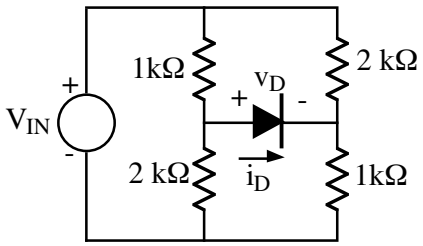
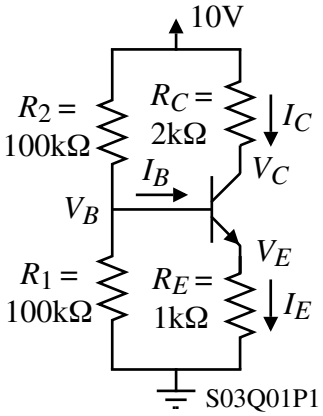
Homework Assignment No. 1

Due on Monday, August 23, 2004

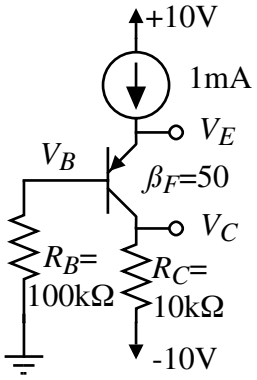
1.) (a.) Find the dc current, I_{DQ}, and the dc voltage, V_{DQ}, of the diode in the circuit shown if V_{IN} is +10V. Assume the large signal model for the diode is a short circuit when $v_D \geq 0$V and an open circuit when $v_D \leq 0$V. (b.) Repeat part (a.) if V_{IN} = -10V.



2.) If β_F = 100 and V_{BEQ} = 0.6V, solve for the dc values of I_B, I_C, I_E, V_B. V_C. and V_E of the transistor circuit shown.



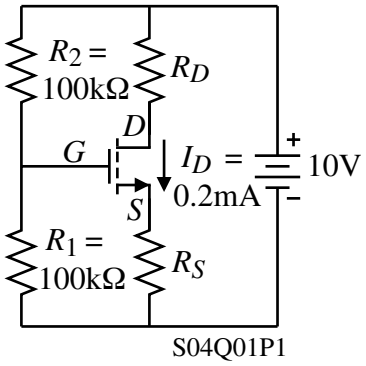
3.) A pnp BJT circuit is shown. (a.) Find the dc values of I_E, I_C, I_B, V_E, V_C and V_B if β = 50 and V_{EB}(on) = 0.65V. (b.) For what value of R_C does the BJT become saturated? (Recall that saturation of a BJT corresponds to the *BE* and *BC* junctions forward biased.)



4.) The NMOS transistor shown has the parameters of K_n = 1mA/V^2, V_{TN} = 1V and λ_N = 0V^{-1}. In saturation, the large signal model is $i_D = 0.5K_n(v_{GS}-V_T)^2$.

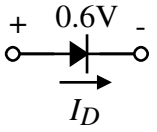
a.) Assume the NMOS transistor is saturated and find the value of R_S that gives a drain current of 0.2mA.

b.) What value of R_D will cause the MOSFET to go from the saturation to the active region when I_D = 0.2mA?



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 = 100fA and V_T = 0.025V (2 pts).



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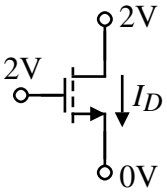
b.) Find the drain-source current, I_{DS}, where $K_n' = 25\mu A/V^2$, V_{TN} = 1V and W/L = 10 (2 pts).



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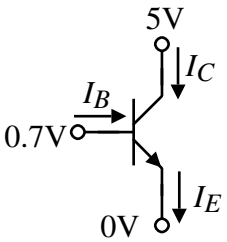
c.) Find the collector, emitter, and base currents, I_C, I_E, and I_B if I_S = 100fA, V_T = 0.025V and β_F = 100 (4 pts).



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d.) Repeat (b.) if V_D = 1V and V_G = 3V (2 pts).