University of Wisconsin-Madison
Chemistry 628 – Electronics
Spring 2017

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The goal of this course is to provide you with a practical introduction to electronics as it applies to chemical research and/or chemical instrumentation. After taking this course you should be able to better understand the electronics behind modern chemical instrumentation, to interconnect and modify commercial instrumental modules for use in new applications, and to build new instrumental modules based on operational amplifiers, microcontrollers, and/or other integrated circuits.

To help meet this objective you will be required to 1) attend lecture and complete periodic problem sets, 2) complete one take home exam, 3) complete the laboratory exercises and their corresponding report sheets, and 4) complete a laboratory project where you build a working module using printed circuit board and enclosure construction techniques.

Grading: Your course grade will based on: Problem sets ~20%, Exam ~ 20%, Regular Labs ~40%, and Project ~20%.

Lecture: We will attempt to cover the following topics during the lectures

Direct Current Circuits- Ohms Law, voltage dividers, Kirchhoff's laws, Superposition Principle, Thevenin's theorem, and Norton's theorem

Alternating Current Circuits- complex transfer functions and impedance analysis of RC, RL, and RLC circuits

Operational Amplifiers- basic concepts, applications, frequency response, feedback theory, and noise

Diodes and Transistors- semiconductor physics and applications

Mixed Digital/Analog Circuits- basic digital terminology, A to D conversion, comparators, timers, oscillators, flip flops, registers, multivibrators, phase locked loops

Signal Processing- Fourier analysis, noise, sampling, lock-in detection, heterodyne detection, digital filtering, digital communication

Other topics of interest- power supply regulation, optoelectronics, transmitter/receiver circuits

There is an almost infinite amount of supporting materials to aid in your understanding of these topics. Here are some of the supporting materials that I find useful.

Introductory Electronics for Scientists and Engineers, **2nd Ed**. Robert E. Simpson

Practical Electronics for Inventors, 2nd. Ed. Paul Scherz

The Art of Electronics, 2nd Ed. Paul Horowitz and Winfield Hill

All About Circuits: www.allaboutcircuits.com

EEVBlog: https://www.eevblog.com/

I will also post book chapters, web pages, application notes, and other supporting items, which directly support the lecture topics, on our Learn@UW site.

Laboratory: Learning electronics is best accomplished by doing electronics and the lab will provide you with the opportunity to do electronics. We will follow the lab schedule below in an attempt to correspond to the lecture coverage of the course topics. There will be times throughout the semester where you will need to come to the laboratory outside of your scheduled lab section.

Week 1	1/18– 1/24	Unit 1- Measuring and Filtering
Week 2	1/25 – 1/31	Unit 1- Measuring and Filtering
Week 3	2/1 – 2/7	Unit 1- Measuring and Filtering
Week 4	2/8-2/14	Unit 2-Operational Amplifiers
Week 5	2/15 – 2/21	Unit 2-Operational Amplifiers
Week 6	2/22 – 2/28	Unit 2-Operational Amplifiers
Week 7	3/1 – 3/7	Unit 3-PIC controller
Week 8	3/8 – 3/14	Unit 3-PIC controller
Week 9	3/15 – 3/28	Unit 4-Oscillators and timing
	3/18-3/27	Spring break-Lab Open
Week 10	3/29 – 4/4	Unit 4-Oscillators and timing
Week 11	4/5 – 4/11	Unit 5-Lock-in Amplifier
Week 12	4/12 - 4/18	Unit 5-Lock-in Amplifier
Week 13	4/19 – 4/25	Lab open for Project work
Week 14	4/26 – 5/2	Lab open for Project work
Finals Week		Project Due May 9