Instructor: Dr. Mike Robertson, HSH-233, 585-1318.

Teaching Assistant: Margaret Buhariwalla, Tuesday 1:30-4:30 p.m.

Course Description: In this course we will learn how to control experiments and collect data using a computer. In particular, we will use your laptops interfaced with National Instruments DAQ interface cards and LabVIEW will be the programming environment.

Outline: The material to be covered will include: the LabVIEW software environment, computer numbering systems, analog-to-digital and digital-to-analog conversion, digital I/O, process control and interfacing techniques.

Text: None. There are some copies of the LabVIEW manuals in the classroom, but we will primarily refer to the help utilities of the software package and online documentation. In addition, the National Instruments website, http://ni.com/, is very helpful. Two files have been uploaded to ACORN that offer an introduction to LabVIEW that you may find helpful: "Halvorsen Introduction to LabVIEW.pdf" and "NI Introduction to LabVIEW.pdf".

Office Hours: Monday, Wednesday, Thursday 4:30-5:30 p.m., or by appointment, or whenever my office door is open.

Method of Instruction: We will start off with lectures and/or labs at 8:30 a.m. Tuesdays and Thursdays and the lab period will be from 1:30-4:30 p.m. on Tuesdays. Towards the end of the term, the emphasis will shift to your major projects and there will be less formal instruction.

Lab: There will be 5 or 6 formal lab exercises for the course and we will start in the lab on the first week of classes. You will be required to hand in a formal lab report on the Tuesday of the week following the lab. All labs will be graded and will be applied to your final mark.

The structure of the lab reports should include the following sections: Introduction, Background Theory, Method, The Program (including flowchart, screen shots of program, etc...), Results and Discussion (can also include screen shots) and Conclusions.

Note that pressing "Alt+PrtSc" will put a copy of the active window into the clipboard and can be pasted into a word processing program for inclusion in your reports. The Windows Snip-it feature also works well.

Lab 1: *Aliasing & Quantization* – In this lab we will learn how to acquire an analog signal, explore the limitations of analog-to-digital conversion, use the Fast-Fourier Transform (FFT), and become familiar with LabVIEW.

Lab 2: *I-V Curve of a Diode* – In this lab we will learn how to use the analog output function, study the importance of circuit isolation, and data averaging.

Lab 3: *Magnetic Induction* – In this lab we will learn how to perform triggered data acquisition and software filtering.

Lab 4: *Newton's Law of Cooling* – In this lab we will learn how to properly interface a temperature sensor and use a PID controller for controlling temperature.

Lab 5: *Lock-In Amplifier* – In this lab we will become familiar with the lock-in measurement technique and how to create a software-based lock-in amplifier.

Project: A major component of the course is your project. It should be some measurement that you perform that involves a ***significant*** amount of computer interfacing, both for collection of the data and control of the experiment. I have some suggested topics, but I encourage you to think of your own ideas. Project proposals are due on Thursday, February 9th, 2017. You will be required to prepare a detailed poster on your project and give a presentation to the class in the last week of classes. In addition, we will have an open house at the end of term for the university community where your project and posters will be displayed. If given permission, your posters may be displayed on the bulletin boards within the Physics Department.

Evaluation:	Laboratory	50%
	Project	50%

Marking Scheme

Formal reports will be required for each laboratory and will be graded using the following marking scheme:

Introduction, Background Theory	
Method & Conclusions:	/5
Program (logic, efficiency, aesthetics):	/5
Results and Discussion:	/5
Writing Quality:	/3
Going Above Minimum Requirements:	/2
Total:	/20