

PART-A

I. CHOOSE THE CORRECT ANSWER 10X1=10

- In an electromagnetic wave travelling in free space the rms value of the electric field is 3 V m^{-1} . The peak value of the magnetic field is
(a) $1.414 \times 10^{-8} \text{ T}$ (b) $1.0 \times 10^{-8} \text{ T}$ (c) $2.828 \times 10^{-8} \text{ T}$ (d) $2.0 \times 10^{-8} \text{ T}$
- Which of the following is an electromagnetic wave?
(a) α - rays (b) β - rays (c) γ - rays (d) all of them
- The electric and magnetic fields of an electromagnetic wave are
(a) in phase and perpendicular to each other
(b) out of phase and not perpendicular to each other
(c) in phase and not perpendicular to each other
(d) out of phase and perpendicular to each other
- If $E = E_0 \sin[10^6 x - \omega t]$ be the electric field of a plane electromagnetic wave, the value of ω is
(a) $0.3 \times 10^{-14} \text{ rad s}^{-1}$ (b) $3 \times 10^{-14} \text{ rad s}^{-1}$ (c) $0.3 \times 10^{14} \text{ rad s}^{-1}$ (d) $3 \times 10^{14} \text{ rad s}^{-1}$
- Consider an oscillator which has a charged particle oscillating about its mean position with a frequency of 300 MHz. The wavelength of electromagnetic waves produced by this oscillator is
(a) 1 m (b) 10 m (c) 100 m (d) 1000 m
- If the amplitude of the magnetic field is $3 \times 10^{-6} \text{ T}$, then amplitude of the electric field for a electromagnetic waves is
(a) 100 Vm^{-1} (b) 300 Vm^{-1} (c) 600 Vm^{-1} (d) 900 Vm^{-1}
- What is the phase difference between electric and magnetic fields in an electromagnetic wave?
(a) 0 (b) π (c) $\pi/2$ (d) $\pi/4$
- The correct option, if speeds of gamma rays, X-rays and microwave are V_g , V_x and V_m respectively will be.
(a) $V_g > V_x > V_m$ (b) $V_g < V_x < V_m$ (c) $V_g > V_x > V_m$ (d) $V_g = V_x = V_m$
- If \vec{E} and \vec{B} represent electric and magnetic field vector of the electromagnetic waves then the direction of propagation of the em wave is that of
(a) $\vec{E} \cdot \vec{B}$ (b) $\vec{B} \cdot \vec{E}$
(c) $\vec{E} \times \vec{B}$ (d) $\vec{B} \times \vec{E}$
- The oscillating magnetic field in a plane electromagnetic wave is given as $B_y = (8 \times 10^{-6}) \sin [2 \times 10^{11} t + 300\pi x] \text{ T}$, wavelength of the em wave is
(a) 0.80 cm (b) $1 \times 10^3 \text{ m}$ (c) $2 \times 10^{-2} \text{ cm}$ (d) 0.67 cm

PART- B

II. Answer the following questions:

4x2=8

- What is displacement current?
- Why are e.m. waves non-mechanical?
- The relative magnetic permeability of the medium is 2.5 and the relative electrical permittivity of the medium is 2.25. Compute the refractive index of the medium.
- What are Fraunhofer lines? How are they useful in the identification of elements present in the sun?

PART-C

III. Answer the following questions:

4x3=12

- Write short notes on (a) microwave (b) X-ray (c) radio waves (d) visible spectrum
- Write down the properties of electromagnetic waves.
- Consider a parallel plate capacitor which is connected to an 230 V RMS value and 50 Hz frequency. If the separation distance between the plates of the capacitor and area of the plates are 1 mm and 20 cm² respectively. Calculate the displacement current at $t = 1 \text{ s}$.
- Explain the types of emission spectrum.

PART-D

IV. Answer the following questions:

3x5=15

- Write down Maxwell equations in integral form.
- Explain the Maxwell's modification of Ampere's circuital law.
- Discuss the Hertz experiment.

All the best