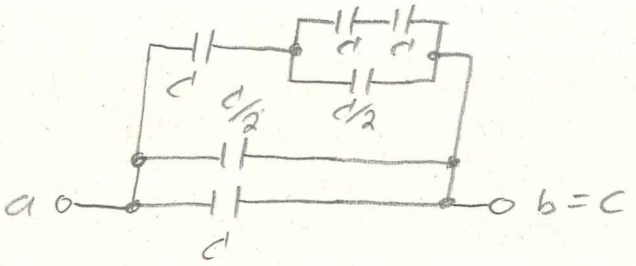
1. WS 16/17

a) $C_{bc} = 0$

b)



$C_{ab} = 2C$

c)

$C_{ac} = C_{ab} = 2C$

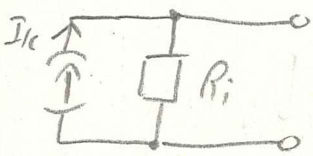
---

d) $R_i = \dfrac{R_1 R_3 + R_1 R_4 + R_3 R_4}{R_1 + R_3}$

e) $\dfrac{I_K}{I_q} = \dfrac{R_1 \| R_3 \| R_4}{R_4} \Rightarrow I_K = I_q \cdot \dfrac{R_1 R_3}{R_1 R_3 + R_1 R_4 + R_3 R_4}$

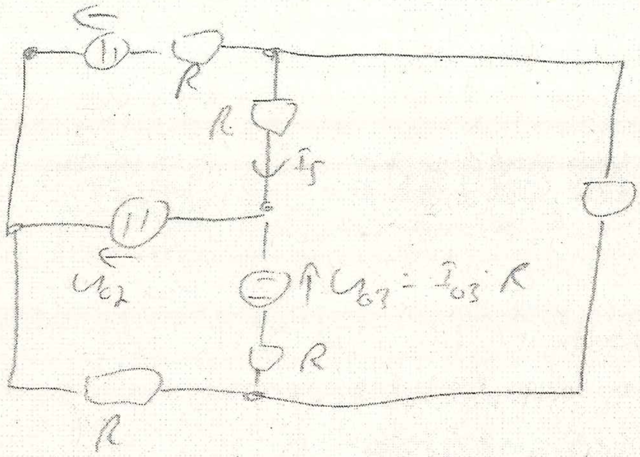
f) $U_L = I_K \cdot R_i = I_q \cdot \dfrac{R_1 R_3}{R_1 + R_3}$

g)



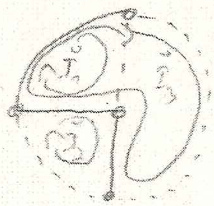
WS16/17

② a) $U_{01} = I_{01} \cdot R_i = I_{01} R$



$R = \frac{2R \cdot 2R}{4R} = R$

b)



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

$$\boxed{\begin{aligned} U_{01} &= 4V \\ U_{02} &= 2V \\ U_{03} &= 1V \end{aligned}}$$

d)

$$\begin{pmatrix} 2R & 0 & R \\ 0 & 2R & -R \\ R & -R & 3R \end{pmatrix} \begin{pmatrix} \mathring{I}_1 \\ \mathring{I}_2 \\ \mathring{I}_5 \end{pmatrix} = \begin{pmatrix} U_{01} - U_{02} \\ U_{02} + U_{03} \\ U_{01} - U_{02} - U_{03} \end{pmatrix}$$

e) $I_5 = \mathring{I}_1$

$$\underline{D} = \det \begin{pmatrix} 2R & 0 & R \\ 0 & 2R & -R \\ R & -R & 3R \end{pmatrix} = 12R^3 + 0 + 0 - (2R^3 + 2R^3 + 0) = \underline{8R^3}$$
$$= 1 \cdot 10^6 \, \Omega^3$$

$$D_1 = \det \begin{pmatrix} U_{01} - U_{02} & 0 & R \\ U_{02} + U_{03} & 2R & -R \\ U_{01} - U_{02} - U_{03} & -R & 3R \end{pmatrix} = 2V \cdot 100\Omega \cdot 150\Omega + 0 + 50\Omega \cdot 3V \cdot (-50\Omega)$$
$$- (1V \cdot 100\Omega \cdot 50\Omega + (-50\Omega) \cdot (-50\Omega) \cdot 2V + 0)$$
$$= 30kV\Omega^2 + (-7{,}5kV\Omega^2) - 5k\Omega^2 - 5k\Omega^2$$
$$= 12{,}5 kV\Omega^2 = \underline{12{,}5\, kA\Omega^3}$$

$$\underline{\underline{\mathring{I}_1 = I_5}} = \frac{D_1}{D} = \frac{12{,}5\,kA\Omega^3}{1000\,k\Omega^3} = \underline{\underline{12{,}5\,mA}}$$

