(1)

$V_i = 100\ V$

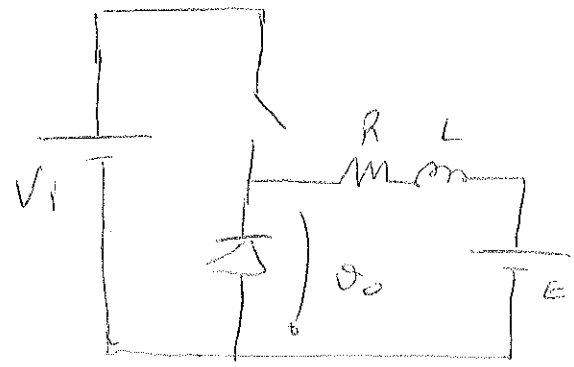
$E = 10\ V$

$R = 10\ \Omega$

$L = 5\ mH$

$f = 1\ kHz$

$D = 0,5$



i)

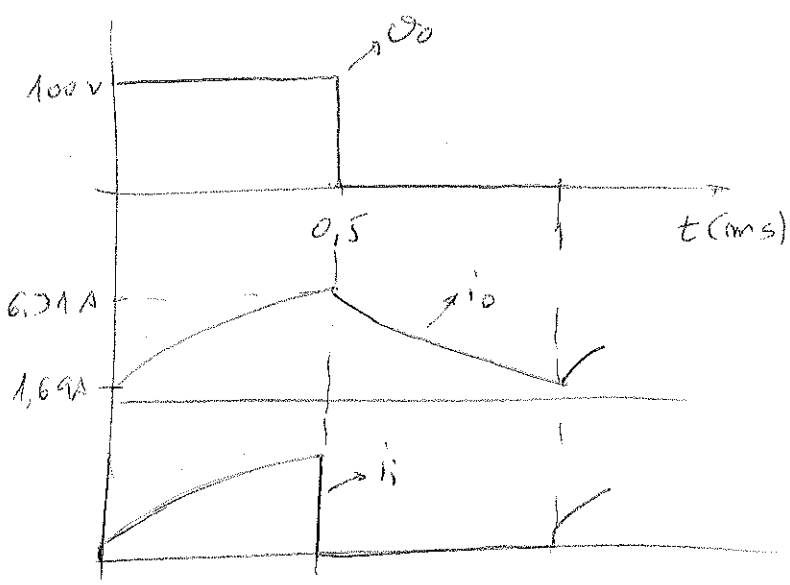
Em regime permanente:

$$I_{min} = \frac{V_i}{R} \times \frac{e^{t_{on}/\tau} - 1}{e^{T/\tau} - 1} - \frac{E}{R} = 1,69\ A > 0 \Rightarrow \text{condução contínua}$$

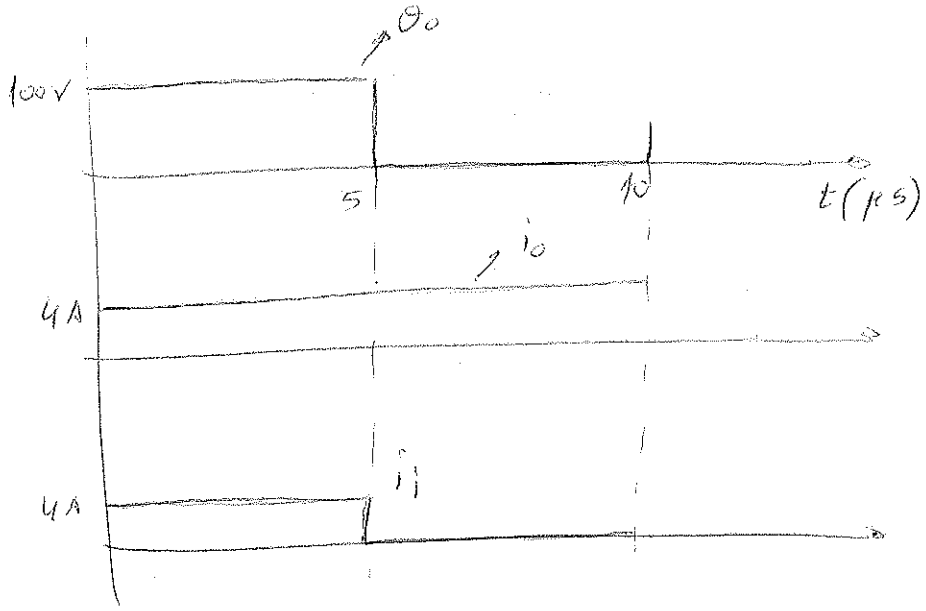
$$I_{max} = \frac{V_i}{R} \times \frac{1 - e^{-t_{on}/\tau}}{1 - e^{-T/\tau}} - \frac{E}{R} = 6,31\ A$$

