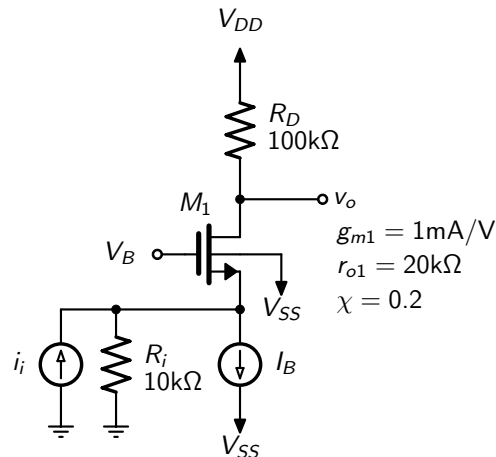


Problem Set 3C - Body Effect

Question 1

It is desired to create a voltage output from a small current source input (say from a photodetector). Shown below, the small current source input and its output impedance is shown as i_i and R_i , respectively. V_B is a dc bias voltage and assume the current source I_B is ideal.

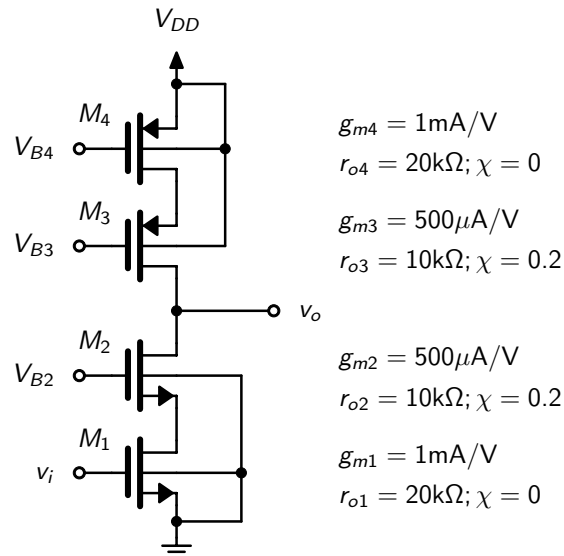


- (a) Find the small-signal gain, v_o/i_i assuming no body effect (in other words, $\chi = 0$).
 (b) Find the small-signal gain, v_o/i_i assuming $\chi = 0.2$.

Answer

- (a) $(v_o/i_i)_a = 63.64\text{k}\Omega$ (b) $(v_o/i_i)_b = 67.57\text{k}\Omega$

Question 2



For the circuit above

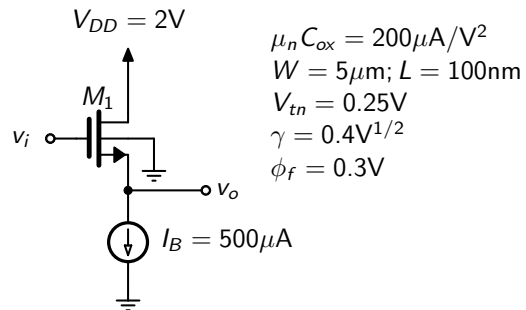
- (a) Find v_o/v_i ignoring body effect (all $\chi = 0$).
 (b) Find v_o/v_i including body effect where for $M2, M3$, $\chi = 0.2$.

Answer

(a) $(v_o/v_i)_a = -60\text{V/V}$ (b) $(v_o/v_i)_b = -70\text{V/V}$

Question 3

Consider the common-drain (or source follower) shown below.



- (a) Ignoring the body effect, find the voltage at v_o when $v_i = V_{DD}$
 (b) Repeat (a) but include the body effect and find the output voltage (an iterative approach is needed here).

Answer

(a) $v_{o,a} = 1.434\text{V}$ (b) $v_{o,b} = 1.205\text{V}$