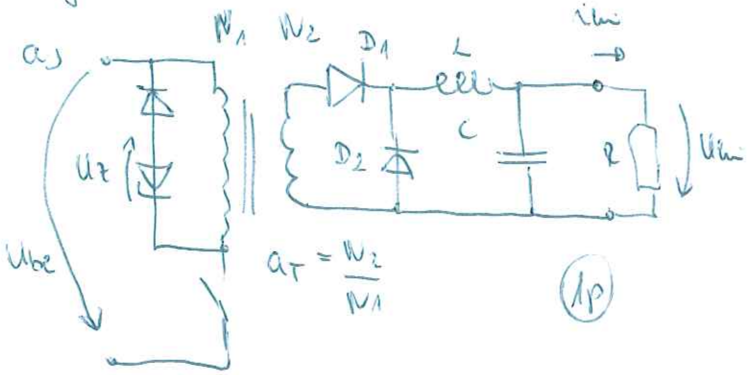
Tápegységtopológiák ZH
2015.

1.) FORWARD, $U_{be} = 350V$, $a_T = 0{,}4$, $L_s = \varnothing$, $L_\mu = 10mH$, $U_{ki} = 24V$, $P_{ki} = 240W$, $f = 20kHz$, $\Delta I_L = 5A$, $\Delta U_{ki} = 0{,}1V$

a)



$a_T = \frac{N_2}{N_1}$ (1p)

b) $d = \frac{U_{ki}}{a_T \cdot U_{be}} = \frac{24}{0{,}4 \cdot 350} = 0{,}171$ (1p)

c) $I_{ki} = \frac{P_{ki}}{U_{ki}} = \frac{240W}{24V} = \underline{10A}$ ($\Delta I_L = 5A \Rightarrow$ Folyamatos vezetés) (1p)

$\underline{L} \geq \frac{a_T U_{be} - U_{ki}}{\Delta I_L} t_{be} = \frac{140-24}{5} \cdot 0{,}171 \cdot 50\mu s = \underline{198{,}36\mu H}$ (2p)

$\underline{C} \geq \frac{\Delta I_L}{8 \cdot f \cdot \Delta U_{ki}} = \frac{5}{8 \cdot 20 \cdot 10^3 \cdot 0{,}1} = \underline{312{,}5\mu F}$ (2p)

d) $\underline{I_{Crms}} = \frac{\Delta I_L}{2\sqrt{3}} = \frac{5}{2\sqrt{3}} = \underline{1{,}44A}$ @ 20kHz (1p)

e) $\underline{\hat{I}_{D1}} = \hat{I}_{D2} = \hat{I}_L = I_{LAV} + \frac{\Delta I_L}{2} = 10 + \frac{5}{2} = \underline{12{,}5A}$ (1p)

$\hat{U}_{D2} = a_T \cdot U_{be} = 140V$

$\hat{U}_{D1} = U_{D2} + U_Z \cdot a_T$, a primer lemágnesezés sebességétől és a szaggatott vezetés kialakulásától függően a felmenetben ez sok minden lehet. Legrosszabb esetben, ha szaggatásban van és a primer is van mágnesezve, akkor $\underline{140V}$ (1p)
jelen esetben folyt. vezetéskor $U_Z \cdot a_T$

f) $\underline{U_{Zmin}} = U_{be} \frac{t_{be}}{T - t_{be}} = U_{be} \frac{d}{1-d} = 350 \cdot \frac{0{,}171}{1-0{,}171} = \underline{72{,}2V}$ (1p)

$\underline{P_Z} = \frac{U_{ki}^2}{2L_\mu a_T^2 \cdot f} = \frac{24^2}{2 \cdot 10 \cdot 10^{-3} \cdot 0{,}4^2 \cdot 20 \cdot 10^3} = \underline{9W}$ (1p)

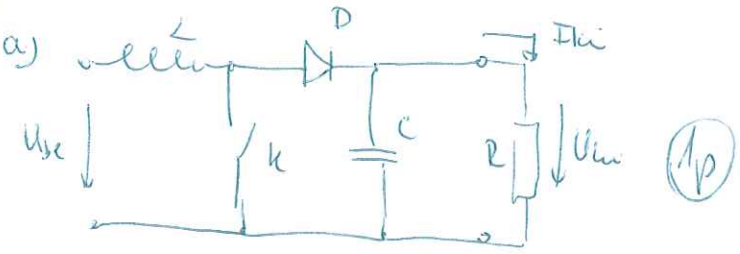
g) $\underline{U_{Kmax}} = U_{be} + U_Z = 350 + 72{,}2 = \underline{422{,}2V}$ (1p)

$I_{Kmax} = \hat{I}_L a_T + I_\mu = 12{,}5 \cdot 0{,}4 + \frac{U_{be}}{L_\mu} t_{be} = 5 + \frac{350}{10 \cdot 10^3} \cdot 0{,}171 \cdot 50\mu s \cong \underline{5{,}3A}$ (1p)

