2/

Expanding $\vec{E}$ + $\vec{B}$ in powers of kr yields

$$\vec{E} \cong \hat{z}\, \frac{I_o}{2\pi a c \varepsilon_o}\, \frac{\sin(\omega t)}{(ka/2)}\, \frac{\left[1 - \left(\frac{kr}{2}\right)^2 + \frac{1}{4}\left(\frac{kr}{2}\right)^4 + \cdots\right]}{\left[1 - \frac{1}{2}\left(\frac{ka}{2}\right)^2 + \cdots\right]}$$

$$\cong \hat{z}\, \frac{I_o}{\pi a c \varepsilon_o}\, \frac{\sin(\omega t)}{ka} \left[1 - \left(\frac{kr}{2}\right)^2 + \frac{1}{2}\left(\frac{ka}{2}\right)^2 + \cdots\right]$$

and

$$\vec{B} \cong \hat{\varphi}\, \frac{I_o}{2\pi a c^2 \varepsilon_o} \sin\omega t\, \frac{kr\left[1 - \frac{1}{2}\left(\frac{kr}{2}\right)^2 + \cdots\right]}{ka\left[1 - \frac{1}{2}\left(\frac{ka}{2}\right)^2 + \cdots\right]}$$

$$\cong \hat{\varphi}\, \frac{I_o}{2\pi a c^2 \varepsilon_o} \sin\omega t\, \frac{r}{a}\left[1 - \frac{1}{2}\left(\frac{kr}{2}\right)^2 + \frac{1}{2}\left(\frac{ka}{2}\right)^2\right]$$

b)

$$W_e = \frac{1}{2}\int \vec{E}\cdot\vec{D}\, dV = \frac{\varepsilon_o}{2}\int_0^{2\pi} d\varphi \int_0^d dz \int_0^a E^2(r)\, r\, dr$$

Using $\langle \sin^2 \omega t \rangle = \frac{1}{2}$ $\qquad c^2 = \frac{1}{\mu_o \varepsilon_o}$

$$W_e = \frac{d\, I_o^2}{2\pi \varepsilon_o c^2 a^2}\, \frac{1}{k^2 a^2} \int_0^a r\, dr = \frac{d\, I_o^2}{4\pi \varepsilon_o a^2 \omega^2}$$

(k^2a^2 terms cancel)

$$W_m = \frac{1}{2}\int \vec{B}\cdot\vec{H}\, dV = \frac{1}{2\mu_o}\int_0^{2\pi} d\varphi \int_0^d dz \int_0^a B^2(r)\, r\, dr$$

$$= \frac{\pi}{\mu_o}\, \frac{d\, I_o^2}{4\pi^2 a^3 c^4 \varepsilon_o^2}\, \frac{1}{2} \int_0^a r^3 \left[1 - \left(\frac{kr}{2}\right)^2 + \left(\frac{ka}{2}\right)^2\right] dr$$

$$= \frac{\mu_o}{4\pi}\, \frac{d\, I_o^2\, a}{8}\left[1 + \frac{k^2 a^2}{12}\right]$$