"Syllabus"

The emphasis will be on a basic working knowledge of digital electronics and, hopefully, a substantial amount of microcontroller interfacing and programming.

The following "syllabus" for the classroom component of the course is a list of topics, but with no specific schedule. In order to make time for the project part of the course, we will try to move as quickly as possible through this material.

- binary arithmetic and logic gates
- combinational logic: multiplexers, decoders
- sequential logic: flip-flops, counters
- finite state machines
- analog-to-digital (A/D) and D/A conversion
- memory, microprocessors

Text

In the past, both this course and the preceding PHYS 431 have used either the "The Art of Electronics" by Horowitz and Hill, which is an excellent reference text and is on the
bookshelf of many scientists and engineers, or "Fundamentals of Electrical Engineering" by Rizzoni. However, both these books are problematic:

Rizzoni is a good book for Electrical Engineers and is worth getting if you find a used copy and can afford it. It has a section on digital electronics. Horowitz and Hill (presently in 2nd Ed.) was published in 1989 and some aspects - particularly the digital sections - are a bit dated. The word on the street (still) is that the 3rd Ed is going to come out later this year, but there is no sign of it yet.

Rather than commit to a specific book, I've decided that we can get along just fine with a combination of class notes and references to online courses and free e-books. I'll be mentioning specifics in class, but below is the most important link, to Kuphaldt.

Volume IV is the digital section and covers all we will do and then some:

- Online Textbooks (Kuphaldt)
- Wikipedia (of course)
- http://www.allaboutcircuits.com

**Homework**

Homework will be assigned weekly, on Wednesday, and collected on the following Friday by 5pm. (Slide it under my office door - Rm 162 Willamette.)

**Labs**

There will be one 3 hour lab a week, in which you will work on your own. (However, you can - and probably should - work in pairs for the project.) The T.A. or professor will be available during the scheduled lab times, but later in the term, you should be able to work on your own outside the scheduled times if necessary.

The laboratory and project are very important components of this course. All students should, by the end of the course, feel comfortable with basic practical electronics and associated techniques. Please obtain a lab notebook, preferably hardcover with quadrille paper, or use one of the notebooks provided. This will be the primary record of your lab work. Your lab report should include any pre-lab notes which are useful to you for carrying out the in-lab work. All data, observations, notes, calculations, etc. should be entered in the notebook.

After the each lab, produce a brief report summarizing the work you did in the lab. Provide headings for your entries which correspond to those of the lab instructions. Clearly indicate the location of required material within your report. Note any unusual or unexpected results. Your reports should be put in the box in Rm 11 by 5pm Friday for grading. When graded, they will be left on the table outside the box.
In order to pass the course, you must complete the labs and project!

Lab Roster

Tue 1-4pm

- Rick Suhr
- Kenny Black
- Brendan Hobbs

Thu 1-4pm

- Nathan Montgomery
- Katherine Woodruff
- Chris Vergara
- Cody Grimm
- Jacob Quanbeck
- Dylan Fast

Thu 4-7pm

- Joe Voss
- Martin Tauc
- Courtney Klosterman
- Lindsay Wills
- Garland Will
- Matt Boggess

Exam

There will be one mid-term on Monday 3rd May, in class.

Project

An important part of this course is the project. We'll reduce the homeworks and lectures in the second half of the course so that we can all focus on projects. A second TA (James Kunert) will also be available.

The basis of the project will be microcontrollers (specifically AVR Atmel controllers, using the Arduino programming environment). These things can then control LEDs, read sensors of various types, write to displays, control actuators etc. Microcontrollers are how digital electronics is done in the 21st Century and your life is full of them, whether you
realize it or not. We would like every group to come up with different applications. There are lots of Web resources and project ideas.

However, just learning how to communicate with them (in C) will be challenging, but very worthwhile. I still get into a frenzy of excitement when a program just turns on an LED.

Here are some application possibilities. I'll keep adding others:

- light-following sensor
- reaction timers/stopwatch
- LED matrix displays
- LCD display interfacing
- guitar tuner
- velocity/acceleration measurement
- tilt sensing
- temperature reading and controlling
- arbitrary function generator
- servo or stepper motor controller
- bar code reader
- credit card reader

Please start thinking about your projects early!

Project Proposals

Project proposals are due Monday April 26th!!! We'll discuss some basics of microcontrollers, so you can have a reasonable idea of what is possible. The proposal should include:

- Brief description of project
- Possibly a block diagram of circuit layout
- Part list, if you need non-standard parts
- Possibly references

You must get your proposal approved by me before you start. If you turn your proposal in early, you will get to start on your project sooner. It is fine to get a project idea from some external source. Please reference this, however, so I can read the original to get a better idea of the project scope. Your proposal will not be "graded", but you need to turn it in.

Project Grading

The final project grade will be based upon the checkout and the write up. You need to schedule an appointment with me to see your project in action before the end of term. The write up, which should consist of your lab book development notes, your amended
proposal, and a summary of the problems you had and what you would do differently next time, is due by 5PM on Thursday June 10th.

The idea, execution, and write up will all be considered in the final project grade. If you are working in a team, try, if possible, to describe who did what.

Grade Composition

The grades for the course will be based on homework (25%), labs (25%), the midterm (15%) and the project (35%).