COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electronics and Communications Engineering

Course Title: Electronic Devices I I

Course Code: EC332

Cairo Branch

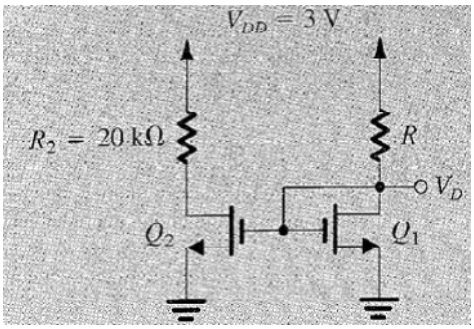
Sheet 4

P1 - Consider the circuit shown below, I_{DQ1} of 80 uA , V_t = 0.6V, $\mu_n C_{ox}$ = 200 μA/V^2 , L = 0.8 μm and W = 4 μm , the drain voltage of Q_1 designed to be 1V and applied to the gate of Q_2, assume the two transistors are identical (Assume $\lambda = 0$).

Find:

a) The drain current of Q_2.

b) The drain voltage of Q_2.

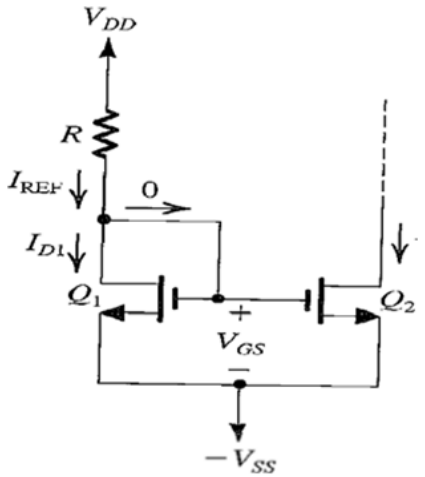


P2 - Using two transistors Q_1 and Q_2 having equal length but widths related by W_2/W_1 = 5, Design the circuit shown on figure 2 to obtain I = 0.5 mA. Let V_{DD}= V_{SS}=5, $(\mu_n C_{ox} W/L)_{Q1}$ = 0.8 mA/V^2, V_t = 1V and $\lambda = 0$.

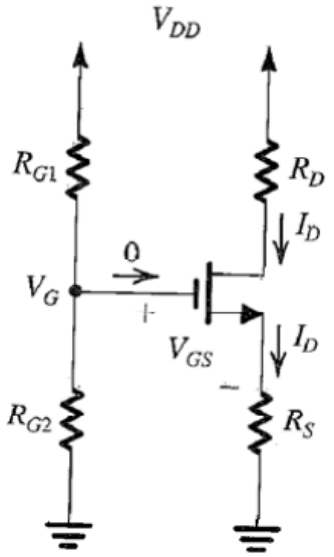
a) Find the required value for R.

b) What is the voltage at the gates of Q_1 and Q_2?

c) What is the lowest voltage allowed at the drain of Q_2 while Q_2 remains in the saturation region?

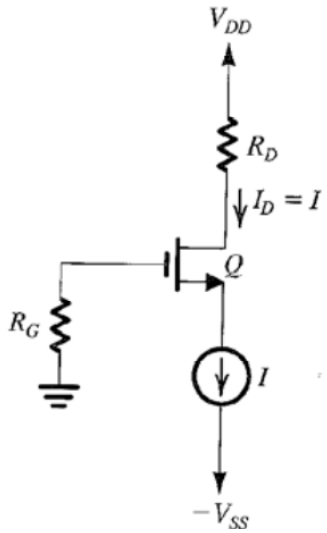


P3 - Consider the circuit shown below. Using a 15v supply, V_t=l.2V, $\lambda = 0$, K_n'=80 $\mu A/V^2$, W = 240 μm and L = 6 μm. Arrange that the drain current is 2 mA, with about one third of the supply voltage across R_S and R_D. Use 22 MΩ for the larger of R_{G1} and R_{G2}.
What are the values of R_{G1}, R_{G2}, R_S and R_D that you have chosen? Specify them to two significant digits.
For your design, how far is the drain voltage from the edge of Saturation?



P4 - For the circuit shown below with I=1mA, R_G=0, R_D=5k and V_{DD}=10V, consider the behavior in each following two cases. In each case, find the voltages V_S, V_D and V_{DS} that results for each cases:

a) V_t=1V K_n'(W/L)=0.5mA/V^2.
b) V_t=2V K_n'(W/L)=1.25mA/V^2.



P5 - As shown in figure below, using a 6V supply with an NMOS transistor for which V_t=1.2V, K_n'(W/L)=3.2mA/V^2 and λ=0, provide a design which biases the transistor at I_D=2mA with V_{DS} larger enough to allow saturation operation for a -2V negative signal swing at the drain.
Use 22MΩ as the largest resistor in the feedback bias network.
What values of R_D, R_{G1} and R_{G2} have you chosen? Specify all resistors to two significant digits.