

PHY-305 Experimental Modern Physics

Gustavus Adolphus College Fall Semester 2023

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Office Hours: <http://gustavus.edu/~huber/schedule.htm>

Required:

- Laboratory Manual for PHY-305
- Two Blank Lab Notebooks (4x4 Quad Ruled, 11.75" x 9.125")
- For reference either:
- *An Introduction to Error Analysis*, 2nd Edition, John R. Taylor; or
- *Data Reduction and Error Analysis for the Physical Sciences*, 3rd Ed., P.R. Bevington and D.K. Robinson

Course Goals:

1. Verification/reproduction of some important experiments in modern physics
2. Development of skills in computerized data acquisition & experiment control
3. Exposure to advanced data analysis techniques
4. Develop of skills for reading scientific papers
5. Continued development of scientific writing skills (both notebooks and formal laboratory reports)
6. Development of presentation skills

Course Policy and Evaluation:

1. **Prerequisites:** Students must have completed (with a grade of C or better) Quantum Universe (PHY225) and Electronics and Instrumentation with Laboratory (PHY-270 and PHY-271).
2. **Lecture Schedule:** The lecture class time is every Tuesday and Thursday morning during 2nd period (9:00-9:50 AM). Lecture periods will be used to introduce topics common to the performance of the experiments, to discuss writing assignments, do presentations, and for other routine items pertaining to course management.
3. **Lab Schedules:** The laboratory class time is nominally periods 678 (1:30-4:20 PM) on Monday and Tuesday afternoons. *Generally, when an experiment is finished, all equipment must be taken apart so that the next lab group may use the equipment.*
4. **Experiments and Preparation:** Experimental work will be performed by students working in groups of two or three. The schedule of experiments will be distributed separately. Descriptions for each of the experiments are located in the laboratory manual. Students are expected to have thoroughly studied the lab manual experiment or other class material **before** coming to the lab. Advance preparation is an absolute requirement for the efficient use of course time, and to make informed and safe use of the equipment. Failure to prepare for the lab is the leading cause of wasted time, useless data, and equipment damage. Simply completing the pre-lab assignment (when required) is not an adequate preparation in itself. Students **must** have a good understanding of what quantities will be measured with what equipment and software, and for what purpose.

5. **Lab Access:** Students are not normally allowed to work in the laboratory outside of their assigned lab periods, and must obtain instructor permission and "keys-on-pipes" to do so. Responsible use and return of temporary keys is expected, and any failure to follow departmental guidelines for the care and return of keys will be handled according to department key policies.
6. **Classroom and Lab Environment/Ethos:** It is expected that all members of this classroom community will treat each other in a respectful and positive manner. This expectation is independent of your role associated with this course. Respectful treatment of others associated with this class is expected whether you are a student in the class, a TA for the class, a tutor for the class, or the professor for the class. Furthermore, should any problem / issue arise, it is expected that an attempt to resolve the situation will be made directly, calmly, respectfully, and professionally by the parties involved. If this fails to resolve the issue and the problematic behavior continues, or if the initial situation is deemed to be of a more serious nature, then the professor for the course should be contacted directly. Physics can, at times, be challenging for all of us. Please do your part in helping to create a positive environment where all members of this community can do their best work.
7. **Pre-lab Assignments:** The Lab Manual contains a number of assignments that need to be completed before coming to lab to begin a particular experiment. These involve theoretical, mathematical and (sometimes) computational (computer) tasks. The completed pre-lab assignment must be submitted before lab begins at 1:30 on Monday.
8. **Lab Notebooks:** Each student's primary responsibility will be to maintain a lab notebook detailing his/her lab experiments. The purpose of the lab notebook is to detail **completely** the theory, procedures, data, analysis and conclusions for every experiment. The lab notebook, completed for each experiment, must be handed-in at the beginning of the lab period (1:30 PM on Monday) on the week following completion of that experiment. The book will be graded and returned by the following week.
9. **Notebook Grading:** Notebooks will be graded on a 10-point basis. All of the following will be important in determining the grade: successful completion of the experimental measurements and data analysis; documentation, appropriateness and accuracy of procedures; and data analysis carried out for the experiment. Additionally, as a minimum, it is expected that the notebooks will be legible and neat. More details on grading of lab notebooks are given in the Lab Manual.
10. **Late Penalties:** There will be a one-point-per-day late penalty assessed on all lab notebooks turned in after the due date. A fraction of a point will be deducted if the notebook is not turned in at the assigned time. For work that is turned in significantly late, there will be a 50% reduction of the grade on that assignment as a maximum late penalty. Zero credit is assigned for any pre-lab assignments that are not turned in at the beginning of the lab period.
11. **Formal Writing Assignments:** This course has been approved as a "Writing in the Discipline" (WRITD) course. The formal writing assignments are outlined below. More details on the format and content expected for lab reports may be found in the lab manual. Writing assignments may be distributed to other members of the class for peer review.

