Electronics

PHYS 252 Spring 2022

Instructors	Section	Email	Office hours	Office Location
Prof. Ran Yang	Monday and Thursday	rxyan2@wm.edu	Monday 3 to 4pm	Small 252
Prof. Eugeniy Mikhailov	Tuesday and Wednesday	eemikh@wm.edu	Tue/Wed 1 to 2pm	Small 230
Olivia Chierchio - TA	Tuesday	oechierchio@email.wm.edu	Mon 10-11am	Small 230
Derek Holmberg - TA	Wednesday	deholmberg@email.wm.edu	Wed 1 - 2pm	Small 230
Kevin Scheuer - TA	Thursday	kscheuer@email.wm.edu	Fri 1-2pm	Small 230

Description

This electronics course provides essential understanding of semiconductor device characteristics for designing and testing the practical circuits in which they are found. The weekly 1-hour lecture (in Small 111) establishes the foundation needed to understand the operation and troubleshooting of electronic circuits and systems that the students will be building in the weekly 3-hour lab section (in Small 230).

Expectations and Goals

This laboratory course is designed for students who are taking their first course in electronics. The prerequisites are Physics 102/108, algebra, trigonometry, calculus – Euler's formula, Taylor series, linear ODE, etc.

The usual electronics problems one faces as a scientist and an engineer are transferring electrical signals from one device to another. To make two devices "play nice" together one often must change the properties of the signals. Our goal is to teach the students enough tools that we can take any given signal and make it into the signal we really want. Along the way we will also touch on most of aspects of analog electronics.

In this course the students will learn to design, build, and characterize sample circuits that illustrate the essential concepts of impedance, amplification, feedback, and frequency analysis. The students will build circuits on "breadboards", which are circuit prototyping systems that make it easy to connect circuit elements. The students will test these circuits using digital multimeters, function generators and oscilloscopes. The students will learn to keep a neatly written scientific lab log during an experiment. The students are expected to know how use software such as *Excel* or *MATLAB* to analyze and plot data. The students will learn to use a

circuit simulation software called *Multisim* to design and simulate circuits. A laptop computer is required for this course.
Troubleshooting is probably the most valuable skill for a scientist and an engineer. Just like computer programming, we spend as much time debugging as we write the code. The circuit we build will most likely not work the first time and will require us to use diagnostic tools and our knowledge of circuit theory to fix them. This carries over to working with and designing electronics for any science research. Much of the lab time will be spent trying to understand what is right or wrong with the circuit and signals.

Course Materials

- Textbook: **Electronic Principles, A. Malvino / D. Bates 9th edition.** The 8th edition is also acceptable.
- Software: Multisim. Please click to sign up a free student account using your W&M email. We will provide the full version's access during our first class.
- Lab book: One graph composition notebook. You may also use a notebook app like GoodNotes on your iPad.
- Personal laptop. Both Mac and PC are acceptable.
- Additional free course materials could also be found on our ***Blackboard – Resources***.

Grades

Category	Percentage	Notes
Homework	20%	Weekly
Lab log and report	40%	Weekly
Midterm exam	15%	Midterm week
Final project	25%	Last three weeks
Total	100%	*No extra credits*

- Homework score is calculated as the average of all homework assignments
- Lab report score is calculated as the average of all lab book reports.
- One homework and one lab report grade will be dropped at the end – normally the lowest.
- Add/drop deadline: Feb 4th, 2022
- Withdraw deadline: March 28th, 2022

Letter Grade and Course Schedule

Letter grade	Percentage	Letter grade	Percentage
A	93% - 100%	C	73% - 76.99%
A-	90% - 92.99%	C-	70% - 72.99%
B+	87% - 89.99%	D+	67% - 69.99%
B	83% - 86.99%	D	63% - 66.99%
B-	80% - 82.99%	D-	60% - 62.99%
C+	77% - 79.99%	F	< 60%

