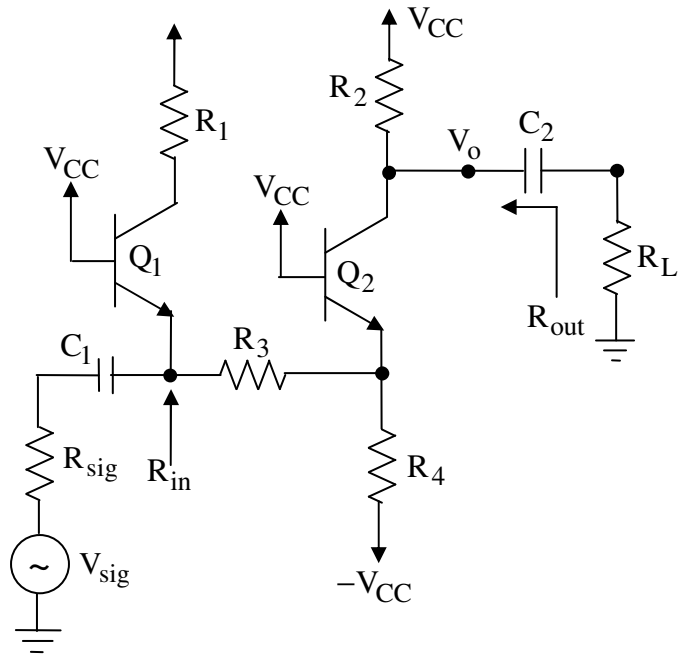


Common-Base

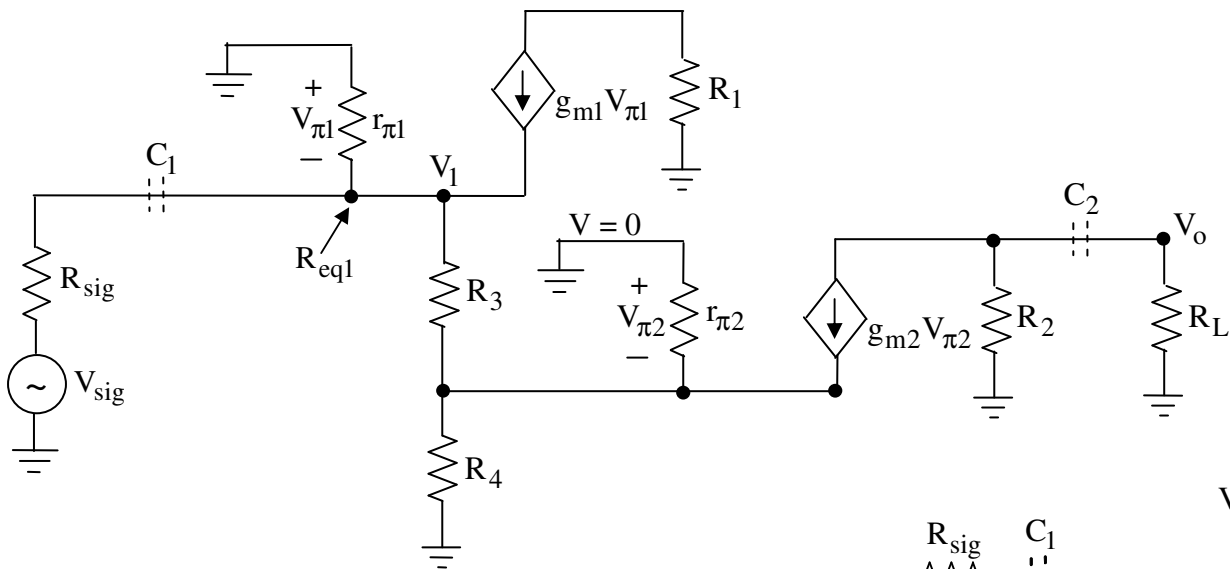


$C_1 = 10 \text{ pF}, C_2 = 10 \text{ nF}, \beta = 100$

Ignore r_o

$$R_{out} = R_2$$

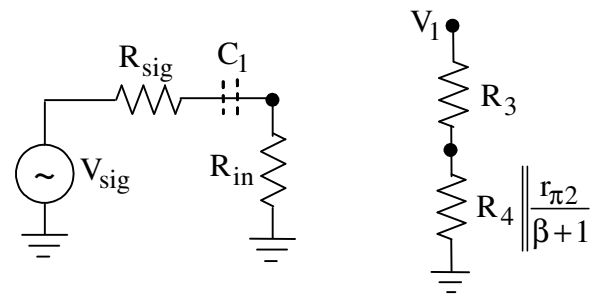
$$R_{in} = \frac{r_{\pi 1}}{\beta + 1} \left\| \left(R_3 + R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) \right.$$



