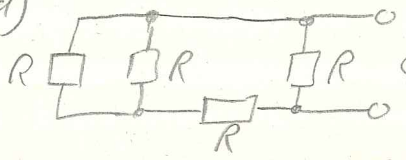
1.

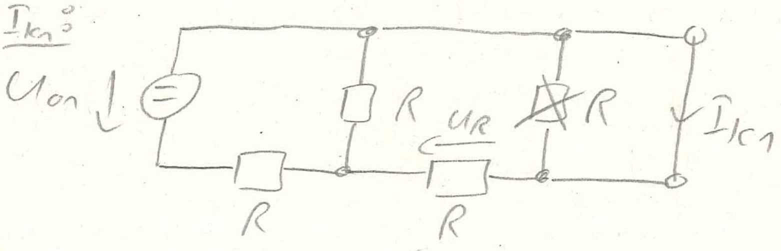
a)



$$\Leftarrow \underline{\underline{R_i}} = ((R \| R) + R) \| R = \frac{\left(\frac{R}{2} + R\right) \cdot R}{\frac{R}{2} + R + R} = \underline{\underline{\frac{3}{5} R}}$$

b) $I_k = I_{k1} + I_{k2}$

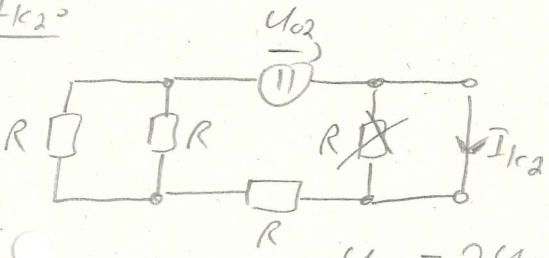
$\underline{I_{k1}}$:



$$\frac{U_R}{U_{01}} = \frac{\frac{R \cdot R}{R+R}}{R + \frac{R \cdot R}{R+R}} = \frac{\frac{R}{2}}{R + \frac{R}{2}} \Rightarrow U_R = \frac{1}{3} U_{01}$$

$$\underline{\underline{I_{k1}}} = \frac{U_R}{R} = \underline{\underline{\frac{U_{01}}{3R}}}$$

$\underline{I_{k2}}$:



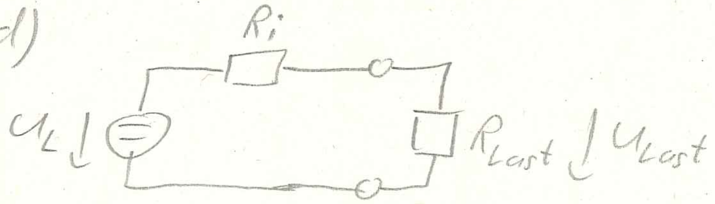
$$I_{k2} = -\frac{U_{02}}{\frac{R}{2} + R} = -\frac{U_{02}}{\frac{3}{2} R}$$

$$\underline{\underline{I_k}} = I_{k1} + I_{k2} = \underline{\underline{\frac{U_{01} - 2U_{02}}{3R}}}$$

c)

$$\underline{\underline{U_L}} = I_k \cdot R_i = \frac{U_{01} - 2U_{02}}{3R} \cdot \frac{3}{5} R = \underline{\underline{\frac{U_{01} - 2U_{02}}{5}}}$$

d)



