

**ENGN/PHYS 208**  
**Washington and Lee University**  
**Electronics**  
**Winter 2019**

**Course Web Page:** [https://erickson.academic.wlu.edu/teaching/electronics\\_w2019/](https://erickson.academic.wlu.edu/teaching/electronics_w2019/)

## Course/Instructor Info

Course Meets: MW 2.45 - 4.15pm, Sci Ad 102  
Instructor: Jon Erickson  
Office Hours: MTWR 1.30 - 2.30 pm  
and by appointment (walk-ins welcome!)  
Where to find me: Howe 221 (office) or Howe 222 (research lab)  
Phone: 458.8293 (office) or 458.8889 (research lab)  
Email: ericksonj@wlu.edu

## Course Texts

There is no official course text, but the following will serve as excellent reference material throughout the term. All of the following are available in hard copy in JE's office and/or the Electronics Lab; you are more than welcome to consult them anytime.

1. *The Art of Electronics*, Paul Horowitz and Winfield Hill. 3rd Edition, Addison-Wesley, 2015. ISBN 978-0521809269.
2. *Practical Electronics for Inventors*, Paul Scherz and Simon Monk. 4th Edition, McGraw Hill, 2016. ISBN 978-1259587542.
3. *Introductory Electronics for Scientists and Engineers*, Robert E. Simpson. 2nd Edition, Addison-Wesley, 1987. ISBN 978-0205083770.

## Introduction and Course Objectives

Electronics is a project-based course focused on integrating digital electronics components into systems that address real-world problems. Along the way, we will study fundamental concepts in digital electronics and learn how to smartly implement various building blocks including:

- Logic Elements (logic gates)
- Digital memory devices (RAM, flash, etc)
- Data protocols (SPI, I2C, UART)
- Microcontrollers (Arduino, Teensy, ESP32, etc.)
- Wireless Devices and Protocols (Bluetooth, Wifi, Xbee, LoRa)
- Sensors and Actuators (pressure, temperature, inertial measurement units, motors, optoelectronic, etc.)

In this course, you will have a great opportunity to gain a lot of hands-on *practical* experience. Emphasis is placed on **becoming confident and independent in designing, building, testing, and analyzing practical electronics systems**. Course Objectives

1. Learn fundamental operational principles of modern electronics devices.
2. Learn to evaluate the specifications and tradeoffs of electronics components, applied to a real-world system design.
3. Learn practical electronics skills (schematic design; PCB layout and fabrication)
4. Design, develop, and perform proof-of-concept for a custom electronics system that addresses a real-world application

## Integrative Course Assignments

All assignments will be based around laboratory work—i.e. building, testing, and analyzing real-world circuits. As such, assignments will integrate theoretical and practical components. In lay terms, on each assignment, you'll be asked to:

1. Build something in the lab and make measurements to see how it works in practice
2. Analyze how the electronics component is supposed to be work in theory
3. Compare and explain how and why theory and experiment agree (or not)

Expect that there will be about 6-8 assignments, concentrated during the first 3-4 weeks of the term. We will likely use one class period per week as lab/workshop time. Assignment submissions will always be due before the day before next assignment begins. Typically, there will be about 5-7 days to complete an assignment. For example, we'll have our start our first assignment on 09 Jan, which will be due 14 Jan. We will also have a schedule for required revisions (see more details below).

For each assignment, you will be initially be awarded one of two possible grades:

1. The venerable *A*. These will be awarded when the assignment crosses a threshold of very good to excellent.
2. *Revision Required*. This indicates some aspects of your lab work and/or written submission merit significant revision. In this case, you must meet with the instructor to review your work to discuss what needs to be improved and how to improve it. It is *your* responsibility to stop by office hours and/or set up a meeting time. You will be given a maximum of 2 opportunities revise a given assignment process for a given assignment. *This revision process is intended to help foster your overall scientific writing capability*. With a good faith effort from the student, the instructor fully expects that the revision process should conclude with the work receiving a grade of A (100% numeric score).
3. *The very rare case that probably/hopefully won't ever come into play*: In the rare event that more than 2 revisions are required to cross the threshold of very good to excellent, the student will still be required to continue revising until reaching the acceptable threshold, but will receive a grade of F (50 % numeric score).

## Exams

There will be 1 mid-term exam. It will be a take-home exam and will incorporate a lab practical. See the course schedule for exam dates. The exam will be closed book, closed note, no calculators permitted. The instructor will provide you with all relevant reference material (e.g., equation sheet). No late exams will be accepted.

## Design Project

This will be the bread-and-butter integrative assignment. Students will work in teams on a “real-life” design project. Expect the design project(s) duration to be 8 weeks, beginning during the 3rd week. More details will follow later in the term.

