Lab Notebook Report: Instructions

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The purpose of this document is to provide the laboratory students with clear instructions and examples of how to create and maintain a lab notebook and produce a final report for submission via Canvas.

Content:

1. Part I - Rules for a professional lab notebook (guidelines for the physical appearance and composition of the notebook). **Note that you are not required to keep and maintain a physical lab notebook for EE2101 though it is good practice to do so.**
2. Part II - How to work with a lab notebook (what to do in class, and what to do at home)
3. Part III - Format of a lab report (description of every section that should appear in each lab report). **This is the report that is to be submitted to Canvas and will be graded.**
4. Part IV - Example of a lab report (short example).

1. Part I - Rules for a professional lab notebook:

- The physical notebook must be a BOUND document. Spiral notebooks, binders, folders, or any other types of document are not acceptable.
- You must number each page in the notebook in increasing order with INK from beginning to end. No scratching or white-out should be present.
- Grid paper is helpful with drawing tables and diagrams but is not mandatory.

2. Part II - How to work with a lab notebook:

During lab, you will be taking notes, writing down your observations, data, results, any calculations you may feel necessary, and any other information that you think would help you in writing your final report. All of these should be done on the back of each page. Do not skip any pages in your lab notebook.

At home, you will be writing your final report. **This report should be typed and organized, clearly and neatly.** If you are keeping a physical lab notebook, this would also be included in the lab notebook and be present on the front sides of the pages. This is **your** lab report. For EE2101, each student is required to submit a report for each lab. **Your report must not**

be a copy of another student's report. Further instructions regarding your final report are provided below.

3. Part III - Format of a lab report:

   A. **Experiment [Number]: [Title of the Experiment] [Date]**
   The heading of every report should include the experiment number, experiment title, and the date on which the experiment was performed.

   B. **Group members**
   The heading should be followed by a list of all group member who worked on the experiment—this includes the notebook owner.

   C. **Objectives**
   Objective/s should be one to several sentences describing the goal of the experiment. This should describe what you are trying to accomplish. It does not need to be long, but should be descriptive enough. Do not copy this from the lab manual. Use your own words.

   D. **Preliminary**
   Preliminary section may be present next. Some labs would require you to perform some work before coming into lab. That work will go under this section. If the lab assignment does not require you to make calculations prior to coming to the lab, then this section will not be present. Most of the current labs do not contain a preliminary.

   E. **Equipment**
   Equipment section is next. Here you will list all the devices, machines, tools, etc. that you have used during your experiment. Brands and model numbers for equipment such as meters, oscilloscopes, etc. should be included here if they are available.

   F. **Procedure**
   Procedure section will be written in succinct sentences and list every step that you have performed in your experiment. Do not copy the procedure from the lab manual! Rewrite the steps in your own words. This section should be in bullet-points or numbered list and written in the third (past) tense. When writing your procedure ask yourself the following question: "if a person who was not present during the experiment reads my procedure, would they be able to replicate it in its entirety?" If there are any helpful diagrams that would assist the reader in replicating your work, include them with a figure/diagram number and title. For this course, you should include all circuit diagrams from the lab manual. If they are important enough to be in the manual, they are important enough to be in your report. For some labs, the circuit diagram may include things like the oscilloscope and DMM and not just circuits built on a breadboard. Do not write your observations and results in this section!

   G. **Observations/Results**
   Observations and results would go under this section and may include tables and figures. Observations may include verbal explanations of what you are

seeing/experiencing. Observations and results should refer directly back to the lab procedure. It is important that you indicate which procedure step produces the observation or result. If any calculations/derivations were made, you do not need to show the full work, only the end result/solution. The full work would go under the next section (Calculations section). Tables and figures need numbers and titles for each and every figure/table and refer to them in your written observations. If numerical data is present, units must be included. NOTE: any figures of waveforms should be clear—any values, scaling, information that is visible to you when you look at the waveform in the lab should also be visible in the waveform figure in your notebook.

H. **Calculations**

If any calculations or derivations were made during the experiment, you will indicate that here. This section will include each formula you have used, and one example of a full calculation (show every step) for that formula. This means that you should show a calculation with all of the values plugged in initially and then simplification steps until an answer is achieved. Any derivations should be complete and show every step. If you are not sure if you are including enough detail, ask your TA!

I. **Conclusions**

In this section, you will write the insights you have gained from conducting the lab. When writing this section think of your objective/s (in your Objectives section) as the "question". The conclusion should be the "answer" to that question. Write down everything that you have learned. In addition, any discrepancies between your expectations/measurements/calculations should be pointed out and explained in this section. This section is hardly ever only one sentence long!

Important Notes:

- This report is to by typed.
- Every section in your lab report should be titled.
- At no point should you copy from the lab manual! Write everything in your own words. If you would like to use a sentence or a paragraph from the lab manual, you must paraphrase it!
- Lab partners must submit individual reports. **They cannot be identical!**

4. Part IV - Example of a lab report:

Note: It may seem that this example relates to one of your actual labs, but it does not! The values are arbitrary and the examples for each section may not relate to each other. Moreover, this example is very short—your reports should be much longer. Do not copy this example to your report.

