

# Homework #3: Phys 3320: Prof. Olness Fall 2019

*Due Tuesday 01 October*

Consider a circuit with a resistor (R), capacitor (C), or inductor (L), and this is driven by an AC source:  $V \sin[\omega t]$ . (If you prefer, you can use an exponential form.)

Part 1a) the circuit with the resistor R, compute the impedance Z, the current and voltage across the resistor as a function of time. What is the relative phase of the voltage and current?

Part 1b) Repeat for the capacitor C.

Part 1c) Repeat for the inductor L.

Part 2) Repeat for an RLC circuit. Compute the impedance Z, the current and voltage across the resistor as a function of time. What is the relative phase of the voltage and current? Plot the current through the system as a function of the frequency  $\omega$ . Why is this called a band-pass filter?

Part 3) For an RLC circuit with  $R=20$  ohms,  $C=10\mu\text{F}$ ,  $L=100\text{mH}$ , and  $V=100$  volts plot the current as a function of  $\omega$ .

a) Find the maximum value of the current.

b) Also, find the values of  $\omega$  where the current is  $\frac{1}{2}$  the maximum value.

c) Overlay plots for  $R=20, 10, 5$  ohms and comment.

d) Is there a value of  $\omega$  that will make the current go to infinity???