York University
Dept. of Electrical Engineering and Computer Science

A laboratory Manual for Electric Circuits Lab
EECS2200

Fall 2015-2016

ACKNOWLEDGEMENT

Prof Mokhtar Aboelaze developed this manual for EECS2200. Mr. Konstantin Bolshakov, who took this course in 2013, invested a lot of time and energy to improve this manual. Mr. Syed Islam updated this manual in Fall 2015.

PREFACE

This laboratory manual is intended for use in EECS2200 Electric Circuits. Every care was taken in preparing this manual, however no one is perfect. If you find any typos or errors in this manual, please contact the course director.

To the student:

The objective of this lab is to get you familiar with the instruments used in electric and electronic circuits measurements. It will introduce you to the concept of "lab book" and to how to design, implement and test simple electric circuits.

The lab will be done in groups of 2. Each lab consists of 2 parts. The prelab part will be done before you arrive to the lab. It will be submitted at the beginning of every lab. Then you have to do the experiment and record results. At the beginning of the next lab you should submit the lab report for the previous lab.

Each lab covers a specific topic in the course that will be clear from the lab title. It is your responsibility to read the theoretical part from the text book and the course notes before you go to the lab.

After you connect the circuit on the breadboard, check with the TA before connecting power. Please read the safety rules and troubleshooting hints before you start your first lab. Please be alert and use common sense during the experiment.

You have to maintain a laboratory book or journal, the TA must sign each page before you leave the lab. The journal will be checked once or twice during the term in order to be sure that you successfully did that part. Tips for maintaining a good journal are explained in this manual, please read "Appendix A: Laboratory Notebook" carefully.

The TA is there to help you, if you have any question ask the TA. A simple question might save you a lot of time and trouble later. Remember, you are dealing with expensive equipment.

To the TA:

Please read the experiment before you come to the lab. In the lab you have to approve the schematic diagram and the circuit connection before the students power up the experiment. Your job is to prevent any accidental mishaps that might injure students or destroy any equipment.

To the course Director:

The course director's responsibility is to be sure that the lab is properly equipped, the TA is qualified to run the lab, the marked reports are returned to the students in a timely manner, and supervising the TA.

Lab 4: Frequency Selective Circuits

OBJECTIVE:

- Measure the frequency response for a low pass filter.
- Learn how to use oscilloscope to measure complex voltages.
- Learn how to use the oscilloscope to calculate the phase difference between 2 voltages.

PRELAB

Read textbook Chapter 14 Section 14.1 and 14.2(p.522-530).
Consider the circuit shown in Fig L4.1.

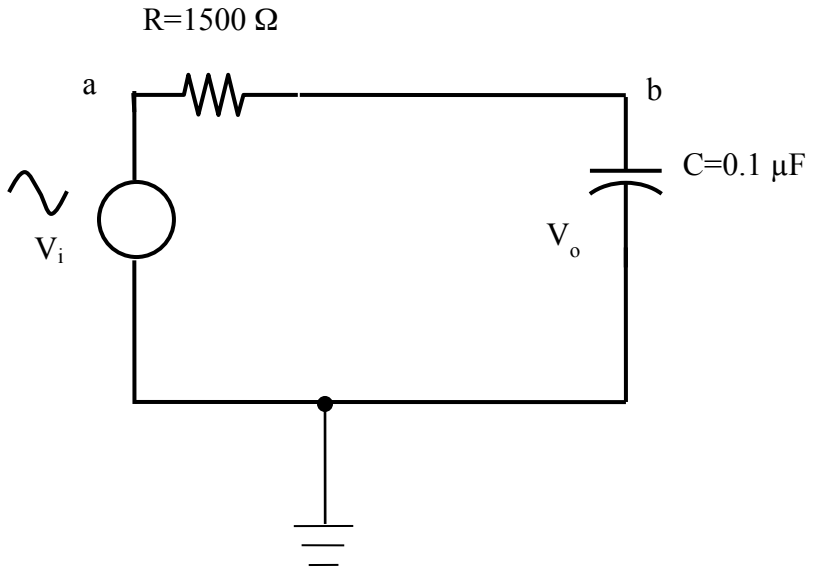

Figure L4.1 A low pass filter

1. Assume that the input voltage in Fig. L4.1 is a sine wave with a frequency f Hz and a maximum magnitude of A. Find the transfer function, i.e. the ratio V_o/V_i as a function of f and A.
2. From the transfer function, derive the magnitude and phase responses using the component values in Fig. L4.1.
3. What is the cutoff frequency (fc) for the above filter?
4. Using Matlab to plot the magnitude of gain vs. frequency from 0.01fc to 100fc on a semi-log scale.
5. Using Matlab to plot the phase angle vs. frequency for the same frequency range on a semi-log scale.
6. Simulate the circuit using Spice and show the gain plot.

LAB:

In this part, you will construct a low-pass filter to measure the frequency response. Please follow the following steps.

1. Construct the circuit, as shown in Fig. L4.1, on a breadboard.
2. Adjust the input frequency to 1% of cutoff frequency.
3. Connect point a to channel 1 of the oscilloscope and connect point b to channel 2 of the oscilloscope.
4. Adjust the oscilloscope so that you can view 2 signals on the display. Make sure to use the same scales for X-axis and Y-axis for both channels.
5. Measure the maximum magnitude of the 2 waveforms.
6. Measure the phase shift between the two waveforms.
7. Change the input frequency from 1% of cutoff frequency to 10 times the cut off frequency. (You can select 10 to 20 points inbetween).
8. Record the magnitude vs. frequency on a smilog graph.
9. Record the phase shift vs. frequency on a semilog graph.