1. $R' = 0{,}2\ \Omega/m$ $\quad C' = 0{,}1\ pF/m$

$L' = 0{,}02\ mH/m$ $\quad G' = 0{,}01\ mho/m$

a. $\gamma = \sqrt{(R' + j\omega L')(G' + j\omega C')}$

$= \sqrt{(0{,}2 + j\omega . 0{,}02 \times 10^{-3})(0{,}01 + j\omega . 0{,}1 \times 10^{-12})}$

$= \sqrt{0{,}002 + j\omega . 0{,}02 \times 10^{-12} + j\omega . 2 \times 10^{-7} - \omega^2 . 2 \times 10^{-18}}$

$\gamma = \sqrt{0{,}002 - 2\omega^2 \times 10^{-18} + j\omega . 2 \times 10^{-7}}$

$2 \times 10^{-14} + 2 \times 10^{-7}$

$2 \times 10^{-17} + 20.000.000 \times 10^{-14}$

$f = 300\ kHz = 3 \times 10^5\ Hz \rightarrow \omega = 2\pi f = 6\pi \times 10^5\ rad/s$

$\gamma = \sqrt{0{,}002 - 2(6\pi \times 10^5)^2 \times 10^{-18} + j(6\pi \times 10^5) . 2 \times 10^{-7}}$

$0{,}0000002 \times 10^{-7}$

$2{,}0000000 \times 10^{-7}$ +

$2{,}0000002 \times 10^{-7}$

2×10^{-7}

$\gamma = \sqrt{0{,}002 - 7{,}106 \times 10^{-6} + j\,0{,}377}$

$\gamma = \sqrt{0{,}002 + j\,0{,}377}$

$r = \sqrt{0{,}002^2 + 0{,}377^2} = 0{,}377$

$\theta = \tan^{-1}\left(\frac{0{,}377}{0{,}002}\right) = 89{,}69°$

$\gamma = \sqrt{0{,}377\ (\cos 89{,}69° + j \sin 89{,}69°)}$

$= \sqrt{0{,}377}\left(\cos\left(\frac{89{,}69°}{2}\right) + j \sin\left(\frac{89{,}69°}{2}\right)\right)$

$\gamma = \sqrt{0{,}377}\ (0{,}709 + j\,0{,}705)$

$\alpha + j\beta = 0{,}435 + j\,0{,}433$

Konstanta redaman : $\alpha = 0{,}435$ Neper/m

Konstanta fasa : $\beta = 0{,}433$ rad/m

$f = 500\ kHz = 5\times10^5\ Hz \rightarrow \omega = 2\pi f = 10\pi\times10^5\ rad/s$

$$\gamma = \sqrt{0{,}002 - 2(10\pi\times10^5)^2\times10^{-18} + j(10\pi\times10^5).2\times10^{-7}}$$

$$= \sqrt{0{,}002 - 1{,}974\times10^{-5} + j0{,}628}$$

$$= \sqrt{0{,}0019 + j0{,}628}$$

$$r = \sqrt{(0{,}0019)^2 + (0{,}628)^2} = 0{,}628$$

$$\theta = \tan^{-1}\left(\frac{0{,}628}{0{,}0019}\right) = 89{,}83^\circ$$

$$\gamma = \sqrt{0{,}628\ (\cos 89{,}83^\circ + j\sin 89{,}83^\circ)}$$

$$= \sqrt{0{,}628}\left(\cos\left(\frac{89{,}83^\circ}{2}\right) + j\sin\left(\frac{89{,}83^\circ}{2}\right)\right)$$

$$\gamma = 0{,}792\ (0{,}708 + j.0{,}706)$$

$$\alpha + j\beta = 0{,}561 + j\ 0{,}559$$

Konstanta redaman : $\alpha = 0{,}561$ Neper/m

Konstanta fasa : $\beta = 0{,}559$ rad/m

$f = 1\ MHz = 10^6\ Hz \rightarrow \omega = 2\pi f = 2\pi\times10^6\ rad/s$

$$\gamma = \sqrt{0{,}002 - 2(2\pi\times10^6)^2\times10^{-18} + j(2\pi\times10^6).2\times10^{-7}}$$

