVID-19: September 6 (Labour Day), September 30 (Truth and Reconciliation Day), Thanksgiving Day (October 11), November 11 (Remembrance Day).

9. 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 emphasize the importance of maintaining academic integrity, and to 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.

10. 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.

11. 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 instructorâ€™s intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy.

12. 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).

13. 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

14. Religious Holy days: 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.

15. 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 studentâ€™s disability or medical condition remains confidential.