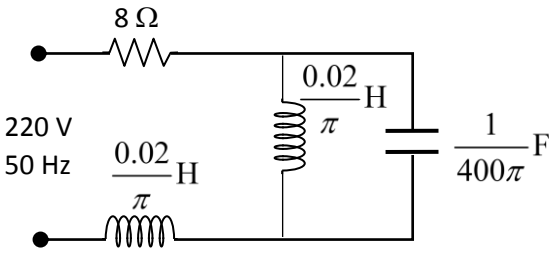
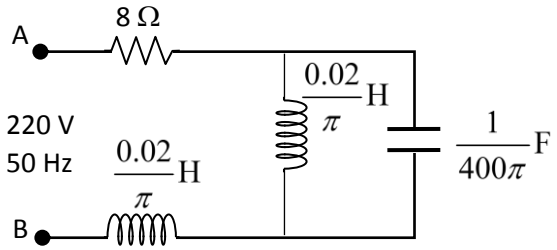
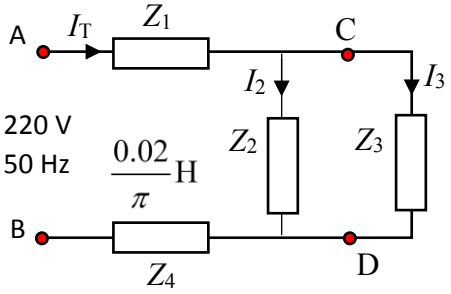
1. En el circuito de la figura hállense:

a) La intensidad total y en cada uno de los elementos.
b) La diferencia de tensión en bornes de cada elemento.
c) Potencia y factor de potencia.







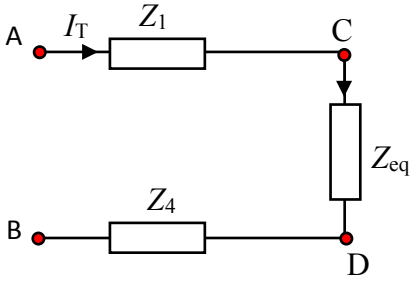
$$Z_1 = 8\,\underline{|0}\ \Omega$$

$$Z_2 = x_L = L\omega j = \frac{0.02}{\pi}100\pi j = 2j = 2\,\underline{|90}\ \Omega$$

||

$$Z_4$$

$$Z_3 = x_C = -\frac{1}{C\omega}j = -\frac{1}{\frac{1}{400\pi}100\pi}j = -4j = 4\,\underline{|-90}\ \Omega$$



$$\frac{1}{Z_{eq}} = \frac{1}{2j} - \frac{1}{4j} = \frac{4j-2j}{-8} = \frac{2j}{-8} = -\frac{j}{4}$$

$$Z_{eq} = \frac{4}{-j} = 4j = 4\,\underline{|90}\,\Omega$$

$$Z_T = 8 + 2j + 4j = 8 + 6j = 10\,\underline{|36.87}\ \Omega$$

a) Intensidad total: $I_T = \dfrac{220\,\underline{|0}}{10\,\underline{|36.87}} = 22\,\underline{|-36.87} = 17.6 - 13.2j$ A

$$I_2 = \frac{V_{CD}}{Z_2} = \frac{88\,\underline{|53.13}}{2\,\underline{|90}} = 44\,\underline{|-36.87}\ \text{A}$$

$$I_3 = \frac{V_{CD}}{Z_3} = \frac{88\,\underline{|53.13}}{4\,\underline{|-90}} = 22\,\underline{|143.13}\ \text{A}$$

b)

