QUES 05:-

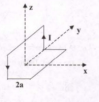
A non-planar loop of conducting wire carrying a current I is placed as shown in the figure. Each of the straight sections of the loop is of length $2a$. The magnetic field due to this loop at the point $P(a, 0, a)$ points in the direction [2001IS]

(a) $\frac{1}{\sqrt{2}}(-\hat{j}+\hat{k})$

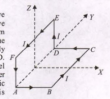
(b) $\frac{1}{\sqrt{3}}(-\hat{j}+\hat{k}+\hat{i})$

(c) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$

(d) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{k})$



(d) Here loop *ADEFA* in *y-z* plane and loop *ABCDA* in the *x – y* plane.



By choosing the loops we find that in one loop we have to take current from *A* to *D* and in the other one from *D* to *A*. Effectively there is no current in AD. Hence these two cancel out the effect of each other as far as creating magnetic field at the point *P* is considered.

The point (a, 0, a) is in the *X-Z* plane.

The magnetic field due to current in *ABCDA* will be in + ve Z-direction.

Due to symmetry the *y*-components and *x*-components will cancel out each other.

Similarly the magnetic field due to current in *ADEFA* will be in *x*-direction.

∴ The direction of resultant magnetic field at $P(a, 0, a)$

$\vec{B} = \frac{1}{\sqrt{2}}(\hat{i}+\hat{k})$.