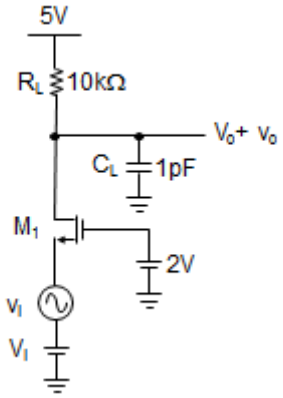
M.S. Comprehensive Exam Spring 2013
Electronic Circuits & Systems - ECE102

Note: Only numerical values approximated by hand calculations are valid answers.

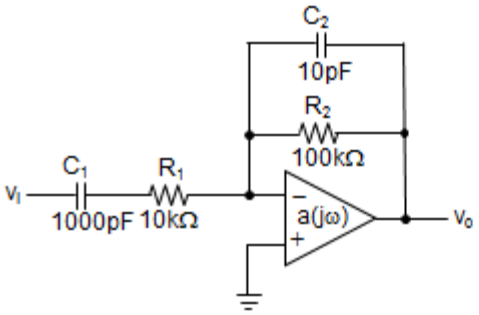
Problem #1:



In the CMOS amplifier shown above, answer with the following parameters: $\mu C_{ox} = 200\mu A/V^2$, $V_{th} = 0.4V$, and $W/L = 200$.

1. What is the nominal input voltage when the output DC voltage is 3V?
2. Estimate the low-frequency small-signal gain v_o/v_i when $V_o = 3V$.
3. Also estimate the –3dB small-signal bandwidth of this amplifier in Hz.
4. What is the minimum V_i to keep M_1 in saturation?
5. Sketch the DC transfer function of V_o vs. V_i for the input range from 0 to 2V.

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 100Hz and 10MHz.

1. Find 2 two frequencies where the gain is unity in Hz.
2. Sketch the Bode plots of the small-signal AC transfer function of $v_o(j\omega)/v_i(j\omega)$ in Hz.
3. When the AC input is $v_i(t) = \sin\{2\pi(50kHz)t\}$, write the equation of the output $v_o(t)$.
4. Estimate the frequency where the feedback loop gain becomes unity in Hz.
5. With C_2 removed, repeat the Question 4.