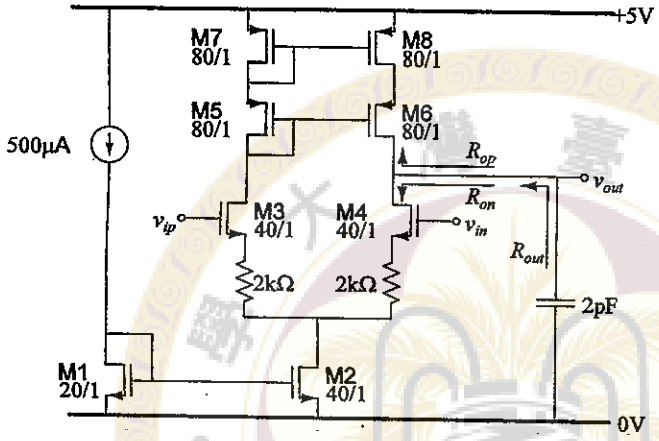
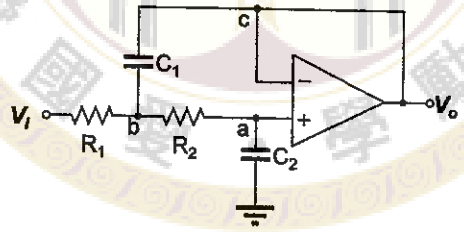
國立臺灣大學 102 學年度碩士班招生考試試題

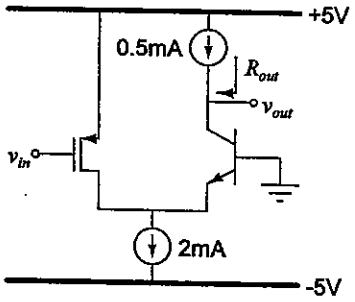
1. (50 分) For the following amplifier:
   (a) Find the slew rate of the amplifier. (10 分)
   (b) Find the output resistances R_{op}, R_{on}, and R_{out}. (30 分)
   (c) Find the small-signal voltage gain ($v_{out}/(v_{ip}-v_{in})$) (10 分)
   [Please ignore channel length modulation effect when calculating bias currents, assume all transistors are biased correctly in the saturation region, and assume $\mu_n C_{ox}=100\mu A/V^2$, $\mu_p C_{ox}=50\mu A/V^2$, $V_{tn}= -V_{tp} =0.5V$, and $\lambda=0.05V^{-1}$]



2. (30 分) The following circuit is a second-order low-pass filter. (a) Please find the transfer function [$V_o(s)/V_i(s)$] in terms of R_1, R_2, C_1, C_2, and s. (b) Assume $R_1=R_2=10k\Omega$, please find C_1 and C_2 such that the filter is a second-order butterworth low-pass filter with a 3-dB cutoff frequency of 2MHz.



3. (20 分) Please find the small-signal voltage gain (v_{out}/v_{in}) and output resistance (R_{out}) for the following circuit. [assume W/L=15, $\mu_p C_{ox}=50\mu A/V^2$, V_{tp} = -0.5V, $\lambda=0.05V^{-1}$ for the PMOS transistor and $|V_A|=50V$, $\beta=200$ for the NPN transistor]



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