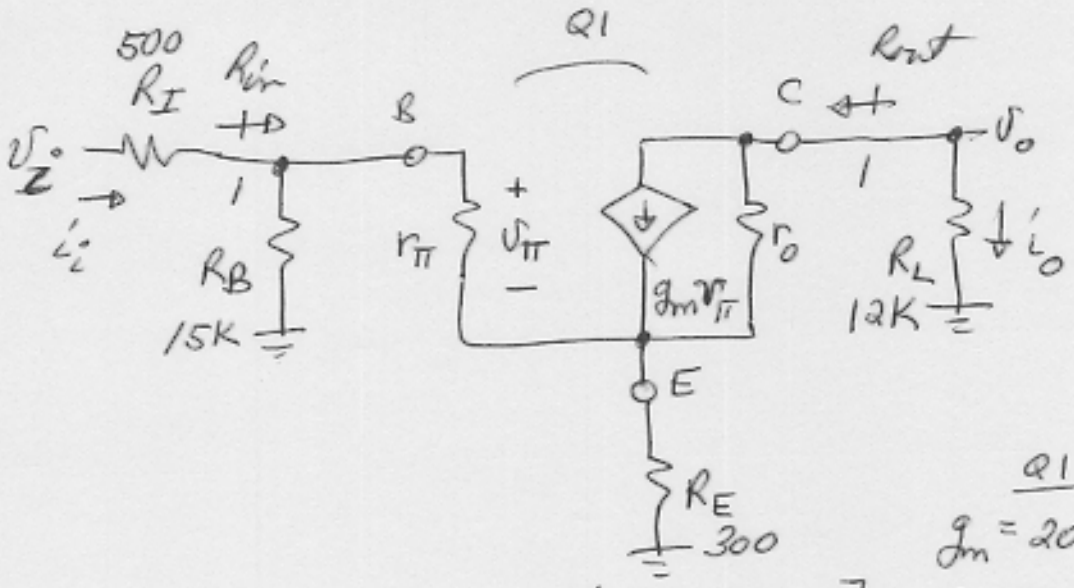
Jaeger 3rd ed

(14.9)



CE amp

[(6)-R_E=620]

Q1

$g_m = 20$ mS

$\beta_o = 75$

$r_o = 100K$

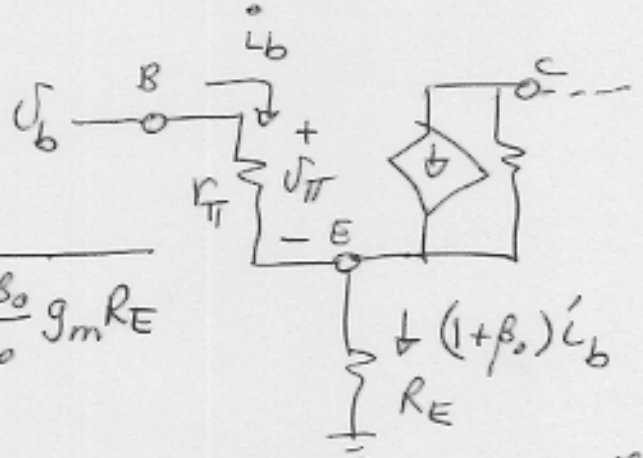
$r_\pi = \frac{\beta_o}{g_m} = 3750\ \Omega$

Reasonable Approximations

$$v_o \cong -g_m (r_o \| R_L) v_\pi$$

$$v_\pi = v_b \frac{r_\pi}{r_\pi + (1+\beta_o) R_E}$$

$$= v_b \frac{r_e}{r_e + R_E} = v_b \frac{1}{1 + \frac{1+\beta_o}{\beta_o} g_m R_E}$$



$$v_\pi \cong \frac{v_b}{1 + g_m R_E}$$

$$r_e \equiv \frac{r_\pi}{1+\beta_o}$$

$$R_{in} = R_B \| \left[r_\pi + (1+\beta_o) R_E \right]$$

$$v_b = v_i \frac{R_{in}}{R_{in} + R_I}$$

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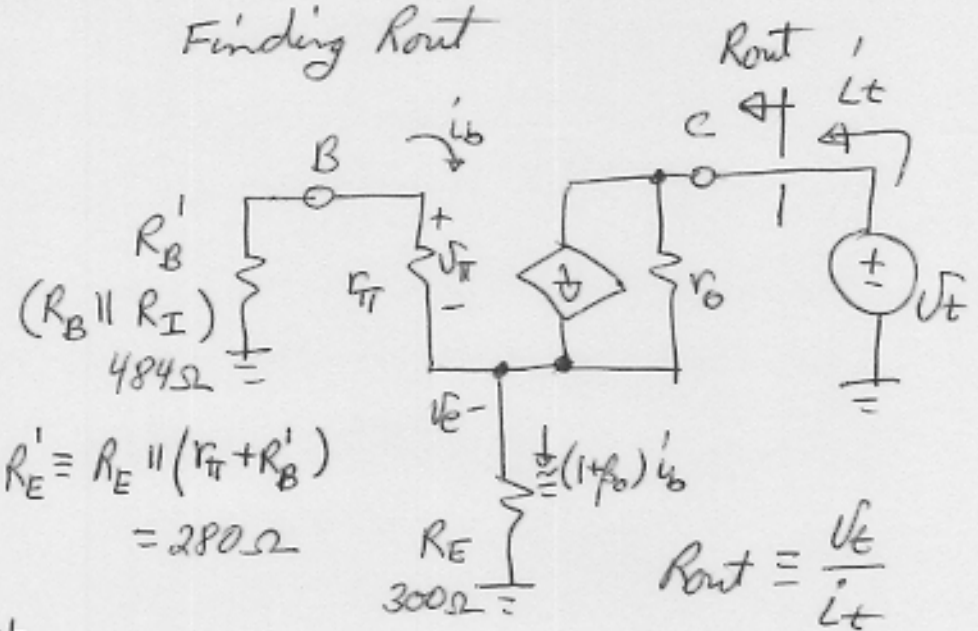
14,9 cont

Finding Rout



$$v_\pi = -\frac{r_\pi}{R_B' + r_\pi} R_E' \, i_t$$

$$v_e = R_E' \, i_t$$

$$v_t = R_E' i_t + (i_t - g_m v_\pi) r_o = \left[R_E' + r_o + \frac{g_m r_o r_\pi R_E'}{R_B' + r_\pi} \right] i_t$$

$$\therefore R_{out} \equiv \frac{v_t}{i_t} = R_E' + r_o + g_m R_E' \frac{r_\pi}{R_B' + r_\pi} r_o = 596 K\Omega$$

$$\cong \left(1 + g_m R_E' \frac{r_\pi}{R_B' + r_\pi} \right) r_o \cong (1 + g_m R_E') r_o$$

$$= 660 K\Omega$$

(a)

$$A_v \equiv \frac{v_o}{v_i} \cong \frac{R_{in}}{R_I + R_{in}} \frac{-g_m (r_o \parallel R_L)}{1 + g_m R_E} = -29 \quad (+29 dB)$$

$$R_{in} = R_B \parallel (r_\pi + (1+\beta_o) R_E) = 9.6 K\Omega$$

$$A_i \equiv \frac{i_o}{i_i} = A_v \frac{R_I + R_{in}}{R_L} = -24 \quad (+28 dB)$$

$$R_{out} \cong (1 + g_m R_E') r_o = 660 K\Omega$$