Σ14p

2) Boost, $U_{be} = 150V$, $U_{ie} = 300V$, $I_{ie} = 10A$, $\Delta I_L = 10A$, $\Delta U_{ie} = 1V$, $f = 40kHz$

a)



1p

b) $d = 1 - \frac{U_{be}}{U_{ie}} = 1 - \frac{150}{300} = 0,5$ (0,5p)

$t_{be} = d \cdot T = 0,5 \cdot 25\mu s = 12,5\mu s$ (0,5p)

$L \geq \frac{U_{be} \cdot t_{be}}{\Delta I_L} = \frac{150 \cdot 12,5\mu s}{10A} = 187,5\mu H$ (2p)

$C \geq \frac{I_{ie} \cdot t_{be}}{\Delta U_{ie}} = \frac{10A \cdot 12,5\mu s}{1V} = 125\mu F$ (2p)

c) $I_L = I_D - I_{ie}$, $I_C = I_D - I_{ie}$ $\Rightarrow$ $\hat{I}_D = \hat{I}_L = \frac{1}{1-d} I_{ie} + \frac{\Delta I_L}{2} = 25A$ (1p)

$\hat{I}_C = 25A - 10A = 15A$ @ 40kHz

d) $\hat{I}_K = \hat{I}_D = \hat{I}_L = I_{LAV} + \frac{\Delta I_L}{2} = \frac{1}{1-d} I_{ie} + \frac{\Delta I_L}{2} = 25A$ (1p)

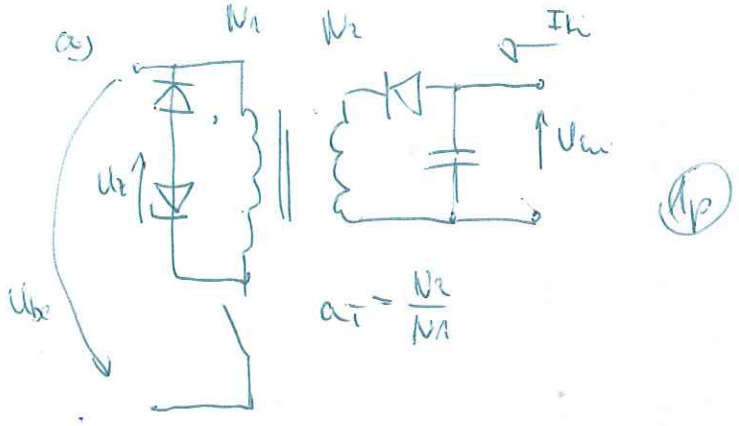
e) $\hat{U}_K = \hat{U}_D = U_{ie} = 300V$ (1p)

f) $I_{ieH} = \frac{U_{be} \cdot T}{2L} d(1-d) = \frac{150V \cdot 25\mu s}{2 \cdot 187,5 \cdot 10^{-6}} 0,5(1-0,5) = \frac{\Delta I_L}{2 \cdot 2} = 2,5A$ (1p)

Σ 10p

3) Flyback, $U_{be} = 325V$, $U_{ie} = 24V$, $a_T = 0,12$, $f = 50kHz$, $P_{ie} = 120W$

a)



1p

b) $d = \frac{U_{ie}}{a_T U_{be} + U_{ie}} = \frac{24}{0,12 \cdot 325 + 24} = 0,269$ (0,5p)

$t_{be} = d \cdot T = 0,269 \cdot 20\mu s \cong 5,4\mu s$ (0,5p)

$L_\mu \geq \frac{U_{bc} \cdot t_{bc}}{\Delta I_L} = \frac{325 \cdot 5{,}4\mu s}{2A} = 877{,}5\mu H$ (2p)

c) $C \geq \frac{I_k \cdot t_{bc}}{\Delta u_{ki}} = \frac{5A \cdot 5{,}4\mu s}{0{,}2V} = 135\mu F$ (2p)

d) $\hat{I}_k = \hat{I}_{L\mu} = I_{L\mu Av} + \frac{\Delta I_L}{2} = \frac{1}{1-d} I_{ki}' + \frac{\Delta I_L}{2} = \frac{1}{1-0{,}269} \cdot 5A \cdot 0{,}2 + \frac{2}{2} = 2{,}36A$ (1p)

$\hat{I}_D = \hat{I}_{L\mu} / a_T = \frac{2{,}36}{0{,}2} \simeq 11{,}8A$ (1p)

e) $u_{kmax} = U_{bc} + U_{ki}' = 325 + \frac{24}{0{,}2} = 445V$ (1p)

$u_{Dmax} = U_{bc}' + U_{ki} = 0{,}2 \cdot 325 + 24 = 89V$ (1p)

f) $u_{kmin} = U_{ki}' = 24 / 0{,}2 = 120V$ (1p)

Σ 11p

Rotoreis:

0 - 14 : (1)
15 - 20 : (2)
21 - 25 : (3)
26 - 30 : (4)
31 - 35 : (5)