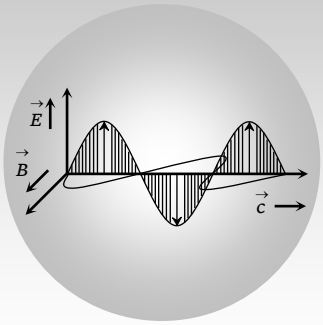


Assignment

Electromagnetic waves

Basic Level

1. The speed of electromagnetic wave in vacuum depends upon the source of radiation **[Kerala PMT 2004]**

(a) Increases as we move from γ-rays to radio waves (b) Decreases as we move from γ-rays to radio waves

(c) Is same for all of them (d) None of these

2. Which of the following radiations has the least wavelength **[AIEEE 2003]**

(a) γ-rays (b) β-rays (c) α-rays (d) X-rays

3. The maximum distance upto which TV transmission from a TV tower of height h can be received is proportional to **[AIIMS**

(a) $h^{1/2}$ (b) h (c) h (d) h^2

4. In short wave communication, waves of which of the following frequencies will be reflected back by the ionospheric layer having electron density 10^{11} per m^3 **[AIIMS 2003]**

(a) 2.8 MHz (b) 10 MHz (c) 12 MHz (d) 18 MHz

5. Which of the following are not electromagnetic waves **[AIEEE 2002; CBSE PMT/PDT 2003]**

(a) Cosmic rays (b) Gamma rays (c) β-rays (d) X-rays

6. Ozone is found in **[DPMT 2002]**

(a) Stratosphere (b) Ionosphere (c) Mesosphere (d) Troposphere

7. The electromagnetic waves travel with a velocity **[J & K CET 2002]**

(a) Equal to velocity of sound (b) Equal to velocity of light (c) Less than velocity of light (d) None of these

8. The ozone layer absorbs **[Kerala PET 2002]**

(a) Infrared radiations (b) Ultraviolet radiations (c) X-rays (d) γ-rays

9. Electromagnetic radiation of highest frequency is **[Kerala PMT 2002]**

(a) Infrared radiations (b) Visible radiation (c) Radio waves (d) γ-rays

10. Which of the following shows green house effect **[CBSE PMT 2002]**

(a) Ultraviolet rays (b) Infrared rays (c) X-rays (d) None of these

11. Which of the following waves have the maximum wavelength **[AFMC 2002]**

(a) X-rays (b) I.R. rays (c) UV rays (d) Radio waves

12. Electromagnetic waves are transverse in nature is evident by **[AIEEE 2002]**

(a) Polarization (b) Interference (c) Reflection (d) Diffraction

13. If $\vec{E}$ and $\vec{B}$ are the electric and magnetic field vectors of e.m. waves then the direction of propagation of e.m. wave is along the direction of **[CBSE PMT 1992, 2002; DCE 2002]**

(a) $\vec{E}$ (b) $\vec{B}$ (c) $\vec{E}\times\vec{B}$ (d) None of these

14. Biological importance of Ozone layer is **[CBSE PM/PD 2001]**

(a) It stops ultraviolet rays (b) Ozone rays reduce green house effect

(c) Ozone layer reflects radio waves (d) Ozone layer controls O_2 / H_2 radio in atmosphere

15. What is ozone hole **[AFMC 2001]**

(a) Hole in the ozone layer (b) Formation of ozone layer

(c) Thinning of ozone layer in troposphere (d) Reduction in ozone thickness in stratosphere

16. Which rays are not the portion of electromagnetic spectrum **[Haryana CEET 2000]**

(a) X-rays (b) Microwaves (c) α-rays (d) Radio waves

17. Radio wave diffract around building although light waves do not. The reason is that radio waves **[AMU 2000]**

(a) Travel with speed larger than c (b) Have much larger wavelength than light

(c) Carry news (d) Are not electromagnetic waves

18. The frequencies of X-rays, γ-rays and ultraviolet rays are respectively a, b and c. Then **[CBSE PMT 2000]**

(a) $a < b, b > c$ (b) $a > b, b > c$ (c) $a > b, b < c$ (d) $a < b, b < c$

19. Radio waves and visible light in vacuum have **[KCET 2000]**

(a) Same velocity but different wavelength (b) Continuous emission spectrum

(c) Band absorption spectrum (d) Line emission spectrum

20. Energy stored in electromagnetic oscillations is in the form of **[Haryana CEET 2000]**

(a) Electrical energy (b) Magnetic energy (c) Both (a) and (b) (d) None of these

21. Heat radiations propagate with the speed of **[AMU 2000]**

(a) α-rays (b) β-rays (c) Light waves (d) Sound waves

22. If a source is transmitting electromagnetic wave of frequency $8.2\times10^{6}\,Hz$, then wavelength of the electromagnetic waves transmitted from the source will be **[DPMT 1999]**

