Lab Notebook Report Instructions

Revised by: Dr. Theresa Swift, 2018

The purpose of this document is to provide the laboratory students with clear instructions and examples of how to maintain and update their lab notebook.

Contents

1 Rules for a professional lab notebook

A professional lab notebook can be purchased from the university's bookstore, or an external source. If you wish, you may create your own notebook with the following guidelines:

- The 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 would help you with drawing tables and diagrams, but is not mandatory.

2 How to work with a lab notebook

You will be working on your lab notebook during each lab session and at home. During lab, you will be working on your rough draft for that lab. That means that 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 draft. All of these should be done on the back of each page. At home, you will be writing your final draft. This draft should be organized, **written/typed clearly and neatly**, and be presented on the front sides of the pages of your lab notebook. Further instructions regarding your final draft are provided below. Do not skip any pages in your lab notebook.

3 The format of a FINAL draft 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) **Aim/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) **Equipments and Components required:**

In this section, 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. The values of individual components has to be mentions for example, 10 $k\Omega$ resistors, 10 μF capacitors.

(E) **Preliminary calculations/works:**

The preliminary section may be present next. Some labs would require you to perform some work before coming into the 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 calculations/works.

(F) **Circuit diagrams:**

Circuit diagrams must be included for all diagrams. If they are important enough to be in the lab manual, they are important enough to be in your report. You should also draw the diagrams yourself rather than pasting figures from the lab manual. Pay attention to use the standard symbols for the components for the circuit diagram. For some labs, the circuit diagram may include measuring equipments like the oscilloscope and DMM and not just circuits built on a breadboard.

(G) **Procedure:**

Procedure section will be written in short and brief 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 a 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?"

For example, instead of writing like the below:

```
Note down the period from the oscilloscope using Cursor.
```

you describe the steps to how to use the Cursor option from the oscilloscope

```
(a) Measure the period of the sinusoidal signal using Cursor
    button in the oscilloscope
    i. Press the cursor button on the oscilloscope and press X
       from softmenu option.
```

```
ii. Press X1 and X2 from the softmenu to move the cursors
    X1 and X2 respectively.
iii. Move the cursors X1 and X2 such that a complete cycle of
    the sinusoidal wave is in between the cursors.
iv. Note down the value △X which indicates the difference
    value of the two cursors and thus indicates the period of
    the sinusoidal wave.
```

Do not write your observations and results in this section!

(H) **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 particular step in 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). Any tables and figures must be taped/glued in this section! **Loose papers are unacceptable!** You may attach them in between observations, or at the end of the observations section.

Either way, you need to number and title 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 lab notebook.

(I) **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!**

(J) **Conclusion(s):**

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:

- 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!
- At any point you have a doubt and not sure about what to put in the lab notebook, email or ask your TA!

4 Example of a FINAL draft 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 Multimeter 09/20/2018

Group members: Joe Miner, Josephine Miner

Aim / Objectives: 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.

Equipments and Components required:

- Simpson Model 260 Analog Multimeter
- Tenma 72-6615 DC Power Supply
- Agilent Model 54622A Oscilloscope
- Elenco Model Rs-500 resistors decade box

Circuit diagram:

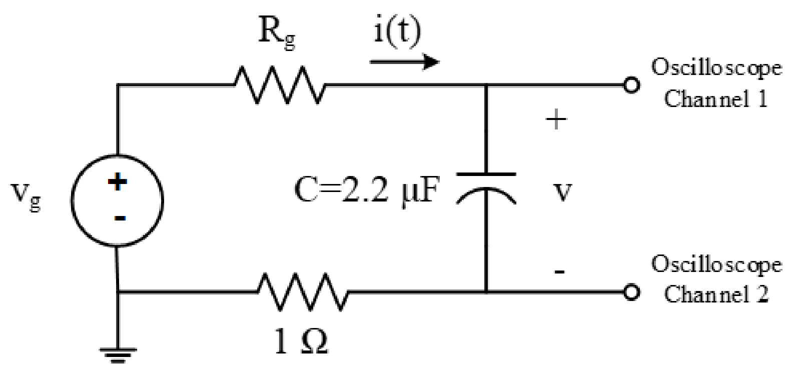

Figure 1: Circuit diagram for procedure step 3 [1]

(NOTE: This image - Fig. 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).

Procedure:

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 10 kΩ and the analog multimeter to 1 mA 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 ...

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 Rm stands for the internal resistance calculation of the analog multimeter.

M2 (mA)	M1 (V)	CH1 (mV)	$R_m(\Omega)$
1.0	9.98	256.4	256
0.8	8.24	217.1	271
...	... *continued* ...	...	...

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

As seen in Fig. 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.

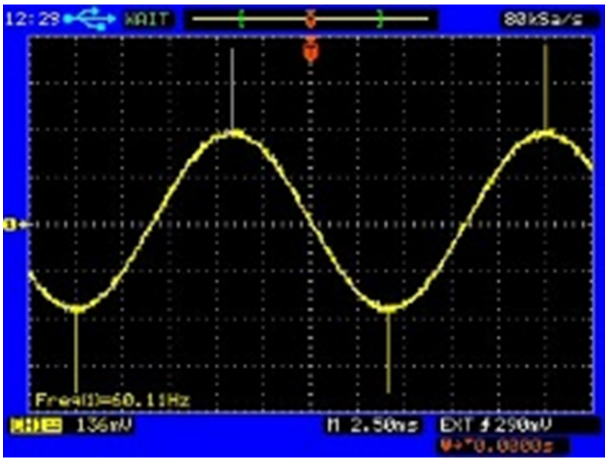

Figure 2: Sine wave with 5V DC offset as appears on oscilloscope with AC Coupling [2]

(NOTE: This image -Fig. 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).

Calculations:

$$R_m = \frac{V_{CH1}}{I_{M2}}$$
$$example: \; R_m = \frac{256.4mV}{1.0mA} = 256.4\Omega \approx 256\Omega$$

Conclusion:

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 . . .

[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%20 Current-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.