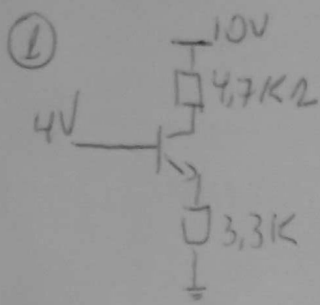


Aula 07 - parte 2



$$\alpha = \frac{\beta}{\beta + 1}$$

$$I_C = I_S \exp \frac{V_{BE}}{V_T}$$

$$V_T =$$

$$4 - V_{BE} - 3,3 \cdot 10^3 I_E = 0 \Rightarrow \frac{I_C}{\alpha} = \frac{4 - V_{BE}}{3,3 \cdot 10^3} \cdot \alpha$$

$$\Rightarrow V_{BE} = 0,7205$$

$$I_C = 9,83 \cdot 10^{-4}$$

$$I_C = \frac{(4 - V_{BE}) \alpha}{3,3 \cdot 10^3}$$

$$I_C = 3 \cdot 10^{-16} \exp \frac{V_{BE}}{V_T}$$

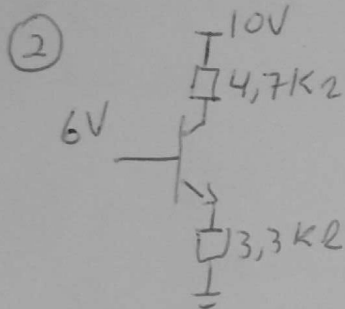
$$i_e = \frac{i_c}{\alpha} = 9,93 \cdot 10^{-4}$$

~~$$V_B = 3,3 \cdot 10^3 \cdot i_e + V_{BE} = 4$$~~

$$V_B = 4V$$

$$V_C = 10 - 4,7 \cdot 10^3 i_c \Rightarrow V_C = 5,37V$$

$\Rightarrow V_C > V_B \Rightarrow$  Região Ativa  $\Rightarrow$  OK



$\Rightarrow$  Resolução idêntica ao anterior, porém  $V_B = 6V$

$$\begin{cases} I_C = \frac{(6 - V_{BE}) \alpha}{3,3 \cdot 10^3} \\ I_C = 3 \cdot 10^{-16} \exp \frac{V_{BE}}{V_T} \end{cases} \Rightarrow V_{BE} = 0,7323$$

$$I_C = 1,6 \text{ mA}$$

~~$$V_B = 6V$$~~

~~$$V_C = 2,57V$$~~

Saturação

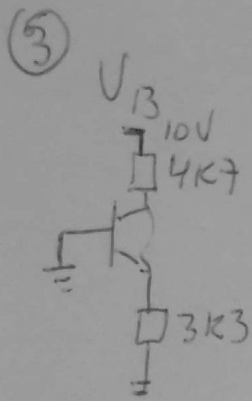
$$V_{BE} = 800 \text{ mV} \text{ e } V_{CE} = 200 \text{ mV}$$

$$\Rightarrow I_E = \frac{6 - 0,8}{3,3 \text{ k}} \Rightarrow I_E = 1,5758 \text{ mA}$$

$$\Rightarrow I_{E0} V_E = 6 - 0,8 \Rightarrow V_E = 5,2V$$

$$\Rightarrow V_C = V_E + V_{CE} \Rightarrow V_C = 5,4V$$

$$\Rightarrow I_C = \frac{10 - V_C}{4,7} \Rightarrow I_C = 0,9787 \text{ mA}$$

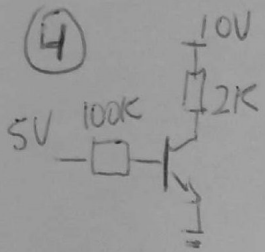


$$V_B = 0 \Rightarrow V_{BE} = 0 \Rightarrow I_C = 0 \Rightarrow I_E = 0 \Rightarrow I_B = 0$$

$$\therefore V_B = 0$$

$$V_E = 0$$

$$V_C = 10V$$



$$5 - 100 \cdot 10^3 I_B - V_{BE} = 0 \Rightarrow \begin{cases} I_C = \frac{5 - V_{BE}}{100 \cdot 10^3} \beta \\ I_C = I_S \exp \frac{V_{BE}}{V_T} \end{cases} \Rightarrow V_{BE} = 0,757V$$

$$I_C = 4,243mA$$

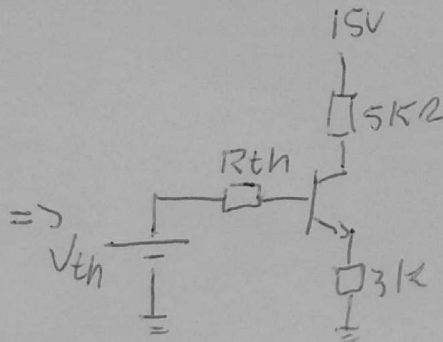
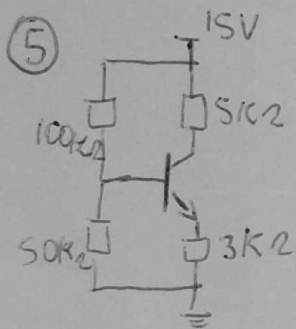
$$I_B = \frac{I_C}{\beta} = 4,243 \cdot 10^{-5} A$$

$$I_E = I_C + I_B \Rightarrow I_E = 4,2854mA$$

•  $V_E = 0$

•  $V_C = 1,5140$

•  $V_B = V_{BE} = 0,757 \Rightarrow V_C > V_B \Rightarrow \text{Região Ativa} \Rightarrow \text{OK}$



•  $V_{th} = \frac{15}{100+50} \Rightarrow V_{th} = 5V$

•  $R_{th} = 100 // 50 \Rightarrow R_{th} = 3,33 \cdot 10^4 \Omega$

•  $V_{th} - R_{th} I_B - R_e I_E = 0$

$$\frac{I_C}{\beta} - \frac{I_C}{\beta} = 0$$

$$I_C \left( \frac{R_{th} + R_e}{\beta} \right) = V_{th} - V_{BE} \Rightarrow \begin{cases} I_C = \frac{V_{th} - V_{BE}}{\frac{R_{th} + R_e}{\beta}} \\ I_C = I_S \exp \frac{V_{BE}}{V_T} \end{cases} \Rightarrow V_{BE} = 0,7269V$$

$$I_C = 1,2705mA$$

•  $I_B = \frac{I_C}{\beta} = 1,2705 \cdot 10^{-5}$

•  $I_E = \frac{I_C}{\beta} = 1,2832mA$

•  $V_E = R_e I_E = 3,8496V$

•  $V_B = V_E + V_{BE} = 4,5765V$

•  $V_C = V_{CC} - R_C I_C = 8,6475V$

$\Rightarrow V_C > V_B \Rightarrow \text{Região Ativa} \Rightarrow \text{OK}$