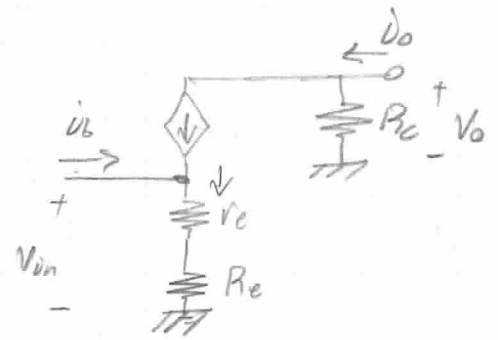
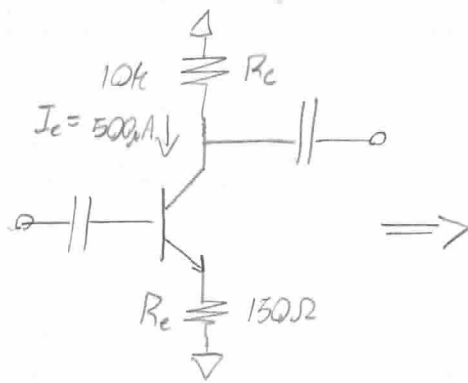


P 6.117



$$R_{in} = \frac{V_{in}}{i_{in}} = (\beta+1)(R_e + r_e) = 101 \cdot (150 + 51.16\Omega) = 20.3172 K \approx 20k\Omega$$

$$i_{in} = i_b = \frac{i_e}{\beta+1} = \frac{V_{in}}{(\beta+1)(R_e + r_e)}$$

$$r_e = \frac{V_T}{I_E} = \frac{V_T}{I_C} = \frac{\beta+1}{(1+\beta)I_C} \approx 51.16\Omega$$

$$V_T = \frac{kT}{q} = \frac{300 \cdot 8.612 \cdot 10^{-5} \text{ eV/K}}{1e} = 25.836 \text{ mV}$$

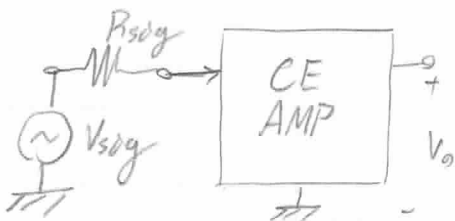
$$\approx 26 \text{ mV}$$

$$R_o = \frac{V_o}{i_o} = \left(\frac{V_o}{R_c} + \beta i_b \right) \Big|_{i_b=0} = \frac{V_o}{V_o/R_c + 0} = R_c$$

$$A_{vo} = \frac{V_o}{V_{in}} \Big|_{R_L=\infty} = -\beta i_b R_c / V_{in} = \frac{-\beta R_c}{V_{in}} \left(\frac{V_{in}}{(\beta+1)(R_e + r_e)} \right) = \frac{-\beta R_c}{R_{in}} = -49.219 \text{ V/V}$$

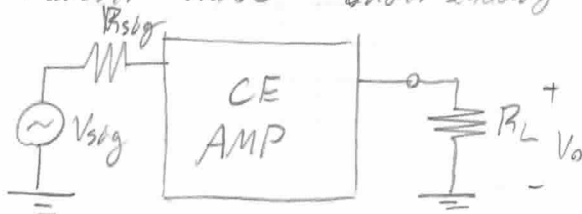
Extra

Observe V_o of V_{sig}



$$V_o = A_{vo} \cdot V_{sig} \frac{R_{in}}{R_{sig} + R_{in}}$$

Further note under loading



$$[V = \left(\frac{R_L}{R_o + R_L}\right) \left(\frac{R_{in}}{R_{sig} + R_{in}}\right) \cdot V \quad \text{Unit check}]$$

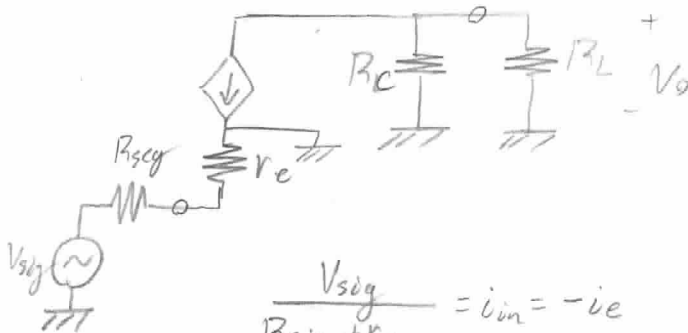
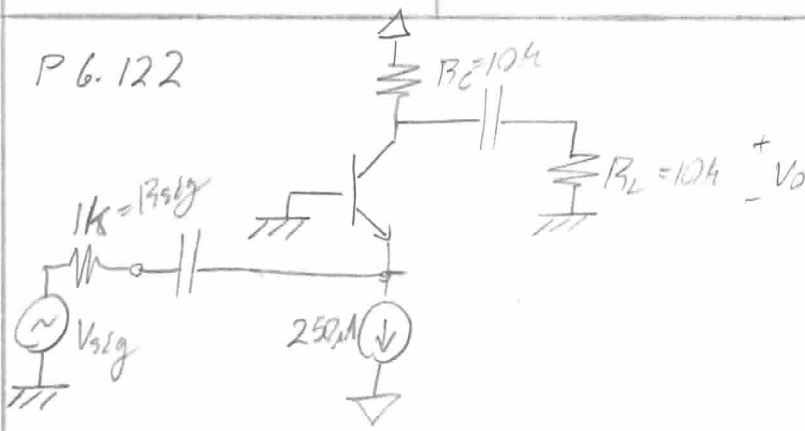
$$V_o = \left(\frac{R_L}{R_o + R_L}\right) A_{vo} \left(\frac{R_{in}}{R_{sig} + R_{in}}\right) \cdot V_{sig}$$

Output Matching

Amp Gain

Input Matching

P 6.122



$$\frac{V_{sig}}{R_{sig} + r_e} = i_{in} = -i_e$$

$$\alpha i_e = i_c$$

$$V_o = -i_c (R_L \parallel R_C)$$

$$V_o = \alpha (R_L \parallel R_C) \frac{V_{sig}}{R_{sig} + r_e} \Rightarrow$$

$$G_V = \frac{\alpha (R_L \parallel R_C)}{R_{sig} + r_e} \approx \frac{5k}{10.1k} \approx \underline{\underline{4.545 \text{ V/V}}}$$

$$r_e = \left(\frac{V_T}{\alpha I_E} \right) \approx \frac{25}{.25} \approx 100$$

$$V_{be} \text{ limit } 10 \text{ mV} \Rightarrow V_{sig} \frac{r_e}{R_{sig} + r_e} \leq 10 \text{ mV}$$

$$V_{sig} \text{ max} = 10 \cdot \frac{10.1k}{0.1k} = \underline{\underline{110 \text{ mV}}}$$

$$V_o \text{ max} = G_V \cdot V_{sig} = \underline{\underline{500 \text{ mV}}}$$

AMTAD