

PHYS 441

Fall 2023

Office: Luter 304

Office Hours: Mon/Wed/Fri 1pm-2pm (mix of online and in person), or by appointment

Dr. Edward J. Brash

[edward.brash@cnu.edu](mailto:edward.brash@cnu.edu)

594-7451

## MODELING AND SIMULATION

### Textbook and Software:

There is not a “required” text for this course. The problems and case studies that we work with in this course will come from a variety of sources, and I will provide you with references as we go through each section of the course.

This course is about how to solve problems on a computer. To do that, one obviously has to choose both a programming language/environment, and a development environment. There are a host of options available for each of these.

This past summer, I spent a lot of time developing solutions to many different types of problems in Python, using PyCharm as the development environment, and my plan is to use Python and PyCharm, together with Jupyter Notebooks as a platform for the examples that we discuss in class. I will provide much more detail in class on how you can get set up your own development environment (on whichever operating system you like).

I will make at some/most/all of these programs available to you, via GitHub, throughout the course, both as a form of lecture material and as starting points for the assignments.

### Goals:

To study and understand some of the most basic and useful techniques in numerical analysis, modeling, and simulation.

To develop a suite of useful programs, methods, and libraries which you will be able to apply to a host of problems going forward.

To develop an appreciation for and understanding of some of the applications of numerical analysis in the modeling and simulation of interesting real-world processes and situations.

**Topics:** Numerical errors in computation, computational solutions to some simple differential equations, methods of calculating derivatives, Runge-Kutta methods, non-linear curve fitting, data science, random number generation, Monte Carlo methods, game strategy.

**Homework:** Assignments will be given periodically, usually once per week, and in most cases will be due approximately one week later.

<b>Grading:</b>	Homework	70%
	Comprehensive Final Project	30%

Homework is due by 5:00 pm on the due date. No extensions will be given, except in the case of a valid DOCUMENTED reason.

The evaluation of your performance in this course will be based entirely on the regular homework assignments and the final project. There is no possibility to do extra work for extra credit.

Final grades will be assigned as follows:

A = 87-100%; A<sup>-</sup> = 80-86 %  
B<sup>+</sup> = 77-89 %; B = 73 -77 %; B<sup>-</sup> = 70 - 73 %  
C<sup>+</sup> = 67-79%; C = 63 -67 %; C<sup>-</sup> = 60 - 63 %  
D<sup>+</sup> = 57-59%; D = 53 -57 %; C<sup>-</sup> = 50 - 60 %  
F < 50%

**Additional Information, provided by the CNU Administration, which you may find useful (and with which I happen to agree, in general):**

**Christopher Newport University  
Official Syllabi Statements  
AY 2022-2023**

**University Statement on Diversity and Inclusion:**

The Christopher Newport University community engages and respects different viewpoints, understands the cultural and structural context in which those viewpoints emerge, and questions the development of our own perspectives and values, as these are among the fundamental tenets of a liberal arts education.

Accordingly, we affirm our commitment to a campus culture that embraces the full spectrum of human attributes, perspectives, and disciplines, and offers every member of the University the opportunity to become their best self.

Understanding and respecting differences can best develop in a community where members learn, live, work, and serve among individuals with diverse worldviews, identities, and values. We are dedicated to upholding the dignity and worth of all members of this academic community such that all may engage effectively and compassionately in a pluralistic society.

If you have specific questions, suggestions or concerns regarding diversity on campus please contact [Diversity.Inclusion@CNU.edu](mailto:Diversity.Inclusion@CNU.edu)

**Disabilities/Accessibility:**

In order for a student to receive an accommodation due to a disability, that disability must be on record in the Office of Student Affairs, 3<sup>rd</sup> Floor, David Student Union (DSU). If you have a diagnosed disability, please contact Jacquelyn Barnes, Student Disability Support Specialist in Student Affairs (594-7160) to discuss your needs.

Students with documented disabilities are to notify the instructor at least seven days prior to the point at which they require an accommodation (the first day of class is recommended), in private, if accommodation

is needed. The instructor will provide students with disabilities with the reasonable accommodations approved and directed by the Office of Student Affairs. Work completed before the student notifies the instructor of his/her disability may be counted toward the final grade at the sole discretion of the instructor.

**Success:**

I want you to succeed in this course and at Christopher Newport. I encourage you to contact me during office hours or to schedule an appointment to discuss course content or to answer questions you have. If I become concerned about your course performance, attendance, engagement, or well-being, I will contact you first. I also may submit a referral through our Captains Care Program. The referral will be received by the Center for Academic Success as well as other departments when appropriate (Counseling Services, Office of Student Engagement). If you are an athlete, the Manager of Athletic Academic Success Programs will be notified. Someone will contact you to help determine what will help you succeed. Please remember that this is a means for me to support you and help foster your success at Christopher Newport.

**Public Health**

The university will provide guidance on public health issues and students will be expected to comply with university protocols.

**Academic Support:**

The Center for Academic Success offers free tutoring assistance for Christopher Newport students in several academic areas. Center staff offer individual assistance and/or workshops on various study strategies to help you perform your best in your courses. The center also houses the Alice F. Randall Writing Center. Writing consultants can help you at any stage of the writing process, from invention, to development of ideas, to polishing a final draft. The Center is not a proofreading service, but consultants can help you to recognize and find grammar and punctuation errors in your work as well as provide assistance with global tasks. Contact them as early in the writing process as you can!

You may contact the Center for Academic Success to request a tutor, confer with a writing consultant, obtain a schedule of workshops, or make an appointment to talk with a staff member about study skills and strategies. The Center is located in Christopher Newport Hall, first floor, room 123. You may email [academicsuccess@cnu.edu](mailto:academicsuccess@cnu.edu) or call (757) 594-7684.

**Course Materials:**

All content created and assembled by the faculty member and used in this course is to be considered intellectual property owned by the faculty member and Christopher Newport University. It is provided solely for the private use of the students currently enrolled in this course. To ensure the free and open discussion of ideas, students may not make available any of the original course content, including but not limited to lectures, discussions, videos, handouts, and/or activities, to anyone not currently enrolled in the course without the advance written permission of the instructor. This means that students may not record, download, screenshot, or in any way copy original course material for the purpose of distribution beyond this course. A violation may be considered theft. It is the student's responsibility to protect course material when accessing it outside of the physical classroom space.

**Honor Code and Cheating**

As all of you know, CNU has an Honor Code, which we all agreed to by both signing and giving a pledge. The spirit of that Honor Code will be strictly observed in this course.

With that said, we need to have a longer discussion in about what "violating the honor code" actually looks like in this type of course.

From my point of view, it is really very simple. I think that pretty much everything will work out well if we can agree that we will not plagiarize. The definition of plagiarism that I use is: Do not present the work or others as one's own work. In other words, don't take credit for something that someone else did. From my point of view, that does NOT mean that we cannot use the work of others, whether it is that of a classmate, or something found on the internet, or something provided by ChatGPT. It just means that we must acknowledge that we did that and give appropriate credit.

If we all follow that rule, then we should be fine!