Phys 13BH / Phys CS 15B **Winter 2014**

Instructor:	John Martinis, Broida 4111	martinis@physics.ucsb.edu
Teaching Assts:	Rohan Bhandari	rohan@physics.ucsb.edu

Lab Room:	Broida Hall 6334
Lecture Time:	Normally W 2-3 pm in lab room, mandatory attendance.
Office hours:	Nominally W 1-2 pm, but drop in anytime.
Lab Times:	W 3-6pm or F 3-6 pm, TA present during these times; M-F 10am-10pm, entry via doorcodes
Lab Due Dates:	Turn in flash drive with weekly work to drawer in lab room by 6 pm Friday. You may work ahead.
Lab Visit Report:	You will report on your laboratory visit starting around week 5.
Design Project:	You will demonstrate your design project and have the class contest during lecture on week 10, Wed. March 12.

Course Web Page: All materials are posted on the course web page, which can be found at http://www.physics.ucsb.edu/~phys13BH/w2014/ .

Textbook: For Physics 13BH, you will learn LABVIEW from our main textbook *Hands-On Introduction to LabVIEW for Scientists and Engineers*, by John Essick, ISBN 978-0195373950, published by Oxford University Press.

I also recommend a textbook that will be very useful for the machine shop course and will be the only required book for next quarter, *Building Scientific Apparatus, Fourth edition* by John H. Moore, Christopher C. Davis, Michael A. Coplan, and Sandra C. Greer, ISBN 978-0521878586, published by Cambridge University Press.

Purpose and coursework: This is the second quarter of a year-long class designed to help you learn to do experimental physics research. This quarter will focus on experimental techniques, specifically the use of personal computers for data taking, along with elementary instruction on machine shop use. The idea here is to teach you enough skills so that next quarter you will be ready to build your own experiment, and that you know and are productive enough to join a research group this summer.

There will be four components to the class:

(1) Data acquisition will be controlled using National Instruments LabVIEW software. After some initial exercises, you will write your own LabVIEW programs that will produce specified voltages and read time-dependent signals via analog-to-digital converters. You will then write a feedback control program that measures the temperature of a copper rod and changes the voltage applied to a heater so as to keep the temperature constant.

Prior programming experience is not required. Please note, however, that the real purpose of the course is not to teach you LabVIEW! Instead, you will be expected to learn it by yourself, with an occasional bit of help. This is much closer to what will happen when you are working in a lab. Everyone in the lab who knows what they are doing will be too busy to teach you!

By the end of each week, you will turn in a flash-drive for the LABVIEW assignment for the week, which the TA will then grade by Wednesday of next week. For those who are familiar with programming, you may find the initial projects simple, so

it is fine to work ahead in order to spend more time on the more interesting experimental parts of the projects.

(2) A design project will help you understand the challenges of putting together an experiment from scratch by building a simple machine. The project is intended to teach you the importance of prototyping – the rapid testing of many ideas using simple materials and construction. This year, we will make a simple "grasshopper" jumper using only cardboard, toothpicks, masking tape, brads, and 3 rubber bands. The contest will be to build a jumper such that the entire machine jumps as high as possible off a table. As part of the final presentation, you will have to analyze the efficiency of your jumper using simple physics.

You will choose a partner for the project. The jumper will be demonstrated to the course instructor during week 9 for a grade. For the last class period, we will have a jump-off contest with a prize for the highest jump.

(3) Machine shop use will be the third component to the course. At a date to be determined later, you will go to the machine shop and get an introduction to the class, watch a safety video, and sign up for instructional time. You will make a small project for the shop course, which will teach you basic operations for the important machines in the shop. You will continue to practice using the shop during construction of you project next quarter.

The machine shop work will be supervised by the instructor in the shop. The instructor will give you a satisfactory/unsatisfactory grade for your work.

(4) A lab visit will be the fourth component of the course, which is intended to have you overcome any shyness about finding out and asking for a research job this summer. Here, you will take the time to explore a research laboratory on campus that might be of interest to you. Nothing beats working in a lab for letting you find out what doing physics is like (little resemblance to classes!), what going to graduate school would be like, and what use all this book learning really is (a lot actually). You will pair up with another student and interview a graduate student or principle investigator for the lab. During the quarter and report back to the class on what you discovered. I will schedule the short oral presentations around the 5^{th} week of class.

As was the case last quarter, you will have 24-hour access to the lab, where there are computers with LabVIEW and associated equipment for you to use.

Grading: If you are enrolled in Physics 13BH, then you will get a letter grade. If you are enrolled in CS 15B, then you will get either 0, 1, 2, or 3 units of credit depending on how much work you have completed. For a grade of A or A- it is 3 units, B+ is 2 units, B is one unit, and B- or below is zero units. You need to finish the shop course and turn in the paper to get full credit.

