Chapter 8

Electromagnetic Waves

Maxwell's Equations & Displacement Current

Displacement Current

- It is a current which produces in the region in which the electric field and hence the electric flux changes with time.
- Displacement current, $I_D = \varepsilon . d\varphi_E / dt$
  where, φ_E is the electric flux.

Ampere-Maxwell Law

$$\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 (I + I_D)$$

where, μ_o = Permeability
$= 4\pi * 10^{-7}$ V / Am

Maxwell's Equations

(i) $\oint_S \mathbf{E} \cdot d\mathbf{S} = \frac{q}{\varepsilon_0}$

This equation is Gauss's law in electrostatics.

(ii) $\oint_S \mathbf{E} \cdot d\mathbf{S} = 0$

This equation is Gauss's law in magnetostatics.

(iii) $\oint_S \mathbf{E} \cdot d\mathbf{l} = -\frac{d}{dt} \oint_S \mathbf{B} \cdot d\mathbf{S}$

This equation is Faraday's law of electromagnetic induction.

(iv) $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 \left(I + \varepsilon_0 \frac{d\phi_E}{dt} \right)$

This equation is Ampere-Maxwell law.