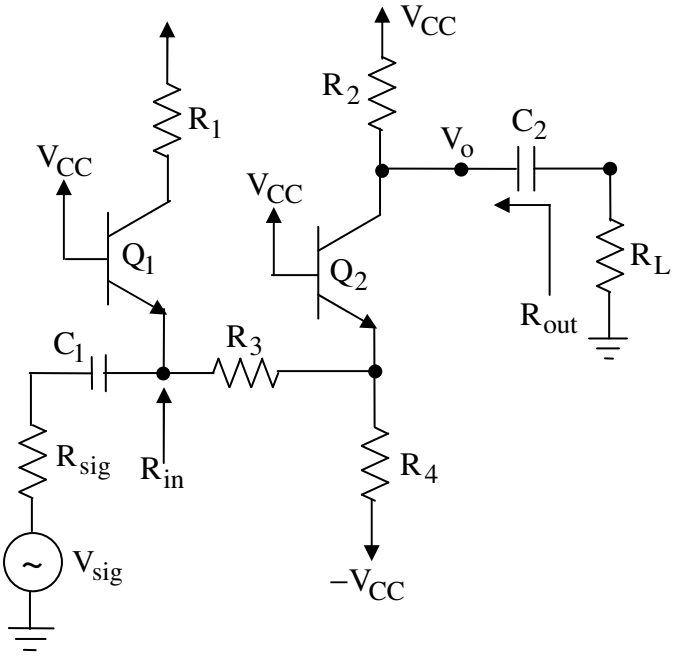
Common-Base

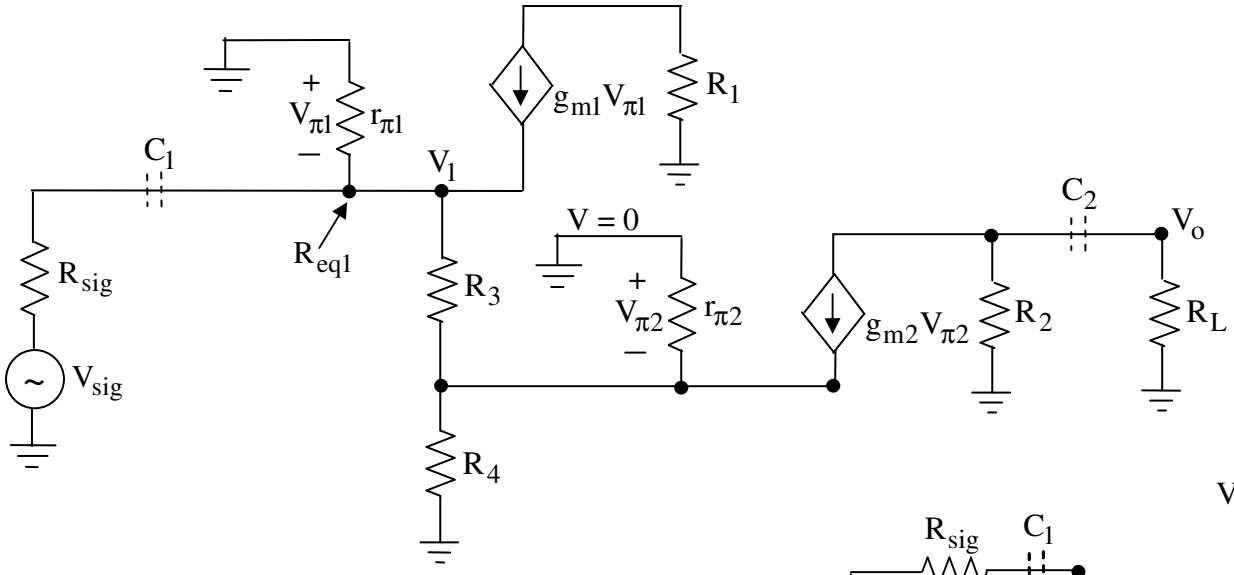


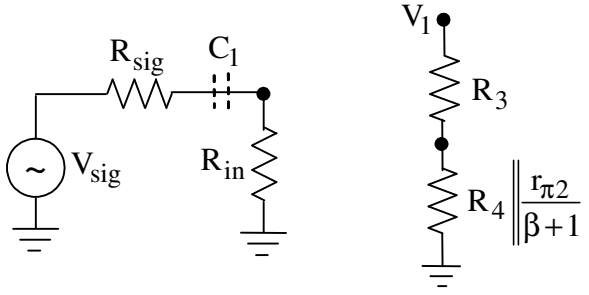
$C_1 = 10\ \text{pF}, \quad C_2 = 10\ \text{nF}, \quad \beta = 100$

Ignore r_o

$$\boxed{R_{out} = R_2}$$

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





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

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

