Class XII
PHYSICS ASSIGNMENT V – ELECTROMAGNETIC WAVES

1 mark type

1. On what factors does the velocity of light in vacuum depend?
2. Sketch E & B fields in an E.M wave and also mark the direction of propagation of the wave.
3. What is the principle of production of E.M. waves?
4. Among X-rays, infra-red rays, ultraviolet rays and visible radiations, which one has (i) highest frequency (ii) longest wavelength?
5. For which frequency of light, the human eye is most sensitive?
6. Mention two uses of gamma rays.

2 / 3 mark type

1. Why is it that induced electric field due to changing magnetic flux are more readily observable than the induced magnetic fields due to changing electric fields?
2. List any four characteristics / properties of an electromagnetic wave.
3. Show that the average energy density of E field equals the average energy density of the B field.
4. Green light of mercury has a wavelength 5.5×10^{-5} cm. (a) What is the freq in MHz and period in μ s in vacuum?
   (a) What is the wavelength in glass, if refractive index of glass is 1.5?
   Ans: (a) $\nu = 5.45 \times 10^{8}$ MHz; T = 1.8×10^{-9} μ s (b) 3.6×10^{-7} m
5. Electromagnetic waves travel in a medium with a speed of 2×10^{8} m/s. The relative permeability of the medium is 1. Find the relative permeability.
   Ans: Er = 2.25
6. In a plane electromagnetic wave, the electric field oscillates sinusoidal at a frequency of 2×10^{10}Hz and amplitude 48 Vm -1
   (i) What is the wavelength of the wave? Ans: 1.5×10^{-2} m
   (ii) Amplitude of the oscillating mag field. Ans: Bo = 1.6×10^{-7} T
   (iii) Total average energy density of the electromagnetic field of the wave. Ans: U = 1×10^{-8} Jm $^{-3}$
7. Give the ratio of velocities of two light waves traveling in vacuum having wavelengths 4000 Å & 8000 Å.
   Ans: 1
8. Name the constituent radiation of electromagnetic spectrum which
   (a) is used in satellite communication
   (b) is used for studying crystal structure
   (c) is similar to the radiation emitted during decay of radioactive nuclei
   (d) has its wavelength range b/w 390 nm & 770 nm
   (e) is absorbed from sunlight by ozone layer
   (f) produces intense heating effect
9. A plane electromagnetic wave of freq 25 MHz travels in free space along x – direction. At a particular point in space & time, $\vec{E}$ = 6.3 jv/m. Determine $\vec{B}$ at this point. Ans: $\vec{B}$ = 2.1×10^{-8} $\hat{k}$ T
10. A parallel plate capacitor figure made of circular plates each of radius R = 6 cm has a capacitance C = 100 pF. The capacitor is connected to a 230 V a.c. supply with angular freq of 300 rad s $^{-1}$.
    (a) What is the rms value of conduction current?
    (b) Is the conduction current equal to the displacement current?
    (c) Determine the amplitude of B at a pt 3.0 cm from the axis between the plates Ans: (a) I = 9 μ A; (c) d = 1 mm
11. About 5% of the power of a 100W light bulb is converted to visible radiation. What is the average intensity of visible radiation?
    (a) At a distance of 1m from the bulb? Ans: I = 0.4 W/m ^{2}
    (b) At a distance of 10m Ans: I = 0.004 W/m ^{2}

12. Write the order of freq range and one use of each of the following electromagnetic radiations:(i) microwaves (ii) ultra-violet rays (iii) gamma rays
13. Which basic oscillatory circuit is used these days to produce e.m. waves? Write an expression for freq of waves so produced.

    Write the principle of RADAR. Why microwaves are used in it?