EELE 250 Formal Lab Report Guidelines

Fall 2011

<u>All jobs in engineering and engineering technology require proficiency in technical writing</u>. The written lab report is just one example.

It is always good engineering practice when writing to begin with a *summary* of each important conclusion, followed by the *results and reasoning* that led to that conclusion, and finally a *review* of what was stated. The report should be written specifically to meet the needs of the reader, meaning that the writing must be *brief*, *interesting*, and *complete*.

Keep in mind that the specific format and content requirements of the lab report may vary depending upon the preferences of the reader, in this case the lab TA.

Although you probably performed the experiment in a team of two, <u>both lab partners must write and submit separate, individual reports</u>.

The report should be assembled in a standard manner. For EELE 250 the format is:

1. <u>Cover Page</u> showing the course name and number, the experiment title and number, date the experiment was performed, date the report was finished, and the name of the author. You should also list your lab partner who worked with you on the experiment itself.

2. <u>Abstract</u> giving a summary of the *complete* report. The abstract is normally written last, and should be no more than 3 or 4 sentences.

3. <u>Introduction</u> giving a 1 or 2 paragraph explanation of what the reader must know to understand the report. Basically, the introduction indicates whether you understood what the lab was all about with sufficient clarity to be able to explain it to others.

4. <u>Procedure</u> describing the steps used in the lab. This need only be sufficient to recreate the experiment in conjunction with the lab notebook, *not* a lengthy minute-by-minute account. The procedural description should not merely refer to the lab write-up: it needs to stand on its own.

5. <u>Results and Discussion</u> of the experiment, including the requested information from the lab write-up, comparisons with pre-lab predictions, and *reasonable* explanations of any difficulties or surprising results. Tables of "raw" data should be left in the notebook, not in the report, except where necessary to support the discussion. *Do* include graphs of the results where appropriate. Include a discussion of the methods and circuits used in the experiment and indicate any extra measurements or investigations you made in addition to the steps in the lab manual. In discussing the results, you should not only analyze the results, but also discuss the *implications* of those results. Moreover, pay attention to the errors that existed in the experiment, both where they originated and what their significance is for interpreting the reliability of conclusions (see “Analysis of Data and Errors” discussion below).

6. Conclusion giving the main items learned in the experiment.

7. Appendix containing any additional material that supports the report, but would not be considered essential to understanding the procedure and results. This might include derivations of formulas, large charts or graphs, and other such material. Most lab reports do not need an appendix.

Before finalizing the report to turn in, look over the entire report with a critical eye. Is the report complete and concise? Is the substance of the report good enough *that you would show it to a potential employer* as an example of the quality of work you do? Does it indicate that you know what you are doing? Are the sections labeled? Are the graphs labeled and *interpreted* (slopes, breakpoints, etc., identified)? Are the circuit diagrams accurate and labeled? Do you tend to use imprecise, meaningless phrases like "very large", "negligible", "this experiment demonstrates to the student...", "the results validate the theory", etc.?

Analysis of Data and Errors

All lab measurements are subject to some degree of uncertainty. Although these uncertainties are casually referred to as "errors," it is better to realize that they represent a fundamental constraint on any physical measurement. Specifically, it is vital to understand and specify the uncertainties in all measurements. For example, it is unreasonable to obtain a result using a calculator to 10 significant digits if the measurements used in the calculation have only 3 significant digits. Always keep in mind the numerical precision of your measurements and perform your mathematical calculations accordingly.

Each electrical component and measurement instrument has a limitation of *tolerance*, *accuracy*, and *precision*.

Tolerance refers to the discrepancy between the marked or "nominal" value of a component and its actual value. Tolerance is often expressed as a percentage of the nominal value, such as a voltage source specified by the manufacturer to be "10 volts ± 1%": meaning that the actual voltage is somewhere between 9.9 volts and 10.1 volts. Another common example of tolerance is a resistor specified with a nominal value in ohms, ± 5% tolerance.

Accuracy refers to the discrepancy between the actual value of a quantity and the reading given by a particular measurement instrument. Accuracy is related to the concept of calibration, where an extremely accurate instrument or measurement technique is used to adjust the accuracy of another instrument.

Precision is different from accuracy. Precision refers to the numerical resolution, repeatability, and stability of a particular instrument, i.e., the “round-off” of the instrument any expected deviation of the reading from measurement to measurement.