#1- Design a common-emitter amplifier with output impedance 10KΩ and a gain of 100 using a transistor of β=200 and a 24V power supply.

\[ V_{cc}=+24V \]

Output impedance = \( RC = 10K\Omega \)

Choose \( V_C = \frac{V_{cc}}{2} \) so the amplifier has +12V swing

\[ i_C = (24-V_C)/R_c = 12/10K = 1.2 \text{ mA} \]

For a gain = -100 choose \( R_c/R_E = 100 \) or \( R_E = 100\Omega \)

Determine the base voltage for biasing R1 and R2-

\[ V_B = V_E + 0.6V = 0.72V \]

Choose \( R_2 = 10 \times R_E \) satisfying \( \beta R_E \gg (1/R_1 + 1/R_2)^{-1} \).

This limits the bias current through the base. We want the input signal current to dominate the base bias current!

\[ R_2 = 1K\Omega \]

\[ i_2 = V_B/R_2 = 0.72V/1000\Omega = 0.72mA \]

\[ i_B = i_C/\beta = 1.2mA/200 \sim 0.01mA \]

\[ i_1 = i_B + i_2 = 0.73mA \]

\[ R_1 = \frac{(V_{cc}-V_B)}{i_1} = 32K\Omega \]

#2- Design an emitter-follower with input impedance of 1 MΩ using a β=500 transistor. If a 300 Ω signal generator is driving the circuit, what is the output impedance?

\[ V_{cc} = 12V \]

\[ R_E = \frac{R_{in}}{\beta} = \frac{1e6}{500} = 2000 \Omega \]

\[ R_{out} = \frac{R_{source}}{\beta} = \frac{300}{500} = 0.6 \Omega \]