2do PARCIAL - JULIO 2013.

1) a)

$$|\vec{B}(r)| = \begin{cases} \dfrac{\mu_0 i r}{2\pi R_1^2} & r < R_1 \\ \dfrac{\mu_0 i}{2\pi r} & R_1 < r < R_2 \\ 0 & r > R_2 \end{cases}$$

b) $u_B = \dfrac{B^2}{2\mu_0} \Rightarrow U_B = \dfrac{h}{2\mu_0}\left[\int_0^{R_1}\left(\dfrac{\mu_0 i r}{2\pi R_1}\right)^2 2\pi r\,dr + \int_{R_1}^{R_2}\left(\dfrac{\mu_0 i}{2\pi r}\right)^2 2\pi r\,dr\right]$

$$= \frac{\mu_0 i^2 h}{4\pi}\left[\frac{1}{4} + \ln\left(\frac{R_2}{R_1}\right)\right] = 76\,\mu J$$

c) $U_B = \frac{1}{2}Li^2 \Rightarrow L = 1{,}52\,\mu H$

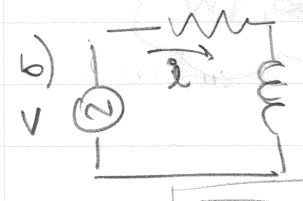
2) 10 A, 4 A/s.

a) $V_+ = Ri + L\,di/dt = 222\,V$

$V_- = Ri - L\,di/dt = 219\,V$ (10 A, 2 A/s)

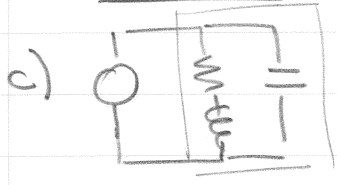
$\Rightarrow L = 0{,}5\,H$, $R = 22\,\Omega$

b)



$$i_{rms} = \frac{V_{rms}}{\sqrt{R^2 + (\omega L)^2}} = 4{,}03\,A$$

c)



z_{eq}

$$z_{eq} = \frac{(R + j\omega L)}{j\omega C(R + j\omega L) + 1} = \frac{R + j\omega L}{1 - \omega^2 LC + j\omega RC}$$

$\varphi = 0 \Rightarrow \omega L/R = \omega RC/(1 - \omega^2 LC) \Rightarrow C = \dfrac{L}{R^2 + (\omega L)^2} = 168\,\mu F$

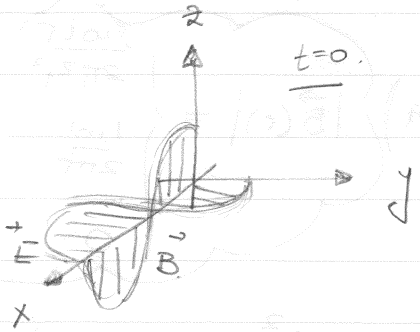
d) $i_{rms} = \dfrac{V_{rms}}{|z_{eq}|}$, $|z_{eq}| = \dfrac{\sqrt{R^2 + (\omega L)^2}}{\sqrt{(1 - \omega^2 LC)^2 + (\omega RC)^2}} = 135{,}6\,\Omega$

$i_{rms} = 1{,}62\,A$

OBS. $i_{rms}^{(d)} < i_{rms}^{(b)}$ ✓

(3)

a) $\omega = 2\pi f = 2\pi \frac{c}{\lambda} = 1{,}88 \text{ rad/s}$



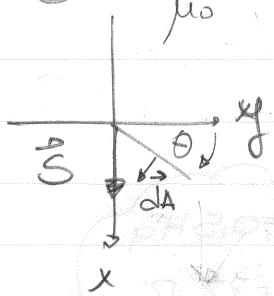
b) $\vec{B}(x,t) = B_0 \cdot \cos\left(\omega t - \frac{2\pi}{\lambda} x\right) \hat{z}$

$\vec{E}(x,t) = cB_0 \cos\left(\omega t - \frac{2\pi}{\lambda} x\right) \hat{y}$

c) $\Phi_B = 0$ pues longitud espira es un nº entero de λ

$\Rightarrow \mathcal{E} = 0 \Rightarrow \boxed{i = 0 \quad \forall t}$

d) $\vec{S} = \frac{cB^2}{\mu_0} \hat{x}$



$\rightsquigarrow$ nos interesa $S \cdot \cos\theta$

$\Rightarrow P = \underbrace{|\vec{S}|}_{\frac{cB_0^2}{2\mu_0}} \cdot L^2 \cos\theta = \frac{cB_0^2}{2\mu_0} L^2 \cos\theta = 66{,}1 \text{ W}$