Special Functions of Mathematical Physics Lab

Course Website: *Moodle*: https://moodle.augsburg.edu

Course Overview: In this course you will receive an introduction to some of the many computational tools physicist and engineers employ. In particular, you will be introduced to using python for numerical methods of approximating solutions, fitting and interpolating data, and error analysis.

Course Outcomes: Upon completion of this course, students will (broadly) be able to:

1. Load, process, and plot data.
2. Apply numerical methods to solve problems that frequently appear in physics and engineering.
3. Assess broken code and debug common errors.
4. Write simple algorithmic procedures.
5. Recognize how a compiler interprets code.

Instructor:

Instructor:	Prof. Daniel Hickox-Young (he/him/his)
Contact:	Hagfors Center 135
	☎ 612-330-1012
	✉ hickoxyo@augsburg.edu
	🔵 https://augsburg.zoom.us/my/hickoxyo
Office Hours:	MWF 1-2pm; Tu 2-3pm in HC 135.
	Drop by whenever my door is open (no appointment necessary).
	If you like appointments, feel free to set one with calendly or by email.
	I am also happy to meet via ZOOM.

Class Meetings:

Lab: Tuesdays from 12:00pm-1:40pm, Hagfors 109

Class sessions will be devoted to hands-on computational activities.

Course Materials: Your primary tool this semester will be your personal laptop computer, with python installed and accessible via the Jupyter notebook environment. If you have trouble gaining access to a device capable of running python, communicate this to your instructor and we can discuss options.

Student Assessments: Assessments are outlined below. Grades will be updated regularly on *Moodle.*

Activity	Weight	Notes
Engagement	10%	Attendance and diligence in lab.
Lab Activities	70%	Ten (10) labs, lowest grade dropped.
Final Project	20%	Applied project on topic of choice.

Engagement: The primary way we will achieve the learning goals for this course is through the completion of hands-on computational activities. It is a benefit to yourself and to your classmates to take on these problems as a community, where we can share insights, ask questions, and learn from one another. Simply engaging and applying yourself to the tasks at hand will pay dividends in your long-term confidence with coding and software development. If you are unable to attend, you will still be responsible for the lab activity that week, and I ask that you communicate with me so that I can be aware of when you may need assistance outside of class to complete activities. In addition, it is Physics Department policy that ***absences in excess of 40% of lab meetings will result in automatic failure*** of the course.

Lab Activities: For each of the first ten (10) weeks of lab, we will complete one computational activity per week. Each activity is designed to introduce a new transferrable skill, which should apply beyond the domain of this course (or even the associated lecture). The goal is for the vast majority of the work to be completed during our class time, but you can expect to spend some small amount of time outside of class completing activities, which are due at the beginning of lab the following week.

Final Project: The final project is a relatively open-ended opportunity to apply computational methods to a problem of interest to the student. We will begin brainstorming ideas and completing initial step about halfway through the semester, before dedicating class time full-time to the projects over the last couple of weeks. The projects will culminate in a final report due during finals week. You will be provided additional information regarding the final project later in the semester.

Grading Scale: Final grades will be assigned using the usual grading scale:

Letter	F	D	C-	C	C+	B-	B	B+	A-	A
Score	$< 59.\bar{9}$	$69.\bar{9}$-60	$73.\bar{9}$-70	$76.\bar{9}$-74	$79.\bar{9}$-77	$83.\bar{9}$-80	$86.\bar{9}$-84	$89.\bar{9}$-87	$93.\bar{9}$-90	> 94

Depending on the results of the course, a curve may be applied to the grading scale. Note that I will NEVER curve grades downward, only upward and only if necessary to account for my misjudgement of the degree of difficulty of an assessment.

Modifications to the Syllabus: I reserve the right to change any part of the course during the term, including assignments, grading structure, due dates, and schedule. Any changes will be communicated to students verbally and *via Moodle*. Please check *Moodle* regularly to keep informed of any changes and announcements.

