

West Chester University
Department of Physics
Physics 310 – Intermediate Laboratory Physics I

Meeting Time: W 3:00 - 6:00 pm
Meeting Place: Merion Science Center 109
Instructor: Paul A. Belony, Jr.
Office: Merion Science Center 132
Office Phone: 610-436-2897
Office email: pbelony@wcupa.edu
Office Hours: M,W,F: 10-11AM Other hours by appointment

TEXT: An Introduction to Error Analysis, John R. Taylor, 2nd ed.

FALL SEMESTER SCHEDULE

29 Aug	Mon	8 a.m.	University classes begin
31 Aug	Wed	3 p.m.	First class meeting of PHY 310
5 Sep	Mon		Labor Day; no classes
10-11 Oct	Mon, Tues		Fall Break; no classes
23 Nov	Wed	8 a.m.	Thanksgiving Recess begins
28 Nov	Mon	8 a.m.	Thanksgiving Recess ends
8 Dec	Wed	3 p.m.	Last class meeting of PHY 310; <i>Laboratory Notebooks due 3 pm</i>
13 Dec	Mon		University classes end

COURSE GOALS, DIRECTION, AND OBJECTIVES

In this course you will choose and individually carry out four experiments dealing with fundamental physical phenomena. The experiments will involve differing techniques of measurement and analysis. Your responsibilities will be to assemble the requisite apparatus, analyze the data, and run the experiment. This course also focuses on writing. During the semester you will produce technical reports describing an experiment that you have personally completed. This course will allow you to quantitatively assess the quality of experimental data and how well these data correspond to current theories, an important function in the practice of physical science. Data and error analysis will also be an integral part of each report. While analyzing the data, it is your responsibility to check how your experiment agrees with the theoretical prediction or someone else's measurement.

In this course you will continue to refine your presentation skills through various oral presentations.

SCHEDULE OF EXPERIMENTS AND ASSIGNMENTS

7 Sep	Introduction to Error Analysis, Chapters 1 & 2
14 Sep	Chapter 2 problems due, 3 pm; Introduction to Error Analysis, Chapter 3
21 Sep	Report #1 due, Chapter 3 problems due, 3 pm; Introduction to Error Analysis, Chapter 4.
28 Sep	Chapter 4 problems due, 3 pm; Introduction to Error Analysis, Chapter 5
5 Oct	Report #2 due, Introduction to Error Analysis, Chapter 6.

Fall Break

12 Oct	Chapter 5 problems due, 3:00 pm; Introduction to Error Analysis, Chapter 7
19 Oct	Introduction to Error Analysis, Chapter 8
26 Oct	Report #3 due, 3:00 pm
2 Nov	Individual Presentations ¹ : Brown, Kralik, Legall, Morrell, Sheriff
9 Nov	Report #4 due, 3:00 pm; Individual Presentations ¹ : Frost, Larkin, Massaro, Most, Snyder.
16 Nov	Individual Presentations ¹ : Gallis, Lawton, Mayer, Murrane, Sutton.

Thanksgiving Recess

30 Nov	Individual Presentations ¹ : Keay, Lechner, McCauley, Savoy, Zeits.
7 Dec	Group Presentations ² . Laboratory notebook due, 3:00 pm. Last class meeting.
12 Dec	Last day of University classes.

¹ Individual presentations are presentations to the class with some faculty attending. They are oral summaries of an experiment for which a written report was previously submitted. Oral presentations can include ancillary support such as transparencies, slides, and demonstrations, and are 15 minutes in length.

² Group presentations are assigned as follows:

- 1) Speed of light: Brown, Larkin, Mayer, Savoy, Sheriff
- 2) Millikan: Frost, Kralik, Massaro, Murrane, Zeits
- 3) Michelson interferometry: Keay, Lawton, Legall, Most, Sutton
- 4) Thermal radiation: Gallis, Lechner, McCauley, Morrell, Snyder

The format for the group presentations is the same as the individual presentations except that the relevant data is analyzed and presented by the group. Group members must collect and analyze data from the entire class. Each group member will receive the same grade for the presentation.

Note: All students are required to conduct the measurement of the speed of light and the Millikan experiment. When conducting group experiments, it is the responsibility of the group members to contact and gather data from students who have conducted similar individual experiments.

AVAILABLE EXPERIMENTS

1. Electron spin resonance and the measurement of the g factor*
2. Franck-Hertz experiment (mercury)[†]
3. Speed of light[†]
4. e/m for an electron[†]
5. Michelson interferometry and the measurement of the wavelength of light[†]
6. Millikan experiment and the fundamental unit of electric charge[†]
7. Planck's constant[†]
8. Measurement of the wavelengths in the spectra of hydrogen and deuterium using a spectrometer*¹
9. Measurement of the wavelengths in the spectra of hydrogen and deuterium using a Fabry-Perot interferometer*¹
10. Current balance and the measurement of μ_0 [†]
11. X-ray diffraction
12. Half-life of a radionuclide¹
13. Thermal radiation experiments and the Stefan-Boltzmann law[†]
14. Gravitational constant
15. Avagadro's number
16. Nuclear magnetic resonance*
17. Hall effect*
18. Zeeman Effect*
19. Nuclear Spectroscopy

Experiments can be conducted in any order, but the ones marked by a (†) are best conducted in the Fall semester and those indicated by a (*) are best conducted in the Spring. Unmarked experiments can be conducted in either semester. I recommend that you conduct Experiments 11 and 12 at some point in PHY 310-320. ¹You will need to speak with the instructor prior to undertaking Experiments 8 and 12 for important safety instructions and practical tips for conducting the experiment.

