

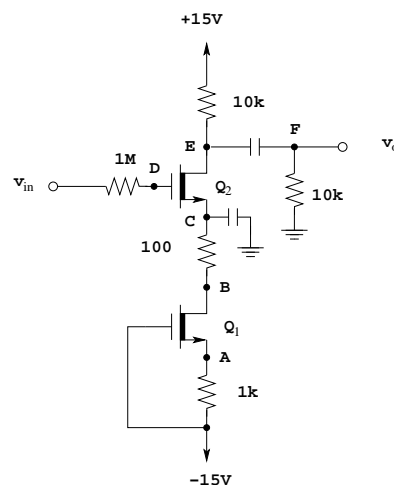
EE 321 - Exam 3

April 18, 1989

Name: _____

Closed book. One page of notes and a calculator are allowed. Show all work. Partial credit will be given. No credit will be given if an answer appears with no supporting work.

1. Consider the following circuit:

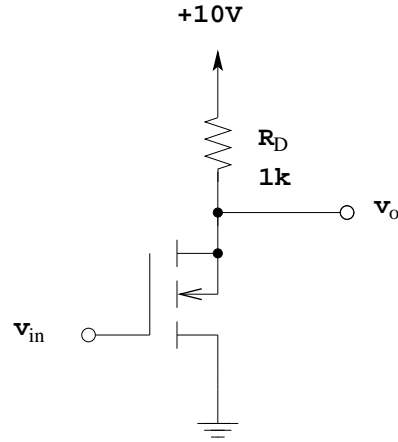


The MOSFET's are matched, and $k'_n(W/L) = 2 \text{ mA/V}^2$, and $V_t = -2 \text{ V}$. Ignore the output resistance r_o , and assume all capacitors are large (all AC signals are passed through, all DC signals are blocked).

- Find I_{D_1} , the drain current through Q_1 .
- What are the bias voltages V_A , V_B , V_C , V_D , V_E and V_F ?
- Draw the small-signal equivalent circuit for the amplifier.
- What is g_{m_2} , the transconductance of Q_2 ?
- What is the input resistance?
- What is the voltage gain v_o/v_i ?

2. For the following problem it is known that $V_t = 2 \text{ V}$ for the NMOS FET, but $k'_n(W/l)$ is not known.

- (a) Your lab partner builds the following circuit using the MOSFET, but the circuit fails to function. What mistake has been made, and how would you correct it?



- (b) After making the correction, you find that $V_o = 6 \text{ V}$ when $V_{in} = 4\text{V}$. Determine $k'_n(W/L)$ for the MOSFET.
- (c) The MOSFET is next used as a switch by changing R_D from $1 \text{ k}\Omega$ to $100 \text{ k}\Omega$. Find V_D when $v_{in} = 0 \text{ V}$, and and when $v_{in} = 4 \text{ V}$.

3. For the MOSFETs in the circuit below $k'_n(W/L) = 5 \mu\text{A}/\text{V}^2$, and $V_t = 2 \text{ V}$. Select R to obtain $V_o = 6 \text{ V}$. Neglect the effect of r_o .

