## Physics 370: Electronics

#### Fall 2017

**Lecture: A104 SCI, Tue, Thur, Fri., 10:00-10:50**

**Lab: A014 SCI, Thur. 11:00 – 13:50** (in basement!)

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| |  |  |  | | --- | --- | --- | | Instructor: | Dr. Chris Verzani | | |  |  | | | E-mail: | [cverzani@uwsp.edu](mailto:cverzani@uwsp.edu) | | | Phone: | 715-346-4764 | | | Office: | SCI B103 | | |  |  |  | | Office Hours: | Mon. 15:00 – 15:50  Tues. 16:00 – 16:50, Wed. 10:00 – 10:50, Fri.9:00 – 9:50, and other times by appointment |  | |  |  | | |  |  | | | Textbook: | [Electronics: A Complete Course](http://wps.prenhall.com/chet_cook_electech_2), Nigel P. Cook | | |  | Second Edition | | |

## Policies

**Attendance:** Although attendance is not recorded for the lectures, it is highly recommended that you attend. Regular attendance will help you learn the material and, thus, lead to better performance on quizzes and exams. Laboratory attendance is required to receive a laboratory grade. Although the laboratory exercises are generally performed in groups of two students, each student *must attend* the lab in order to receive a grade for the lab.

**Course Goals:** The course is basically separated into **three distinct parts**. Although you will likely learn many new concepts pertinent in electronics, it’s fair to state that this course is **less** of a **theoretical** study of electronics, and much **more** an **applied** “hands-on”, laboratory based course. This course has a strong emphasis on a learning how to “do electronics” in the laboratory , and primary course goals are to be actively engaged in applied electronics design, construction, and circuit testing (“de-bugging”).

While lecture will essentially be review for the first third of this semester, as we will be covering material that you should have some familiarity with from a 2nd semester introductory physics course, it will likely feel new again, with the lab based emphasis. Familiar subjects, such as circuits with combinations of resistors, capacitors, and inductors will be covered, but will be covered in greater detail (though not necessarily with much greater depth). This section of the course is essentially “**analog**” circuitry.

The second part of the semester will emphasize **digital** circuitry. This includes subjects such as diodes, transistors, and integrated circuits (IC’s), and again, emphasis will be in applied, lab-based learning.

The final part of the semester is something you get the chance to help determine. We will dedicate this portion of this class entirely to **projects**. The more specific details for this part of the course will be given later in the semester. When working on your projects, you will get the opportunity to take what you’ve already learned, and use it to create something new! Hopefully, this will be a rewarding part of the class, and allow you to trail-blaze into an area of electronics that is of particular interest to you.

**Learning outcomes:**

1. Integrate conceptual reasoning, critical thinking skills, mathematical skills, and principles to explain and solve problems related to many different types of electric circuit designs covered in this course. This includes taking quizzes, exams, turning in pre-lab exercises, and in the laboratory through exercises where you successfully construct many different electronic circuits.
2. Investigate experimentally by identifying how to create functioning circuits. Also, you will use the circuits to make measurements, collect reliable data, analyze results, and draw justifiable conclusions. Labs reports and worksheet will be completed to satisfy this outcome.
3. Communicate effectively by clearly writing out an explanation of how and why your circuits operate, and in some cases why your circuits may not be performing as you may have expected prior to construction. Justifiable conclusions about circuit performance should be drawn, and explained in lab reports.

Effective communication will also occur when you design and build your own circuit, as a lab project. (More information under “Projects” below).

**D2L:**  A great deal of information about this course will be posted on D2L. Some of these items: grades, some lecture notes, deviations from the course calendar, etc..

**E-mail:**  Any notices to the class will be sent via e-mail, so it is a good idea to check your UWSP e-mail regularly.

**Grading:** Grades are calculated based on the scores of quizzes, lab worksheets, and exams.  The final percent grade will be calculated as follows:

final grade percentage = (your quiz points)/(possible quiz points)\*20% + (your lab points)/(possible lab points)\*40% + (your exam points)/(possible exam points)\*40%

Letter grades are determined by calculating the final grade percentage (see above), and then using the table shown below. For example, if a student's final grade percentage is 89.8%, the student's letter grade is a B+.

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| --- | --- |
| A | 94.0% or higher |
| A- | 90.0% or higher |
| B+ | 86.0% or higher |
| B | 83.0% or higher |
| B- | 80.0% or higher |
| C+ | 76.0% or higher |
| C | 73.0% or higher |
| C- | 70.0% or higher |
| D | 60.0% or higher |
| F | Less than 60% |

It is anticipated that the number of points for the various parts of the course will be roughly as follows:

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| --- | --- |
| Quizzes: | 7 x 10 points = 70 total points |
| Exams: | 4 x 30 points = 120 total points |
| Labs: | 10 x 12 points = 120 total points |

**Homework:** Although assigned homework problems are not collected or graded, answering the questions at the end of each chapter should help increase your scores on quizzes and exams.  The answers to the odd-numbered questions are given in the back of your textbook.  Discuss any difficulties you have answering these questions with the instructor during office hours or, if there is time, during your lab session.  Another great way to review the course material is to take the review quizzes on the textbook website:  <http://wps.prenhall.com/chet_cook_electech_2>.  From the pull-down menu in the upper-left portion of the browser window, select the chapter you wish to review; and then select the type of questions you wish to be asked.  When you are finished answering the questions, you can submit the quiz for immediate grading and feedback.  Although these practice quizzes are a great way to review, please do not e-mail the results to your instructor.

