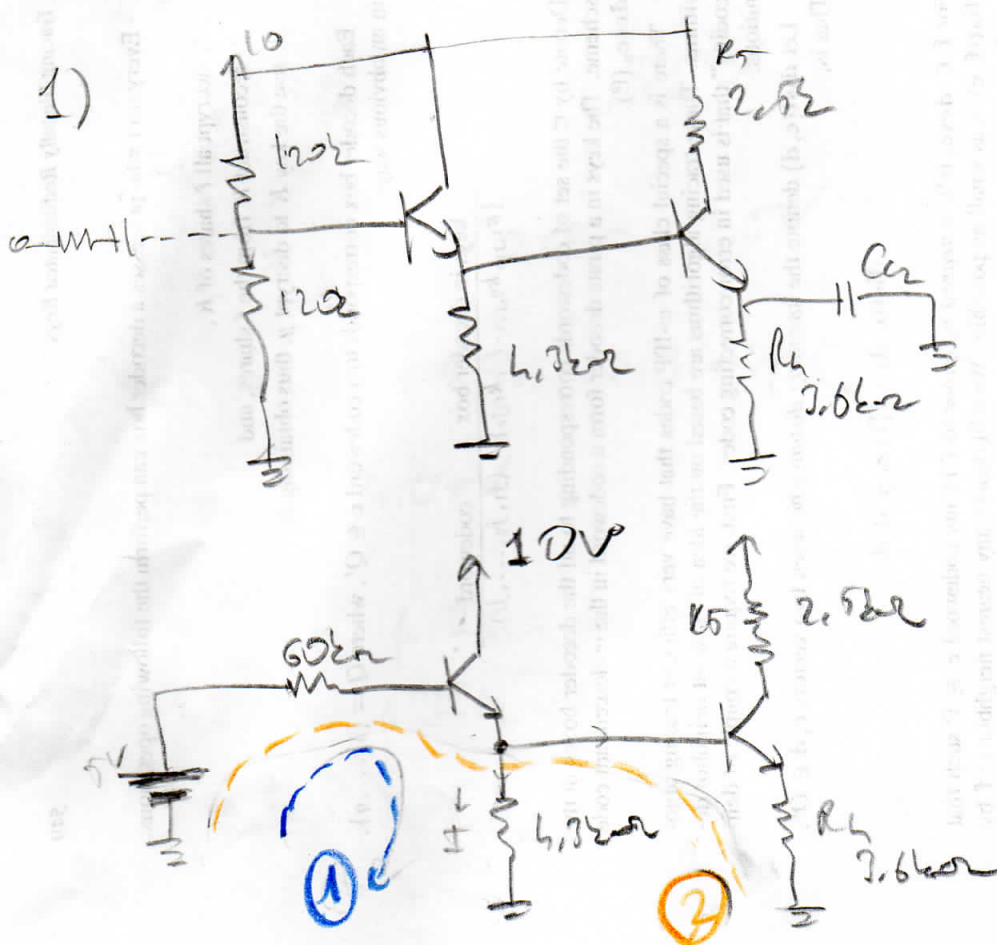


HMWorke - 2



$$5 - 60k\Omega I_{B1} - 0,65V - I \cdot 4,3k\Omega = 0$$

$$\downarrow$$

$$I \approx I_{C1} - I_{B2}$$

$$\textcircled{1} \quad 5 - 60k\Omega I_{B1} - 0,65V - 300 I_{C1} \cdot 4,3k\Omega + I_{B2} \cdot 4,3k\Omega = 0$$

$$\textcircled{2} \quad 5 - 0,65V - 0,65V - 60k\Omega I_{B1} - 3,6k\Omega \cdot \beta \cdot I_{B2} = 0$$

$$I_{C2} \approx I_{E2}$$

$$\textcircled{1} \quad 4,35V - 1350k I_{B1} + 4,3k I_{B2} = 0$$

$$\textcircled{2} \quad 3,7V - 60k I_{B1} - 1080 I_{B2} = 0$$

$$\Rightarrow I_{B1} = 3,23\mu A$$

$$I_{B2} = 3,26\mu A$$

$$\begin{bmatrix} 4,35V \\ 3,7V \end{bmatrix} = \begin{bmatrix} 1350k & -4,3k \\ +60k & +1080k \end{bmatrix} \begin{bmatrix} I_{B1} \\ I_{B2} \end{bmatrix}$$

