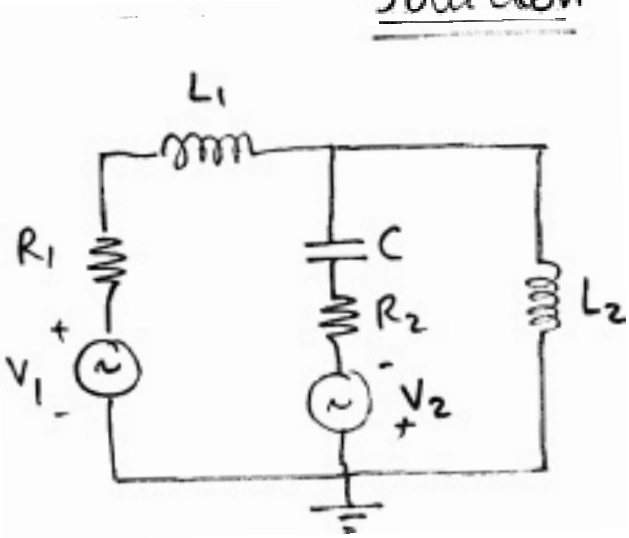
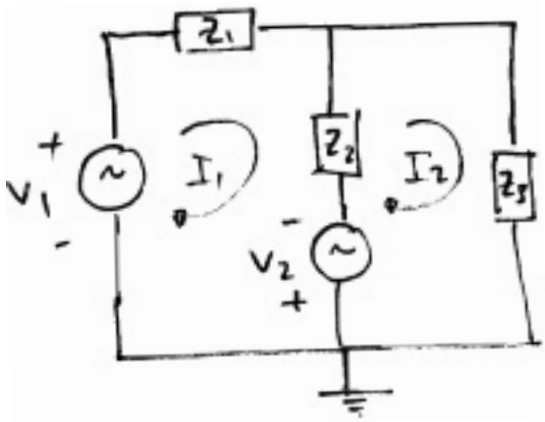
Solución

1.-



- Aplicamos Malla (más usado)

$Z_1 = R_1 + j X_{L_1}$
$Z_2 = R_2 - j X_{C_1}$
$Z_3 = j X_{L_2}$



$Z_1 = 1\Omega + j2\Omega$
$Z_2 = 4\Omega - j8\Omega$
$Z_3 = j6\Omega$

Malla 1:

$$V_1 - I_1 Z_1 - I_1 Z_2 + V_2 + I_2 Z_2 = 0$$
$$V_1 + V_2 - I_1 (Z_1 + Z_2) + I_2 Z_2 = 0$$
$$V_1 + V_2 = I_1 (Z_1 + Z_2) - I_2 Z_2 \quad (I)$$

Malla 2:

$$-V_2 - I_2 Z_2 - I_2 Z_3 + I_1 Z_2 = 0$$
$$-V_2 - I_2 (Z_2 + Z_3) + I_1 Z_2 = 0$$
$$-V_2 = I_2 (Z_2 + Z_3) + I_1 Z_2 \quad (II)$$

$$\begin{bmatrix} V_1+V_2 \\ -V_2 \end{bmatrix} = \begin{bmatrix} Z_1+Z_2 & -Z_2 \\ -Z_2 & Z_2+Z_3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$I_1 = \frac{\begin{bmatrix} V_1+V_2 & -Z_2 \\ -V_2 & Z_2+Z_3 \end{bmatrix}}{\begin{bmatrix} Z_1+Z_2 & -Z_2 \\ -Z_2 & Z_2+Z_3 \end{bmatrix}}$$

$$I_1 = \frac{(V_1+V_2)(Z_2+Z_3) - (-Z_2)(-V_2)}{(Z_1+Z_2)(Z_2+Z_3) - (-Z_2)(-Z_2)}$$

