

2º PARCIAL 20/17/20

Ejercicio 1

a) $\vec{B} = B(r) \hat{e}_\phi$ $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_{encerrada}$



$r < a$: $|j| = \frac{i_{total}}{a^2 \pi}$ $\oint \vec{B} \cdot d\vec{l} \rightarrow$ círculo radio r encierra
 una $i_{enc} \Rightarrow j = \frac{i_{enc}}{r^2 \pi} \Rightarrow i_{enc} = j \pi r^2$

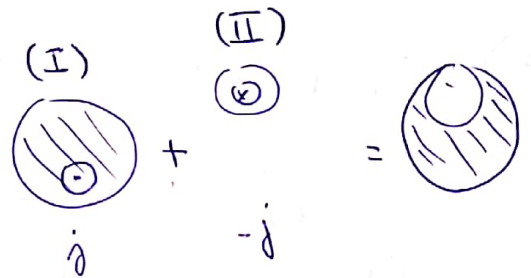
$\oint \vec{B} \cdot d\vec{l} = \mu_0 j \pi r^2 \Rightarrow \left[\vec{B}(r) = \frac{\mu_0 j r}{2} \hat{e}_\phi \right]$

$r \geq a$ $i_{TOT} = j \pi a^2$

$\oint \vec{B} \cdot d\vec{l} = \mu_0 j \pi a^2 \Rightarrow \left[\vec{B}(r) = \frac{\mu_0 j a^2}{2r} \hat{e}_\phi \right]$



b) uso principio de superposición



en P el campo generado por (I):

$\vec{B}_I(r) = \frac{\mu_0 j a^2}{2r} \hat{e}_\phi$

radio = a densidad j
 dist a p = r

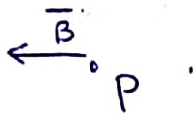
en P el campo generado por (II):

$\vec{B}_{II}(r) = \frac{-\mu_0 j a^2 / 4}{2(r - a/2)} \hat{e}_\phi$

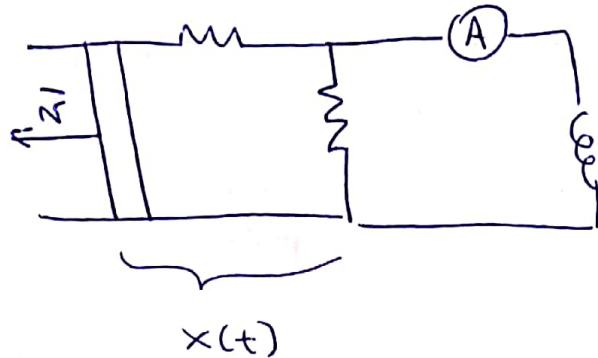
radio $a/2$
 dist a p: $r - a/2$
 densidad: $-j$

$\vec{B}_P(r) = \vec{B}_I + \vec{B}_{II} = \frac{\mu_0 j a^2}{2} \left[\frac{1}{r} - \frac{1}{4(r - a/2)} \right] \hat{e}_\phi$

estudiando el signo de $\left[\frac{1}{r} - \frac{1}{4(r-a/2)} \right]$ vemos que es positivo entonces la dirección de B es

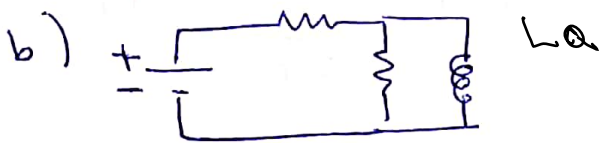


Ejercicio 2:



a) $\mathcal{E} = -\frac{d\phi_B}{dt}$ $\phi_B = B \cdot A = B \cdot l \cdot x(t)$

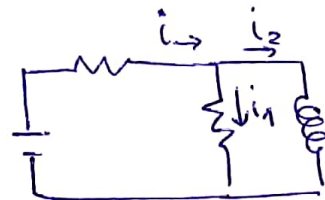
$\mathcal{E} = -\frac{d}{dt} [B \cdot l \cdot x(t)] = -B \cdot l \cdot v = -7,5 \text{ V}$



c) $\mathcal{E}_{ind} - iR_1 - i_1 R_2 = 0 \text{ (I)}$

$-L \frac{di_2}{dt} + i_1 R_2 = 0 \text{ (II)}$

$i_1 + i_2 = i \text{ (III)}$



d) $\mathcal{E}_{ind} = iR_1 + i_1 R_2 = 0$ usando III $i_1 = \frac{\mathcal{E} - i_2 R_1}{R_1 + R_2}$

reemplazado en II $\rightarrow -L \frac{di_2}{dt} + \left[\frac{\mathcal{E} - i_2 R_1}{R_1 + R_2} \right] R_2 = 0$

