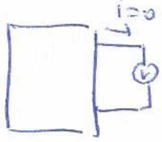
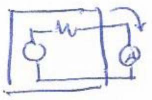
Exame CE/EI 20 Jun 2022

1a) Sendo os instrumentos ideais $R_{voltímetro} = \infty$; $R_{amperímetro} = 0$

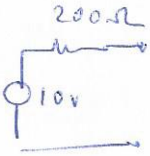
Logo



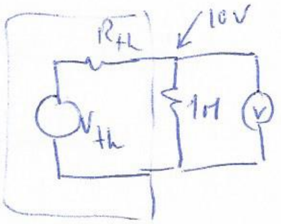
$i = 0 \Rightarrow V_s = V_{th} = 10V$



$I_{cc} = 50\,mA$ $R_{th} = \dfrac{V_{th}}{I_{cc}} = 200\Omega$

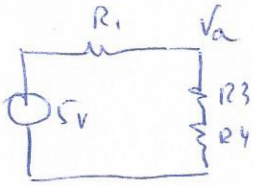


b) Se $R_v = 1\,M\Omega$
$R_{ap} = 100\,\Omega$



$$\begin{cases} 10V = V_{th} \times \dfrac{1\times10^6}{1\times10^6 + R_{th}} \\ 50\times10^{-3} = \dfrac{V_{th}}{R_{th} + 100} \end{cases} \rightarrow \begin{array}{l} V_{th} = 10,001\,V \\ R_{th} = 100,02\,\Omega \end{array}$$

2. Retirando a fonte de corrente para aplicar o princípio da sobreposição



$V_A = 5 \times \dfrac{R3+R4}{R1} = 2,7\,V$

Retirando a fonte de tensão

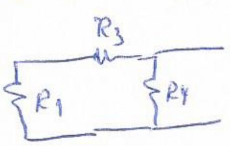
$I_{R1} = 10\times10^{-3}\dfrac{R3+R4}{R1+R3+R4} = 0,0054A \rightarrow V_A = R_1 \times I_{R1} = 2,53\,V$

Logo $V_A = 2,7 + 2,53 = 5,2\,V$

b) A tensão na fonte de corrente será $V_{fonte} = V_A + i_2 R_2 = 5,2 + 10\times10^{-3} \times 1k\Omega = 15,2V$

c) Olhando da saída do circuito, para sabermos a impedância, substituímos a fonte de tensão pela sua impedância (0) Logo

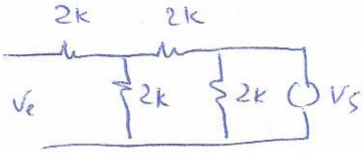
Vejo



$= R4//(R3+R1) = R_{th} = 172\,\Omega$

$V_{th} = V_A \times \dfrac{R4}{R3+R4} = 2,1\,V$

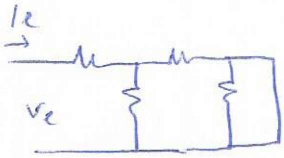
3. $h_{22} = \left.\frac{i_s}{v_s}\right|_{i_e=0}$ $\qquad$ $h_{12} = \left.\frac{v_e}{v_s}\right|_{i_e=0}$



$$h_{22} = \frac{i_s}{v_s} = \frac{1}{R_{eq}} = \frac{1}{\frac{2000 \times (2000+2000)}{6000}} = 7{,}5 \times 10^{-4}\ \Omega$$

$$h_{12} = \frac{\cancel{v_s}\,\frac{2000}{4000}}{\cancel{v_s}} = \frac{1}{2}$$

$$h_{11} = \left.\frac{v_e}{i_e}\right|_{v_s=0} \qquad h_{21} = \left.\frac{i_s}{i_e}\right|_{v_s=0}$$



$$h_{11} = \frac{v_e}{i_e} = R_{eq} = 2000 + 2000 // 2000 = 3000\ \Omega$$

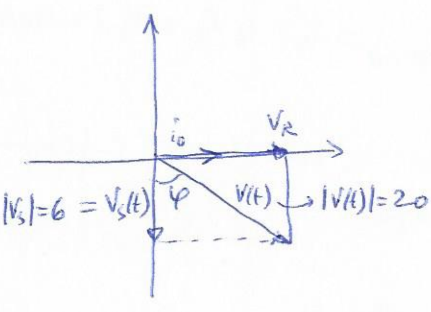
$$h_{21} = \frac{i_s}{i_e} = \frac{-i_e * \frac{2000}{4000}}{i_e} = -\frac{1}{2}$$

4.

a) $\begin{cases} v_e(t) = \sqrt{(R i_0)^2 + \left(\frac{1}{\omega C}\right)^2 i_0^2} \\ V_s(t) = \frac{1}{\omega C}\, i_0 \end{cases} \rightarrow C = 5{,}06 \times 10^{-7}\ F$

b) $\varphi = -tg^{-1}\left(\frac{R i_0}{\frac{1}{\omega C}\, i_0}\right) = -72{,}54^\circ$

c)



5. a)

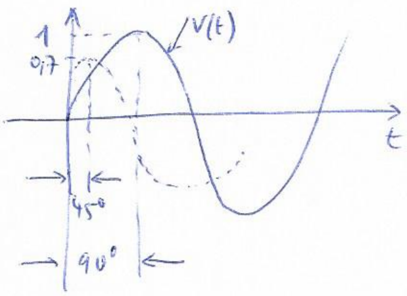
Usando fasores

$1\angle 0 = R\bar{I} + Z_L\bar{I}$

$$\bar{I} = \frac{1\angle 0}{R + j\omega L} = \frac{1\angle 0}{1000 + j320\pi} = \frac{1\angle 0}{1417\angle 45} = 0{,}7\times 10^{-3}\angle -45 \text{ A}$$

$V_L = j\omega L\bar{I} = 1005\angle 90 * \bar{I}$

$V_L = 0{,}703\angle 45 \qquad V_L(t) = 0{,}703\cos(\omega t + 45)$



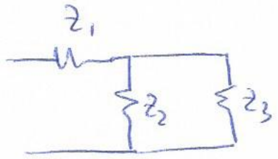
6. a)

$2\,mF = -25j$

$4\,mF = -12{,}5j$

$2H = 40j$

Podemos redesenhar o circuito como



onde $Z_{in} = Z_1 + (Z_2 // Z_3)$

$$= 20 - 25j + \frac{(-12{,}5j)(50+40j)}{(50+40j) - 12{,}5j}$$

$$= 22{,}40 - 38{,}82j \ \Omega$$

b) $Z_{in} \Rightarrow 22{,}40 - 38{,}82j = 44{,}8\angle -60$

$V(t) = 5\,\text{sen}\,\underset{20}{\omega} t = 5\cos(20t - 90) = 5\angle -90$

$$\bar{I} = \frac{\bar{V}}{Z_{in}} = \frac{5\angle -90}{44{,}8\angle -60} = 0{,}11\angle -30 \Rightarrow i(t) = 0{,}11\cos(20t - 30)$$