

Physics 145 Syllabus, Winter 2010

Introduction to Experimental Physics I

<http://www.physics.byu.edu/faculty/campbell/physics145/>

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Motivation: Physics, the study of physical phenomena, is an observational science as well as a theoretical science. While most of your physics courses will lean towards the theoretical, our introductory lab sequence is an opportunity to do hands-on physical experiments. To this end, you are expected to become familiar with a variety of laboratory instruments and techniques, to carefully record your observations and insights, and to further develop experimental common sense and “physical intuition”. In contrast to your exposure to DC electronics in Physics 140, this course will focus on AC physics, with a special emphasis on time and frequency-dependent physical responses. Combined with faith and critical thinking, your efforts to master the content of our physics laboratory courses will help to prepare you for a successful career and meaningful service.

Learning Outcomes: You will learn the basic concepts, tools and techniques of geometric and wave optics, Fourier transforms, AC impedances (electrical, mechanical and acoustical), time and frequency-dependent transducer responses, data analysis (e.g. statistics, error estimation and propagation, curve fitting), and computer-assisted data acquisition and experiment control (with NI Labview).

Lab Time/Location: We will meet, according to section, in the Physics 145 lab located in room S420 ESC (see the course schedule below). Lab sections are held once a week in the Winter or twice a week in the summer. Due to a limited number of lab stations, we can only accommodate 14 students per section. Because most of the sections are full, students will generally be required to attend their regularly-scheduled lab period.

Lecture Time/Location: There is also a weekly multi-section lecture/discussion period in C460 ESC, which is intended to prepare students for advanced concepts that they will encounter in the lab. As indicated in the class schedule, these lectures are not provided every week. While all students are strongly encouraged to attend the lectures, those who are able to prepare adequately by reading the lab descriptions and course reference materials will not be penalized for missing lectures.

Lab exercises: Brief outlines for each laboratory period will be provided. These outlines will not always provide a step-by-step procedure for making measurements, though they will outline the nature of the data to be collected as well as the tools and techniques available. Students will generally work in pairs. Well-trained TAs will be available in the lab to provide guidance as needed.

Homework: Pre-lab homework assignments will be attached to at least one of the labs to help students prepare for more advanced topics. These assignments must be submitted with the associated lab.

Lab notebook: Use your lab notebook to create an accurate and thorough record of each experiment that you conduct as you conduct it, along with a record of your motivations, questions, insights and interpretations. Engineers or scientists must learn to permanently record their work in sufficient detail that they (or someone else) could reproduce any significant results long after the original experiment. Lab notebooks are also commonly used as the basis for reports, patents, presentations and publications. Each lab report will be written in black ball-point pen in your laboratory notebook. The choice of pen is

for permanence, black ball-point pen consistently being the most permanent. The lab notebook should be bound (not spiral) so that sheets stay put. Never tear a sheet out of a lab notebook. If a section is found to be in error, you can carefully place a big X over the section, still leaving it readable. You will also need to bring a scientific calculator each week.

Lab reports: While students work together in teams (usually pairs) at each lab station, each student is graded individually on a 10 point scale based on the report that they prepare in their lab notebook and their participation in conducting the experiment. You must submit your lab notebook at the end of your lab period for grading. It will be then be graded and returned to the lab by the morning of the day before your next lab period. Each lab report should be organized under the following three section headings:

Introduction and Experiment Plan (2 points). This section (along with a careful reading of the lab description) must be completed before your lab period begins, and will be graded during the first 15 minutes of each lab period. It will generally be brief (a few sentences) and should include some background material as well as a tentative plan or strategy for successfully conducting the experiment. While your plan may change, it is nevertheless valuable to think through the experiment beforehand and to record your plan.

Procedures, Data and Observations (5 points). This section will be completed as the experiment is carried out and comprises the heart of your report. You will record a step-by-step description of your experimental procedures and the data that you collect, including sketches, tables and graphs where needed to make your work as clear as possible. Also include and explain any calculations that you make. Insert numerous real-time observations, insights, ideas, reactions, and intent during the course of the experiment (e.g. “That didn’t turn out as expected – why?”). The section is to be written entirely while you are performing the experiment. Record what happens when it happens.

Discussion and Conclusion (2 points). Here you will “think in the notebook” about the results of the completed experiment, interpret the outcome and it’s significance, and use a final sentence or two to concisely state the conclusions of the experiment.

Participation (1 point). Credit will also be awarded for being fully involved in the process of conducting your experiment and for participating in class discussion.

Final Exam: There will be a written one-hour comprehensive final exam in the classroom where we usually meet for lecture and discussion. This exam will will carry a weight equal to one regular lab.

Final grades: Most students should be able to receive an A or a B in this class merely by diligently completing each assignment, though grades will fall off sharply due to missed or incomplete lab reports. The final grade scale is as follows:

Score	95%	92%	89%	86%	83%	80%	77%	74%	70%	65%	60%
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-

Late work: If you miss a lab due to extenuating circumstances, you will be permitted to make up one lab during the make-up lab period indicated in the class schedule. Staff will be on hand that day to assist with the transport and installation of equipment. Because the lab equipment is returned to storage at the end of each week (usually on Saturday), it will generally not be possible to make up labs at other times. Work completed on time but submitted for grading after the due date will receive a 10% late penalty.

Physics 145, Class Schedule, Winter 2010

Lab	Lab Title	Lecture Tu 12-1 pm	Sec 1: W 3-6 pm	Sec 2: Th 8-11 am Sec 3: Th 11am -2 pm Sec 4: Th 3-6 pm	Sec 5: F 2-5 pm
1	Geometric/Wave Optics	Jan 5	Jan 6	Jan 7	Jan 8
2	Spectroscopy	Jan 12	Jan 13	Jan 14	Jan 15
3	Interference/Diffraction	Jan 19	Jan 20	Jan 21	Jan 22
4	Data Analysis I	Jan 26	Jan 27	Jan 28	Jan 29
5	Data Analysis II	Feb 2	Feb 3	Feb 4	Feb 5
6	Labview	Feb 9	Feb 10	Feb 11	Feb 12
7	High-Pass Filter	--	Feb 17	Feb 18	Feb 19
8	Low-Pass Filter	--	Feb 24	Feb 25	Feb 26
9	LRC Circuits	Mar 2	Mar 3	Mar 4	Mar 5
10	Mechanical & Acoustical Resonators	Mar 9	Mar 10	Mar 11	Mar 12
11	Fourier Spectra	Mar 16	Mar 17	Mar 18	Mar 19
12	Loudspeakers	--	Mar 24	Mar 25	Mar 26
13	Student Designed Lab	--	Mar 31	Apr 1	Apr 2
	Make-up Labs	--	Apr 7	Apr 8	Apr 9
Final Exam: 2:30-3:30 PM on Wednesday April 21					

Honor Code Standards: In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Harassment: Harassment of any kind is inappropriate at BYU. Specifically, BYU's policy against sexual harassment extends not only to employees of the university but to students as well. If you encounter sexual harassment, gender-based discrimination, or other inappropriate behavior, please talk to your professor, contact the Equal Employment Office at 422-5895 or 367-5689, or contact the Honor Code Office at 422-2847.

Disabilities: BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the student and instructor by that office.

Children in the Classroom: The serious study of the physical and mathematical sciences requires uninterrupted concentration and focus in the classroom. Having small children in class is often a distraction that degrades the educational experience for the entire class. Please make other arrangements for child care rather than bringing children to class with you. If there are extenuating circumstances, please talk with your instructor in advance.