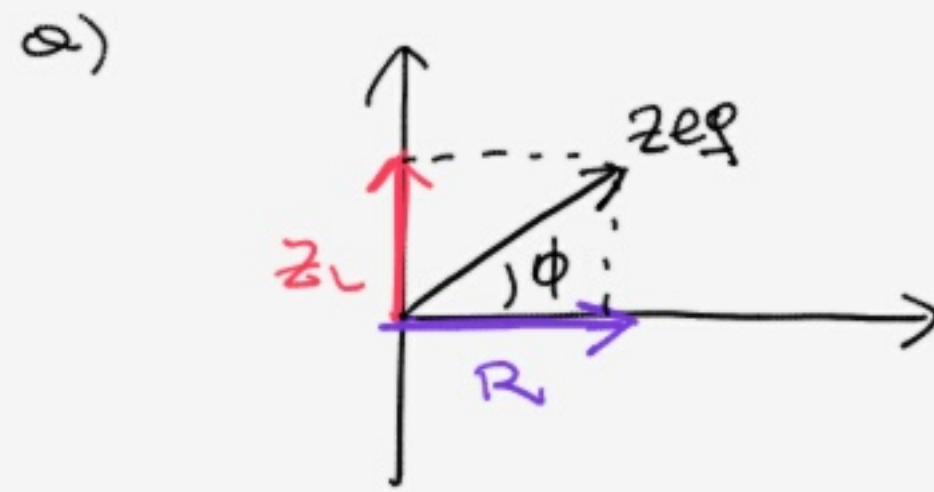
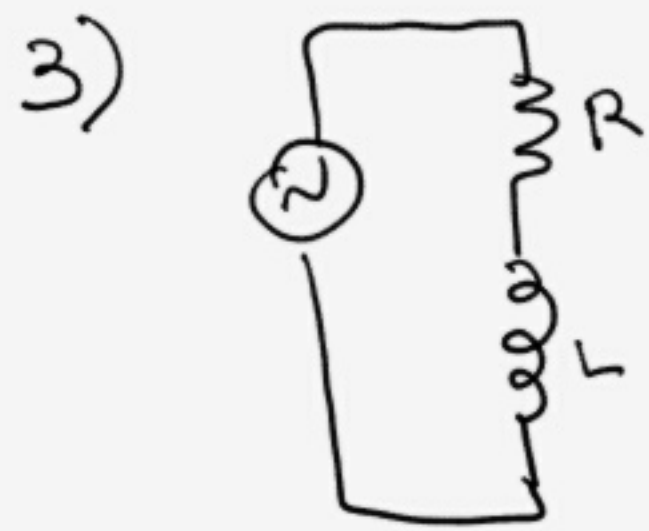
$\frac{di_2}{dt} + \frac{1}{L} \frac{R_2 R_1}{R_1 + R_2} i_2 = \frac{1}{L} \frac{R_2}{R_1 + R_2} \mathcal{E}$

$i_2(t) = \frac{\mathcal{E}}{R_1} \left(1 - e^{-\frac{1}{2} \frac{R_1 R_2}{R_1 + R_2} t} \right)$ con condiciones iniciales $i_2(0) = 0$

$$\left[i_2(t) = 7,5A \left(1 - e^{-\frac{2}{3L}t} \right) \right]$$

$$e) i_2(0,5s) = 0,4A \Rightarrow i_2(0,5) = 7,5A \left(1 - e^{-\frac{2}{3L}0,5s} \right)$$

