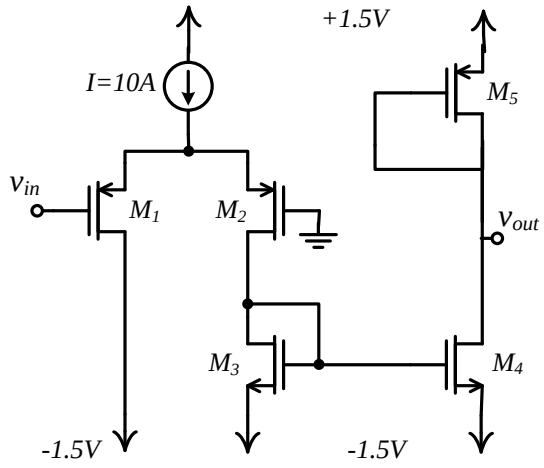
Student Name:

Student ID:

EHB262E Electronics II
Homework 2

Deadline: 29/11/2012 (before the lecture)



Voltage Amplifier

Transistor	L (µm)	W (µm)
M_1	1	20
M_2	1	20
M_3	1	10
M_4	1	10
M_5	1	1

Consider an integrated amplifier shown above. Assume that input and output DC operating points are both zero (ground level), and all MOSFETs are operating in saturation region. Transistors have the following parameters: $k_p'=\mu_p c_{ox}=16A/V^2$, $k_n'=\mu_n c_{ox}=70A/V^2$, $V_{An}= V_{Ap} =100V$, $V_{T0,p}=-0.8V$, $V_{T0,n}=1V$.

a) Calculate the small signal gain $\boldsymbol{v_{out}/v_{in}}$.

b) To verify your calculated result, find the small gain $\boldsymbol{v_{out}/v_{in}}$ using SPICE.

- Use AO6407 and AO6408 SPICE models for PMOS and NMOS transistors, respectively.
- Use a sine signal with 1mV peak-to-peak amplitude and 1kHz frequency as a small signal voltage source. Calculate $\boldsymbol{v_o/v_i}$ as a ratio of the corresponding sine signals' amplitudes.

c) Cascade two identical amplifiers each of which is same as the one shown (analyzed) above. Now calculate the gain of the new amplifier $\boldsymbol{v_o/v_i}$.

d) To verify your calculated result, find the gain of the new amplifier $\boldsymbol{v_o/v_i}$ using SPICE.

Grading: a) 30%, b) 40%, c)10%, d)20%

Note: *Do not forget to attach SPICE* ***output file*** *prints to your homework!*