Guidelines for a Lab report 2 EEET2493: OpAmp and Filters

Title of the session (you can be creative highlighting your findings)

Student name 1, s123456, Student name 2, s123456, Student name 3, s123456, Names are to be centered in Times (or Times Roman) 12-point nonboldface. Leave two blank lines before your Abstract

Title and abstract: 1 marks.

***Abstract*—Provide a summary of the session. What was done, what measurements were taken, brief methods, what calculations, brief conclusion. The Abstract should be approximately 250 words or fewer, italicized, in 10-point Times (or Times Roman.) Please leave two spaces between the Abstract and the heading of your first section. It should briefly summarize the essence of the paper and address the following areas without using specific subsection titles. Objective: Briefly state the problem or issue addressed, in language accessible to a general scientific audience. Technology or Method: Briefly summarize the technological innovation or method used to address the problem. Results: Provide a brief summary of the results and findings. Conclusions: Give brief concluding remarks on your outcomes. Detailed discussion of these aspects should be provided in the main body of the paper.**

***Index Terms*—keywords, temperature, xxxx equation, etc.**

I. Introduction

1.2 Marks

DESCRIBE: What is signal conditioning? (1 paragraph 3-5 lines. 0.2 marks).

What electrical elements are needed to build analogue signal conditioning circuits? (1 paragraph 2-4 lines. 0.2 marks)).

What type of analogue filters exist? (1 paragraph 3-8 lines. 0.2 marks)).

How filters are characterized/tested in the lab. (1 paragraph 3-8 lines. 0.2 marks)).

What is a bode plot? What is phase diagram? (1 paragraph 3-8 lines. 0.2 marks)).

In this report, (last paragraph of the intro, describe what did you do over the last sessions...) (1 paragraph 2-6 lines. 0.2 marks)).

II. Materials and Methods.

1.0 Marks

Include ONE single image that contains 5 subsets of images of the circuits used (a- inverting amplifier, b - non inverting amplifier, c- High Pass Filter, d- Low Pass Filter, e- Active Band Pass Filter) 0.4 mark.

Describe the circuits you used. Refer to image above and describe them briefly (1 paragraph 3-8 lines) 0.3 mark.

How circuits were characterized? What materials, instruments, tools, devices did you used, what variables were measured and over what ranges? (1 paragraph 5-8 lines) 0.3 mark

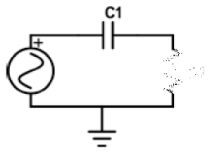

Fig. 1. Example of figure 1. Include ONE single image that contains 5 subsets of images of the circuits used (a- inverting amp, b - non inverting amp, c- HPF, d- LPF, e- Active BPF). Make sure all numbers in the figure can be read, and that the caption explains the figure.

III. Results

Total: 3.6 Marks

3 - Oscilloscope Figures: 1.2 Marks

3 - Tables: 1.2 Marks

3 - Bode/Phase plots 1.2 Marks

Show tables and plots of any data collected and describe with words what your plots are showing. Describe the relationship between variables. Each Figure and Table should have its own caption. Do not be afraid to use lengthy figure and table captions better that than confusing or incomplete ones. Results (7 Figures, 3 Tables)

Oscilloscope Figures

0.4 Marks each figure, including description.

Figure 2. *Inverting Amplifier or Non-Inverting Amplifier*: One Image of the oscilloscope's screen showing the measurement of v_{out}/v_i of your choice, Inverting or Non-Inverting configuration. See Fig. 2
Describe the image and write down the theoretical gain vs experimental gain at other 3 different frequencies, you can refer to the relevant table. (Note: for the table the theoretical wont change, but the experimental may change).

