# 1º Mini-teste EO (31/10/2007)

**Versão B**

a) Como na versão (A)

$$\vec{D} = \frac{\lambda}{2\pi}\frac{1}{r}\vec{e}_r = \frac{\lambda}{2\pi}\frac{1}{d_1+d_2/4}\vec{e}_r$$

b) Quase como na versão (A) (agora o dielectrico está no exterior)

$$\phi_1 = \frac{\lambda}{2\pi\varepsilon_0}\ln\left(\frac{d_1}{R_1}\right) + \frac{\lambda}{2\pi\varepsilon_1}\ln\left(\frac{d_2}{d_1}\right) = 120.2\,V$$

c) $\sigma' = -|P|_{r=d_1} = -\frac{\varepsilon_1-\varepsilon_0}{\varepsilon_1}\frac{\lambda}{2\pi}\frac{1}{d_1} = -\frac{1}{2}\frac{\lambda}{2\pi}\frac{1}{d_1} = 7.96\times10^{-9}\,C/m^2$

d) $U_{ele} = \frac{1}{2}\int_V \vec{E}\cdot\vec{D}\,dV = \frac{1}{2}\int_0^L dz\int_0^{2\pi} d\varphi\int_{R_1}^{d_2} dr\, r\,|\vec{E}||\vec{D}|$

$$= \frac{1}{2}L\,2\pi\,\frac{\lambda^2}{(2\pi)^2\varepsilon_0}\left[\int_{R_1}^{d_1} dr\,\frac{1}{r} + \frac{1}{\varepsilon_{r_1}}\int_{d_1}^{d_2} dr\,\frac{1}{r}\right]$$

$$= L\,\frac{1}{2}\,\frac{\lambda^2}{2\pi\varepsilon_0}\left[\ln\left(\frac{d_1}{R_1}\right) + \frac{1}{\varepsilon_{r_1}}\ln\left(\frac{d_2}{d_1}\right)\right]$$

$$= L\,\frac{1}{2}\,\lambda\,\phi_1 = \frac{1}{2}Q\,\phi_1$$

$$\frac{U_{ele}}{L} = \frac{1}{2}\lambda\,\phi_1 = 1.2\times10^{-7}\,J/m$$