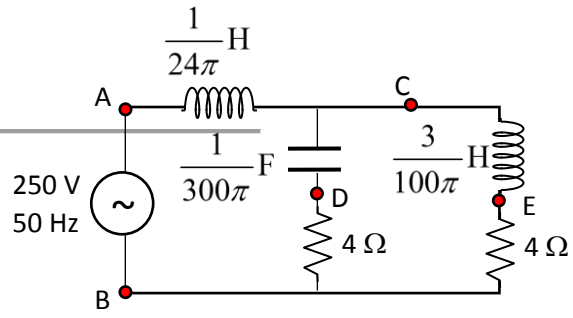
$$V_{AC} = I_T \cdot Z_1 = 22\,\angle -36.87 \cdot 8\,\angle 0 = 176\,\angle -36.87 = 140.8 - 105.6\,j \text{ V}$$
$$V_{CD} = I_T \cdot Z_{eq} = 22\,\angle -36.87 \cdot 4\,\angle 90 = 88\,\angle 53.13 = 52.8 + 70.4\,j \text{ V}$$
$$V_{DB} = I_T \cdot Z_4 = 22\,\angle -36.87 \cdot 2\,\angle 90 = 44\,\angle 53.13 = \underline{26.4 + 35.2\,j \text{ V}}$$
$$220 + 0\,j$$

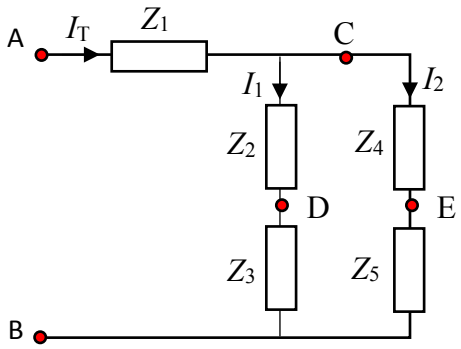
c) Factor de potencia: cos 36.87 = 0.8

Potencia del circuito:

$$P = VI\cos\varphi = 220 \times 22 \times 0.8 = \boxed{3872 \text{ W}}$$

2. En el circuito de la figura, determínense:
   a) Caída de tensión entre D y E.
   b) Diagrama de intensidades y tensiones.





$$Z_1 = L_1\omega j = \frac{1}{24\pi}100\pi j = \frac{100}{24}j = \frac{25}{6}j\ \Omega$$

$$Z_2 = -\frac{1}{C\omega}j = -\frac{1}{\frac{1}{300\pi}100\pi}j = -3j\ \Omega$$

$$Z_3 = Z_5 = 4\ \Omega$$

$$Z_4 = L_2\omega j = \frac{3}{100\pi}100\pi j = 3j\ \Omega$$

$$Z_{\text{Rama 1}}\quad 4-3j = 5\,\underline{|-36.87}\ \Omega$$

$$Z_{\text{Rama 2}}\quad 4+3j = 5\,\underline{|36.87}\ \Omega$$

$$\frac{1}{Z_{ep}} = \frac{1}{4-3j}+\frac{1}{4+3j} = \frac{4+\cancel{3j}+4-\cancel{3j}}{25} = \frac{8}{25}$$

$$Z_{ep} = \frac{25}{8}\,\underline{|0} = 3.125\,\underline{|0}\ \Omega$$

$$Z_T = Z_1 + Z_{ep} = \frac{25}{6}j + \frac{25}{8} = 5.2\,\underline{|53.13}\ \Omega$$

$$I_T = \frac{250\,\underline{|0}}{5.2\,\underline{|53.13}} = 48\,\underline{|-53.13} = 28.8-38.4j\ \text{A}$$

$$V_C - V_B = I_T \cdot Z_{ep} = 48\,\underline{|-53.13}\cdot\frac{25}{8}\,\underline{|0} = 150\,\underline{|-53.13}\ \text{V}$$

$$I_1 = \frac{V_C - V_B}{Z_{R_{ama1}}} = \frac{150\,\underline{|-53.13}}{5\,\underline{|-36.87}} = 30\,\underline{|-16.27} = 28.8-8.4j\ \text{A}$$

$$I_2 = \frac{V_C - V_B}{Z_{R_{ama2}}} = \frac{150\,\underline{|-53.13}}{5\,\underline{|36.87}} = 30\,\underline{|-90} = 0-30j\ \text{A}$$