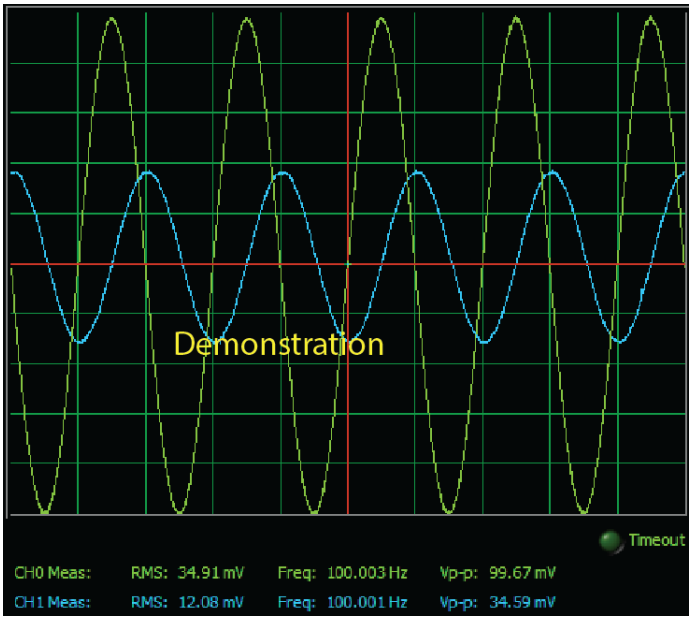

Fig. 2. Example of figures 1-3. Make sure all numbers in the figure can be read, and that the caption explains the figure.

Figure 3. *Low Pass Filter or High Pass Filter*: One Image of the oscilloscope's screen showing the measurement of v_{out}/v_i on either the LPF or HPF.
Describe the image and write down the theoretical gain vs experimental gain at 3 different frequencies, you can refer to the relevant table.

Figure 4: *Active Band Pass Filter*: One Image of the oscilloscope' screen showing the measurement of v_{out}/v_i on the active filter (ABPF).
Describe the image and write down the theoretical gain vs experimental gain at 3 different frequencies, you can refer to the relevant table.

Tables - 3 Tables

0.4 Marks each table including description

TABLE I
HIGH PASS FILTER.

Frequency	Measured Gain		Theoretical Gain	
Hz	v_{out}/v_i	db	v_{out}/v_i	db
10	??	??	??	??
100				
etc				
etc				
etc				

Table I, presents the calculated gain from measurements of xxxx, and the calculated from the transfer function of the circuit. Columns: [0 Freq, 1 Gain for each frequency tested as v_{out}/v_i, calculated from measured Vpp values, 2 Gain in db: $20log_{10}(v_{out}/v_{in})$, 3 theoretical gain from the transfer function as v_{out}/v_i, 4 theoretical gain in db from the transfer function].

TABLE II
LOW PASS FILTER.

Frequency	Measured Gain		Theoretical Gain	
Hz	v_{out}/v_ii	db	v_{out}/v_i	db
10	??	??	??	??
100				
etc				
etc				
etc				
etc				
etc				

Table II, presents ...

TABLE III
ACTIVE BAND PASS FILTER.

Frequency	Measured Gain		Theoretical Gain	
Hz	v_{out}/v_i	db	v_{out}/v_i	db
10	??	??	??	??
100				
etc				
etc				
etc				
etc				
etc				

Table III, presents ...

You can generate a table in a latex format online, then copy-paste it into a latex document. Explore: tablesgenerator.com

Bode and Phase Plots

0.4 Marks each figure, including description.

Figure 5: Bode Plot of either High Pass Filter or Low Pass Filter. See Fig. 5. Composed by two lines: experiment (line A) & theory (line B). Line A: log freq vs log gain from the results from Table I or II, depending on your choice. Line B: 10 calculated theoretical points (log freq vs log gain) using the transfer function of the filter. The bode diagram you have from the soft panel may be included in the appendix only for comparison.

Figure 6: Bode Plot of the Active Band Pass Filter. See Fig. 6. Composed by two lines: experiment (line A) & theory (line B). Line A: log freq vs log gain from the results from Table III. Line B: 10 calculated theoretical points (log freq vs log gain) using the transfer function of the filter (line B). The bode diagram you have from the soft panel may be included in the appendix only for comparison.

Figure 7: Only one Phase Diagram of any of the three filters tested. It can be a screen shot from NI-Soft Panel or calculated from Excel, its your choice.

Figure 8: Optional. Oscilloscope screen-shot waveform of the audio experiment v_in vs v_{out}.

Equations to be included when referring to bode plots calculations (discussed on class):

- Transfer function of the Passive High Pass Filter used.
- Transfer function of the Passive Low Pass Filter used.
- Transfer function of the Active Band Pass Filter used.

