Phys 5061 **Experimental Methods** **Spring 2019**

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Course info: http://www.d.umn.edu/~jmaps/phys5061/
Prerequisites Phys 2033, Phys 3061 or the equivalents.

Text Essick, *Hands-on Introduction to LabVIEW*, 4th edition, for much of the lab work early in the semester;

Additional references Horowitz and Hill, *The Art of Electronics*; Dunlap, *Experimental Physics - Modern Methods*; Preston and Dietz, *The Art of Experimental Physics*; Bevington and Robinson, *Data Reduction and Error Analysis for the Physical Sciences, 3rd ed.*; Taylor, *An Introduction to Error Analysis*; Melissinos and Napolitano, *Experiments in Modern Physics*.

Course content Useful electronics and signal processing techniques, use of computers for data acquisition and experiment control, experimental uncertainties and error analysis, survey of experimental techniques in various areas. 2 hours/week lecture 3 hours/week lab.

Learning Outcomes (1) Execution: Students will be able to design, set-up, and carry out experiments using a variety of instruments, laboratory equipment, and data acquisition techniques, including the use of high level software tools. (2) Communication: Students will be able to communicate methods and results of experiments in written form.

Lab work Labs will meet weekly in MWAH 395. The book by Essick will serve as the basis for a number of lab exercises early in the semester. Once a foundation in using LabVIEW for data acquisition chores is established, the labs will progress to more open-ended projects. You will need a lab notebook for keeping notes on work done in lab. Beyond documenting lab work in the notebook, short summaries on lab exercises and more substantial reports on later projects will be assigned.

The lab notebook should be a bound notebook, and your life will be much easier if it is ruled like graph paper. There are a couple styles available, which you use is not critical. While doing the lab, write down what you are doing and what happens on the right hand page. Include schematics/diagrams of the circuits you build and print-outs or diagrams from software you create. If you have a figure or graph to add later, draw or tape it in on the left hand page. Number such figures so you can refer to them in your commentary. After the lab and before you hand it in, go back to the notebook, elaborate, and clarify. The goal of the lab notebook is for someone who has not done the experiment before (or you, ten years later, when you're in a real research situation and want to remember how to build a notch filter) to be able to pick it up, walk into the lab, and duplicate your work.

Homework: A number of homework (and in-class) exercises will be assigned during the semester. Discussion of homework problems with classmates is permitted and encouraged. Use of solution manuals or comparable resources is not permitted. All work turned in must be your own, *i.e.*, you are able to present you solution and explain it to the instructor and class.

Homework-style work is an essential part of designing and/or understanding an electronic circuit or experiment; in research projects you would not sit down and do all your work at the lab bench. It involves calculating, planning, and designing in advance.

When writing out your homework solutions, include not only the schematics and equations which lead to the answer, but elaborate on the reasoning that led you to the steps in your answer. Think of it this way: your homework should be presented in a fashion so another student can present/explain it to the class given a minute or two to look it over. The solution must be presented in a systematic, step-by-step fashion, with brief explanations of what is being done and the reasoning involved. (Yes, that means using words and learning to write/speak the language of experimental physics!) Without a reasonably complete explanation, you will not get full credit.

Late work Work submitted after 5 pm on the due date is late. Late work is penalized 10% per day.

Assessment Samples of student work in this course will be collected for the purposes of assessment of student learning in terms of desired program outcomes, particularly with regard to: *Execution* and *Communication*.

Grading The following components and weights are anticipated, subject to adjustment: Lab notebook and brief reports 25%, project reports 25%, homework/in-class problems 25%, mid-term exam 10%, final exam 15%. Letter grades are based on a scale that will be no stricter than
$\geq 90\% = A-, A, \geq 80\% = B-, B, B+, \geq 70\% = C-, C, C+, \geq 64\% = D+, D$.

Disabilities Individuals who have a disability, either permanent or temporary, which might affect their ability to perform in this class are encouraged to inform the instructor at the start of the semester. Appropriate adaptation of methods, materials, or testing may be made as possible to provide for equitable participation. To learn about services that UMD provides to students with disabilities and to identify appropriate accommodations contact the Office of Disability Resources, in 256 KSC (726-6130) or visit www.d.umn.edu/access.

Miscellaneous policies The information in this syllabus is intended as a guide. The instructor may adjust course requirements and policies as outlined here as deemed necessary. Such changes will be posted.
Students need to be familiar with the UMD academic policies outlined at
http://www.d.umn.edu/academic-affairs/academic-policies/classroom-policies/recommended-syllabi-policy-statements.