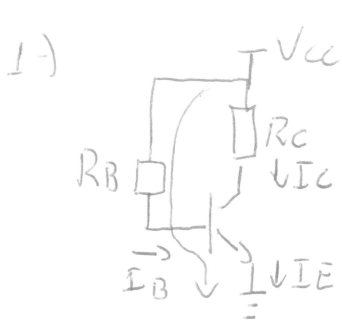


Aula 8 A - Exercícios

- $V_{CC} = 10V$; $R_C = 1k\Omega$; $R_{B3} = 200k\Omega$; $\beta = 100$; $I_S = 10^{-6}A$; V_T
 $V_T = 26mV$; $R_1 = 10k\Omega$; $R_2 = 10k\Omega$; $R_E = 200\Omega$



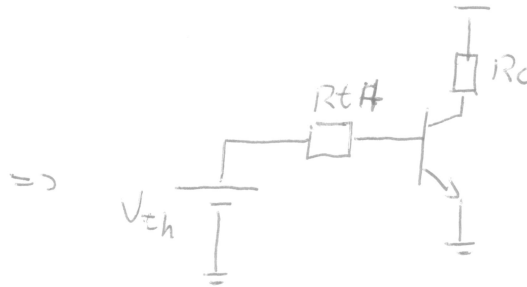
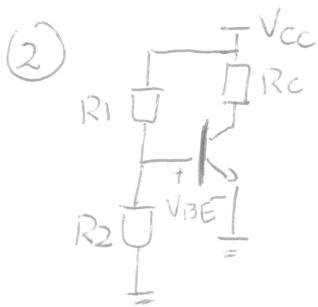
$$V_{CC} - R_{B3} I_B - V_{BE} = 0 \Rightarrow I_C = \frac{(V_{CC} - V_{BE})\beta}{R_{B3}} \quad (1)$$

$$I_C = I_S \cdot \exp\left(\frac{V_{BE}}{V_T}\right) \quad (2)$$

$$(1) = (2) \Rightarrow I_S \exp\left(\frac{V_{BE}}{V_T}\right) - \frac{(V_{CC} - V_{BE})\beta}{R_{B3}} = 0 \Rightarrow V_{BE} = 0,8179V$$

$$(2) \quad I_C = 4,5910mA$$

$$V_C = V_{CC} - R_C I_C \Rightarrow V_C = 5,409V \Rightarrow V_C > V_{BE} \Rightarrow \text{Região Ativa} \Rightarrow \text{OK}$$



$$V_{TH} = \frac{V_{CC} \cdot R_2}{R_1 + R_2} = 0,9091V$$

$$R_{TH} = R_1 || R_2 \Rightarrow R_{TH} = 5,000k\Omega$$

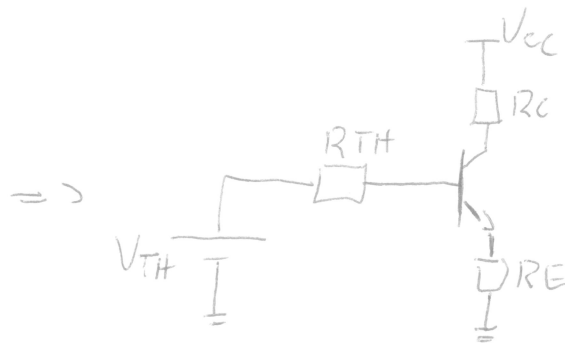
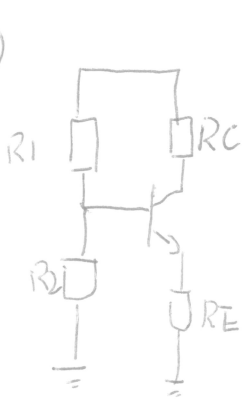
$$V_{TH} - R_{TH} \cdot \frac{I_C}{\beta} - V_{BE} = 0 \Rightarrow \begin{cases} I_C = \frac{V_{TH} - V_{BE}}{R_{TH}} \cdot \beta \\ I_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right) \end{cases}$$

$$V_{BE} = 0,8334V$$

$$I_C = 8,3278mA$$

$$V_C = V_{CC} - R_C I_C \Rightarrow V_C = 1,6722V \Rightarrow V_C > V_{BE} \Rightarrow \text{Região ativa OK}$$

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$V_{TH} = 0,9091V$
 $R_{TH} = 909,09\Omega$
 idem anterior

$V_{TH} - R_{TH} \cdot \frac{I_C}{\beta} - V_{BE} - R_{E} \cdot \frac{I_C(\beta+1)}{\beta} = 0 \Rightarrow \frac{I_C}{\beta} [R_{TH} + R_E(\beta+1)] = V_{TH} - V_{BE}$

$\frac{I_C}{\beta} (R_{TH} + \beta R_E) = V_{TH} - V_{BE} \Rightarrow I_C = \frac{\beta \cdot (V_{TH} - V_{BE})}{R_{TH} + R_E(\beta+1)}$
 $I_C = I_S \cdot \exp\left(\frac{V_{BE}}{V_T}\right)$

$V_{BE} = 0,8100V$
 $I_C = 3,3840mA$

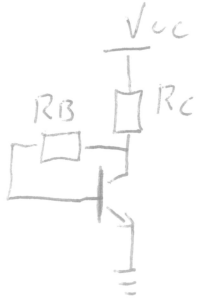
$I_B = \frac{I_C}{\beta} \Rightarrow I_B = 3,3840 \cdot 10^{-5} A$

$I_E = I_C + I_B \Rightarrow I_E = 3,4179mA$

$V_C = V_{CC} - R_C I_C \Rightarrow V_C = 1,8783V \Rightarrow V_C > V_B \Rightarrow \text{Região Ativa} \Rightarrow \text{OK}$

$V_B = V_E + V_{BE} \Rightarrow V_B = 0,8100V$

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$V_{CC} - R_C(I_C + I_B) - R_B I_B - V_{BE} = 0$

$R_C I_C \left(1 + \frac{1}{\beta}\right) + \frac{R_B I_C}{\beta} = V_{CC} - V_{BE}$

$I_C \cdot \left(R_C \left(1 + \frac{1}{\beta}\right) + \frac{R_B}{\beta} \right) = V_{CC} - V_{BE}$

$I_C = \frac{(V_{CC} - V_{BE}) \cdot \beta}{R_C(\beta+1) + R_B} \Rightarrow V_{BE} = 0,7079V$
 $I_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right) \Rightarrow I_C = 6,6831 \cdot 10^{-5} A$

$V_C = V_{CC} - R_C I_C \Rightarrow V_C = 9,9332V \Rightarrow V_C > V_B \Rightarrow \text{Região Ativa} \Rightarrow \text{OK}$