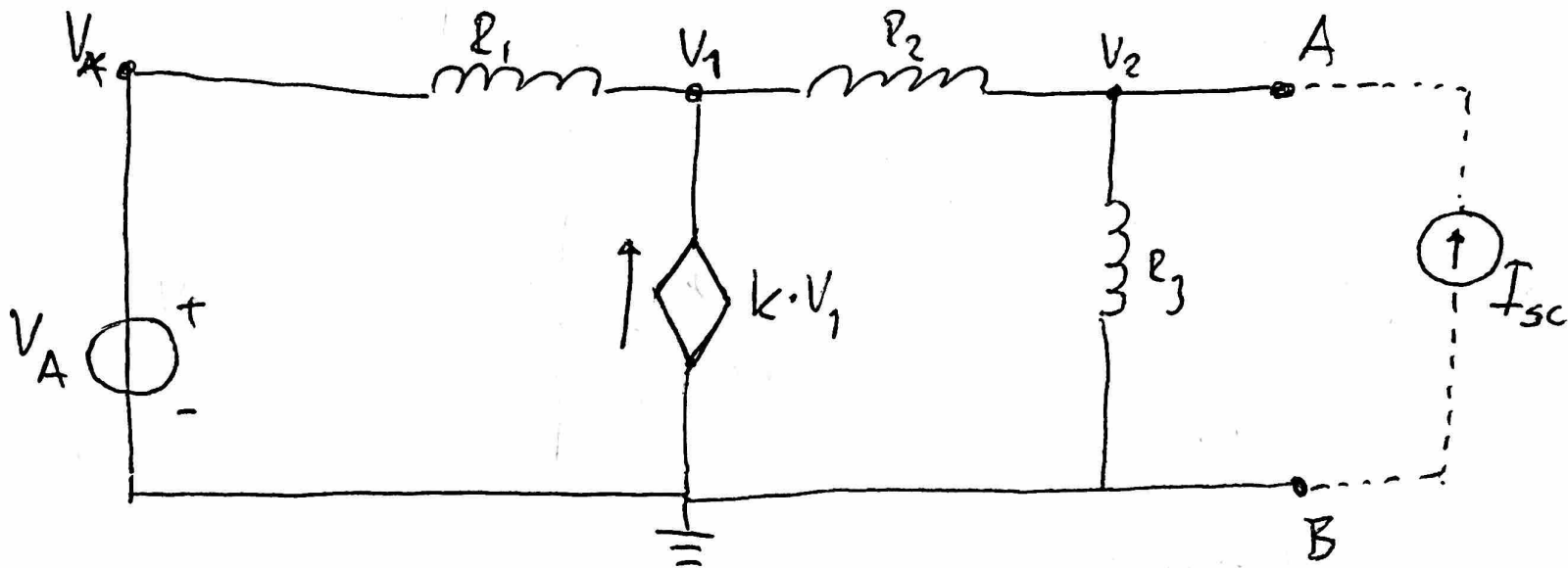


# **Home Assignment 3**

IE1206 Embedded Electronics

Emil Ståhl

# PROBLEM 1



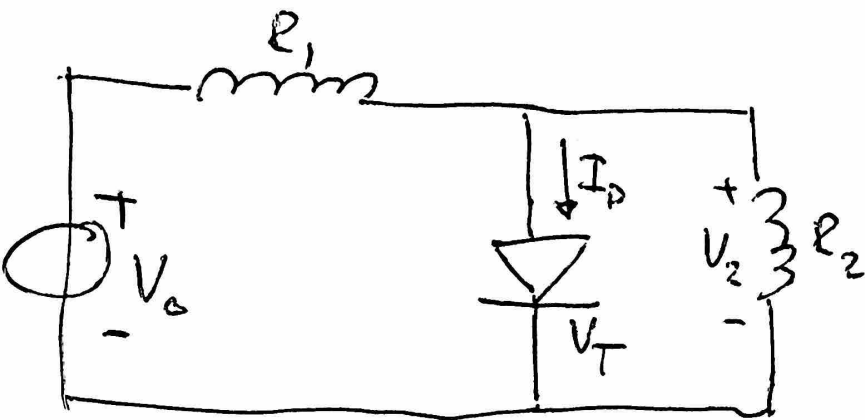
$$\text{KCL IN } V_1: \frac{V_2 - V_1}{R_2} + \frac{V_x}{R_1} - \frac{V_1 - V_x}{R_1} = 0$$

$$\text{KCL IN } V_2: I_{sc} - \frac{V_2 - V_1}{R_2} - \frac{V_2}{R_3} = 0$$

$$\text{VOLTAGE DIVIDER: } V_x = V_1 \cdot \frac{R_1}{R_2}$$

$$P_{TH} = \frac{V_2}{I_{sc}}$$

## PROBLEM 2



$$\begin{cases} V_2 < V_T \Rightarrow I_D = 0 \Rightarrow V_2 = R_2 \cdot \frac{V_0}{R_1 + R_2} = \frac{R_2}{R_1 + R_2} \cdot V_0 = \frac{V_0}{2} \\ V_2 > V_T \Rightarrow I_D > 0 \text{ AND } V_D = V_T \Rightarrow V_T = V_2 \end{cases}$$

a)  $V_0 = 1.0$

$$V_2 = \frac{1}{2} = 0.5 \text{ V THAT IS } < V_T \Rightarrow I_D = 0 \Rightarrow V_2 = 0.5 \text{ V}$$

