Physics 230

Classical Physics Lab

Dr. Bo Gao
Office: 1240B HN
Email: bgao@hunter.cuny.edu
Tel: (212) 396-6828
Office Hours: Tuesdays 2:00 - 3:00 pm or by appointment

Fall 2018
Tuesday & Thursday
12:10 - 2:00 pm
3 Credits

Course Objectives and Outcomes:

This lab course is designed to prepare students the data collection, data analysis and error analysis techniques. The techniques will be performed in Mathematica and emphasized throughout the six selected experiments of mechanics, electricity/magnetism, and thermodynamics.

Students will learn error analysis techniques including the importance of reporting uncertainty, how to report uncertainty, propagation of uncertainties, mean standard deviation, random uncertainties, and normal distribution.

Students will also learn to use Mathematica software for graphing and data analysis. Aspects of Mathematica will be discussed in the lecture part of the class and handouts will be provided to the students. However, the student may wish to learn more about Mathematica and for this purpose "The Beginner's Guide to Mathematica" by Gray and Glynn is recommended.

Various homework assignments involving error analysis will also be made. Several short quizzes on error analysis will be given during the semester. The student will have a week to prepare for the quiz.

Attendance is required for this course unless special arrangements are made with the instructor.

Pre-requisites: Physics 120 or 121

Textbook: "An Introduction to Error Analysis" 2nd edition, by John R. Taylor (University Science Books)
Lab Manuals are provided and can be downloaded through Blackboard.

Class Rules and Regulations:

1. No eating or drinking in the labs.
2. Students must read the manual before every lab and prepare for the experimental procedure with your understanding of the relevant theory.
3. Complete the experiment with the help of the instructor. Record lab notes, the procedures and data on the lab notebook and make sure your notes are signed by the instructor each time before you leave the lab session.
4. Each student will write a lab report for each experiment. The lab reports should include:
   (i) A cover page which contains course title, lab title, student's name, instructor's name, date.
   (ii) Introduction/Objectives (a brief description of the purpose and goals of the lab, equipment and supplies).
   (iii) Results: experimental methods, tabulated results, calculations.
   (iv) Error analysis
   (v) Conclusions
   (vi) The original lab data sheet

Grading:

- Lab reports 80%
- Quizzes and homework 10%
- Attendance 10%

"Hunter College regards acts of academic dishonesty (e.g. plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of

intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures."

Lab Schedule for Physics 230 Fall 2018 (Tentative)

8/28	**Ch 1: Preliminary description of error analysis**	**8/30**	**Ch 2: How to report and use uncertainties**
9/4	**Ch 3: Propagation of uncertainties**	**9/6**	**Ch 4: Statistical analysis of random uncertainties**
9/13	**Ch 5: The normal distribution**	**9/20**	**Ch 6: Rejection of data**
9/25	**Ch 7: Weighted average**	**9/27**	**Ch 8: Least-squares fitting**
10/2	**Ch 9: Covariance and correlation**	**10/4**	**Ch 10: The binomial distribution**
10/9	**Ch 11: The Poisson distribution**	**10/11**	**Ch 12: The Chi-Squared test for a distribution**
10/16	**Introduction to Mathematica**	**10/18**	**Driven harmonic oscillator resonance (1)**
10/23	**Driven harmonic oscillator resonance (2)**	**10/25**	**Driven harmonic oscillator resonance (3)**
10/30	**Coupled oscillators (1)**	**11/1**	**Coupled oscillators (2)**
10/6	**Coupled oscillators (3)**	**11/8**	**Fourier analysis/filtering (1)**
11/13	**Fourier analysis/filtering (2)**	**11/15**	**Carnot engine (1)**
11/20	**Carnot engine (2)**	**11/27**	**Carnot engine (3)**
1/29	**Nonlinear pendulum**	**12/4**	**Liquid nitrogen heat of vaporization**
12/6	**TBA**	**12/11**	**TBA**