(a) 36.6 m (b) 40.5 m (c) 42.3 m (d) 50.9 m

23. In an apparatus, the electric field was found to oscillate with an amplitude of 18 V/m. The magnitude of the oscillating magnetic field will be **[Pb. PMT 1999]**

(a) $4\times10^{-6}\,T$ (b) $6\times10^{-8}\,T$ (c) $9\times10^{-9}\,T$ (d) $11\times10^{-11}\,T$

24. According to Maxwell's hypothesis, a changing electric field gives rise to **[AIIMS 1998]**

(a) An e.m.f. (b) Electric current (c) Magnetic field (d) Pressure radiant

25. In an electromagnetic wave, the electric and magnetising fields are $100\,V\,m^{-1}$ and $0.265\,A\,m^{-1}$. The maximum energy flow is **[Pb. PMT 1997, 98]**

(a) $26.5\,W/m^2$ (b) $36.5\,W/m^2$ (c) $46.7\,W/m^2$ (d) $765\,W/m^2$

26. The 21 cm radio wave emitted by hydrogen in interstellar space is due to the interaction called the hyperfine interaction is atomic hydrogen. the energy of the emitted wave is nearly **[CBSE PMT 1998]**

(a) 10^{-17} *Joule* (b) 1 *Joule* (c) 7×10^{-8} *Joule* (d) 10^{-24} *Joule*

27. TV waves have a wavelength range of 1-10 *meter*. Their frequency range in *MHz* is **[KCET 1998]**

(a) 30-300 (b) 3-30 (c) 300-3000 (d) 3-3000

28. The velocity of all radio waves in free space is $3\times10^{8}\,m/s$. The frequency of a radio wave of wavelength 150 m, is **[CPMT**

(a) 45 *MHz* (b) 2 *MHz* (c) 2 *KHz* (d) 20 *KHz*

29. Maxwell's equations describe the fundamental laws of **[CPMT 1996]**

(a) Electricity only (b) Magnetism only (c) Mechanics only (d) Both (a) and (b)

30. An electric charge moving with a uniform velocity has **[CBSE PMT 1996]**

(a) Only an electric field around it (b) Only a magnetic field around it

(c) Both electric and magnetic field around it (d) Neither an electric field nor a magnetic field around it

31. Which of the following rays has minimum frequency **[CBSE PMT 1995]**

(a) U.V. rays (b) X-rays (c) Microwaves (d) Infrared rays

32. Which one of the following electromagnetic radiations have the smallest wavelength **[CBSE PMT 1994]**

(a) Ultraviolet waves (b) X-rays (c) γ-rays (d) Microwaves

33. The oscillating electric and magnetic vectors of an electromagnetic wave are oriented along **[CBSE PMT 1994]**

(a) The same direction but differ in phase by 90° (b) The same direction and are in phase

(c) Mutually perpendicular directions and are in phase (d) Mutually perpendicular directions and differ in phase by 90°

34. Energy of E.M. waves is due to their **[AFMC 1994]**

(a) Wavelength (b) Frequency

(c) Electric and magnetic field (d) None of these

35. In which one of the following regions of the electromagnetic spectrum will the vibrational motion of molecules give rise to absorption **[SCRA 1994]**

(a) Ultraviolet (b) Microwaves (c) Infrared (d) Radio waves

36. An electromagnetic wave travels along z-axis. Which of the following pairs of space and time varying fields would generate such a wave **[CBSE PMT 1994]**

(a) E_x, B_y (b) E_y, B_x (c) E_z, B_x (d) E_y, B_z

37. Which of the following rays has the maximum frequency **[CBSE PMT 1994]**

(a) Gamma rays (b) Blue light (c) Infrared rays (d) Ultraviolet rays

38. Radio waves of constant amplitude can be generated with **[CPMT 1993]**

(a) FET (b) Filter (c) Rectifier (d) Oscillator

39. A signal emitted by an antenna from a certain point can be received at another point of the surface in the form of **[CPMT 1993]**

(a) Sky wave (b) Ground wave (c) Sea wave (d) Both (a) and (b)

40. Speed c of E.M. waves through vacuum is given by **[CBSE PMT 1993]**

(a) $c = \sqrt{\mu_0 \varepsilon_0}$ (b) $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ (c) $c = \sqrt{\frac{\mu_0}{\varepsilon_0}}$ (d) $c = \sqrt{\frac{\varepsilon_0}{\mu_0}}$

