Unit 1 Report: Circuits, Laws, and Equipment

Report overview and requirements

Now you are asked to provide a report for the unit of this lab that includes **laboratory exercises 1 through 4**. In a document of 3 to 6 pages, you are expected to give a well-formatted report containing thoughtful evaluations as well as measured data and plots in support of your report (see Graphical Representation of Data below). In particular, your report should touch upon these aspects:

- Analyze and calculate the equivalent resistance and rated power of the Resistor Network you used (one resistor is at 1/4 Watt).
- The efficiency, η, of the Resistor Network for Speed Control circuit. Solve for a numeric estimate of η.
- The agreement (or disagreement) of actual measurements taken to confirm Kirchhoff's laws.
- The use of the equipment: Ohmmeter, voltmeter, ammeter, power supply, battery, oscilloscope.
- The modules you completed and their learning objectives.

Just do your best and feel free to discuss these topics with classmates, but **do not just copy answers** or you will be penalized for plagiarism.

Appendix

Graphical Representation of Data

How can we depict our measurements in a manner that is easy to read, understand, and draw conclusions from? We can use **graphs**! But we must take care when creating a graph in order to avoid ambiguity. Well-measured data, when poorly plotted, can lead to erroneous conclusions and be very confusing to someone reading your report. Even your future self will likely have difficulty interpreting your own report.

Graphs (and charts) are very concise and useful methods of depicting a large amount of data. This portion of the lab outlines the necessary components for an informative graph. You will be required to draw a few graphs by hand, but most will be produced using a powerful computing platform – MATLAB. So, in addition to an introduction to "good plotting habits", you will get a quick introduction to plotting graphs using MATLAB. **MATLAB** is a high-level programming language and computing environment that has become a very common tool among engineers. It is important that you get comfortable with it early in your academic career.

Plotting Graphs

Below are the details that are necessary when plotting a graph. Without these details, a person reading your lab report might not understand what your graph means and you will not receive full credit.

Title/Caption

The title of your graph should give the reader an idea of what is plotted and why it matters. In a lab course like ECE110, it should be made clear which step (or question) in the procedure is being addressed by the graph.

Example caption:

Figure 6: The IV characteristic of a DC motor with a linear curve fit to the region after turn-on.

Axes labels and Units

The labels for your axes should tell the reader what physical quantity is being plotted. Calling your axes x and y is uninformative and is considered inadequate in a quantitative experimental setting. Common labels in ECE110 include time (in seconds) as the horizontal axis and voltage (in Volts) as the vertical axis or voltage (V) as the horizontal axis and current (mA) as the vertical axis. Always, where appropriate, include the units in the axis label.

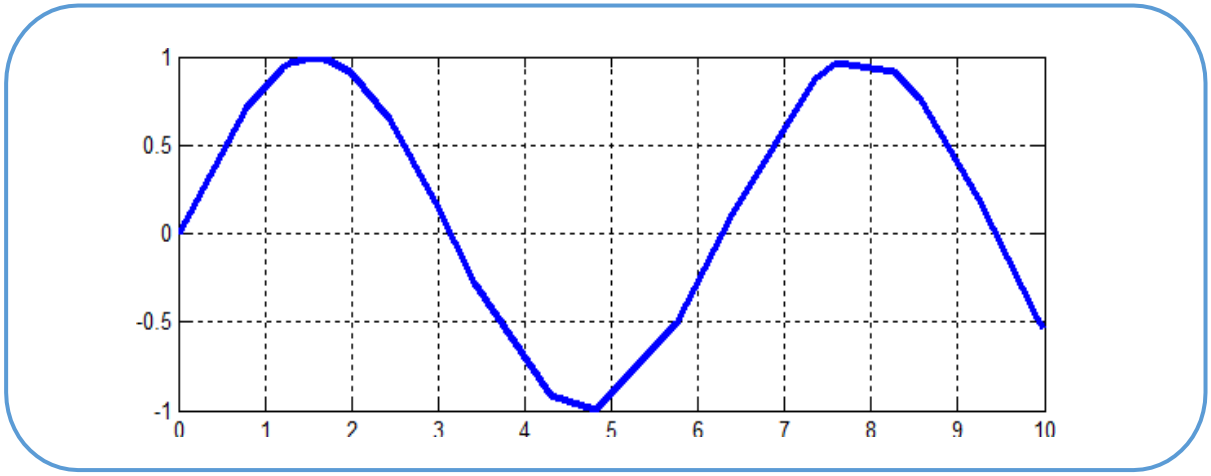
Axes scales

The scale of your axes is usually depicted by labeling three or more divisions with a numerical value. Sometimes your scale will be integer-valued and in other cases it might not be. Keep in mind that the scale of your graph should be chosen to show critical detail. If you choose a scale too large, the plot will be too small and the reader will have a hard time seeing important aspects of the curve.

