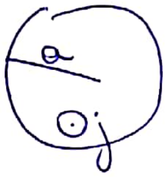
2° PARCIAL 2017/20

Ejercicio 1

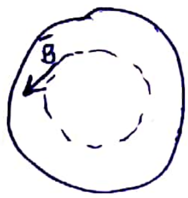
a) $\bar{B} = B(r)\hat{e}_\phi$ $\quad \oint \bar{B}\, d\bar{l} = \mu_0\, i_{encerrada}$



$\underline{r<a}$: $|j| = \dfrac{i_{total}}{a^2\pi}$ $\quad j$ cte $\to$ circulo radio r encierra

una $i_{enc} \Rightarrow j = \dfrac{i_{enc}}{r^2\pi} \Rightarrow i_{enc} = j\pi r^2$

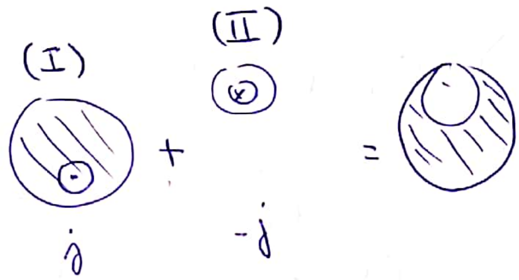
$\oint \bar{B}\, d\bar{l} = \mu_0 j \pi r^2 \Rightarrow \left[\bar{B}(r) = \dfrac{\mu_0 j r}{2}\hat{e}_\phi\right]$



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

$\oint \bar{B}\, dl = \mu_0 j \pi a^2 \Rightarrow \left[\bar{B}(r) = \dfrac{\mu_0 j a^2}{2r}\hat{e}_\phi\right]$.

b) uso principio de superposición.



en P el campo generado por (I):

$\bar{B}_I(r) = \dfrac{\mu_0 j a^2}{2r}\hat{e}_\phi$ $\quad$ radio = a $\quad$ densidad j
dist a p = r

en P el campo generado por (II):

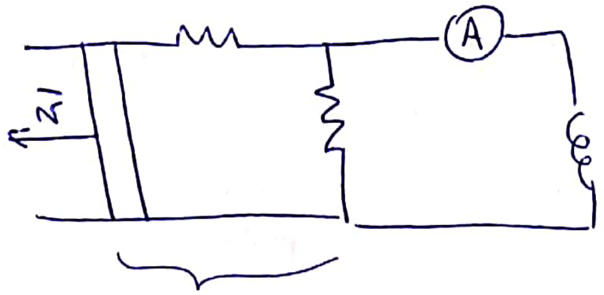
$\bar{B}_{II}(r) = -\dfrac{\mu_0 j a^2/4}{2(r-a/2)}\hat{e}_\phi$ $\quad$ radio a/2
dist a p: r−a/2
densidad: −j

$\bar{B}_p(r) = \bar{B}_I + \bar{B}_{II} = \dfrac{\mu j a^2}{2}\left[\dfrac{1}{r} - \dfrac{1}{4(r-a/2)}\right]\hat{e}_\phi$

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

$$\xleftarrow{\bar{B}} \cdot P$$

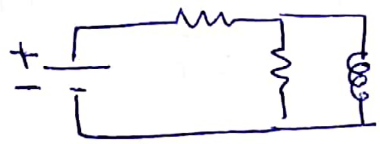
<u>Ejercicio 2</u>:



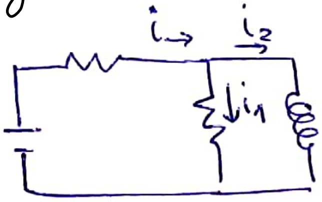
$x(t)$

a) $\varepsilon = -\frac{d\phi_B}{dt}$ $\qquad \Phi_B = B \cdot A = B \cdot \ell \cdot x(t)$

$$\varepsilon = -\frac{d}{dt}\left[B \ell x(t)\right] = -B \ell v = -7{,}5\,V$$

b) 

La fem es en sentido horario por la ley de Lenz quiere oponerse el cambio en el flujo magnético.



c) $\varepsilon_{ind} - iR_1 - i_1 R_2 = 0$ (I)

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

$i_1 + i_2 = i$ (III)

d) $\varepsilon_{ind} = iR_1 + i_1 R_2$ $= 0$ usado III $\qquad i_1 = \frac{\varepsilon - i_2 R_1}{R_1 + R_2}$

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

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

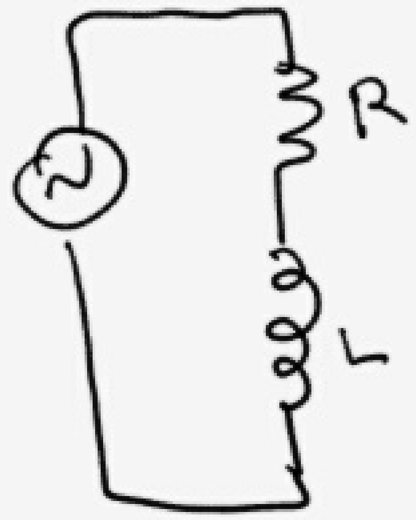
$$i_2(t) = \frac{\varepsilon}{R_1}\left(1 - e^{-\frac{1}{L}\frac{R_1 R_2}{R_1 + R_2}t}\right)$$ con condición inicial $i_2(0) = 0$

