Date: / /

22/2/22

20/2/22 Assignment - I

Que-1 Which law indicates the absence of Magnetic Monopoles?

→ The Maxwell's Gauss law in Magnetostatics indicates the absence of Magnetic Monopoles.
It can be mathematically represented as

$$\nabla . B = 0$$

Qu-2 changing electric field induces the magnetic field. Write mathematic relation to this effect.

→ The Maxwell is third equation of Faraday is law of Electromagnetic Induction shows the relation between electric field and magnetic field. It can be mathematically written as

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

Qu-3 Which Maxwell's equation are coupled together?

→ The faraday's law and Amphere Maxwell law are dynamically coup equations forming the core of electromagnetic wave theory.

1. Faraday's law of Induction:

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

2. Amphere Maxwell law:

$$\nabla \times B = J + \frac{\partial D}{\partial t}$$

Qu- Write the characteristics of EM waves?

→ Characteristics of EM waves:

1.) Transverse Nature.

Date: / /

2.) Travel at the speed of light (in vaccum) $c = 3 \times 10^8$

3.) Carry Energy and Momentum.

Energy $= \frac{1}{2}\left(\epsilon_0 E^2 + \frac{B^2}{\mu_0}\right)$

4.) EM waves consists of $\vec{E}$ and $\vec{B}$ oscillating perpendicular to wave propagation of wave.

5.) Oscillation of $\vec{E}$ and $\vec{B}$ occurs in same phase.

6.)

u-5) Which Maxwell equation remains unchanged under all condition?

→ The second Maxwell equation, Gauss law in magnetism remains unchanged under all conditions. It states:

$$\nabla \cdot B = 0$$

-6) What is plane Electromagnetic wave?

→ A plane EM wave is a type of EM wave in which electric field (E) and Magnetic field (B) oscillate perpendicular to each other and to the direction of wave propagation.

-7 When do Maxwell's equations become uncoupled and with what consequence?

→ Maxwell's equations become uncoupled in regions where there is no free charges ($\rho = 0$) and no free currents ($J = 0$), such as in free space or vaccum.

The equations for free space will be

$$\nabla^2 E = \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2} \quad \text{—— (1)}$$

$$\nabla^2 H = \mu_0 \epsilon_0 \frac{\partial^2 H}{\partial t^2} \quad \text{—— (2)}$$

Page :
Date: / /

Consequences of Uncoupling!

The Maxwell's equations will not depend on each other as there is no free electrons and no current ($J=0$) in free space.

Qu-8) The light is generally characterised by electric vector although it also possess Magnetic vector. Explain?

→ In light, electric field dominate over magnetic field vector. Light, as it goes through a medium which has small probability to interact with magnetic field component with medium and mainly, so, electric field components predominate.

Qu-9) What is plane polarised EM wave?

→ The light wave that has vibrations occuring only in one plane is called plane polarised on EM waves.

Qu-10) Which relation indicates EM waves are related to speed of light?

→ The relation which indicates EM Waves are related to speed of light

$$C = \frac{1}{\sqrt{\mu_0 \epsilon_0}} = 3 \times 10^8 \text{ m/s}$$

$$\nabla^2 \phi = \frac{1}{c^2} \frac{\partial^2 \psi}{\partial t^2}$$