## Grading Policies

1. **You must satisfactorily complete all integrative/lab assignments in order to pass this class.**
2. Assignments submitted after the due date without prior approval from the instructor will not be accepted for grading. Of course, reasonable exceptions are made in extenuating circumstances.
3. **No grade will be awarded for the course until your lab/project station is verified to be clean and tidy, with every part put back in its original and proper place at the end of the term.**
4. Numeric grades are tabulated as follows:

Integrative Assignments/Labs	20%
Midterm Exam	15%
Design Project	60%
Intellectual growth, independence, class participation	5%
<hr/> Total	<hr/> 100%

Your final state of competence is more important than your overall numerical average. The subjective component is simply a mechanism by which—*when appropriate*—I can translate your final state into an appropriate letter grade. Throughout the term we will have many occasions to interact in the classroom and in the lab. At the end of the 12 weeks together I gain a very good sense for placing students on the spectrum of who really “knows their stuff.” Factors considered during this evaluation include, but are not limited to: class and lab participation, intellectual growth, demonstrated overall integrity and competency in course and lab work. Please know that this policy is in place neither to hurt or help you. If you have any questions about this grading policy, please come talk to me.

# COURSE POLICIES

## Academic Honesty

According to the White Book<sup>1</sup>, the Honor System is the “fundamental principle that a spirit of trust pervades all aspects of student life.” The system is one of “mutual trust” which clearly establishes that “Students should do their own work, *represent themselves truthfully, and claim only that which is their own*” (emphasis added by JE). The system is not designed to “work against or frighten” students, rather it was designed to allow students “unparalleled academic freedom.”

You are expected to abide by the W&L Honor System at all times. Any suspected Honor Violation will be reported to the Executive Committee. In such an event, the instructor reserves the right to assign a grade of zero on that assignment and/or a failing grade for the course. (I believe in my heart that this policy will never ever come into play, but I am, more or less, legally compelled to explicitly state it in the official course syllabus.) Specific policies regarding homework assignments, lab reports, and exams are described in detail below. If you are ever in doubt about whether an action is within bounds, please consult with me first.

## Integrative Assignment Policy

You are allowed and strongly encouraged to discuss integrative assignment problems with class mates, but your written solutions must be generated by you alone. Consultation with or seeking aid from solutions from previous offerings of this course is strictly forbidden.

## Lab Work/Data Sharing Policy

This term, you will work with a classmate (team of 2) during all lab sessions. It is crucial that both you and your lab partner actively participate to master the core skill set in the Circuits lab. You are allowed and encouraged to *share raw data*. However, *each student must generate his or her own final graphics/figures from (shared) raw data*. Reasonable accommodations are made by the instructor with regard to sharing files that generated in collaboration with your lab partner, but you must *ask first*.

## Exam Policy

Any collaboration on, or discussion pertaining to, exams is strictly prohibited.

## Design Project Policy

You may of course fully collaborate with your team member. Inter-team collaboration is also permitted and encouraged.

## Special Academic Accommodations

Washington and Lee University makes reasonable academic accommodations for qualified students with disabilities. All undergraduate accommodations must be approved through the Title IX Coordinator and Director of Disability Resources, Elrod Commons 212, (540) 458-4055. Students requesting accommodations for this course should present an official accommodation letter within

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<sup>1</sup>Full text of White Book available at <http://www.wlu.edu/x48217.xml>

the first two weeks of the term and schedule a meeting outside of class time to discuss accommodations. It is the students responsibility to present this paperwork in a timely fashion and to follow up about accommodation arrangements. Accommodations for test-taking must be arranged with the professor at least a week before the date of the test or exam, including finals

## Attendance Policy

### Lectures

You are *strongly encouraged* to attend all class—hopefully the time together in the classroom and lab are beneficial to you and worth attending. That is, there is no formal attendance policy. If you miss class for a legitimate reason (illness, family emergency, etc.) I will make every effort to help you get caught up as soon as possible. You must notify me *before class, in person or by phone*, to explain the circumstances of an excused absence. In the event of an unexcused absence (i.e., “Whoops, I slept in”; “I had paper due for another class”; “I left a day early for Thanksgiving Break”, etc.), you are solely responsible for staying up to date with class notes and news (e.g., deviations from the calendar of topics covered, exam procedures, etc.).

### Note on Athletics

Sanctioned athletic competitions, but not practice sessions, qualify as an excused absence. Please notify me of an athletic absence well in advance of the athletic event.

## Electronic Devices and Texting



Figure 1: Electronics is a No Texting Zone.

I would like to believe I am a pretty easy-going, congenial guy, but the one thing that absolutely drives me bonkers is texting during class. So, thank you in advance for powering down your cell phone/iPhone/whichever device, and for respecting the strict no-texting policy.

If you must have your phone on for tending to, say, a medical or family emergency, please inform me before the start of class.

Regarding laptops in class: You’ll definitely want your laptop while working in the lab. This is a course in digital electronics, after all! Conversely, there isn’t really any compelling reason why you would use one during lecture, so if you have insist on using a laptop, please ask me first—any reasonable requests will be entertained and carefully considered (but I do not promise to grant it).

## Sick Day Policy

If you are feeling ill, please stay home, get some rest, get a friend to bring you notes from class and chicken soup and get better soon! It is in everyone’s best interest for you to minimize interpersonal contact when you are feeling sick, especially when you are symptomatic. I trust your judgment and do not require a doctor’s note. (However, please remember to contact me regarding this absence).

## **Suggestions and Feedback**

Suggestions for improvement, constructive criticism, and positive feedback are welcome at anytime. Please do not hesitate to approach me with any concerns you may have about this course. I take your feedback very seriously and will sincerely respond to all received comments. It is the main mechanisms by which the course will improve over time (sometimes instantaneously, when possible!).