

Physics 210 (4 credits)
Analog and Digital Electronics; Spring 2014

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Office Hours: MWF 11-12, other times by appointment.

Course Description:

The course introduces analog and digital electronic circuitry through both theory and laboratory work. The class will emphasize circuit design, and the lab will acquaint students with test equipment and troubleshooting. The course is suitable for science students wishing to become comfortable working in the laboratory, students with an interest in electronic art and music, students interested in computer science, and also those simply wanting a deeper understanding of the innards of integrated circuits.

Analog topics include direct and alternating current circuits, filters, diodes and rectification, bipolar and field effect transistors, operational amplifiers, and oscillators. Digital topics include combinational and sequential logic, gates, and flip-flops and memory. Other topics may include audio signals, transducers, analog/digital conversion, and microprocessor basics.

Prerequisite: Mathematics 210, or the permission of the instructor. No prior physics required, though it's helpful.

Course Requirements and Grading:

Weekly problem sets: due the following week. Problem sets will be checked or given a zero.

Exams: Two, one hour midterm quizzes (dates to be announced), each accounting for 25% of the total test grade. One, two hour final exam, accounting for 50% of the total test grade.

Weekly labs: you must read the lab handout before coming to lab. If a design is called for, have it done before coming to lab. I will be monitoring your labwork and lab write-up in lab. The good news is there is no post-lab write-up.

Homework and lab work can change your total test grade by two grades (*i.e.*, a B test grade can result in anywhere from between an A- to a C+). You can also gain up to 20 points of extra credit on your total test grade by designing, building, and troubleshooting a circuit of some practical interest. Examples are a 4 bit, 2 function calculator that displays the results, a radio receiver and tuner, and a digital clock that uses the 60 Hz from the wall as the basic oscillator.

Text: Principles of Electronic Instrumentation by Diefenderfer and Holton.

Physics 210: Tentative Schedule

- Week 1: Direct current circuits, voltage and current dividers, equivalent circuit theorems.
Read Chapter 1.
- Week 2: Capacitors and inductors, low and high pass filters.
Read Chapter 2.
- Week 3: Alternating current circuits. Transformers.
Read Chapter 3 and Sections 4.1, 4.2, and 4.5.
- Week 4: Diodes, zeners, rectification, power supplies.
Read Chapter 5.
- Week 5: Bipolar junction transistors (BJT's), emitter followers, emitter amplifiers, and gain.
Read Sections 8.1 - 8.5.
- Week 6: Field effect transistors (FET's), transistor switches.
Read Sections 8.6 - 8.14.
- Week 7: Transistor circuits.
- Week 8: Operational amplifiers.
Read Sections 9.1 - 9.8.
- Week 9: Comparators, Schmidt triggers.
Read Sections 9.9 - 9.12.
- Week 10: Active filters, oscillators, and integrated circuit (IC) regulators.
Read Chapter 10.
- Week 11: Combinational logic, numbering systems, gates.
Read Chapter 11.
- Week 12: Sequential logic, flip-flops, counters, registers, multiplexing and data transmission.
Read Chapter 12.