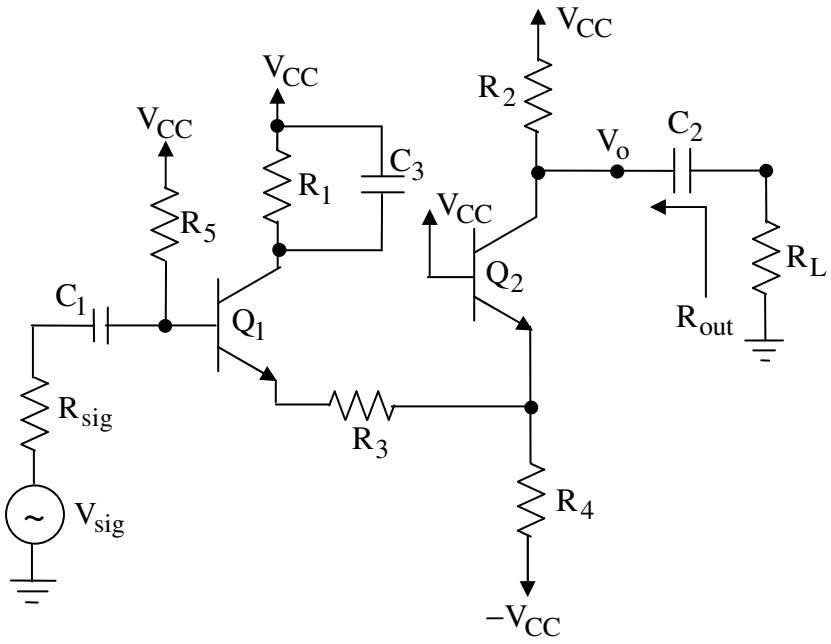
$$\boxed{\frac{V_o}{V_{sig}} = \frac{g_{m2} \left(R_2 \| R_L \right) \left(R_4 \left\| \frac{r_{\pi 2}}{\beta+1} \right. \right) R_{in}}{\left[\left(R_4 \left\| \frac{r_{\pi 2}}{\beta+1} \right. \right) + R_3 \right] \left[R_{in} + R_{sig} \right]}}$$

Low frequency poles $\Rightarrow$

① $\boxed{\dfrac{1}{C_2 \left(R_2 + R_L \right)}}$ ② $\boxed{\dfrac{1}{C_1 \left(R_{sig} + R_{in} \right)}}$

