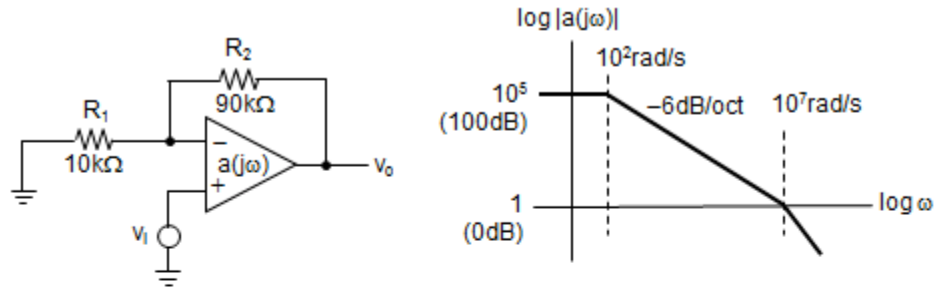


MS Exam: ECE 102 (Spring 2012)

Problem #1



An operational amplifier is used to make a feedback amplifier as shown above. Its open-loop Bode gain plot is also sketched with straight lines. It has two poles at 10^2 and 10^7 rad/s, respectively.

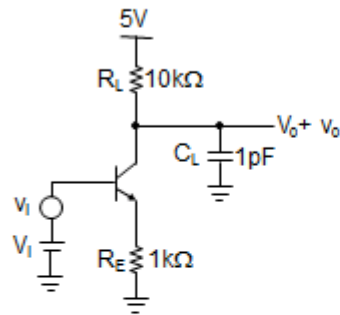
1. Using the same straight line, sketch the frequency response v_o/v_i on the above plot, and mark the low-frequency gain and the cut-off frequency.

2. Is the phase margin greater than 60° ? Explain why.

3. If $v_i(t) = \sin(10^6 t)$ in steady state, what is $v_o(t)$?

4. If the low-frequency output resistance of the opamp is $1\text{k}\Omega$, what is the low-frequency output resistance of this amplifier?

Problem #2



An emitter degenerated bipolar amplifier is shown with the input bias voltage V_i . The input and output small signals are marked as the low-case v_i and v_o , respectively. Use the followings: $kT/q = 25\text{mV}$, $V_{BE} = 0.7\text{V}$, $V_{CEsat} = 0.2\text{V}$.

1. What is the maximum bias voltage V_i to keep the transistor in the forward-active range of operation?
2. What is the DC bias voltage V_i to set the output DC voltage to be 3V?
3. Estimate the low-frequency small-signal voltage gain v_o/v_i in the above bias condition.
4. What is the -3dB bandwidth?