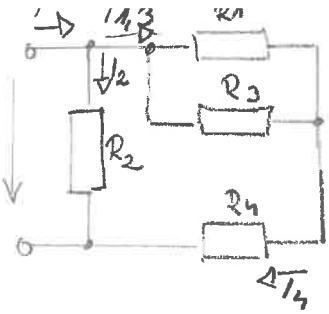
1)



$R_1 = 60\Omega$
$R_2 = 200\Omega$
$R_3 = 30\Omega$
$R_4 = 180\Omega$
$U = 24V$

$R_c = ((R_1 \times R_3) + R_4) \times R_2 = 100\Omega \Rightarrow I = U/R_c = 24V/100\Omega = 240mA$

($R_1 \times R_3 = 20\Omega$; $20\Omega + 180\Omega = 200\Omega$)

$U_{R2} = U = 24V$

$I_{R2} = U/R_2 = 24V/200\Omega = 120mA$

Mivel $I_{1,3} = I_4$, $I_4 + I_2 = I$ $\Rightarrow I - I_2 = I_4 = 240mA - 120mA = 120mA$

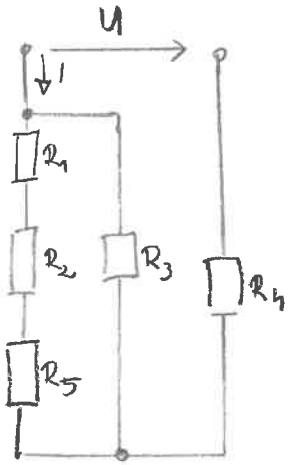
$U_{R4} = I_4 \cdot R_4 = 120mA \cdot 180\Omega = 21,6V$

$U_{R1} = U_{R3}$, $U_{R1} + U_{R4} = U$ $\Rightarrow U - U_{R4} = U_{R1} = 24V - 21,6V = 2,4V$

$I_{R1} = U_{R1}/R_1 = 2,4V/60\Omega = 40mA$
$I_{R3} = U_{R3}/R_3 = 2,4V/30\Omega = 80mA$

$\Sigma: I_{R1} + I_{R3} = I_4$ ✓

2)



$R_1 = 20\Omega$
$R_2 = 0,1k\Omega$
$R_3 = 75\Omega$
$R_4 = 10\Omega$
$R_5 = 30\Omega$
$U = 12V$

$R_c = ((R_1 + R_2 + R_5) \times R_3) + R_4 = 60\Omega$

($R_1 + R_2 + R_5 = 150\Omega$; $150\Omega \times R_3 = 50\Omega$)

$I = U/R_c = 12V/60\Omega = 200mA$

$I_{R4} = I = 200mA$

$U_{R4} = I_{R4} \cdot R_4 = 200mA \cdot 10\Omega = 2V$

$U_{R3} = U - U_{R4} = 12V - 2V = 10V$

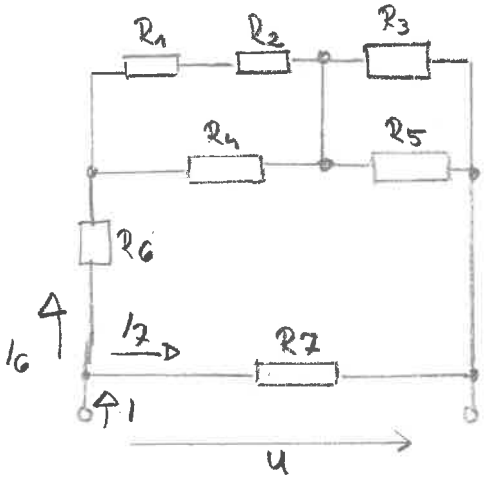
$I_{R3} = U_{R3}/R_3 = 10V/75\Omega = 133\,mA$

$I_{R1} = I_{R2} = I_{R5} \Rightarrow I - I_{R3} = 200\,mA - 133\,mA = 67\,mA$

$U_{R1} = I_{R3} \cdot R_3 = 67\,mA \cdot 20\,\Omega = 1{,}34\,V$
$U_{R2} = I_{R3} \cdot R_2 = 67\,mA \cdot 0{,}1\,k\Omega = 6{,}7\,V$
$U_{R5} = I_{R3} \cdot R_5 = 67\,mA \cdot 30\,\Omega = 2{,}01\,V$

$\Sigma\ U_{R1} + U_{R2} + U_{R5} = U_{R3}$

3.)



