QUES 05:-

Biot-Savart law indicates that the moving electrons (velocity v) produce a magnetic field B such that

1) B $\perp$ v
2) B $\parallel$ v
3) it obeys inverse cube law
4) it is along the line joining the electron and point of observation

Sol. 1) B $\perp$ v

The Biot-Savart law states how the value of the magnetic field at a specific point in space from one short segment of current-carrying conductor depends on each factor that influences the field. The magnitude of $\vec{B}$ is $B \propto |q|; B \propto v; B \propto \sin\phi, B \propto \frac{1}{r^2}$

$B \propto \frac{|q|v\sin\phi}{r^2}$

$B = \frac{\mu_0}{4\pi}\frac{|q|v\sin\phi}{r^2}$

where $\frac{\mu_0}{4\pi}$ is a proportionality constant, 'r' is the magnitude of position vector from charge to that point at which we have to find the magnetic field and ϕ is the angle between $\vec{v}$ and $\vec{r}$.

or $\vec{B} = \frac{\mu_0}{4\pi}\frac{|q|(\vec{v}\times\vec{r})}{|r^3|}\hat{n}$

Where $\hat{n}$ is the direction of $\vec{B}$ which is in the direction of cross product of $\vec{v}$ and $\vec{r}$. Or we can say that $\vec{B}$ $\perp$ to both $\vec{v}$ and $\vec{r}$.

where is a proportionality constant, V' is the magnitude of position vector from charge to that point at which we have to find the magnetic field and <f) is the angle between v and F.

Where h is the direction of B which is in the direction of cross product of v and F. Or we can say that $\vec{B}$ $\perp$ to both and v and F.