Chapter 8

Electromagnetic Waves



8.1 Introduction

- We will discuss about electromagnetic waves, their properties and characteristics, and also their practical
 uses in our day-to-day life.
- One of the most important applications of electromagnetic waves is in communication.
- Some of the important applications of electromagnetic waves are:-
 - 1. We are able to see everything around us because of electromagnetic waves.
 - It helps in aircraft navigation and helps the pilot for the smooth take-off and landing of aeroplanes. It also helps to calculate the speed of the aeroplane.
 - 3. In the medical field it has got very important applications. For example: In laser eye surgery, in x-rays.
 - 4. In radio and television broadcasting signals. These signals are transmitted by electromagnetic waves.
 - 5. Electromagnetic waves helps in determining the speed of the passing vehicles.
 - 6. They are used in electronic appliances like T.V. remotes, remote cars, LED TV, microwave ovens etc.
 - Voice transmission in mobile phones is possible because of electromagnetic waves.

What are Electromagnetic Waves?

- Electromagnetic (EM) waves are the waves which are related to both electricity and magnetism.
- Electromagnetic (EM) waves are the waves which are coupled time varying electric and magnetic fields that propagate in space.
- Waves associated with electricity and magnetism and as they are waves so they will propagate in the space.
- When the electric and magnetic fields combine together and when they are varying with time they both will give rise to electromagnetic waves.
- Electromagnetic equations emerged from Maxwell's equations.
- Maxwell found these EM waves have so many special properties which can be used for many practical purposes.
- Time varying electric field + Time varying magnetic field = Electromagnetic waves.

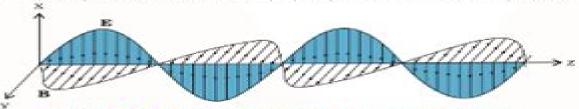


FIGURE 8.4 A linearly polarised electromagnetic wave, propagating in the z-direction with the oscillating electric field E along the x-direction and the oscillating magnetic field B along the y-direction.

Maxwell's Experiments

- Maxwell proposed that the time varying electric field can generate magnetic field.
- Time varying magnetic field generates electric field (Faraday-Lenz law).
 - According to <u>Faraday Lenz law</u> an EMF is induced in the circuit whenever the amount of magnetic flux linked with a circuit changes.
 - 2. As a result electric current gets generated in the circuit which has an electric field associated with it.

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