Instructor:

Anyes Taffard, ataffard@uci.edu
All Lab/lecture meetings will be held in MSTB 113, M/W 2:00-4:50pm.

Goals:

The purpose of the lab is to acquaint the student with:

• Analog & digital devices
• Design of circuits
• Instruments and procedures for electronic tests and measurements.

The aim is to teach a practical skill that the student can use in the course of his or her own experimental research projects in physics, astronomy, electronic engineering, or another science.

At the end of this course, the student should be able to:

• Design and built simple circuits of his or her own design.
• Use electronic test & measurement instruments such as oscilloscopes, function generators etc… commonly used in experimental research.

Required lab manual:

Authors: Thomas C. Hayes
Title/Edition: Learning the Art of electronics, Hands-on Lab course.
Publisher: Cambridge University Press
ISBN: 978-0-521-17723-8
Amazon link

Optional companion textbook:
Authors: Paul Horowitz and Winfield Hill
Publisher: Cambridge University Press
ISBN: 0-521-29837-7 (paperback) 0-521-23151-5 (hard covers)

The course website provides useful links to equipment datasheets and other useful documentation.
Grading scheme:

- 50% Lab Assignments (8 labs)
- 20% Written test (Midterm)
- 30% Final project

There are eight, equally weighted, lab assignments covering the material from each of the first 8 weeks, and due at the beginning of Monday lecture of the following week. Two students working together on a lab report should only turn in a single report and both will receive the same grade for that week. If the class has an odd number of students, we’ll rotate to have one student working on his/her own.

The midterm will be a written test covering the material from weeks 1-4: reading material, lecture slides, lab experiments. The midterm will take place during Wed class in week 5. The midterm is close books, close notes. A basic calculator may be needed.

Weekly reading assignment

You are expected to come prepared to the lab.

Each week, there will be a reading assignment from your lab course manual. You should read at least half before Monday lab and complete it before Wed lab. Part of the assignment will suggest to go through some worked examples. You are strongly encourage to do so since these will help you understand the lab. This material is also part of the midterm exam.

Lab reports:

For each week lab, students (team of not more than two students) will prepare a lab report for grading. This report is distinct for the notebook, the notebook is not a substitute.

Weekly lab reports are due at the beginning of Monday lecture of the following week. They must be submitted electronically on the course dropbox on myEEE as a single PDF document.

Make sure to follow the instructions regarding the format and content of the lab report which are available on the course website.

Lab report should be typed on letter format paper. Please make sure to label what lab section and what question you are answering (see template provided on the course website.)

The lab allows you to organize simple experiments and to document your results effectively so that others know exactly what you did and what you learned form the experience (conclusions). In case your experiments or measurements go awry (it does happen!), keep your calm, ask for help and engage your thinking skills to overcome the problem at hand. Recall that physicists/engineers are problem solvers who can see a
way out where others may be lost. Often the issue have to do with not following the instructions correctly, or mistakes in breadboarding.

**Lab notebook:**

As part of training to be a scientist, students should maintain a personal notebook, just as a research scientist does. This lab notebook will not be graded, but the student must have one and use it. It must be bound, with no loose pages.

Here is guideline for a lab notebook: a notebook should contain sufficient detail so that a year later the experiment could be duplicated exactly.

In the notebook, you should:

- Draw schematic diagram for every circuit that is built.
  - Label this diagram with:
    - Part numbers
    - Pin designations
    - Output/input designations
  - Show the major connections to external power supplies etc…
- List the instrument used by type and model (at least once if you use the same set each time)
- Experiment procedure and its subtleties.
- Record a table of all measurements
  - Include units (eg. mV) for inputs and outputs
  - Record the scale (eg 200 mV) of the oscilloscope or meter
  - For digital circuits, this table may be in the form of a truth table.
- Observations, conclusions of results obtained.

**Final project**

The final two weeks of the quarter are reserved for designing and testing an electronics project of your choice. You should build something that you would be interested in, or that might even be useful or fun for you. You should consult with the instructor to select a suitable topic that can be completed within two weeks. The project should be neither too hard, neither too easy. You must not plagiarize project you find on the internet. Your proposal should be submitted to the instructor by Tuesday, February 26th, as a written document. You are more than welcome to iterate with the instructor ahead of time to define a well-suited project.

Some examples of suitable project are (you are not require to do one of these projects):

- Optical communication link
- Random number generator
• Motion tracker (with an accelerometer and/or gyro)
• Heart rate monitoring
• Guitar effect box or theremin
• Musical instrument tuner
• Home alarm system
• Robot with Arduino

You will research a design, build the circuit, and provide a working demonstration of your project.

The grade on the final project will be based on the following items that you turn in:
• Project proposal submitted by the deadline above.
• A one-page description of your design including its purpose and specification goals.
• A schematic of your circuit as built (using EDA)
• A printed-circuit board (PCB) layout suitable for the two-layer fabrication (using EDA). Instructions are provided on the course website and will be reviewed in week 9. For Arduino project, turn in code.
• A description of the measurements and tests you performed to characterize your actual circuit’s behavior.

The deadline to submit the items above is noon, Wednesday 20th of March (during final week). The above must be submitted electronically (uploaded to the course dropbox), as a single PDF document.

In addition, you should be prepared to give a working demonstration of your project in class during week 10, or alternatively, you can upload a YouTube video showing your circuit in action (due Wed 20th, March at noon).

For your project you may use any of the components from this course (including the Arduino) or others available in the lab stock room. “Pricy” components (eg Arduino and interfaces) must be returned to the lab at the end of your project.

You can also use any other components (free samples are a great resource and digikey is a good online vendor for small quantities) but getting them in time will be your responsibility.

Holidays

Monday January 21st, and Monday Feb 18th are official UCI holidays. The lecture for these weeks will typically be the week(s) before. You will have access to the lab throughout the week and on Saturdays. Two buddy policy applies.

Makeup Policy:

Attendance to all Mo/Wed labs is mandatory.
**Academic Honesty:**

All the normal rules of Academic Honesty apply to this course. The UCI Academic Senate policy on Academic Integrity can be found at [https://aisc.uci.edu/index](https://aisc.uci.edu/index).

The most important is that the lab reports and final project that you turn in must be your own work and not copied from anyone else's lab report or any other source. **If you or your lab partner violate this then both of you will receive a failing grade for the entire course.** Note that detection of cheating and subsequent prosecution is pursued vigorously in this course.

**Enrollment Issues:**

The Instructor cannot deal with enrollment. You can only do so through WebReg - Electronic Add/Drop ("EAD"). See Physics Undergraduate Affairs for more details. Questions regarding these policies should be taken to the Physics Undergraduate Affairs Office, RH 4109.

The last day to add/change the section in which you are enrolled is Friday, January 18th (end of week #2). The last day to drop the class without a 'W' designation on your transcript is Friday, Feb 15th (end of week #6).