$$V_o = -g_{m2} V_{\pi 2} (R_2 \parallel R_L)$$

$$V_{\pi 2} = \frac{-V_1 \left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right)}{\left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) + R_3} \quad V_1 = \frac{V_{sig} (R_{in})}{R_{in} + R_{sig}}$$

$$\frac{V_o}{V_{sig}} = \frac{g_{m2} (R_2 \parallel R_L) \left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) R_{in}}{\left[\left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) + R_3 \right] [R_{in} + R_{sig}]}$$

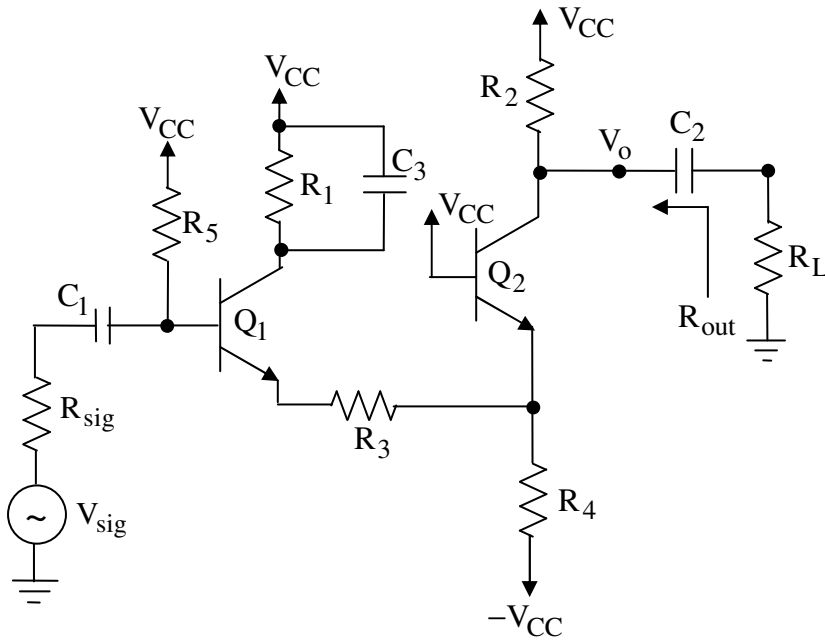


Low frequency poles \Rightarrow

$$\textcircled{1} \frac{1}{C_2 (R_2 + R_L)} \quad \textcircled{2} \frac{1}{C_1 (R_{sig} + R_{in})}$$

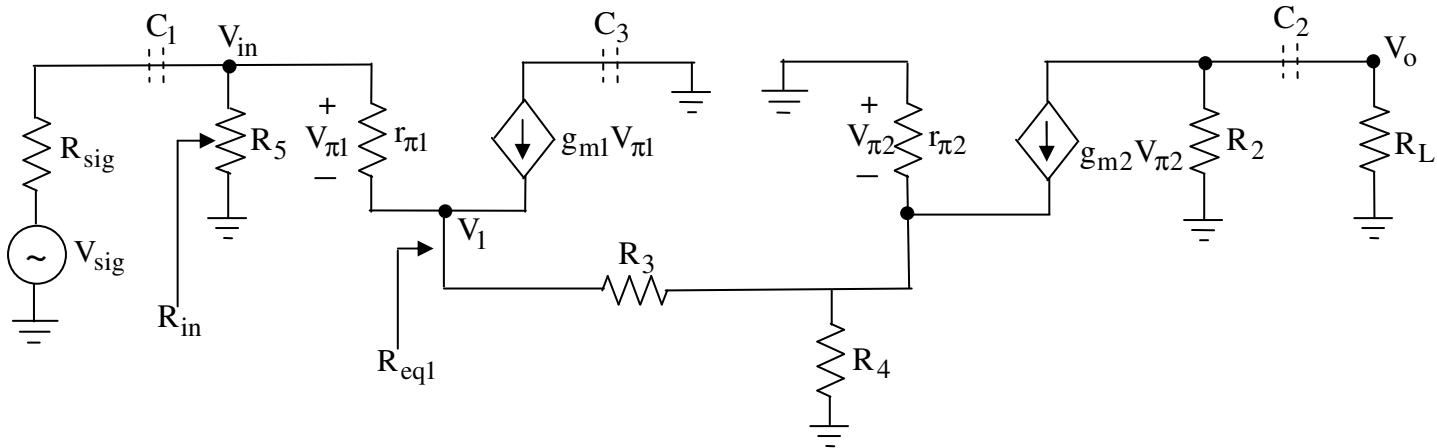
Capacitor * (R seen at cap nodes)

