PHYS 301-002 Analog and Digital Electronics
Spring 2021

Instructor: Isaac Woodard
Office hours: By appointment.

Lecture (Remote):	W & F	9:00 am - 9:50 am (50 min)
Laboratory (Remote):	W & F	10:00 am - 11:45 pm (1 hour and 45 min)

PHYS 301 ANALOG AND DIGITAL ELECTRONICS (2-4-4)(S)(CID): Introduction to electronic test instrumentation, discrete semiconductor devices, and their use in integrated circuits. Effective presentation and interpretation of technical data is stressed through written lab reports and oral communication projects. PREREQ: ENGL 102, PHYS 212, 212L.

Optional Textbook: Paul Scherz and Simon Monk, Practical Electronics for Inventors, 4th ed. 2016, McGraw-Hill (ISBN 978-0-07-177133-7)

Grading

Lab score is based on your 26 best out of 28 labs at 30 points each	780 pts
Required Individual Project	50 pts
Required Resume Assignment	30 pts
8 Homeworks at 25 points each	200 pts
2 Exams at 50 points each	100 pts
Final Review Exam	100 pts
Total	1260 points

Extra Credit

LaTeX Schematic Assignment	5 pts
Course Evaluation	5 pts

Grading is on a curve with the following guarantees:

A+ > 95% and 25 labs completed A 91-94% and 25 labs completed A- 88-90% and 25 labs completed B+ 85-88% and at least 23 labs completed	B 80-84% and at least 23 labs completed B- 75-79% and at least 23 labs completed C+ 70-74% and at least 20 labs completed C 65-69% and at least 20 labs completed C- 60-64% and at least 20 labs completed
Borderline cases will be determined by performance on the Final Review Exam and class participation	

Lecture & Lab

Lecture and lab will be delivered over Zoom. Class will begin with the lecture and then students will be separated into breakout rooms to complete the lab. Labs will be completed in groups of 2 (or three if necessary). Groups will be assigned randomly for each week. You can ask me to join your breakout room at any time if you have a question, and I may drop into breakout rooms periodically to check on your progress.

Submitting Assignments

Homework is due by the end of the day on the specified dates. Homework should be submitted on Blackboard as a pdf compiled with LaTeX. Answers to problems should be typeset, but work may be handwritten and attached as an image.

For each problem on a homework typeset cleanly and in its entirety with LaTeX, one point will be forgiven on that homework's total score (LaTeX will be discussed on the first day of class).

Lab write-ups should be submitted on Blackboard as a Word document. Instead of drawing traces on the write-ups, snapshots of CircuitLab graphs should be included (with the axes visible). Students can download Microsoft Office for free: https://www.boisestate.edu/oit-software/microsoft-office/student-advantage-microsoft-office-365-proplus/#eligibility.

Remember that while all assignments and write-ups are turned in individually, the labs should be completed cooperatively. As long as you were present during the lab, the lab write-up may be turned in late. No lab write-ups will be accepted after April 30th.

Online Resources

Labs will be completed using the online circuit simulator CircuitLab. You can register a free account at circuitlab.com if you sign up under Boise State University's license. We'll go through the basics of CircuitLab the first day of class.

We will be using Overleaf to write and compile LaTeX documents. You can register a free account at https://www.overleaf.com/register. LaTeX is a typesetting system designed to compile documents as pdfs. Overleaf is an online LaTeX editor which makes the language much easier to work with. We will also cover how to use Overleaf and LaTeX the first day of class. For reference, here is a link to Overleaf's LaTeX Guides: https://www.overleaf.com/learn/latex/Main_Page.

While you can always contact me by email, a Slack workspace has also been setup for this course. Slack is a messaging software aimed at businesses which is meant to keep conversations more organized and briefer than email. While it's possible to use Slack in the browser, it also has a mobile and desktop version. The desktop version can be found at https://slack.com/downloads. If you have trouble joining the class workspace, send me an email.

Exams

Exams will be delivered using Blackboard. More details to come.

Late Work Policy

Given the remote format of the course, all labs missed due to an excused absence may be made up by the end of April 30th. In addition, each student may make up 2 labs over the semester by the same date. Zoom recordings of the lab lecture will be posted on Blackboard. Make-up labs must be completed individually.