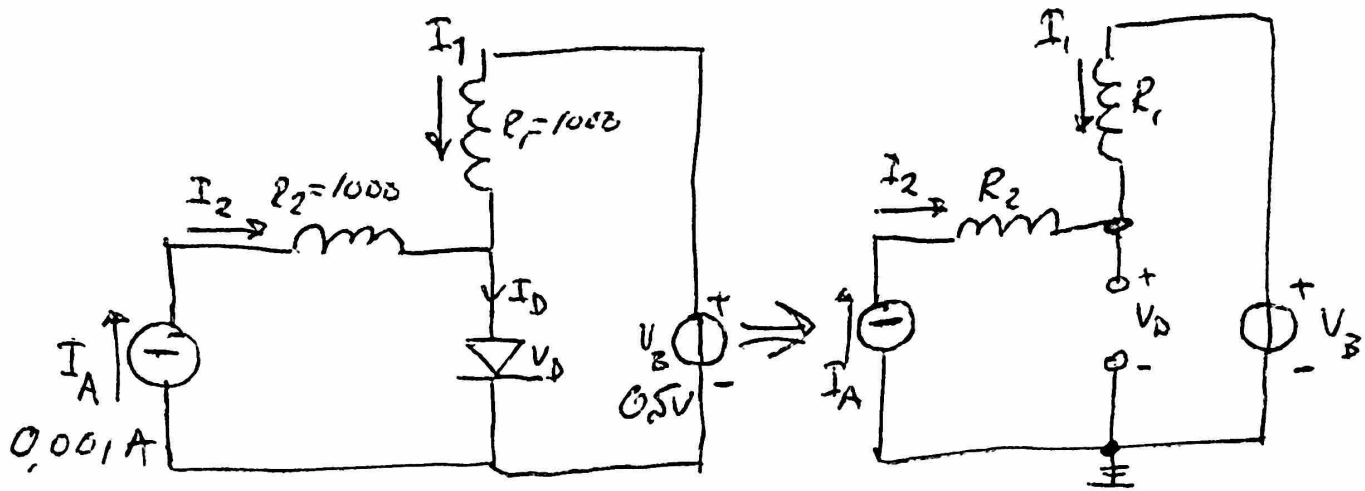
b)  $V_0 = 2.0$

$$V_2 = \frac{2}{2} = 1 \text{ V THAT IS } > V_T \Rightarrow V_2 = V_T = 0.7 \text{ V}$$

c)  $V_0 = 3.0$

$$V_3 = \frac{3}{2} = 1.5 \text{ V THAT IS } > V_T \Rightarrow V_2 = V_T = 0.7 \text{ V}$$

### PROBLEM 3



$$\text{KVL} \Rightarrow V_B - R_1 \cdot I_1 + R_2 \cdot I_2 = 0$$

$$0.5 - 1000 \cdot I_1 + 1000 \cdot 0.001 = 0 \Rightarrow I_1 = 0.0015 \text{ A}$$

$$V_1 = 1000 \cdot 0.0015 \Rightarrow V_1 = 1.5 \text{ V}$$

$$V_D = V_B - V_1 \Rightarrow 0.5 - 1.5 = -1.0 \text{ V}$$

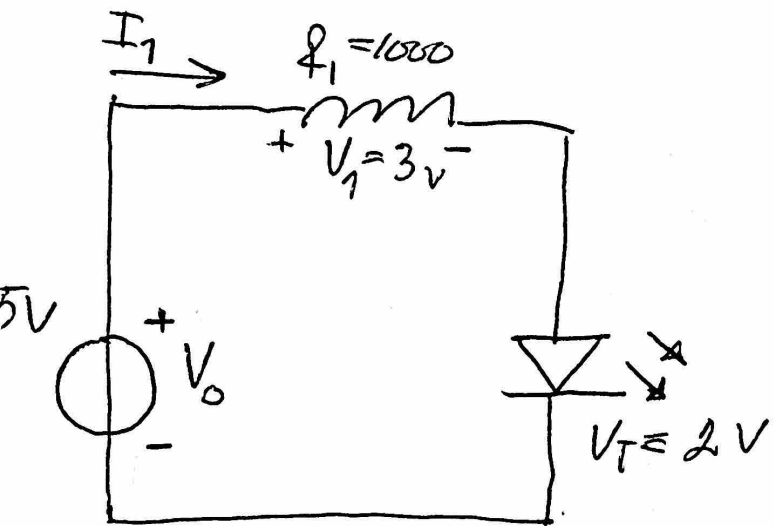
$$V_D > V_T \Rightarrow I_D > 0$$

$$I_A = I_2$$

$$\text{KCL} = I_1 + I_2 = I_D \Rightarrow 0.0015 + 0.001 = 0.0025 \text{ A}$$

$$I_D = \underline{\underline{2.5 \mu \text{ A}}}$$

# PROBLEM 4



$$V_1 = I_1 \cdot R_1 \Rightarrow V_1 = I$$

$$\frac{3}{1000} = \frac{I_1 \cdot (1000)}{1000}$$

$$I_1 = 0.003 \text{ A} = 3 \mu\text{A}$$

$$P_D = I_D \cdot V_D$$

$$P_D = 0.003 \cdot 2$$

$$P_D = 0.006 = 6 \mu\text{W}$$