Physics 320 - Electronics
Syllabus - Fall 2017

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Required Items:

- *Electronics: A Systems Approach, 4th Ed.* by Neil Storey
- A quad-ruled bound lab notebook (You may use the one you used in Advanced Lab or another course, if you have one.)
- Elenco AK-100 Learn to Solder Kit (Available from Amazon.com)

  `http://www.amazon.com/Elenco-AmeriKit-Learn-Solder-Kit/dp/B0009Z3JJA/ref=sr_1_cc_1?s=aps&ie=UTF8&qid=1408412204&sr=1-1-catcorr&keywords=ak-100+solder+practice+kit`

From the Catalog: A strongly laboratory-oriented survey of electronic devices and circuits. Electronic test instruments; passive devices; transistors; operational amplifiers; logic chips. NOTE: Honors Scholar Course. NOTE: This course counts toward the 63-hour Liberal Arts and Sciences (LAS) graduation requirement.

Prerequisite: PHYS 196 with grade of "C" or higher.

General Information: Regardless of the phenomenon being measured, almost all experiments require the manipulation of electronic signals. The electronics course serves two purposes: (1) to help you understand the use and evaluate the performance of electronic equipment used in experiments, (2) to prepare you to design and build electronic equipment for use in experiments. Although these goals may seem only of use for prospective experimentalists, they also prepare a theorist to evaluate the results of experiments. And who knows, you may intend to be a theorist but end up an experimentalist.

The Electronics course is a hands-on, practical introduction to electronics covering DC and AC circuits, diodes, transistors, operational amplifiers, and a brief introduction to digital logic. The approach to electronics taken in this course will be a mixture of physical concepts and design principles. Thus the course will at times appear more qualitative compared to other physics courses.

We cannot begin to scratch the surface of the field of electronics in a one semester course. Rather than cover a few topics in detail you will be exposed to a moderate range of concepts and areas of electronic circuits design. The knowledge you gain will provide a foundation upon which you can build. You should also be equipped to pursue any area of electronics that may interest you in the future. The course will prepare you to understand basic electronic circuits and devices, to read complicated schematic diagrams, and to acquire components for, construct and test your own specialized electronic devices (for research, work, home, etc.) By the end of the course you will be much more comfortable with wiring electronic components together to create a working circuit.

Course Structure: Most of the scheduled class time will be used to build working circuits. You will learn the "theory" of electronics mainly from the textbook and homework. Any time spent lecturing will be to provide background information for the lab and information complementary to the text. You are responsible for material in the assigned reading as well as the material covered during the class sessions. (This is a natural part of the structure of the course). The lab component is, by far, the most essential aspect of the course. In the lab you will learn to use and understand the basic operation of basic instruments (multimeters, signal generators, oscilloscopes, etc.) and to construct, test and modify basic circuits.

Labs: You should be able to finish most labs during one class period. As the semester progresses you will have more involved labs that may take two class periods. Each lab assignment is due *at the beginning* of the next class period after the lab.

The lab period is a time reserved for you to work on your circuits and receive help from me. You are also encouraged to work on the circuits outside of the formally scheduled times if necessary. You may leave your equipment set up between lab periods. You may also ask for help from me at times outside the regularly scheduled time, but be aware that I will not always be able to provide it. Also take note that I will be less inclined to ignore my other work to help you if a) you have not been working during the lab time b) it is the day the lab is due and you are still *just getting started*. **You** are responsible for finishing the lab on time - so do not procrastinate.

There may also be occasional lab Practicals where you must demonstrate the proficient use of an instrument, make an accurate measurement or analyze an electronic circuit.

The lab component is the most important (certainly in terms of the grade you receive). There will likely be occasions when you will need extra time to work on a circuit (outside of the assigned class time). I will make the lab available to you to work independently; this is to be anticipated and is certainly part of the expectations of the course.

Attendance: Attendance is mandatory. This is a hands-on course. As physicists you should know that it is impossible to get your hands on anything when you are not in physical proximity. If you must miss class, I will consider requests for make-up labs on a case-by-case basis. The following are necessary but not sufficient conditions to be allowed to make up a lab: you notified me *before* class that you would be missing and you have a good reason for missing class.