WS16/17

3.

a) $\underline{H}(j\omega) = \dfrac{\underline{U}_2(j\omega)}{\underline{U}_1(j\omega)} = \dfrac{R \| C}{R + (R \| C)} = \dfrac{1}{2 + j\omega C R}$

b) $|\underline{H}(j\omega)| = \dfrac{1}{\sqrt{4 + \omega^2 C^2 R^2}}$; $\varphi(\omega) = -\arctan\left(\dfrac{\omega C R}{2}\right)$

c)

$\underline{\omega = 0:}$ $\underline{H}(j\omega = 0) = \dfrac{1}{2}$ $\qquad \varphi(\omega = 0) = 0$

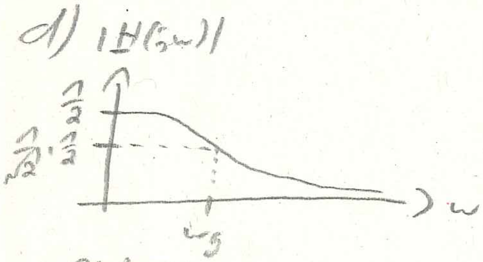
$\underline{\omega \to \infty:}$ $\underline{H}(j\omega \to \infty) = 0$ $\qquad \varphi(\omega \to \infty) = -\dfrac{\pi}{2}$

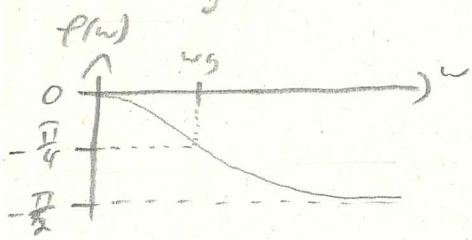
$\underline{\omega_g:}$ $\underline{H}(j\omega_g) = \dfrac{1}{\sqrt{2}} \cdot H_{max} = \dfrac{1}{\sqrt{2}} \cdot \dfrac{1}{2}$

$\Rightarrow \dfrac{1}{\sqrt{2}} \cdot \dfrac{1}{2} = \dfrac{1}{\sqrt{4 + (\omega_g C R)^2}} \Rightarrow \underline{\underline{\omega_g = \dfrac{2}{CR}}}$

$\underline{\underline{\varphi(\omega_g) = -\dfrac{\pi}{4}}}$

d)



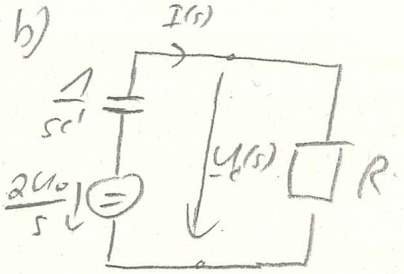


e) Tiefpass

(4.)

a) $u_c(t=0+) = u_c(t=0-) = 2U_0$

b)

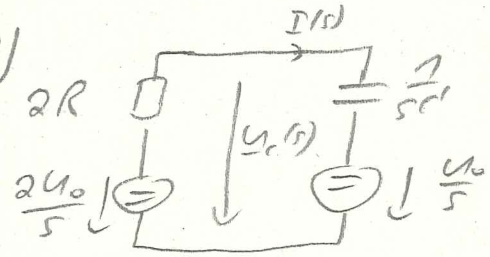


c) $\frac{U_c(s)}{2\frac{U_0}{s}} = \frac{R}{R+\frac{1}{sC}} \Rightarrow U_c(s) = 2U_0 \cdot \frac{1}{s+\frac{1}{RC}}$

d) $u_c(t) = 2U_0 \cdot e^{-\frac{1}{RC}t} \quad ; t \geq 0$

e) $u_c(t=T) = 2U_0 \cdot e^{-\frac{1}{50k\Omega \cdot 40\mu F} \cdot 1{,}3862s} = 2U_0 \cdot 0{,}5 = \underline{\underline{U_0}}$

f)



g) $I(s) = \frac{\frac{2U_0}{s} - \frac{U_0}{s}}{2R + \frac{1}{sC}} = \frac{U_0}{s} \cdot \frac{sC}{2sRC+1}$

$\underline{\underline{U_c(s)}} = I \cdot \frac{1}{sC} \cdot e^{-sT} + \frac{U_0}{s} = \underline{\underline{\frac{U_0}{s} \cdot \frac{\frac{1}{2RC}}{s+\frac{1}{2RC}} \cdot e^{-sT} + \frac{U_0}{s}}}$

h) $u_c(t) = U_0 \cdot \left(1 - e^{-\frac{1}{2RC}(t-T)}\right) + U_0 \quad ; t \geq T$

i)