2 Stage ⇒ Common Collector/Common Base



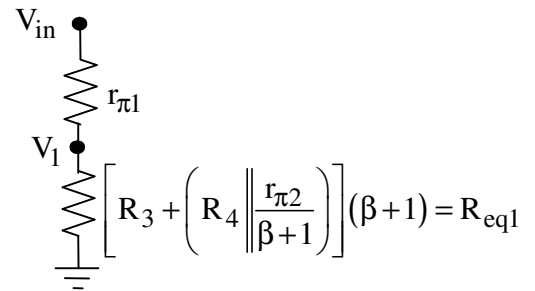
$$R_{out} = R_2$$

$$R_{in} = R_5 \parallel \left[r_{\pi 1} + \left(R_3 + R_4 \parallel \frac{r_{\pi 2}}{\beta + 1} \right) (\beta + 1) \right]$$



$$V_o = -g_{m2} V_{\pi 2} (R_2 \parallel R_L)$$

$$V_{\pi 2} = \frac{-V_1 \left(R_4 \parallel \frac{r_{\pi 2}}{\beta + 1} \right)}{\left(R_4 \parallel \frac{r_{\pi 2}}{\beta + 1} \right) + R_3} \quad V_1 = \frac{V_{in} \cdot R_{eq1}}{R_{eq1} + r_{\pi 1}}$$



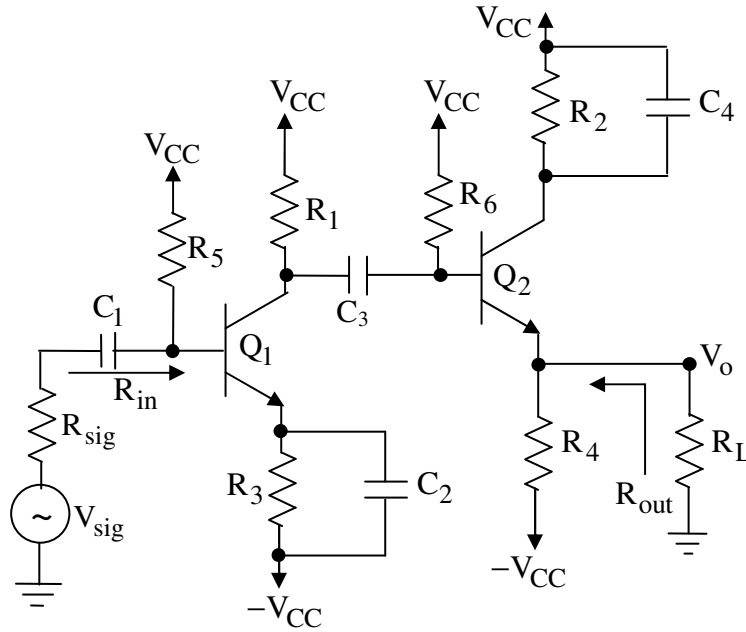
$$V_{in} = \frac{V_{sig} \cdot R_{in}}{R_{in} + R_{sig}}$$

Low frequency poles ⇒

$$\frac{V_o}{V_{sig}} = \frac{g_{m2} (R_2 \parallel R_L) \left(R_4 \parallel \frac{r_{\pi 2}}{\beta + 1} \right) R_{in} \cdot R_{eq1}}{\left[\left(R_4 \parallel \frac{r_{\pi 2}}{\beta + 1} \right) + R_3 \right] [R_{in} + R_{sig}] [R_{eq1} + r_{\pi 1}]}$$