Each student must create three printed papers in the scientific letter format (about 5-6 double spaced pages). The format to be followed is that found in *American Physical Society* publications such as *Physical Review Letters*. The paper must be double-spaced, with a minimum font size of 12-point Times New Roman or similar throughout, including references. The paper may include figures or graphics in the form of data or drawings. These graphics must be machine made and not hand-drawn or taped onto the page. See the lab manual and handouts in class for more on style and formatting. The papers will be graded on content, style, and college-level use of English. The final draft of each formal report must take into account all of the comments of peers and the instructor. In addition to correcting grammatical, formatting, and other basic errors, the student will be expected to make other changes to bring the paper to a level that would allow it, in theory, **to be published**.

This may require reanalysis of data, replotting graphs, or other more extensive revisions of the original lab report. The original formal report, including instructor comments, must be attached to the rewritten formal lab report.

12. **Presentations:** Scientists usually present their work at conferences in advance of publication in order to receive feedback and suggestions from colleagues working in the field. To that end, each lab group will present on two experiments near the end of the semester. The first presentation will consist of two tries with chance for revision between them on one of the experiments performed early in the semester. The second presentation will be on the last three-week lab the group performs.
13. **Attendance:** Students are required to attend all lecture and lab periods as scheduled. Students must inform the instructor in writing during the first five days of the semester of any scheduled or anticipated athletic, music, or other college activities that may require their absence during the meeting times of the course. Such written notice does not imply or grant a waiver of course requirements or an agreement to reschedule meeting times or due dates for assignments. Excessive absences or consistently coming to class or lab late *will* result in a reduction in the final course grade. Students are responsible for all announcements and assignments.

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| 14. Evaluation: | Lab Notebooks | 50% |
| | Pre-Labs, Presentations, & Homework | 15% |
| | Preparation and Participation | 5% |
| | Formal Letter 1 | 10% |
| | Formal Letter 2 | 10% |
| | Formal Letter 3: | 10% |

Assignment of final letter grades will be based upon the following guidelines:

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| A = 94-100% | B+ = 86-90% | C+ = 74-78% | D+ = 62-66% |
| A- = 90-94% | B = 82-86% | C = 70-74% | D = 58-62% |
| | B- = 78-82% | C- = 66-70% | |

15. **Incompletes:** A grade of incomplete may be awarded at the discretion of the instructor, if requested by the student, under the following conditions: 1) the last day to withdraw has passed, 2) and unforeseen circumstances beyond the student's control (usually restricted to illness or family emergency) preclude completion of the remaining work for the course by the semester deadline. Note that poor planning or having a lot of work to complete at the end of the term are not, in fairness to other students, considered circumstances beyond a student's control. This additional time to complete coursework may not extend beyond the final day of the following semester, and earlier limits may be set at the discretion of the instructor.
16. **Academic Honesty:** In the context of this course, students are encouraged to collaborate and to discuss their out-of-class assignments. However, submitting under one's own name work that is merely copied from another is a violation of the Honor Code. The overarching principle of the Academic Honesty Policy is that students shall submit their own work, in fairness to others and to self. Your Professor wants you, a developing scholar, to be able to take pride in your own academic work and to maintain your academic integrity. Citations must accompany any use of another's words or ideas that are not common knowledge. Quoting or paraphrasing from electronic sources without proper citation is as serious a violation as copying from a book or other printed source. *Using content generated by an artificial intelligence third-party service or site (AI-generated content) without proper attribution or authorization would also be a form of plagiarism.* A student may not submit work that is substantially the same in two courses without first gaining permission of both instructors if the courses are taken concurrently, or permission of the current instructor if the work has been submitted in a previous semester. Ask your Professor if you have questions about a particular assignment or kind of work. Please make sure you fully understand the rules related to online work, as it pertains to this course. Unauthorized aid during online exams and assignments is every bit as serious and inappropriate as it would be in an in-person course.