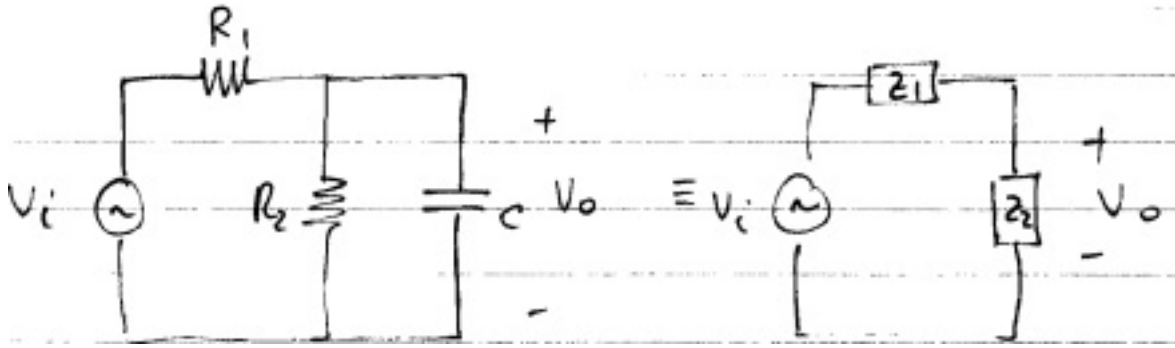
$$I_1 = \frac{60.58 \angle 28.3}{63.53 \angle 28.1} = 0.95 \angle 0.2^\circ \ \langle A \rangle$$

$$I_2 = \frac{\begin{bmatrix} Z_1+Z_2 & V_1+V_2 \\ -Z_2 & -V_2 \end{bmatrix}}{\begin{bmatrix} Z_1+Z_2 & -Z_2 \\ -Z_2 & Z_2+Z_3 \end{bmatrix}}$$

$$I_2 = \frac{(Z_1+Z_2)(-V_2) - (V_1+V_2)(-Z_2)}{(Z_1+Z_2)(Z_2+Z_3) - (-Z_2)(-Z_2)} = \frac{80.95 \angle -58.7}{63.53 \angle 28.2}$$

$I_2 = 1.3 \text{ A} \angle -87^\circ$

2.-



Por divisor de tensión:

$$V_o = V_i \frac{Z_2}{Z_1 + Z_2} \Rightarrow \frac{V_o}{V_i} = \frac{Z_2}{Z_1 + Z_2}$$

$$Z_1 = R_1$$

$$Z_2 = R_2 \,//\, (1/jwC)$$

$$\frac{V_o}{V_i} = \frac{R_2 \,//\, (1/jwC)}{R_1 + R_2 \,//\, (1/jwC)} = \frac{\frac{R_2 (1/jwC)}{R_2 + 1/jwC}}{R_1 + \frac{R_2 (1/jwC)}{R_2 + 1/jwC}}$$

$$\frac{V_o}{V_i} = \frac{\frac{R_2}{R_2 jwC + 1}}{R_1 + \frac{R_2}{R_2 jwC + 1}} = \frac{R_2}{R_1 (R_2 jwC + 1) + R_2}$$

$$\boxed{\frac{V_o}{V_i} = \frac{1}{j R_1 wC + 2}}$$

$$\left|\frac{V_o}{V_i}\right| = \frac{1}{\sqrt{(R_1 \omega C)^2 + 2^2}}$$

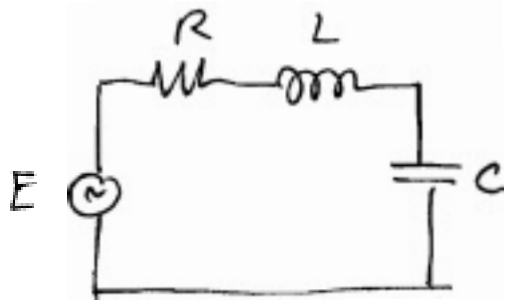
$\omega \to 0 \Rightarrow \left|\frac{V_o}{V_i}\right| \approx 0.5$

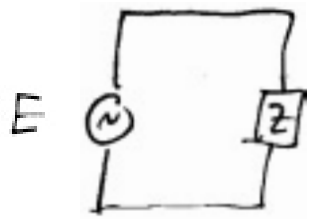
$\omega \to \infty \Rightarrow \left|\frac{V_o}{V_i}\right| \approx 0$