**Exams:** The weeks of the three written exams are on the course schedule (The exact dates are tentative). You should bring a basic scientific calculator, pencil, and eraser to the exams.  You should not bring any notes or books.  Make-up exams are possible at the instructor's discretion. (Note: There is no final exam. Instead, your project presentation counts as your final exam.)

**Laboratory:** There is no lab manual for this course; instead, you will be given lab handouts each week**.**  Occasionally the lab handouts refer to figures from the textbook. The textbook is also a valuable reference, and (even though it’s a heavy book) it’s recommended that you bring a textbook with you to lab. Pre-lab handouts will also be assigned as part of each lab. Pre-lab handouts are provided to familiarize you with concepts, and circuit operation for the experiments you will conduct in the laboratory. As part of the pre-labs, you will be tasked with simulating circuits, and conduct exercises, and answer questions about circuit operations. Completed pre-lab **and** lab worksheets should be turned in for grading at the end of each laboratory session

**Pre-Labs:** You will be given a pre-lab worksheet prior to each lab. This worksheet is designed to get you thinking about the concepts that the lab will cover and is to be completed prior to coming to lab. They will often require the use of simulator software that is available through the following website: <http://www.falstad.com/circuit/>. You can download a stand-alone version if you prefer to work offline. The software requires Java-Script to be installed on the computer, which is available on all standard campus load computers. (Computers are not available in the laboratory room, so you will need to set aside time outside of the classroom to complete the pre-lab.) A good set of directions to use this software can be found at <http://www.falstad.com/circuit/directions.html>.

**One** of the labs this semester will be selected as a **formal lab report**, that will be typed. This piece of writing should be articulate, grammatically correct, organized, and should include; references (example: from the Textbook), evidence (data) and supported ideas.

Although the timetable lists the course as having three separate hours of lecture and one three hour lab per week, there will not always be an equal division of lab and lecture time on any given week.  In other words, some days may be devoted more to lecture while other days are devoted entirely to lab.  You are expected to complete the laboratory exercises during the scheduled times for labs (and/or lectures).  Make-up labs are possible; however, they are usually less enjoyable since they are performed alone.  It is your responsibility to contact the instructor if you need to schedule a make-up lab.

**Projects:**  During the last three (or four) weeks of the course, students will work on projects (including; design, construction, and circuit testing).  Each group will determine an appropriate project in consultation with the instructor.  Each group will give a graded presentation on their project during the final exam period.  The number of points for the project will be the same as for a midterm exam.

You will write and submit a proposal for the project circuit you want to build. Projects will have a budget requirement, so you need to include circuit parts needed for your circuit. Finally, you will do two presentations to the class. The first presentation will be a mid-way progress report for your circuit. The final presentation will summarize your project results. In each your presentations, explanations of your circuits should be included, as well as circuit diagrams, and discussion of circuit testing, results, and a clear summary. Furthermore, each student will be given evaluation forms to critique the presentations of other students. These evaluations are to provide effective and useful feedback to improve your communication, but will not have any influence on grades for presentations.

**Quizzes:** Most weeks you will be taking a quiz based on material covered the previous week. Quizzes are based on material from your textbook, lectures, and lab exercises.  Questions will resemble those at the end of each chapter, on the textbook website, and on your lab worksheets.  You should have a basic scientific calculator, pencil, and eraser for the quizzes; but you may not use any notes or the textbook.

## Schedule

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| **Week** | **Lecture/Lab Topics** | **Chapters** |
| 9/04 | Current, Voltage, Resistance, & Power | [1](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch1.doc) & [2](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch2.doc) |
| 9/11 | Series & Parallel Circuits | [3](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch3.doc), [4](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch4.doc), & [5](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch5.doc) |
| 9/18 | Capacitors & RC circuits | [6 & 7](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch6-7.doc) |
| 9/25 | Inductors & RLC circuits | [8 & 9](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch8-9.doc) |
| 10/02 | Semiconductors & Diodes | [10](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch10.doc) |
| Exam 1  (End of week 9/28) Ch. 1-9 | | |
| 10/09 | Diodes | [11](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch11.doc) |
| 10/16 | Transistors | [12](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch12.doc) |
| 10/23 | Op-Amps | [15 (part 1)](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch15-1.doc) |
| 10/30 | Timers and Clock Generators | [15 (sect. 3)](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch15-3_to_Ch18.doc) |
| Exam 2  (End of week 10//26)  Ch. 10, 11, 12, & 15 (sect. 1) | | |
| 11/06 | Number Systems and Codes & Logic Gates | [17 & 18](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch15-3_to_Ch18.doc) |
| 11/13 | Logic Circuit Simplification | [19](http://www.uwsp.edu/physastr/taft/phys370/study_guides/ch19.doc) |
| 11/20 | Projects ([instructions](http://www.uwsp.edu/physastr/taft/phys370/Physics%20370%20Project%20Instructions.doc)) |  |
| 11/27 | Projects |  |
| 12/04 | Projects | |
| 12/11 | Projects | |
| Exam 3  (End of week of 11/13)  Ch. 15 (sect. 3), 17, 18, 19, & 28 | | |
| Project Presentations: during the "final exam" period 12/20/2017, Wednesday, from 12:30 -14:40, Rm, A104  Note: Exam dates are tentative (except the project presentation time). | | |