6.3.

1. $E = E_{0x}\cos(K_z z - \omega t + \delta_x)\hat{x}$

$$\nabla^2 E = \nabla^2 \begin{bmatrix} E_x \\ E_y \\ E_z \end{bmatrix} = \begin{bmatrix} 0 + 0 - K_z^2 E_{0x}\cos(K_z z - \omega t + \delta_x) \\ 0 + 0 + 0 \\ 0 + 0 + 0 \end{bmatrix}$$

$$= \frac{1}{c^2}\frac{d^2 E(x,t)}{dt^2} = \frac{1}{c^2}\begin{bmatrix} -\omega^2 E_{0x}\cos(K_z z - \omega t + \delta_x) \\ 0 \\ 0 \end{bmatrix}$$

$$-K_z^2 E_{0x}\cos(K_z z - \omega t + \delta_x) = \frac{1}{c^2}[-\omega^2 E_{0x}\cos(K_z z - \omega t + \delta_x)]\hat{x}$$

$$E_{0x}\cos(K_z z - \omega t + \delta_x) = \frac{1}{c^2}[c^2 E_{0x}\cos(K_z z - \omega t + \delta_x)]\hat{x}$$

$B = B_{0x}\cos(K_z z - \omega t\ \delta_x')\hat{x} + B_{0y}\cos(K_z z - \omega t + \delta_y')\hat{y}$

$$\nabla^2 B = \nabla^2 \begin{bmatrix} B_x \\ B_y \\ B_z \end{bmatrix} = \begin{bmatrix} 0 + 0 - K_z^2 B_{0x}\cos(K_z z - \omega t + \delta_x') \\ 0 + 0 - K_z^2 B_{0x}\cos(K_z z - \omega t + \delta_y') \\ 0 + 0 + 0 \end{bmatrix}$$

$$\frac{1}{c^2}\frac{d^2 B(x,t)}{dt^2} = \frac{1}{c^2}\begin{bmatrix} -\omega^2 B_{0x}\cos(K_z z - \omega t + \delta_x') \\ -\omega^2 B_{0x}\cos(K_z z - \omega t + \delta_y') \\ 0 \end{bmatrix}$$

$$-K_z^2 B_{0x}\cos(K_z z - \omega t + \delta_x') = \frac{1}{c^2}[-\omega^2 B_{0x}\cos(K_z z - \omega t + \delta_x')]\hat{x}$$

$$B_{0x}\cos(K_z z - \omega t + \delta_x') = \frac{1}{c^2}[c^2 B_{0x}\cos(K_z z - \omega t + \delta_x')]\hat{x}$$

$$-K_z^2 B_{0y}\cos(K_z z + \omega t + \delta_y') = \frac{1}{c^2}[-\omega^2 B_{0y}\cos(K_z z - \omega t + \delta_y')]\hat{y}$$

$$B_{0y}\cos(K_z z - \omega t + \delta_y') = \frac{1}{c^2}[c^2 B_{0y}\cos(K_z z - \omega t + \delta_y')]\hat{y}$$

2. $\nabla \times E = -\partial B/\partial t$

$$\nabla \times E = \left(\cancel{\partial E_z/\partial y} - \cancel{\partial E_y/\partial z}\right)\hat{x} + \left(\partial E_x/\partial z - \cancel{\partial E_z/\partial x}\right)\hat{y} + \left(\cancel{\partial E_y/\partial x} - \cancel{\partial E_x/\partial y}\right)\hat{z}$$

$$\nabla \times E = \partial E_x/\partial z \; \hat{y} = K_z E_{0x} \sin(K_z z - \omega t + \delta_x)\hat{y}$$

$$-\partial B/\partial t = -B_{0x}\cos(K_z z - \omega t + \delta'_x)\hat{x}\, \partial/\partial t - B_{0y}\cos(K_z z - \omega t + \delta'_y)\hat{y}\, \partial/\partial t$$

$$= \omega B_{0x} \sin(K_z z - \omega t + \delta'_x)\hat{x} + \omega B_{0y}\sin(K_z z - \omega t + \delta'_y)\hat{y}$$

$$B_{0x} = 0, \quad \delta_x = \delta'_y, \quad c = |\omega/k|, \quad E_{0x} \propto B_{0y}$$

$$E_{0x}\sin(K_z z - \omega t + \delta_x) = \frac{1}{c}\left[\frac{\omega}{k} B_{0y} \sin(K_z z - \omega t + \delta'_y)\right]\hat{y}$$

3. $E = E_{0y}\cos(K_z z - \omega t + \delta_y)\hat{y}$

$$\nabla \times E = -\partial E_y/\partial z \; \hat{x} = -K_z E_{0y}\sin(K_z z - \omega t + \delta_y)\hat{x}$$

$$-\partial B/\partial t = \omega B_{0x}\sin(K_z z - \omega t + \delta'_x)\hat{x} + \omega B_{0y}\sin(K_z z - \omega t + \delta'_y)\hat{y}$$

$$B_{0y} = 0, \quad \delta_y = \delta'_y, \quad c = |\omega/k|, \quad E_{0x} \propto B_{0y}$$

$$E_{0y}\sin(K_z z - \omega t + \delta_y) = \frac{1}{c}\left[\frac{\omega}{k} B_{0y}\sin(K_z z - \omega t + \delta'_y)\right]\hat{x}$$

4. $B = \frac{1}{c}\hat{K} \times E = \begin{matrix} K_x & K_y & K_z \\ E_x & E_y & E_z \end{matrix}$

$$\frac{1}{c}\left[(K_y E_z - K_z E_y)\hat{x} - (K_x E_z - K_z E_x)\hat{y} + (K_x E_y - K_y E_x)\hat{z}\right]$$

For $E = E_{0x}\cos(K_z z - \omega t + \delta_x)\hat{x}$

$$B = \frac{1}{c}\left[K_z E_x \hat{y} - K_y E_x \hat{z}\right] \quad K_y = 0 \text{ so } B = \frac{1}{c}\left[K_z E_x \hat{y}\right] = \frac{1}{c} K_z E_{0x}\cos(K_z z - \omega t + \delta_x)\hat{y}$$

For $E = E_{0y}\cos(K_z z - \omega t + \delta_y)\hat{y}$

$$B = \frac{1}{c}\left[-K_z E_y \hat{x} + K_x E_y \hat{z}\right] \quad K_x = 0 \text{ so } B = \frac{1}{c}\left[-K_z E_y \hat{x}\right] = -\frac{1}{c} K_z E_{0y}\cos(K_z z - \omega t + \delta_y)\hat{x}$$