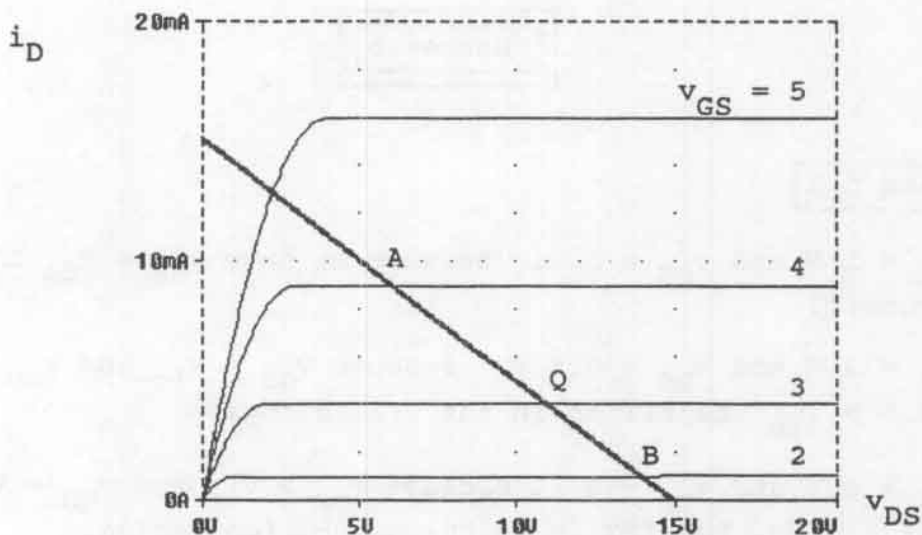


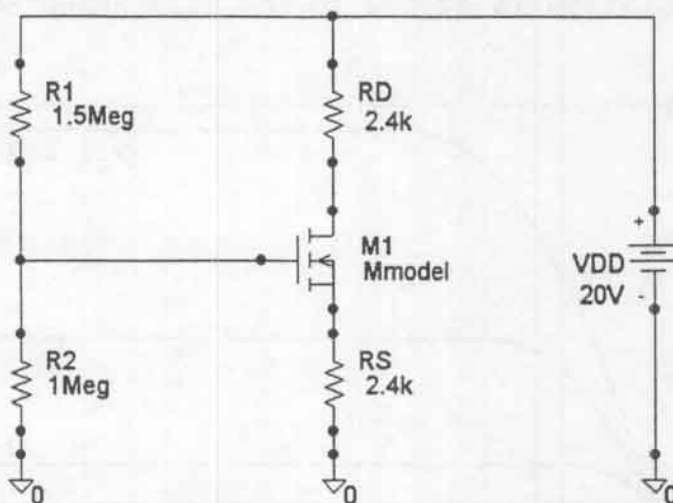
Exercise 5.3

The characteristics and the load line are shown on the next page. The simulation is stored in the file named Exer5_3.



For $v_{in} = +1$ we have $v_{GS} = 4$ and the instantaneous operating point is A. Similarly for $v_{in} = -1$ we have $v_{GS} = 2$ V and the instantaneous operating point is at B. We find $V_{DSQ} \cong 11$ V, $V_{DSmin} \cong 6$ V, $V_{DSmax} \cong 14$ V.

Exercise 5.4



The analysis is similar to Example 5.3 in the book.

$$K = \left(\frac{W}{L} \right) \frac{KP}{2} = 1 \text{ mA/V}^2$$

$$V_G = V_{DD} \frac{R_2}{R_1 + R_2} = 20 \frac{1}{(1.5 + 1)} = 8 \text{ V}$$

$$V_{GSQ}^2 + \left(\frac{1}{R_{SK}} - 2V_{to} \right) V_{GSQ} + (V_{to})^2 - \frac{V_G}{R_{SK}} = 0$$

After values are substituted, we have

$$V_{GSQ}^2 - 3.583V_{GSQ} + 0.6667 = 0$$

Solving we find $V_{GSQ} = 3.39 \text{ V}$. (The second root is extraneous and should be discarded.) Then we have

$$I_{DQ} = K(V_{GSQ} - V_{to})^2 = 1.92 \text{ mA}$$

$$V_{DSQ} = V_{DD} - (R_D + R_S)I_{DQ} = 10.8 \text{ V}$$

Exercise 5.5

We should choose $R_D = 0$ for a source follower. Many values will work for the other resistors. A reasonable set of values is $R_S = 3.9 \text{ k}\Omega$, $R_1 = 1 \text{ M}\Omega$, and $R_2 = 2 \text{ M}\Omega$. These values yield $I_{DQ} = 1.98 \text{ mA}$ and $V_{DSQ} = 7.26 \text{ V}$. Use SPICE to check that your design provides a Q-point close to the desired value.