PROBLEM ASSIGNMENTS FROM TEXT

Chapter 2 Problems: 2-7, 9, 11, 15, 17, 22, 27, 28, 29, 31.

Chapter 3 Problems: 1, 3, 5, 9, 11, 15, 17, 24, 25, 27-31, 39, 49.

Chapter 4 Problems: 1, 7, 11, 13, 17, 19, 21, 23, 25, 27.

Chapter 5 Problems: 2-5, 9, 14, 19, 21, 25, 33, 35, 37.

Some extra interesting problem assignments may be announced at class meetings.

Laboratory Notebook: You are expected to keep a record of your laboratory activities, both for the individual experiments and the group experiments. You must use the same notebook for PHY 310 and PHY 320. Use a bound, quadrille-ruled laboratory notebook for this purpose. This notebook will be submitted and evaluated at the end of the semester.

Laboratory Reports: All reports must be typewritten and use a technical writing style. This writing style is described in the AIP Style Manual. A paper copy is available in the laboratory;

an on-line version can be found at <http://www.aip.org/pubservs/style/4thed/toc.html> Analysis should follow the guidelines described in that document. You may wish (and are encouraged) to discuss the contents of your reports with other class members and the instructor. Of course, the submitted report must be the work of the individual(s) submitting it, with proper acknowledgments and references.

Attendance policy, due dates, and deadlines: You are expected to complete all of the reports by the date and time due. These deadlines will be strictly enforced – to the second. Please do not ask for an exception. Because unforeseen circumstance befalls us all, you ought to complete the work and submit it as far in advance of the deadline as is practical. Reports not meeting the deadline receive a grade of zero. Attendance at the regularly scheduled class meetings is not required, but you will certainly agree that they are useful. Often the instructor will present some new material regarding data and error analysis, some practical pitfalls to avoid in the experiments, guidance as to conducting the experiments, etc. These remarks may take approximately an hour.

Grade: Your grade will be determined by the quality of your written work, the oral presentations, your participation, and the degree of independence you show in conducting the course requirements. Your final grade in PHY 310 is based primarily on the following partition: 4 lab reports @ 15% each; 1 individual presentation, 15%; 1 group presentation, 10%; homework/participation, 10%; and independence, 5%.

Note on meeting times: The scheduled laboratory meeting time is Wednesday from 3 to 6 pm. As mentioned above, the instructor will not utilize all the scheduled laboratory time; typically, less than an hour will be devoted to introductory remarks. You will find that you will want to work at other times outside of the scheduled meeting time. The laboratories and computer facilities of the Department of Physics are available during normal business hours. Still, you may not find that convenient. You will likely want to request keyed access to the laboratories so that you can work outside of class times and normal business hours. Access can be requested from the Dr. Waite. A \$20 deposit will be required upon issuance of a key. In addition, you can request weekend access; contact Cindy Pistrutto, the Physics office manager, and she will arrange for access.

Special note regarding Experiments 8 and 9: The goal of these experiments is to determine the difference in wavelength between corresponding emission lines in the spectra of hydrogen and deuterium. That is, can you detect the difference in wavelength between the red line in hydrogen and the red line in deuterium? (And similarly for the aquamarine line and the violet line.) No written outline of the procedure to follow is provided. You must determine how to best utilize the equipment to achieve the goal. Note, too, that you must inspect the apparatus long prior to using it to determine that all is in working order. This is especially true for the precision interferometer used in the Fabry-Perot mode. If any part is missing or inoperative, please submit a specification for ordering the needed items. Though you may choose to conduct these experiments in PHY 320 in the Spring, you should check to confirm that the equipment is in working order at the beginning of the Fall semester. You will be required to conduct these experiments during the Spring semester. (Half the class will use the spectrometer and the other half will use the Fabry-Perot interferometer.)

Please report immediately any breakage or other problems with any equipment in this course. For any equipment that does not function, you are responsible for specifying the manner in which the equipment is to be made operational, including the ordering information for parts or making the arrangements to send it out for repair, if needed.

Disability:

We at West Chester wish to make accommodations for persons with disabilities. Please make your needs known by contacting the Office of Services for Students with Disabilities at extension 3217 as well as myself. Sufficient notice is needed in order to make the accommodations possible. The University and I desire to comply with the ADA of 1990.

Academic Integrity Statement

If you commit a violation of academic integrity, you will receive zero credit for the entire course. This is not negotiable. For more information regarding violations of academic integrity, consult pages 51-55 of the 2010-2011 Undergraduate Catalog.

Public Safety:

The Emergency Communication Committee has made the recommendation that the emergency phone number for WCU's Department of Public Safety be listed on all course syllabi. That number is **610-436-3311**. This specific recommendation is made to help the campus be prepared in case of an emergency situation.