$R_1 = 2\,k\Omega$
$R_2 = 3\,k\Omega$
$R_3 = 4\,k\Omega$
$U = 50\,V$

$R_4 = 5\,k\Omega$
$R_5 = 6\,k\Omega$
$R_7 = 7\,k\Omega$
$R_6 = 1\,k\Omega$

$R_e = (((R_1 + R_2) \times R_4) + (R_3 \times R_5) + R_6) \times R_7 = 3{,}2\,k\Omega \Rightarrow I = U/R_e =$

$50\,V / 3{,}2\,k\Omega = 15{,}625\,mA$

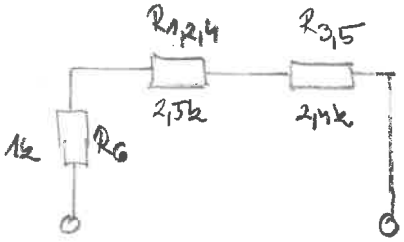
$R_1 + R_2 = 5\,k\Omega$
$(R_1 + R_2) \times R_4 = 2{,}5\,k\Omega$
$R_3 \times R_5 = 2{,}4\,k\Omega$
$(R_1 + R_2) \times R_4 + (R_3 \times R_5) + R_6 = 5{,}9\,k\Omega$

$U = U_{R7} = 50\,V$

$I_{R7} = U_{R7} / R_7 = 50\,V / 7\,k\Omega = 7{,}14\,mA \Rightarrow I_6 = I - I_{R7} = 15{,}625\,mA - 7{,}14\,mA = 8{,}485\,mA$

$U_{R4} = U_{R1} + U_{R2}$
$U_{R3} = U_{R5}$
$U_{R6} + U_{R4} + U_{R5} = U$

egyszerűsített ábra



$U_{R6} = U \cdot \frac{R_6}{R_\Sigma} = 8{,}47\,V$

$U_{R1,2,4} = U \frac{R_{1,2,4}}{R_\Sigma} = 21{,}18\,V$

$U_{R3,5} = U \frac{R_{3,5}}{R_\Sigma} = 20{,}33\,V$

$I_{R3} = U_{R3,5} / R_3 = 20{,}33\,V / 4\,k\Omega = 5{,}08\,mA$
$I_{R5} = U_{R3,5} / R_5 = 20{,}33\,V / 6\,k\Omega = 3{,}388\,mA$

$\Sigma\ I_{R3} + I_{R5} \overset{?}{=} I_{R6}$

$I_{R4} = U_{R1,R4} / R_4 = 21{,}18\,V / 5\,k\Omega = 4{,}236\,mA$

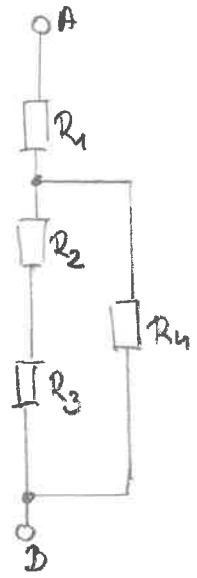
$I_{R1,2} = I_G - I_{R4} = 8{,}485\,mA - 4{,}236\,mA = 4{,}249\,mA$

