Q & A class 2 2025-26

1. **Show that the wave equation is linear and that this leads to superposition of waves.**

Ans: The wave equation, $\frac{\partial^2 E}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E}{\partial t^2}$ is linear as E is to the power of 1 and we do not have terms like $E\frac{\partial^2 E}{\partial x^2}$ or $E\frac{\partial^2 E}{\partial t^2}$ or Log E or Sin E etc. Consider two waves given by $E_1 = E_0 sin(kx - \omega t)$ and $E_2 = E_0 sin(kx - \omega t)$. Each of these is a solution to the differential equation as can be verified by substituting them in the wave equation. Thus we have $\frac{\partial^2 E_1}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E_1}{\partial t^2}$ and $\frac{\partial^2 E_2}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 E_2}{\partial t^2}$. Adding them we get $\frac{\partial^2 (E_1+E_2)}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 (E_1+E_2)}{\partial t^2}$ and we see that $E_1 + E_2$ is also a solution. But $E_1 + E_2$ is superposition of waves

2. **What are circularly and elliptically polarised light?**

Ans: When the electric vector undergoes a rotational motion as the wave propagates, we call this circular polarised. The E vector can rotate clockwise or anticlockwise with respect to the observed. If along with the rotational motion the amplitude of the electric vector is different along two mutually perpendicular directions then we get elliptically polarised light as the tip of the vector traces out an ellipse.