Standardized Laboratory Report Format for
Department of Electrical and Computer Engineering

A report is a condensation of an experiment or series of experiments. It documents the most important or relevant aspects of the activity in such a way that it can be read years later and still be understood. It must be self-contained but can reference other available material.

This guide suggests a basic structure of a typical technical report and is modelled after the typical content and delivery of a journal article. The structure may not fit all situations so adaptations can be made. The report should not refer to the laboratory course or to you. The report is on the data and results and conclusions; it is not about your experience or your feelings. Any difficulties you experienced, however, are certainly relevant.

The outline of a report should contain the following:
- Cover page with abstract,
- Introduction,
- Theory,
- Experimental procedure,
- Data and Analysis, and
- Summary and/or conclusions.

Cover Page
The cover page should be comprised of the following: title, relevant names, date, course, instructor, and the abstract. The content of the report starts at the top of the next page. The cover page allows someone to know everything about the report without turning a page.

Abstract
The abstract should typically be less than 100 words. It should convey all the most important aspects of the report, leaving nothing important for later. One should be able to read only the abstract and still be able to talk about the crux of the experiment, including the most important results obtained and important conclusions reached. See and read also the article on writing an abstract on Dr. Lush’s EE 3329 web site (http://www.ece.utep.edu/courses/ee3329/ee3329/).

Introduction
The introduction gives the context of the experiment. It answers the question, “Why is the information relevant to the reader?” Why should one be interested in the area of inquiry in which the work resides? If your experiment was related to bandpass filters, for example, you would briefly discuss why they are important and list typical applications. References to books or articles are usually given in case the reader wishes to know more. This section should be thorough, but not long, and can rarely be “complete” as typically the relevance of your area of inquiry extends to many fields.

Theory
This section must provide the theoretical background needed to understand the work and analysis that is presented in the report. Most of the related equations are presented and discussed here. (Nothing should appear in your report unless it is discussed in the text of the report.) References
to more complete discussions of the theory are highly appropriate in this section.

**Experimental procedure**

The procedure should not be highly detailed, but relevant details must be included. A critical reader uses this section to decide whether your data are to be trusted. Is your work thorough, and are your measurements carefully done? The procedure should not be a step-by-step list, but it should rather be more at the level of a block diagram--again, however, do not leave out relevant details. Decisions on the level of detail are left to the author(s), but remember that the reader is going to judge your work and your skills as a researcher or laboratory worker by how well you understand what are the most important steps.

Actual block diagrams of your set-up are highly valued by readers as they provide a picture of what you are doing that many words would otherwise be needed to adequately describe. The equipment used can be listed or itemized, but things like resistors and capacitors or commonly used instruments like multimeters need not be listed unless their values or their use is relevant or the level of precision of the results of the experiment are dependent upon them.

**Data and Analysis**

First of all, the word data is a *plural* noun. If one is speaking of a single data point, datum is used. One says, therefore, that “Data are most clearly presented, generally, in tables and plots.” But it is not enough to just present the data, they must be explained in the text of the report. Including a plot without discussing it suggests that the plot was not important--so why is it in the report? Discussion of the figure/table usually starts with a description of the behavior of the data and then compares and contrasts it to expected behavior--here is where you tie the data to theory in order to confirm the theory. If the data do not confirm theory, the reasons should be given.

Analysis also includes error estimates or calculations. Error “estimates” are made with respect to the measurements you made based on how precise the measurement is, in your opinion, but also based on quantifiable reasons. An example is a simple carbon-based resistor, which claims only 5% tolerance. The 5% tolerance of a resistor is not just a reference to the fact that a 100 Ohm resistor might be actually 95 Ohm, but also to the fact that once you start using the resistor and it heats up, the resistance will change. The change *should* be within 5% of its claimed value, but the point is that you cannot know the value of the resistor to more than about 2 significant digits.

For example, if you are determining the current through a resistor by measuring the voltage across it and dividing by its resistance, you can only know the current to an accuracy greater than or equal to the tolerance of the resistor (the voltage measurement instrument contributes some error as well). If it is important that you know the current to within, say 1%, then you must measure it directly or use a more precise resistor such as those made from metal-films. The section on experimental procedure needs to point out your choices of special items like a metal-film resistor because, again, the critical reader is trying to decide whether your results and conclusions are valid, and you do not want a reader to put your paper/report down thinking, erroneously, that this work was shoddily done. (If the work was shoddily done, of course, you should not be reporting that fact to an international audience.)
Discussions of error or precision are quantitative, not qualitative. Statements such as “The results are good” or “pretty accurate,” therefore, are not useful because one person’s idea of “good” will not be the same as another. Percent error and percent difference should be the result of a calculation.

Percent error can either be an estimate of how precise your final results are based on the experimental error that exists in all measurements (which is going to be a function of how good your equipment is and how well it is calibrated), or it could be a measure of how different your results are from theory or from results previously published or presented.

Percent difference is simply the relative difference between two related numbers. Going back to the resistor example, if a 100 Ohm resistor is found to exhibit 98 Ohm of resistance as measured by an ohmmeter, there would be a 2% difference. There is no “error” in the value of the resistor.

Again, no plot or diagram or table should be presented if it is not described or explained relative to the expected behavior which was presented in the theory section. Make sure the theory section has all that is needed for your analysis.

**Summary and/or Conclusions**
This is the big finale--like at fireworks shows. Summary and conclusions are not the same words. A summary simply recounts what was reported in this report. Conclusions are ideas that take the data and analysis and infer something from them. “The authors conclude that this low-frequency amplifier is the best ever designed because no one has reported a better signal-to-noise ratio for the frequencies of interest.” Now that is a powerful conclusion--but it is based on experimental data and results, not on the opinion of the authors.

**Other Elements**
Figures should be numbered sequentially (Figure 1, Figure 2, etc.). In referring to a figure, capitalize--Figure 1. When in the middle of a sentence, shorten it. “The number of bananas baked over the last ten years is shown in Fig. 3.” You should never start a sentence with a shortened word so start sentences like this, “Figure 2 displays the sinusoidal wave.”

Numbers greater than ten should be presented as digits, 47 or 123. Numbers smaller than 11 should be written out, one, two, three, or seven. Never start a sentence with a digital number, however. “123 people were there.” You can write “Twenty-seven cookies makes a good lunch.”

Equations should be sequentially numbered and centered on the page. Usually the equation number is placed at the far right, but many different “rules” are used. Equations are to be treated grammatically as part of a sentence, so punctuation such as commas and periods are needed.

The equation for a line is,

\[ y = mx + b, \tag{1} \]

where \( m \) is the slope, and \( b \) is the intercept. The rules for referring to equations is the same as for figures. Shorten to, “The equation of a line is shown in Eq. 1 above.” Start sentences with, “Equation 1 is the standard equation for a line.”