The class will meet 2-3 p.m. on Wednesday, and attendance is required. You will be allowed one unexcused absence, after which you will lose one letter grade per additional unexcused absence. As we meet only ten times during the quarter, this policy is intended to ensure that you do not fall behind in your work. If you have a difficult situation, talk with me in person beforehand. If you convince me that you are up to date with your work, it is likely something can be worked out. Repeated unexcused arrival in class more than 10 minutes late will be counted as absence.

For each week, there is an assignment sheet posted on the course web page. It may include programming LabVIEW, doing calculations, or both. Once you have completed the assigned work, you will copy any code you have written to a flash drive that we will provide to you for the quarter. All code necessary to run your assignment,

including sub-VIs, must be in the correct folder on your flash drive. Calculations must be written out on paper, or placed in a folder on your flash drive.

You will get two grades for each week's assignment. One grade will reflect whether your code and calculations are correct (that is, whether they produce the correct result), and the other will reflect the quality of your code. This second grade will take into account the readability, efficiency, robustness, and elegance of the programs you have written.

The oral presentation of the lab visit will also count toward your course grade.

Instructor Office Hours: Although my official office hours are W 1-2 pm, I prefer that students drop by and discuss things with me at any time. I spend most of the time during the day in my office, and if I'm not working on something with a deadline I will be happy to talk with you. If you send me an email, please avoid non-trivial questions about physics or your experiments, as it is much more efficient to talk about those things in person.

Graduate Student Teaching Assistant: The TA will be in the laboratory during the W and F afternoon classes in order to answer your questions. The TA will be grading the weekly assignments.

Notebook: Although you will only be turning in work via the flashdrives, I also recommend that you practice taking notes in your laboratory notebook used last quarter.

Practicalities:

1. Weekly assignments are listed on the website.

2. Door codes from last quarter should still work.

3. Additional parts for any setup or other major items can be obtained by contacting either Bob Pizzi (room 3310, phone 893-2553) or Dan Bridges (room 3217, phone 893-4072). If those rooms are empty, then you should also look for one of them in the senior labs on the 3rd floor, ocean side, or the lower division labs on the 2nd floor on the mountain side of Broida.

4. Computers must not be altered or have any additional software installed without permission. The computer labs need LABVIEW and special hardware to do the more advanced experiments, so the work needs to be done in the laboratory. Please do not alter the computers or install any software without permission. Please note that the TAs can not read your computer files if they have links to any special software.

Course Policy: You must do your own experimental work and writing in this class. You are, however, encouraged to discuss your work with other students.

Academic dishonesty will be dealt with severely. Among the prohibited activities are (1) any form of plagiarism. You must have written or created 100% of the work you turn in. (2) Attempting to misuse any course-related computer system. (3) Tampering with another student's coursework.

If not prearranged with the instructor, absence will be excused only in case of serious illness, death in the family, or unavoidable circumstances of similar severity. Documentation may be requested, and in case of illness you will need to convince the instructor you were actually sick. Please don't come to class if you have a fever.

Turning In Your Assignments. You will be given a flash drive to use during the quarter for submitting homework assignments. Please note:

- For each week, please make a folder at the top level of the flash drive, the name of which is your last name followed by an underscore and the week. For example, if your name is Enrico Fermi, you should make a folder called fermi_week1 for your week 1 assignment. Place all code and associated files that you would like to have graded for that week in the appropriate folder.
- All weekly assignments are due in the drawer in the laboratory room by 6:00 p.m. on Friday of each week. The flash drives, when graded, will be returned to this drawer.
- The folder for each week's assignment must be self-contained. In other words, all code necessary to run your assignment, including any sub-VIs, must be in the folder.
- You are responsible for keeping backup copies of all your work. I strongly suggest that you immediately back up your work to a personal drive each time you end a programming session.
- Files stored on the lab computers may be wiped out at any time by software updates.

Lab Visit and Presentation Guidelines. So that you can become better informed about research activities and opportunities on campus, you and your partner will visit a research group and report back to the class on what you learned. Please follow these guidelines when you make your lab visits:

- You and your partner should sign up for a lab to visit.
- Unless the signup sheet explicitly states that you should contact the principal investigator (PI), please don't. Instead, go to the lab and ask a graduate student or postdoc if they would be willing to answer a few of your questions and show you around. It is better just to go, rather than trying to contact them ahead of time. If they cannot talk with you, ask whether you can come back later. If you are supposed to contact the PI, try going to posted office hours.
- Be polite! You are asking these people to give up their valuable time to talk with you, so be sure to show your appreciation.
- Take notes on your impressions of a lab immediately after your visit.

For the presentations, please provide the following information in each 10-minute presentation:

1. Who is the PI? What is his/her educational and professional background?
2. What specific scientific expertise does this research group have? What experimental techniques and equipment and/or theoretical methods do they use in their research?
3. What scientific problems is this group working on?
4. What results have they obtained?
5. Do they have any available positions for summer undergraduate research assistants?