1) Displacement current:

$$\boxed{I_D = \varepsilon_0 \frac{d\phi_E}{dt}}$$

proof:- $\phi_E = E \cdot A$

$d_E = EA\cos\theta$

$\phi_E = EA$ — ①

$Q = CV$

$Q = \frac{A\varepsilon_0}{d} V$

Since, $V = Ed$

$\therefore Q = \frac{A\varepsilon_0 Ed}{d}$

$i_D = \frac{dQ}{dt} = \frac{d}{dt} A\varepsilon_0 E$

$= \varepsilon_0 \frac{d}{dt} AE$

$$\boxed{i_D = \varepsilon_0 \frac{d\phi_E}{dt}}$$

② Ampere's circuital law:

$$\boxed{\oint \vec{B} \cdot \vec{dl} = \mu_0 I_{inside}}$$

③ Modified Ampere's circuital law:

$$\boxed{\oint \vec{B} \cdot \vec{dl} = \mu_0 \left[I_c + \varepsilon_0 \frac{d\phi_E}{dt} \right]}$$

⑧ Pressure exerted By EM Waves:

$$\boxed{P = \frac{I}{c}}$$

4) Maxwell's equations:

i) $\oint \vec{E} \cdot \vec{ds} = \frac{q}{\varepsilon_0}$ } Gauss' law in Electrostatic

2) $\oint \vec{B} \cdot \vec{ds} = 0$ } " " Magnetism

3) $\oint \vec{E} \cdot \vec{dl} = -\frac{d\phi_B}{dt}$ } faraday's law

4) $\oint \vec{B} \cdot \vec{dl} = \mu_0 \left[I + \varepsilon_0 \frac{d\phi_E}{dt} \right]$ } Ampere's law.

5) EM wave:

i) Velocity of electromagnetic waves in free space, $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = \frac{E_0}{B_0}$ $\boxed{E_0 = c B_0}$

ii) Velocity of EM waves in material medium,

$$V_m = \frac{1}{\sqrt{\mu_m \varepsilon_m}}$$

6) Refractive index (η) of a material medium:

$$\eta = \frac{c}{V} = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} \times \frac{\sqrt{\mu \varepsilon}}{1} = \sqrt{\frac{\mu \varepsilon}{\mu_0 \varepsilon_0}}$$

$$\boxed{\eta = \sqrt{\mu_r \varepsilon_r}}$$

$\mu_r = \frac{\mu}{\mu_0}$ = releative permeability

$\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}$ = relative permittivity

⑨ Intensity of EMW:

$$\boxed{I = \frac{1}{2} \frac{E_0 B_0}{\mu_0} = \frac{1}{2} \frac{B_0^2}{\mu_0} \times c = \frac{1}{2} \varepsilon_0 E_0^2 \times c}$$

Displacement current Betn Plates of Capacitor.

$$I_D = \varepsilon_0 \frac{d(EA)}{dt} = \varepsilon_0 A \frac{dE}{dt}$$

$$= \varepsilon_0 A \frac{d}{dt}\left(\frac{V}{d}\right) = \frac{\varepsilon_0 A}{d} \frac{dV}{dt}$$

$$\boxed{I_D = C \frac{dV}{dt}}$$

Momentum transported By EMW:

$\boxed{p = \frac{U}{c}}$, $U \rightarrow$ Energy transport By EMW

Energy transported By EMW per second per unit area:

$$\vec{S} = \vec{E} \times \vec{H} = \frac{1}{\mu_0}(\vec{E} \times \vec{B})$$

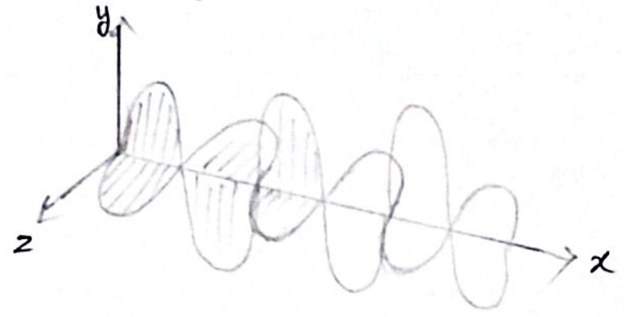
If E_0 & B_0 be the peak values of the electric & magnetic fields, then

$$I = \frac{E_0 B_0}{2\mu_0} = \frac{E_0^2}{2\mu_0 c} = \frac{c B_0^2}{2\mu_0}$$

$\boxed{E_0 = \sqrt{2} E_{rms}}$ & $\boxed{B_0 = \sqrt{2} B_{rms}}$

• Charge ka flow $\rightarrow$ Conduction I

• $\vec{E}$ vary with time $t \rightarrow$ Displacement I



→ $\vec{E} \times \vec{B} \rightarrow$ direction of EM wave.

→ Both are $\perp^{rd}$

→ Both are in same phase