

Physics 0520 course structure *Fall, 2017*

Lecturer – Lectures are not the primary component of this course. Prof. Steven Dytman (dytman@pitt.edu, 412-624-9244, Allen 416) will help conduct the experiments and provide advice on analysis. When appropriate, occasional lectures will be given. Istvan Danko (izdanko@pitt.edu) is in charge of equipment for this lab. He is responsible for all advanced teaching labs in the department of Physics and Astronomy.

Scope – This is a lab course normally taken by sophomore Honors students in either physics or Engineering physics programs. It carries 3 credits. The subjects both look back to topics from the introductory physics sequence and look forward to courses taken later in the undergraduate experience.

Skills needed, to be learned – The only prerequisite is the Introductory physics sequence, either 0174-5 (calculus based) or 0475-6 (honors). Previous ‘experimental’ experience of many types is useful. The main purpose of the course is to greatly expand the student’s storehouse of common sense.

Textbook – There is unfortunately no suitable textbook for the material in this course. The professor can give advice on background material at the appropriate level for many topics. The handouts (all in Courseweb) are mostly self-contained but definitely not complete. Some reading from other sources will be required; prof and Dr. Danko can help.

Attendance – Official class time is Tuesday and Thursday, 1-4pm. Like all college classes, the assumption is that the student has the maturity to decide about attendance. In practice, it is dangerous to miss lab sessions because of the work required to complete labs. The professor will generally only be available during regular class times; other students can also help with problems. Sometimes, there are conflicts with religious holidays; in the past, these students have to make extra effort but it always worked out. The lab will be open Mon-Fri roughly 8am-4pm and every student is welcome to use the facilities outside class times; in fact, many students have found this time important to keep up the pace required.

Partners – There is enough equipment in the lab for about 10 students working independently. This term, you will work partly in pairs, choose a partner.

Notebooks – Each student keeps a lab notebook and the grade for that work comes from what is there. Progress on each experiment is documented in the notebook. When *each* experiment is finished, a 1-2 page summary of findings and issues is added and that notebook is handed in to the professor. Each student therefore must purchase 2 notebooks so that progress can happen while the grading is done. The notebook contains all relevant steps/findings; experience will be the best guide. The goal is to write enough that a reader, e.g. the professor, can follow the key steps and understand the problems encountered along with their solution. A typical lab session should produce a few pages of notes.

Final project – There will be no exams, but each student will submit a research paper. The paper will be based on a Nobel Prize physics experiment. Their work will be described in a short paper (8-15 pages double spaced) which emphasizes the measurement and physics aspects of the topic studied. It should have an introduction and a conclusion with some theoretical discussion. This paper is due December 6 (last day of classes), the only formal due date in the course.

Grades – Your grade for the course will be based on the work on the experiments (80%) and on the final project (20%). Each experiment will provide a grade based on the notebook. The course is small and the emphasis is on your work, so the instructor will know each student well. Approximately 7 labs (2 required, 5 optional) will be required for the course.

Writing option – This course can be used to satisfy your Writing Option requirement. Since you already have to do some writing for the course, this is a good option. That course requires 3 formal documents. They will be significantly expanded versions of your notebook. This course has a separate lecture; first lecture will be Wed, September 17.

Experiments – A list will be provided. The first 2 experiments are *Test Equipment* and *Introduction to Numerical Methods*, each is required for all students. Handouts for all experiments are in Courseweb.

Lab Techniques – This course is unusual for CAS because lectures are secondary and your own work is the emphasis. Thus, an enterprising student can go as far as he/she wishes.

Students choose experiments with advice of the prof as requested. All experiments beyond the 2 required *must be approved in advance* by the prof. That way, the equipment will be ready. If you have a partner, you will have to agree on experiments you do together.

The time required for each experiment is not fixed, the prof will help you make choices to finish advantageously. The balance will be between finishing in reasonable time and a deep enough understanding of the material. Any experiment taking more than 2 weeks can be a problem.

Quality of the equipment and the lab manual varies considerably. We've been recently adding 2 new experiments per year, so improvement is always underway. The prof is always available during class period for discussion. Sometimes, you will be learning about a new experiment with less than perfect lab manual. Your notes will then contribute to the upcoming version of the lab manual.

Notebooks (2 of them) are required. You bring the notebook every day to class and regularly write down your measurements and comments. The comments include thoughts on how the measurement is done and what it means. Every distinct part of the experiment must have a *good quality diagram* of the apparatus; it is best to make this picture at the beginning to help you understand the pieces then again at the end when you need to explain what you really did. Every experiment must have a 1-2 page summary of what you did and what you learned. Incomplete notebooks will be returned for improvement.