Inclusion Statement: Augsburg University values the diversity of persons, perspectives, and convictions. Critical thinking, rigorous analysis, and open discussion across a full range of ideas lie at the heart of the University's mission as an institution of higher learning. Essential to the University in living out its mission of educating students to be "informed citizens, thoughtful stewards, critical thinkers, and responsible leaders" is that the foundation be one of diversity, inclusion, equity, and intercultural competency.

I expect everyone to contribute to creating an inclusive environment. At a minimum, this means affirming the identities we bring to the classroom by using each other's names and pronouns. Beyond this foundational necessity, I believe each class should have the opportunity to shape their own community guidelines. To help create a space in which the diverse backgrounds, perspectives, and approaches will enrich our discussion without causing harm, we will spend some time on our first day of class crafting community agreements to unpack what that means to us.

Academic Support and Accommodations: Your success in this class is important to me. We all need accommodations at times because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course.

Academic Tutoring: Your tuition provides you free access to academic support resources. You can find a list of tutoring resources at Academic Advising.

Writing Center: Augsburg's Writing Center provides both in-person and online opportunities to get support and feedback on your written assignments. The Writing Center is in Lindell Library, Main Floor, just inside the street level entrance and to the left of the circulation desk or online at https://sites.augsburg.edu/writingcenter.

Disability Accommodations and Accessibility: If you need disability-related accommodations to have equal access in this course, please contact the CLASS Office (Disability Resources) at class@augsburg.edu or schedule a meeting with CLASS at www.augsburg.edu/class.

Phone: (612) 330-1053.

Location: Lindell Library, 216.

If accommodations are required, the CLASS Office will notify me privately about your needs. Please note that you will not be required to disclose your disability, only your accommodations. The sooner you let me know your needs, the sooner I can assist you in achieving your learning goals in this course.

Health and Wellness: As part of the University's support systems, you also have access to campus resources to maintain your safety, health, and well-being. We understand that as a student you may experience a range of issues that can cause barriers to learning. These stressful moments can impact academic performance or reduce your ability to engage. If you or someone you know are suffering from any challenges, you should reach out for support. For concerns about physical or mental well-being, the Center for Wellness and Counseling is located on the first floor of Anderson Residence Hall, 612-330-1707 or https://www.augsburg.edu/cwc/. Student Support Services maintains a Student Support Guide that lists a wide range of community resources for Crisis Support, Academic Support, Personal Concerns, Health Concerns, and Basic Living Needs.

Academic Integrity: It goes without saying that the entire academic enterprise is founded on academic honesty. All work submitted in this course should be your own and produced exclusively for this course. The use of sources (ideas, quotations, paraphrases) should be properly acknowledged and documented. Academic dishonesty can have serious consequences. You can review the full academic honesty standards and consequences by viewing the Augsburg Academic Honesty Policy and talk to me if you have any questions. In addition, the Augsburg Physics Department has adopted the following specific policies:

◇ Grading, curving, and points awarded are at the discretion of the instructor in circumstances of academic dishonesty.

◇ At the discretion of the instructor, generative text, code, images that do not represent an individual's authentic work will be zeroed in the gradebook.

Course Schedule: The course material is subject to change. The anticipated schedule is provided below and will be updated on *Moodle* as the course progresses.

Week	Day	Date	Description
1	Tu	1/16	NO LAB
2	Tu	1/23	Getting Started and Plotting
3	Tu	1/30	Digital Signal Filtering (FFT)
4	Tu	2/6	Numerical Integration
5	Tu	2/13	Numerical Differentiation
6	Tu	2/20	Data Processing
7	Tu	2/27	Assessment Day - NO LAB
8	Tu	3/5	Introduction to Interpolation
9	Tu	3/12	Spring Break - NO LAB
10	Tu	3/19	Least Squares Fitting
11	Tu	3/26	Error Propagation
12	Tu	4/2	Ordinary Differential Equations
13	Tu	4/9	Linear Algebra
14	Tu	4/16	Final Project
15	Tu	4/23	Final Project 2