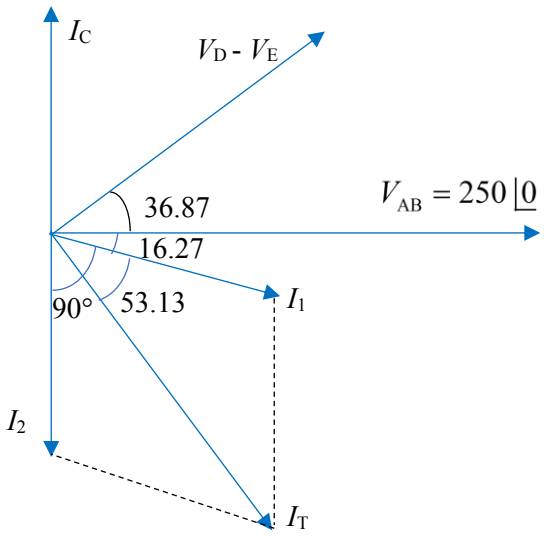
$$V_C - V_D = I_1 \cdot Z_2 = 30\,\underline{|-16.27}\cdot 3\,\underline{|-90} = 90\,\underline{|-106.27} = -25.21-86.4j\ \text{V}$$

$$V_C - V_E = I_2 \cdot Z_4 = 30\,\underline{|-90}\cdot 3\,\underline{|90} = 90\,\underline{|0}\ \text{V}$$

a)

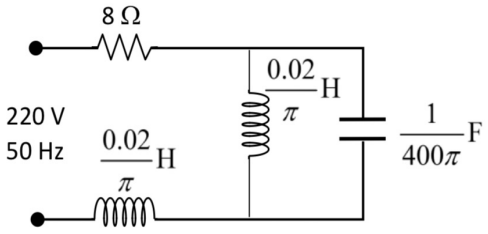
$$V_D - V_E = -(V_C - V_D) + (V_C - V_E) = -(-25.21-86.4j) + 90 = 115.2+86.4j = 144\,\underline{|36.87}\ \text{V}$$

b)

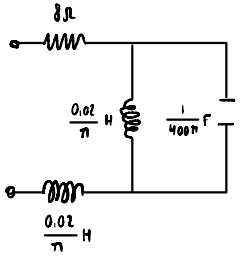


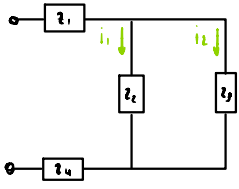
1. En el circuito de la figura hállense:

a) La intensidad total y en cada uno de los elementos.
b) La diferencia de tensión en bornes de cada elemento.
c) Potencia y factor de potencia.



2)

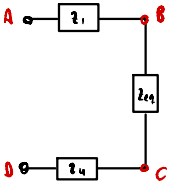




$\dot{Z}_1 = R = 8\ \Omega$

$\dot{Z}_2 = \dot{Z}_4 = L\omega j = L2\pi f j = \frac{0.02}{\pi} 2\pi 50 j = 2\angle 90\ \Omega$

$\dot{Z}_3 = -\frac{1}{C\omega} = -\frac{1}{C2\pi f} = -\frac{1}{\frac{1}{400\pi} 2\pi 50 j} = 4\angle -90\ \Omega$



$\frac{1}{\dot{Z}_{eq}} = \frac{1}{\dot{Z}_2} + \frac{1}{\dot{Z}_3} = \frac{1}{2\angle 90} + \frac{1}{4\angle -90} = \frac{1}{4}\angle -90$

$\dot{Z}_{eq} = 4\angle 90\ \Omega$

$\dot{Z}_T = \dot{Z}_1 + \dot{Z}_{eq} + \dot{Z}_4 = 8 + 4\angle 90 + 2\angle 90 = 10\angle 36{,}8699\ \Omega$

$\dot{I}_T = \frac{V_{Gn}}{\dot{Z}_T} = \frac{220}{10\angle 36{,}8699} = 22\angle -36{,}8699\ A$

$V_{BC} = I_T \cdot \dot{Z}_{eq} = 22\angle -36{,}8699 \cdot 4\angle 90 = 88\angle 53{,}1301\ V$

$i_1 = \frac{V_{BC}}{\dot{Z}_2} = \frac{88\angle 53{,}1301}{2\angle 90} = 44\angle -36{,}8699\ A$

