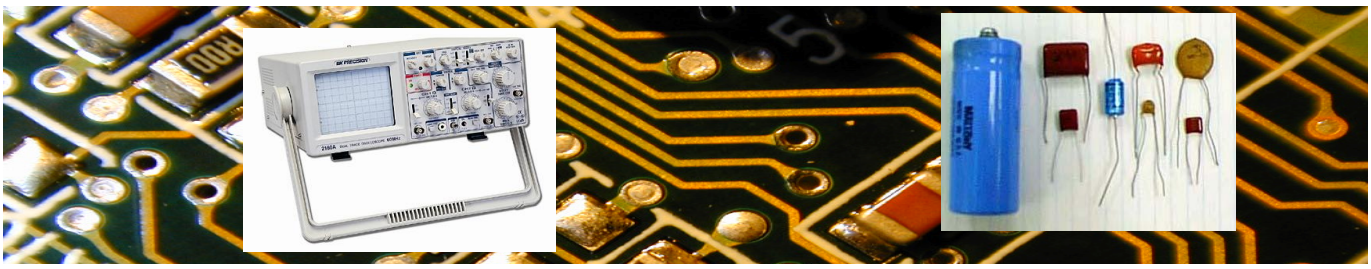

Course Description - *PHY 2250, Electronics & Circuit Theory 4 hours credit*
Prerequisite: PHY 1140, Intro to Physics
This course provides a thorough introduction to the concepts and principle of electronics and circuit theory. The course will emphasize the design of circuits relevant for audio engineering applications. The emphasis on design implies that we will be principally concerned with the function of circuit elements and how they work together, however we *will* discuss the physical processes which make these functions possible.

Instructor: Dr. Hawley
Office: Janet Ayers Academic Center (JAAC) room 4008, & Zoom: https://tinyurl.com/hawleyzoom
Phone: (615) 460-6206
E-mail: scott.hawley@belmont.edu
Office Hours: MW 4-6pm, F 4-5pm, WF 11am-noon, and by appointment.
This is your time. Do not hesitate to come see me if you have questions or want to talk.

Meeting Times and Locations
Turn off all cell phones, pagers, recorders etc. before coming to class. If you do not you will be asked to leave class and it will count as an unexcused absence.

Class:	12 noon – 12:50am	MWF	JMC 404
Laboratory:	3:30pm – 5:20pm	Tues	MCWH 402

Course Objectives

1. To provide students with a sufficient knowledge electronics and circuit theory to serve as a solid foundation for applications in the discipline of audio engineering.
2. By end of term, students will be able to demonstrate their understanding of electronic circuit elements, circuit design and construction, and circuit testing, through both written work (tests & homework) and real-world implementation (labs & projects).
3. To provide practical, hands-on experience in designing, building and testing electronic circuitry.
4. To give students opportunities to attain a reasonable skill level at tasks such as oscilloscope operation and 'debugging' a signal path.
5. Synthesis: Students will be able to apply their knowledge and reasoning skills to solve *new* problems.

Textbook: - Grob's Basic Electronics by Mitchell E. Schultz, McGraw-Hill. (required)
- with McGraw-Hill Connect Digital Access (required)

Course Web Site: http://hedges.belmont.edu/~shawley/PHY2250, and Blackboard.

Lab Manual: Electronics & Circuit Theory Laboratory Manual by Scott H. Hawley, download via web site.

Course Outline:

DC Circuits:
Review & Foundations (Chapters 1-5)
Series-Parallel Circuits (Chapter 6)
Voltage Dividers & Current Dividers (Chapter 7)

AC Circuits & Reactive Elements:
- Alternating Voltage and Current (Chapter 15, and Supplemental notes re. math)
- Capacitance (Chapter 16)
- Capacitive Reactance (Chapter 17)
- Capacitive Circuits (Chapter 18)
- RC Time Constants (Chapter 22)
- Electromagnetism, Inductance and Transformers (Parts of 14, 19, & Supplemental)
  - E/M in Audio Gear (Supplemental)
- Alternating Current Circuits (Chapter 23)
- Filters (Chapter 26)

Semiconductor Devices & Active Circuits:
- Diodes and Diode Applications (Chapter 27)
- Bipolar Junction Transistors (Chapter 28)
- Transistor Amplifiers (Chapter 29)
- Field Effect Transistors (Chapter 30)
- Operational Amplifiers (Chapter 33)

Course concepts should be regarded as *cumulative*, i.e. later chapters build on (and assume proficiency with material in) earlier chapters.