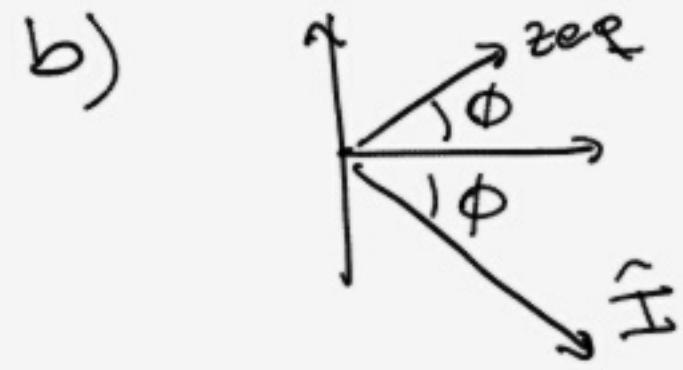
$$\Rightarrow \left[L = 6,08H \right]$$



$$z_L = i\omega L \quad \text{con } \omega = 2\pi f$$

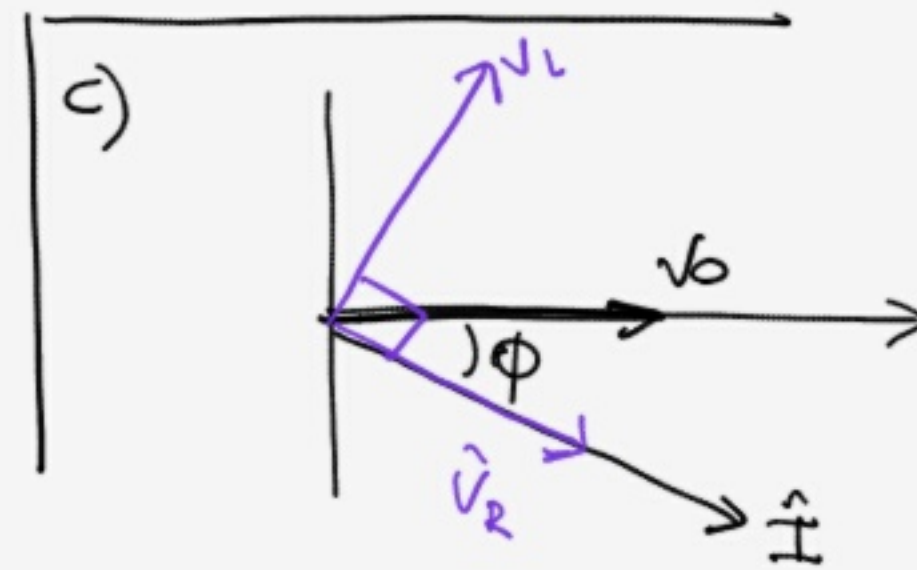
$$\Rightarrow \tan \phi = \frac{\omega L}{R} \Rightarrow \phi = 66,4^\circ$$

$$|z_{eq}| = \sqrt{R^2 + \omega^2 L^2} = 250 \Omega$$



$$|\hat{I}| = \frac{V_0}{|z_{eq}|} = 1,24 \text{ A}$$

$$\text{f.p. } \cos \phi = \frac{R}{|z_{eq}|} = 0,4$$



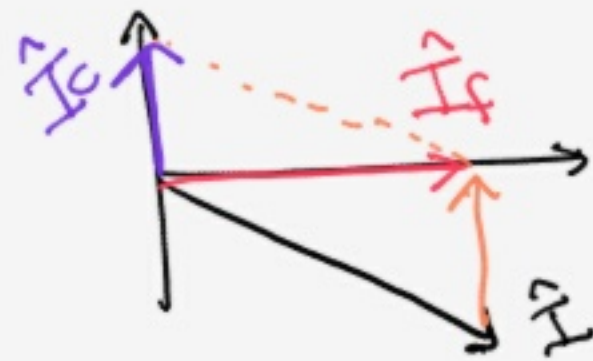
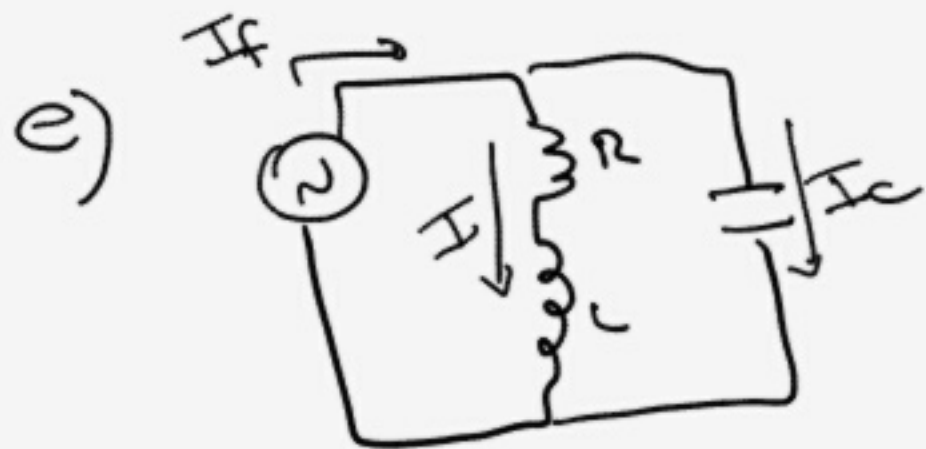
$$\hat{V}_L \perp \hat{V}_R, \quad \hat{V}_R \parallel \hat{I}$$

$$|\hat{V}_L| = \omega L |\hat{I}| = 285 \text{ Volt}$$

$$|\hat{V}_R| = R |\hat{I}| = 124 \text{ Volt}$$

d) $\bar{P} = R I_{\text{rms}}^2 = 77 \text{ W}$

$$I_{\text{rms}} = \frac{|\hat{I}|}{\sqrt{2}}$$



\hat{I} por R y L es la que ya hallamos

La corriente por el capacitor cumple:

$$V_0 = \frac{1}{j\omega C} \hat{I}_c \Rightarrow \hat{I}_c = j\omega C V_0$$

$$|\hat{I}_c| = \omega C V_0$$

$$\hat{I}_c + \hat{I} = \hat{I}_f \text{ sobre el eje real}$$

$$\Rightarrow |\hat{I}_c| = |\hat{I}| \tan \phi = \frac{V_0}{|z_{eq}|} \frac{\omega L}{|z_{eq}|}$$

$$C = \frac{L}{|z_{eq}|^2} = 11,7 \mu\text{F}$$