

$$b) \quad u_p = \frac{c}{\sqrt{1-(\lambda/2a)^2}} = 4.70 \times 10^8 \text{ (m/s)}$$

$$\lambda_g = \frac{\lambda}{\sqrt{1-(\lambda/2a)^2}} = 0.157 \text{ (m)} = 15.7 \text{ (cm)}$$

$$\beta = \frac{2\pi}{\lambda_g} = 40.1 \text{ (rad/m)}$$

$$(Z_{TE})_0 = \frac{\eta_0}{\sqrt{1-(\lambda/2a)^2}} = 590 \text{ } (\Omega).$$

P.10-16 Given: $a = 2.5 \times 10^{-2}$ (m), $b = 1.5 \times 10^{-2}$ (m), $f = 7.5 \times 10^8$ (Hz)

$$a) \quad \lambda = \frac{c}{f} = \frac{3 \times 10^8}{7.5 \times 10^8} = 0.04 \text{ (m)}$$

$$F_1 = \sqrt{1-(\lambda/2a)^2} = 0.60$$

$$\lambda_g = \lambda/F_1 = 0.0667 \text{ (m)} = 6.67 \text{ (cm)}$$

$$\beta = 2\pi/\lambda_g = 94.2 \text{ (rad/m)}$$

$$u_p = c/F_1 = 5 \times 10^8 \text{ (m/s)}$$

$$u_g = c \cdot F_1 = 1.8 \times 10^8 \text{ (m/s)}$$

$$(Z_{TE})_0 = \eta_0/F_1 = 200\pi = 628 \text{ } (\Omega).$$

$$b) \quad \lambda' = \frac{\lambda}{\sqrt{2}} = \frac{0.04}{\sqrt{2}} = 0.0283 \text{ (m)}$$

$$F_2 = \sqrt{1-(\lambda'/2a)^2} = 0.925$$

$$\lambda'_g = \lambda'/F_2 = 0.0343 \text{ (m)} = 3.43 \text{ (cm)}$$

$$\beta' = 2\pi/\lambda'_g = 183.2 \text{ (rad/m)}$$

$$u_p' = u/F_2 = 2.57 \times 10^8 \text{ (m/s)}$$

$$u_g' = u \cdot F_2 = 1.75 \times 10^8 \text{ (m/s)}$$

$$(Z_{TE})_0 = \frac{\eta_0}{\sqrt{2} F_2} = 323 \text{ } (\Omega).$$

P.10-17 Given: $a = 7.20 \times 10^{-2}$ (m), $b = 3.40 \times 10^{-2}$ (m), $f = 3 \times 10^9$ (Hz)

$$a) \quad \lambda_c = 2a = 14.40 \times 10^{-2} \text{ (m)}$$

$$f_c = \frac{c}{\lambda_c} = 2.08 \times 10^9 \text{ (Hz)}$$

$$b) \quad \lambda = \frac{c}{f} = 0.1 \text{ (m)}, \quad \sqrt{1-(\frac{\lambda}{2a})^2} = 0.720$$

$$\lambda_g = \frac{\lambda}{\sqrt{1-(\frac{\lambda}{2a})^2}} = 0.139 \text{ (m)}$$

$$c) \quad R_p = \sqrt{\frac{2\mu_0}{\epsilon_0}} = 1.429 \times 10^{-2} \text{ } (\Omega) \rightarrow (\alpha_c)_{TE} = \frac{R_p \left[1 + \frac{2b}{a} \left(\frac{f}{f_c} \right)^2 \right]}{\eta_0 b \sqrt{1-(f/f_c)^2}} = 2.26 \times 10^{-3} \text{ (Np)}$$

$$d) \quad e^{-\alpha_c z} = \frac{1}{2} \rightarrow z = \frac{1}{\alpha_c} \ln 2 = 307 \text{ (m)}$$



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