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

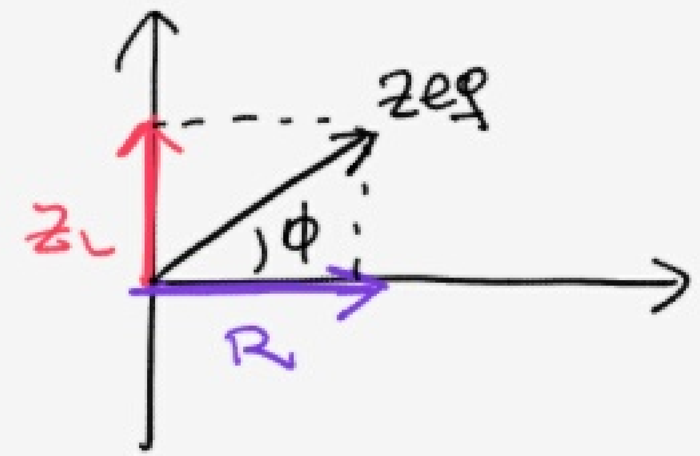
e) $i_2(0{,}5\,s) = 0{,}4\,A \Rightarrow i_2(0{,}5) = 7{,}5\,A\left(1 - e^{-\frac{2}{3L}0{,}5\,s}\right)$

$$\Rightarrow \boxed{L = 6{,}08\,H}$$

3)



a)

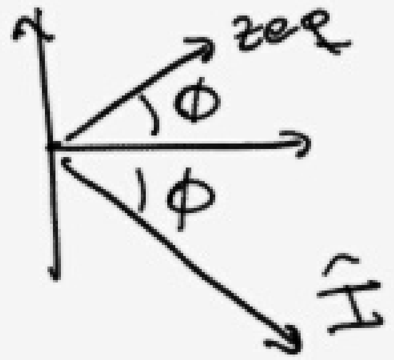


$Z_L = i\omega L \quad \text{con} \quad \omega = 2\pi f$

$\Rightarrow \operatorname{tg}\phi = \dfrac{\omega L}{R} \Rightarrow \phi = 66{,}4^\circ$

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

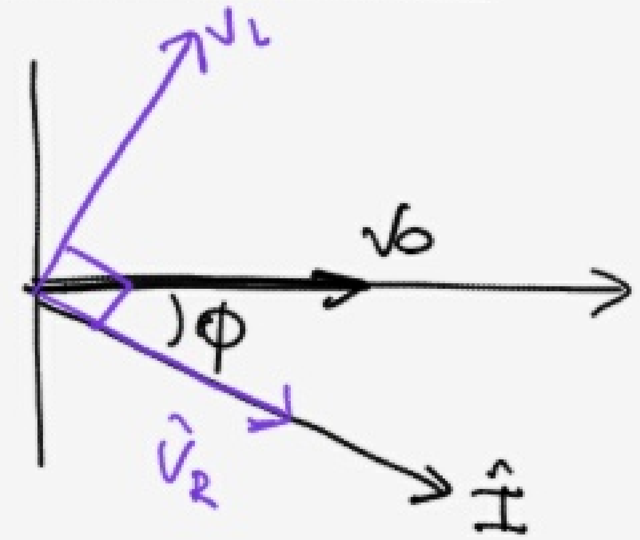
b)



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

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

c)



$\hat{V}_L \perp \hat{V}_R$ y $\hat{V}_R \parallel \hat{I}$

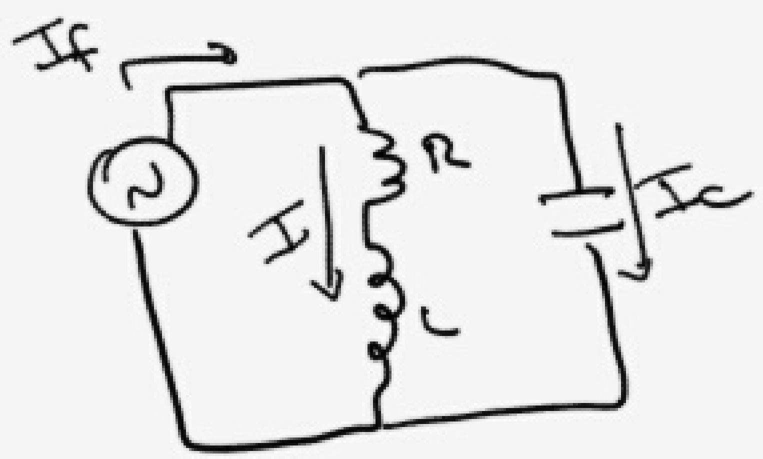
$|\hat{V}_L| = \omega L |\hat{I}| = 285$ Volt

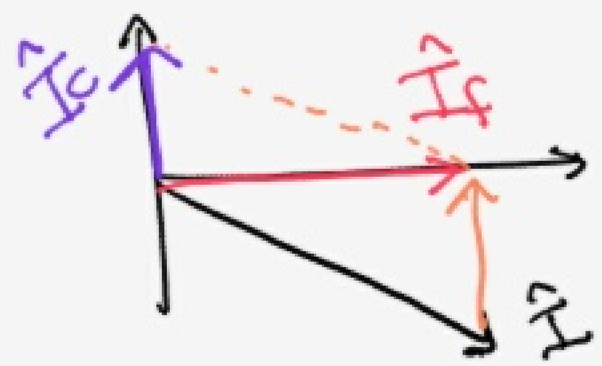
$|\hat{V}_R| = R|\hat{I}| = 124$ Volt

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

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

e)





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

La corriente por el capacitor cumple:

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

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

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

$\Rightarrow |\hat{I}_c| = |\hat{I}| \operatorname{sen}\phi = \dfrac{V_0}{|z_{eq}|}\dfrac{\omega L}{|z_{eq}|}$

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