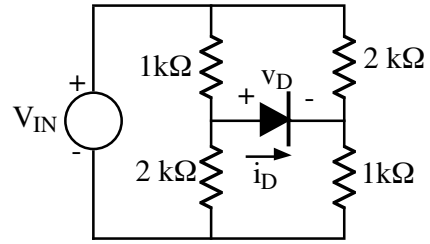


Homework Assignment No. 1

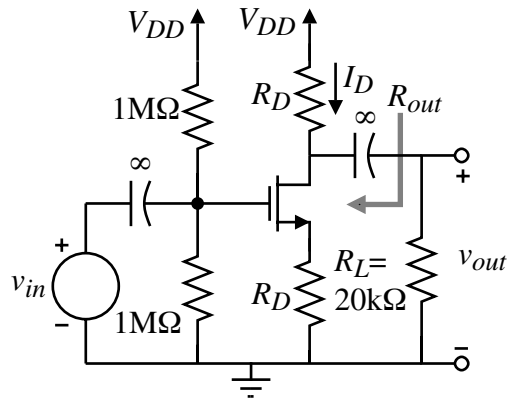
Due on Monday, January 13, 2003

1.) (a.) Find the dc current, I_{DQ} , and the dc voltage, V_{DQ} , of the diode in the circuit shown if V_{IN} is +10V. Assume the large signal model for the diode is a short circuit when $v_D \geq 0V$ and an open circuit when $v_D \leq 0V$. (b.) Repeat part (a.) if $V_{IN} = -10V$.

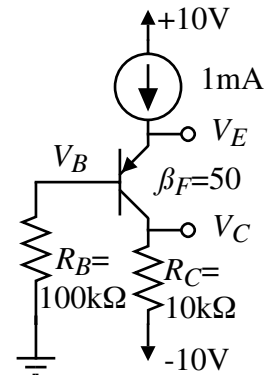


2.) An enhancement NMOS amplifier is shown. The following questions are independent of each other (i.e. the answer of one is *not* used in the next question).

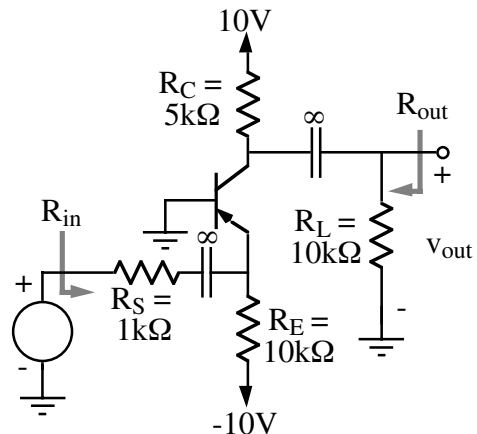
- (a.) If $I_D = 0.5mA$ and $K = 0.5mA/V$, find g_m .
- (b.) If $g_m = 0.5mA/V$ and $r_o = \infty$, find an algebraic expression for R_{out} and $A_v = v_{out}/v_{in}$.
- (c.) Design R_D and R_S to give $R_{out} = 20k\Omega$ and $A_v = -10V/V$ if $g_m = 2mA/V$ and $r_o = \infty$.



3.) A pnp BJT circuit is shown. (a.) Find the dc values of I_E , I_C , I_B , V_E , V_C and V_B if $\beta = 50$ and $V_{EB(on)} = 0.65V$. (b.) For what value of R_C does the BJT become saturated? (Recall that saturation of a BJT corresponds to the *BE* and *BC* junctions forward biased.)

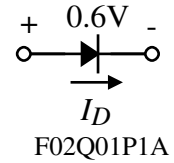


4.) For the transistor shown, $\beta = 100$, $r_{\pi} = 2.5k\Omega$, and $g_m = 0.04S$. Draw the small signal model and find the numerical values of the small signal voltage gain, v_{out}/v_{in} , the input resistance, R_{in} , and the output resistance, R_{out} .

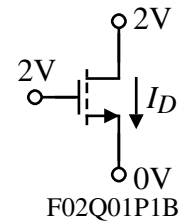


5.) The following questions give the dc voltages at the terminals of an active device. You are to calculate the designated dc current.

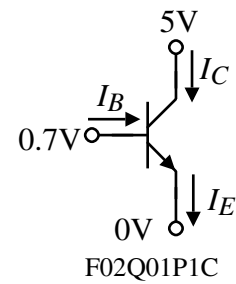
a.) Find the diode current, I_D , where $I_S = 100\text{fA}$ and $V_T = 0.025\text{V}$ (2 pts).



b.) Find the drain-source current, I_{DS} , where $K_n' = 25\mu\text{A}/\text{V}^2$, $V_{TN} = 1\text{V}$ and $W/L = 10$ (2 pts).



c.) Find the collector, emitter, and base currents, I_C , I_E , and I_B if $I_S = 100\text{fA}$, $V_T = 0.025\text{V}$ and $\beta_F = 100$ (4 pts).



d.) Repeat (b.) if $V_D = 1\text{V}$ and $V_G = 3\text{V}$ (2 pts).