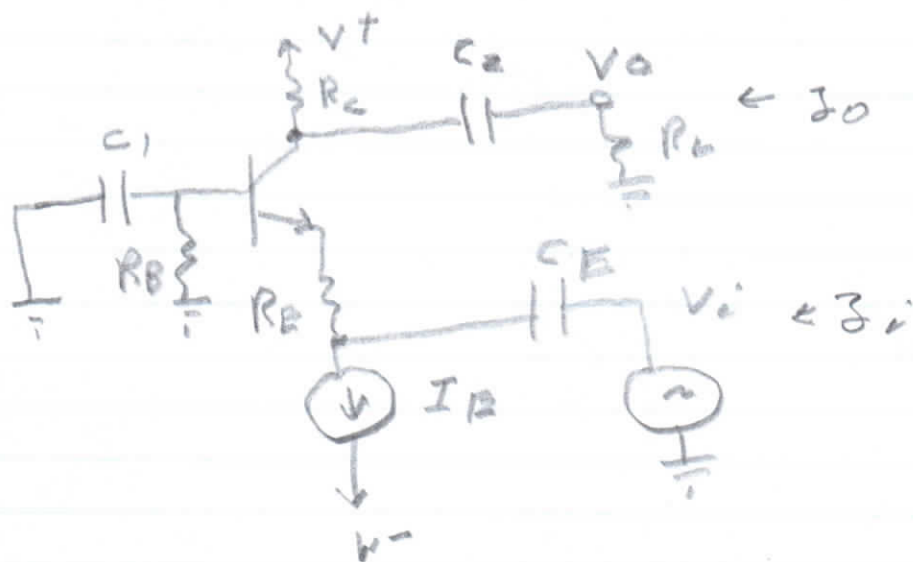
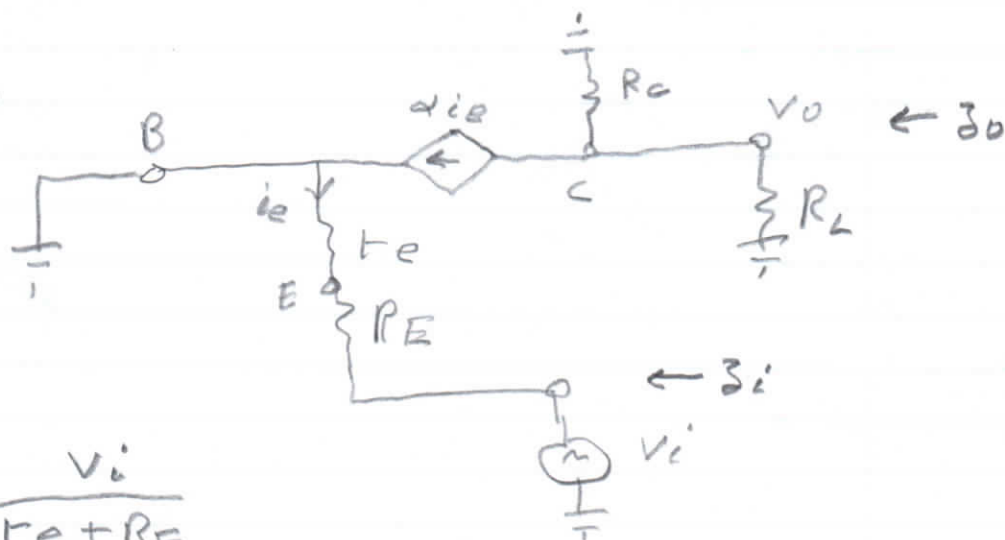


