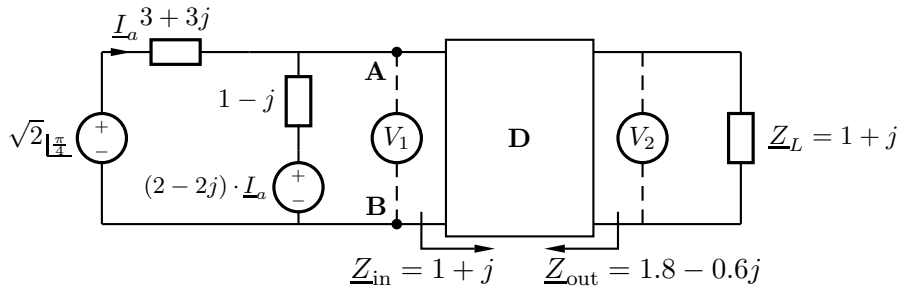
1. ARIKETA — DENBORA: 60 min (10 PUNTU)

Irudiko zirkuituan fasoreen balioak maximoak dira, eta lan maiztasuna $\omega = 10^3\,\text{rad/s}$ da.



Se pide:

a A eta B arteko Thevenin baliokidea. **(3 puntu)**

Aurreko atelean lortutako emaitza edozein izanda ere, hurrengo galderetan erabili A eta B arteko Thevenin baliokide hau: $\underline{V}_{TH} = 1\lfloor_0$ y $Z_{TH} = 1$.

b V_1 boltimetroan irakurritako balioa. **(0.5 puntu)**

c Irudiko D zirkuituaren insertzio eta transmisio galerak, jakinda V_2 irakurritako balioa 0.5 V dela. **(1.5 puntu)**

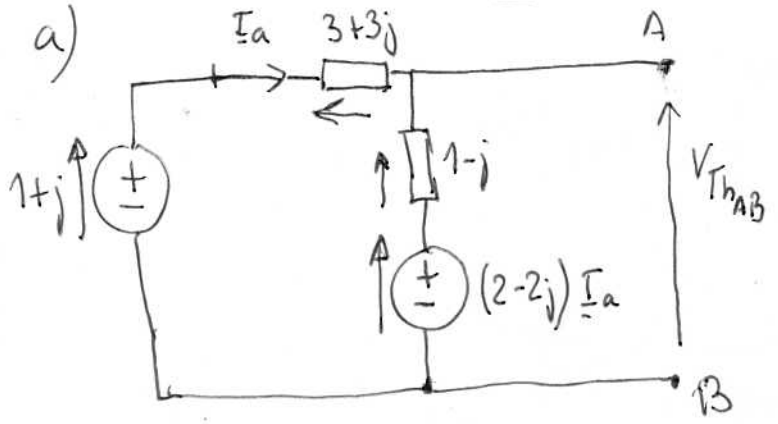
d LC egokitzapen zirkuitua erabili da $\underline{Z}_L$ inpedantziak potentzia maximoa jaso dezan. Diseinatu LC zirkuitua (osagaien balio fisikoak), jakinda DCn lan eginda potentzia kargan nulua ez dela. **(2.5 puntu)**

e Kalkulatu LC zirkuituaren insertzio galerak. **(1 puntu)**

f Kalkulatu V_2 boltimetroaren irakurketa berria, LC zirkuitua txertatu ondoren. **(1.5 puntu)**

PROBLEMA (JUNIO 2018)

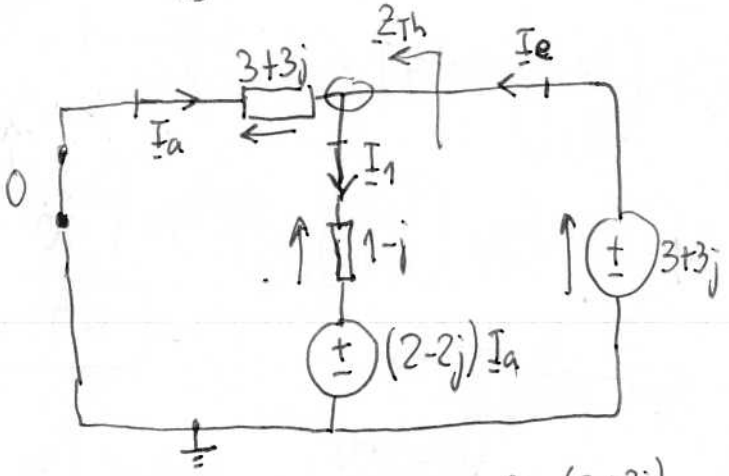
(1) a)



