Chapter - 8
ElectroMagnetic Wave

Q.1 Write the maxwell equations.
2 Define displacement current.
3 What do you understand by the electromagnetic wave? Write it's properties.

Ans.① The equations of of maxwell are -

A) $\oint \vec{E} \cdot d\vec{S} = \frac{q}{\varepsilon_0}$ [Gauss's Theorem for Electricity]

B) $\oint \vec{B} \cdot d\vec{S} = 0$ [Gauss's Theorem for Magnetism]

C) $\oint \vec{E} \cdot d\vec{l} = -\frac{d\phi}{dt}$ [2nd law of faraday]

D) $\oint \vec{B} \cdot d\vec{l} = \mu_0 (I + I_d)$ [Ampere cirpital law]

Ans.3.

ElectroMagnetic Wave :- when Electic field and magnetic field is applied mutually perpendicular then its perpendicular a visible wave is generated this wave is called ElectroMagnetic Wave. (E.M.W.)

$$\rightarrow \quad E = E_0 \sin(kx - \omega t)$$

$$\Rightarrow \quad B = B_0 \sin(kx - \omega t)$$

$$\Rightarrow \quad C = \frac{E_0}{B_0} = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

$$\boxed{\text{Value of } C = 3 \times 10^8 \text{ m/s}}$$

Ans. 2) Varrying electric flux create current is called displacement current, represented by "I_d".

$$I_d = \frac{dq}{dt}$$

$$\because \quad \phi = \frac{q}{\varepsilon_0}$$

$$\Rightarrow \quad q = \phi \varepsilon_0$$

$$\Rightarrow \quad I_d = \frac{d(\phi \varepsilon_0)}{dt}$$

$$\Rightarrow \quad \boxed{I_d = \varepsilon_0 \frac{d\phi}{dt}}$$

Ans. 3. Properties :-

a) speed of electromagnetic wave is same as ~~air that is~~ speed of light in vaccum or air that is 3×10^8.

b) The nature of Electromagnetic wave is transverse.

c) Electromagnetic wave always propagating (perpendicular to the electric and magnetic field.

d) Electromagnetic wave does not affect by electric and magnetic field.

e) speed of electromagnetic wave is $\frac{1}{\sqrt{\mu_0 \varepsilon_0}} = c$.

4 What is electromagnetic spectrum?

5 Write the name of electromagnetic wave and prepare a chart the following heads :-

i) Name of wave
ii) Name of discoverer
iii) Wave length range
iv) Frequency range
v) source name
vi) Use

Ans.4) All Electromagnetic wave are arranged in particular way, this arrangment is called Electromagnetic spectrum.

Electromagnetic wave & types -

i) Visible spectrum -
ii) Invisible spectrum

i) Visible spectrum :- which spectrum that can be seen by our naked eyes. Example → VIBGYOR

ii) Invisible spectrum:- The spectrum that can not be seen by our naked eyes. Example — UV ray, x-ray, Infrared ray.

Associating order

S.No	Name of wave	Name of discoverer	wave length range	frequency range	source	use
1.	Gamma ray (~~X~~-ray)	Bequrall (1896)	10^{-14} m to 10^{-11} m	10^{22} Hz to 10^{19} Hz	Radio active element	Treatment of cancer
2.	X-ray	Rontazon (1801)	$10^{-11} - 10^{-8}$ m		(Heavy element) + (Stricking charge Particle)	To study the structure of atom
3.	UV-ray	~~Newton (1666)~~ W. Ritter (1801)	$10^{-8} - 10^{-7}$ m		Sun	~~for~~ water purification
4.	Visible ray	~~Harshall (1800)~~ Newton (1666)	$4\times10^{-7} - 7.8\times10^{-7}$ m		Sun	To see any object
5.	Infrared ray	~~Hurtz (1887)~~	$10^{-7} - 10^{-3}$ m		Hot body	~~To increase the~~ In green house effect
6.	Micro wave	Hurtz (1887)	10^{-3} m - 1m		Laboratory	In RADAR system & SONAR system.
7.	Radio wave	Marconi (1889)	1m - 10^{8} m		Lab.	For communication

Ans. (i) → Harshall (1800)

(ii) → Also known as Thermal ray.