# Olin College of Engineering
# ENGR2410 – Signals and Systems

## Assignment 3

### Problem 1

A. Find the equivalent impedance of a series RLC combination.

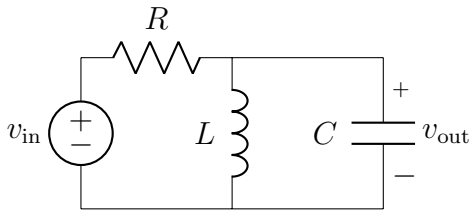
B. Find an expression for the quality factor Q of the series RLC in terms of the characteristic impedance $Z_0 = \sqrt{L/C}$. Recall that Q is defined as $\frac{\omega_0}{2\alpha}$.

C. Find a condition for R such that $Q \gg 1$. In the limit, is R acting more like a short or an open circuit?

D. Repeat the previous three parts for the parallel RLC combination.

### Problem 2

A. Find the transfer function for the parallel RLC circuit using impedances.




B. Show that at low frequencies a capacitor may be replaced with an open circuit and an inductor may be replaced with a short circuit. Show that the inverse is true at high frequencies.

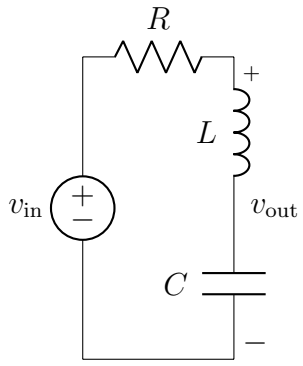
C. Draw equivalent circuits for low frequencies and high frequencies. Use them to verify the extremes of the Bode plot from last week.

D. What is the equivalent impedance of the parallel LC combination at resonance? What can you replace it with?

E. Draw an equivalent circuit at resonance. Does it correspond to your Bode plot?

**Problem 3**

A. Find the transfer function for the circuit shown below using impedances.




B. Sketch the Bode plot of the magnitude of H(s).

C. Recall that at low frequencies a capacitor may be replaced with an open circuit and an inductor may be replaced with a short circuit and the inverse is true at high frequencies. Draw equivalent circuits for low frequencies and high frequencies. Use them to verify the extremes of the Bode plot.

D. Draw an equivalent circuit at resonance.

**Course feedback**
Feel free to send any additional feedback directly to us.

Name (optional):

A. End time: How long did the assignment take you?

B. Are the lectures understandable and engaging?

C. Was the assignment effective in helping you learn the material?

D. Are you getting enough support from the teaching team?

E. Are the connections between lecture and assignment clear?

F. Are the objectives of the course clear? Do you feel you are making progress towards those objectives?

G. Anything else?