PHYS 248 – Computer Assisted Mathematics and Physics

January-April 2026

Lecture	M,Th	10:00am - 11:20am	CRN 22619
Lab	M,Th	11:30am - 12:50pm	CRN 22620

Professor Bob Kowalewski, kowalews@uvic.ca, Elliot 204
Office hours: TBA

UVic Calendar Description:
Use of a high-level computing language for physics simulations, physics calculations and modelling of physical systems. Use of both packaged routines and purpose-written short programs for numerical and symbolic computation, visualization, and data management. Taught in a computing language with strong support for physics calculations. Emphasis on hands-on coding in a variety of physical applications.

Topics
Topics include: number systems on computers, numerical analysis, verification and validation, numerical solutions to differential equations, use of pseudo-random processes (Monte-Carlo, etc), data visualization, discovering statistical trends in data, and symbolic computation.

Learning outcomes
The focus is on using python in Jupyter notebooks as a tool for exploring and understanding physical systems. This is not a course in basic coding – you've already taken that. We apply computational methods to problems that are sometimes open ended; you need to decide what questions to ask, what validation checks to do, what plots to make, what conclusions to draw. Assignments and labs emphasize practical exercises in programming and computational analysis and require students to critically assess the results they obtain with their calculations. The computation and its output must be incorporated into a clear narrative description of the problem under study, i.e. you must write in English as well as in python.

Python has a huge number of external libraries available; we sample only a few, but you learn how to access and use other libraries as needed. The course also explores how generative AI can be used as a tool to help with computational problem solving. There is an emphasis on validating and exploring computer-generated solutions. We prioritize clarity and correctness over computational efficiency.

Teaching Assistants
Three TAs will be supporting this class. TAs will offer office hours on several days each week; details will be posted on Brightspace. TAs will monitor and respond to requests for help, preferentially through the Student Forum on Brightspace, as time permits.

Course Delivery

You are encouraged to bring your laptop to the lectures. Attendance in the labs is required, and you ***must bring your own laptop*** (tablets aren't adequate). Computational work is performed on a central teaching server via a web browser. There are no special software requirements other than an up-to-date browser, such as Firefox or Safari or Chrome.

Course Textbook

There is no required textbook. There are abundant, free resources available online; links to some of these are provided on Brightspace. Take advantage of these resources, including generative AI models that can both produce python code and explain how it works.

Assessments and Final Grade

The final grade is computed from the lab completion mark (10%), a mid-term exam (15%), assignments (4 x 10%) and the final exam (35%). Exams are written in exam booklets with no online access. The mid-term exam is in class on **February 26**. The final exam data will be announced later.

Each lab has two activities that must be completed in a Jupyter notebook on the course server. Each activity has one or more numerical or character string answers that must be entered into the associated Brightspace quiz. A correctly completed activity yields one point. There are 2 points per lab, 1 lab per week for 11 weeks, giving a total of 22 points. The first activity must be completed during the lab session and the second before the next class. TAs will spot-check lab notebooks; if your notebook does not correspond to your submitted answer your point will be revoked. ***You must complete 60% of the total number of laboratory activities to pass the course***. If a lab point is missed (e.g. due to illness-related absence) it can be recovered until the end of the following week by talking to a TA and showing them the work.

There are four graded homework assignments related to the material covered in the lectures and labs. These assignments must be done independently by each student. If generative AI is used it must be ***appropriately cited***, saying which AI model was used, and providing the prompt string(s). You are responsible for ensuring that the assignments are correct and complete – no sympathy points are awarded if "the AI gave me the wrong answer." The assignments ask you not only to write code to solve a problem, but also to determine what scenarios to explore with your code and to discuss your results. These discussions are important – they count for nearly ½ of the marks, so take them seriously. Given the easy access you have to tools both for coding and for writing English text, handing in assignments that are wrong, or incomplete, or poorly explained is strongly penalized by the markers. You should write these assignments as if they were being prepared for your boss/manager in a professional setting, and as if your pay or promotion depended on it.

Missed Assessments

There are no makeup assignments or exams. If you are excused from the midterm, the final exam will count for 50% of your final grade. All assignments must be completed – if you are unable to complete an assignment by the usual due date I deduct 5% per day late. If you have a valid reason for late completion I reduce or remove the late penalty as appropriate.

University policies

The general UVic undergraduate course policies apply (see the "About this course" module on Brightspace for details). You are required to review and acknowledge the section on academic integrity and complete the associated self-assessment on Brightspace.