AP 185 Activity[1]

# Frequency Response of Systems

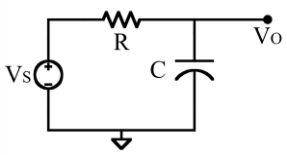
In this experiment we will practice how to obtain the Bode Plot of a system. The Bode Plot represents the frequency response or the DYNAMIC characteristics of a system. The transfer function of a system can be estimated from Bode Plots.

Materials: passive electrical components (resistors, capacitors, inductors.), signal generator, oscilloscope with two probes.

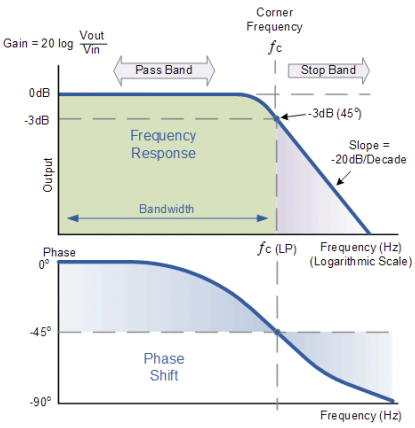
## Procedure:

### Part A

1. Set up the RLC circuit below (low pass filter ) with R and C of your choosing. Record these values.




2. Drive the circuit with a sinusoid with frequencies incremented in orders of 10. For example, 10Hz, 100Hz, 1kHz, 10kHz, 100kHz, 1MHz, 10Mhz, 100MHz. For finer increments and a smoother curve, you can also do 10Hz, 50Hz, 100Hz, 500Hz, 1kHz, 5kHz, etc. If you expect resonance, use finer increments.
3. For each frequency, tabulate the amplitude and phase shift of the output sinusoid. You may need to observe input and output signals simultaneously to measure phase shift. At certain frequencies, the output might appear to vanish. Increase the output channel y-axis sensitivity until you see the output signal again.
4. For each frequency, calculate the Gain of the system G = 20 log(Vout/Vin) . Create a plot of G vs. log of frequency and another for phase shift vs. log of frequency similar to the Illustration below. These are called Bode plots.




[1] From Dr. MSoriano 185 activities

5. Using the same value for R and C, build the following circuits and obtain their Bode plots :

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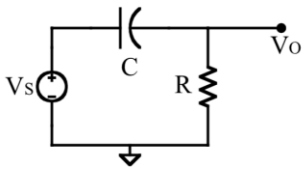
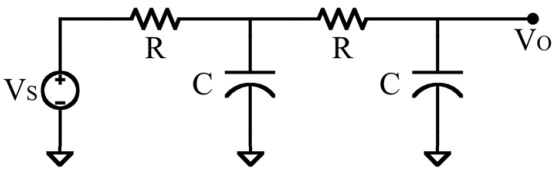
<td> 

High pass filter</td>
<td> 

Second order low pass filter</td>
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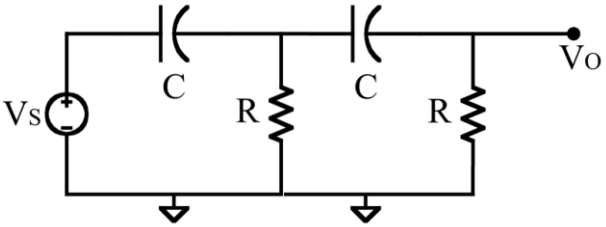
<td> 

Second order high pass filter</td>
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6. Estimate the transfer function of the system using the Bode plot. Compare with analytic transfer function computed from your circuit diagram.