Objective:
• Compare measured and theoretical Bode plots.

Procedure:
1. Calculate and record the corner frequency for the filter shown in Figure 1 in both radians per second ($\omega_c = 1 / (R C)$) and in Hertz ($f_c = \omega_c / (2\pi)$).
2. Construct the circuit shown in Figure 1. Connect one channel of the oscilloscope to measure the function generator output ($v_s$) and the other channel to measure the filter output ($v_o$). Set up the function generator to produce a 100 Hz sinusoid with a peak voltage of 5 V.
3. Record (1) frequency, (2) $v_s$ peak voltage, (3) $v_o$ peak voltage, (4) time shift between $v_s$ and $v_o$. If $v_o$ lags $v_s$, record the time shift as negative; if $v_o$ leads $v_s$, record the time shift as positive.
4. Increase the frequency to 200 Hz and repeat step 3. Adjust the $v_s$ peak voltage to 5 V as necessary.
5. Keep increasing the frequency and recording data until the frequency is at least a decade above $f_c$. You can take large frequency steps when the output amplitude is changing slowly with frequency. Take smaller steps when the output amplitude starts to change more quickly. (There should be more rapid changes in amplitude when the function generator frequency is near the corner frequency, so take more measurements at frequencies around the corner frequency.) Try to take at least 15 – 20 measurements.

Report:
Include your table of collected data in your lab report. Add columns for the (1) linear gain (V/V), (2) gain in dB, and (3) phase shift (degrees). Use MATLAB/Octave to create magnitude and phase Bode plots of your measured data. (Use the `semilogx` function to get a log frequency axis.) Use LTSpice to simulate the circuit and produce (separate) Bode plots of the magnitude and phase. Adjust the axis limits (both vertical and horizontal) in either MATLAB/Octave or LTSpice so that the plots can be directly compared. Derive the transfer function for the circuit and use MATLAB/Octave to create the theoretical Bode plots from the transfer function.