Physics 3330: Electronics for the Physical Sciences -SPRING 2014

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Course Webpage: http://www.colorado.edu/physics/phys3330

Introduction: This course is designed to be a rewarding, challenging, creative, and even fun experience. It will provide you a deep introduction to electronics and to experiential design/modeling, using electronics. Modern physical measurements, communication, and computation rely on electronic hardware and instrumentation. Electronic instrumentation is used in all sub-fields of physics, including condensed matter, elementary particles, nuclear physics, and atomic/molecular/optical physics. Electronic measurements are no less common in the other physical sciences, and are essential in many modern interdisciplinary areas such as satellite-based environmental monitoring, the experimental study of chaos, nanotechnology, and the search for extraterrestrial life.
Electronics for the Physical Sciences provides an introduction to electronic design through hands-on experimentation. You will be building electronic systems from scratch, then debugging them and demonstrating that you understand how they work.

Organization: There are ten student workstations, each consisting of a set of electronic measuring instruments. You will work in pairs, using the same workstation throughout the semester, but sharing it with students belonging to the other lab sections. Individual experiments, on the other hand, are built up on circuit boards that your team keeps for the entire semester. This allows you to continue to work on your circuit for as long as you need to complete the work.

A course calendar showing the lab and lecture plan for the semester and other useful information is posted on the course webpage. During the semester, announcements will be posted on the course web page and, if needed, sent to you by e-mail. In accordance with University policy, you are required to maintain and regularly check an e-mail account. You are also encouraged to use e-mail to communicate with the instructors.

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Lab Sessions: Each section has one 3-hour instructional lab per week in Duane G-230, supervised by your lab instructor. You must attend your scheduled lab. The course will go much more smoothly (and quickly) for you if you are well prepared for each lab session so you can get most of the work done while your instructor is there to help. The lab is open for unsupervised work any time the building wing is open, and when no other section is meeting. Access will be via the eastern stairwell. These times are available for you to complete unfinished experiments or to explore your own ideas. Your Buff One Card will open the lab door. Please do not prop open the lab door or the hallway barrier door: doing so will result in a warning and then loss of keycard access to the lab.

Lectures: There will be a series of lectures on Tuesdays and Thursdays from 1:00 to 1:50 pm in Duane G2B-41. We will be using iClicker remote transmitters for the class. They are the white iClicker (Radio Frequency Classroom Response System) ones, available in the CU bookstore. The material includes theoretical background that you will need to do the experiments as well ask discussion of lab skills, such as creating a professional lab notebook. The schedule for the lectures is posted on the web site. The midterm exam will cover material from the lectures and from the labs.

Textbook: There is not a required textbook. Two of very useful references which you will likely need to consult at different times in the semester are The Art of Electronics, 2nd Edition by Horowitz and Hill and The Electronics Companion by A.C. Fischer-Cripps (IOP Press). Copies of these references are available in the lab room. A variety of manuals and specification sheets for particular electronic components will be essential and available through the course website.

Midterm Exam: There will be a midterm exam given about Week 10 in the evening. We will advise about the exact date later in the semester. This exam will focus primarily on the theoretical material covered in the lectures as well as some practical knowledge that you are expected to have gained from the lab work.

Lab-prep: Preparation for the lab experiments is critical. Preparation will consist of two components. The first will be done using Mathematica where you will have to predict the response of the circuits you will build in lab. The second part will be addressing laboratory preparation as called for in the specific lab-guides. Lab-prep documents are due at midnight the evening before your lab and should be uploaded to the dropbox on D2L as well as brought to lab preferably on your laptop (or USB memory stick). Late submissions will NOT be accepted.

Lab Partners: You may perform the experiments either individually or with a partner. Groups larger than two are not permitted. If you work with a lab partner you should analyze the data separately and turn in separate Lab-prep and Lab notebook scans.

Lab notebook: For details, please see the course website.

1. A lab notebook will provided at the beginning of the course. You should bring the notebook to every lab including the times you work on your final project. Do not use loose sheets. If you ever forget to bring your notebook to the lab and have to use loose sheets instead, be sure to tape or glue these into your lab book as soon as possible.

2. Don't skip pages. Use them all. Write in ink. Don't erase mistakes, rather, box them and put a line through with short explanation e.g., 'Wrong!'. Do not tear out or remove pages.

3. Enter the date in your notebook when you start to work each day. Use a consistent format so it is easy to find the work that was done on a given day or a given experiment. Noting the time in your lab book for the start of specific experiments is also useful.

