Name: Okeme Christian Ubughenaan
Dept: Elect/Elect Engr.
Mat No: 17/Eng04/054

Question (3)

Solution

a) E_y – Propagation in x-axis for E and H Component
ω – Angular frequency (rad/s)
μ – Permeability of medium (H/m)
σ – Conductivity of medium
ε – Permittivity of medium (F/m)

b) $\sigma = 0$, if the medium is lossless

$$V_p = \frac{1}{\sqrt{\mu\varepsilon}}$$

c) $\mu_r = 1$, $\mu_0 = 4\pi \times 10^{-7}$ H/m
$\varepsilon_r = 1$, $\varepsilon_0 = 8 \times 854 \times 10^{-} F/m$

$\mu = \mu_0 \mu_r = 4\pi \times 10^{-7} \times 1 = 4\pi \times 10^{-7}$ H/m

$\varepsilon = \varepsilon_0 \varepsilon_r = 8.854 \times 10^{-12} \times 1 = 8.854 \times 10^{-2}$ F/m

$V_p = ?$ $Z_0 = ?$

$$V_p = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{1}{\sqrt{4\pi \times 10^{-7} \times 8.854 \times 10^{-12}}}$$

$$V_p = 299.4 \times 10^6$$

$$Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}} = \sqrt{\frac{4\pi \times 10^{-7}}{8.854 \times 10^{-12}}}$$

$$= 376.7$$

d) Magnetic field will be lined up in the y-direction because, the magnetic field is always perpendicular to the Electric field

Question (7)

Solution

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

$\mu_0 = 4\pi \times 10^{-7}$ H/m

a) $C = \frac{2\pi\varepsilon_0}{\log_e b/a}$ where $a = 3mm = 0.003m$, $b = 10mm = 0.01m$

$C = \frac{2\pi \times 8.854 \times 10^{-12}}{\log_e (0.01/0.003)}$

$C = 46.75 \times 10^{-12}$ F/m

b) $L = \frac{\mu_0}{2\pi} \cdot \log_e \frac{b}{a}$

$L = \frac{4\pi \times 10^{-7}}{2\pi} \times \log_e \left(\frac{0.01}{0.003}\right)$

$= 2.4 \times 10^{-7}$ H/m

c) $Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}}$

$= \sqrt{\frac{4\pi \times 10^{-7}}{8.854 \times 10^{-12}}}$

$= 376.7$

d) $\mu = \mu_0 \mu_r = 4\pi \times 10^{-7} \times 1 = 4\pi \times 10^{-7}$ H/m

$\varepsilon = \varepsilon_0 \varepsilon_r = 8.854 \times 10^{-12} \times 1 = 8.854 \times 10^{-12}$ F/m

$V_p = \frac{1}{\sqrt{\mu\varepsilon}}$

$= \frac{1}{\sqrt{4\pi \times 10^{-7} \times 8.854 \times 10^{-2}}}$

$V_p = 299.4 \times 10^6$