Common Base



Small signal model



$$i_e = - \frac{V_i}{r_e + R_E}$$

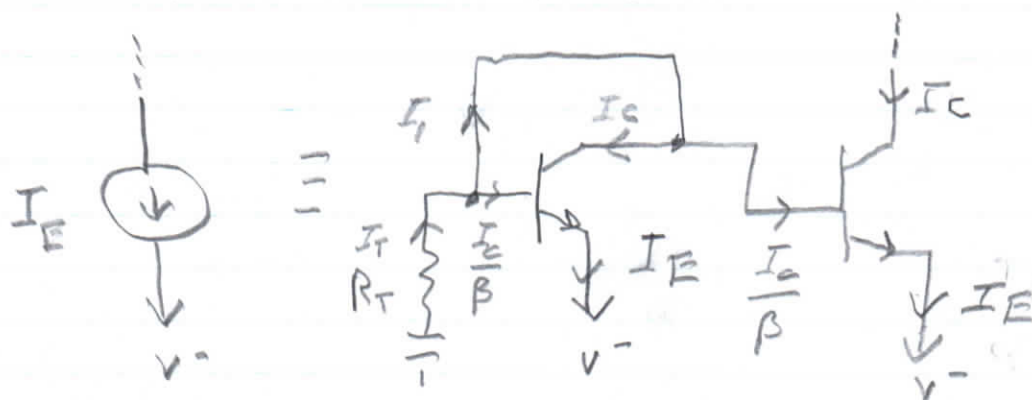
$$V_o = -\alpha i_e R_C \parallel R_L$$

$$T = +\alpha \frac{R_C \parallel R_L}{r_e + R_E}$$

$$Z_i = R_E + r_e$$

$$Z_o = R_C$$

Transistor Current Source



Transistors are matched have same V_{BE} so I_C & I_E equal for both.

$$I_1 = I_C + \frac{I_C}{\beta} \quad I_T = I_1 + \frac{I_C}{\beta}$$

$$I_T = I_C + 2 \frac{I_C}{\beta} \quad I_T = - \frac{V_R}{R_T}$$

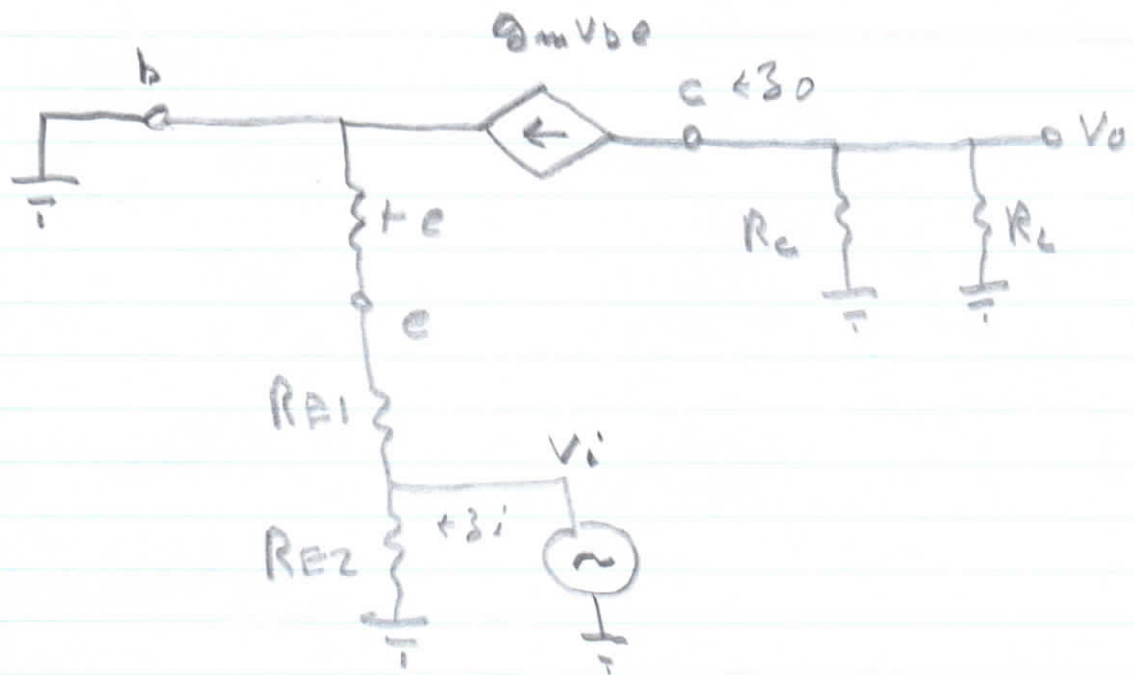
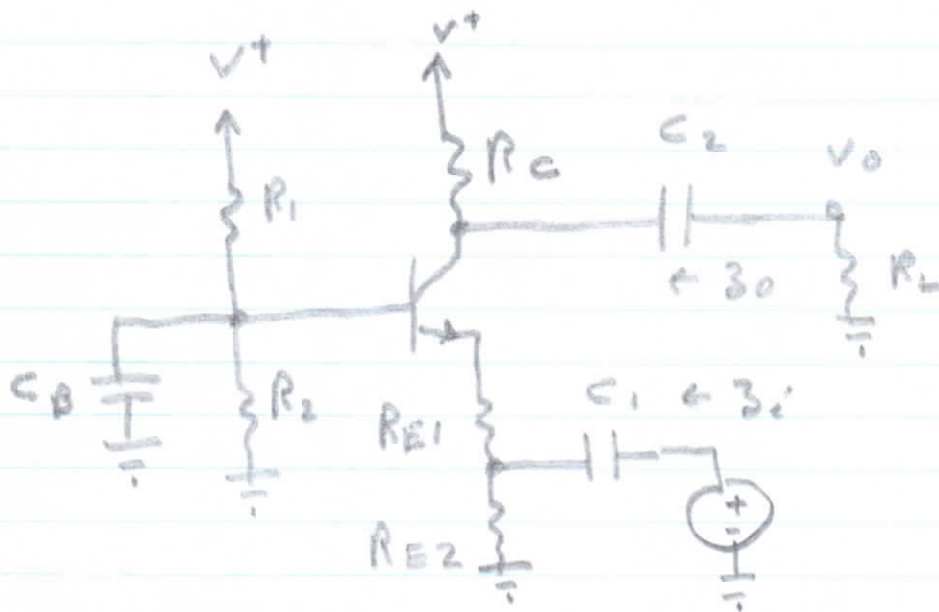
$$V_B - V_E = V_B - V^- = V_{BE} \Rightarrow V_R = V^- + V_{BE}$$

