1. This problem is similar to the example given in section 10.9, except for the polarization. Instead of (10.110), the incident electric field is

$$\mathbf{E}_i = E_0 \boldsymbol{\epsilon}_2 e^{ik(z\cos\alpha + x\sin\alpha)} \tag{1}$$

Then accordingly, (10.111), (10.112), (10.113) becomes

$$(\mathbf{n}\times\mathbf{E}_i)_{z=0} = -E_0 \boldsymbol{\epsilon}_1 e^{ikx'\sin\alpha} \tag{2}$$

$$\mathbf{E}(\mathbf{x}) = -\frac{ie^{ikr}E_0}{2\pi r}(\mathbf{k}\times\boldsymbol{\epsilon}_1)\int_0^a \rho\, d\rho \int_0^{2\pi} d\beta\, e^{ik\rho[\sin\alpha\cos\beta - \sin\theta\cos(\phi-\beta)]} \tag{3}$$

$$\mathbf{E}(\mathbf{x}) = -\frac{e^{ikr}}{r}a^2 E_0 (\mathbf{k}\times\boldsymbol{\epsilon}_1)\frac{J_1(ka\xi)}{ka\xi} \tag{4}$$

giving the power per unit solid angle

$$\frac{dP}{d\Omega} = P_i \frac{(ka)^2}{4\pi}\left(\frac{\cos^2\theta + \sin^2\phi\sin^2\theta}{\cos\alpha}\right)\left|\frac{2J_1(ka\xi)}{ka\xi}\right|^2 \tag{5}$$

2. Both (5) and (10.114) have azimuthal dependence (apart from that contained in ξ), unlike results (10.119) from the *scalar* Kirchhoff approximation. With normal incidence $\alpha = 0$, and for a special observation location at $\phi = \pi/4$, (5) and (10.114) produce the same θ-distribution, as it should due to the symmetry in this configuration.