Analog and Digital Electronics, PHYS0525

Spring 2025

Lecture: Tuesdays 11:00am-12:55pm, 106 Allen Hall
Lab: Tuesdays 2:00pm-4:55pm, 324 OEH

Instructor:

Thomas Purdy
Office: 210 Allen Hall, email: tpp9@pitt.edu
Office hours: Monday 10:00-11:00am, and after lecture or by appointment

Lab Manager:

Dr. Istvan Danko
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TA:

Youssef Tawfik
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Textbook:

Title: Electronics: A Physical Approach
Author: D. W. Snoke
Publisher: Pearson (2015)

Other texts that may be useful supplementary resources are:
D. Eggleston, Basic Electronics for Scientist and Engineers (Cambridge University Press 2011). Another text on topic of the course, available as an online resource through Pitt ULS.
P. Horowitz and W. Hill, The Art of Electronics (Cambridge University Press 2015). This is a good comprehensive reference on electronic circuits, but harder to read than the other texts.
A. Malvino, D. Bates, and P. Hope, Electronics Principles 9^{th} (or 8^{th}) edition, McGraw Hill. This textbook is sometimes used as the main book for this course.

Course Website:

https://canvas.pitt.edu/
The materials for this course will automatically be available to students enrolled in the course. Communications regarding the course will be disseminated via Canvas notifications. Please ensure your Canvas notification setting allow you to receive these announcements. All assignments and lab reports must be submitted via Canvas. Do not give the Instructor, TA, or Lab Manager paper or email copies of your submissions. Grades for assignments, reports, and exams will be posted on Canvas as soon as they are available.

Course Description

Physics 0525 is a one-term lecture and laboratory course that introduces basic electronic circuits. The emphasis is on hands-on laboratory work such as using standard electronic test instruments and building and testing circuits. The weekly lectures cover the theory of analog and digital electronics. Whenever possible, the lectures will include a discussion of lab project of the week, but it is not always possible to synchronize labs and lectures exactly. Therefore, you should always read the chapter of the textbook that deals with the subject of the current lab experiment.

Learning Objectives

Students should learn the theory and practice of basic analog electronic systems including passive and active circuits, as well as an understanding of basic digital electronics including microprocessors.

Couse Schedule:

This course will consist of a lecture on Tuesday mornings and a lab on Tuesday afternoons. We will try to adhere to the following schedule of topics:

Week 1	Jan. 14	Lecture but No Lab
Week 2	Jan. 21	DC circuits: breadboard and DMM; voltage and current divider.
Week 3	Jan. 28	RC circuits: function generator and oscilloscope; capacitor charging, RC differentiator and integrator.
Week 4	Feb. 4	AC circuits: RC low- and high-pass filter, RLC resonance.
Week 5	Feb. 11	Transmission lines: coaxial cable characteristics, reflections and impedance matching.
Week 6	Feb. 18	Diodes: rectifiers, diode clamping, limiting.
Week 7	Feb. 25	Bipolar transistors: emitter follower, current gain, common emitter amplifier
Spring Break	Mar. 4	No Class
Week 8	Mar. 11	Field-effect transistors: JFET characteristics, current source, source follower.
Week 9	Mar. 18	Midterm Exam (during Lecture) Op-amps I: basic negative-feedback circuits
Week 10	Mar. 25	Op-amps II: comparator, Schmitt trigger (positive feedback); optional: transimpedance amplifier.
Week 11	Apr. 1	Pulses and timing: RC relaxation oscillator, 555 timer, 74121 one shot.
Week 12	Apr. 8	Arduino I: Digital and analog input/output.
Week 13	Apr. 15	Arduino II: hardware and software interrupts, parallel/serial communication.
Week 14	Apr. 22	Arduino III: PID temperature control.
Finals week	TBD	Final Exam

Course Requirements and Grading:

- **Lab Reports (50% of final grade)**
  For each lab you will complete a lab report worksheet. The laboratory reports guide your lab work. Each week's worksheet is available ahead of time on Canvas. You will be given a paper copy of the worksheet at the beginning of each lab period to fill out. The format of this worksheet is such that most measured data and their analysis can be entered directly in blank spaces or in the blank graph forms. Labs often contain one or more calculations to be done during the lab or afterwards is there is insufficient time. Lab reports can be turned in either at the end of the lab session or at the beginning of the next lab session (if you are unable complete all the calculations during the lab period). Each student is responsible for completing and submitting their own report, even if you work with a partner in the lab. It is important to attend every lab and lecture. Make up labs will only be given for university recognized reasons, and must be scheduled with the lab manager.

- **Homework (20% of final grade)**
  Homework will be assigned weekly. The assignments will be posted on Canvas, and are to be submitted electronically via Canvas. You are responsible for legibly digitizing your completed work. Students are allowed to collaborate or work in groups on the homework assignments. However, you are not simply allowed to copy the solutions from another student (or directly copy solutions from any other source). Each student must submit their own version of their homework solutions. Please note on your assignment, if you have worked collaboratively with other students. A 20% per day penalty will assessed for late assignments.

- **Midterm Exam (10% of final grade)**
  One midterm examination will be given during lecture on **March 18, 2025**. This midterm will test the material covered during the first 7 weeks of the course, including material from the lectures and labs.

- **Final Exam (20% of final grade)**
  A final examination will be given during finals week in accordance with the schedule set by the Registrar's office. The final exam will be comprehensive, covering all topics addressed during the course.

University Policies:

Academic Integrity
Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process,

initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.
To learn more about Academic Integrity, visit the Academic Integrity Guide for an overview of the topic. For hands- on practice, complete the Academic Integrity Modules.

Disability Services
If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.