

Syllabus

Instructor:

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Course Objectives:

1. Learn about a handful of beautiful physics experiments
2. Perform measurements and estimate their uncertainties
3. Learn technical skills:
 - to analyze and present experimental data using MATLAB
 - to write scientific reports

Experiments:

We have seven experiments available (see below), of which you will chose to complete three.

1. Oscillations in an LCR circuit
2. Electron e/m Ratio (Thomson experiment)
3. Magnetic Field Measurements
4. Superconductivity Measurements
5. Photon Interference
6. Physical Pendulum: determine g
7. Cavendish experiment: determine G

What I expect from you:

1. Be collaborative. You will work in teams during the term. Each team will have two weeks to complete a lab. You and your teammates will perform experiments, take notes, and write the lab reports together. Each team member should contribute to the lab. *At the end of lab report, please use a paragraph to specify the contribution of members to the lab. For example, who wrote the report, who took measurements, who analyzed data.*
2. Be prepared. Please read the detailed instructions and complete the pre-lab questions in advance. At the first day of a lab, you will need to show your solutions to the prelab questions written in the lab notebook. You will not be allowed to operate the equipment unless you come prepared - this is necessary for your own safety (in one case you will be dealing with 2500 V!) as well as keeping you from damaging sensitive equipment.
3. Be well-documented. Each group should keep detailed notes on what you did for each lab. Please purchase a ruled composition book as your lab notebook. In the lab notebook, you need to record your solutions to the prelab questions, your plan to take data, the details of your experiments, experimental data, and results of data analysis. Please keep the notes neat, organized and readable. You will need to leave the lab notebook in the lab. If you need to use the notebook outside the lab, please take digital scans of it. *After each lab session, you and your TA will sign off on the lab notebook.*

Grading Policy:

Your grade will be determined based upon the following components.

- Pre-lab questions: 10%
- Lab Notebook: 20%
- laboratory reports: 50%
- Final Presentation: 20%

About Lab Reports:

To judge the quality of a lab report, I will use the criteria listed in table 1. Each of the items will be graded according to clarity and conciseness. As the term progresses I will slowly raise my standards for each of the categories.

For example, each figure should be clear to a reader without having to refer to the main text in the lab report. Thus the axes must be properly labeled, the data-points identified in a legend (if appropriate), and the figure caption must have enough information so that the message of the figure is conveyed. But the caption should not be more than a few lines of text and therefore has to be concise. Equations should not randomly appear, and instead are a part of the narrative. Also, don't include lots of algebra, so it's OK to say "... after some algebra, Eq. (1) simplifies to ..."

The introduction should contain a concise synopsis of the theory and background about your lab. Do not derive all the equations in great detail. Just need to provide a quick refresher to someone who has learned the physics but has perhaps forgotten some of the details. The procedure section should contain description on the instrument(s) used, how the physical quantities are measured, what method did you used to analyze data. The result section should have a list of the measured quantities. Uncertainty for each measured quantity should be listed. The discussion/analysis section should contain error analysis, identify the major sources of experimental error, discuss possible methods/techniques to reduce experimental error in the lab. In the conclusion section, you can compare your results to accepted values to justify whether your results make sense and tell the readers what conclusions can be drawn from your results.

Table 1: Grading rubric for lab reports

| | | |
|----------------------|---|-----|
| Figure | Figure labels and legends | 5% |
| | Figure captions (below figure) | 5% |
| | Mention each figure in the text | 5% |
| Tables and Equations | | |
| | Table captions (above table) | 5% |
| | Mention each table and most equations in the text | 5% |
| | | |
| | Abstract | 5% |
| | Introduction | 5% |
| Text | Procedure | 15% |
| | Results | 20% |
| | Discussion/analysis | 25% |
| | Conclusion | 5% |

Learning Disabilities:

If you need course adaptations or accommodations because of a disability, or any other private concerns, please make an appointment with me as soon as possible.