

**PHY305: Experimental Modern Physics**  
**Gustavus Adolphus College**  
**Fall 2003**

Professor: Dr. Dennis C. Henry  
e-mail: dchenry@gac.edu  
Office: Olin 213, 933-7314

Professor: Dr. Steven H. Mellema  
e-mail: mellema@gac.edu  
Office: Olin 210, 933-7306

Textbooks:

Two Computation Notebooks (Required)

Experimental Modern Physics Lab Manual (Required)

*Data Reduction and Error Analysis for the Physical Sciences*, 3rd Ed., P.R. Bevington and D.K. Robinson (Recommended)

Course Goals:

1. To allow verification/reproduction of some important experiments in modern physics;
2. To develop techniques and experiments using computerized data acquisition and control;
3. To provide experience with advanced data analysis techniques;
4. To continue the development of scientific writing skills (both in notebooks and written 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 meeting times are Tuesday and Thursday during 4th period (11:30-12:20). Lecture periods will be used to introduce topics common to the performance of the experiments, and to discuss writing lab reports. The lecture schedule will be distributed during the first class period. The lecture portion of the course will be completed by about the end of October. Students wishing to enroll in other courses for the second half of the semester, and who experience a conflict with the last few lectures in this course should consult with Prof. Henry or Mellema.
3. Lab Schedules: The laboratory periods are 789 (2:30-5:20 PM) on Monday and Tuesday afternoons and 678 (1:30-4:20 PM) on Wednesday and Thursday afternoons. When an experiment is finished, all equipment must be taken down so that the next lab group may use the equipment.
4. Experiments: Experimental work will be performed by students working in pairs. The schedule of experiments will be distributed on the first day of class. Groups will draw for schedules on the first day of class.
5. Lab Manual: The lab manual for this course will be purchased from the Book Mark by each

student. Supplements and revisions will be distributed in class or lab, or made available by other announced means.

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 and graded on an alternating basis. The books must be the 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 the week's experiment, must be handed in to the instructor at the beginning of the lab period on the due date listed in the schedule. The book will be graded and returned before the next lab period. Short and formal reports are also due according to the schedule.
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 used for the experiment; organization, and the overall quality of the notebook's written and graphical exposition. A separate handout details some of the criteria that are involved in grading of laboratory notebooks.
8. Late Assignments: ***There will be a one-point-per-day late penalty assessed on all lab notebooks or reports turned in after the due date and time!*** A fraction of a point will be deducted if the notebook or report is not turned in at the beginning of the assigned lab period. 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. Writing Assignments: This course has been approved as a level II writing (W) course. The writing assignments are outlined below. More details on the format and content expected for lab reports may be found in the Formal Lab Reports handout and in the Checklist for Formal Lab Reports handout. Some of the writing assignments may be distributed to other members of the class for peer review.
  - A. Written Lab Summary: Each student must create a short printed paper summarizing **two** of the lab experiments. 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 Roman or Universe/Abadi throughout, including end notes. The paper must be printed on a laser 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. These short papers must be turned in with the lab notebook, on the dates shown in the lab schedule. The papers will

be graded on content, style, and college-level use of English.

- B. Formal Lab Report: Each student will prepare and submit a formal lab report for two of the experiments performed. The first of these will be either the Franck-Hertz or  $e/m$  of the electron lab. The second will be either the Millikan or magnetic shielding measurements lab. The formal report should be about 1750-2000 words (7-9 text pages) in length and follow the same formatting requirements as the short papers.
- C. Rewrite Requirements of First Formal Lab Report: The first formal report will be rewritten by each student and resubmitted for a second grading. The rewritten 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 the lecture and lab periods as scheduled. Students must inform the instructor in writing during the 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, distributed by e-mail, or posted on Olin Hall bulletin boards used for the course.
11. 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.
12. Preparation: Students are expected to have thoroughly studied the lab manual experiment or other class material before coming to the lab or lecture. 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 is not an adequate preparation in itself. It is understandable that not all possible questions regarding unfamiliar equipment and phenomena may be anticipated. However, students should bring significant questions to the instructor in advance of the lab period, and be prepared to raise other uncertainties during the oral introduction at the beginning of the lab. In a nutshell, one can say that a reasonably well-prepared student will have a good understanding of what quantities will be measured with what equipment and software, and for what purpose.
13. Academic Honesty and Honor Code: 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 with their lab partner on carrying out and analyzing the results of experiments. 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 Honesty Policy and Honor Code may be found in the Gustavus Academic Bulletin 2003-04, p. 32.)

14. Evaluation: The graded components of the work in this course will contribute to the final grade with approximately the following weights:

50% Lab Notebook  
12% Prelabs and Written Homework  
13% Written Lab Summaries (Short Reports)  
25% Formal Lab Reports

Final course grades will be assigned using the following scale as a guide only:

96-100 A	80-84 B-	64-68 D+
92-96 A-	76-80 C+	60-64 D
88-92 B+	72-76 C	0-60 F
84-88 B	68-72 C-	

Assignment of final letter grades may also take into account the instructor's subjective evaluation of the student's attendance (both in lecture and lab), preparation, care of equipment, and evidence of improvement.

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 the College policy.*