Course Materials

You will need a calculator (*other* than the one in your cell phone) for homework and tests.

Grading Procedures

Tests (3)	45%
Final Examination (comprehensive)	20%
Laboratory Work	25%
Homework	10%

Grading Scale

Course Average	Letter Grade
90 -100	A
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
67 - 70	D+
63 - 66	D
60 - 62	D-
Below 60	F

Academic Standards:

- *Clarity*: Written work (e.g., homework) will be clearly *readable, intelligible* and *explain* the *reasoning* behind each solution, exercise, etc. A simple list of formulas --- or worse, an "answer" with no supporting work --- will not do. Imagine that you are writing to explain to fellow students, such that if they picked up your paper, they could follow your reasoning and arrive at your conclusion. **This applies to tests and assignments where "Show Work" is required: answers (even correct ones) with no supporting work will receive zero credit.**
- *Presentation*: In addition to clarity of *content* described above, assignments will be neatly written (recopy your original calculations as needed, vast amounts of scribbling should be omitted, etc.), any "ratty spiral binder detritus" will be removed, and multiple pages will be *stapled* or secured with a paperclip.
- *Accuracy*: Answers will be numerically and conceptually correct, and not claim undue degrees of numerical precision (i.e. pay attention to "significant digits")
- *Units*: Rarely in physics is a dimensionless number the requested quantity. All (applicable) answers will contain the appropriate units (meters, volts, etc.).

Policy on Missed Examinations

No make-up labs or examinations will be given. Should you have a valid reason for missing an examination, then your score on the final examination will be used in lieu of the examination you missed. If you fail to take an examination without a valid reason, then you will be assigned a zero on that examination. The course instructor determines the validity of your reason for missing an examination.

Policy on Class & Lab Attendance

There is no policy of attendance for attendance's sake, however it is **your** (not the instructor's) responsibility to keep yourself up to date with **all** material covered in class, **all** assignments given in class, and **all** work performed **during** class. In particular, because lab times necessarily involve work and will also be used for administering exams, your missing lab time for any reason not excused will necessarily affect your grade adversely. **No make-up labs will be given.** The University policy on class attendance, stated on pages 51 and 52 of the current ***Belmont University Bulletin***, will be followed. You must complete all work that you miss as a consequence of not being in class. **Lab will begin promptly at the designated time, beginning with a quiz about your reading of the lab book beforehand.** If you arrive late, you will miss 10% of your lab grade in the form of this quiz.

Note that days preceding and following Belmont Holidays are not holidays. You will be expected to attend class accordingly. Travel plans will not constitute excused absences. Failure to return because of travel related delays etc. will not constitute excused absences.

Policy on Assignments: No late work.

All work is due at the beginning of class on the day the assignment is due. Late work is not accepted. Homework and Lab reports not submitted by their due date & time will receive a zero.

University Policies

Honor Pledge:
"I will not give or receive aid during examinations; I will not give or receive false or impermissible aid in course work, in the preparation of reports, or in any other type of work that is to be used by the instructor as the basis of my grade; I will not engage in any form of
academic fraud. Furthermore, I will uphold my responsibility to see to it that others abide by the spirit and letter of this Honor Pledge."

Disabilities Compliance:
In compliance with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, Belmont University will provide reasonable accommodation of all medically documented disabilities. If you have a disability and would like the university to provide reasonable accommodations of the disability during this course, please notify the Office of the Dean of Students located in Beaman Student Life Center (460-6407) as soon as possible.

Disclaimer:
The policies, topics and course organization described in this syllabus are subject to change. Adequate prior notice will be provided to all students in the event of a change.