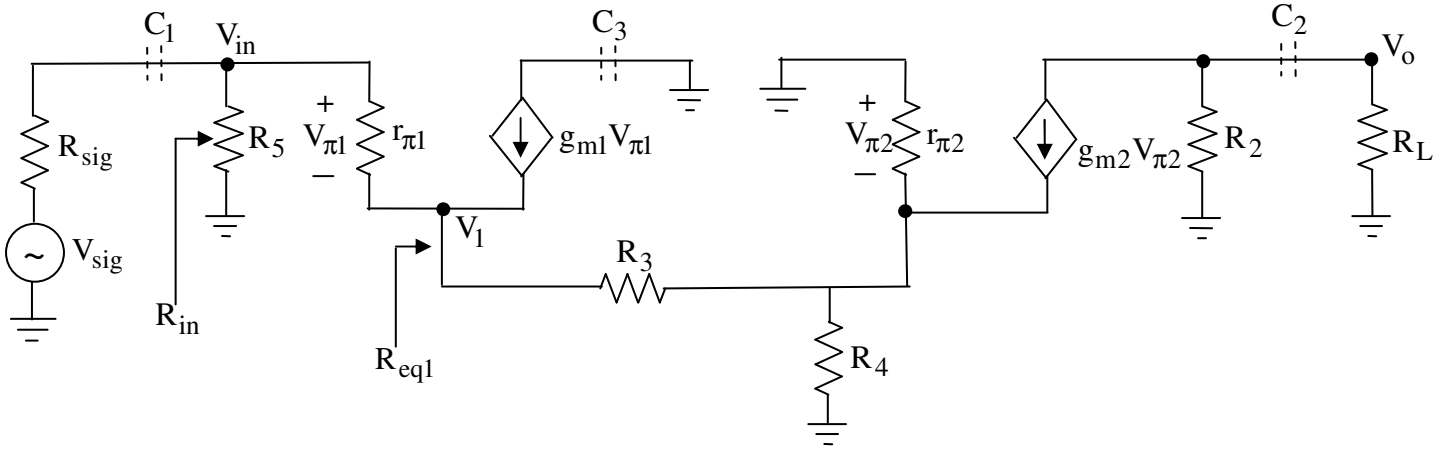
Capacitor * (R seen at cap nodes)

2 Stage ⇒ Common Collector/Common Base



$$R_{out} = R_2$$

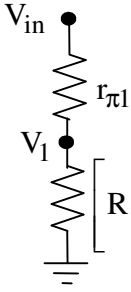
$$R_{in} = R_5 \left\| \left[r_{\pi 1} + \left(R_3 + R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) (\beta + 1) \right] \right.$$



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

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

$$V_1 = \frac{V_{in} \cdot R_{eq1}}{R_{eq1} + r_{\pi 1}}$$



$$\left[R_3 + \left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) \right] (\beta + 1) = R_{eq1}$$

