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Electromagnetic Induction [EMI]

Hand Notes For JEE Mains, Advance, NEET UG, Class 11 & 12 etc…

Hand Notes

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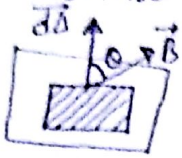
ELECTROMAGNETIC INDUCTION [E.M.I]

To produced induced current in the loop or, Induced emf, there should be relative motion betn coil & the magnets, so that the magnetic flux change w.r.t time.

Magnetic flux (ϕ)

It is no. of lines of force passing through a surface placed normal to magnetic field.



Flux with small area element.

$$d\phi = B(dA\cos\theta)$$

$$d\phi = \vec{B}\cdot d\vec{A}$$ (scalar quantity)

unit → Wb, $T\times m^2$ = MKS

Maxwell, $G\times cm^2$ = CKS

$$1\,Wb = 10^8\,Maxwell$$

Case-I → If field is uniform & surface is plane.

$$\phi_{net} = \int B\,dA\cos\theta$$

$$= B\cos\theta \int dA$$

$$\phi_{net} = BA\cos\theta$$

$$\phi_{net} = \vec{B}\cdot\vec{A}$$

If no. of turn in the coil are 'N'

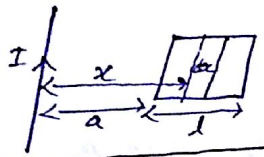
$$\phi = NBA\cos\theta$$

Case-II → In case of non-uniform field.

$$\phi_{net} = \int \vec{B}\cdot d\vec{A}$$

A square of side 'l' is placed in same plane with a long wire as shown fig. then flux with loop.

$$\phi_{net} = \frac{\mu_0 I l}{2\pi} \log_e\left[\frac{a+l}{a}\right]$$

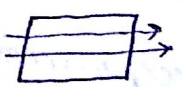


$\phi = NBA\cos\theta$

$\phi = f(B, A, \theta)$

→ If ϕ ⇒ const ⇒ NO EMI.

→ If ϕ ⇒ non-const ⇒ EMI. ✓

|i| →  $A \perp B$ ⇒ $\phi = 0$

|ii| →