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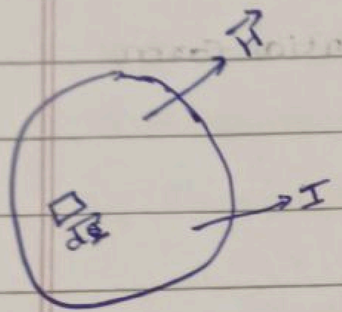
CO-2 ALM

ii) Ampere's Law:

The line integral of magnetic field intensity ~~H~~ around closed loop is equal to the total current enclosed by that closed loop.

$$\boxed{\oint \vec{H} \cdot \vec{dl} = I}$$



As per Ampere circuit law

$$\oint \vec{H} \cdot \vec{dl} = I \quad \text{—} ①$$

Total current $I = I_c + I_d$

If we have charge density J

$$I = \int \vec{J} \cdot \vec{ds} \quad \text{—} ②$$

$\because \vec{J} = \vec{J_c} + \vec{J_d}$

from eq ① & ②

$$\boxed{\oint \vec{H} \cdot \vec{dl} = \int \vec{J} \cdot \vec{ds}} \longrightarrow \text{Integral form}$$

As per stokes theorem

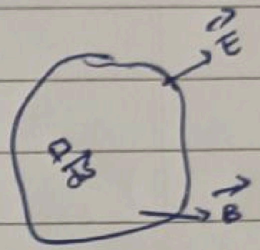
$$\oint \vec{H} \cdot \vec{dl} = \int (\vec{\nabla} \times \vec{H}) \, \vec{ds} = \int \vec{J} \cdot \vec{ds}$$

$$\boxed{\vec{\nabla} \times \vec{H} = \vec{J}} \rightarrow \text{Differential form}$$

(iv) Faraday's law:

Rate of change of magnetic flux with respect to time generates induced emf in the circuit.

$$\boxed{V_{emf} = -\frac{d\phi_B}{dt}} \quad \text{— (1)}$$



As per potential

$$V_{emf} = -\int \vec{E} \cdot \vec{dl} \quad \text{— (2)}$$

from eq (1) & eq (2)

$$\int \vec{E} \cdot \vec{dl} = -\frac{d\phi_B}{dt}$$

magnetic flux $\phi_B = \int \vec{B} \cdot \vec{dS}$

$$\boxed{\int \vec{E} \cdot \vec{dl} = -\frac{d}{dt} \int \vec{B} \cdot \vec{dS}} \rightarrow \text{Integral form}$$

As per stock's theorem

$$\int \vec{E} \cdot \vec{dl} = \int (\vec{\nabla} \times \vec{E}) \, \vec{dS}$$

Hence,

$$\int (\vec{\nabla} \times \vec{E}) \, \vec{dS} = -\frac{d}{dt} \int \vec{B} \cdot \vec{dS}$$

$$\boxed{\vec{\nabla} \times \vec{E} = -\frac{d\vec{B}}{dt}} \rightarrow \text{Differential form}$$

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