PHY-305 Experimental Modern Physics

Gustavus Adolphus College Fall Semester 2022

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Office Hours: MTWRF 10:30-11:20
Required:

- Laboratory Manual for PHY-305 in Paper and/or PDF in Moodle
- 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 (PHY-225) 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 (11:30 AM–12:20 PM). 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 (as necessary). 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. Some of the writing assignments may be distributed to other members of the class for peer review.

    Scientific Letter: 1200-1500 words (5-6 double-spaced text pages)

    Each student must create three printed papers in the scientific letter format. The format to be followed is that found in *American Physical Society* publications such as *Physical Review Letters*. The paper must be created on a word processor, 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 the instructor (and by peers made in the class). 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.

14. **Evaluation**:

Lab Notebooks	50%
Pre-Labs, Presentations, & Homework	15%
Preparation and Participation	5%
Formal Letter 1 first draft	5%
Formal Letter 1 second draft	5%
Formal Letter 2	10%
Formal Letter 3:	10%

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

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 will only be given for work not completed due to circumstances beyond the control of the student. (This is college policy)

14. **Academic Honesty**: Having signed and agreed to abide by the College's Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. In the context of this course, students are expected 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. Furthermore, seeking outside assistance during exams

is expressly forbidden. A full description of the Academic Honesty Policy and the Honor Code can be found in the Academic Catalog (online at:www.gustavus.edu/general_catalog/current/acainfo).

15. **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.

16. **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.

17. **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/.

18. **Departmental Expectations:** As is expected in any course in the physics department, each student is asked to work, along with the instructor and their student peers, to develop a culture of cooperation and inclusion within our department. The physics major can be challenging, and we all need the respect and support of others. While it would be unreasonable to assume that every single person will develop a close working relationship with every other, it is expected that each individual will be supportive of, and a positive influence on, every member of the departmental community that they encounter.