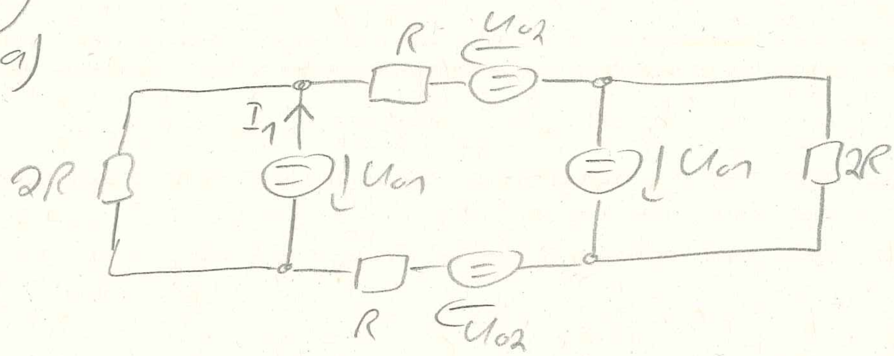
e) Leistungsanpassung: $R_{Last} = R_i$

$$\frac{U_{Last}}{U_L} = \frac{R_{Last}}{R_i + R_{Last}} = \frac{1}{2} \Rightarrow \underline{\underline{U_{Last}}} = \frac{1}{2} \cdot \frac{U_{01} - 2U_{02}}{5} = \underline{\underline{\frac{U_{01} - 2U_{02}}{10}}}$$

$$P_{Last} = \frac{U_{Last}^2}{R_{Last}} = \frac{\left(\frac{U_{01} - 2U_{02}}{10}\right)^2}{\frac{3}{5}R}$$

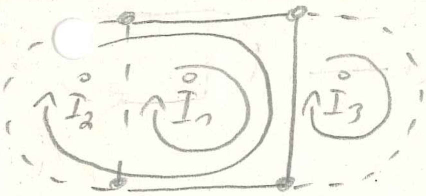
2.

a)



$$U_{02} = R \cdot I_{02}$$

b)



c) $m = z - (k-1) = 3$

d)

$$\begin{pmatrix} 2R & 2R & 0 \\ 2R & 4R & 0 \\ 0 & 0 & 2R \end{pmatrix} \begin{pmatrix} \mathring{I}_1 \\ \mathring{I}_2 \\ \mathring{I}_3 \end{pmatrix} = \begin{pmatrix} 0 \\ -U_{01} \\ U_{01} \end{pmatrix}$$

e) $I_1 = \mathring{I}_1$

I: $2R\mathring{I}_1 + 2R\mathring{I}_2 = 0$

II: $2R\mathring{I}_1 + 4R\mathring{I}_2 = -U_{01}$

III: $2R\mathring{I}_3 = U_{01}$

I: $\mathring{I}_2 = -\mathring{I}_1$

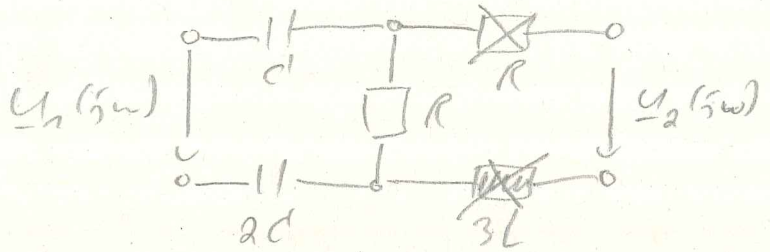
in II: $2R\mathring{I}_1 - 4R\mathring{I}_1 = -U_{01}$

$\Leftrightarrow \quad -2R\mathring{I}_1 = -U_{01}$

$\Leftrightarrow \quad \mathring{I}_1 = \frac{U_{01}}{2R}$

$\Rightarrow \underline{\underline{I_1}} = \mathring{I}_1 = \frac{U_{01}}{2R} = \frac{1V}{2k\Omega} = \underline{\underline{0{,}5\,mA}}$

3.



a) $\underline{H}(j\omega) = \frac{\underline{U}_2(j\omega)}{\underline{U}_1(j\omega)} = \frac{R}{\frac{1}{j\omega C}+\frac{1}{j\omega 2C}+R} = \frac{R}{\frac{3}{j\omega 2C}+R} = \frac{1}{1-j\frac{3}{\omega 2CR}}$

b) $|\underline{H}(j\omega)| = \frac{1}{\sqrt{1+\left(\frac{3}{\omega 2CR}\right)^2}}$, $\varphi(\omega) = \arctan\left(\frac{3}{\omega 2CR}\right)$

c) $\omega \to 0$: $|\underline{H}(j\omega)|_{\omega \to 0} = 0$ $\qquad \varphi(\omega)_{\omega \to 0} = \frac{\pi}{2}$

