Solution:

(1) $$V(a) - V(\infty) = \int_a^\infty E_2 \, dr = \int_a^b + \int_b^\infty =$$

$$= \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{\varepsilon_2 a} - \frac{1}{\varepsilon_2 b} + \frac{1}{b}\right) = \frac{Q}{4\pi\varepsilon_0}\,\frac{(\varepsilon_2 - 1)a + b}{\varepsilon_2 a b}$$

(2) Legge di Ampere

$$\oint \bar{H} \cdot d\bar{l} = \int_S \bar{J} \cdot d\bar{S}$$

$$\oint \bar{H} \cdot d\bar{l} = 2\pi r H$$

1) $\bar{J} = 0 \Rightarrow \bar{H} = 0$

2) $$\bar{J} = \frac{I}{\pi(R_2^2 - R_1^2)} = \frac{I}{15\pi R_1^2}$$

$$\int_S \bar{J} \cdot d\bar{S} = \frac{I}{15\pi R_1^2}\,\pi\left(d_1^2 - R_1^2\right) = \frac{I}{5}$$

$$H = \frac{I}{20\pi R_1} = 1.6\ \frac{A}{m}$$

3) $$\int_S \bar{J} \cdot d\bar{S} = I \quad . \quad H = \frac{I}{2\pi d_2} = \frac{I}{10\pi R_1} = 3.2\ \frac{A}{m}$$

(3) $I_L(t=0) = \frac{f}{R} = I_0$

dopo l'apertura:

$$I_L(t) = I_L(t=0)\, e^{-\frac{t(R_1+R_2)}{L}}$$

$$W_{R_2}(t) = R_2 I_0^2\, e^{-\frac{2t(R_1+R_2)}{L}}$$

(4)

$$i = -\frac{1}{R}\frac{d\Phi(\vec{B})}{dt}$$

$$\Phi(\vec{B}) = \int_S \vec{B}\cdot d\vec{S} = \int_S B\, dx\, dy = \int_{x_0}^{x_0+\ell}\int_{y}^{y+\ell} a y\, dx\, dy$$

$$\Phi(\vec{B}) = \frac{a\ell^2}{2}(2y+\ell)$$

$$i = -\frac{a\ell^2 v_0}{R} = -1\cdot 10^{-5} A$$

(5) $\lambda = \frac{2\pi}{K} = \frac{2\pi}{3} \simeq 2m = 20a \gg a$

$$f_i = -\frac{d\Phi}{dt} = -\frac{d}{dt}\left(B\pi a^2\right) = -\pi a^2 \frac{d}{dt}\left[B_0\cos(\omega t)\right] =$$

$$= \pi a^2 \frac{E_0}{c}\sin(\omega t)\cdot\omega = \pi a^2 K\sqrt{2Z_0 I}\sin(\omega t)$$

$$i_{eff} = \frac{1}{\sqrt{2}}\cdot\frac{1}{R}\cdot\left(\pi a^2 K\sqrt{2Z_0 I}\right)$$