Experiment # 1: Analog Multimeters 9/13/2017

<u>Group members</u>: Joe Miner, Josephine Miner

<u>Objectives</u>: To learn how analog multimeters can be used to measure voltages and currents in a circuit, and how the internal resistance of such devices can be calculated.

<u>Preliminary</u>: [this section may or may not be present…follow the instructions in your manual]

<u>Equipment</u>: Simpson Model 260 Analog Multimeter, Tenma 72-6615 DC Power Supply, Agilent Model 54622A Oscilloscope, Elenco Model Rs-500 resistors decade box

<u>Procedure</u>:

1. Connected the analog multimeter in series with the decade box and the power supply.
2. Connected the oscilloscope channel in parallel with the analog multimeter.
3. Set the decade box resistance to 10kΩ and the analog multimeter to 1mA scale.
4. Turned on the power supply and increased the voltage until the analog multimeter indicated full scale of current.
5. Turned on the oscilloscope and measured …

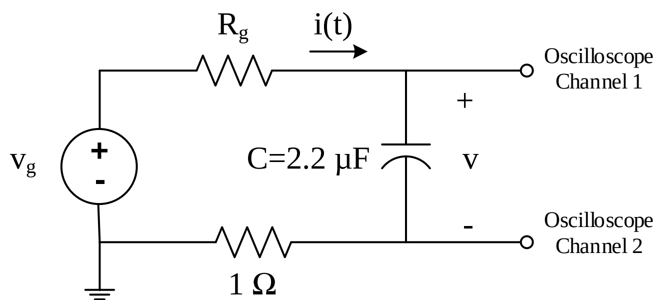

Figure 1: Circuit diagram for procedure step 3 [1].

(NOTE: This image—figure 1—is not related to the description above and is only placed here for illustration on how a figure should look like in your notebooks).

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Observations/Results:

Table 1 shows the current measurements on the analog multimeter with their related voltage values as appeared on the DC power supply and the oscilloscope channel. It also include the calculated resistance values that correspond to each measurement. M2 stands for current measurements on the analog multimeter, M1 stands for voltage measurements on the DC power supply, CH1 stands for the voltage value measurement on the oscilloscope, and R_m stands for the internal resistance calculation of the analog multimeter.

M2 (mA)	M1 (V)	CH1 (mV)	R_m (Ω)
1.0	9.98	256.4	256
0.8	8.24	217.1	271
…	…continue…	…	…

Table 1: Current measurements on the analog multimeter and their corresponding values

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As seen in figure 1, when applying AC coupling to the waveform, the DC offset was removed from the signal and it appeared to be centered around the ground level.

(NOTE: This image—figure 2—is not related to the description above and is only placed here for illustration on how a figure should look like in your notebooks).

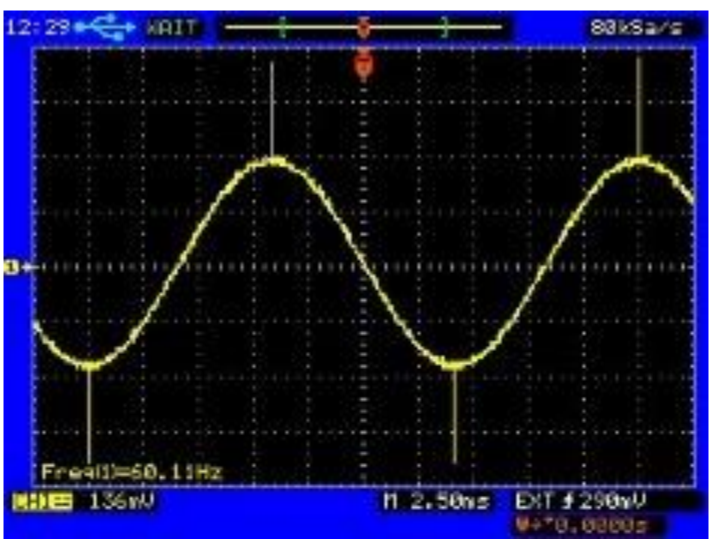

Figure 2: Sine wave with 5V DC offset as appears on oscilloscope with AC Coupling [2].

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Calculations:

- $R_m = \frac{V_{\text{CH1}}}{I_{M2}}$ ex. $R_m = \frac{256.4\text{ mV}}{1.0\ mA} = 256.4\ \Omega \approx 256\ \Omega$

Conclusions:

Currents can be calculated in a circuit by connecting an analog multimeter in series with the devices through which the desired current runs. On the other hand, voltages can be measured by connected the multimeter in parallel with the two nodes that correspond to the desired voltage. Theoretical current values are not exactly the same as the values measured by the multimeter due to the internal resistance of the multimeter which limits that current further. However, because that internal resistance is small, the results are still relatively accurate. The internal resistance can be measured by …

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[END OF DOCUMENT]

References

[1] "Experiment 8: Capacitor Current-Voltage Relationship." Department of Electrical and Computer Engineering, Missouri University of Science and Technology, http://ece.mst.edu/media/academic/ece/documents/EE%202101%20Lab8%20-%20Capacitor%20Current-Voltage%20Relationship%20-%207.26.18.pdf.

[2] "1V, 60Hz, Sine Wavform." *Function & Arbitrary Waveform Generator Guidebook*, B&K Precision, www.bkprecision.com/support/downloads/function-and-arbitrary-waveform-generator-guidebook.html.