Syllabus Phys 221: Advanced Physics Lab II

Time: Tuesday and Thursday 1:35-4:25pm.

This is a 2cr. laboratory class and hence you are expected to devote about 6-9hrs per week to this class. You are expected to spend at least 6 hours in the lab working on the lab experiments. Some work outside of the lab such as writing reports is required
During the core times short lectures may be given.

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Contents:
In this class, we will cover the basics and some advanced concepts of experimental physics with a focus on experimental methods and instrumentation and the way the can be implemented in an automated way.

You will learn in a practical hand-on fashion
- how to program an Arduino board to control stepping motors
- how to control commercial instruments with Labview,
- how to evaluate experimental data and compare them to models using Python.
- how to write a description of an experiment using LaTeX
- how to design an experiments including hardware, software control, and development of models to evaluate experiments.
- how to use basic instrumentation such Lock-In amplifiers, Motion Controllers, CCD Cameras, Temperature Controllers, Laser Diode Controllers,
- how to use a 3D Printer
- how to operate a lathe and drill in the machine shop

The experiments are out of the areas of Optics such as:
- Interferometry
- Spectroscopy
- Laser Diodes
- Confocal Microscopy
- Polarization

Required Competencies: Basic Lab Skills as obtained in Phys 12, 22, and Phys 220. Use of oscilloscope, power supplies, electric circuits (transistors, Op.amp), use of Arduino, Basic Python programming, basic lab view programming.

Final Competencies:
- Able to write programs in Labview to control a variety of instruments.
- Build instruments that can be controlled by Labview and/or Python .
- Design of experiments from scratch
- Demonstrate how these programming environments can interact.
- Ability to handle large data sets.

- Understand the optical concept that are covered in Phys 21 on a level that allows the design of advanced instrumentation.
- Ability to come up with model and fit experimental data to this model.
- Ability to find creative solution with available resources
- Write coherent informative reports that can be understood by physics majors that have not taken the course yet.
- Effectively present experiments and results in an oral presentation

Degree Requirements: This course is a required course for all Physics majors.

LabManual:
There is no formal lab manual for this course. An outdated lab manual will be posted on course site for reference. This manual is meant to give some background and basic ideas.
You will need to keep a lab-book to document what you are doing throughout the labs. The outcomes of them are summarized in reports and oral presentations. *In a sense, you are writing a lab manual.*

Grades:
The basis for your grades will be your work in the lab as demonstrated in reports, experiment descriptions and a final project paper, and the demonstration of the proficiencies in class. We will also have an informal peer evaluation (see below). The basis for your grade is the demonstration of the final competencies outlined above.

Demonstration of Proficiency in the Lab (throughout):		**30%**
4 Written Experiment Description for Peers:		**40%**
Final Project	**30%**	
Total:		**100pts**

Accommodations for Students with Disabilities:
If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, Williams Hall, Suite 301 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

The Principles of Our Equitable Community:
Lehigh University endorses The Principles of Our Equitable Community [http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Since we are working as teams and teams are relying on other teams these principles are very important for the success of the class.