4. Keep a record of your data as well as of the experimental procedure, describing what you tried, what worked and what did not work etc.

5. Your lab book will be your main format for communicating what you did in the lab, your results, and scientifically argued conclusions. Make sure that you get your instructor's initials and date on your lab notebook before leaving the lab.

6. More details about keeping a complete lab notebook will be covered in lecture and at the beginning of the first lab section.

Final Project: The last four weeks of the semester are devoted to projects. You will use the skills you have learned to explore a topic of your choice. A list of projects from previous years is posted on the web site, just to give you some ideas. If you have an idea for a project at any time during the semester, by all means discuss it with your instructor and begin reading and collecting the materials you will need. This course is mostly about analog rather than digital electronics, because a good knowledge of analog is more important for laboratory scientists. We will discourage projects that are all or mostly digital. You may not incorporate high voltages into your final project without prior discussion with your lab section instructor. Your instructor may disallow or discontinue any project that uses high voltages if strict safety rules are not observed. The final project topic should be something you can build and allows you to utilize what you learned during the semester. Final project is worth 200 points total and will be assessed for 4 different components:

1. Project proposal (40 pts)
2. Progress reports (10 pts each/ 4 total)
3. Oral Presentation (60 pts) will be Monday the final Week of the course. Talks will be scheduled from 9 am to 5 pm. You should plan to give a computer-based presentation (e.g. PowerPoint, keynote etc.). The quality of your presentation will be graded in addition to the details of the project. Demonstration of your project to the class should also be the part of the presentation. More information on the presentation will be provided later in the term.
4. Project reports (60 pts) due on the last Week of the course. You must submit fully polished, typed documents with complete figures, diagram and data. If you work in team, you need to submit only one report per team but must specify the contributions of each member to building the project and to the write-up. The quality of writing will be graded in addition to the details of project.

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Grading: The grading will be based on a maximum of 1000 points.

Clicker questions (lectures)	40
Online Surveys (Week 1 and 15)	10 (5 pts each for participation)
Lab Skill Activities (online)	20
Lab-prep (Mathematica/ lab books)	90 (10 pts for each guided lab)
Lab participation	140 (10 pts for each week)
Lab notebooks	400 (40 pts for each guided lab)
Midterm exam	100
Final project	200 totals
Project proposal	40
Weekly progress reports	40 (10 pts each week)
Final presentation	60
Final written report	60

Lab-prep is due midnight prior to your of your lab section (D2L dropbox).
Late lab-prep will not be given credit.

Lab notebook scans are due at midnight on Sunday for the Tuesday lab sections and midnight on Tuesday for the Thursday lab section. (D2L dropbox).

Late lab notebook penalty: for labs that are submitted (via scanned labbook into D2L) that are less than 1 day late, 25% will be taken off your score, from 1 day to 1 week late 50% will be deducted. Lab notebook scans will NOT be accepted more than 1 week late.

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Important Lab Rules:

1. If you are the last to leave the lab, first be sure to turn off all equipment, especially soldering irons and hot plates. Then close all windows and turn out the lights. Never prop the door open. Anyone who has authorization to use the lab will have access. The equipment is expensive and it would be very difficult to replace.

2. Before you leave the lab, clean up your mess. Your bench top should be totally clear except for the test equipment and the toolbox. Your own circuit boards and other equipment should be left on your labeled shelf in one of the storage cabinets. Communal equipment, including meters, stop watches, tools from the bench, cables, etc. should be returned to their storage locations.

3. Faults or damage that may occur to any instrument or non-trivial component should be reported to an instructor or to Michael Thomason (his phone number is posted in the lab). Label the offending item with a tag stating the nature of the fault to help us with repairs.

Other policies set by the University

Disability issues: If you qualify for accommodations because of a disability, please submit a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and http://www.colorado.edu/disabilityservices.

Religious observances: Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. See full details at http://www.colorado.edu/policies/fac relig.html. Please contact us if you will miss a lecture or laboratory session due to a religious observance to arrange an appropriate remedy.

Classroom behavior: Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. We will gladly honor your request to address you by an alternate name or gender pronoun. Please advise of this preference early in the semester so that we may make appropriate changes to my records. See polices at http://www.colorado.edu/policies/classbehavior.html and http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#studentcode.

Honor code: DON'T CHEAT. All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu;303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and http://www.colorado.edu/academics/honorcode.

Discrimination & sexual harassment: The University of Colorado at Boulder policy on Discrimination andHarassmenthttp://www.colorado.edu/policies/discrimination.html, the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment(ODH) at303-492-2127 or the Office of Judicial Affairs at303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh.