Syllabus, Phys 0525: Analog and Digital Electronics


```
Instructor:              Joseph Boudreau
Email:                   boudreau@pitt.edu
Office:                  418 Allen Hall
Phone:                   412 552 8335
Zoom (if/when needed):   478 805 8218
Office Hours:            Wednesday, 1:00-3:00

Lab Manager:             Dr. Istvan Danko
Email:                   izdanko@pitt.edu
Office:                  329 OEH
Phone:                   412 624 9030

Teaching Assistant: Hongbo Cai
Email: hoc34@pitt.edu
```



```
Textbook:  Electronics, A Physical Approach
Author:    David Snoke
Publisher: Pearson
ISBN-13:   978-0-321-55133-7
ISBN-10:   0-321-55133-7
```


```
Lecture:    Tuesdays, 11:00-12:55, Allen Hall (AH) 106
Laboratory: Tuesday, 2:00-4:55, Old Engineering Hall (OEH) 324
```

Course Description: Physics 0525 is a laboratory course in modern electronics. The aim of the course is to develop an understanding of electronic circuits and their characteristics, confidence in exploring and characterizing electronic circuits with laboratory equipment, the ability to design simple analog and digital circuits, and practical experience with circuitry used in modern physical measurement. The course meets for two hours of lecture and three hours of laboratory work each week. This course is especially recommended for those who wish to pursue studies in experimental physics or other experimental science, and even those who just want to develop skill with electronics.

The textbook written by Prof. David Snoke at the University of Pittsburgh emphasize both circuit design and the physical principles underlying the op-

eration of devices such as batteries and fuel cells, passive and active circuit elements, sensors and antenae, to name a few. This book is slow in arriving at the bookstore; however an e-book can be purchased online from their site (https://pitt.verbacompare.com). A good **reference source** for further reading, covering principles of circuit design, *The Art of Electronics* by Paul Horowitz and Winfield Hill, is on reserve in the Benedum Engineering library. This is a more advanced text that gives short shrift to underlying physics principles but is excellent for those trying to design good circuits:

```
For further reading: The Art of Electronics, 3rd Edition
Author:              Paul Horowitz and Winfield Hill
Publisher:           Cambridge University Press
ISBN:                978-0-521-80926-9
```

There is a small collection of books in the electronics lab, where you can also find this book.

Grading:

```
Laboratory:  55%
Homework  :  10%
Midterm 1 :  10%
Midterm 2 :  10%
Final Exam:  15%
```

Here is a tentative **course schedule** of reading and laboratory assignments; lectures will synchonize with these topics:

Date	Reading	Laboratory
10 Jan	Snoke 1.1-1.6	DC Circuits (intoducing the Breadboard, DMM, Power supply)
17 Jan	Snoke 2.1-2.4	RC Circuits (introducing function generator, oscilloscope)
24 Jan	Snoke 2.5-2.10	AC Circuits (RC low-pass & high-pass filter, RLC resonance)
31 Jan	Snoke 3.1-3.3	Transmission lines: coaxial cables characteristics, reflections & impedance matching
7 Feb	Snoke 4.1-4.5	Diode circuits (rectifiers, diode clamping, limiting)
14 Feb	Snoke 5.1-5.3	Bipolar transistors (emitter-follower, current gain, common emitter amplifier)
21 Feb	Snoke 5.4-5.5	Field effect transistors (JFET characteristics, current source, source follower)
28 Feb	Snoke 6.1-6.3	Op-amps I: basic negative-feedback circuits
14 Mar	Snoke 6.4-6.5	Op-amps II: comparator, Schmitt trigger, PWM or transimpedance amplifier
21 Mar	Snoke 7.1-7.8	Pulses and timing: RC relaxation amplifier, 555 timer, 74121 one-shot
28 Mar		Arduino I: Digital and analog input/output
4 Apr		Arduino II: hardware and software interrupts, parallel/serial communication.
11 Apr		Arduino III: PID temperature control.
18 Apr		Final Exam Part I (Practical Segment, in two sessions morning/afternoon)
26 Apr		Final Exam Part II (Written Segment) 4:00-5:50 PM Allen Hall 103

- **Laboratory sessions**: Electronics laboratory gives students hands-on experience with electronic circuits, electronic measurement, and the electronic instrumentation such as that that which one typically finds in experimental facililities of all scales. Handouts consisting of instructions and worksheets accompany each of the laboratory sessions, and are available ahead of time on Canvas. Printed copies will be available at the start of each laboratory session. These handouts are to be completed and returned one week later. In these laboratory sessions, you will build one or more circuits; you must have your work for each part verified and initialed by the instructor or the TA before you leave the lab. If you have not finished, you can schedule another time to make up the lab, in which case your work must also be verified. Missing labs: Students can be excused from missing a lab only for a university-recognized,documented reason(e.g., a written doctor's report, athletic event). In this case it is the student's responsibility to schedule another time to make up the lab and have the TA or instructor verify the work. The class size requires that most students work in groups of two. Each student is expected to participate in the laboratory work, and must submit his/her own completed lab assignment.

- **Weekly homework assignments** are based upon material covered in lectures.

- **Two Midterm Exams** are given during a portion of the lecture hours.

- **A final exam** consists of a hands-on segment, carried out in the laboratory during the last week of classes, and a written segment, held during finals week. The hands-on segment will be taken in the electronics laboratory by one half of the students in the morning, and the other half in the afternoon. The written part is administered during finals week (26 April, 4:00-5:50 PM).

Pitt academic policies on accessibility, diversity and inclusion, and classroom recording can be found at this link.