4.1 (a.) $E_\alpha = [(j\eta k I_o \Delta l e^{-jkr})/(4\pi r)][1-(\sin\theta\cos\phi)^2]^{0.5}$, $H_\beta = E_\alpha/\eta$

(b.) $D_o = 1.5$

4.3 (a.) $E_\alpha = [(j\eta k I_o \Delta l e^{-jkr})/(4\pi r)][\cos\theta]$, E_θ - polarization

(b.) $E_\alpha = [(j\eta k I_o \Delta l e^{-jkr})/(4\pi r)]$, E_ϕ - polarization

(c.) $E_\alpha = [(j\eta k I_o \Delta l e^{-jkr})/(4\pi r)][\sin\phi]$, E_ϕ - polarization

4.5 (a.) Using duality, $E_r(\boldsymbol{J}) \Rightarrow H_r(\boldsymbol{M})$, $E_\theta(\boldsymbol{J}) \Rightarrow H_\theta(\boldsymbol{M})$, $H_\phi(\boldsymbol{J}) \Rightarrow -E_\phi(\boldsymbol{M})$

(b.) The magnetic dipole pattern is the same as the electric dipole, $D_o = 1.5$ (1.76dB)

4.11 Using (4-6a) and (4-6b), substitute into (3-58a) and (3-58b).

4.15 (a.) $E_\theta = [(j\omega\mu I_o e^{-jkr})/(4\pi r)][(e^{-jZ}\sin Z)/Z]\sin\theta$, $Z = (kl/2)(1-\cos\theta)$, $H_\phi = E_\theta/\eta$

(b.) $W = |E_\theta|^2/2\eta$

4.18 (b.) $E_\theta = [(j\eta I_o l\, e^{-jkr})/(2\pi r)]\{\cos[(\pi/2)\cos\theta]\}/\sin\theta$, $H_\phi = E_\theta/\eta$

4.21 $H_\theta = [(jI_m e^{-jkr})/(\eta 2\pi r)]\{\cos[(\pi/2)\cos\theta]\}/\sin\theta$, $E_\phi = -\eta H_\theta$

4.25 $P_r = 0.2$ mW

4.26 $W = 17.4\ \mu W/m^2$

4.27 (a.) $R_{in} = 146\ \Omega$, $X_{in} = 85\ \Omega$

(b.) $X = -j\ 335.8\ \Omega$ (capacitive)

(c.) VSWR = 1.53

4.31 $|E_\theta| = 4620$ V/m, $|H_\phi| = 12.25$ A/m

4.33 (a.) $R_r = 186\ \Omega$, $X_A = 191\ \Omega$

(b.) $R_{in} = 372\ \Omega$, $X_{in} = 386\ \Omega$

(c.) VSWR = 1.24

4.37 $h = 0.288\lambda$, $D_o = 5.12$ (7.1dB), $R_r = 0.37\ \Omega$

4.41 (a.) $Z_{in} = 99.55 + j\ 31.25\ \Omega$

(b.) $Z_{in} = \infty$

(c.) VSWR = ∞

4.44 $h = 8.6382$ m