Chapter8

Electromagnetic waves

Question bank

LEVEL –A

1) State Ampere's Circuital law and give its mathematical form.(2)

2) What is the inconsistency which Maxvell observed in Ampere's Circuital law?(2)

3) What is Displacement current? Explain.(2)

4) Write Maxwells equation and explain the existence of EM waves.(3)

5) Explain how EM waves are produced?(2)

6) Write the properties of EM waves.(3)

7) Define the term electromagnetic spectrum and mention its components? (2)

8)What are the components of the invisible parts of electromagnetic spectrum?(2)

9) Write wavelength ranges of following electromagnetic radiations

    (a) Radio waves (b) micro waves (c) ultraviolet(uv) radiation (d) visible light (e) infrared radiations

    (f) X – rays and (g) gamma rays.
(3)

(10)   Mention any oneuse of the following radiations.

      (a) Radio waves (b) micro waves (c) ultraviolet(uv) radiation (d) infrared radiations

    (f) X – rays and (g) gamma rays. (3)

11) Write frequency ranges of following electromagnetic radiations

    (a) radio waves (b) micro waves (c) ultraviolet(uv) radiation (d) visible light (e) infrared radiations

    (f) x – rays and (g) gamma rays.
(3)

12) Arrange the following em waves in increasing order of their frequency

Gamma rays, UV rays, visible radiation, IR radiation

(2)

LEVEL B

1) Draw the diagram of electromagnetic plane polarized electromagnetic wave travelling in the forward direction and mark the directions of electric and magnetic field vectors and also the direction of propagation of the wave.(3)

2) What is the relation between the magnitudes of electric field and magnetic field in an em wave?

Define the term radiation pressure and explain with an example.(3)

3) The amplitude of magnetic field part of a harmonic em wave in vacuum is Bo=510nT.What is the amplitude of electric field part of the wave?

4) Electric field vector is along the X direction and Magnetic field vector is along Y direction .What do you say about the direction of propagation of the wave?(1)

5) Identify the type of em wave associated with the following

   a) used to take photograph under foggy conditions   b)radiation emitted during welding

   c) emitted during radioactive decay (3)

6) Identify the type of em wave associated with the following wavelength/frequency ranges.

a) 0.1 to 1m   b) 10^{14}Hz   c) 1^0 A to 100^0 A   (3)

7) Name the em radiation is in electric ovens and mention its other uses.(3)

8) What physical quantity is same for gamma rays of wavelength 10^{-13}m and red light of wavelength 6800A^0 (1)

9) What are the physical quantities a) that remain constant b) increase and c) decease as one moves from Gamma rays to Radio waves in an emspectrum.(3)

10)What does an em wave consist of? On what factors does the velocity of em wave depend?(3)

11) Why did Maxwell introduce the concept of displacement current? Explain.(2)

12) How does a Microwave oven work? (2)

13) What type of em radiation is used in the following?

   a) Resource mapping of the earth b) TV transmission   c) Radar systems for aircraft navigation

d) used in water purifiers to kill germs (2)

14) A radio can tune into any station 7.5MHz to 12MHz band.What is the corresponding wavelength band?(2)

15) Scientists predict a 'Nuclear winter 'if there is a global nuclear war which may have a devastating effect on earth.What might be the basis of this prediction?
(2)

16) Optical and radio telescopes are built on the ground but X-Ray astronomy is possible only from satellite orbiting the earth.Why?(2)

LEVEL – C

(1) The electric field of a plane electromagnetic wave in vacuum is represented by $E_x=0$, $E_z=0$ and $E_y=0.7\cos[2\Pi x10^8(t-x/c)]$
(3)

   a) What is the direction of propagation of em wave?

   b) Determine the wavelength of the wave.

   c) Compute the component of associated magnetic field.

  2) A plane em wave is travelling along the X – direction has a wavelength of 3mm .The variation in the electric field occurs in the Y direction with the amplitude of 66V/m .What is the equation for the variation of electric and magnetic fields as a function of x and t.
(3)

3) Show that the energy of em wave is equally divided between electric and magnetic fields. (3)

4) An em wave of frequency n=3MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon=4$.What will happen to its frequency and wavelength?
(2)

5)What might be the frequency of em wave which is best suited to observe a particle of size $3x10^{-4}$m?(2)

6) Suppose the electric field amplitude of em wave is $E_0=150$N/C and its frequency n=70MHz.Find the expression for electric and magnetic field vectors.
(3)

7) An ammeter is connected with a battery , switch and capacitor .When switch is put on, explain your observations.
(3)