Week	Date	Lab	Topic	Reading
1	Monday, January 24, 2022		No Lab	Syllabus, Multisim, chapter 1
2	Monday, January 31, 2022	Lab 1	Electronics basics	Chapter.1
3	Monday, February 7, 2022	Lab 2	Circuit components and impedance	Chapter 1 and 2
4	Monday, February 14, 2022	Lab 3	Frequency analysis and filters	Ch 14, 19, handouts
5	Monday, February 21, 2022	Lab 4	Diodes and Bipolar Junction Transistors	Chapter 3 ,4, 6
6	Monday, February 28, 2022	Lab 5	BJT Biasing and amplifiers I	Chapter 6, 7, 8
7	Monday, March 7, 2022	Lab 6	BJT amplifiers II and Midterm exam	Chapter 8, 9 and 10
8	Monday, March 14, 2022		Spring break	Relax
9	Monday, March 21, 2022	Lab 7	Op-Amps and negative feedback	Chapter 16 and 17
10	Monday, March 28, 2022	Lab 8	Linear Op-Amp applications	Chapter 18
11	Monday, April 4, 2022	Lab 9	More Op-Amp Applications & Active Filters	Chapter 18, 19 and 20
12	Monday, April 11, 2022	Lab 10	Comparators, Schmitt trigger & Oscillators	Chapter 21
13	Monday, April 18, 2022		Final project proposal and design	Chapter 22 and 23
14	Monday, April 25, 2022		Final project building and testing	
15	Monday, May 2, 2022		Final project debugging and presentation	

Assignment submission

Both homework and lab report are directly submitted to Gradescope. Homework and Lab assignments will be posted before Sunday. Homework attempts must be done before your lab starts. We will check everyone's attempts and 20% will be deducted with poor attempts or no attempts. Every homework is due the next Monday at 2pm. Every lab report is due at 2pm before your next lab starts.

For example, for lab 1:

- Both homework assignment 1 and lab assignment 1 will be posted on the Blackboard by Sunday 1/30/22.
- You must attempt your homework 1 by 2pm, 2/1 if you are in Tuesday lab section, 2/2 Wednesday and 2/3 Thursday.
- You must submit your homework 1 to Gradescope by 2pm 2/7 for all sections.
- You must submit your lab reports 1 to Gradescope by 2pm 2/8 if you are in Tuesday lab section, 2/9 Wednesday and 2/10 Thursday.

Late

Both homework and lab book report have due time. Late turn-in penalty: 5% of the total grade deduction per day for a maximum of three days. After three days your score will be zero.

Makeups

Makeup homework

All homework assignments are submitted to Gradescope. Points will be deducted if you submit late (see above) unless you have an excuse and a permission from one of the professors. Your homework score will be zero if you don't turn it in.

Makeup labs and reports

You may do a makeup lab if you miss one. You are not allowed to turn in a lab report if you are absent for that lab. If you must miss a lab, do let one of the professors know, and schedule a makeup lab with your TA. Your lab report score will be zero if you miss a lab and /or if you don't turn the report in.

Makeup exams

If you miss an exam without any notes, your exam score will be zero. Do let one of the professors know in advance and get an excuse note from the Dean of Students, then we will schedule a makeup exam for you when you are available.

Attendance

All lectures, labs and final project attendance are mandatory. If you are to be absent, please inform the professors in advance. You should also get a note from the Dean of Students for long-term absence. See Makeups for more information.

Absences – Covid Related or other

Referring to the Attendance policy and Late policy. With professor's permission, it is possible

to do a missed lab at another time in case of medical or family issues. An excuse letter from the Dean of Students is preferred for long-term issues.

Blackboard

We use Blackboard extensively for this course. All the students' grades will be posted on the Gradebook. The column "Weighted total" is your current grade shown as *91.46% A-* for example. All the course materials such as lecture notes and lab assignments can be found on our Blackboard as well. Make sure your Blackboard is working. If you have any troubles, please contact IT help desk (support@wm.edu or 757-221-4537) immediately. I cannot fix your Blackboard issues. And that your blackboard is not working is not an excuse for not completing assignments.

Gradescope

Both homework and lab report must be submitted on the Blackboard by due date. Design assignments must be done with Multisim and submit to Gradescope with your homework as one pdf document.