$$V_{E1} = 5 - 60\Omega \cdot 3.23\mu A - 0.65 = 4.16$$

$$V_{CE1} = 10 - 4.16 = 5.84V$$

$$V_{E2} = V_{E1} - 0.65 = 3.51V$$

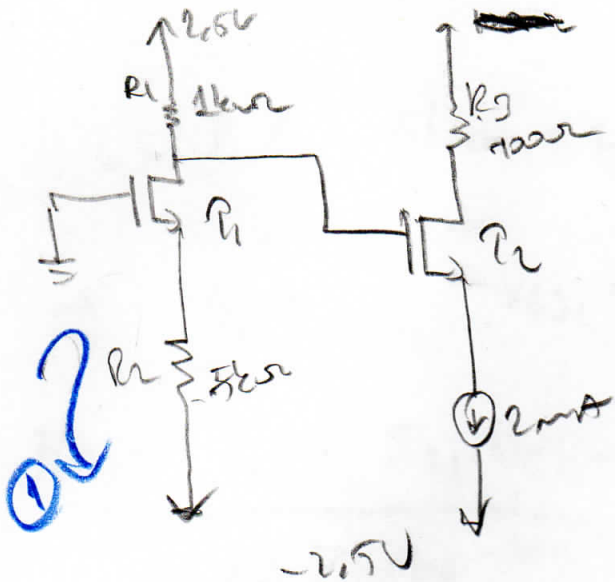
$$V_{CE2} = 10 - 2.5\Omega \cdot 100 \cdot 3.26\mu A = 7.57$$

$$V_{CE2} = 4.07V$$

$$I_{C1} = \beta \cdot I_{B1} = 0.97mA$$

$$I_{C2} = \beta \cdot I_{B2} = 0.97mA$$

②



$$I_{D2} = 2\text{mA}$$

$$I_{D1} = \frac{1}{2} k_n' \frac{W}{L} (V_{GS1} - V_T)^2$$

$$I_{D1} = \frac{1}{2} \cdot 126 \mu\text{A/V}^2 \cdot \frac{10}{2} (V_{GS1} - V_T)^2$$

$$0 - V_{GS1} - I_{D1} \cdot 5k + 2.5V = 0 \Rightarrow V_{GS1} = 2.5 - 5000 I_{D1}$$

①

$$I_{D1} = \frac{126 \cdot 10}{2} \cdot 10^{-6} (2.5 - 0.7 - 5000 I_{D1})^2$$

$$I_{D1} = 0.58 \mu\text{A}$$

$$I_{D1} = 0.21 \mu\text{A}$$

$$V_{GS1} = 1.45\text{V}$$

Saturation condition!

$$V_{GS2} \Rightarrow 2\text{mA} = \frac{1}{2} \cdot 126 \cdot \frac{10}{2} \mu\text{A/V}^2 (V_{GS2} - V_T)^2$$

$$I_{D2} = 2\text{mA}$$

$$\frac{2 \cdot 10^{-3}}{126 \cdot 10 \cdot 10^{-6}} = (V_{GS2} - V_T)^2 =$$

$$\Rightarrow (V_{GS2} - V_T) = 2.2\text{V}$$

$$V_{GS2} = 2.96\text{V}$$

$$V_{GS1} = 2,5 - 5k\Omega \cdot 0,2mA = 1,65V$$

$$\Rightarrow V_{G1} = 0 \quad V_{GS1} = V_{G1} - V_{S1} \Rightarrow V_{S1} = -1,65V$$

$$V_{D1} = 2,5 - I_{D1} \cdot 1k\Omega = 2,28V$$

$$V_{DS} > V_{GS} - V_T$$

$$V_{DS1} = 3,74V$$

$$V_{D1} = V_{G2}$$

$$V_{GS2} = 2,86V \Rightarrow V_{S2} = -0,65V$$

$$\Rightarrow V_{D2} = 2,5V - 100\Omega \cdot 2mA = 2,3V$$

$$\Rightarrow V_{DS2} = 2,3 + 0,65 = 2,95V$$