$i_2 = \frac{V_{BC}}{\dot{Z}_3} = \frac{88\angle 53{,}1301}{4\angle -90} = 22\angle 143{,}1301\ A$

b) $V_{z_1} = I_T z_1 = 22 \angle -36,8699 \cdot 8 = 176 \angle -36,8699$ V

$V_{z_2} = i_1 z_2 = 44 \angle -36,8699 \cdot 2 \angle 90 = 88 \angle 53,1301$ V

$V_{z_3} = i_2 z_3 = 22 \angle 143,1301 \cdot 4 \angle -90 = 88 \angle 53,1301$ V

$V_{z_2} = V_{z_3}$

$V_{z_4} = I_T z_4 = 22 \angle -36,8699 \cdot 2 \angle 90 = 44 \angle 53,1301$

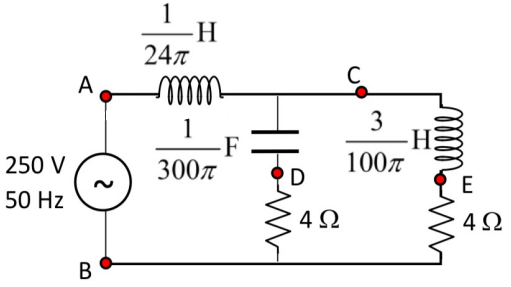
c) $FP = \cos z_T^\circ = \cos 36,8699 = 0,7999$

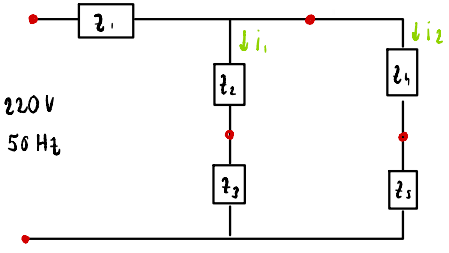
$P = VI \cos z_T^\circ = 220 \cdot 22 \cdot 0,7999 = 3871,516$ W

2. En el circuito de la figura, determínense:

a) Caída de tensión entre D y E.

b) Diagrama de intensidades y tensiones.



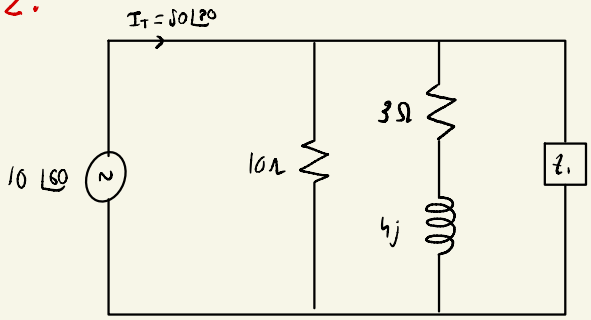


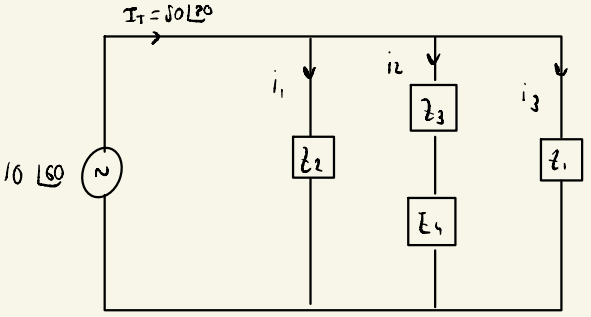
$$\underline{Z}_1 = Lwj = L2\pi fj = \frac{1}{24\pi} 2\pi 50\, j = \frac{25}{6} j\ \Omega$$

$$\underline{Z}_2 = -\frac{1}{Cwj} = \frac{1}{C2\pi fj} = \frac{1}{\frac{1}{300\pi} 2\pi 50\, j} = -3j\ \Omega$$

2.

