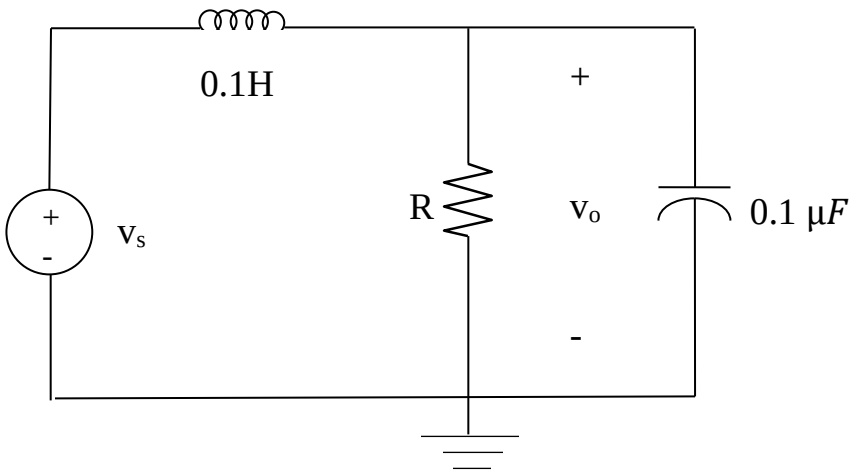
**ECE 211 Analog Discovery Lab #3**




1. Determine the transfer function of the above circuit, $H(s) = V_o/V_s = K / (s^2 + 2\zeta\omega_o s + \omega_o^2)$.
2. Determine the DC gain and infinite frequency gain for this circuit. Sketch $|H(j\omega)|$.
3. Using R = 500 Ω solve for ζ. Does the frequency response have a peak somewhere between 0 and ∞?
4. Determine the theoretical cutoff frequency for this circuit with R = 500 Ω.

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5. Build the circuit with R = 500 Ω.
6. Select Wavegen, Scope, Spectrum Analyzer & Network Analyzer. Don't forget to select RUN after making changes.
7. Use the Wavegen to produce a 1 V peak, 200 Hz square wave for $v_s$ (Scope channel 1). Use Scope channel 2 for the output. Tie all grounds together and connect to the ground on the circuit.
8. View the input and output on the scope. Briefly describe how the input and output differ.
9. Change the frequency to 1 kHz. Note the effect.

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10. Select the spectrum analyzer (the small green down arrow at the top right). Change the Freq. Range to Auto, Start to 100 Hz, and Stop to 20 kHz. In the Magnitude box select $V_{peak}$ (V) and 2 V.
11. Describe what you see on the spectrum analyzer. Note how the input and output spectra differ.

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12. Select the Network Analyzer. Set the Scale to Linear, Start to 100 Hz, and Stop to 5 kHz. In the Magnitude box set the range to 1 V and click Single to generate the plots.
13. The top plot is $|H(j\omega)|$. Does this plot agree with your answer to problem 3?
14. Measure the cutoff frequency. Compare this to the theoretical value from problem 4.
15. Set the Magnitude to dB and Scale to Logarithmic to see the Bode plot. Note the cutoff frequency on this plot.

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16. Using R = 15 kΩ, solve for ζ. Does the frequency response have a peak somewhere between 0 and ∞?
17. Change the circuit resistor to 15 kΩ. Click single to update the plots. Adjust the magnitude range to 5 V. Does this plot agree with your answer to problem 15?

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18. With the 1 kHz square wave input signal, view the input and output signals on the scope. How does ζ affect the relationship between input and output signals?
19. Change the input to a 50 Hz square wave. How does this change the relationship between input and output signals when viewed on the scope?