

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.

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.

1. Due the second week of classes at the beginning of class: Resume.
2. Due second week of classes at the beginning of class: Circuit decay lab report, which is to be turned in individually although 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.
3. Due third week of classes at the beginning of class: Baird, Chapter 2, problems 11, 12; Chapter 3, problems 3, 4, 5, 7, 8, 9, 11, 12, 13, 17; noise and uncertainty lab reports. Begin

labs in assigned teams: e/m measurement, Doppler shift, laser diffraction, optical spectroscopy, microwave and optical detector characterization by polarization.

4. Due fourth week of classes at the beginning of class: Baird, Chapter 5, problems 3, 19, 23; Chapter 6, problem 3.
5. Due at the beginning of class of the sixth, eighth, tenth, twelfth, fourteenth weeks of classes: lab reports.
6. Due the fifteenth week of classes: book report.

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

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

PH315	Points	Grade
Introduction and optional abstract (5 Points)		
Objective, begins with topic sentence, outline of expt, results	5	
Methods and Materials (20 Points)		
Theory, including working equations	10	
Description of the expt; equipment and wiring schematics	5	
Procedures used	5	
Results (30 Points)		
Calculations clear, figures and tables complete	10	
Uncertainty analysis: discussion, numerical data; calculation based on theory	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		

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.