print name (first last): _____

course: ECET 337 2025-11-19

lab date (mo/day/yr): _____

lab section (day time): _____

instructor: _____

Filter Design Project
In-lab

Performance Checks

_____ **(15 pts)** Matlab or Multisim Laplace Block Analysis-Low or High Pass _____

_____ **(15 pts)** Multisim Circuit AC Analysis-Low or High Pass-Standard Values _____

_____ **(20 pts)** Hardware Implementation-Low or High Pass _____

_____ **(15 pts)** Matlab or Multisim Laplace Block Analysis-Bandpass _____

_____ **(15 pts)** Multisim CircuitAC Analysis-Bandpass-Standard Values _____

_____ **(20 pts)** Hardware Implementation-Bandpass _____

All required signed ***Performance check offs*** ..... (100%)→ _____

Lab Report Scoresheet **There is *no* lab report. All points are awarded, above, for demonstrated performance.**

Prelab Activity:

There are *no* formal, credit-carrying prelab procedures. *However*, both the Laplace simulation and the Multisim circuit elements (60% of the four week's credit) can/should be done outside of lab. The results must be demonstrated, on the computer, to your lab instructor during your lab period. But, it is wise to complete these tasks outside of your lab period, saving all of the eight lab hours for getting the hardware to work. If you use lab time to accomplish the software tasks, there is a very low probability that you will get both hardware circuits to meet specifications. *If* you choose to postpone your work and do not complete the software tasks at home, then *at least* you will have learned about the consequences of such poor time management.

Objectives

Design and verify the design of a low pass or high pass and a band pass filter.

Approach and Results

1. General Suggestions

a. You are to design two filters to the given specifications, while not exceeding a sixth order system. Enough information has been provided in lecture and previous labs to perform the given task. Success is fulfillment of the filter specification ($\pm$0.1 dB).

b. Any method to design, analyze and verify the filters can be used. If methods outside of what has been covered in the course are used, your demonstration must be detailed enough that the instructors can duplicate the procedures/methods/etc… and achieve the same results.

c. Design is an iterative process. Be prepared to repeat steps until the specifications are met. Be prepared to 'over-ride' the tools that are helping in the design process, if necessary. The main lab objective is a functional circuit that meets specifications ($\pm$0.1 dB).

d. The filter cannot exceed 6th order.

e. Choose either Butterworth or Chebyshev approximations, but do not be hesitant to change design, if problems arise.

f. Circuit design and testing will be performed in a 'lab practical' manner.

g. You are permitted to arrive with a pre-built circuit(s), but breadboards are to be stripped clean (in the instructor's view) as soon as your filter is checked off.

h. Filter verification will be performed with the oscilloscope's Frequency Response Analysis feature. Set the frequency range to match or just exceed your specifications. Initially, set the number of points/decade to 50 or less to get a quick analysis. Once your circuit's performance is close, increase the points/decade to get better resolution. This will take longer.

2. Low Pass or High Pass Filter, then Band Pass Filter

a. Specifications
- **1)** Access the Variate link for this lab exercise , Low or High Pass on Brightspace.
- **2)** The program will produce your unique filter specifications.
- **3)** ***Print these out***, including the image, and the table with the numerical specifications. These numbers are *random*. You *must* save these specifications. If you click the link again, you may get a different set of numbers!

b. Demonstrate the following for the software checkoff:
- **1)** Matlab Script file or Multisim Laplace Blocks.
- **2)** Frequency response magnitude plot with cursors at each of the values in your table.
- **3)** Complete the appropriate column of your table.

c. Demonstrate the following for the Multisim circuit components checkoff:
- **1)** Schematic with final component values.
- **2)** AC Analysis with cursors marking each of the values shown in your table.
- **3)** Complete the appropriate column of your table.

d. Demonstrate the following for the hardware checkoff:
- **1)** Schematic with final, *actual, measured* component values.
- **2)** Frequency Response Analysis of the working circuit.
- **3)** Complete the appropriate column of your table.

3. Band Pass Filter

a. Specifications
- **1)** Access the Variate link for this lab exercise on Brightspace. It is just the bottom part of the previous filter specifications.
- **2)** The program will produce your unique filter specifications.
- **3)** ***Print these out***, including the image, and the table with the numerical specifications. These numbers are *random*. You *must* save these specifications. If you click the link again, you may get a different set of numbers!

b. Demonstrate the following for the software checkoff:
- **1)** Matlab script file or Multisim Laplace Blocks.
- **2)** Frequency response magnitude plot with cursors at each of the values in your table.
- **3)** Complete the appropriate column of your table.

c. Demonstrate the following for the Multisim circuit checkoff:
- **1)** Schematic with final component values.
- **2)** AC Analysis with cursors marking each of the values shown in your table.
- **3)** Complete the appropriate column of your table.

d. Demonstrate the following for the hardware checkoff:
- **1)** Schematic with final, *actual, measured* component values.
- **2)** Frequency Response Analysis of the working circuit.
- **3)** Complete the appropriate column of your table.