UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: September 2002
REVISED COURSE IMPLEMENTATION DATE: September 2018
COURSE TO BE REVIEWED: (six years after UEC approval) February 2024
Course outline form version: 09/15/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: PHYS 393	**Number of Credits:** 3 Course credit policy (105)
Course Full Title: Computational Physics I **Course Short Title (if title exceeds 30 characters):**	
Faculty: Faculty of Science	**Department (or program if no department):** Physics

Calendar Description:

Symbolic and numerical computational physics focusing on plotting and fitting data; applications of numerical techniques and Monte Carlo methods; simulating and animating time-dependent systems; and random walks and diffusive processes.

Prerequisites (or NONE):	None.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	PHYS 221. Note: As of January 2019, PHYS 221 must be taken as a prerequisite course.

Equivalent Courses (cannot be taken for additional credit)
Former course code/number:
Cross-listed with:
Equivalent course(s):
Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit
Transfer credit already exists: ☐ Yes ☒ No
Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)
Resubmit revised outline for articulation: ☐ Yes ☐ No
To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 75
Typical structure of instructional hours:

Lecture hours	75
Seminars/tutorials/workshops	
Laboratory hours	
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**75**

Special Topics
Will the course be offered with different topics?
☐ Yes ☒ No
If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit
Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 24

Expected frequency of course offerings (every semester, annually, etc.): On demand, usually every 3 years

Department / Program Head or Director: Jeff Chizma	**Date approved:**	May 12, 2017
Faculty Council approval	**Date approved:**	May 26, 2017
Campus-Wide Consultation (CWC)	**Date of posting:**	September 15, 2017
Dean/Associate VP: Lucy Lee	**Date approved:**	May 26, 2017
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	February 23, 2018

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Perform symbolic calculations using a computer algebra system.
- Produce publication-quality plots.
- Apply iterative numerical algorithms to tasks such as finding roots, computing definite integrals, and solving initial-value problems.
- Animate a discretized, time-dependent physical system.
- Apply Monte Carlo methods to numerical integration, sequential probabilistic events, and error propagation.
- Apply random walk models to simulate diffusion of a non-interacting collection of particles.
- Perform a weighted least-squares fit of a data set to some function with free parameters.
- Design a four-week long investigation of a non-trivial physical system utilizing simulations and/or numerical methods.
- Construct a research poster.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods (guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion)

Active learning classroom, projects

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☒

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials (if more space is required, download Supplemental Texts and Resource Materials form)

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.		http://www.wolfram.com/support	☐		
2.		https://www.python.org/doc/	☐		
3.			☐		
4.			☐		
5.			☐		

Required Additional Supplies and Materials (software, hardware, tools, specialized clothing, etc.)

A student licence for Mathematica is highly recommended.

Typical Evaluation Methods and Weighting

Final:	%	Assignments:	50%	Midterm exam:	%	Practicum:	%
Quizzes/tests:	%	Lab	%	Field experience:	%	Shop work:	%
Project/Presentation	50%	Other	%	Other:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

- Algebra and calculus using a computer algebra system
- Importing, exporting, manipulating, and plotting data
- Applying numerical methods to root finding, integration, and initial-value problems
- Simulating/animating time-dependent physical systems
- Monte Carlo methods and applications
- Random walks and diffusive processes
- Curve fitting and residuals
- Final project and poster: Students will be required to numerically investigate a non-trivial scientific system that they have simulated using either Mathematica or Python. Students will then create a high quality poster presenting their results