Physics 252 - Electronics I: Introduction to Analog Circuits.

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- Office Hours:
  - M 14:05-15:00
  - T 11:00-12:00
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  - and by appointment.

T.A. lab report grader: Austin Ziltz

T.A. lab book grader: Gleb Romanov

Course Objectives

The primary purpose of this course is to teach you how to design basic analog electronic circuits for connecting one device to another properly and efficiently: this is generally the function of most lab-built electronic circuits.

Along the way, we will also learn how to do basic analog circuit design and to a lesser extent signal acquisition and detection. More specifically, you will learn about the following essential concepts:

- impedance
- amplification
- frequency analysis
- feedback

You will also learn to use the following components and equipment:

- resistors, capacitors, inductors.
- diodes, photo-diodes, transistors, FETs.
- Op-amps, comparators.
- Multimeters, oscilloscopes, function generators.
- Breadboards and soldering irons.
- Modern circuit design and lay-out software.

Texts

There is no official textbook for the course. I will be posting introductory chapters and laboratories created specifically for the course on my website before the lecture. These chapters and labs were originally created by Prof. Jeff Nelson, Prof. Bill Cooke and Prof. Seth Aubin. They have been adapted to the current course. While there are many good electronics textbooks, I would use the following two:

- as a good introductory book "Basic Electronics: An Introduction to Electronics for Science Students" by Curtis. A. Meyer
  - available at print on demand web service lulu.com (direct link http://www.lulu.com/content/paperback-book/basic-electronics-an-introduction-to-electronics-for-science-students/7226280)
    - **Note**: This book has several typos and errors, please visit the Erratum Page
- as a **fantastic** reference book for design tips and concepts "The Art of Electronics" (2nd Edition, 1989-1999) by P. Horowitz and W. Hill.
  - It is available in the Library under call number TK7815.H67 1989. A copy is also available for reading in my office.

Both books will be useful for the Digital Electronics class in the next semester.

Class Format

The class hours are divided into two parts: Lecture and Lab. The lecture will be on Monday 1:00-1:50 pm in the Millington 117, and will cover the concepts to be tested in the lab later in the week. The lab portion of the class will be held on Wednesday 2:00-4:50 pm for Physics 252-01 and Thursday for Physics 252-02 in the Millington 207.

Evaluations

Your final grade for the course will be determined from the following grading weight distribution:

- Notebooks/Lab: 30% (design exercises 10%, lab 20%)
- Lab Reports: 20%
- Quizzes/Participation: 15%
- Midterm: 15%
- Final: 20%

Most labs will include a design component. **The designs must be prepared prior to attending lab so as to finish the lab measurements on time.** I will check preparation of the design exercise at the beginning of each lab. **An unprepared/incomplete design exercise will have up to 50% penalty.**

Grading

Grade	Score percentage	Grade	Score percentage	Grade	Score percentage
		A	94-100	A-	90-93
B+	87-89	B	84-86	B-	80-83
C+	77-79	C	74-76	C-	70-73
D+	67-69	D	64-66	D-	60-63
F	<60				

Lab books

Your lab book should be a regular style notebook without rings with either line or quadrangle ruling or a computation logbook. It can be obtained at most stationary stores (i.e. Staples, etc ...)

Your lab book is the primary record of your work and data. You should record everything that you do in the lab book, so that anyone (such as the instructors and yourself) can understand what you have done and measured. You should include circuit diagrams, observations, questions, answers, design considerations, measurement data, and analysis. Diagrams, data, graphs, and other notes on separate pieces of paper should be glued, taped, or stapled into the lab book. If something falls out of the lab book during reading/shaking/transporting, it is not the part of the log book and will be discarded. All notes should be written in **pen**. Mistakes and errors in design, data, and analysis will occur, and they should be crossed out neatly.

The lab book will be graded primarily on completeness and to a lesser extent on neatness (i.e. better to be complete than neat, though doing both is better yet). It should also feature a table of contents. The lab books will be turned in every week or two and returned before the next lab.

You should enter you lab notes and data directly into the lab book. A "scratch" lab book that is neatly copied into the lab book at a later time is not appropriate and will result in a significantly reduced participation grade. It is OK though to use scratch paper which is glued into the lab book after.

Lab reports

Scientists and engineers communicate their activities and research results through short reports. The instructor will indicate for which labs a lab report is due: In general, lab reports will be due every other week. The lab report is due by the following Monday in class. Lab books do not need to be submitted for evaluation on Thursday/Friday when a lab report is due the following Monday. However, the lab book results for that week should be complete, since they will be evaluated the following week (along with the following week's material).

The lab report should present what you did in the lab, or some aspect of what you did as long as it encompasses the main theme of the lab. The reports should have the following characteristics and components:

- Typed or printed.
- Short report (14pts font, **max 3 pages** single space, but shorter is better).
- Structured with an introduction, a main body, and a conclusion.
- Measurement data should be included in tables and plots.
- All data should be analyzed and interpreted.
- Important measured numbers should include a justified error bar.
- All figures should be labeled, numbered, and referred to in the text.

Quizzes

There will be frequent 5 minute quizzes at the beginning of lecture and lab to encourage you to review concepts and circuit design.

Midterm test

There will a 1 hour midterm test in lab on February 24-25. There will be a lab session after the midterm.

Final exam

There will be a final exam on May 10 (2:00pm - 5:00pm) covering all course materials.

Due dates/time

Lab books are due by 5pm on next day after lab (i.e. Thursdays for the Wednesday section and Fridays for the Thursday section) and will be returned by the next lab period. Reports are due in class the following week.

Late reports or logbooks will have points deducted. If you know you will have a problem getting the report on time please send me an email as soon as you can to let me know about your situation.

Illness

Please notify the instructor if you are ill, so that arrangements can be made to make up missed labs.

Weekly Topics

Week 0: 1/18	NO CLASS
Week 1: 1/25	DC Circuits Basics.
Week 2: 2/01	Kirchhoff's Law's and Thevenin's Theorem.
Week 3: 2/08	Capacitors, Inductors, and Complex Impedance.
Week 4: 2/15	Passive Filters and Transmission Lines
Week 5: 2/22	Diodes. **MIDTERM TEST** during labs time
Week 6: 3/01	Transistors 1: BJTs
Spring Break	NO CLASS
Week 7: 3/15	Transistors 2: More BJTs
Week 8: 3/22	Transistors 3: FETs
Week 9: 3/29	Op-Amps 1: Introduction to Op-Amps
Week 10: 4/5	Op-Amps 2: detectors, filters, power amplifiers
Week 11: 4/12	PID Control Theory
Week 12: 4/19	Electronic Circuit Design Tools
Week 13: 4/26	Comparators
Week 14: 5/13	**FINAL EXAM** Monday May 10, 14:00-17:00