

**6.87**

$$g_m = \frac{I_C}{V_T} = \frac{0.6 \text{ mA}}{0.025 \text{ V}} = 24 \text{ mA/V}$$

$$r_\pi = \frac{\beta}{g_m} = \frac{120}{24} = 5 \text{ k}\Omega$$

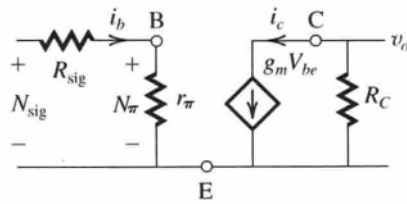
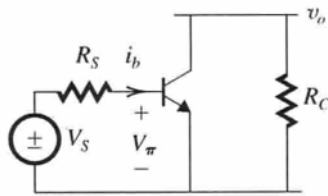
$$r_e = \frac{r_\pi}{\beta + 1} = \frac{5 \text{ K}}{121} \approx 41.3 \text{ }\Omega$$

$$g_m = \frac{60 \text{ }\mu\text{A}}{0.025 \text{ V}} = 2.4 \text{ mA/V}$$

$$r_\pi = \frac{\beta}{g_m} = \frac{120}{2.4} = 50 \text{ k}\Omega$$

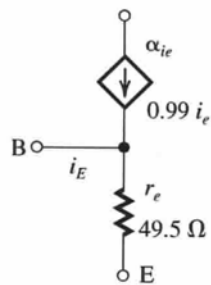
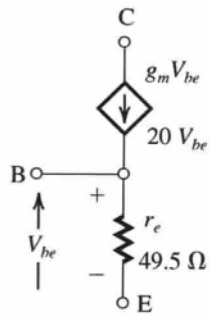
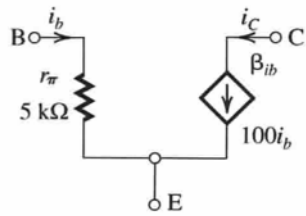
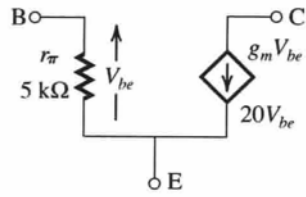
$$r_e = \frac{r_\pi}{\beta + 1} = \frac{50 \text{ K}}{121} = 413 \text{ }\Omega$$

6.97



$$\begin{aligned} \frac{v_O}{v_{sig}} &= \frac{v_1}{v_1} = \frac{r_\pi}{r_\pi + R_{sig}} (-) g_m R_C \\ &= \frac{-r_\pi g_m}{r_\pi + R_{sig}} R_C \\ &= \frac{-\beta R_C}{r_\pi + R_{sig}} \end{aligned}$$

6.94



$$g_m = \frac{I_C}{V_T} = \frac{0.5}{0.025} = 20 \text{ mA/V}$$

$$r_\pi = \frac{\beta}{g_m} = \frac{100}{20} = 5 \text{ k}\Omega$$

$$r_C = \frac{\alpha}{g_m} = \frac{0.99}{20} \Rightarrow 49.5 \text{ }\Omega$$