Calcular Z_1 y FP del circuito





$Z_2 = R = 10\,\Omega = Z_{rama\,1}$

$Z_3 = R = 3\,\Omega$

$Z_4 = 4j\ \Omega$

$\Big\}\ 3 + 4j\,\Omega = Z_{rama\,2}$

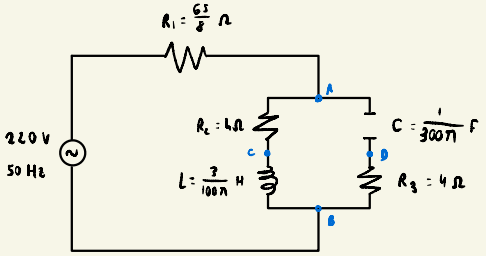
$V_{BC} = I_T \cdot Z_1$

$$I_T = \frac{V_{Gen}}{Z_T} \rightarrow Z_T = \frac{V_{Gen}}{I_T} = \frac{10 \angle 60}{50 \angle 30} = \frac{1}{5} \angle 30\ A$$

$$\frac{1}{Z_T} = \frac{1}{Z_{R1}} + \frac{1}{Z_{R2}} + \frac{1}{Z_1} \rightarrow \frac{1}{\frac{1}{5} \angle 30} = \frac{1}{10} + \frac{1}{3 + 4j} + \frac{1}{Z_1}$$

$$\frac{1}{Z_1} = \frac{1}{\frac{1}{5} \angle 30} - \frac{1}{10} - \frac{1}{3+4j} = 4{,}72 \angle -29{,}65 \rightarrow Z_1 = 0{,}21 \angle 29{,}65$$

$$FP = \cos \theta = \frac{\sqrt{3}}{2} = 0{,}86$$



a) Z_T

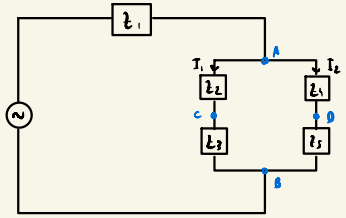
b) I_T

c) I_1, I_2

d) P_y FP

e) P_{dis1}, P_{dis2}, P_{dis5}

f) V_{CD}



a) $Z_1 = \frac{65}{8}\ \Omega$

$Z_2 = 4\ \Omega$

$Z_3 = L\omega j = \frac{3}{100\pi} 2\pi 50\, j = 3j\ \Omega$

$\Big\} Z_{R_1} = 4 + 3j\ \Omega$

$Z_4 = -\frac{1}{C\omega} j = -\frac{1}{\frac{1}{300\pi} 2\pi 50}\, j = -3j\ \Omega$

$Z_5 = 4\ \Omega$

$\Big\} Z_{R_2} = 4 - 3j\ \Omega$

$$\frac{1}{Z_{eq}} = \frac{1}{Z_{R1}} + \frac{1}{Z_{R2}} = \frac{1}{4+3j} + \frac{1}{4-3j} = \frac{8}{25} \rightsquigarrow Z_{eq} = \frac{25}{8}\ \Omega$$

$$Z_T = Z_1 + Z_{eq} = \frac{65}{8} + \frac{25}{8} = \frac{90}{8}\ \Omega$$

b) $$I_T = \frac{V_G}{Z_T} = \frac{220}{\frac{90}{8}} = \frac{176}{9}\ A$$

c) $$I_T = \frac{V_G}{Z_{eq}} \rightarrow V_G = I_T Z_{eq} = \frac{176}{9} \frac{25}{8} = \frac{550}{7}\ V$$

$$I_1 = \frac{V_{AB}}{Z_{R1}} = \frac{\frac{550}{9}}{4+3j} = \frac{88}{9} - \frac{22}{3} j$$

$$I_2 = \frac{V_{AB}}{Z_{R2}} = \frac{\frac{550}{5}}{4-3j} = \frac{88}{9} + \frac{22}{3} j$$

d) $FP = \cos\alpha = \cos 0 = 1$

$P = VI\cos\alpha = 220\ \frac{550}{9}\ 1 = \frac{121000}{9}\ W$

e) Solo aplicable a R

$P_{dis\,Z_1} = I_1^2 Z_1 = \left(\frac{176}{9}\right)^2 \frac{65}{8} = 3107,16\ W$