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

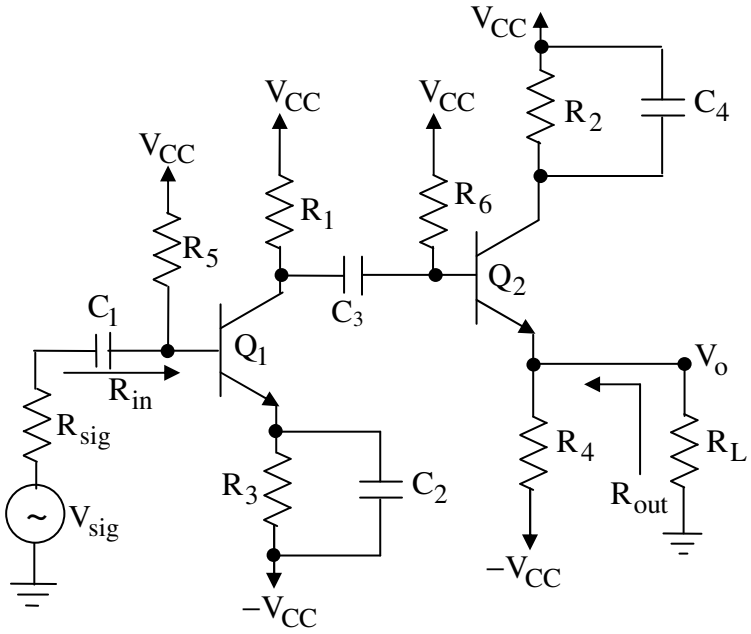
Low frequency poles ⇒

① $\dfrac{1}{C_2 \left(R_2 + R_L \right)}$ ② $\dfrac{1}{C_3 \cdot R_1}$

③ $\dfrac{1}{C_1 \left(R_{sig} + R_{in} \right)}$

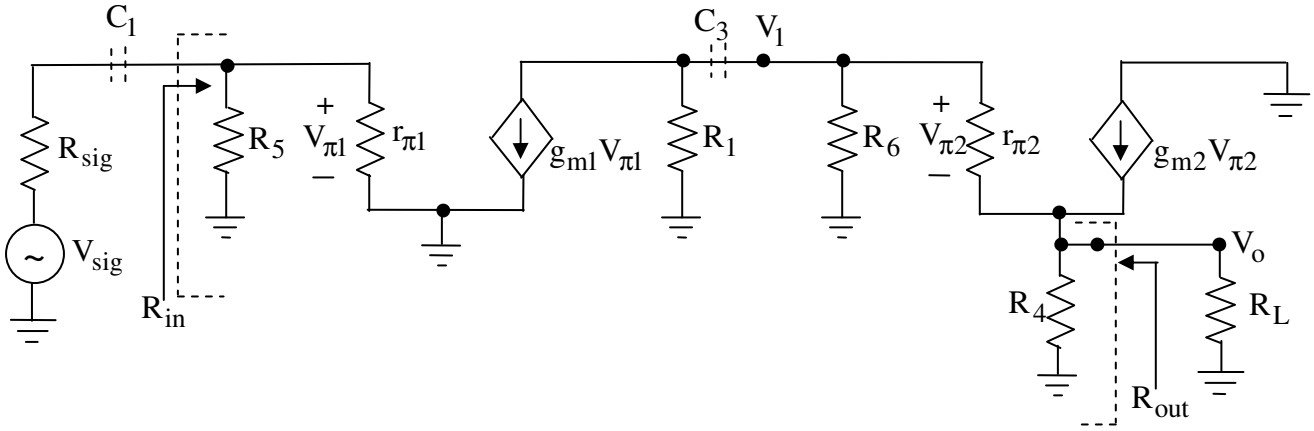
$$\frac{V_o}{V_{sig}} = \frac{g_{m2} \left(R_2 \| R_L \right) \left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) R_{in} \cdot R_{eq1}}{\left[\left(R_4 \left\| \frac{r_{\pi 2}}{\beta + 1} \right. \right) + R_3 \right] \left[R_{in} + R_{sig} \right] \left[R_{eq1} + r_{\pi 1} \right]}$$

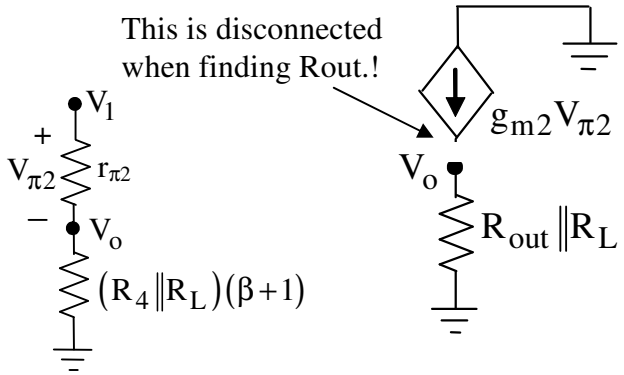
2 Stage ⇒ Common-Emitter/Common-Collector



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

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





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

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

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

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

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

Low frequency poles ⇒ **NOTE THAT C_4 IS NOT SEEN BY OUTPUT – Do not need**

$$\frac{1}{C_1 (R_{sig} + R_{in})} \text{ en } \frac{1}{C_2 \cdot R_3} \quad \frac{1}{C_3 \left(R_1 + \left(R_6 \left\| \left(r_{\pi 2} + (R_4 \| R_2)(\beta+1) \right) \right) \right)} \text{ ing } \frac{1}{C_4 \cdot R_2}$$