ECE 469 - Power Electronics Laboratory

Instructors:

This course has recently been taught by Professor Pilawa.

Prerequisites:

The prerequisites for this course are ECE 343 (Electronic Circuits Lab) and credit or concurrent registration in ECE 464 (Power Electronics).

When to Take It:

ECE 469 is the lab course for ECE 464 (Power Electronics), so it is best to take them at the same time. It is, of course, possible to take it later, but ECE 464 and ECE 469 are meant to stay in sync - the material in ECE 469 helps with the material in ECE 464 (and vice-versa). There is no rush to take this course because there are no undergraduate power courses that follow it. The prerequisite for ECE 464 is ECE 342 (Electronic Circuits), which is not absolutely necessary, but the lab experience from ECE 343 (especially the power lab) can be useful.

Class Content:

There are about ten lab projects, each a week long. You'll work in pairs, and stick with your partner the entire semester; you might want to find a partner before you take this course.

The first three labs cover rectifier circuits, in which you will take an AC signal and rectify it to a DC value through combinations of diodes, and then filter the output. The next several labs cover DC-DC converters, and you will build a buck, boost, and possibly other simple topologies. The lab then moves on to inverters, which are DC-AC converters, and introduces PWM converters at the same time (there is significant overlap in the content). The last labs before the final project require measuring the non-idealities of inductors and capacitors (most notably, the equivalent series resistant, ESR). Finally, the last several weeks are dedicated to building the final project converter.

Work:

There is a three hour lab once a week, and a one hour lecture at the beginning of the week to introduce new material. Prelabs are usually turned in during the lecture; the prelabs are fairly reasonable, with only a couple of parts to one or two problems. After two or three lab projects, students write a report (about six pages per project) according to a rather rigid format and take a decent amount of time - but an all-nighter the night before they're due is usually sufficient (though not recommended).

There is a final project at the end of the semester for about three to four weeks where you are assigned a converter to build with your partner (graduate students are typically assigned tougher converters, while undergrads are usually assigned basic DC-DC converters). You are expected to meet specifications for ripple and voltage, etc. by working around the limitations of real components; then, you must build a feedback network into your converter which stabilizes it. The projects are graded according to their difficulty, so more difficult projects are given more leeway for not meeting their specifications.

Life After:

No undergraduate classes depend on ECE 469, but it is extremely useful for talking to companies about power electronics. Many companies, even those that don't do anything about power electronics, love for you to know how basic things like DC-DC converters work.