41. Approximate height of ozone layer above the ground is **[CBSE PMT 1991]**

(a) 60 to 70 km (b) 59 km to 80 km (c) 70 km to 100 km (d) 100 km to 200 km

42. The electromagnetic waves do not transport **[Pb. CET 1991]**

(a) Energy (b) Charge (c) Momentum (d) Information

43. An electromagnetic radiation of wavelength λ and frequency ν propagating in air with velocity c, is incident on a glass plate and is transmitted through. Which of the following statements is true for the wave inside the glass plate **[NCERT 1983]**

(a) The velocity of wave remains c but wavelength changes

(b) The frequency ν and wavelength λ remain unchanged but the velocity changes

(c) The wavelength λ remain unchanged but frequency changes

(d) The frequency ν remains unchanged but the wavelength changes

44. An electric charge oscillating with a frequency of 1 *kilo* cycles/*second* can radiate electromagnetic waves of wavelength

(a) 100 km (b) 200 km (c) 300 km (d) 400 km

45. If a free electron is placed in the path of a plane electromagnetic wave, it will start moving along

(a) Centre of earth (b) Equator of earth (c) Magnetic field (d) Electric field

46. A plane electromagnetic wave is incident on a material surface. If the wave delivers momentum p and energy E, then

(a) $p = 0, E = 0$ (b) $p \neq 0, E \neq 0$ (c) $p \neq 0, E = 0$ (d) $p = 0, E \neq 0$

47. An electric field $\vec{E}$ and magnetic field $\vec{B}$ exist in a region. If these fields are not perpendicular to each other, then the electromagnetic wave

(a) Will not pass through the region (b) Will pass through region

(c) May pass through the region (d) Nothing is definite

48. Which of the following has zero average value in a plane electromagnetic wave

(a) Kinetic energy (b) Magnetic field (c) Electric field (d) Both (b) and (c)

49. In a plane E.M. wave, the electric field oscillates sinusoidal at a frequency of $2.0 \times 10^{10}\ Hz$ and amplitude $48\ V\,m^{-1}$. The wavelength of the wave is

(a) $24 \times 10^{-10}\ m$ (b) $1.5 \times 10^{-2}\ m$ (c) $4.16 \times 10^{8}\ m$ (d) $3 \times 10^{8}\ m$

50. Beyond which frequency, the ionosphere bends any incident electromagnetic radiation but do not reflect it back towards the earth

(a) 50 *MHz* (b) 40 *MHz* (c) 30 *MHz* (d) 20 *MHz*

51. Radio waves with frequencies higher than television signals are

(a) Ultrasonic waves (b) Sound waves (c) Light waves (d) Microwaves

52. Radio waves do not penetrate in the band of

(a) Ionosphere (b) Mesosphere (c) Troposphere (d) Stratosphere

53. A radar sends the waves towards a distant object and receives the signal reflected by object. These waves are

(a) Sound waves (b) Light waves (c) Radio waves (d) Microwaves

54. In electromagnetic wave, the average energy density is associated to

(a) Electric field only (b) Magnetic field only

(c) Equally with electric and magnetic fields (d) Average energy density is zero

55. A laser beam is sent to the moon and reflected back to earth by a mirror placed on the moon by an astronaut. If the moon is 384000 *km* from earth, how long does it take the light to make the round trip

(a) 5 *minutes* (b) 2.5 *minutes* (c) 2.5 *s* (d) 500 *s*

56. An electromagnetic wave, going through vacuum is described by $E = E_0 \sin(kx - \omega t)$. Which of the following is independent of wavelength

(a) k (b) ω (c) k/ω (d) $k\omega$

57. The energy contained in a small volume through which an electromagnetic wave is passing, oscillates with

(a) Zero frequency (b) One-fourth frequency of wave

(c) One-third frequency of wave (d) Double frequency of wave

58. (P-151) An electromagnetic wave going through vacuum is described by $E = E_0 \sin(kx - \omega t)$; $B = B_0 \sin(kx - \omega t)$. Which of the following equation is true

(a) $E_0 k = B_0 \omega$ (b) $E_0 \omega = B_0 k$ (c) $E_0 B_0 = \omega k$ (d) None of these

59. An *LC* resonant circuit contains a 400 *pF* capacitor and a 100 μH inductor. It is set into oscillation coupled to an antenna. The wavelength of the radiated electromagnetic waves is

(a) 377 *mm* (b) 377 *metre* (c) 377 *cm* (d) 3.77 *cm*

60. A brilliant arc lamp delivers a luminous flux of 100 *W* to a 1 cm^2 absorber. The force due to radiation pressure is

