Requirements for Laboratory Notebooks

Learning to maintain a laboratory notebook is one of the most important skills you have to develop to become an excellent experimentalist. In a research setting, this Notebook can have a legal status because it provides written proof of when an important discovery was made. A good laboratory notebook is essential when you begin to write papers or to develop oral presentations summarizing your experimental reports. A clear well-written narrative that includes experimental schematics, plots of raw data, and details of your analysis methods will enable you to receive quick feedback and assistance during lab sessions from peers, TA's and instructor. A poorly maintained notebook will prove immensely frustrating to you and your instructor. It is very difficult to answer questions like `why didn't the experiment work' or `why was my result off by an order of magnitude?' without being able to clearly and easily trace your efforts using your notebook.

You are required to use the lab notebooks given to you for the Optics Labs. **Bring your lab book to every lab session.** We may collect your notebook at any time in order to evaluate how you are doing. After the Lab #8 (Hologram), we will collect and grade your notebooks. In addition, **the owners of the best 3 lab books will receive extra bonus points up to 2 toward your overall grade.**

Your lab book should record your procedure as well as your results. All your work should be in the lab book - including any mistakes or duplicate measurements. In other words, your lab book is a recording of the procedure that you went through including, any false steps. It should be readable at later time by you or anyone else. The lab book can contain diagrams, narratives, tables of raw data, formulas, computations, reduced data, error analysis and conclusions.
The lab book should especially explain your choices on procedure which were not specified for you in the lab handout. False steps should be neatly crossed out and a note should be recorded in the lab book indicating the nature of the mistake. This is the method used by practicing scientists for the recording of their experimental measurements. If you felt your bad data were caused by following the lab instructions, be sure to point out the problem area in your lab report.

The lab book should also contain:

- The name of the experiment, your name, your partner's name, and the date on the first page for each lab session,
- Rough sketches of apparatus
- Identifying information (grating code, lens number, for example) which will allow your instructor/TA to determine the equipment used in your experiments.

- Answers to questions posed in the lab writeup/instruction intended to be answered before measurement
- A sketch of how you measured something, if it's not just reading a dial
- Your original data (write it in the book, rather than typing directly into a spreadsheet, unless a computer is directly producing the data file)
- Estimates of errors in measurements, and why you chose this estimated uncertainty.
- "On the fly" calculations to assess quality of data

Keeping your lab book in a neat compact and orderly arrangement will enable you to reconstruct for any given day what you did. Using the experimental data and your lab book, you will prepare a lab report to be handed in at the beginning of the following lab session.

The following is a more extensive list of guidelines to follow when performing laboratory work.

- Writing results down on pieces of paper and then copying them later into the notebook is not allowed. Don't ever erase, use whiteout, or tear out pages of a lab notebook. If you make mistake, just cross it out (but leave it legible, in case your "mistake" wasn't so) and write down the correct input. These may prove to be not so incorrect as initially thought and will very often be useful as a guide to how the experiment was done and provide clues on how to better execute the experiment next time.
- Create a descriptive table of contents and make an entry every time you add new material. Title the TOC with the following: Date – Contents – Page. Use descriptive headings that will be useful later on when reviewing your notebooks.
- **Number and date every page.** Each day's entry should begin with a date, time, a brief statement of what you plan to do. Preparatory questions and solutions should be written in your lab notebooks. Following the preparatory questions, state the essential physics of the experiment in your own words. List your experimental objectives and how they relate to the essential physics. After listing the objectives, identify the things you will have to do, the data you must obtain and identify the required calibrations.
- During the experiment, you may want to record other times because the phenomena you are observing might be time dependent.
- Careful drawings of your experimental set up must be done. Of course, with advent of digital cameras, it is acceptable to photograph your apparatus and paste an annotated picture of it into your notebook. However, it will probably be easier to draw some diagrams describing optical paths by hand.
- Estimates of systematic and random experimental errors should be recorded. "How accurate is my caliper and to what precision did I measure that distance?" "Does the instrument read zero when there is no signal present?" "Is the reading drifting with time?"
- Sometimes you will be taking data with a computer, and you certainly will be using a computer to create graphs. It is very important to **record in your notebook the names of these data and graphing files.** Likewise, if you write a program to analyze your results, you should record the file name.
- At the end of each session, make a summary of your accomplishments and unresolved problems. This can be useful for you to **write a lab report outside of your normal lab sessions**.