Grading job	TA	Grading job	TA
Homework 1	Kevin Scheuer	Homework 6	Derek Holmberg
Report 1	Derek Holmberg	Report 6	Olivia Chierchio
Homework 2	Olivia Chierchio	Homework 7	Kevin Scheuer
Report 2	Kevin Scheuer	Report 7	Derek Holmberg
Homework 3	Derek Holmberg	Homework 8	Olivia Chierchio
Report 3	Olivia Chierchio	Report 8	Kevin Scheuer
Homework 4	Kevin Scheuer	Homework 9	Derek Holmberg
Report 4	Derek Holmberg	Report 9	Olivia Chierchio
Homework 5	Olivia Chierchio	Homework 10	Kevin Scheuer
Report 5	Kevin Scheuer	Report 10	Derek Holmberg

Personal laptop

Every student should bring their personal laptop to the lab. You need your laptop to view the lab assignments and other data sheets posted on our Blackboard if you choose not to print out hard copies. You need a computer to do your homework, design circuits and analyze your data. You should also bring your laptop to the lectures. We often practice designing circuits together in our lectures. Carrying a USB flash drive with you is usually very helpful. If you use a MacBook, MacBook pro or MacBook air that only has a USB-C port, you need to bring a USB-C to USB adapter with you.

Cell phone

You may bring your cell phones to both lectures and the labs. I like to use phones to snap a quick photo, to take polls and as a scientific calculator. If you don't have a scientific calculator, do download a scientific calculator app to your phone. My favorite app (for iOS) is called

Calculator ∞. Most nice calculator apps may cost a few of dollars so you don't need to watch ads while calculating.

Homework

The purpose of all our homework is to make sure you are well prepared for the lab. Otherwise, you may be stuck in the lab until the sun turns into a red giant. Every student must attempt to finish the homework before attending your lab. Your professor will collect your homework at 2pm and return the homework to you with suggestions and comments. The professor is not grading your homework attempt. The professor wants to see your work and your effort and know that you come into our lab prepared. You will lose 20% of your total homework points if you fail to turn in your homework attempt.

You may first convert the Word doc into a PDF then submit it to Gradescope. Ask for help if you don't know how to. You have about a week to refine your work after you get the feedback from your professor in the lab. All homework is due at 2:00pm on Monday See below for policies on late turn-ins.

Lab book/report

One graph notebook is required. A note app like GoodNotes via an iPad is acceptable. Lab book contains two parts: your experiment procedure and logs that you write down during your lab and your data analysis and results post your lab. Do not use a scratch lab book.

Lab partner

Mostly you will complete a lab on your own without a partner. You may be paired with a different lab partner every week. Each partner must submit a separate lab book report.

Poll Everywhere

We will use Poll Everywhere ("PollEv") throughout this semester. With PollEv, you use your computer, tablet, or phone to answer questions, take a poll, discuss, and more. Please plan on bringing a smart phone, tablet, or laptop with you to every class. You will need to connect your device to the W&M wireless network. Also, if you use an Apple or Android device, please download the free *Poll Everywhere app*. The app is not required, but it will make the participation process easier.

Instructions for logging into your PollEv account can be found on the IT website here. There is no fee associated with your student PollEv account, however you must login with your W&M email and password by selecting "Next" and choosing the "Log in with William & Mary" option at login. Though we might use PollEv informally in the beginning of the semester, we will use PollEv for graded activities in the future. I will let you know in advance. If you need assistance setting up your device to work on the W&M wireless network, please navigate to the IT help page here.

It is your responsibility to bring an operable device to class each session to participate in the polls. You can participate in polls using only your account. Additionally, use of Poll Everywhere should adhere to the William & Mary honor code expectations.

Help

- We will use Piazza the online forum for Q&A: https://piazza.com/class/ky972wojapf5pl
- Read your textbook again.
- Office hours for any professor. Please come by.
- Meeting with your TA or professor by appointment.

Accommodation

William & Mary accommodates students with disabilities in accordance with federal laws and university policy. Any student who feels they may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at sas@wm.edu to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please visit their webpage here.

Honor Code

The College of William & Mary has had an honor code since at least 1779. Academic integrity is at the heart of the university, and we all are responsible for upholding the ideals of honor and integrity. Your full participation and observance of the Honor Code is expected. The student-led honor system is responsible for resolving any suspected violations of the Honor Code, and the professors are expected to report all suspected instances of academic dishonesty to the honor system. The Student Handbook includes your responsibilities as a student and the full Code. To read the Honor Code, click here.

Academic dishonesty can include plagiarism in the form of "deliberate" or "reckless" representation of another's words, thoughts, or ideas as one's own without appropriate attribution to the original author in academic work (whether graded or otherwise), unauthorized collaboration, use of unauthorized materials, fabrication of data, and lying.