Physics 5620
Electronic Instrumentation for Scientists
Wayne State University - Fall 2011
Lecture: 4:05-5:30 MW, 177 Physics
Lab: 5:40-8:30 MW, 169 Physics

Amplifier circuits, operational amplifiers, oscillators, digital electronics, analog and digital measurements. This is a 5 credit course

Instructor

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Office hours: by appointment.

Prerequisites

Physics 2140/2180

Textbook

James Diefenderfer and Brian Holton, *Principles of Electronic Instrumentation*, 3rd edition (Saunders College Publishing, 1994, ISBN13: 9780030747090)
There are a few errors to the main text. Check the resources folder on Blackboard.
A very useful additional reference is the set of lecture notes of Doug Gingrich at the Univ. of Alberta.

Objectives

At the end of this course you should be familiar with the fundamentals of analog and digital electronics as applied to scientific instrumentation. You will have an appreciation of the work of an electronics technician and of an electrical engineer and be able to converse with them professionally. You will be able to build prototype circuits and test their operation. You will be familiar with a few sensors and with methods of interfacing computers to experiments.

Laboratory

During the three-hour laboratory period you will construct circuits, make measurements, and compare expected with actual performance of the circuits. You will learn how to use common measuring instruments. You will use computers to collect data and control simple experiments. You will need a bound lab book to keep records of your circuits and measurements. I will collect and grade lab notebooks. This grade will be added to the overall lab grade. A lab report is due one week after the lab. For this course, keep the lab reports simple but concise, with brief explanations of the circuits and measurements, the results of the measurements, and any calculations or graphs that are requested. Neatness counts!

Homework

Problems will be assigned at approximately one to two week intervals. Problems will be due when the next problem set is assigned. Students may consult with the instructor or each other, but each student must write out their own answers individually.

Exams

There will be one midterm and one final. Exams are closed book. There will be no make-up exams.

Grades

Assignments will carry the following weighting:

Homework	25%	
Midterm exam	10%	Wednesday, October 31 (Tentative)
Laboratory reports	50%	
Final Exam	15%	Monday, December 19

Weekly Schedule (*subject to change!*)

Week of	**Topic**	**Chapter (Pages)**	**Lab**	**Homework**
Aug. 31	Wednesday	Meet to distribute syllabus and outline course.		
Sept. 5	Monday	**No class, Labor Day holiday**		
Sept. 7	DC circuits, Capacitors, Inductors	**1** (1 – 18) **2** (23 – 36)	**No Lab**	**Ch. 1:** 1, 4, 7, 8, 18, 23. **Ch. 2:** 1, 6, 10. **Ch. 3:** 6, 7, 13, 22.
Sept. 12	AC circuits	**3** (43 – 55)	**1&2:** DC circuits and filter circuits	
Sept. 19	Diodes and power supplies	**4** (61- 64) **5** (75 – 97)	**3:** Diode and Power Supply Circuits	**Ch. 4:** 1, 7, 11, 16. and complex number review.
Sept. 26	Transistors	**8** (155–179)	**4:** Transistors	**Ch. 5:** 3, 5, 7, 8.
Oct. 3	Transistor circuits	**9** (183 – 190)	**5:** Intro to Multisim	**Ch. 8:** 14, 19.
Oct. 10	Op-Amps	**9** (191–210)	**6:** Op-amps	**Ch. 9:** 5, 12.
Oct. 17	Op-Amp Filters	**10** (215–219)	**7:** Theremin	
Oct. 24	Op-Amp Oscillators & Waveform Generators	**10** (220-231)	**8:** 555 Timer	**Ch. 10:** 2.
Oct. 26, Wed.	Midterm Review			
Oct. 31	**Midterm Exam**	**Analog Circuits**	**No Lab**	
Nov. 2, Wed.	Intro to Digital Electronics	**11**		**Ch. 11:** 2, 5abc, 6a, 7a, 8, 16.
Nov. 7	The Gate Zoo	**11**	**9:** Logic Gates	
Nov. 14	Flip Flops, Latches, Adders	**12**	**10:** Flip Flops	**Ch 12:** 1, 9, 19.
Nov. 21	One Shots, Digital Acquisition, Transducers	**14, 7**	**No Lab**	
Nov. 23-26	**Thanksgiving Break – No Classes**			
Nov. 28	DAC's and ADC's	**14**	**11:** Robot-1	
Dec. 5	Noise, Boe-Bot Robot	**15**	**12:** Robot-2	
Dec. 12, Mon.	Wrap-up, review		**No Lab**	
Monday, December 19, **Cumulative Final Exam**				