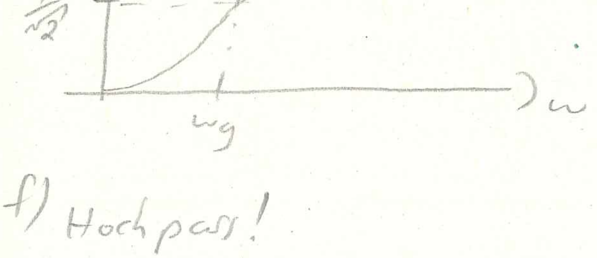
$\omega \to \infty$: $|\underline{H}(j\omega)|_{\omega \to \infty} = 1$ $\qquad \varphi(\omega)_{\omega \to \infty} = 0$

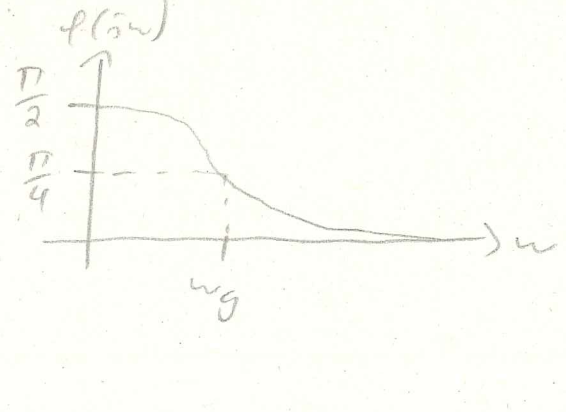
$\omega = \omega_g$: $\frac{|\underline{H}_{max}|}{\sqrt{2}} = |H(j\omega_g)| \Rightarrow \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{1+\left(\frac{3}{\omega_g 2CR}\right)^2}}$

$\Rightarrow \omega_g = \frac{3}{2CR}$

$\varphi(\omega_g) = \arctan(1) = \frac{\pi}{4}$

e)



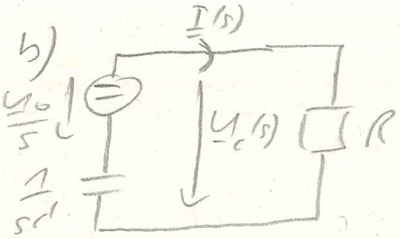


f) Hochpass!

4.

a) $u_C(t=0-) = u_C(t=0+) = U_0$

b)

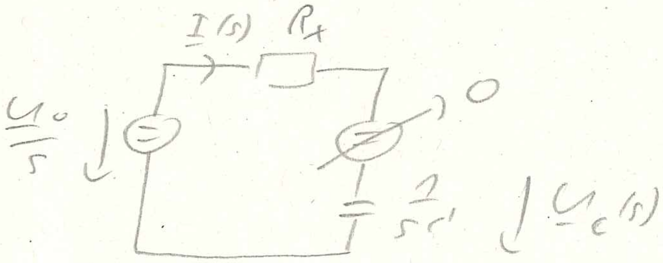


c) $\frac{\underline{U}_C(s)}{\frac{U_0}{s}} = \frac{R}{\frac{1}{sC}+R} \Rightarrow \underline{U}_C(s) = U_0 \cdot \frac{1}{s+\frac{1}{RC}}$

d) $u_C(t) = U_0 \cdot e^{-\frac{1}{RC}t}$; $t \geq 0$

e) $u_C(t=T-) = u_C(t=T+) = 0$

f) $T \to \infty$:



g) $\frac{\underline{U}_C(s)}{\frac{U_0}{s}} = \frac{\frac{1}{sC}}{\frac{1}{sC}+R_+} \Rightarrow \underline{U}_C(s) = U_0 \cdot \frac{\frac{1}{CR_+}}{s\left(s+\frac{1}{CR_+}\right)} \cdot e^{-sT}$

h) $u_C(t) = U_0 \cdot \left(1-e^{-\frac{1}{CR_+}(t-T)}\right) = U_0 - U_0 \cdot e^{-\frac{1}{CR_+}(t-T)}$; $t \geq T$

i)