Legend/plot labels

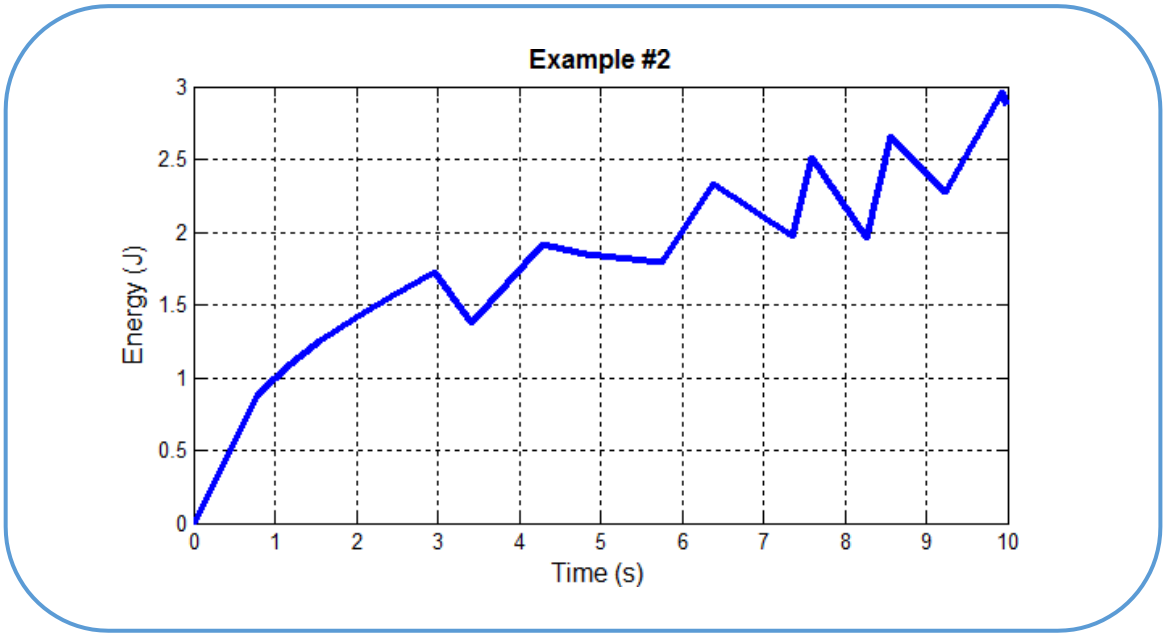
Legends are necessary when you have multiple curves on one graph. Each plot should be clearly labeled so that is clear what data are represented by each curve on your graph.

Below are some examples of graphs generated with various data sets. Identify whether each graph is acceptable or not. If you feel a graph is inadequate, clearly state why. This is a good time to discuss your thoughts with your classmates.



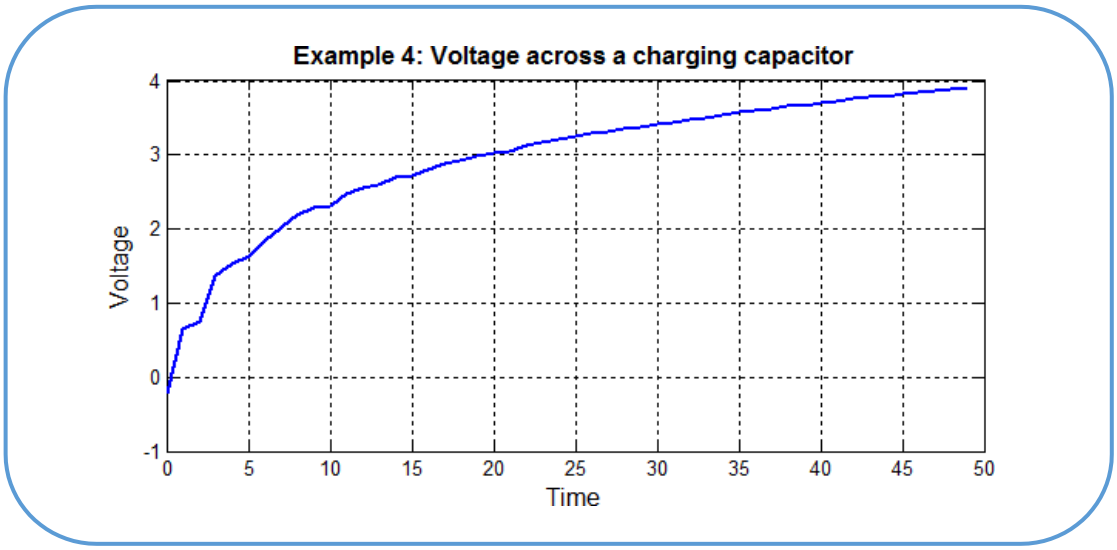
What is wrong with the graph above? Consider the key features of a good graph described earlier.

No title or caption, no axes labels, no units



What is wrong with the graph above?

Title does not tell us anything about the data. A more-descriptive title and/or caption is needed.



What is wrong with the graph above?

No units