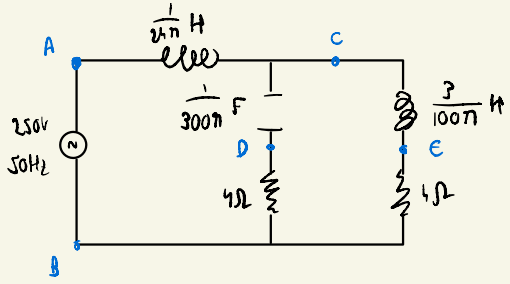
$P_{dis\,Z_2} = I_1^2 Z_2 = \left(\frac{88}{9}\right)^2 4 = 382,419\ W$

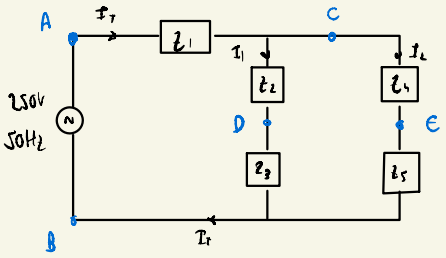
$P_{dis\,Z_3} = I_2^2 Z_3 = \left(\frac{88}{9}\right)^2 4 = 382,419\ W$

f) $V_{AC} = I_1 Z_2 = \left(\frac{88}{9} - \frac{22}{3}j\right)(4) = \frac{352}{9} - \frac{88}{3}j$

$V_{AD} = I_2 Z_4 = \left(\frac{88}{9} + \frac{22}{3}j\right)(-3j) = 22 - \frac{88}{3}j$

$V_{CD} = V_{AD} - V_{AC} = \left(22 - \frac{88}{3}j\right) - \left(\frac{352}{9} - \frac{88}{3}j\right) = -\frac{154}{9}$





$$Z_3 = Z_5 = 4\,\Omega$$

$$Z_1 = L\omega j = \frac{1}{2\pi} 2\pi \cdot 50\, j = \frac{25}{6} j\ \Omega$$

$$Z_4 = L\omega j = \frac{3}{100\pi} 2\pi\, 50 j = 3j\ \Omega$$

$$Z_2 = -\frac{1}{C\omega} j = -\frac{1}{\frac{1}{300\pi} 2\pi 50} j = -3j\ \Omega$$

$$Z_{rama1} = Z_2 + Z_3 = 4 - 3j\ \Omega$$

$$Z_{rama2} = Z_4 + Z_5 = 4 + 3j\ \Omega$$

$$\frac{1}{Z_{eq}} = \frac{1}{Z_{r1}} + \frac{1}{Z_{r2}} = \frac{1}{4-3j} + \frac{1}{4+3j} = \frac{8}{25} \rightarrow Z_{eq} = \frac{25}{8}\ \Omega$$

$$Z_T = Z_1 + Z_{eq} = \frac{25}{8} + \frac{25}{6} j\ \Omega$$

$$I_T = \frac{V_{Gen}}{Z_T} = \frac{250\angle 0}{5{,}2\angle 53{,}13} = 48\angle -53{,}13 = 28{,}8 - 38{,}4\, j\ A$$

$$V_{CD} = I_T Z_{eq} = 48\angle -53{,}13 \ \ \frac{25}{8}\angle 0 = 150\angle -53{,}13\ V$$

$$I_1 = \frac{V_{CD}}{Z_{rama1}} = \frac{150\angle -53{,}13}{5\angle -36{,}87} = 30\angle -16{,}27 = 28{,}8 - 8{,}1\, j\ A$$

$$I_2 = \frac{V_{CD}}{Z_{rama2}} = \frac{150\angle -53{,}13}{5\angle 36{,}87} = 30\angle -90 = -30j\ A$$

$$V_{ED} = V_{EC} - V_{CD} = I_2 \cdot Z_4 - I_1 \cdot Z_2 = 30\angle -90\ 3\angle 90 - 30\angle -16{,}27\ \ 3\angle -90 = 115{,}2 + 86{,}4\, j\ V$$

Potencia disipada

$P_{f_1} = P_{f_2} = P_{f_4} = 0$

$P_{f_3} = |I_1|^2 f_3 = 30^2 \cdot 4 = 3600\ W$

$P_{f_5} = |I_2|^2 f_5 = 30^2 \cdot 4 = 3600\ W$

Representar los fasores de la potencia (forma polar)