$$I_T = \left(1 + \frac{2}{\beta}\right) I_C = \frac{V^- + V_{BE}}{R_T}$$

$$R_T = - \frac{[V^- + V_{BE}]}{\left(1 + \frac{2}{\beta}\right) I_C}$$

Specify I_C and compute R_T .

Common Base

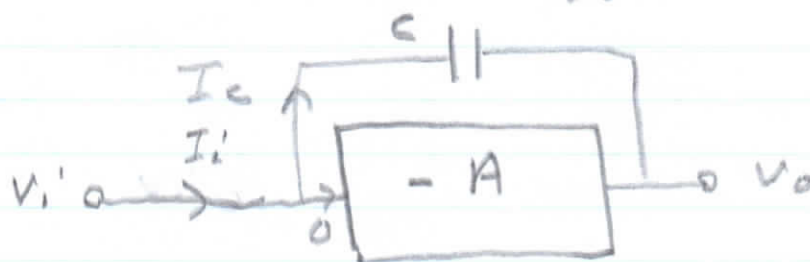


$$V_{be} = -v_i \frac{r_e}{r_e + R_{E1}}$$

$$T(\omega) = \frac{V_o}{V_i} = -R_C \parallel R_L \left(-\frac{r_e}{r_e + R_{E1}} \right) g_m = \alpha \frac{R_C \parallel R_L}{r_e + R_{E1}}$$

