# 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:-
  - 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.
  - 7. 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.

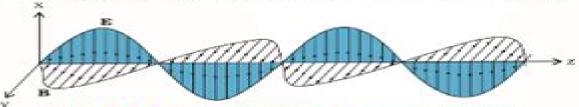


FIGURE 8.4 A linearly polarised electromagnetic wave, propagating in the z-direction with the oscillating electric field E along the x-direction and the oscillating magnetic field B along the y-direction.

#### 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.

# **Notes Of Electromagnetic Wave Guide**

**R Barnett** 

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## **Table of Contents Notes Of Electromagnetic Wave Guide**

- 1. Understanding the eBook Notes Of Electromagnetic Wave Guide
  - The Rise of Digital Reading Notes Of Electromagnetic Wave Guide
  - Advantages of eBooks Over Traditional Books
- 2. Identifying Notes Of Electromagnetic Wave Guide
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Notes Of Electromagnetic Wave Guide
  - User-Friendly Interface
- 4. Exploring eBook Recommendations from Notes Of Electromagnetic Wave Guide
  - Personalized Recommendations
  - Notes Of Electromagnetic Wave Guide User Reviews and Ratings
  - Notes Of Electromagnetic Wave Guide and Bestseller Lists

- 5. Accessing Notes Of Electromagnetic Wave Guide Free and Paid eBooks
  - Notes Of Electromagnetic Wave Guide Public Domain eBooks
  - Notes Of Electromagnetic Wave Guide eBook Subscription Services
  - Notes Of Electromagnetic Wave Guide Budget-Friendly Options
- 6. Navigating Notes Of Electromagnetic Wave Guide eBook Formats
  - ∘ ePub, PDF, MOBI, and More
  - Notes Of Electromagnetic Wave Guide Compatibility with Devices
  - Notes Of Electromagnetic Wave Guide Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Notes Of Electromagnetic Wave Guide
  - Highlighting and Note-Taking Notes Of Electromagnetic Wave Guide
  - Interactive Elements Notes Of Electromagnetic Wave Guide
- 8. Staying Engaged with Notes Of Electromagnetic Wave Guide
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Notes Of Electromagnetic Wave Guide
- 9. Balancing eBooks and Physical Books Notes Of Electromagnetic Wave Guide
  - Benefits of a Digital Library
  - o Creating a Diverse Reading Collection Notes Of Electromagnetic Wave Guide
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Notes Of Electromagnetic Wave Guide
  - Setting Reading Goals Notes Of Electromagnetic Wave Guide
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Notes Of Electromagnetic Wave Guide
  - Fact-Checking eBook Content of Notes Of Electromagnetic Wave Guide
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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