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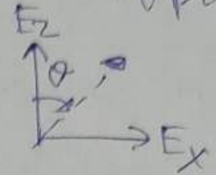
Subject: PHN-005: Assignment (3)

(1.) $\vec{E} = 4\sin(ky-\omega t)\hat{k} + 3\sin(ky-\omega t)\hat{i}$

$= \sin(ky-\omega t)\cdot\left(\frac{4\hat{k}+3\hat{i}}{5}\right)\cdot 5 = 5\sin(ky-\omega t)\cdot\underbrace{\left(\frac{3\hat{i}+4\hat{k}}{5}\right)}_{\text{[unit vector of propagation]}}$

So, the $\vec{E}$ is "linearly polarised" as travelling in only one direction. having angle $\theta = \tan^{-1}\left(\frac{3}{4}\right)$ with Z-axis in x-z plane.



(2.)(a) $\vec{E} = E_0\cos(kz-\omega t)\cdot\sqrt{2}\cdot\underbrace{\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)}_{\text{again unit vector of propagation}}$

$\vec{E}$ is "linearly polarised", making an angle of $\frac{\pi}{4}$ with x-axis in x-~~y~~ plane.

(2.)(b) $\vec{E} = \hat{i}E_0\sin(\omega t-kz) - E_0\sin(\omega t-kz-\frac{\pi}{4})\hat{j}$.

So: $E_x = E_0\sin(\omega t-kz)$
$E_y = -E_0\sin(\omega t-kz-\frac{\pi}{4})$.

as the $\Delta\phi$ = phase difference $= \frac{\pi}{4}$. it will be "elliptically polarised" with: eq^n as:

$$\boxed{\left(\frac{E_x}{E_0}\right)^2 + \left(\frac{E_y}{E_0}\right)^2 - \sqrt{2}\,\frac{E_x}{E_0}\cdot\frac{E_y}{E_0} = \frac{1}{2}}$$

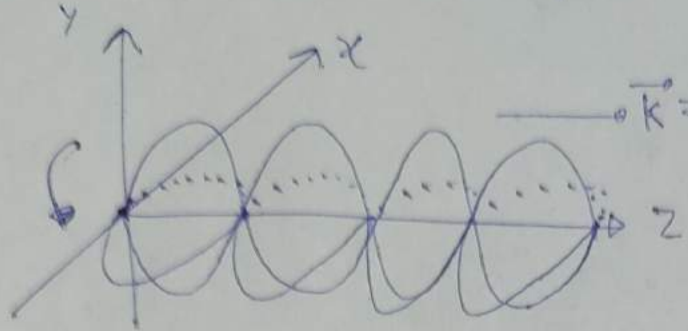
(2.)(c) $\vec{E} = E_0\sin(kz-\omega t)\hat{i} - E_0\cos(kz-\omega t)\hat{j}$.

as $E_x^2 + E_y^2 = E_0^2$ # circularly polarised. Ans

$\boxed{\Delta\phi = \frac{\pi}{2}}$

(3.) $\vec{E_x} = \cos(\omega t)\hat{i}$; $\vec{E_y} = \sin(\omega t)\hat{j}$.

Left handed circular standing wave. Ans



(4.) In natural light, each filter passes 38% of the incident beam.

Half of the incoming flux-density is in the form of a P-state parallel to the extinction-axis, and effectively none of this emerges. Thus, 76% of the light parallel to the transmission-axis is transmitted. In the present problem, (38% I_i) enters the second filter, and 76% (38% I_i) leaves it.

So: Ans: $\frac{76}{100} \times \left(\frac{38}{100} \times I_i\right) = 28.88\% \, I_i$ Ans

(5.) State of wave can be:

(a) circular polarised

(b) unpolarised.