$$Z_i = R_{E2} \parallel (R_{E1} + r_e) \quad Z_o = R_C$$

Miller Effect



$$v_o = -A v_i$$

$$I_c = \frac{v_i - v_o}{\frac{1}{sC}} = sC [v_i - v_o]$$

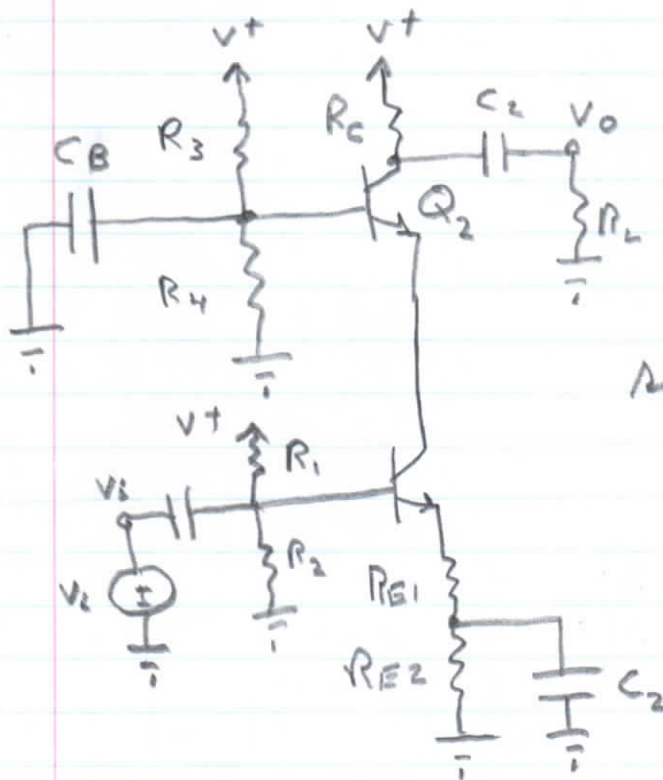
$$I_c = sC [v_i + A v_i] = (A+1) sC v_i$$



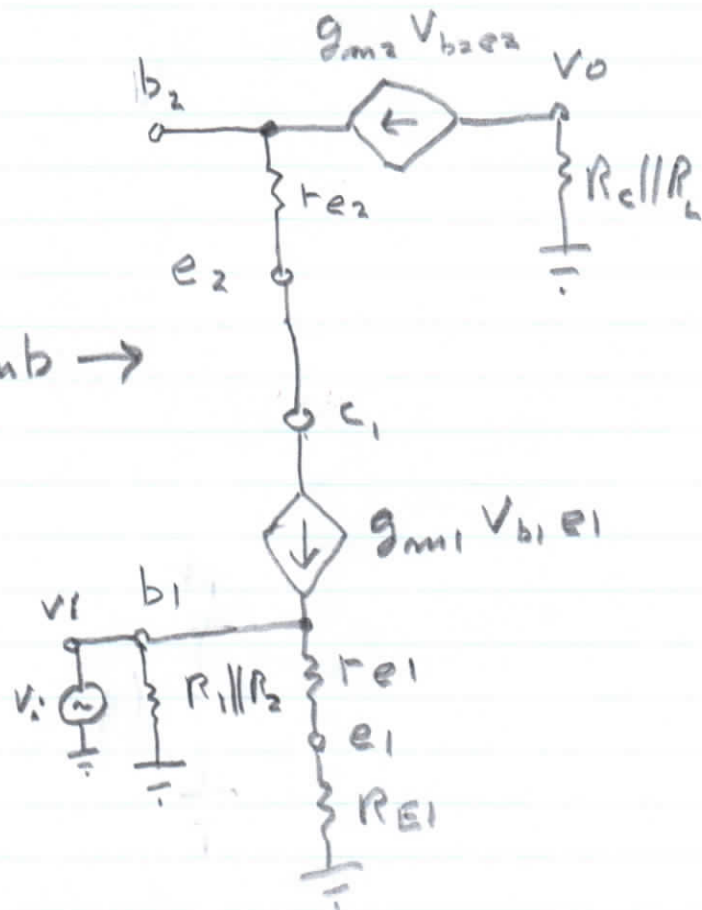
Limits Bandwidth

$$I_c = \frac{(A+1) sC}{-A} v_o = -\left[1 + \frac{1}{A}\right] sC v_o$$

Cascode Amplifier



Small-signal model →



$$v_{be1} = \frac{r_{e1} v_i}{r_{e1} + R_{E1}}$$

$$i_{c1} = \frac{g_{m1} r_{e1}}{r_{e1} + R_{E1}} v_i \quad v_{be2} = r_{e2} i_{c1}$$

$$v_{be2} = \frac{r_{e1} r_{e2} g_{m1}}{r_{e1} + R_{E1}} v_i$$

$$T(s) = \frac{v_o}{v_i} = -g_{m2} v_{be2} R_{c1} \parallel R_L$$

$$= \frac{g_{m1} r_{e1} g_{m2} r_{e2}}{r_{e1} + R_{E1}} \cdot R_{c1} \parallel R_L =$$

$$= \alpha_1 \alpha_2 \frac{R_{c1} \parallel R_L}{r_{e1} + R_{E1}}$$