$$\langle v_o \rangle = D V_i = 0,5 \cdot 100 = 50\ V$$

$$\langle i_o \rangle = \frac{\langle v_o \rangle - E}{R} = 4\ A$$



ii) $f = 100\ kHz$



b) $\langle i_i \rangle = 4 \times \frac{1}{2} = 2A$

c) $P_i = \frac{1}{T}\int_0^T v_i \cdot i_i \, dt = V_i \times \frac{1}{T}\int_0^T i_i \, dt = V_i \cdot \langle i_i \rangle = 100 \times 2 = 200W$

$P_o = \frac{1}{T}\int_0^T v_o \cdot i_o \, dt = \langle i_o \rangle \cdot \frac{1}{T}\int_0^T v_o \, dt = \langle i_o \rangle \langle v_o \rangle = 4 \cdot 50 = 200W$

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iii) $f = 100\ Hz$

a) Em regime permanente:

$$I_{min} = \frac{V_i}{R} \cdot \frac{e^{t_{on}/\beta} - 1}{e^{T/\beta} - 1} - \frac{E}{R} = -11 < 0 \Rightarrow \text{condução descontínua}$$

Em condução descontínua:

$$I_{max} = \frac{V_i - E}{\beta}\left(1 - e^{-t_{on}/\beta}\right) = 9A$$

$$I_{min} = 0$$

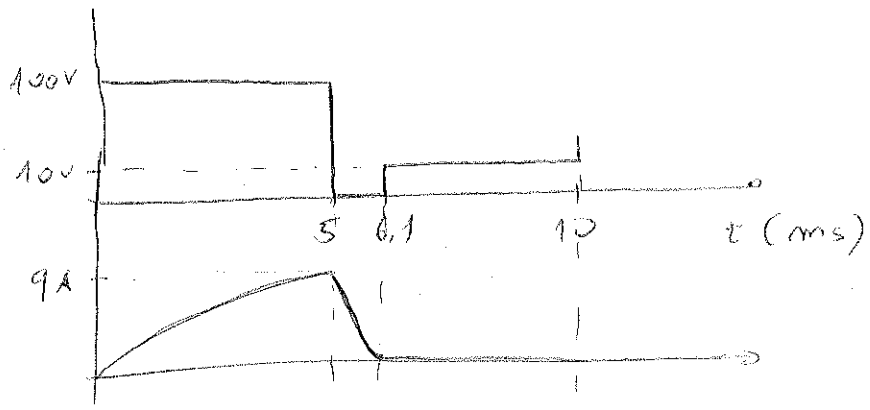
b)

$$t_c = t_{on} + \tau \ln\left[1 + \frac{V_i - E}{R}\left(1 - e^{-t_{on}/\tau}\right)\right] = 6{,}1\ ms$$

$$\langle v_o \rangle = D V_i + \left(\frac{T - t_c}{T}\right) E = 53{,}8\ V$$

$$\langle i_o \rangle = \frac{53{,}8 - 10}{10} = 4{,}38\ A$$

c)



d) No transição contínuo/descontínuo, Imin em regime permanente = 0

$$I_{min=0} = \frac{V_i}{R} \cdot \frac{e^{t_{on}/\tau} - 1}{e^{T/\tau} - 1} - \frac{E}{R} \Rightarrow t_{on} = 8{,}85\ ms$$