

PH 315, Modern Physics Laboratory

Coordinators:

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Texts. *QED: The strange theory of light and matter*, by R.P. Feynman, and *Experimentation: An introduction to measurement theory and experiment design*, by D.C. Baird.

Goals. The primary goal of this course is to develop skills in experimental physics and technical writing. Another goal is to learn how to model a physical system, which is the foundation of the scientific process. That is, we develop a model of some aspect of the observable world. The experiments will either verify a model or measure a physical quantity as accurately as possible, given experimental constraints. Thus, it is important to understand the sources of experimental uncertainties, how to quantify them, how they propagate, and how to design a procedure to analyze them. In addition, communicating your results in a written report leads to a self-critical evaluation of your understanding of that process.

Attendance. Attendance is required for each lab session for the full period. If you finish the experimental work, you may devise further experiments or begin work on the lab report and data reduction while an instructor is available to help you.

Notebook. Acquire a lab notebook for note taking during lab. Keep a detailed record of your experiments in this notebook. This notebook is for your reference only. It will not be evaluated for your grade.

Laboratory Reports. You will be required to turn in 8 laboratory reports in all. The outline for these reports is discussed in detail in a separate handout. See <http://www.mines.edu/~mmyoung/AdvLab.htm>. An additional resource is the campus writing center (<http://www.mines.edu/academic/lais/wc/>).

Book Report. A report on the book *QED: The strange theory of light and matter*, by R.P. Feynman, is required. Relate the discussion in the text to the experiments performed in this course. A rubric will be provided as the deadline nears. However, start reading well before the deadline so that you can understand how the book relates to the experiments as you do them.

Resume. Please write and submit a resume. Please look at the Web site of the CSM Career Center, http://www.mines.edu/stu_life/career/resume.htm, for the link for writing resumes. If you already have a resume, make sure it conforms with the specifications given at this site. See also <http://www.mines.edu/Academic/courses/physics/phgn471/resume.htm>. Please include 3 or 4 references with your resume.

Problem sets and schedule. All labs subsequent to the circuit decay lab are team reports. The circuit decay lab report is to be turned in individually, even though you may have collected data in a group. In writing this lab you must convince the reader that the decay of the RC circuit is either exponential (as you were taught in PHGN200) or not, depending on the data collected and

the associated errors. Subsequent lab reports will be team reports, though some people may be asked to submit individual introductions, analyses, and conclusions.

Week	Activity	Deliverable
1	Capacitor lab	None
2	Noise and uncertainty labs	Capacitor lab report
3	Round-robin lab 1	Noise and uncertainty lab reports; Baird, Chapter 2, problems 11, 12; Chapter 3, problems 3, 4, 5, 7, 8, 9, 11, 12, 13, 17
4	RR1, cont.	Baird, Chapter 5, problems 3, 19, 23; Chapter 6, problem 3; resumé
5	Round-robin lab 2	Lab rept. 1
6	RR2, cont.	None
7	Round-robin lab 3	Lab rept. 2
8	RR3, cont.	None
9	Round-robin lab 4	Lab rept. 3
10	RR4, cont.	None
11	Diffraction or acoustics lab	Lab rept. 4
12	Diffraction or acoustics lab, cont.	None
13	Acoustics or diffraction lab	Diffraction or acoustics rept.
14	Acoustics or diffraction lab, cont.	None
15	Thanksgiving	Thanksgiving
16	Feynman video	Acoustics or diffraction rept., book report

Grades. Laboratory reports 75 %, book report 10 %, problem sets 10 %, and resume 5 %.

Rubrics. Here is the rubric we will use for grading your lab reports:

PH315	Points
Introduction and optional abstract (5 Points)	
States objective, begins with topic sentence, outlines expt, states results	5
Procedure (20 Points)	
Theory, including working equations	10
Description of the expt, equipment, and wiring schematics	5
Procedures used	5
Results (30 Points)	
Calculations clear, graphs and tables complete	10
Uncertainty analysis: discussion, numerical data; calculation based on theory; enumerating errors, 5; calculating, 5	10
Results stated clearly, compared to expected values or expectations	10
Discussion/Conclusion (15 Points)	
Summary of findings, comments about results	5
Recommendations or conclusions	5
3-6 pertinent, technical references	5
Preparation of Report (30 Points)	
Correct spelling, grammar, punctuation, word usage; consistent tense	5
Well organized - short, readable, numbered sections, appropriate page layout	5
Tables, figures, equations, numbers, units, references: correctly formatted, axes labeled, captions, cited in text, naked decimal points, significant figures, etc.	10
Clear, concise writing, presentation of data - written in active voice, no wordiness, specific descriptions	10
Final Grade	

And here is the rubric we will use for grading your book reports:

Evaluation of written report	Name of student			
Date	Name of evaluator			
	Exceeds expectations	Meets expectations	Needs improvement	Is inadequate
Content (50 %)				
States objective clearly				
Displays main idea clearly				
Tells coherent story				
Organization (20 %)				
Clear pattern or structure				
Good transitions (paragraphs, subheads)				
Mechanics (30 %)				
Grammar, spelling, punctuation aid understanding				
Interesting writing engages reader				
Report formatted correctly (units, numbers, SI symbols, equations, ..., if any)				

Please note that PH 315 is part of Writing across the Curriculum and that the preparation of your reports will account for 30 % of your report grade.