

PYQ [IIT-JAM]

(Chapter 1 Superposition Principle)

Q1. At a given point in space the total light wave is composed of three phasors $P_1 = a$, $P_2 = \frac{a}{2}e^{i\theta}$ and $P_3 = \frac{a}{2}e^{-i\theta}$. The intensity of light at this point is

(a) $4a^2 \cos^2\left(\frac{\theta}{2}\right)$

(b) $4a^2 \cos^4\left(\frac{\theta}{2}\right)$

(c) $a^2 \cos^2(\theta)$

(d) $4a^2 \cos^2(2\theta)$

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Ans. 1: (b)

Solution: $P = P_1 + P_2 + P_3 = a + \frac{a}{2}e^{i\theta} + \frac{a}{2}e^{-i\theta} = \frac{a}{2}(2 + \cos\theta + i\sin\theta + \cos\theta - i\sin\theta)$

$$= a(1 + \cos\theta) = 2a \cos^2 \frac{\theta}{2}$$

$$I = P^2 = 4a^2 \cos^4\left(\frac{\theta}{2}\right)$$