The sanction in this course for a violation of the Honor Code involving plagiarism, copying another student on an exam, or other kinds of cheating on a single assignment will usually be an "F" on the plagiarized assignment or exam. For a more significant event, your Professor reserves the right to assign you a grade of "F" for the course. In addition, for any Honor Code violation, your Professor will notify the Provost's Office. A letter will be generated by the Provost's Office and sent to you. The letter will remain on file. There will be no further consequence, beyond the course penalty and the letter, if you do not commit any further Honor Code violations. Repeat offenses could ultimately lead to dismissal from the College. You have the right to appeal any Honor Code violation through an Honor Board hearing process. In this course, your Professor aims for you to learn how to cite sources properly, do your own work on all exams, and function as a scholar with integrity. Please feel welcome to ask questions about the important matter of Academic Honesty and let me know how I can best support your learning. Full descriptions of the Academic Honesty Policy and the Honor Code can be found in the Academic Catalog, online at https://gustavus.edu/general_catalog/current/acainfo.

17. **Help for Multilingual Students:** Some Gusties may have grown up speaking a language (or languages) other than English at home. If so, we refer to you as "multilingual." Your multilingual background is an incredible resource for you, and for our campus, but it can come with some challenges. You can find support through the Center for International and Cultural Education's (<https://gustavus.edu/cice/>) Multilingual and Intercultural Program Coordinator (MIPC), Pam

Pearson (ppearson@gustavus.edu). Pam can meet individually for tutoring in writing, consulting about specific assignments, and helping students connect with the College's support systems. If you want help with a specific task (for example, reading word problems on an exam quickly enough or revising grammar in essays), let your professor and Pam know as soon as possible. In addition, the Writing Center (<https://gustavus.edu/writingcenter/>) offers tutoring from peers (some of whom are themselves multilingual) who can help you do your best writing.

18. **Requesting Accommodations:** Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a disability and anticipate or experience barriers to equal access, please speak with the accessibility resources staff about your needs. A disability may include mental health, attentional, learning, chronic health, sensory, physical, and/or short-term conditions. Students with a documented elevated risk of COVID-19 may also request academic accommodations. When appropriate, staff will guide students and professors in making accommodations to ensure equal access. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact them as early as possible. Accessibility resources staff are located in the Academic Support Center (<https://gustavus.edu/asc/accessibility/>) (x7227). Accessibility Resources Coordinator, Katy Clay, (clayk@gustavus.edu), can provide further information.
19. **Mental Wellbeing:** The Gustavus community is committed to and cares about all students. Strained relationships, increased anxiety, alcohol or drug problems, feeling down, difficulty concentrating, and/or lack of motivation may affect a student's academic performance or reduce a student's ability to participate in daily activities. If you or someone you know expresses such mental health concerns or experiences a stressful event that can create barriers to learning, Gustavus services are available to assist you, and include online options. You can learn more about the broad range of confidential health services available at <https://gustavus.edu/counseling/> and <https://gustavus.edu/deanofstudents/services/>.
20. **Title IX: Sexual Misconduct Prevention and Resources:** Gustavus Adolphus College recognizes the dignity of all individuals and promotes respect for all people. As such, we are committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know) has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available; you can learn more online at <https://gustavus.edu/titleix/>.

Please know that if you choose to confide in me, I am required by the College to report to the Title IX Coordinator, because Gustavus and I want to be sure you are connected with all the support the College can offer. Although it is encouraged, you are not required to respond to outreach from the College if you do not want to. You may speak to someone confidentially by contacting the Sexual Assault Response Team (SART/CADA), Chaplains, Counseling Center, or Health Service staff; conversations with these individuals can be kept strictly confidential. SART/CADA can be reached 24 hours a day at 507-933-6868. You can also make a report yourself, including an anonymous report, through the form at <https://gustavus.edu/titleix/>.