

Physics 209
Spring 2013

PHYS-209. Electronics for Scientists

Foundations of analog and digital circuits. DC and AC circuits, transistors, operational amplifiers, digital electronics. Prerequisite: PHYS-112. Three hours lecture and three hours of laboratory per week. *Four semester hours.*

Text: *Basic Electronics for Scientists and Engineers*, Dennis L. Eggleston, Cambridge University Press, 2011, ISBN 978-0-521-76970-9 (hard cover), 978-0-521-15430-7 (paperback)

Final grade will be determined by:

Homework, special problems or projects	10%
Laboratory	25 %
Exams (in class) (3)	40%
Final exam	25%
Total	100%

Attendance

I will take attendance in our regular class meetings. I will not penalize you for poor attendance, but I will report an unusually large number of absences to either the Dean or your Academic Advisor. In cases where your grade is close to the dividing line between two grades, I will review your attendance record and increase your grade if your attendance has been satisfactory; attending class has educational value that is not always evaluated by exams.

Homework

I will assign homework problems on a regular basis. I will ask that some of this work be handed in. I encourage collaboration, but no direct copying. The names of your collaborators should be on your work.

Course Objectives

Physics 209 introduces students to some aspects of electromagnetic theory such as circuit analysis, and solid state and electron physics that have practical applications in the laboratory. The laboratory part of the course introduces students to the theory and use of electronic instrumentation such as voltmeters, ammeters, measurement of inductance and capacitance, oscilloscopes, signal generators, etc., and their use in circuit and instrument analysis. By the end of the semester you will be able design data acquisition by electronic instrumentation, specify requirements for the same, and be able to troubleshoot malfunctioning apparatus.

Laboratory

Assume that each experiment you do has the potential for either a patent or Nobel Prize. In order to make sure that you get proper credit, your experiment design and data, with dates and all relevant details, must pass a judicial review. If what you do results in a patent with a potential for lots of money to be made, you will be sued, and your lab notebook will be the basis for establishing your rights.

All experiment design details and data should be recorded in a hard cover notebook. List the make, and model number of apparatus used. Record all experimental data in the notebook. Do not erase, or remove pages. If you use computer software to plot a graph, or analyze data, staple a copy to the relevant data sheets. If you do some preliminary analysis, and make a mistake, do not erase, just cross-out. Put your initials and date immediately after your work on a given day; no blank space. Some private companies required a notary public's signature, seal, and date on each page of the notebook.

I will collect your notebooks and grade as follows: A "NI" means that your work needs improvement. I will provide comments. An "OK" means just that, I might add some comments, but your work is basically satisfactory.

Your lab grade will be determined by your progress. If you start with NIs but gradually improve to Oks, you will get full credit for the laboratory; numerically this will be a 95.

If a class is cancelled do to severe weather I will notify you by email if I am still at home. If I am in transit and a class is to be cancelled, I will need the phone numbers of at least two students that I can notify, and I will also notify the administrative assistant in Pfahler.

SPTQ and assessment of the course.

SPTQ provides a mechanism for you to provide feedback on the course. Unfortunately SPTQ is administrated at the end of the semester so if something is bothering you, you should let me know as soon as possible. For example, if you think the exams are too easy, let me know right away.

Some aspects of an electronics course can rely on concepts in mathematics and electromagnetic theory that you are not familiar with. I will try to access your knowledge, but, on occasion, might forget; make sure I am aware of problems.

Syllabus

1. Basic concepts and resistor circuits.
2. AC circuits.
3. Thermionic emission, Child-Langmuir Law, vacuum diodes and triodes.
4. Band theory and diode circuits.
5. Bipolar junction transistors.
6. Field-effect transistors.
7. Operational amplifiers.
8. Oscillators.
9. Digital circuits and devices.