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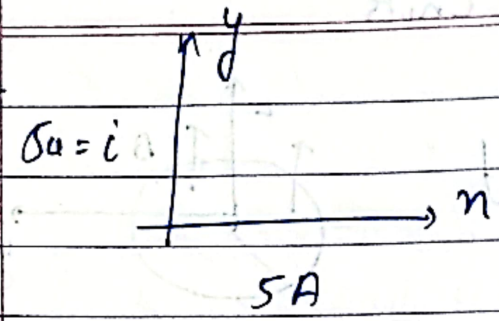
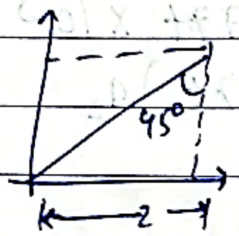
Assignment -3

Ans-1-



(a) (2, 20)



$$B = \left(\frac{\mu_0}{4\pi}\right) \times \frac{5}{2}\left[\sin 45^\circ + \sin 90^\circ\right] \times 2$$

$$B = 10^{-7} \times 5\left[\frac{1}{\sqrt{2}} + 1\right] \quad \left[\frac{\mu_0}{4\pi} = 10^{-7}\right]$$

$$B = 8.52 \times 10^{-7}$$

$$\vec{H} = \frac{B}{\mu} = \frac{8.52 \times 10^{-7}}{\frac{\mu_0}{4\pi}} \times \frac{1}{9\pi} = \frac{8.52}{9\pi}$$

$$\vec{H} = -6.69 a_z \ A/M$$

Similarly (b) $0.1989 a_z$ A/M

(c) $0.1989 a_x + 0.1989 a_y$ A/m

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Ans-2 (a) $\vec{J} = \Delta \times \vec{H}$

$$\vec{J} = \begin{vmatrix} a_n & a_y & a_z \\ d/dn & d/dy & d/dz \\ An & Ay & A_z \end{vmatrix} = \begin{vmatrix} a_n & a_y & a_z \\ d/dn & d/dy & d/dz \\ yz(n^2+y^2) & -n^2y^2 & (-n^2yz) \end{vmatrix}$$

$$\vec{J} = \left[\frac{d(4n^2y^2)}{dy} - \frac{d(-ny^2z)}{dz}\right] a_n - \left[\frac{d(4n^2y^2)}{dn} - \frac{d}{dz} y^2(n^2+y^2)\, ny\right] a_y + \left[\frac{d}{dn}(-ny^2z) - \frac{d}{dy}(y^2(n^2+y^2))\right] a_z$$

$$\vec{J} = (8n^2y + ny^2)\, a_n - (8ny^2 - y(n^2+y^2))\, a_y - (y^2z + (n^2z + 3yz^2))\, a_z$$

(b) $I = \int_2 I \cdot dS$

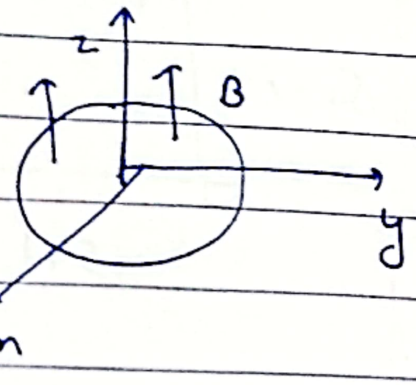
$$I = \int_0^2 \int_0^2 (8n^2y + ny^2)a_n - (8n^2 - y(n^2+y^2))a_y - y^2z + (n^2z + 3yz^2)\, a_z$$

$$I = \int_0^2 \int_0^2 (8n^2y - ny^2)\, dy\, dz$$

$$I = \int_0^2 \int_0^2 (8y + y^2)\, dy\, dz$$

$$I = \left(16 + \frac{8}{3}\right)(2) = 37.33\ A$$

Ans-3: Transformer V_{emf}



$$\Rightarrow -\int \frac{dB}{dt} dS$$

$$\frac{dB}{dt} = -10 \times 377 \times \sin 377t \times 10^{-3} a_z$$

$$\Rightarrow -3.77 \sin(377t) a_z$$

$$dS = \rho d\rho d\phi a_z$$

$$V_{emf} = -\int \frac{dB}{dt} \cdot dS = -\int_{\phi=0}^{2\pi} \int_{\rho=0}^{0.2} -3.77 \sin(377t) \rho d\rho d\phi$$

$$V_{emf} = 3.77 \sin(377t) \int_{\phi=0}^{2\pi} \int_{\rho=0}^{0.2} \rho d\rho d\phi = 0.473 \sin(377t) V$$

It is the voltage induced.

Ans-4- Transformer = Is a device that transfer electric energy from one alternating current circuit to one or more other circuit, either increasing & reducing the voltage.
Eg door bells, toy electric trains.

Mohional emf ⇒ An emf induced by motion relative to a magnetic field is called mohional emf and given by

$$emf = BlV$$

Where BlV are perpendicular

$l \rightarrow$ length of object.

$V \rightarrow$ relative speed to field.