How to Succeed in this Course:

- *Prepare.* Studies in education research show that learning occurs best when students' *first exposure* to course material occurs in private, *prior* to class. (Note: This does *not* include sitting in the hallway immediately before class trying to cram.) Thus this instructor recommends reading the relevant section of the text the evening before class.
- *Work problems, answer questions, work problems*. Physics can be regarded as a *reasoning skill* which can be acquired through *practice*. By doing so, you *train your brain* through the *actions* of applying the concepts you're learning. Reading the text is helpful for first exposure and clarification, but for "studying" (e.g., before a test) there is little substitute for experience. In particular, "memorization" is rarely a useful avenue for success in a physics course.
- Become skilled in using ***both*** the *concepts* as well as the *mathematical tools* used in the course. Being able to "do the math" without understanding the concepts behind it is a frequent pitfall of engineering students. Likewise, lack of mathematical proficiency will severely limit your performance in the course.
- Complete all assignments on time and in compliance to Academic Standards (below).
- *Begin* assignments at least two days prior to due date, so you can ask the instructor one class period prior to their due date
- *Make use of the instructor's office hours.* Do not be afraid to come ask questions, share concerns, make suggestions, etc.
- *Stay current*. This course will move quickly. Do not fall behind!
- *Put in the time.* You are (very) unlikely to attain proficiency without investing substantial, *focused* time *daily* toward studying and working problems. Unfortunately, there are no shortcuts.

***Tentative* Class Schedule:**

Italics indicate the reading or other preparation you are expected to have performed for that day

Week of	Mon	Tues (Lab)	Wed	Fri
Jan-8			Syllabus/ Electric Charge / Start "Structure of Matter" slides	*HW "0" Due,* *Finish "Structure of Matter"* Current, Resistance & Ohm's
Jan 15	MLK Holiday	*Read the Lab* Lab: Ohm's Law	*HW 1 Due* Activity: Series Circuits	*5-1 to 5-2* Parallel Circuits
Jan 22	Activity: Parallel Circuits	*Read the Lab* Lab: Internal Resistance	*HW 2 Due* Series-Parallel Parallel	*6-1 to 6-2* More Series-Parallel Circuits
Jan 29	*7-1 to 7-3* Activity: Cue System Circuits	*Prelab Due* Lab: Breadboard & Loaded Voltage. Div.	*HW 3 Due, 15-1 to 15-9* Basic AC. quantities	Activity: Work problems in AC & Series-Parallel Circuits
Feb 5	*Practice Test 1* Review for Test	**Test 1** – Chs 6, 7, 16, 15, 19	*16-1 to 16-4* Capacitors	*17-1 to 17-2* Capacitive Reactance
Feb 12	*18-1 to 18-2* Series RC Circuits	*Prelab Due* Lab: Scope Intro	*18-3 to 18-4* More RC Circuits	*HW 4 Due, 18-5* Parallel RC Circuits
Feb 19	RC Circuit Review / Work Problems	Lab: RC Time Constant	*HW 5 Due, 14-8, 14-9* Electromagnetism, Faraday's Law	E&M in Audio Gear: Electromagnetism, Induction, Lorentz Force Law
Feb 26	Transformers & Inductors	Lab: Inductive Reactance / Loudspeaker Impedance	*HW 6 Due, 26-1 to 26-5* Filters	Hawley at conference: Individual consultations (optional)
Mar 4	Spring Break	Spring Break	Spring Break	Spring Break
Mar 11	*Practice Test 2* Review for Test	**Test 2:** Chs 22, 17, 20, 18, 21, 23	*27-1* Semiconductors	*27-2.* Activity: P-N Junction, Diodes, *27-6.* More on Diodes, Zeners,
Mar 18	*HW 7 Due* Power Supplies, Regulators	No Lab	No Class, Hawley at conference	BJTs, circuits
Mar 25	Transistor Amplifiers	Lab: Diodes & Power Supplies	*HW 8 Due* Amplifier circuit analysis	Easter Break
Apr 1	Easter Break	Lab: Transistors & Simple Amp	Activity: Designing Amplifier Q-Point	Multi-Transistor Amps: Diff., Darlington, P-P
Apr 8	*HW 9 Due, 30-1, 30-4&30-6* FETs	No Lab	Ch 34 - Op Amps	Overview of Op-Amp Circuits
Apr 15	*Practice Test 3* Review for Test	**Test 3:** Chs 26, 28, 29, 30	Analysis of Op-Amp Circuits	*HW 10 Due* Tubes
Apr 22	*Practice Final* Review for Final	Lab: "Distortion Pedal"		

Final Exam Date & Time: See https://www.belmont.edu/registrar/exam-schedules.html