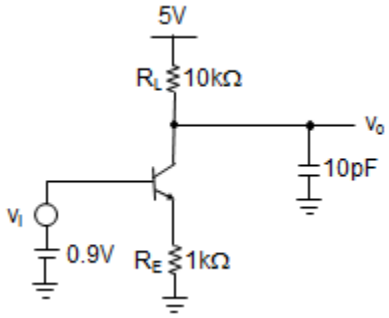
MS Exam: Electronic Circuits & Systems - ECE102 (Fall 2012)

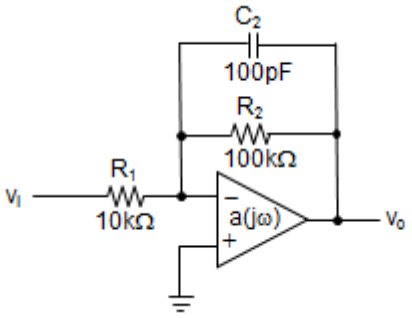
Problem #1:



In the bipolar amplifier shown above, answer with the following parameters: kT/q = 25mV, V_{BE} = 0.7V, V_{CEsat} = 0.2V. Calculate all numerical values approximately.

1. What is the nominal DC output voltage?
2. Estimate the low-frequency small-signal gain v_o/v_i.
3. Estimate the –3dB small-signal bandwidth of this amplifier in Hz.
4. What is the DC input V_i to get the lowest DC output?
5. Sketch the DC transfer function for the range of V_i from –1 to 1V.

Problem #2:



A feedback amplifier is made using an operational amplifier as shown above. The open-loop transfer function of the operational amplifier a(jω) has a DC gain of 100dB and two poles at 10Hz and 1MHz. Calculate all numerical values approximately.

1. Sketch the Bode plots of the small-signal AC transfer function of $v_o(j\omega)/v_i(j\omega)$ in Hz.
2. When the AC input is $v_i(t) = \sin\{2\pi(16\text{kHz})t\}$, write the equation of the output $v_o(t)$.
3. When a step input of 1V is applied at t = 0, write the equation of the output $v_o(t)$.
4. Estimate the frequency where the feedback loop gain becomes unity in Hz.
5. If C_2 is removed, what is the –3dB small-signal bandwidth of this amplifier in Hz?