$2^a K$: $1+j-\underline{I}_a(3+3j)-\underline{I}_a(1-j)-(2-2j)\underline{I}_a=0$

$$\Rightarrow \underline{I}_a=\frac{1+j}{3+3j+1-j+2-2j}=\frac{1+j}{6}=$$

$$\underline{V}_{Th_{AB}}=\underline{I}_a(1-j)+\underline{I}_a(2-2j)=\underline{I}_a(3-3j)=\boxed{1\angle 0}$$



$$\underline{Z}_{Th}=\frac{3+3j}{\underline{I}_e}$$

$$\underline{I}_a=\frac{0-(3+3j)}{3+3j}=-1$$

$$\underline{I}_1=\frac{(3+3j)-(2-2j)(-1)}{1-j}=\frac{5+j}{1-j}$$

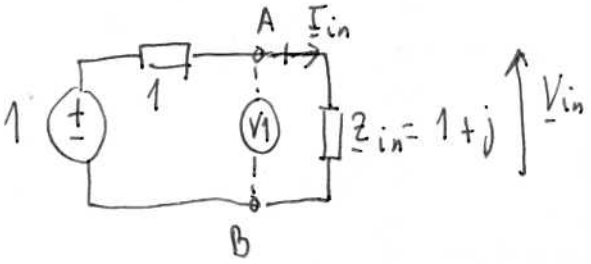
$1^a K$: $\underline{I}_a-\underline{I}_1+\underline{I}_e=0\Rightarrow \underline{I}_e=\underline{I}_1-\underline{I}_a=$

$$=\frac{5+j}{1-j}+1=$$

$$=\frac{6}{1-j}$$

$$\Rightarrow \underline{Z}_{Th}=\frac{3+3j}{6}\cdot(1-j)=2\cdot\frac{3}{6}=\boxed{1\Omega}$$

b)



$$\underline{I}_{in} = \frac{1}{1+(1+j)} = \frac{1}{2+j}$$

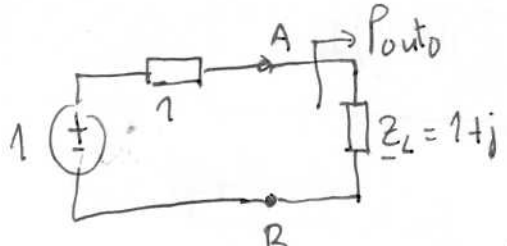
$$\underline{V}_{in} = \underline{I}_{in} \cdot \underline{Z}_{in} = \frac{1+j}{2+j} = 0,6+0,2j = \sqrt{0,4}\angle 0,32$$

$$V1 = \frac{|V_{in}|}{\sqrt{2}} = \frac{\sqrt{0,4}}{\sqrt{2}} = \sqrt{0,2} = \boxed{\frac{1}{\sqrt{5}}\ V}$$

c) $$P_{in} = 1 \cdot \left(\frac{V_1}{|Z_{in}|}\right)^2 \cdot Re(Z_{in}) = 1 \cdot \frac{|V_1|^2}{2} \cdot 1 = \frac{|V_1|^2}{2} = \frac{1}{10}\ W$$

$$P_{out} = 1 \cdot \left(\frac{V_2}{|Z_L|}\right)^2 \cdot Re(Z_L) = 1 \cdot \frac{|V_2|^2}{2} \cdot 1 = \frac{|V_2|^2}{2} = \frac{1}{8}\ W$$

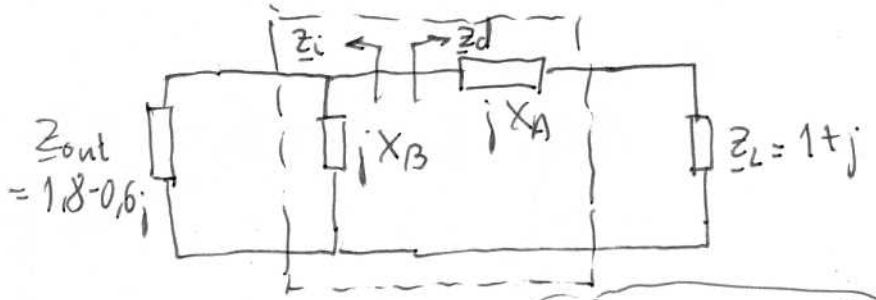
$$\alpha_t = 10 \log_{10}\left(\frac{P_{in}}{P_{out}}\right) = 10 \log_{10}\left(\frac{8}{10}\right) = \boxed{-0,97\ dB}$$



$P_{out,0} = P_{in}$, por ser $\underline{Z}_L = \underline{Z}_{in}$

$$\alpha_i = 10 \log_{10}\left(\frac{P_{out,0}}{P_{out}}\right) = \alpha_t = \boxed{-0,97\ dB}$$

