

ECE 2100 Circuit Analysis Laboratory
Project Description
Summer 2018

Project Scope

The project for ECE 2100 is to find the internal resistance of at least four AA batteries. The batteries must be of two different chemical types or brands. Do this using two batteries each, of two different chemical types or brands. You may test more batteries if you wish.

You will find the resistance by performing tests on the batteries. You will need to acquire your own batteries. Your goal will be to find the value of the internal resistance, and to find out if this value changes as the battery loses energy, or “*runs down*”. If the internal resistance changes, you are to determine how it changes during the process of losing energy, and how to most clearly display the result. You may work by yourself, or with one partner.

You will need to determine an appropriate way to run down the battery, and to accurately determine the internal resistance of the battery during this process. For the purposes of this project, assume that the battery can be modeled by a voltage source in series with a resistance. The internal resistance is the resistance value in this model. You will need to decide whether the value of the voltage source in your model changes with time, or not.

You can measure the internal resistance using the equipment available in the electronics laboratory. It will be up to you to decide how to make measurements, how to run down the battery, and how to determine when the battery has been run down. You will need to explain all of these choices in your formal report, along with an analysis of what your results mean in the use of these kinds of batteries.

Research Question

Before beginning your experiments, decide what it is you are trying to accomplish, and express this goal as a simple question. This is your *Research Question*. This question, as well as the answer to it as found by your experimentation, will be included in the Formal Report. Instructions on how to prepare the Formal Report will be given in a separate lecture.

Reporting

You must write and submit a formal report on your project. If you choose to work with a partner, you will have the same data as your partner, but you must prepare your reports individually; all writing is to be your own. Your formal report due date is indicated on the class schedule. The final report must be submitted to Blackboard’s TurnItIn.com site. Late reports will incur a penalty of one letter grade each day they are late.

Your document must be submitted in a word processing format, i.e., either MSWord or equivalent. DO NOT submit a text document (.txt) or an Adobe Acrobat file (.pdf). Further, you must use the following naming convention: “*LastName_FirstName_Forma*l_Summer2018”. For example, if Dr. Trombetta were submitting a report, as a Microsoft Word document, the filename would be Trombetta_Len_Forma_l_Summer2018.docx. Please note the underscore characters: these are not spaces. Do not change this format; do not add characters or spaces, and do not leave out the underscore. If you use any other naming convention, five points will be subtracted from your paper.

Your paper will be compared to other material using Turnitin. Write your own paper, by yourself, with appropriate references to material that you have consulted in the writing of your paper. Failure to do so may result in initiation of an Academic Honesty violation allegation.

The format for the report is given in the document, “FormalReportFormat_9feb2016.docx”, which is available on the course website under “Formal_Reports”. You will find sample formal reports on this site as well. For this report, an appendix is required, and must include a table or tables with the raw data obtained in performing your experiments. This appendix must not be just a collection of data. It must be written with explanations of what is contained within it. If this appendix is not present or not properly formatted, credit will be deducted.

The body of the paper must not exceed 8 pages in length, including figures, graphs, and tables. By “body” of the paper is meant everything from the *Introduction* to the *Conclusion*. The body does not include the title page, abstract, acknowledgments, references, or appendices. Font size should not be less than 10 pt. Times New Roman. Larger fonts are acceptable. Line spacing should be either 1.5 or double spaced (as defined by MS Word). Do not move figures, graphs, and tables that belong in the body of the report to the appendix in order to “buy” more space; this will result in a reduction in your grade.

Technical Considerations

The simplest model for a battery that includes an internal resistance is a Thevenin equivalent, which is a voltage source in series with a resistance. You may choose to use a more complex model than a Thevenin equivalent for your battery, but you are not required to do so. We are assuming that the battery internal resistance changes as the battery wears down; this is what you are to measure. One thing you will want to consider in designing your experiment and in doing your analysis is whether the voltage source also changes. Whether such changes occur, and whether your experimental design accounts for them, will be considered in arriving at a grade for the project.

Your report should reflect knowledge of experimental technique and reporting appropriate to ECE 2100. For example, you are expected to know the appropriate use of units, as well as how to choose and report an appropriate number of significant figures in measurement results. You are also expected to know how to make proper voltage and current measurements, including consideration of meter non-idealities. Finally, you should expect to lose significant credit if your experimental design causes circuit components to exceed their ratings, including power, voltage, and current limits.