UNIVERSITY OF CALGARY
FACULTY OF SCIENCE

Department of Physics & Astronomy
Science B 605
403 220-5385
phasoffice@ucalgary.ca

COURSE OUTLINE

1. **Course:** PHYS 581, Computational Physics III - Winter 2021

   Lecture 01: T 09:30 - 10:20 - Online

Instructor	Email	Phone	Office	Hours
Dr Brian Jackel	bjackel@ucalgary.ca	403 220-4271	SB 627	2-4pm Wednesday

Online Delivery Details:

Some aspects of this course are being offered in real-time via scheduled meeting times. For those aspects you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

Lectures for each class will be delivered via Zoom. Recordings of each session will be placed in D2L.

The "discussion" and "project presentation" elements can be done asynchronously by students submitting video recordings.

Although this instance of Physics 581 is registered for "hybrid" delivery, it should be possible for students to complete all graded course components asynchronously.

1) Live lectures will be presented via Zoom Tuesday/Thursday from 9:45-10:15am with recordings available via the D2L page. Zoom breakout rooms will be available for students to work in teams and interact with the instructor, but this will not be mandatory.

2) Student driven micro-topic presentations and discussions will take place on Zoom from 9:30 to 9:45am Tuesday/Thursday. Asynchronous student presentations may be submitted as video files.

The instructor will be available for guidance on Zoom from 10:15 to 11:00 Tuesday/Thursday. Additional contact time can be scheduled as needed.

Course Site:

D2L: PHYS 581 L01-(Winter 2021)-Computational Physics III

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section 3.5.C in the Faculty of Science section of the online Calendar.

Prerequisite(s):
Physics 481; and Mathematics 433 or Physics 435.

3. **Grading:**

The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Workflow	10	
Discussion	10	
Assignments (5-7)	60	Throughout term
Project report and presentation	20	April 30

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

Grading

Discussion (10%) - during the term each student will select two topics that are somehow connected to course material. They will enter a title and supporting link(s) to the discussion board and make a brief (1-5 minute) class presentation with questions. [For asynchronous participation a 3-5 minute video and follow-up to questions in the discussion thread will be accepted.] There will be 0-3 of these micro-topics covered in each class.

Workflow (10%) - interim document (epub or pdf) after reading week (5%), final document by end of classes (5%)

Assignments (60%) 5-7 Jupyter notebooks roughly every 3-4 classes. Students can work in groups of 1-3. Lowest assignment grade will be zero-weighted ie. you can skip one assignment.

Project (20%) - student selected topic (as individual). Proposal/preliminary work due 2 weeks after reading week for class feedback and revision (5%). Final report due by end of term (15%).

4. **Missed Components Of Term Work:**

   The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

   In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

5. **Scheduled Out-of-Class Activities:**

   There are no scheduled out of class activities for this course.

6. **Course Materials:**

   Course notes and links provided on D2L.

   In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

   - A computer with a supported operating system, as well as the latest security, and malware updates;
   - A current and updated web browser;
   - Webcam/Camera (built-in or external);
   - Microphone and speaker (built-in or external), or headset with microphone;
   - Current antivirus and/or firewall software enabled;
   - Stable internet connection.

   For more information please refer to the UofC ELearning online website.

7. **Examination Policy:**

   No aids are allowed on tests or examinations.

   Students should also read the Calendar, Section G, on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

   There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

   For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

10. **Human Studies Statement:**

    Students will not participate as subjects or researchers in human studies.

    See also Section E.5 of the University Calendar.

11. **Reappraisal Of Grades:**

    A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

    a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections I.1 and I.2 of the University Calendar

    b. **Final Exam:**The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **Other Important Information For Students:**

    a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).

    b. **SU Wellness Services:** For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.

    c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208. The complete University of Calgary policy on sexual violence can be viewed at (https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf)

    d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional Code of Conduct and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

       Student Handbook on Academic Integrity
       Student Academic Misconduct Policy and Procedure
       Research Integrity Policy

       Additional information is available on the Student Success Centre Academic Integrity page

    e. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at procedure-for-accommodations-for-students-with-disabilities.pdf.

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email phas.ahugrd@ucalgary.ca or phone 403-220-8127. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.

f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.

g. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: ombuds@ucalgary.ca.

h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

Syllabus

Workflow - coding with notebooks and IDEs; documentation management and report generation with LaTeX and Sphinx.

Moore's law and limits to computing

Neural networks for classification and regression

Complex error function - power series and continued fractions, advanced algorithms, calling c/Fortran from python

super-scalar programming: vector computation, shared memory, multiple processes with multiple cores, multiple systems

Geomagnetic field modelling - spherical harmonics, field line tracing, adiabatic invariants

Course Outcomes:

- Assess how problems in physics and astrophysics can be recast into computationally solvable problems
- Construct logic and flow approaches to physical solutions to more complex physical and astrophysical problems. Determine which aspects of a physical problem are best served by computational or numerical analysis
- To understand how their graduate research will be advanced by the use of modern scientific computing skills and tools
- The ability to analyse more complex physics and astrophysics problems using more advanced numerical techniques.
- Grasp the importance of the use of random numbers in physics and astrophysics
- Master the world of Monte-Carlo techniques and its ramification to various problems in academia and beyond academia.
- Develop a keen sense of analysis of differential equations with a much wider application in physics and astrophysics

- How to use Finite-difference, Finite-volume and Finite-elements methods to problems in hydrodynamics, plasma physics and other known physical and astrophysical problems.
- How to apply of Fast Fourier Transform to a wide variety of real problems in physics, signal analysis, engineering etc ...

Electronically Approved - Jan 08 2021 14:39

Department Approval

Electronically Approved - Jan 10 2021 15:59

Associate Dean's Approval