$U_{R1} = I_{R1,2} \cdot R_1 = 4{,}249\,mA \cdot 2\,k\Omega = 8{,}498\,V$

$U_{R2} = I_{R1,2} \cdot R_2 = 4{,}249\,mA \cdot 3\,k\Omega = 12{,}747\,V$

$U_{R1} + U_{R2} \overset{?}{=} U_{R1,R4}$

4)



$U_{AB} = 14\,V$

$R_1 = 1\,k\Omega$

$R_2 = 4{,}7\,k$

$R_3 = 800\,\Omega$

$R_4 = 6{,}8\,k\Omega$

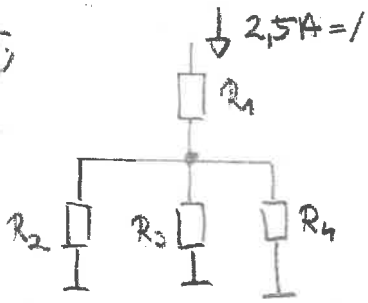
$$U_{R4} = U \cdot \frac{\overbrace{(R_2+R_3)}^{5{,}56\,k} \times R_4}{\underbrace{(R_2+R_3) \times R_4}_{3{,}05\,k} + R_1} = 10{,}54\,V$$

$$U_{R3} = U_{R4} \cdot \frac{R_3}{R_2+R_3} = 1{,}63\,V$$

$$U_{R2} = U_{R4} \cdot \frac{R_2}{R_2+R_3} = 8{,}9\,V$$

$U_{R2} + U_{R3} \overset{?}{=} U_{R4}$

5)



$R_1 = 800\,\Omega$

$R_2 = 1\,k\Omega$

$R_3 = 4{,}7\,k\Omega$

$R_4 = 960\,\Omega$

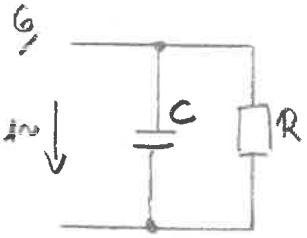
$$I_{R2} = I \cdot \frac{\overbrace{R_3 \times R_4}^{0{,}792\,k}}{R_2 + (R_3 \times R_4)} = 1{,}1\,A$$

$$I_{R3} = I \cdot \frac{R_2 \times R_4}{R_3 + \underbrace{(R_2 \times R_4)}_{0{,}489\,k}} \cong 0{,}236\,A$$

$$I_{R4} = I \cdot \frac{R_2 \times R_3}{R_4 + \underbrace{(R_2 \times R_3)}_{0{,}8215\,k}} = 1{,}15\,A$$

$I_{R1} + I_{R2} + I_{R3} \overset{?}{=} I$

6)



$U = 5\,V$

$C = 100\,nF$

$R = 1{,}5\,k\Omega$

$f = 1\,kHz$

a) I, I_R, I_C

b) Z

c) φ + vektor

↓

tapasztam fáljeszültség $\varphi = 25°$

a) $X_C = \frac{1}{2\pi f C} = 1{,}59\,k\Omega$

$I_R = U/R = 3{,}33\,mA$

$I_C = U/X_C = 3{,}14\,mA$

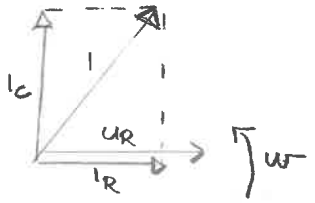
$I^2 = I_R^2 + I_C^2 \Rightarrow I = \sqrt{I_R^2 + I_C^2} = 4{,}57\,mA$

b) $Z = \frac{U}{I} = \frac{5\,V}{4{,}57\,mA} = 1{,}09\,k\Omega$

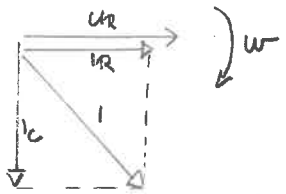
– vagy –

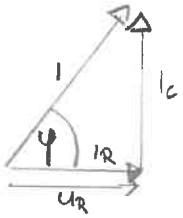
$$Z = \frac{1}{\sqrt{(1/R^2) + (1/X_C^2)}} = 1{,}09\,k\Omega$$

c) vektorábra



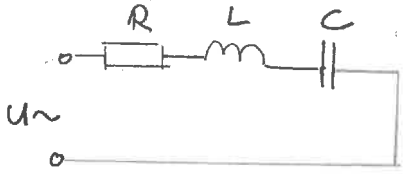
– VAGY –





$$\varphi = tg^{-1}\frac{I_C}{I_R} = 43{,}3°$$

7)



