CHIRANJIB DASH
CLASS :- XII DB
SCHOOL NO :- 9882

H.W

Date
Page

HOME ASSIGNMENT (CONCEPT OF MAGNETIC FIELD ON THE AXIS OF A CIRCULAR CURRENT LOOP

2) $B_{\text{straight line current}} = \frac{\mu_0 I}{2\pi r}$ — (i)

$B_{\text{circular current}} = \frac{\mu_0 I}{2r}$ — (ii)

$B_{net} = \left(\frac{\mu_0 I}{2\pi r} + \frac{\mu_0 I}{2r}\right)$

$= \frac{\mu_0 I}{2r}\left(1 + \frac{1}{\pi}\right)$

3) Magnetic field at the centre O of concentric arcs AB and CD by

$B = \frac{\mu_0 I \alpha}{4\pi r}$

When α is the angle subtended at the centre. Magnetic field at point O due to wires RQ and PS.

Magnetic field due to wire QP will be

$B_1 = \left(\frac{\alpha}{2\pi}\right)\left(\frac{\mu_0 I}{2a}\right)$

Direction of B_1 is coming out of the plane of the figure. Similarly field at O due to wire RS are

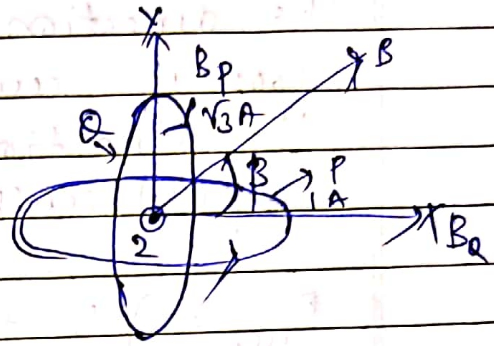
$B_2 = \left(\frac{\alpha}{2\pi}\right)\left(\frac{\mu_0 I}{2a}\right)$

Direction of field vector B_2 is going into the plane

The resultant field at O is

$$B = B_1 - B_2 = \frac{\mu_0 I \alpha (b-a)}{4\pi ab}.$$

coming out of plane



4) $B_P = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0}{2\pi r}$

$B_Q = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 \sqrt{3}}{2\pi r}$

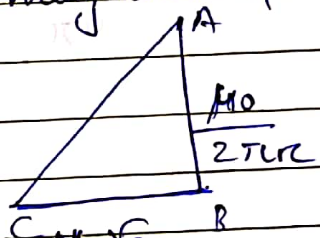
$$B_{net} = \sqrt{B_P^2 + B_Q^2}$$

$$= \sqrt{\left(\frac{\mu_0}{2\pi r}\right)^2 + \left(\frac{\mu_0\sqrt{3}}{2\pi r}\right)^2}$$

$$= \frac{\mu_0}{2\pi r}\sqrt{4}$$

$$= \frac{\mu_0}{\pi r}$$

The direction of net magnetic field



$$\tan\beta = \frac{AB}{BC} = \frac{\frac{\mu_0}{2\pi r}}{\frac{\mu_0\sqrt{3}}{2\pi r}} = \frac{1}{\sqrt{3}}$$

$\beta = 30°$

∴ So the direction of net magnetic field is 30° with the X direction.

5) The magnetic field due to a circular loop is given by

$$B = \frac{\mu_0}{4\pi} \cdot \frac{2\pi I a^2}{(a^2+r^2)^{3/2}}$$

where a = radius of loop
r = distance of O from the centre of loop.

XII - DB, 9882

$$B_1 = B_2 = \frac{\mu_0}{4\pi} \cdot \frac{2\pi I a^2}{(a^2+x^2)^{3/2}}$$

The direction of net magnetic field due to loop (1) will be away from O and the direction of net magnetic field due to loop (2) will be towards O

$$B_{net} = \sqrt{B_1^2 + B_2^2}$$

$$= \frac{\mu_0}{4\pi} \cdot \frac{2\pi\sqrt{2} I a^2}{(a^2+x^2)^{3/2}}$$