(5)

$$\nabla \times \vec{E} = -N\frac{d\vec{B}}{dt}$$

(ii) if $N=1$

$$\boxed{\nabla \times \vec{E} = -\frac{\partial \vec{B}}{dt}}$$ → Maxwell's 2^{nd} eq^n for ~~static field~~ time varying field (differential form or point form)

$\boxed{\vec{B} = \mu\vec{H}}$ → magnetic flux Density

$\boxed{\vec{D} = \epsilon\vec{E}}$ → electric flux Density

(3) Ampere's law : closed loop

It states that line integral of tangential component of magnetic field is equal to current enclosed by that closed loop.

$$\oint_l \vec{H}\cdot\vec{dl} = I_{enc} \quad \text{—— (1)}$$

Let $\vec{J_c}$ be conduction current Density $\left(\frac{A}{m^2}\right)$

$$I = \int_s \vec{J_c}\cdot\vec{ds} \quad \text{—— (2)}$$

$$\boxed{\oint \vec{H}\cdot\vec{dl} = \int_s \vec{J_c}\cdot\vec{ds}}$$ Maxwell's 3rd equation (integral form)

For time varying field

$$\oint \vec{H}\cdot\vec{dl} = \int_s \left(\vec{J_c} + \vec{J_D}\right)\cdot\vec{ds}$$

$\vec{J_c}$ = conduction current Density $(\sigma\vec{E})$

conductivity of the conductor

$\vec{J_D}$ = Displacement current Density $\left(\frac{\partial \vec{D}}{\partial t}\right)$

$\Rightarrow$ For differential form,

From stokes's theorem

$$\int_S (\nabla \times \vec{H}) \cdot d\vec{s} = \int_S \vec{I_c} \cdot d\vec{s}$$

$$\boxed{\nabla \times \vec{H} = \vec{J_c}}$$ (static field)

For time varying field,

$$\boxed{\nabla \times \vec{H} = \vec{J_c} + \vec{J_D}}$$ → Maxwell's 3rd eqn. (differential form)

(4) Isolated magnetic monopole does not exist:

Total magnetic flux passing through closed surface is always zero.

$$\boxed{\oint \vec{B} \cdot d\vec{s} = 0}$$ ⇒ Maxwell's 4th equation (integral form)

applying Divergence theorem: $\oint \vec{D} \cdot d\vec{s} = \int_V (\nabla \cdot \vec{D})\, dv$

$$\Rightarrow \int_V (\nabla \cdot \vec{B})\, dv = 0$$

$$\boxed{\Rightarrow \nabla \cdot \vec{B} = 0}$$ ⇒ Maxwell's 4th equations in (Differential form)