

PHY-305 Experimental Modern Physics
Gustavus Adolphus College Fall Semester 2009

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Textbooks:

- Laboratory Manual for PHY-305
- 2x Computation Notebooks (**Required**)
- 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. Continued development of scientific writing skills (both notebooks and formal laboratory reports)

Course Policy and Evaluation:

1. **Prerequisites:** Students must have completed (with a grade of C- or better) Modern Physics (PHY-260) and Electronics and Instrumentation I with Laboratory (PHY-270 and PHY-271).
2. **Lecture Schedule:** The lecture class time is every Tuesday and Thursday morning during 3rd period (10:30-11:20 AM). Lecture periods will be used to introduce topics common to the performance of the experiments, to discuss writing assignments, and for other routine items pertaining to course management.
3. **Lab Schedules:** The laboratory class time is periods 678 (1:30-4:20 PM) on Monday and Tuesday afternoons and periods 789 (2:30-5:20 PM) on Wednesday and Thursday 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. A well-prepared student will 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. **Lab Notebooks:** Each student's primary responsibility will be to maintain lab notebooks detailing his/her lab experiments. Two such books will need to be purchased because they will be handed-in on a rotating basis. The books should be bound, computation notebooks (available at the Book Mark). 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 Monday or 2:30 PM Wednesday) on the week following completion of that experiment. The book will be graded and returned by the following Monday (Wednesday).
7. **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. More details on grading of lab notebooks are given in the lab manual.
8. **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.
9. **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 **Formal Lab Reports** and **Checklist for Formal Lab Reports** sections of the lab manual. Some of the writing assignments may be distributed to other members of the class for peer review.
 - A. **Short Report** (Written Lab Summary): Each student must create a short printed paper summarizing the Interferometer experiment. The format to be followed is that found in such publications as "Physics News" section of a journal such as *Physics Today* or *Scientific American*. 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 end notes. The paper must be printed on a laser (or equivalent quality) printer, and may include color in graphics. This paper must begin with a brief discussion the history and importance of the experiment (one to two paragraphs), and continue with a summary of the equipment and technique used for the experiment (one to two paragraphs). The paper concludes with two or three paragraphs on the results and their significance. Essential references are cited as end notes. The paper should *not* include procedural steps or details. As much as possible, the author should avoid equations and mathematical manipulation, and include at most one or two graphs. The papers will be graded on content, style, and college-level use of English.

B. Formal Lab Reports:

1. **Letter:** 1200-1500 words (5-6 double-spaced text pages)
2. **Article:** 1750-2000 words (7-9 double-spaced text pages)

Each student will prepare and submit formal lab reports for two of the experiments performed. The first of these will be a paper on the Millikan Oil Drop lab in the format/style of a “letter” such as those published in the journals “Physical Review Letters” or “Optics Letters”. The second will be a paper on either the Franck-Hertz or e/m experiment, done in the format of a full article, similar to those appearing in the “American Journal of Physics”. A formal report should follow the same formatting requirements as the short papers.

The final formal report will be written by each student in two drafts. The first draft will be reviewed by the instructor (and possibly by peers in the class) and resubmitted for a second grading. The final draft of the formal report must take into account all of the comments of 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.*

10. **Attendance:** Students are required to attend punctually the 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 made in the classroom or distributed by e-mail.

11. Evaluation :	Lab Notebooks	60%
	Pre-Labs and Written Homework	10%
	Short Report	5%
	Formal Letter	10%
	Formal Article First Draft	5%
	Formal Article Final Draft:	10%

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

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

12. **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. Footnotes or some other acceptable form of citation must accompany any use of another's words or ideas. 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. (The full text of the Gustavus Academic Honor Code Policy may be found in the Gustavus Academic Bulletin).
13. **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)