

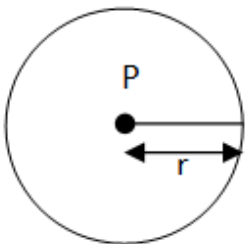


23. A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of 1 m from the diode is:

- (1) 1.73 V/m                      (2) 2.45 V/m                      (3) 5.48 V/m                      (4) 7.75 V/m

**Answer:**

We know intensity at a distance  $r$  for a light source of power  $P$  is given by



$$I = \frac{P}{4\pi r^2} \rightarrow (1)$$

Intensity of electromagnetic wave is given by

$$I = \frac{1}{2} C \epsilon_0 E_0^2 \rightarrow (2)$$

From equation (1) and (2) we get

$$\frac{1}{2} C \epsilon_0 E_0^2 = \frac{P}{4\pi r^2} \text{ or } E_0 = \sqrt{\frac{P}{4\pi r^2} \times \frac{2}{C \epsilon_0}}$$

Given :  $P = 0.1 \text{ W}$ ,  $r = 1 \text{ m}$ ,  $\frac{1}{4\pi \epsilon_0} = 9 \times 10^9$

$$E_0 = \sqrt{\frac{0.1}{1} \times \frac{2 \times 9 \times 10^9}{3 \times 10^8}}$$

$$= \sqrt{6} = 2.449 \approx 2.5 \text{ V/m}$$

**Correct choice is option (2) 2.5 V/m**