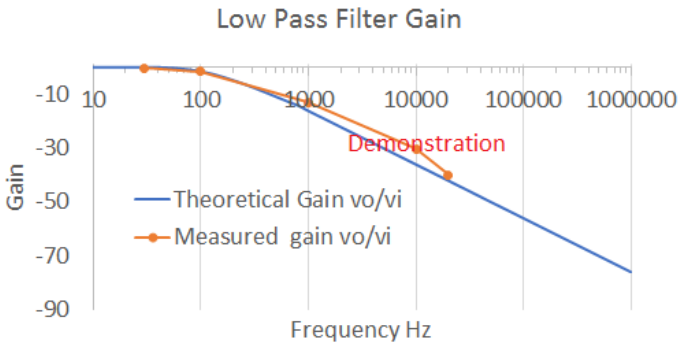

Fig. 5. Example of a frequency response of a filter. Make sure all numbers in the figure can be read, and that the caption explains the figure. This image is missing units in the vertical axis.

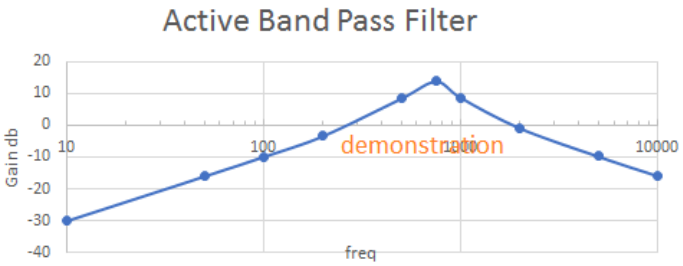

Fig. 6. Example of a frequency response of a filter. Make sure all numbers in the figure can be read, and that the caption explains the figure. This plot is missing Experimental results and legend name for the data line.

IV. Discussion and Summary

1.0 Mark.

Summarize your findings. Discuss any interesting result related to the materials used or to any claim from the introduction. Discuss your measurements using engineering terms (accuracy, precision, resolution, etc). Give technical conclusions. Restate the main objectives and how or to what degree they were achieved. Describe some applications of your results and comment any possible recommended future work.

Appendix A
Workout of the transfer functions.

2.0 Marks.

Full marks if all workout is presented neatly for the three transfer functions of the filters used. Student clearly demonstrates the origin and development of the concepts used through equations and its workout.

- Transfer function of the Passive High Pass F. (0.5 marks)
- Transfer function of the Passive Low Pass F. (0.5 marks)
- Transfer function of the Active Band Pass F. (1.0 marks)

References

0.1 Mark.

Example of data book:

[1] National Operational Amplifiers Databook. Santa Clara: National Semiconductor Corporation, 1995 Edition, p. I-54.

Example of textbook:

[2]M. Young, The Technical Writers Handbook. Mill Valley, CA: University Science, 1989.

Example of scientific journal paper:

[3] J.W. Smith, L.S. Alans and D.K. Jones, An operational amplifier approach to active cable modeling, IEEE Transactions on Modeling, vol. 4, no. 2, 1996, pp. 128-132.

Example of conference paper proceedings:

[4] J.W. Smith, L.S. Alans and D.K. Jones, Active cable models for lossy transmission line circuits, in Proc. 1995 IEEE Modeling Symposium, 1996, pp. 1086-89.

Example of Internet web page:

[5] Approximate material properties in isotropic materials. Milpitas, CA: Specialty Engineering Associates, Inc. web site: www.ultrasonic.com, downloaded April 20, 2019.

List and number all bibliographical references at the end of your paper in **9 or 10 point** Times, with 10-point interline spacing. When referenced within the text, enclose the citation number in square brackets, for example [1].

Use IEEE format. Cite any external work that you used (data sheets, text books, Wikipedia articles, . . .). If you get a formula from a Wikipedia article, you must cite the article, giving the title, the URL, and the data you accessed the article as a minimum. If you copy a figure, not only must you cite the article you copied from, but you must give explicit figure credit in the caption for the figure: This image copied from . . . . If you modify a figure or base your figure on one that has been published elsewhere, you still need to give credit in the caption: This image adapted from . . . .