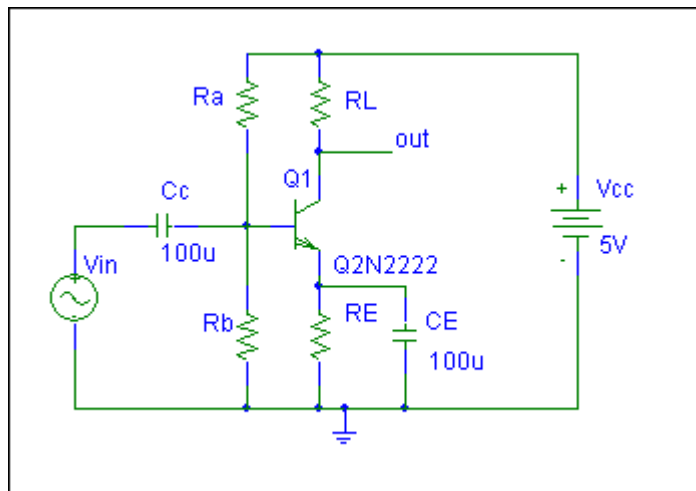


1. 50 points (amplifier response)

For the following amplifier assume the 2N2222 is biased at  $I_C=10.5\text{mA}$ ,  $V_{CE}=2\text{V}$  and  $I_B=60\mu\text{A}$  (as done in class). Check on Spice that this bias holds and if not recalculate  $R_a$  &  $R_b$  so that it does. Then run transient analysis with  $v_{in}$  a sine wave of  $1\text{mV}$  amplitude first at  $1\text{KHz}$  and then at  $100\text{MEGHHz}$ . Compare the outputs including amplitude and phases. Then repeat with a lower  $R_b$  of  $100\text{KOhm}$  keeping the bias as above.



2. 50 points (current mirror)

For the following BJT current mirror using 2N3904 transistors choose  $R$  for a design of an input current  $I_{in}$  of  $3\text{mA}$  in  $R$  (calculate first using  $V_{BE}=0.7\text{V}$  and then refine by running Spice; record both values of  $R$ ). For  $I_{in}=3\text{mA}$  calculate the theoretical output current when  $V_{out\_ideal} = V_{cc}-RI_{in}$  as well as for all  $V_{out}$  in the range

$$V_{out\_ideal} \leq V_{out} \leq V_{cc}.$$

Then run Spice and compare the Spice  $I_{out}$  results with your theoretical calculations.

