



CHEM 628 section 001 Syllabus

Chemical Instrumentation: Design and Control Applications

COURSE INFORMATION

Chemical Instrumentation: Design and Control Applications

CHEM 628 001 (3 Credits)

2020 Spring (1204) [1204]

Description

The design and application of chemical instrumentation; basic principles for monitoring and controlling chemical experiments; optical, electrical and mechanical sensors and transducers of importance to analytical chemical instrumentation; lecture and lab. Enroll Info: Chem 524, 621 or consent of instructor

Prerequisite(s)

Prerequisites are Chem 524 or 621 or graduate student standing.

Breadths

P - Physical Science

Instruction Mode

Online Only

Section Level Com B

False

Department: CHEMISTRY

College: Letters and Science

Canvas Course URL

<https://canvas.wisc.edu/>



2020 Spring (1204) [1204]

Term Start Date: Tuesday, 21-Jan-2020 **Term End Date:** Monday, 1-Jun-2020

Location and Schedule: ONLINE 12:00 AM-12:00 AM

CRN: 224002803

How the Credit Hours are Met

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 will be able to 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 these goals you will be required to: 1) use supporting materials to learn fundamental background information related to electronics. The supporting materials include texts, data sheets, videos, web sites, and research papers. 2) complete periodic problem sets, 3) complete the take home exam, 4) complete the laboratory exercises and their corresponding report sheets, and 5) complete a laboratory project.

We will cover the following electronics topics:

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

Alternating Current Circuits- complex transfer functions and impedance analysis of RC circuits.

Diodes and Transistors- semiconductor physics and applications.

Microcontroller Programming- digital input-output, A to D conversion, Pulse width modulation, serial communication

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

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

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.

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

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

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

All About Circuits: www.allaboutcircuits.com

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

w2aew: <https://www.youtube.com/user/w2aew>

greatscott: <https://www.youtube.com/user/greatscottlab/>

I will also post book chapters, web pages, application notes, and other supporting items that support the course topics, on our CANVAS page.

Learning electronics requires doing electronics and the laboratory will provide you with the opportunity to do electronics. We will follow the accompanying schedule to cover the course topics. There also may be times throughout the semester where you will need to come to the laboratory outside of your scheduled section.

The laboratory activities are done in room 2330 Chemistry.

INSTRUCTORS AND TEACHING ASSISTANTS

Instructor



ROB MCCLAIN

ROBERT.MCCLAIN@WISC.EDU

Instructor Availability

I am generally available during laboratory sessions. Outside of the laboratory times, I am available by appointment.

office: room 2330 B Chemistry

office phone: 262-5615

TA Office Hours

TAs are available during laboratory times, or by appointment.

GRADING AND COURSE MATERIALS

Course Learning Outcomes (CLOs)

- 1 After taking this course you will be able to 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, micro-controllers, and/or other integrated circuits.
[S8111]

Grading

Grading: Your course grade will be based on: Problem sets ~15%, Exam ~ 15%, Regular Labs ~50%, and Project ~20%.

Laboratory Sessions

Week 1	1/22– 1/24	Unit 1 Measuring and Filtering
Week 2	1/27 – 1/31	Unit 1 Measuring and Filtering Unit 1 Measuring and Filtering
Week 3	2/3 – 2/7	Unit 1 Measuring and Filtering Unit 1 Measuring and Filtering
Week 4	2/10-2/14	Unit 2 Discrete Solid-state Components Unit 2 Discrete Solid-state Components
Week 5	2/17 – 2/21	Unit 2 Discrete Solid-state Components Unit 3 Microcontrollers
Week 6	2/24 – 2/28	Unit 3 Microcontrollers Unit 3 Microcontrollers
Week 7	3/2 – 3/6	Unit 4 Operational amplifiers Unit 4 Operational amplifiers
Week 8	3/9 – 3/13	Unit 4 Operational amplifiers Unit 4 Operational amplifiers
	3/16 – 3/20	Spring break
Week 9	3/23 - 3/27	Unit 5 Oscillators and timing Unit 5 Oscillators and timing
Week 10	3/30 – 4/3	Unit 5 Oscillators and timing Project Work
Week 11	4/6 – 4/10	Project Work
Week 12	4/13 - 4/17	Project work
Week 13	4/20 – 4/24	Project work
Week 14	4/27 – 5/1	Project work

Finals Week		Project Due Friday May 8
-------------	--	--------------------------

Required Textbook, Software, & Other Course Materials

ACADEMIC POLICIES



ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. [Academic misconduct](#) compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review.



ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA."



DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals."

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world."



RELIGIOUS OBSERVANCES

UW faculty policy states that mandatory academic requirements should not be scheduled on days when religious observances may cause substantial numbers of students to be absent. Refer to the university's [Academic Calendar](#) for specific information.