Trans-Electric Mode :(TE)

(Rectangular Wave guide)

Considering the Magnetic field vector equation given as Ref Eq-

$$\frac{\partial^2 H_z}{\partial x^2} + \frac{\partial^2 H_z}{\partial y^2} + \gamma^2 H_z = -\omega^2 \epsilon \mu H_z \quad \text{eq (22)}$$

let $\quad H_z = X Y$ —— (48)

putting it in the equation (22) in the similar way done in (TM) Mode we get the relation

$$\frac{1}{X}\frac{d^2X}{dx^2} + h^2 = -\frac{1}{Y}\frac{d^2Y}{dy^2} = A^2 \text{ —— (49)}$$

Where A^2 is a common constant

We have $\frac{1}{X}\frac{d^2X}{dx^2} + B^2 = 0$ —— (50) where $B^2 = h^2 - A^2$

The Solution of equation (50) is given as

$$X = C_5 \cos Bx + C_6 \sin Bx \text{ —— (51)}$$

Contd:

Similarly for Y solutions

$$\frac{1}{Y}\frac{d^2Y}{dy^2} + A^2 = 0$$

$$Y = C_7 \cos Ay + C_8 \sin Ay \quad \text{——} (52)$$

Since $H_z = XY$

$$H_z = (C_5 \cos Bx + C_6 \sin Bx)(C_7 \cos Ay + C_8 \sin Ay)$$

$$H_z = C_5 C_7 \cos Bx \cos Ay + C_5 C_8 \cos Bx \sin Ay$$
$$+ C_6 C_7 \sin Bx \cos Ay + C_6 C_8 \sin Bx \sin Ay) \quad \text{—} (53)$$

Applying boundary condition

at $x = 0$ $\quad C_8 = 0 \quad C_5 \neq 0 \quad C_6 = 0$

We have

$$H_z = C \cos Bx \cos Ay \quad \text{——} (54)$$

For Boundary Condition $x = a$ & $y = b$

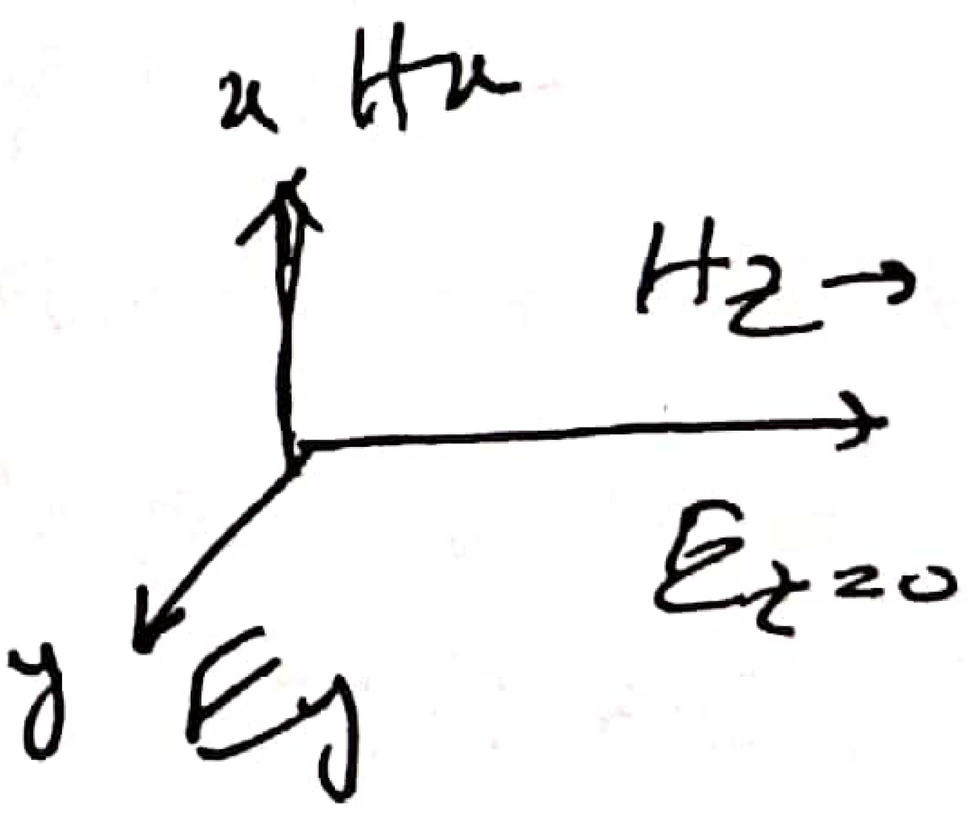
$$H_z = C \cos Ba \cos Ab$$

Where $Ba = m\pi$

or $B = \frac{m\pi}{a}$

& $Ab = n\pi$

or $A = \frac{n\pi}{a}$



$$H_z = C \cos\left(\frac{m\pi}{a}\right)x \cos\left(\frac{n\pi}{b}\right)y \quad \text{——} (55)$$

H_x & E_y can be found from Eqns 24 & 27

Assignment for Students