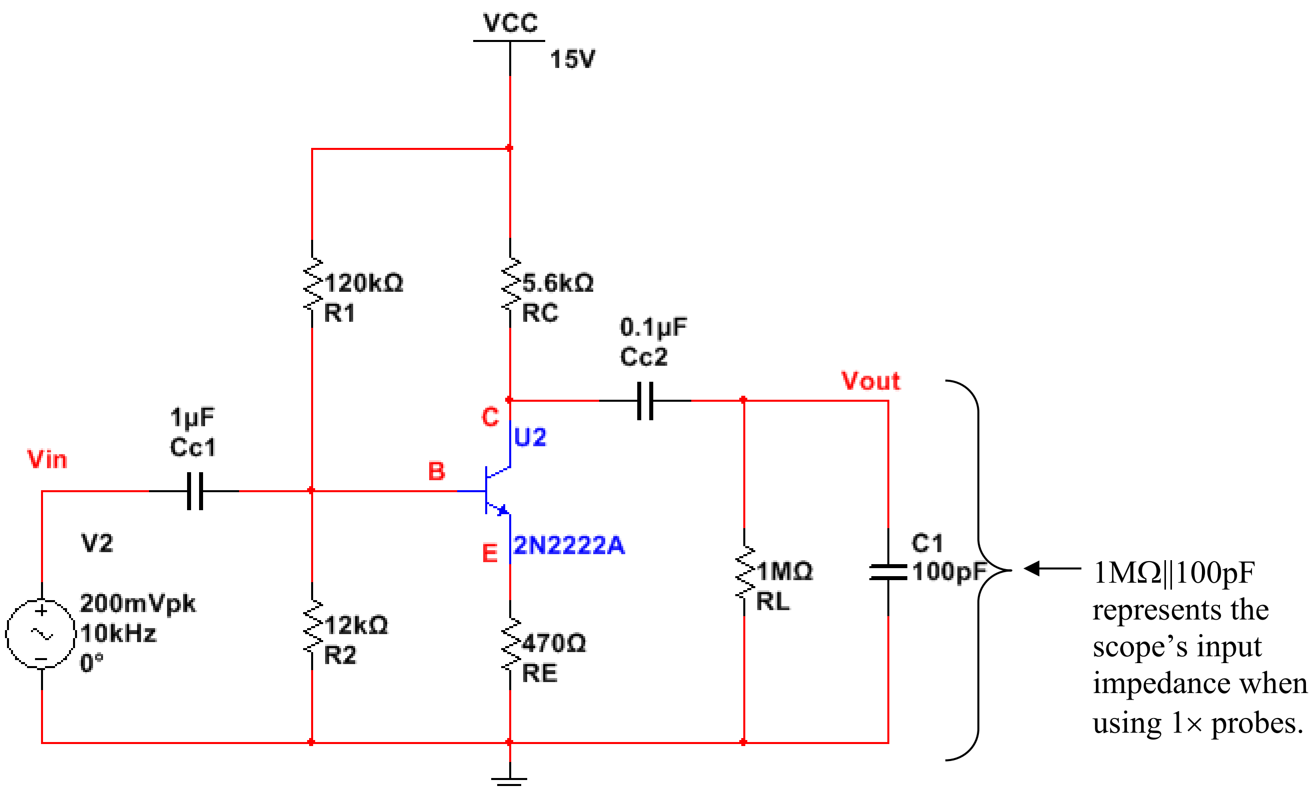
CE Frequency Response

1. A CE amplifier circuit is shown below. The BJT has $\beta = 220$, $r_\pi = 4.2k\Omega$, $r_o = 76k\Omega$, $r_x = 0.13\Omega$, $g_m = 52mS$, $C_\pi = 27pF$ and $C_\mu = 9pF$. Estimate the mid-band voltage gain using Equation (7.111):

$$A_{vo} = -\frac{g_m R_C}{1 + g_m R_E}$$

Use the SCTC method to determine values for C_{C1} and C_{C2} that result in $f_L \cong 20Hz$. Assign 90% to the dominant τ. Note: C1 = 100pF presents a high reactance at low frequencies. It is the parasitic capacitance of the scope cable and, like the BJT parasitic capacitances, it is modeled as an open circuit at low to mid-band frequencies. Use the OCTC method to estimate the value for f_H.



Lower 3-dB Frequency, f_L

2. Build the circuit. Set up a 400mV peak-to-peak, 10 kHz sin wave and use 1× probes to measure the circuit's mid-band voltage gain, $A_{vo} = v_{out}/v_{in}$. Compare with your pre-lab estimate.

3. Reduce the signal frequency until v_{out} falls to 70.7% of its mid-band value. How close is your measured value for f_L to the SCTC estimate?

Upper 3-dB Frequency, f_H

4. Increase the signal frequency beyond 10 kHz until v_{out} again falls to 70.7% of its mid-band value. How close is your measured value for f_H to the OCTC estimate? Switch to 10× probes and re-measure f_H. Explain your results.