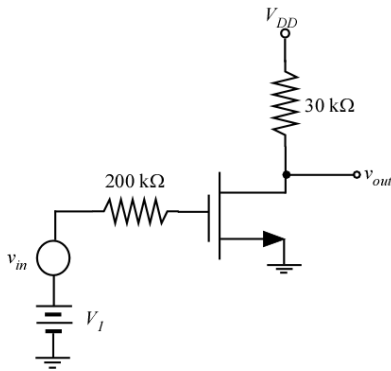
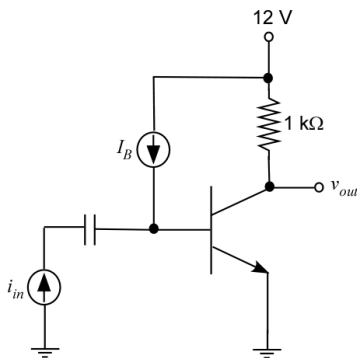


1. Assume that $g_m = 3 \text{ mA/V}$, $r_{ds} = 100 \text{ k}\Omega$, $C_{gs} = 1 \text{ pF}$, $C_{gd} = 0.5 \text{ pF}$, and $V_{DSQ} = 6 \text{ V}$ for the MOSFET of the circuit. The input voltage is a positive-going 20-mV step function.

- Calculate the time constant, τ , and sketch the output voltage with time showing values of voltage levels.
- If the circuit is now driven with a small sinusoidal input signal, what is the upper corner frequency of the circuit, f_{high} ?
- How do τ and f_{high} relate to each other?



2. The BJT shown in the figure is an abrupt junction BJT with $\omega_b = 6.28 \times 10^6 \text{ rad/s}$, $\beta = 70$, and $C_{\mu} = 20 \text{ pF}$ at $V_{CB} = 6 \text{ V}$. Assuming that $\psi_o = 0.8 \text{ V}$, find the bandwidth of v_{out}/i_{in} when $I_E = 1 \text{ mA}$.



3. Assuming that f_{β} is defined as the frequency at which the short-circuit base-to-collector current gain is down 3 dB from the midband value and that f_{i_c} is defined as the frequency at which this gain is equal to unity, prove that

$$f_t = \beta \times f_\beta$$

4. The BJT in the circuit shown in the figure has the following parameters: $\beta = 100$, $r_x = 100 \Omega$, $V_{BE} = 0.6 \text{ V}$, $f_t = 10^7 \text{ Hz}$, and $C_{\mu} = 10 \text{ pF}$ at the bias point used. Calculate the midband voltage gain and the upper corner frequency of the circuit. Neglect the loading effect of the bias resistors.

