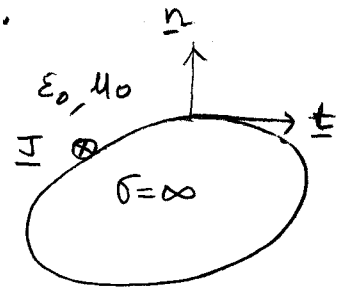
고급전자기학 I, Problem Set 4_Solutions

1.



$D_n = \rho_s \rightarrow E_n = \frac{\rho_s}{\varepsilon_0}$

$E_t = 0$

$H_n = 0$

$H_t = \underline{J} \times \underline{n}$

2.

$E_x = 10 \exp(-2\pi z)$ (V/m), $E_y = 0$, $E_z = 0$

1)

$\underline{H} = \frac{\hat{z} \times \underline{E}}{\eta_0} = \hat{y} H_y$, $\eta_0 = 377$

$H_y = \frac{10}{377} \exp(-2\pi z)$ (A/m)

2) $S = \frac{1}{2}|\underline{E} \times \underline{H}| = \frac{1}{2} 10 \times \frac{10}{377} = \frac{50}{377}$ (W/m^2)

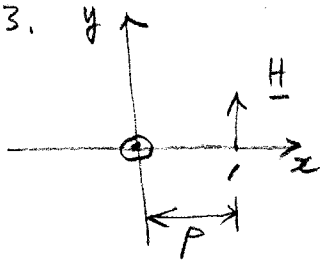
3) $E_x = 10 \exp(-2\pi z) = 10 \exp(-kz)$

$k = 2\pi$ (rad/m)

4) $k = \frac{2\pi}{\lambda} = 2\pi$, $\lambda = 1$ m

5) $\lambda = \frac{c}{f} = \frac{3 \times 10^8}{f} = 1$, $f = 3 \times 10^8$ Hz $= 300$ MHz

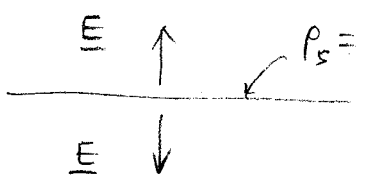
3.



$H_\phi = \frac{I}{2\pi\rho} = \frac{1}{2\pi}$

$\underline{H} = \hat{y} \frac{1}{2\pi}$ (A/m)

4.



$\underline{E} = \frac{\rho_s}{2\varepsilon_0} \hat{z} = \frac{10^{-9}}{2\varepsilon_0}$ (V/m)

$\varepsilon_0 = 8.854 \times 10^{-12}$ (F/m)