QUES 03:-

A long straight wire along the Z-axis carries a current I in the negative Z-direction. The magnetic vector field $\vec{B}$ at a point having coordinates (x, y) in the $Z = 0$ plane is [200228]

(a) $\frac{\mu_0 I(y\hat{i} - x\hat{j})}{2\pi(x^2 + y^2)}$ (b) $\frac{\mu_0 I(x\hat{i} + y\hat{j})}{2\pi(x^2 + y^2)}$

(c) $\frac{\mu_0 I(x\hat{j} - y\hat{i})}{2\pi(x^2 + y^2)}$ (d) $\frac{\mu_0 I(x\hat{i} - y\hat{j})}{2\pi(x^2 + y^2)}$

(a) The wire carries a current I in the negative z-direction. We have to consider the magnetic vector field $\vec{B}$ at (x, y) in the $z = 0$ plane.

Magnetic field $\vec{B}$ is perpendicular to OP.

$\therefore \vec{B} = B\sin\theta\hat{i} - B\cos\theta\hat{j}$

$\sin\theta = \frac{y}{r}, \cos\theta = \frac{x}{r}$ $B = \frac{\mu_0 I}{2\pi r}$, $x^2 + y^2 = r^2$

$\therefore \vec{B} = \frac{\mu_0 I}{2\pi r^2}(y\hat{i} - x\hat{j})$

or $\vec{B} = \frac{\mu_0 I(y\hat{i} - x\hat{j})}{2\pi(x^2 + y^2)}$.