Advanced Electronics and Instrumentation (PHYS 116)

Lecture and Lab: Sequoia 140
Tuesday 12:00 – 4:00
Thursday 1:00 – 4:00

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Course Summary

Physics 116 is an advanced topics course in electronics and instrumentation for scientists. Topics for the course include noise reduction techniques, signal recovery, frequency analysis, transfer functions, computerized instrument control, and instrument development.

Office Hours

DeGraffenreid: Wed and Fri, 9:30 – 11:00, SQU 232; By Appointment.
Hillbrand: Mon and Wed, 9:00 – 10:00, SQU 442; By Appointment.

Required Texts

DeGraffenreid, W. (ed.), *Advanced Electronics and Instrumentation*. McGraw-Hill, 2004.

Simpson, R. *Introductory Electronics for Scientists and Engineers.* (115 textbook)

Smith, S. *The Scientist and Engineer's Guide to Digital Signal Processing*. http://www.dspguide.com

Recommended Texts

Essick, John. *Hands-On Introduction to LabVIEW for Scientists and Engineers*. Oxford. (115 textbook)

Modus Operandi

Physics 116 formally consist of one hour of lecture and six hours of laboratory per week. In some cases, we may use part of the "lab" time for lectures. For the sanity of students and instructor, lectures *will not* exceed two hours. There is not a manual, so experiments will be distributed electronically via DeGraffenreid's website.

Dr. DeGraffenreid is responsible for the lecture portion of the class and Dr. Hillbrand is responsible for the laboratory component. That said, DeGraffenreid will often be available during lab (hiring committee obligations permitted).

A copy of the projected schedule is attached.

Grading

Your final grade you earn will be based on the following breakdown:

Homework	10 %
Evaluation of Lab Skills	5 %
Lab Reports	20 %
Project	25 %
Midterm Exam (1 one-hour long exam)	15 %
Final Exam (1 two-hour long final)	25 %
Total	100 %

We intend to use standard percentages in assigning grades: A = 90-100%; B = 80-90%, etc. However, we will take into consideration the distribution of scores prior to making a final decision.

Homework

Homework will be assigned weekly during the first 2/3 of the semester. The due dates will be indicated on the website. Late homework ***will not*** be accepted without prior approval.

Lab Reports

The bulk of the lab reports will be based on the LabVIEW code that you wrote. You do, however, need to include a written summary of your

observations, problems, tricks learned, and any circuit or data analysis that goes along with the code.

LabVIEW VIs and summaries should be emailed to Dr. Hillbrand. Written summaries must be submitted as PDF files.

For those labs that do require circuit analysis, don't forget to include:

- sketches of circuits that you designed, if any
- tables and/or graphs of results, and
- a comparison of results to predictions.

Lab reports are due one week after the completion of the exercise and late reports are subject to significant penalty, although you will be given five free late days for your lab reports. Labs are all equally weighted and will be graded on a 10 point scale. A copy of the grading sheet is attached.

Project

You are required to build a project in the last month of the semester. This project should demonstrate your mastery of electronics and instrumentation. In an ideal case, the project will integrate electronics and computerized data acquisition and analysis. Types of projects to consider are those that automate data collection for advanced physics lab, optics lab, or research environments. Stand-alone, handheld devices are also acceptable projects with prior approval. The Department of Physics and Astronomy can provide support for these projects, but any unusual or particularly costly components may require student purchase. Your project requires a written report, due by noon at the end of final's week. The report should include: motivation, description, results, and a self-analysis of your work. The 116 projects functionality will be emphasized more in grading than 115, and it needs to be "scientifically useful," rather than just "useful."

Exams

The exams are closed book, closed notes. I will provide sheets of Laplace and Fourier Transforms as needed. The midterm exam is tentatively scheduled for Thursday March 20 (just prior to Spring Break). It is one hour long. The final exam is scheduled for will be held on Tuesday May 20 at 12:45, per University Schedule. It will be two hours long. There will likely be a practical portion on the final.

Academic Dishonesty Statement

The Department of Physics and Astronomy has unanimously approved the following statement:

"The faculty of the Department of Physics and Astronomy will not tolerate academic dishonesty. Falsification of data, copying, unauthorized collaboration, plagiarism, alteration of graded materials, or other actions (as described in, but not necessarily limited to the CSUS Policy Manual) *will be promptly reported to the Office of Student Affairs.* The offending student will be penalized on the assignment in question. Serious infractions will result in course failure and a recommendation for administrative sanctions."

If you have any questions regarding this statement, please come and speak with us about it.

Additional Information

If you have a disability and require accommodations, you need to provide disability documentation to SSWD, Lassen Hall 1008, 916-278-6955. Please discuss your accommodation needs with us after class or during our office hours early in the semester.

This is an upper division physics course, the first one for some of you. In general, you ought to expect to spend 2 – 3 hours on a class for every unit. As this is a four unit course, this means that you shouldn't be surprised to spend 8 – 12 hours to succeed in in this class.

We have collected electronic data sheets and information about our instruments, it is available online: http://www.csus.edu/indiv/d/degraffenreidw/Resource.htm.

Other useful texts:

K.R. Fowler, *Electronic Instrument Design.* (Used to be required for EEE193, may be at bookstore)

P. Horowitz and W. Hill, *The Art of Electronics*. (Strongly recommended for those interested experimental physics).

J.H. Moore, C.E. Davis, M.A. Coplan and S. Greer, *Building Scientific Apparatus*.