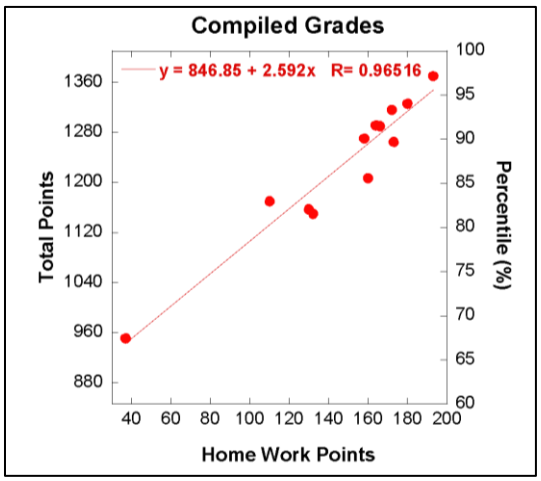
In general, homework will not be accepted late because solutions will be posted on the due dates.

Keys to Success

Problems in the exams are based on the homework problems and concepts in lab. The labs make up the majority of the points in the course, but completing and understanding the homework is important for success on the exams, which are the second largest portion of the final grade.

"Homework assignments were often difficult as we did not practice too many problems in class and the textbook did not have many problems in it. My understanding of the problems was much stronger after I was able to see the solutions and work back through them."

-By an anonymous student



Course Schedule

Week	Wednesday				Friday			
	Date	**Lecture**	**Chapter**	**Lab**	**Date**	**Lecture**	**Chapter**	**Lab**
1	1/13	Introductions, Oscilloscopes, Function generators, DMM	1., 2.21, 7.3, 7.4	L0. Oscilloscopes	1/15	Ohm's Law and Voltage dividers	2.1 - 2.16	L1. Voltage dividers
2	1/20	Kirchhoff's law, Thevenin's and Norton's Theorems	2.17-2.19	L2. Kirchhoff's law and Thevenin's theorem	1/22	Transient Circuits	2.23-2.24, 2.34	L3 RC Transients
3	1/27	AC Circuits	**HW1 due** 2.20-2.22, 2.25-2.29	L4. AC Circuits	1/29	RC Filters, Ch 9	2.32	L5. RC Filters
4	2/3	AC with RLC and freq domain	2.30-2.33, Ch 9	L6. Resonant Circuits and Bandpass Filters	2/5	Diodes and rectification	4.1-4.2	L7. Diodes Charac. and rectification
5	2/10	Full wave rectifier, zener Diode, and regulators	**HW2 due** 3.6.11, 3.8, 4.2, Ch 11	L8. Full wave rectifier, zener Diode, and regulators	2/12	Diode Circuits and LEDs	4.1-4.2, 5.3	L9. Diode Circuits and LEDs
6	2/17	BJT Characteristics	4.3	L10. BJT Characteristics	2/19	Common Emitter Inverting Amplifier	4.3.1-4.3.2	L11 Transistor as a Switch, Biasing and Common-Emitter Inverting Amplifier
7	2/24	Phototransistor	**HW3 due**	L12. Phototransistor	2/26	**Exam 1**	Ch1, Ch 2, Ch 3	L13. FM Radio Transmitter (3.7, 10.5)
8	3/3	JFET Characteristics	4.3.3	L14. JFET Characteristics	3/5	JFET Circuits	4.3.3	L15. JFET Current Sources
9	3/10	JFET Amplifiers	**HW4 due** 4.3.3	L16. JFET Common Source Amplifier	3/12	Voltage Controlled Resistor	Ch 4	L17. AM Radio Transmitter
10	3/17	Op Amps and Charac	8.1-8.3	L18 Op Amps Charac	3/19	Operation Amp Feedback	8.4	L19. Operation Amp Feedback
11	3/24	Differentiators and Integrators	**HW5 due** Ch 8	L20. Differentiators and Integrators	3/26	Hybrid Amps	Ch 8	L21. Hybrid Amps
12	3/31	**Exam 2** 555 Timers and Oscillators	Ch 13	L22 555 Timers	4/2	Digital Logic and Apps	Ch 12	L23. Apps of Digital Logic

13	4/7	Apps. of Digital Devices	**HW6 due** Ch 12	L24. Counting and Displays	4/9	Adv. Digital Devices	Ch 12	L25. Counting and Displays
14	4/14	No Class	Spring Break	No Lab	4/16	No Class	Spring Break	No Lab
15	4/21	Digital to Analog Conv.	**HW7 due** Ch 12	L26. Digital to Analog Conversion	4/23	Analog to Digital Conv.	Ch 12	L27. Analog to Digital Conversion
16	4/28	Review I		Individual Project	4/30	Review II		**Project Demonstration**
17	5/3	**HW8 due**	Review Exam Wednesday, May 5, 9:30a.m.-11:30 a.m. https://www.boisestate.edu/registrar/boise-state-academic-calendars/final-exam-schedules/					

(Note: This syllabus is subject to change)