PH315 Modern Physics Laboratory: sec. A Tuesday 9:30-10:30 GRLA upstairs then 10:30-12:20 GRLA downstairs and sec. B Thursday 1:00-2:00 GRLA upstairs then 2:00-3:50 GRLA downstairs

Coordinators:
Instructors: Flix Therrien [felix.therrien@gmail.com], Bradon Skogen [bskogen@mymail.mines.edu], Jacob Neumann [jneumann@mymail.mines.edu], and
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(office hours: Tuesday: 1-3, and Thursday 9-12)

Texts: Experimentation: An introduction to measurement theory and experiment design, by D.C. Baird and **How to Lie with Statistics** by Darrell Huff and the Feynman videos or book on **QED:The strange theory of light and matter**.

Goals: The primary goal of this course is to develop skills in critical thinking, experimental physics, and technical writing. By the end of the course you will be able construct a quantitative argument which addresses the issue of the data supporting or not supporting a model. A subsidiary goal is to practice modeling a physical system, which is the foundation of the scientific process. Most experiments will either verify a model or measure a physical quantity (which is part of some model) as accurately as possible, given experimental constraints. For both types of experiments it is important to identify and understand the sources of experimental uncertainties, how to quantify the uncertainty, how uncertainty propagates in models, and how to design a procedure to mitigate uncertainty. In addition, communicating your results in a written report leads to a self evaluation of your understanding of that process. After this course you should have improved in your abililty to "think critically, reason analytically, and use language accurately and effectively."[1]

Laboratory Reports: The class will be divided into lab groups, each of which will turn in 7 laboratory reports (individually for the last one), not including the circuit decay report. The report must at least include: Abstract, Author Contributions, Model Section (theory), Procedure, Data Analysis, Discusion/Conclusions, References (**please try not to use wikipedia citations**). The deliverables are:

1. A draft of the report due the second lab period. It must include well developed Model and Procedure sections. The TAs or I will check this document (and record it as part of your participation grade) before you leave this second lab session. It must be readable on some device you bring to lab (no hard copy is needed). Be prepared to discuss the other sections.

2. A LaTeX generated hardcopy of the **full report** must be turned in when due. The objective of the lab report is to convince the reader that the data does or does not support the model. One writing resource is the campus writing center ($http://inside.mines.edu/LAIS-Writing-Center-$).

3. Discuss the assumptions and possible validity of the model. For example, v/c (cart velocity over speed of light) is small compared with the error in the measurement and therefore can be neglected or the glass bulb could collect a static charge which generates an electric force not included in the model of the e/m apparatus. Finish the model section with a **working equation** from which your error analysis begins in the next section. The conclusion section summarizes the issue of the data supporting or not supporting the model.

4. Each section of the report must have the name of the group member who wrote it with the title of that section.

5. In the Author Contributions section of the full report, indicate the work each student did on the report (this must alternate for each report).

6. Use googlebooks to find book references rather than web citations when possible.

Laboratory Activities:

[1] Passing Oxbridge Admissions Tests by R. Hutton and G. Hutton

1. Schedule: In the first lab period you will collect data and evaluate it to determine if it supports your model using a quick calculation. You then assign report duties and begin writing the report. In the second lab period the data is carefully collected, evaluated, and the rough draft of the complete report is evaluated for errors by all members of the group. As described above, the TAs and I will evaluate this draft. Be prepared to answer questions individually about the lab, show that you understand how to collect data for that lab, and/or get feedback on your lab report.

2. At the start of a new lab, the group that previously performed the lab you are about to do will give a presentation to your group about the lab. You will then switch roles, explaining what you did in the lab you just finished to a group which is about to start the lab.

3. These presentations will be evaluated by the groups listening, by giving both positive and negative comments on a written form that I will hand out. These evaluation forms will then be given to the presenting group as feedback for improving their future presentations.

Report: A report on the video (or book version if you want to purchase it) **QED:The strange theory of light and matter** by R.P. Feynmann is required. In writing this report please relate the discussion in the video to the experiments performed in this course. Start viewing well before the deadline so that you can understand how the video relates to the experiments as you do them.

Resume: Please submit a resume at the beginning of the third class period in writing. Use the link for writing resumes at the Web site of the CSM Career Center, if you have questions.

Grades: Laboratory reports 30%, final lab report individually written 30%, book report 5 %, problem sets 5%, and class and lab participation 30% (any issues with group members not doing "their share" of the work will affect this part of the grade).

Policy on academic integrity/misconduct: The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining an fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every students academic achievements, and giving credence to the universitys educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times. Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.