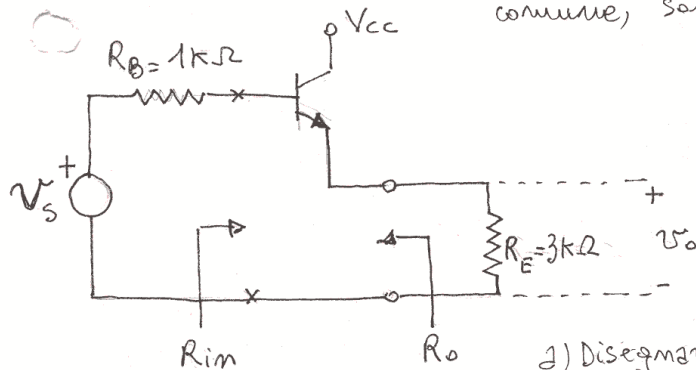


Esercizio 3-44  
(Esercizi Millman)

3) parametri per piccoli segnali a bassa frequenza del BJT in figura, montato a collettore comune, sono:



$$g_m = 40 \text{ mS}$$

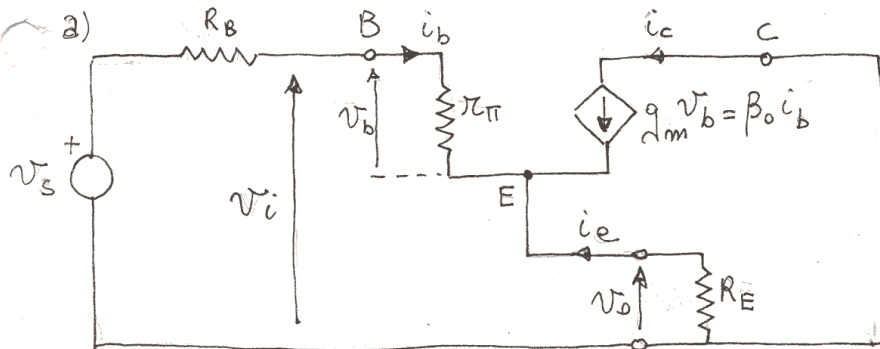
$$\beta_o = 150$$

$$r_o \rightarrow \infty$$

$$r_{\pi} = \frac{\beta_o}{g_m} = 3,75 \text{ k}\Omega$$

- a) Disegnare il circuito equivalente ai piccoli segnali  
b) Determinare  $R_{in}$  e  $R_o$   
c) Valutare la funzione di trasferimento  $\frac{v_o}{v_s}$

SOLUZIONE



b)

$$R_{in} = \frac{v_i}{i_b} = \frac{r_{\pi} i_b - R_E i_e}{i_b} = \frac{r_{\pi} i_b + R_E (i_c + i_b)}{i_b}$$

$$= \frac{r_{\pi} i_b + R_E (\beta_o i_b + i_b)}{i_b} = r_{\pi} + R_E (\beta_o + 1) = \frac{\beta_o}{g_m} + R_E (\beta_o + 1)$$

$$= \frac{150}{40 \text{ mS}} + 3 (150 + 1) = 3,75 + 453 = 456,75 \text{ k}\Omega$$

c)

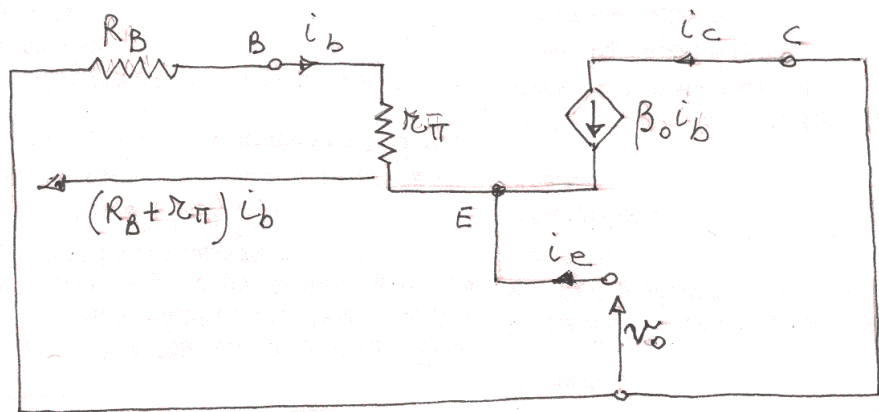
$$A_v = \frac{v_o}{v_i} = \frac{R_E i_e}{r_{\pi} i_b + R_E (\beta_o + 1) i_b} = \frac{R_E (i_b + i_c)}{[r_{\pi} + R_E (\beta_o + 1)] i_b} = \frac{R_E (1 + \beta_o)}{R_E (1 + \beta_o) + r_{\pi}} < 1$$

$$= \frac{3 (1 + 150)}{3 (1 + 150) + 3,75} \approx 0,99$$

$$A_v = \frac{R_{in}}{R_{in} + R_B} A'_v \approx A'_v = 0,99$$

(segue Es. 3-44)

b)



$$R_o = \left. \frac{v_o}{i_e} \right|_{v_s=0} = \frac{v_o}{-i_b - i_c} = \frac{v_o}{-(1+\beta_0)i_b}$$

DATO CHE (2° K)

$$v_o + (R_B + r_{\pi})i_b = 0 \quad i_b = -\frac{v_o}{R_B + r_{\pi}}$$

$$R_o = \frac{v_o}{(1+\beta_0) \frac{v_o}{R_B + r_{\pi}}} = \frac{R_B + r_{\pi}}{1+\beta_0} = \frac{1+3,75}{151} \approx 31,5 \, \Omega$$