Grades:

55 %	Lab projects, experiments, Practicals, reports
15 %	Homework problems
30 %	Two Exams (Midterm & Final, 15% each)

Laboratory grades: By far the most important aspect of the course will be the lab exercises. You will be expected to finish all of the lab exercises and complete all of the assigned circuits. Grades for these will be given for (1) completion; (2) correct function; (3) required modifications; (4) analysis of the circuit; and (5) written documentation. Most labs have data sheet for recording your results. The data sheet and your lab notes will provide the documentation required for grading. See the notes below on the lab notes.

Grades on a lab exercise will be reduced for the following reasons: (a) incomplete; (b) not functioning; (c) incorrect or incomplete documentation (i.e., no lab notes); (d) incorrect or incomplete analysis; (e) *excessive* assistance from the instructor. I am quite happy to help you troubleshoot your circuit but you should have already made a reasonable effort to figure it out on your own first. Learning to troubleshoot is a skill that will serve you well for the rest of your life regardless of your career path.

Homework: Homework assignments will consist largely of problems from the text and will help you with your theoretical (conceptual & mathematical) understanding of the material. We will cover approximately one chapter every week or two but specific assignments will be made as the course progresses so that I can adjust the pace to the needs of the class.

Exams: There will be a midterm and a final exam covering the entire material covered prior to the exam date. These two exams will cover theoretical (conceptual & mathematical) aspects of the course as covered in the printed materials "handouts"), lectures, and skills/results/behaviors discovered experimentally in the

lab. The emphasis of the exams will be on basic information that you should have at your fingertips in the lab.

Students with Disabilities: I am committed to working with students with disabilities in conjunction with Trumans Office of Disability Services to fulfill any needs of those students, in alignment with the Americans with Disabilities Act (ADA) of 1990. Please let me know early if you have special needs.

Academic Honesty: Obviously, you are to do your own work in this class. In addition, you must learn to properly cite the work of others in your lab reports. It is part of scientific writing to cite the work of authors who have preceded your work in a field and whose work directly influences your work. If you have questions about proper citation please ask me before you turn in the report. Plagiarism is using the work of others and claiming it as your own. Plagiarism will be grounds for disciplinary action that may include expulsion from school. Changing your data is scientific misconduct and will not be tolerated.

Office Hours: Office hours are not the only times I am available for help. My listed office hours just indicate the times I guarantee I will be in or near my office (MG 3172) or my lab (MG 3147). I encourage you to come and ask questions when you need help. If you cannot make it during the regular office hours, then please schedule a time to meet with me. My class schedule is posted on my door. You are also welcome to stop in if my door is open. Also, a one of my office hours is preceded by my Physics 196 Lab. I am sometimes still in class helping students after 4:30. Please come down to MG 1006 if I am not in my office at 4:30 on Monday.

Lab Notebook: The lab notes will serve as a technical journal of what you have done in the lab. Do not record lecture notes or homework assignments on notes pages (although you may wish to copy pertinent information from a lecture or handout for reference in the lab). Learning to keep a good lab notebook now will help in the Advanced Lab course where you also will be required to keep a good lab notebook. You may, in fact, use your lab notebook from this class in the Advanced Lab course. Please obey the following rules for keeping records:

- Write neatly - your notebook must be readable by others. Write concisely - avoid large printing/writing, as this will make your information more spread out and less easy to review. But do not write so small as to make your writing unreadable. It is not necessary to have flawless notes! Scratch-outs are fine, as are abbreviations and side notes and even late insertions (just be sure to date a later entry).
- Draw a diagram of the circuit(s) you are building; they should be simple, but with enough detail that you could repeat the entire process with only the lab notes.
- Record changes you make, and results of measurements. Write questions you have and concerns about the results. Make simple tables and/or graphs of the results. They need not be final and graphs are certainly "rough."
- Always provide enough detail that you could repeat the entire process with only the lab notes as source. Remember that there may be several days between lab sessions, so you might want to write a summary of what has been done and what needs to be done for the next time you work in the lab.

Safety: To maintain a safe working environment (for you and the equipment), please **LISTEN** and **FOLLOW** directions. **ASK ME** if you do not understand something. **TURN OFF** power to your circuit when you come to get me to ask me about something. **STOP, TURN OFF THE POWER, AND THINK** if you blow a fuse or trip a circuit breaker on your equipment. There was a reason the fuse blew or circuit breaker tripped. Figure out what that reason was before applying power to the circuit again.