

Lab 3 Capacitor and RC Passive Filter

Hand in your attempt of Homework 3 to your professor.

Complex Impedance and RC circuit

1. Use a DMM to measure 3 capacitors' capacitance C (small, medium, large). What's the difference between polarized and unpolarized capacitors? Is your DMM able to measure all 3's values? Any problems? Calculate the 3 capacitors' impedance(reactance) at 500Hz and 1MHz.
2. Talk to your partner and build one of the RC filters you two designed in *Homework 3 problem iv*. Use the function generator to generate the input voltage. Keep the input peak voltage at a value anywhere from 3V to 10V.

Passive Filter

1. Look at the simple circuit you built on the breadboard, is it a high pass filter or low pass filter? Send your output signal of your filter to Channel 1 of our oscilloscope (if not already) and send the output signal of the function generator to Channel 2 of our oscilloscope. Set the input frequency at 100 Hz for now. Adjust your scope settings to make sure you have both yellow and blue sine waves displayed nicely and calmly (properly triggered) on the screen. Take a screen shot, tape it to your lab book (leave some blank space if you are to do this later).
2. Use the oscilloscope to measure the output peak voltage of your RC circuit at 15 different frequencies from 10 Hz to 50 kHz. Measure more points around your filter's cutoff frequency. Record the results. Do the numbers make sense? Explain. Make sure you can see the signals at different frequencies clearly. What's the cutoff frequency of your filter? What happens when the input frequency is near the cutoff frequency?
3. Measure the peak voltage at cutoff frequency. Calculate the voltage gain and the decibel voltage gain at cutoff frequency from your measured data. Measure the phase angle at cutoff frequency. You cannot directly measure the angle in degrees. Figure out how to do this. Learn to use cursors on your scope screen for easy data reading. Compare your measured results with the theoretical results (you need to calculate the theoretical values). Take screen shots of the voltage and phase angle measurements at cutoff frequency and tape to your lab book.
4. [*Only if time allows*] Switch the position of the resistor and the capacitor of your circuit, and everything else remains the same. Now you have a high pass filter or low pass filter? Think of a way to prove it. Show us your measurements and record everything. What's the cutoff frequency of your new filter? Does the value make sense to you and agree with your measurements?