ASSIGNMENT 10 : Solutions

Q1. (b), 90° in H-plane and 45° in E-plane.

Q2. (b), SLL in H-plane are generally less as compared to those in E-plane.

Q3. (c), efficiency first increases and then saturates

Q4. (b), 70°

Q5. (b), $\lambda_g/4$.

Q6. For TE_{10}, $f_{cut\text{-}off} = \frac{c}{2a}$

$\because a = 5.1'' = 129.5$ mm $\Rightarrow \therefore f_{cut\text{-}off} = \frac{3\times10^{11}}{2\times129.5}$

(d) $= 1.15$ GHz

Q7. 7.1 (b) decreases.

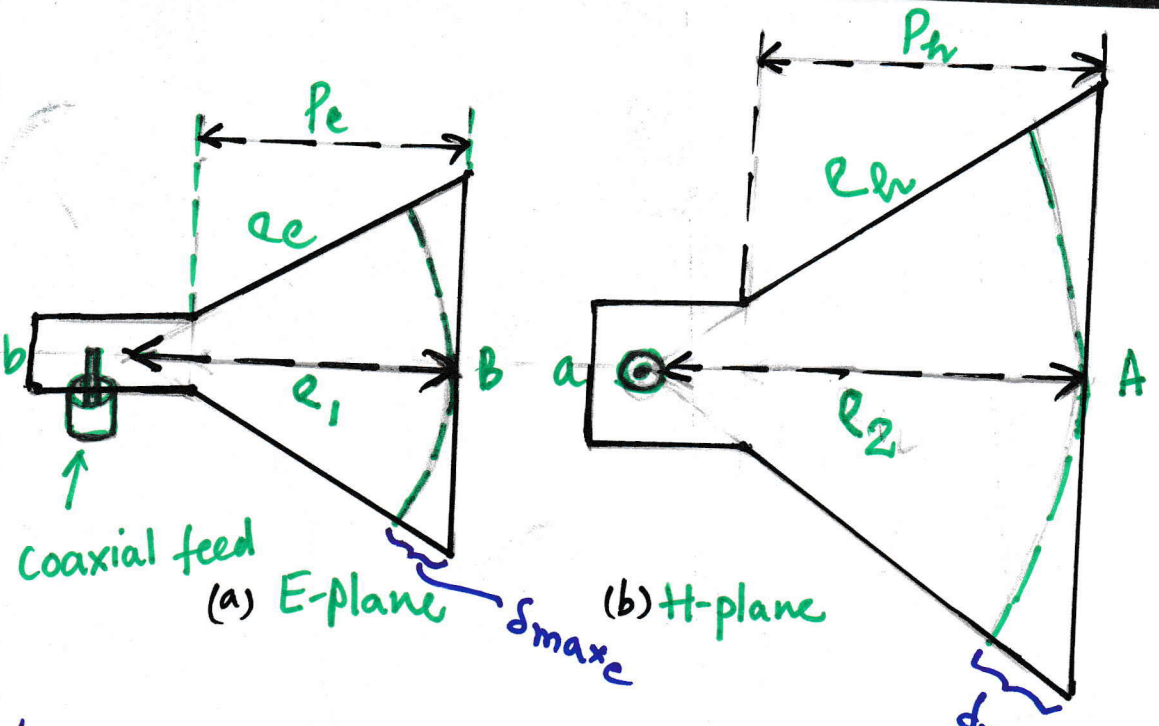
7.2 (a) increases.

Q 8-10 Given waveguide (WR975): $a = 248$ mm, $b = 124$ mm

Aperture: $A = 500$ mm, $B = 400$ mm

Horn Length $= P_e$ or $P_h = 275$ mm

$f = 915$ MHz $\Rightarrow \lambda = \frac{300}{0.915} = 327.9$ mm.



$$\therefore \delta_{max_e} = 360^\circ \frac{\rho_e - \rho_1}{\lambda} \text{ or } 360^\circ \frac{B^2}{8\lambda\rho_1} \text{ or } \frac{360^\circ}{8\lambda\rho_e}$$

Exact value — Approximate

and

$$\delta_{max_h} = 360^\circ \frac{\rho_h - \rho_2}{\lambda} \text{ or } 360^\circ \frac{A^2}{8\lambda\rho_2} \text{ or } \frac{360^\circ}{8\lambda\rho_h}$$

Exact value — Approximate

Calculate: ρ_1, ρ_2, ρ_e and ρ_h.

$$\frac{\rho_1}{\rho_e} = \frac{B}{B-b} \Rightarrow \rho_1 = \rho_e \frac{B}{B-b} = 398.5 \text{ mm}$$

$$\rho_e = \sqrt{\rho_1^2 + \left(\frac{B}{2}\right)^2} = 445.9 \text{ mm}$$

and

$$\frac{\rho_2}{\rho_h} = \frac{A}{A-a} \Rightarrow \rho_2 = \rho_h \cdot \frac{A}{A-a} = 545.6 \text{ mm}$$

$$\rho_h = \sqrt{\rho_2^2 + \left(\frac{A}{2}\right)^2} = 600.2 \text{ mm}.$$

Q.8 $\therefore \delta_{max_e} = \underset{\text{(Exact)}}{52^\circ}$ or $\underset{\text{Approx.}}{55^\circ}$ or 49° (C) 52°

Q.9 $\delta_{max_h} = \underset{\text{(Exact)}}{59.9^\circ}$ or $\underset{\text{Approx.}}{62.9^\circ}$ or 57° (C) 60°

Q.10

$\because G = \eta \cdot \frac{4\pi}{\lambda^2} \cdot A \cdot B$

Given $\eta = 72\% = 0.72$

$\therefore G = \frac{4\pi}{\lambda^2} \cdot A \cdot B \cdot 0.72$

$= \frac{4\pi}{(327.9)^2} \times 500 \times 400 \times 0.72 = 16.9$

$= 12.3$ dBi

(a)