Boğaziçi University
Department of Physics

Phys 442 Spring 2011

Experimental Physics I

Instructor: Taylan Akdoğan

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Office hours: Thursday 13:00-14:00 or by appointment. Feel free to stop by my office at other times. I will answer your questions if I am available.

Course assistants:

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Course schedule:
Lectures will be held on wednesdays between 17:00-18:50 in KB316.
Laboratory Section I: Fridays between 9:00-13:00 in Modern Physics Laboratory.
Laboratory Section II: Fridays between 13:00-17:00 in Modern Physics Laboratory.

Course page: Can be accessed through "http://www.phys.boun.edu.tr/∼akdogan/". Problem sets, general course information and other announcements will be distributed though this page.

About the course: Experiments illustrative of basic experimental techniques in modern physics such as photoelectric effect, charge to mass ratio of the electron, scattering, Cavendish torsion balance, study of counting statistics, x-ray scattering, radioactivity, quantization of atomic energy levels. Furthermore, quick review of data analysis: statistics, probability distributions, least squares method, Chi-square test.

Prerequisites: Phys 311 or Phys 407.

Required text: *Advanced Physics Experiments*, by Erhan Gülmez (Boğaziçi University Press, 1999). This is going to be your main reference to perform the experiments. Department has some number of copies of this book. They can be borrowed from the instructor by signing a list. It must be returned to the instructor by the end of the term. Our bookstore carries a limited number of copies for sale. I strongly suggest that those who will also take Phys 443 should by a copy from the bookstore. Priority in borrowing will be given to those who will take only Phys 442.

Recommended text: *Data Reduction and Error Analysis for the Physical Sciences* by P. Bevington, D. K. Robinson. We will follow some part of this book during the lectures.

Partnership: Collaborative effort is important in experimental physics. You will perform the experiments with a partner. You are free to choose your partner. Send your decision by March 4^{th} via e-mail. If you choose not to choose a partner yourself, you will be paired randomly and notified accordingly.

Attendance/Makeup: You are expected to come to the laboratories on time. There will be a makeup week on May 13^{th} 2011. If you miss an experiment, you can makeup this only on this date, provided that you have a valid excuse. The validness of the excuses will be evaluated individually. If you miss two or more experiments, you will still be able to makeup only *one* experiment, which will be determined according to the availability of the experimental setups, and you will get no credit for the rest. Having a valid partner's excuse is a valid excuse for yourself. I strongly advise you **not** to miss any experiments.

Flip the page...

Lectures: During the first few weeks, you will be provided a solid background in data analysis methods which will be covering everything you will need to analyze your experimental data. After this bare minimum, we will continue to our study in computational methods required for experimental physics in general. This will include; basic numerical methods in linear algebra, interpolation in multi-dimension, numerical integration, ODE and introduction to Monte Carlo methods. Bi-weekly problem sets will be assigned for these lectures.

There will be a midterm after the last in-classroom lecture. The date will be announced at a later time. You will be responsible only for the subjects discussed in the lectures, and subjects assigned as a homework. There will be no final examination for this experimental physics course.

Laboratories: The following eight experiments will be performed in the laboratory:

- Charge to Mass Ratio of the Electron
- Photoelectric Effect
- X-ray Scattering: The Duane-Hunt Displacement Law
- Radioactive Decay
- Poison Statistics
- The Frank-Hertz Experiment
- Scattering in Two Dimensions
- The Cavendish Experiment

You should be prepared to discuss the theoretical background and the methods you will follow to perform the experiment. The instructor will stop by on each experiment station during the laboratory session, and will ask questions about the experiment to the each partner separately. This will continue during the data taking as well. Your performance will be graded.

Reports: You are required to submit a report by the end of the next Friday after the experiment. Thus you will have seven days to complete the report. You are required to write these reports using a modern word processor, like LaTeX, Microsoft Word and Apple Pages. If you need to access a computer to write these reports, see the instructor. The exact template will be posted on the course page. Handwritten reports will not be accepted.

The report should start with an *Abstract* giving a summary of everything in the report in a single paragraph. Then, an *Introduction* must follow which gives a brief theoretical background of the experiment and its importance to the modern physics. Then, the method used for the experiment including the experimental setup should be given in the *Experimental Setup* section. The raw data, and methods used to extract the final results must be given in the next section; thus *Data and analysis*. Finally, a conclusion must be provided, discussing the results you found in the *Results* section. If you encounter any problem, inaccuracies, etc. this should be discussed in this section as well. Recommendation to improve the experiments, if any, must also be provided in this section. Finally, if you wrote any code to analyze your data or did some more complex calculation than required, it must be attached as an *Appendix*.

The instructor will asks questions about your previous reports during the laboratory sessions and lectures, before the final grade is given for the report.

Although, your are required to work together with your partner collaboratively, your are required to write your report alone. The only common identical information on two reports will be the raw data you gathered together. You can discuss the matter with your partner, friends, course assistant and, off course, with your instructor. But the final work will be your own. Any collaborative work on reports or plagiarism of any kind will be punished **strongly**.

Grading: The weights that will determine the cumulative grade are as follows:

	Contribution
Midterm	20/110
Problem Sets	10/110
Experiments	80/110

Each of the eight experiments will have equal weights. You will be given a total of 20 points for each experiment, which will be normalized according to the table shown above. 20 points will be divided into 3 parts: 3 points for the pre-oral-quiz during the laboratory session, 14 points for the report, 3 points for the post-oral-quiz about the report.

The final (letter) grades will be determined according to the cumulative grades and the overall performance.