UW EE 205 Winter 2024 – Introduction to Signal Conditioning
Lecture: M/W/F 9:30am – 10:20am, HRC 145
Lab: Tu 3:30pm - 6:20pm, ECE 137

Instructor: Prof. Matt Reynolds, M 226 ECE, matt.reynolds@ece.uw.edu
Instructor Office Hours: Mon 10:30 - 11:30am, or Zoom via appointment

TA Office Hour #1: (Wed 2:30-3:30pm) (Lab TA) Ms. Sara Reyes, reyess4@uw.edu
TA Office Hour #2: (Thurs 10:00-11:00am) (Problem Session TA) Mr. Kevin Ho, kjho@uw.edu

Course Summary

This course will provide a hands-on introduction to analog sensors and analog circuits, and how they are interfaced with digital systems to create "mixed signal" systems. Topics include Kirchhoff's Laws, independent and dependent voltage and current sources, resistors, capacitors, inductors, bipolar and MOS transistors, op amps, and how they can be used to implement amplification, attenuation, filtering, sampling, etc. We will also discuss sources of noise and how noise can be mitigated in analog and digital processing. Students will design and simulate analog circuits in SPICE and use these circuits to interface analog sensors with a microcontroller to perform digital processing of sensor signals.

Prerequisites

The course is intended for non-EE majors, and enrollment is open to computer engineering and computer science students only. Prerequisite: either MATH 126 or MATH 136; and either PHYS 122 or PHYS 142.

Students will need to provide a Mac or Windows laptop capable of running LTspice, the Arduino IDE, and Python (Jupyter Notebook).

LTspice:
https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html
Arduino IDE:
https://www.arduino.cc/en/software
Jupyter Notebook:
https://jupyter.org/install

Textbook

Practical Electronics for Inventors, 4th ed.; Scherz & Monk, 2016. ISBN 978-1259587542

Grading

25% Homework Assignments (5 assignments)
30% Lab Assignments (5 assignments)
15% Midterm Exam **In-Class Monday Feb 5, 9:30-10:20am, Room HRC 145**
30% Final Exam - **Wednesday March 13, 8:30-10:20am, Room HRC 145**

Homework and Lab Report Policy

Homework and Lab Reports are due via **PDF upload to Canvas by 9:00am on the Friday it is due**. To be fair to everyone, the acceptance window closes at 9:00am, as we will be discussing homework/lab solutions in class. **There will therefore be no credit for late homework/labs**, however your lowest homework score and your lowest lab score will be dropped.

Course Delivery Policy

The course will be delivered in-person. For maximum flexibility, and to accommodate student travel, illness, or other absences, lectures will be recorded and made available as video recordings via Canvas on a best-efforts basis. PDF lecture notes will be posted to Canvas after each lecture.

Policy on Group Work and Academic Integrity

Preparation and delivery of Homework shall be individual effort. You are encouraged to study and consult with others, but all homework solutions must be your own. Any use of outside resources (e.g. assistance given by others, Web searches, other online resources) must be identified and annotated alongside your solution. **The use of ChatGPT or similar AI tools to assist with the completion of Homework or Exam problems is not permitted.**

Preparation and delivery of Lab Assignments shall be a team effort. A summary of the contributions of each team member to the Lab Assignments shall be supplied as an addendum to each lab report. **The use of ChatGPT or similar AI tools to assist with the completion of Lab problems is not permitted.**

At all times, students are expected to adhere to the University of Washington Student Code of Conduct, Washington Administrative Code (WAC) 478-121, and are expected to properly credit the work of others in all assignments and interactions with the instructor and other members of the class. Any suspected instances of academic misconduct will be reported in accordance with these policies.
https://www.engr.washington.edu/current/policies/academic-integrity-misconduct

Policy on Religious Accommodation

"Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)."

Lec.	Date	Topic	Reading	Assignments
1	Wed 1/3	Course Overview, design tools, Units and symbols	Syllabus Scherz Ch 1	
	Fri 1/5	Problem Session #1		
2	Mon 1/8	Resistance, Ohm's Law, power, resistor combinations	Scherz 2.8 - 2.12, 3.5	Lab 1 assigned (Intro. Instruments) HW 1 assigned
3	Wed 1/10	[Sara] DC sources, Voltage and current dividers, Thevenin and Norton theorems	Scherz 2.12 - 2.19	
	Fri 1/12	[Kevin] Problem Session #2		HW 1 due, 9:00am SHARP
	Mon 1/15	***** University Holiday - No Lecture - Dr. Martin Luther King Day *****		
4	Wed 1/17	[Kevin] Intro to AC circuits and time varying signals	Scherz 2.20 - 2.24	
	Fri 1/19	Problem Session #3		Lab 1 due (Intro. Instruments)
5	Mon 1/22	Capacitors and Inductors	Scherz 2.20 - 2.24	HW 2 assigned
6	Wed 1/24	AC circuits w/ R L C	Scherz 2.25 - 2.29	
	Fri 1/26	Problem Session #4		HW 2 due, 9:00am SHARP
7	Mon 1/29	Semiconductor Devices: Diodes	Scherz 4.1 - 4.2	Lab 2 assigned (RLC circuits) HW 3 assigned
8	Wed 1/31	Bipolar junction transistors - switches and amplifiers	Scherz 4.3	
	Fri 2/2	Problem Session #5	Midterm Exam Review	HW 3 due, 9:00am SHARP
	Mon 2/5	***** MIDTERM EXAM - In Class (50 min) *****		
9	Wed 2/7	FETs - switches and amplifiers	Scherz 4.3	
	Fri 2/9	Problem Session #6		Lab 2 due (RLC circuits)

Lec.	Date	Topic	Reading	Assignments
10	Mon 2/12	Op amps - amplifiers and analog filters	Scherz 8.1 - 8.18	HW 4 assigned Lab 3 assigned (opamps)
11	Wed 2/14	Op amps - amplifiers and analog filters	Scherz 8.1 - 8.18	
	Fri 2/16	Problem Session #7		HW 4 due, 9:00am SHARP
	Mon 2/19	***** University Holiday - No Lecture - Presidents' Day *****		
12	Wed 2/21	Oscillators	Scherz 10.1 - 10.7	Lab 4 assigned (oscillators)
	Fri 2/23	Problem Session #8		Lab 3 due (opamps)
13	Mon 2/26	Voltage regulators and power supplies	Scherz 11.1 - 11.11	HW 5 assigned
14	Wed 2/28	Analog-to-digital conversion	Scherz 12.9	
	Fri 3/1	Problem Session #9		HW 5 due, 9:00am SHARP Lab 4 due (oscillators) Lab 5 assigned (Sig Proc w/ Arduino)
15	Mon 3/4	Digital signal processing		
16	Wed 3/6	Digital signal processing		
	Fri 3/8	Problem Session #10	Final Exam Review	Lab 5 due (Sig Proc w/ Arduino)
	***** FINAL EXAM *** - Wednesday March 13, 8:30am-10:20am, Room HRC 145 *****			