EC 201: Problem Set 4

Note Title 9/11/2008

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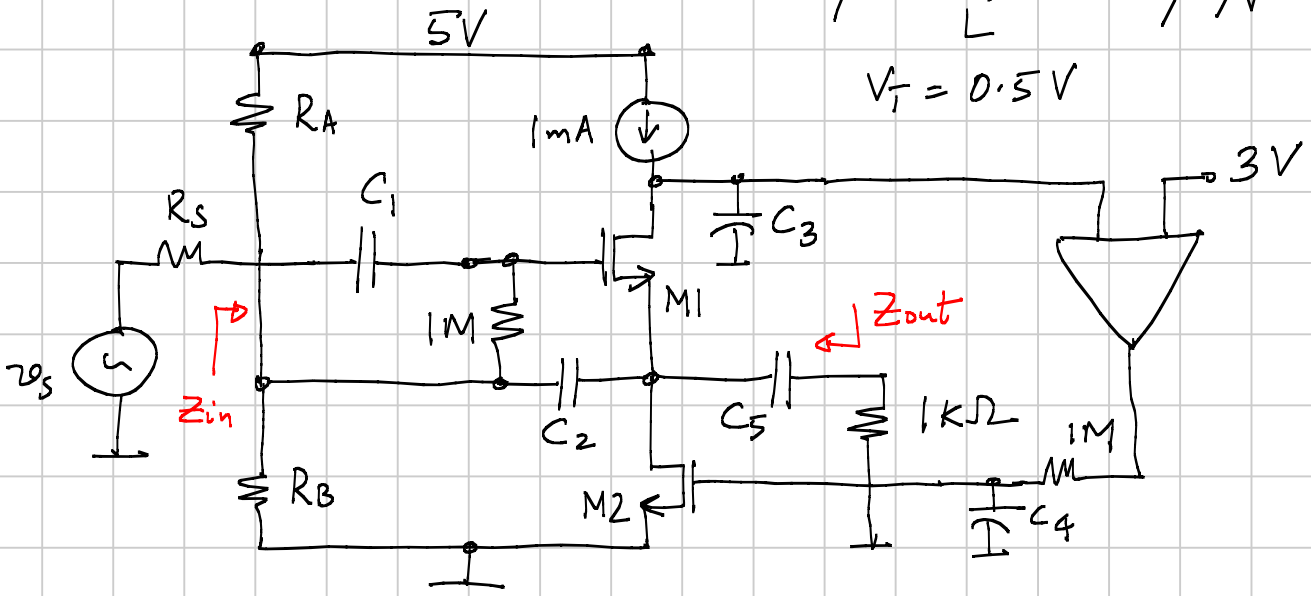
$\mu_n C_{ox} \frac{W}{L} = 50000\ \mu A/V^2$

$V_T = 0.5\ V$



The circuit above shows yet another way of stabilizing the operating point of a transistor. The opamp is ideal.

(a) Determine the signs on the opamp for DC negative feedback.

(b) Determine R_A & R_B so that the swing limits for positive and negative inputs are equal.

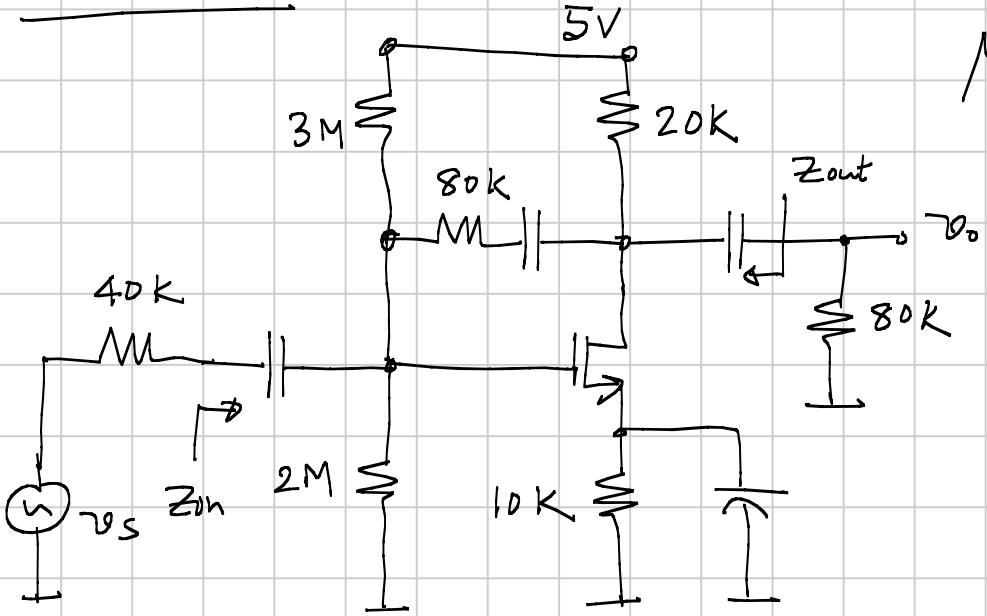
$R_A \| R_B$ must be $1M\Omega$.