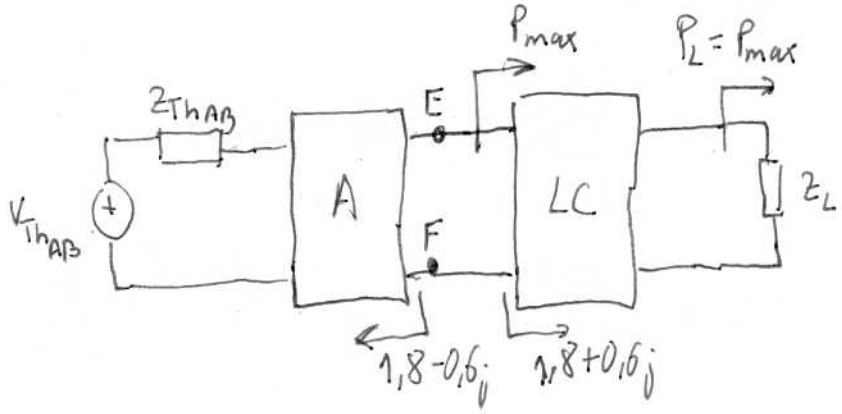
d)



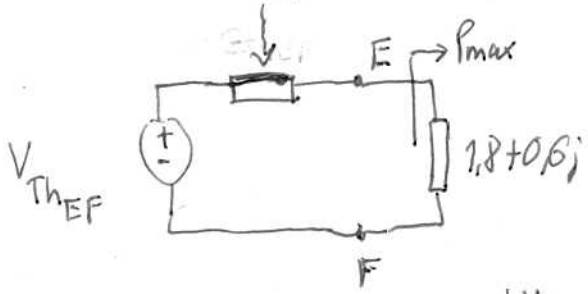
$$\underline{Z}_i = \underline{Z}_d^* \Rightarrow \begin{cases} \boxed{X_B = -3,\ X_A = 0} \\ \boxed{X_B = 1,5,\ X_A = -2} \end{cases}$$

$$j\cdot(-3) = \frac{-j}{C\cdot 10^3} \Rightarrow C = \frac{1}{3\cdot 10^3} = \boxed{\frac{1}{3}\ mF}$$

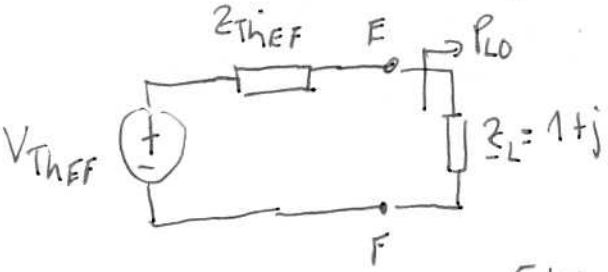
e)



$$Z_{Th\,EF} = 1,8-0,6j$$



$$P_L = P_{max} = \frac{1}{2}\frac{|V_{Th\,EF}|^2}{(2\cdot 1,8)^2}\cdot 1,8 = \frac{1}{2}\frac{|V_{Th\,EF}|^2}{4\cdot 1,8} = \frac{|V_{Th\,EF}|^2}{14,4}$$

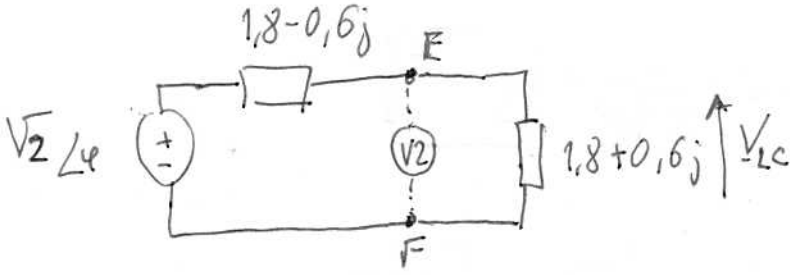


$$P_{LO} = \frac{1}{2}\left[\frac{|V_{Th\,EF}|^2}{(1,8+1)^2+(-0,6+1)^2}\right]\cdot 1 = \frac{|V_{Th\,EF}|^2}{16}$$

$$\alpha_{i_{LC}} = 10\cdot\log_{10}\left(\frac{P_{LO}}{P_L}\right) = 10\cdot\log_{10}\left(\frac{14,4}{16}\right) = \boxed{-0,46dB}$$

f) $$P_{LO} = 1\cdot\frac{(V2)^2}{|Z_L|^2}\cdot Re(Z_L) = 1\cdot\frac{\left(\frac{1}{4}\right)}{(2)}\cdot 1 = \frac{1}{8}\,W = \frac{|V_{Th\,EF}|^2}{16}$$

$$\Rightarrow |V_{Th\,EF}|^2 = 2 \Rightarrow |V_{Th\,EF}| = \sqrt{2}$$



$$V_{LC} = \frac{\sqrt{2}\angle\varphi}{2 \cdot 1,8} \cdot (1,8 + 0,6j)$$

$$V2 = \frac{|V_{LC}|}{\sqrt{2}} = \frac{1}{2 \cdot 1,8} \cdot |1,8 + 0,6j| = \boxed{0,527\ V}$$