$$= \sqrt{0{,}002 - 7{,}89\times10^{-5} + j.1{,}257}$$

$$= \sqrt{0{,}0019 + j1{,}257}$$

$$r = \sqrt{(0{,}0019)^2 + (1{,}257)^2} = 1{,}257$$

$$\theta = \tan^{-1}\left(\frac{1{,}257}{0{,}0019}\right) = 89{,}91^\circ$$

$$\gamma = \sqrt{1{,}257\ (\cos 89{,}91^\circ + j.\sin 89{,}91^\circ)}$$

$$= \sqrt{1{,}257}\left(\cos\left(\frac{89{,}91^\circ}{2}\right) + j.\sin\left(\frac{89{,}91^\circ}{2}\right)\right)$$

$$\gamma = 1{,}121\ (0{,}707 + j.0{,}706)$$

$$\alpha + j\beta = 0{,}793 + j.0{,}792$$

Konstanta redaman : $\alpha = 0{,}793$ Neper/m

Konstanta fasa : $\beta = 0{,}792$ rad/m

b. Untuk nilai konstanta primer (R', L', C', G') yang tetap, semakin besar frekuensi yang digunakan maka semakin besar pula nilai konstanta redaman dan konstanta fasa yang dihasilkan.

Jika nilai konstanta redaman dan konstanta fasa semakin besar, maka konstanta propagasi juga semakin besar

2. a. Konstanta primer Saluran transmisi
   - Resistansi : R' (Ω/m) ; merupakan resistansi sepanjang saluran transmisi
   - Konduktansi : G (S/m) ; merupakan

2.

3. $\alpha = \frac{0,2 \text{ Neper}}{2 \text{ meter}} = 0,1 \text{ Neper/m}$

$\beta = \frac{0,2 \text{ rad}}{2 \text{ meter}} = 0,1 \text{ rad/m}$

$\gamma = \alpha + j\beta = 0,1 + j\,0,1$

4. Panjang saluran : $L = X$

Impedansi antena : $Z_L = 500\,\Omega$

Impedansi karakteristik : $Z_0 = 50\,\Omega$

a. Karena impedansi antena tidak sama dengan impedansi karakteristik ($Z_L \neq Z_0$), maka saluran transmisi dalam kondisi tidak matching.

Karena saluran transmisi tidak matching maka nilai koefisien pantul tidak nol ($\Gamma \neq 0$), sehingga ada sinyal pantul dalam saluran transmisi.

b. $\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{500 - 50}{500 + 50}$

$= \frac{450}{550}$

$= \frac{9}{11}$

$\Gamma = 0,82$

$|T| = 1 + |\Gamma| = 1 + 0,82 = 1,82$

Sinyal datang : E^+ → sinyal dari sumber

Sinyal pantul : E^-

Sinyal transmisi : E^{2+}

$$|\Gamma| = \frac{E^-}{E^+} \qquad |T| = \frac{E^{2+}}{E^+}$$

$$E^- = E^+ |\Gamma| \qquad E^{2+} = E^+ |T|$$

$$E^- = 0,82\ E^+ \qquad E^{2+} = 1,82\ E^+$$

Dampak bagi antena adalah sinyal yang sampai di antena lebih besar dibanding yang dikirim sumber, sehingga ada kemungkinan overload atau kelebihan daya pada antena.

Dampak bagi sumber adalah sinyal yang dikirimkan sumber harus dengan daya yang kecil agar mencegah overload pada beban (antena)

c. $L = Y$

$$Z_L = 200 + j100$$

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{200 + j100 - 50}{200 + j100 + 50}$$

$$= \frac{150 + j100}{250 + j100}$$

$$= \frac{3 + j2}{5 + j2} \times \frac{5 - j2}{5 - j2}$$

$$= \frac{15 - j6 + j10 + 4}{5^2 + 2^2}$$

$$\Gamma = \frac{19 + j4}{29} = \frac{19}{29} + j\frac{4}{29}$$

$$\Gamma = \sqrt{\left(\frac{19}{29}\right)^2 + \left(\frac{4}{29}\right)^2}\ \angle \tan^{-1}\left(\frac{4/29}{19/29}\right) = 0,67 \angle 11,89^\circ$$