Assume that the incremental voltage at the gate of M1 is v_s.

(c) Given the results in (b) above, determine Z_{in} & Z_{out}.

(d) Now, C_2 is removed. Calculate Z_{in} & Z_{out}. What do you notice?

Problem 2



$\mu_n C_{ox} \frac{W}{L} = 460\ \mu A/V^2$

$V_T = 0.5\ V$

(a) Determine the quiescent operating point of the transistor.

(b) Find the incremental gain $\frac{v_o}{v_s}$, Z_{in} & Z_{out}.

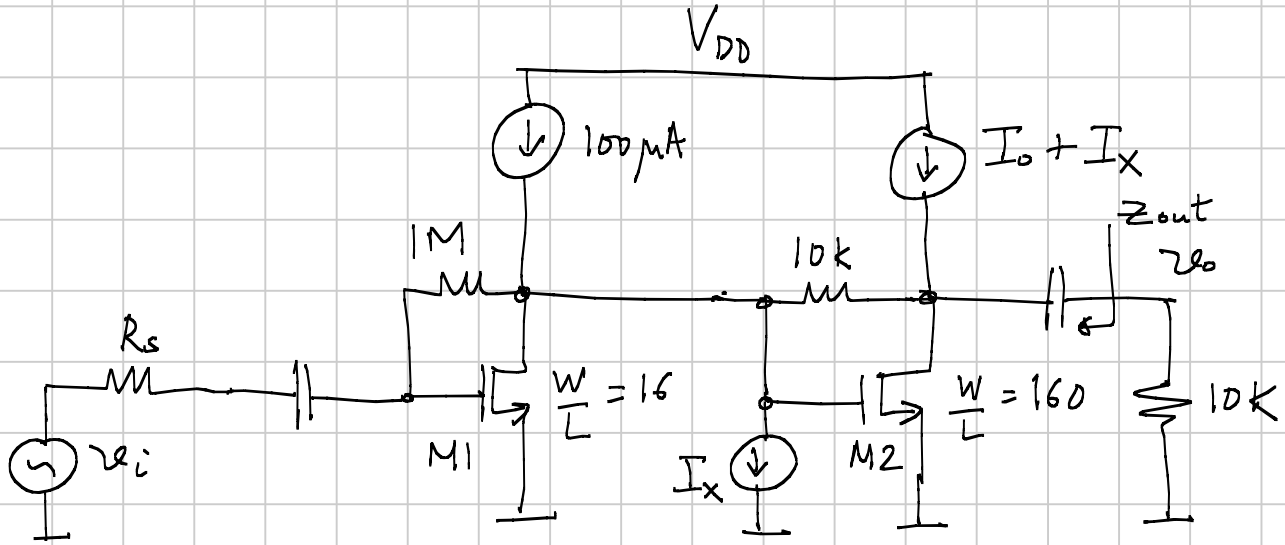
(c) Find the maximum amplitude permissible for the input sinewave, so that clipping is avoided.

(d) Repeat (b) if the 80K feedback

resistor is changed to 40 K.

What do you notice when you compare R_{in} & R_{out} with those obtained in part (b)?

Problem 3



$\mu_n C_{ox} = 200\ \mu A/V^2$

(a) Determine I_o so that the quiescent current through M_1 is 100 μA. What is the quiescent V_{DS} of M2 (in terms of I_x)?

(b) Find the incremental $\frac{R_o}{R_i}$ and R_{out}.

(c) Choose I_x so that the output just clips at both extremes. What is maximum permissible input amplitude?