FIELDS AND WAVES - QUIZ 1

Solutions to Q 1. (32 points)

1a) If a lossless transmission line is terminated in the characteristic impedance, there are no standing waves

True

1b) If a lossless transmission line is 1/2 wavelength long, then the input impedance of the line is the load impedance.

True

2) A resistor is 6 cm long. Estimate at what frequency transmission line effects start to become important.

Assumptions: \[ V_p = c = 3 \times 10^8 \text{m/s} \], \[ \frac{d}{l} = 0.01 \] when T-line effects come into picture.

\[ \frac{d}{f} = \frac{1}{c} \Rightarrow \frac{df}{c} = 0.01 \]

\[ \Rightarrow f = 50 \times 10^6 \text{Hz} = 50 \text{MHz} \]

3) Express \( \vec{E} = E_0 \cos(\omega t - kz) \hat{a}_x \) as a phasor

\( \vec{E} = E_0 e^{-j\frac{k}{2}x} \hat{a}_x \)

4) Given the phasor \( \vec{E} = -j30 \hat{a}_x + j10 \hat{a}_y \) at 10 MHz. Write the expression for time domain.

\( \vec{E} = -30 e^{j\frac{\pi}{2}x} + 10e^{j\frac{\pi}{2}y} \)