} Filtro Pasabajas

ω	$\left\|\frac{V_o}{V_i}\right\|$
1	0.49
10	0.45
20	0.35
30	0.28
40	0.22
50	0.18
60	0.16
70	0.13
80	0.12
90	0.11
100	0.10

3.-





$$I = \frac{E}{Z} \qquad Z = R + jX_L - jX_C$$

$$I = \frac{100V \angle 0°}{6\Omega + j7\Omega - j15\Omega} = \frac{100V \angle 0°}{10\Omega \angle -53.13°}$$

$$\mathbf{i} = 10A \angle 53.13° \leftarrow \text{ángulo entre } V \text{ e } I$$

$$P = U \cdot I \cos a = (100V)(10A)\cos(53.17°)$$

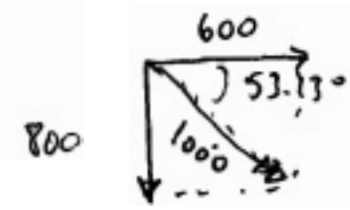
$$P = 600\ W \leftarrow \text{Potencia disipada}$$

$$Q = VI \operatorname{Sen}\theta = (100V)(10A)\operatorname{Sen}(53.13°)$$

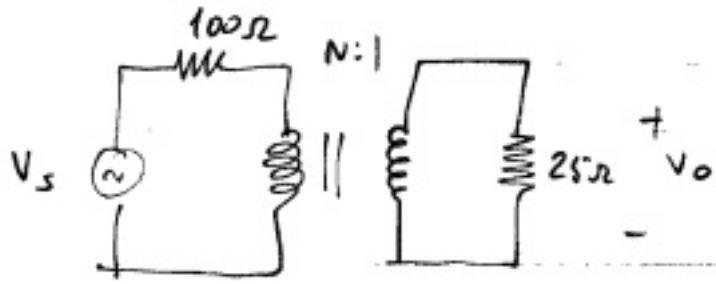
$$Q = 800\ VAR \leftarrow \text{Potencia reactiva}$$

$$S = V \cdot I = (100V)(10A) = 1000\ V \cdot A$$

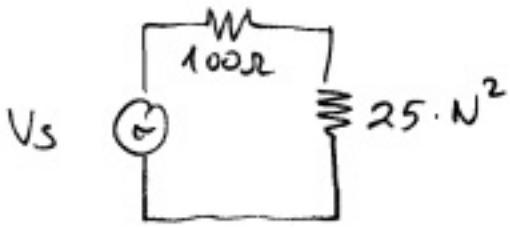
$$F.P. = \frac{P}{S} = \frac{600\ W}{1000\ VA} = 0.6$$

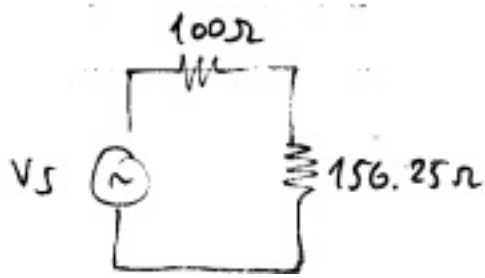


4.-



Reflejando hacia el primario del transformador

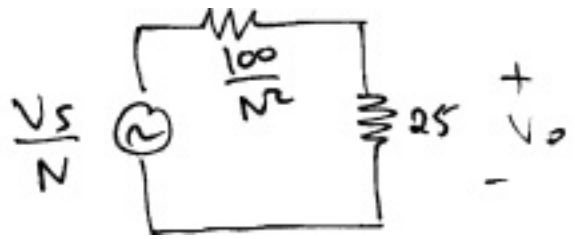




$$i_s = \frac{V_s}{100 + 156.25\Omega} = \frac{294\cos(377t)}{256.25\Omega}$$

$$i_s = 1.15\,A\cos(377t)$$

Reflejando hacia el secundario del transformador



Aplicamos divisor de tensión

$$V_o = \frac{V_s}{N}\,\frac{25\Omega}{25\Omega + \frac{100\Omega}{N^2}} = 117.6\cos(377t)\,\frac{25\Omega}{25\Omega + 16\Omega}$$

$$V_o = 71.7\cos(377t)$$