

Solution

NAME: _____

ECE2280

Quiz #6

(open book/notes)

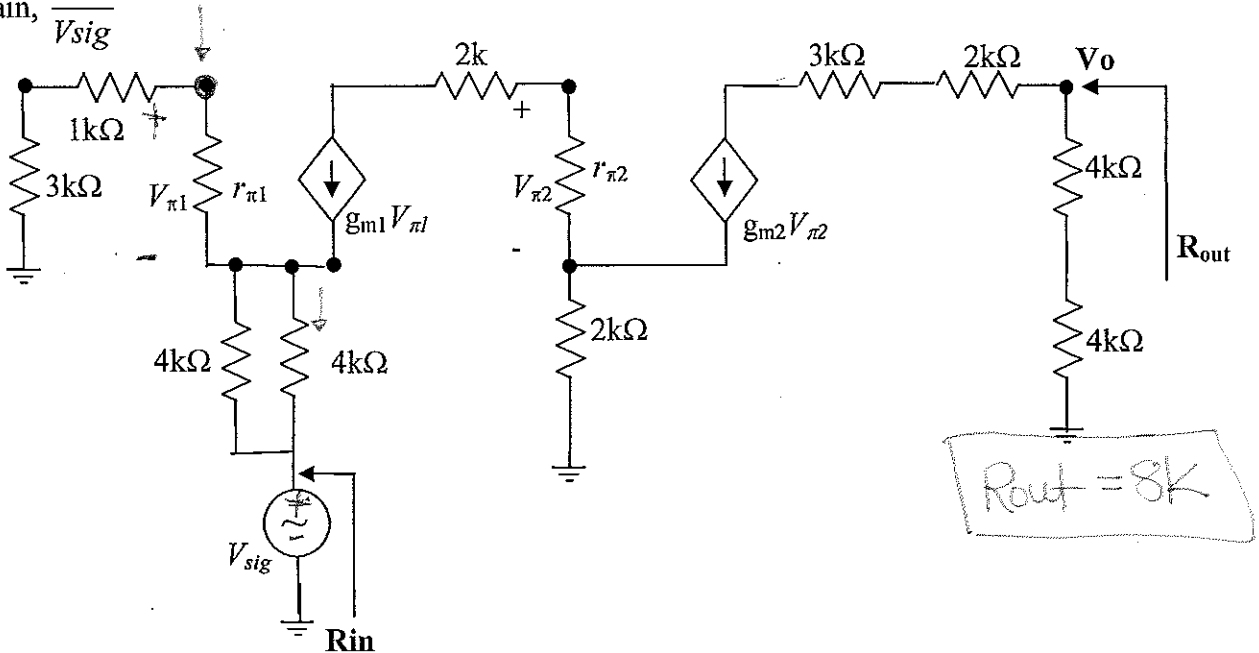
I certify that the work below is my own.

Signature: _____

Use: ignore r_o , Use $|V_{BE}|=0.7$, $\beta=100$, $r_{\pi 1}=4,000$, $r_{\pi 2}=1,000$, $g_{m1}=25\text{mA/V}$, and $g_{m2}=100\text{mA/V}$.

For the following hybrid- π equivalent circuit below, find the following values:

- (a) R_{in} (input resistance -ignore only the input source, V_{sig} and include all resistors)
- (b) R_{out} (output resistance-include all resistors at the collector{no load is connected})
- (c) midband gain, $\frac{V_o}{V_{sig}}$



$$R_{in} = 2k + \frac{r_{\pi 1} + 4k}{\beta + 1} = 2k + \frac{4k}{\beta + 1} + \frac{4k}{\beta + 1} = 2k + 39.6 + 39.6$$

$R_{in} \approx 2,079$

$$V_o = -g_{m2} V_{\pi 2} (8k)$$

$$V_{\pi 2} = -g_{m1} V_{\pi 1} r_{\pi 2}$$

$$V_{\pi 1} = \frac{-V_{sig} \left(\frac{r_{\pi 1}}{\beta + 1} \right)}{\frac{r_{\pi 1}}{\beta + 1} + \frac{4k}{\beta + 1} + 2k}$$

$$V_o = -100m(8k)(-25m)(1k) \cdot V_{\pi 1}$$

$$V_o = +20k \left(\frac{-V_{sig}(39.6)}{2,079} \right)$$

$\frac{V_o}{V_{sig}} \approx -381 \text{ V/V}$