$U = 6V$ $\quad f = 5kHz$

$X_L = 2{,}5k\Omega$ $\quad R = 2k\Omega$

$X_C = 4k\Omega$

a) Z, I

b) U_R, U_C, U_L

c) L, C

a) $Z = \sqrt{R^2 + (X_L - X_C)^2} = 2{,}5k\Omega$

$I = U/Z = 6V/2{,}5k\Omega = 2{,}4mA$

b) $U_R = I \cdot R = 2{,}4mA \cdot 2k\Omega = 4{,}8V$

$U_C = I \cdot X_C = 2{,}4mA \cdot 4k\Omega = 9{,}6V$

$U_L = I \cdot X_L = 2{,}4mA \cdot 2{,}5k\Omega = 6V$

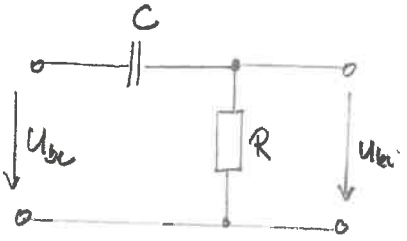
$\Sigma U \overset{?}{=} U$

$U = \sqrt{U_R^2 + (U_C - U_L)^2} = U$ ✓

c) $X_L = 2\pi f L \Rightarrow L = \frac{X_L}{2\pi f} = \frac{2{,}5k\Omega}{2\pi \cdot 5kHz} = 79{,}6mH$

$X_C = \frac{1}{2\pi f C} \Rightarrow C = \frac{1}{2\pi f X_C} = \frac{1}{2\pi \cdot 5kHz \cdot 4k\Omega} = 7{,}9nF$

8)



$U_{be} = 15V$

$f = 2{,}5kHz$

$R = 0{,}3k\Omega$

a) C ha f_h 3,2kHz!

b) Z_{be}, I_{be} (@ 2,5kHz)

c) U_{ki}, φ

d) A kimenetet egy 4,7kΩ-os ellenállással terhelve adja meg az új határfrekvenciát!

a) $R = X_C$

$R = \frac{1}{2\pi f C}$

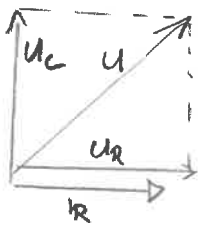
$\Rightarrow C = \frac{1}{2\pi R \cdot f_h} = \frac{1}{2\pi \cdot 0{,}3k\Omega \cdot 3{,}2kHz} = 15nF$

b) $X_C = \frac{1}{2\pi \cdot f C} = \frac{1}{2\pi \cdot 25\,kHz \cdot 15\,nF} = 4{,}24\,k\Omega$

$Z_{bc} = \sqrt{R^2 + X_C^2} = \sqrt{3{,}3^2\,k\Omega + 4{,}24^2\,k\Omega} = 5{,}37\,k\Omega$

$I_{bc} = U_{bc} / Z_{bc} = 15\,V / 5{,}37\,k\Omega = 2{,}79\,mA$

c) $U_{ba} = U_{bc} \cdot \frac{R}{Z} = 15\,V \cdot \frac{3{,}3\,k\Omega}{5{,}37\,k\Omega} = 9{,}21\,V$



$\varphi = tg^{-1} \frac{U_C}{U_R} = tg^{-1} \frac{X_C}{R} = 52{,}1°$

↳ w