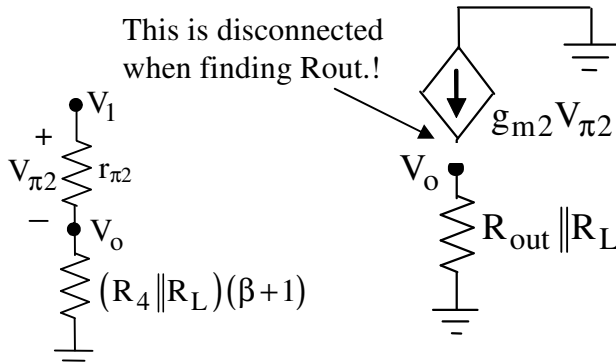
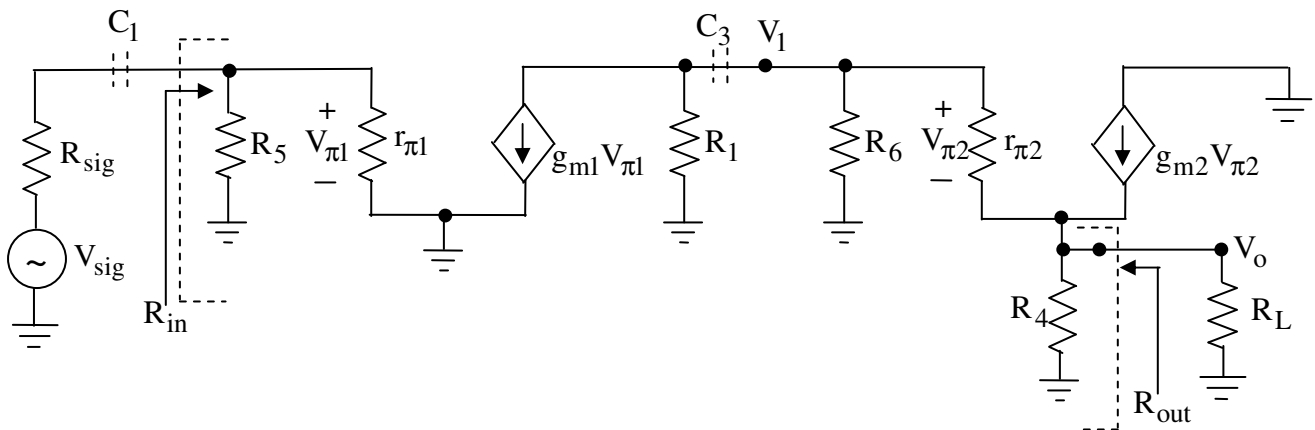
- ① $\frac{1}{C_2 (R_2 + R_L)}$
- ② $\frac{1}{C_3 \cdot R_1}$
- ③ $\frac{1}{C_1 (R_{sig} + R_{in})}$

2 Stage ⇒ Common-Emitter/Common-Collector



$$R_{out} = \left[R_4 \left\| \left(\frac{r_{\pi 2}}{\beta + 1} + \frac{R_6 \parallel R_1}{\beta + 1} \right) \right. \right]$$

$$R_{in} = R_5 \parallel (r_{\pi 1})$$



$V_o = V_1 - V_{\pi 2}$ OR $V_o = \frac{(R_4 \parallel R_L)(\beta + 1)V_1}{[(R_4 \parallel R_L)(\beta + 1) + r_{\pi 2}]}$

$V_1 = -g_{m1} V_{\pi 1} \left[R_1 \parallel R_6 \parallel (r_{\pi 2} + (R_4 \parallel R_L)(\beta + 1)) \right]$

$V_{\pi 2} = \frac{V_1 (r_{\pi 2})}{r_{\pi 2} + (R_4 \parallel R_L)(\beta + 1)}$

$V_{\pi 1} = \frac{V_{sig} (R_5 \parallel r_{\pi 1})}{(R_5 \parallel r_{\pi 1}) + R_{sig}}$

$$\frac{V_o}{V_{sig}} = \frac{(R_4 \parallel R_L)(\beta + 1)}{[(R_4 \parallel R_L)(\beta + 1) + r_{\pi 2}]} \cdot \frac{(-g_{m1})[R_1 \parallel R_6 \parallel (r_{\pi 2} + (R_4 \parallel R_L)(\beta + 1))]}{[(R_5 \parallel r_{\pi 1}) + R_{sig}]}$$

Low frequency poles ⇒ **NOTE THAT C4 IS NOT SEEN BY OUTPUT – Do not need**

$$\frac{1}{C_1 (R_{sig} + R_{in})}$$

en $\frac{1}{C_2 \cdot R_3}$

$$\frac{1}{C_3 \left(R_1 + \left(R_6 \parallel (r_{\pi 2} + (R_4 \parallel R_2)(\beta + 1)) \right) \right)}$$

ing $\frac{1}{C_4 \cdot R_2}$