Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring
Year: 2025
Course Prefix: PHYS
Course and Section #: 3330-001
Course Title: Computational Physics
Credits: 3

Course Description

This course introduces to physics majors the foundational principles and ideas of applying programming methods to solve complex physics problems from multiple fields. Students will also learn fundamental signal processing techniques to produce meaningful and easily interpreted results from data analysis algorithms. The first lecture of the week will introduce the topic for the week and the format of problems to be solved, subsequent lectures will focus on the students' progress through the weeks project.

Course Attributes

This course has the following attributes:
☐ General Education Requirements
☐ Global/Intercultural Graduation Requirements
☐ Writing Enriched Graduation Requirements
☒ Discipline Core Requirements in Program
☐ Elective Core Requirements in Program
☐ Open Elective
Other: *Click here to enter text.*

Instructor Information

Instructor Name: Dr. Brian Patchett

Student Learning Outcomes

When completed the successful student will be able to do the following:
- Solve basic ordinary and partial differential equations in Matlab.
- Construct general numerical and iterative algorithms to model or solve physics problems.
- Create fundamental numerical analysis algorithms.
- Implement mathematical algorithms to solve undergraduate physics problems from any field.
- Display outputs in simple, easy to digest forms, such as plots, tables, executive summaries, etc.
- Use Matlab as both a general data analysis tool, and a physics modeling tool.

Course Materials and Texts

Computational Physics 330 by R. L. Spencer and M. Ware
Computational Physics 430 by R. L. Spencer and M. Ware
Introduction to Matlab by R. L. Spencer and M. Ware

Laptop with latest release of Matlab installed.
Internet access to view assignments and texts on Canvas.

Course Requirements

Course Assignments, Assessments, and Grading Policy

- Lecture quizzes worth 5 pts. make up 30% of the grade.
- Programming projects worth 10-20 pts. each make up 60% of the grade.
- A final project worth 20 pts. will make up 10% of the grade.

Required or Recommended Reading Assignments

All textbooks listed above by Spencer/Ware. (provided)
In-class handouts with additional information on completing the assignments successfully. (provided)
Random Data 4th ed. by J. S. Bendat and A.G. Piersol (recommended)

General Description of the Subject Matter of Each Lecture or Discussion

Week 1: Introduction to Matlab and Basic Plotting Functions
Week 2: Advanced Visualization tools, Basic Signal Input and Analysis
Week 3: Numerical Integration Techniques Using Calculus and Differential Equations
Week 4: More Numerical Solutions to Ordinary Differential Equations
Week 5: Intermediate Signal Analysis
Week 6: Numerical Solutions for Projectiles Starting with a Baseball
Week 7: Advanced Visualization Tools, Animation
Week 8: Signal Processing, Using Matlab to Perform a Fast Fourier Transform
Week 9: Signal Processing, Application of Windowing Functions to Data Sets
Week 10: Signal Processing, Cross- and Auto-spectra
Week 11: Computational Analysis, Transfer Functions and the Impulse Response
Week 12: Computational Analysis, Find Impulse Response of a Given Data Set
Week 13: Computational Analysis, Beam Forming and Signal Location
Week 14: Propose your Final Project and Begin
Week 15: Submit Final Project

Required Course Syllabus Statements

Generative AI

AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to develop your own individual voice. At the same time, you should learn how to use AI and in what instances AI can be helpful to you. The use of generative AI tools (e.g. ChatGPT, Google Bard, etc.) is permitted in this course for the following activities:

· To help you clarify concepts and find real world applications.
· Homework support if you have attempted the problem and sought one of the following resources first: your textbook, a fellow classmate, a tutor, or the professor.
· Using AI as a tutoring system to practice problems and concepts.

The use of generative AI tools is not permitted in this course for the following activities:

· To find the final equation to plug your numbers into.
· During class, including group problems and tests.

Using Remote Testing Software
☒ This course does not use remote testing software.

☐ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities
Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity
At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX
Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation
UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.
To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.