Syllabus Introduction to Computational Physics
PHYS F220 F01 – Spring 2022

Credits:	4.0
Laboratory:	Noyes Lab, REIC Thur 08:00 – 11:00
Lecture:	REIC 165 MWF 13:00 – 14:00
Prerequisites:	MATH F202X; PHYS F211X; PHYS F212X; PHYS F213X; or permission of instructor.
Instructor:	Martin Truffer
Office:	ELVE 401D (Geophysical Institute or GI)
Office Hours:	During all laboratory periods, 12-1:00 pm MWF at REIC 116 or at the GI by appointment. My schedule at the GI is uncertain; please arrange an appointment via email (preferred) or telephone prior to visiting. I can also set up zoom sessions at your request, which might work best for helping with code.
Contact:	ELVE 401D 474-5359 Email `mtruffer2@alaska.edu`
Website:	I will post all course material, syllabus, homework assignments, labs, solutions, and sample code on Google Classroom.
Text:	The course curriculum is based on *Computational Physics, 2nd Ed.* by Giordano and Nakanishi. The book is not required, but does provide useful additional information. However, the book is Fortran based, and we will program in Python in this class. I will distribute a manuscript with lecture notes that are based on this book for your use. A good Python based book is *Computational Physics* by M. Newman. Much of that material is available online at http://www-personal.umich.edu/~mejn/computational-physics/ Generally, there are many online resources for help with Python, and you're encouraged to spend some effort finding one that suits you well. For specific programming questions https://stackoverflow.com is an amazing resource.
Grading:	Grades will be based on the weights given here and ± modifiers will be used. Letter grade ranges will be assigned as follows: A+ [97-100%], A [93-96%], A- [90-92%], B+ [87-89%], B [83-86%], B- [80-82%], C+ [77-79%], C [73-76%], C- [70-72%], D+ [67-69%], D [63-66%], D- [60-62%] and F [<60%].
Course Description:	This course is intended as an introduction to the art and science of solving physics problems with a computer. The computer will be used as a tool to provide insight into physical systems and their behavior in all areas of physics. It is designed for undergraduate students who have completed their introductory coursework in physics and calculus. The course combines lectures and computer laboratory exercises.
Learning outcomes:	The overarching goal of this course is to teach you how to think critically about using the computer as a tool for understanding the physical world.

Mid-term Exam	20%
Final Exam	25%
Homework	10%
Project	20%
Laboratory	20%
Participation	5%

	Specific goals are: 1) Learn to develop numerical algorithms and turn them into workable code. 2) Learn to solve ordinary differential equations using computational tools. 3) Introduce computational data handling tools, such as the Fast Fourier Transform and simple data fitting. 4) Introduce the numerical solution of partial differential equations 5) Understand the concept of using random walks to solve physical problems The course will have succeeded if you will know the necessary tools to address problems in physics that cannot be solved analytically, and if you feel comfortable using these tools.
Lab Sessions:	There is a weekly 3-hour lab session associated with this course. Each week you will have a laboratory session involving problems in computational physics. You should be able to complete the bulk of your lab work and report during the laboratory session. **During the lab sessions you should not expect me to provide answers to your every question, as the laboratory is a place of self-discovery.** However, I will be present in the lab and help you through potential sticky spots.
Homework:	Weekly homework assignments are based on the lectures and labs. These assignments will be due one week after they are assigned.
Participation:	You are expected to fully attend both the laboratory and lecture sessions. Planned absences should be discussed with me in advance. Habitual tardiness or absenteeism affects not only your own performance, but also that of your classmates. Assessment will be based on your contributions to class discussions and laboratory investigations.
Project:	You will choose a computational physics problem of your own, develop and execute a solution. You are encouraged to develop your own idea, but extensions to lab problems (add more physics) are suitable topics. The textbook, other books, and the internet offer many suggestions for suitable projects. You are encouraged to discuss these with the instructor. A written project proposal will be submitted not later than the lecture session of 9 March. The project proposal should be no longer than 2 typewritten pages. It includes a fitting title, concise abstract, a description of the physics addressed in the project, a short description of the numerical methods used, and a list of expected results (figures, code, etc). The instructor will provide feedback on the content of this proposal, as well as the writing. The project proposal is part of the final project grade. You will submit a complete, written solution of the problem, to include working codes, prior to the beginning of the final scheduled lecture. The final report will be an expanded version of the Project Proposal with title, abstract, explanation of the physics investigated, description of the numerical method, presentation of results, a conclusion, and a bibliography. The expected length of the report is about 4 pages. You should also submit all working code as an appendix (in addition to these 4 pages). You will give a 10-minute presentation of your project to the class during the final lab session on 24 April. The presentation should be structured similarly to your written report. You will receive some additional guidance for making oral

	presentations during class, one or two weeks before the end of the semester.
Exams:	A one-hour mid-term examination will be given in lieu of lecture on 23 March. A two-hour final examination will be given 3 May, beginning at 13:00, per the UAF Exam Schedule. Both will be held in REIC 165.

Course modality: The general expectation is that the course will be taught in person, but depending on the Covid situation this might change to online or hybrid. There will also be a few times this semester when the instructor is away from Fairbanks due to research commitments and will either do pre-recorded or online lectures. This will be communicated well ahead of time.

Student Code of Conduct: You are expected to submit work that is your own and properly acknowledge the work of others. You are responsible for understanding and adhering to the Student Code of Conduct that is printed in the UAF Course Catalog. **Abide By It.** Violations of the Code will be reported to the Dean of Students.

Special Needs: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. We will work with the Office of Disabilities Services (Room 203 WHIT, Phone 474-7043) to provide reasonable accommodation to students with disabilities.

Plagiarism: Plagiarism and cheating are matters of serious concern for students and academic institutions. This is true in this class as well. The UAF Honor Code (or Student Code of Conduct) defines academic standards expected at the University of Alaska Fairbanks which will be followed in this class. (Taken from the UAF plagiarism web site, which has many links with good information about this topic)

Complaints and Concerns: You are always welcome to talk to me about anything, however, if you have a non-subject matter question or concern that cannot be resolved by me, contact the Center for Student Rights and Responsibilities (https://uaf.edu/csrr/index.php).

Student Protections and Services: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/.

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: https://alaska.edu/nondiscrimination/.

Incomplete Grade: Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy: “The letter “I” (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student’s control, such as sickness, has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an “I” grade.”

Technology requirements: To access instructor’s lecture notes on Google Classroom, students will need to have access to the internet and software to view pdf files.

Effective communication: Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from the UAF Department of Communication's Speaking Center (907-474-5470, speak@uaf.edu) and the UAF English's Department's Writing Center (907-474-5314, Gruening 8th floor), and/or CTC's Learning Center (604 Barnette Street, 907-455- 2860).