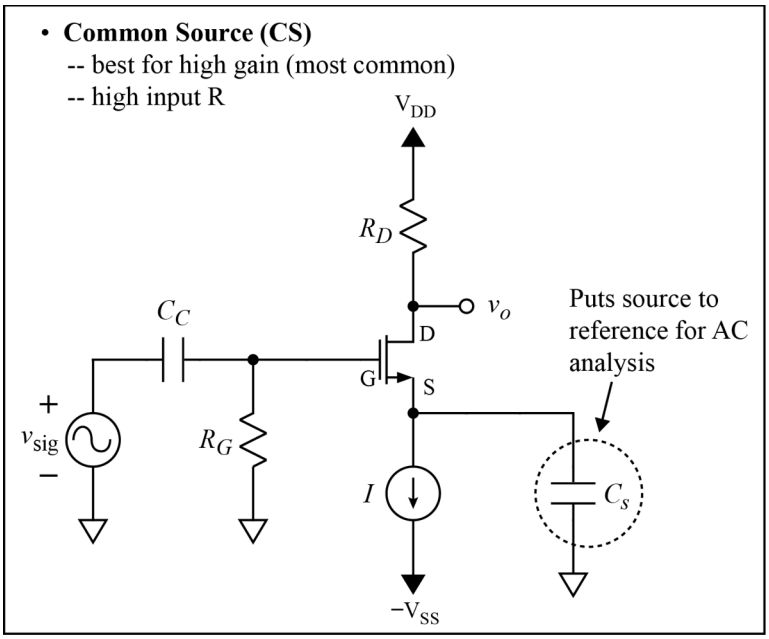
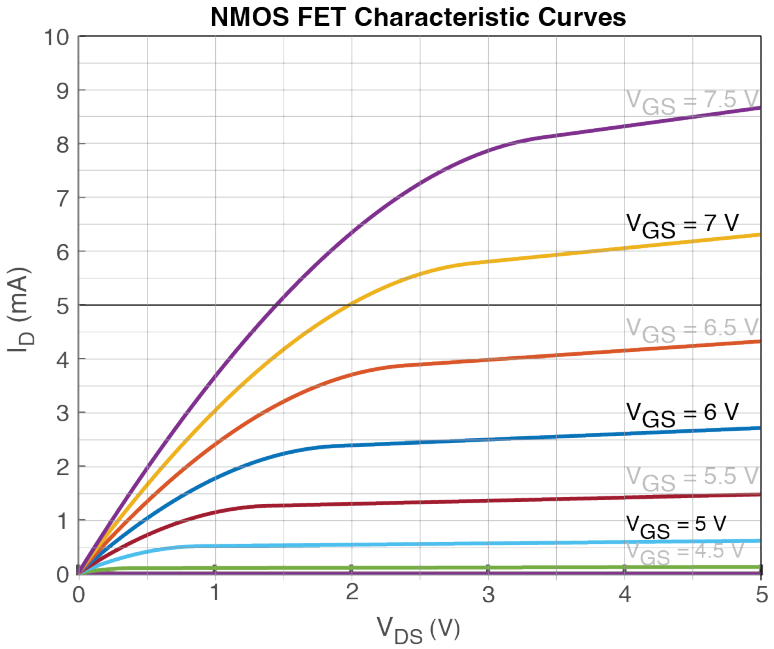
INFO:



PROB: Find the DC operating point of the circuit.

$V_{DD} = 5\text{V}$, $-V_{SS} = -8\text{V}$, $I = 5\text{mA}$, $R_G = 100\ \text{k}\Omega$, $R_D = 2\ \text{k}\Omega$



SOLN: The capacitors, C_C and C_S, act like open circuits for DC, so we may ignore the capacitors and v_{sig}. We have the following additional information:

$V_{DD} = 5\text{V}$, $-V_{SS} = -7\text{V}$, $I = 5\text{mA}$, $R_G = 100\ \text{k}\Omega$, $R_D = 2\ \text{k}\Omega$.

The current source dictates that $I_D = I = 5\,\text{mA}$. Since I_D flows in R_D, and since $V_{DD} = 5\,\text{V}$, we have

$$V_D = V_{DD} - I_D R_D = 5\,\text{V} - 5\,\text{mA} \cdot 2\,\text{k}\Omega = -5\,\text{V}.$$

Since no current flows in R_G, the gate voltage is $0\,\text{V}$.

$$V_G = 0\,\text{V}$$

That means V_S will become whatever voltage is necessary to cause $I_D = I = 5\,\text{mA}$. The line for $I_D = I = 5\,\text{mA}$ is shown as a dashed line across the characteristic curves. The operating point must lie on this line. But where?

Since we know V_G and V_D, and since V_S is the same for both, we can say that we have the following relationship between V_{GS} and V_{DS}:

$$V_G - V_D = 0\,\text{V} - -5\,\text{V} = 5\,\text{V} = V_{GS} - V_{DS}.$$

Points on the characteristic curves where $V_{GS} - V_{DS} = 5\,\text{V}$ are marked by green dots and line fit on the characteristic curves. The solution must also lie on this line.

The operating point is marked with a circle on the characteristic curves below.

