

USAF Academy
Department of Electrical and Computer Engineering
ECE 332 – Electrical Circuits and Systems II

Spring 2016

Bandpass and Band-Reject Filters – Prelab

(Due at beginning of class IAW syllabus. Make a copy for yourself)

Authorized Resources: 1) ECE332 course documents and 2) course text.

Collaboration Policy: This is individual effort. Attach your work on engineering paper.

(25 pts) Theory

1. Pick circuit topologies for both your broadband and high-Q designs. Include schematics labeling the input signal V_1 and output signal V_2 . Be sure to include the source resistance R_{sig} and load resistance R_L .
2. Derive the transfer function for each design in terms of the parts R, C, and/or L. For example a bandpass, series RLC circuit would have the form

$$T(s) = \frac{\frac{R}{L}s}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$$

3. Derive the governing equations relating your specifications to parts R, C, and/or L. For a bandpass, series RLC circuit

$$B = R/L \text{ and } \omega_o = 1/\sqrt{LC} = 2\pi f_o$$

4. Express your transfer function for each design in terms of your given specs. This is your theoretical transfer function. For a bandpass, series RLC circuit with $B=100 \text{ rad s}^{-1}$ and $\omega_o=10^3 \text{ rad s}^{-1}$

$$T(s) = \frac{100s}{s^2 + 100s + 10^6}$$

(25 pts) Design

Through hand calculations using the governing equations above, design your circuits for R, C, and/or L to meet specifications given in the lab handout. Ensure you use standard parts available in the lab as listed on the course website. Ensure you account for source resistance R_{sig} and load resistance R_L .

(25 pts) Simulation

For both designs attach your MultiSim simulations (circuit schematics and graphs) along with Matlab simulations (graphs). Fill in the table below showing your errors. When calculating error for Passband Gain, first convert dB to volts/volt. Ensure to include overlay plots of Matlab and Multisim Bode plots.

Broadband Design					
Parameter	Specifications	Calculation	% Error	Simulation	% Error
B (kHz)					
f_{low} (kHz)					
Max Op Amps (-)					
Passband Gain (dB)					
R_L (k Ω)					
High-Q Design					
Parameter	Specifications	Calculation	% Error	Simulation	% Error
Q (-)					
f_o (kHz)					
Max Op Amps (-)					
Passband Gain (dB)					
R_L (k Ω)					

(25 pts) Procedure/Test Plan

Describe how will you measure, collect and analyze data. Describe the test equipment you will use. Draw a schematic showing how your test equipment is connected to your circuit. Describe how will determine if you meet specifications.

Documentation: