PHYSICS 623
ELECTRONIC AIDS TO MEASUREMENT
Sep 5, 2007

The course is scheduled to include 14 laboratory sessions. The experiments are to be done one per week in the three hour scheduled laboratory period. You will work with one lab partner or possibly by yourself. Please bring to the first session of the laboratory the required type of notebook (≥100 numbered pages, spiral bound, quadrille — we strongly recommend the "Harvard Coop"-style notebook: #22-157 at the bookstore). Your name and "afternoon" or "evening" for the section you are in should be prominently displayed on the front cover.

Most data can be plotted directly in the notebook. If graph paper is used, it should be fastened into the notebook permanently using the glue or tape provided, as should computer-generated plots and oscilloscope screen snapshots. The write up of the experiment should be completed in the laboratory. That is, there is no need to take the book out of the laboratory in order to "pretty" it up, and notebooks should not be removed from the lab without permission. The lab books will be graded and returned at the beginning of the following lab. For best results you should do the analysis as the lab progresses. Some labs require calculations to be done in advance of the lab, in which case you can glue or tape them into your notebook.

It is essential to read and understand the directions prior to coming to the lab. Your lab instructor will answer your questions in a general meeting at the beginning of the period and will, of course, help you individually as you have questions or problems through out the laboratory.

Your laboratory notebook is to be kept as a simple research notebook; there are no formal reports. A few points are worth noting:

- Although neatness is not formally considered in the grading, a sloppy lab book will fail to communicate to the instructor the competence and diligence of its author.
- A rule of thumb you can use concerning the write up is that *you* should be able to figure out what you did six months later.
- **Start each procedure with a one-sentence description of what is being done.**
- Where ever possible or appropriate, the measured values of quantities should be compared with expected values obtained by calculation and the error given.
- When plotting graphs, be sure to label the axes appropriately, to put the measurements on the graph as discrete data points, and to put the theoretical curve, where applicable, as a continuous line.

It is a good idea to write a <u>short</u> summary paragraph at the end of the report stating what you learned, difficulties, etc. Suggestions for improving the laboratories are also welcome.

There are no scheduled makeup labs, but access to the laboratory can and should be negotiated with the instructor if you must miss a lab due to research activities or illness.

NOTES ON NOTEBOOKS

1. Don't **write** too much. You **don't** need to put in extensive discussions of the theory or "purpose" of the experiment. Equipment lists are not required in this lab. **Fewer words — More Pictures!**

2. Don't write anything on scrap paper. Do scratch calculations in your notebook. You can cross them out later (or reserve the left hand page everywhere for scratch calculations etc.). If you bring in some work you prepared outside (eg derivation of an equation, circuit diagram etc), then **tape it in** your notebook as soon as your get to lab.

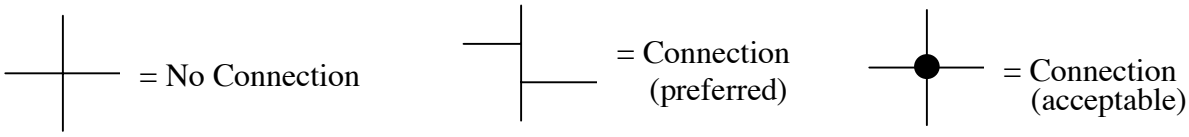
3. You should *always* **always ALWAYS** have a circuit diagram of the circuit you are working on. (If you wish you can Xerox the one from the write-up and tape it in.) You should always get the circuit diagram in your notebook *first, then* build the circuit — following the diagram. (If you are using Integrated Circuits ("ICs"), then put the IC pin numbers on the diagram *before* wiring the circuit.)

   See Appendix E of Horowitz and Hill for instructions on how to draw proper circuit diagrams.

4. Note the conventional way of showing a coaxial cable (e.g. Figs. 9.40-41 in Horowitz and Hill). For most circuit setups you needn't bother to indicate that you had in fact used coax - but for some (eg. the transmission line lab) it is a crucial feature.

5. Ask about circuit symbols you don't recognize. Measuring instruments are not usually shown. (It is assumed that you are close enough to the ideal case where the instrument does not perturb the circuit - make careful note of what you did when this is not the case.) You can show the point where a meter or scope is connected — see 8. below.

6. Signals go generally left to right. Power supply line at the top, ground at the bottom (except for push-pull circuits, where ground is in center, positive supply at the top and negative supply at the bottom). Wires are just lines. Crossing lines do **not imply an electrical connection** unless the intersection is enhanced by a large solid dot.



7. Typical Ground Symbols: 

   Sophisticated circuits often have more than one kind of ground — then the distinction between these may be important. Until then — don't worry about it.

8. If you wish to refer to the voltage at a particular point in the circuit, then just label it. Then you need only use the label. Note that the voltages are always potential **differences** between two points. Whenever there is a reference to the "voltage *at* a point", it is implied that this is the potential *difference* from the circuit *ground*, which is usually marked with one of the above symbols.