(a) $3.3 \times 10^{-4}\ N$ (b) $16.5 \times 10^{-7}\ N$ (c) $3.3 \times 10^{-6}\ N$ (d) $3.3 \times 10^{-7}\ N$

61. Waves used for telecommunication are

(a) Visible light (b) Infrared (c) Ultraviolet (d) Microwaves

62. To double the covering range of a TV transmitter tower, its height should be made

(a) Two times (b) Four times (c) $\sqrt{2}$ times (d) 8 times

63. A radio receiver antenna that is 2 *m* long is oriented along the direction of the electromagnetic wave and receives a signal of intensity $5 \times 10^{-16}\ W/m^2$. The maximum instantaneous potential difference across the two ends of the antenna is

(a) 1.23 μV (b) 1.23 *mV* (c) 1.23 *V* (d) 12.3 *mV*

64. The transmitting antenna of a radio-station is mounted vertically. At a point 10 *km* due north of the transmitter the peak electric field is 10^{-3} *volt/metre*. The magnitude of the radiation magnetic field is

(a) 3.33×10^{-10} *Tesla* (b) 3.33×10^{-12} *Tesla* (c) 10^{-3} *Tesla* (d) 3×10^{5} *Tesla*

65. Tick the correct statement

(a) E.M. radiations act as waves when they move place to place

(b) E.M. radiations behave as photons when interacting with material substances

(c) The main factor which makes the microwave range unsuitable for vision is associated with corpuscular nature of e.m. radiation

(d) All of the above

66. Television signals broadcast from the moon can be received on the earth while the TV broadcast from Delhi cannot be received at places about 100 *km* distant from Delhi. This is because

(a) There is no atmosphere around the moon

(b) Of strong gravity effect on TV signals

(c) TV signals travel straight and cannot follow the curvature of the earth

(d) There is atmosphere around the earth

67. An *LC* current contains inductance $L = 1\ \mu H$ and capacitance $C = 0.01\ \mu F$. The wavelength of electromagnetic wave generated is nearly

(a) 0.5 *m* (b) 5 *m* (c) 188 *m* (d) 30 *m*

68. The ratio of electric field vector *E* and magnetic field vector *H* *i.e.*, $\left(\frac{E}{H}\right)$ has the dimensions of

(a) Resistance (b) Inductance

(c) Capacitance (d) Product of inductance and capacitance

69. The frequency modulated waves are

(a) Reflected by atmosphere (b) Absorbed by atmosphere (c) Bend by atmosphere (d)

70. A TV tower has a height of 100 *m*. The average population density around the tower is 1000 per km^2. The radius of the earth is $6.4\times10^6\ m$. the population covered by the tower is

(a) 2×10^6 (b) 3×10^6 (c) 4×10^6 (d) 6×10^6

71. The ionosphere

(a) Reflects back radio waves in the AM band (b) Reflects back radio waves in the FM band

(c) Absorbs radio waves in the AM band (d) Absorbs radio waves in the FM band

72. The wavelength 21 *cm* emitted by atomic hydrogen in interstellar space belongs to

(a) Radio waves (b) Infrared waves (c) Microwaves (d) γ-rays

Electromagnetic waves

Advance Level

73. A parallel plate capacitor of plate separation 2 *mm* is connected in an electric circuit having source voltage 400 *V*. if the plate area is 60 cm^2, then the value of displacement current for 10^{-6} sec will be

(a) 1.062 *amp* (b) 1.062×10^{-2} *amp* (c) 1.062×10^{-3} *amp* (d) 1.062×10^{-4} *amp*

74. A long straight wire of resistance *R*, radius *a* and length *l* carries a constant current *I*. The Poynting vector for the wire will be

(a) $\frac{IR}{2\pi al}$ (b) $\frac{IR^2}{al}$ (c) $\frac{I^2R}{al}$ (d) $\frac{I^2R}{2\pi al}$

75. In an electromagnetic wave, the amplitude of electric field is 1 *V/m*. the frequency of wave is $5\times10^{14}\ Hz$. The wave is propagating along *z*-axis. The average energy density of electric field, in *Joule*/m^3, will be

(a) 1.1×10^{-11} (b) 2.2×10^{-12} (c) 3.3×10^{-13} (d) 4.4×10^{-14}

76. To establish an instantaneous displacement current of 2*A* in the space between two parallel plates of $1\mu F$ capacitor, the potential difference across the capacitor plates will have to be changed at the rate of

(a) $4\times10^4\ V/s$ (b) $4\times10^6\ V/s$ (c) $2\times10^4\ V/s$ (d) $2\times10^6\ V/s$

77. A laser beam can be focussed on an area equal to the square of its wavelength *A* *He-Ne* laser radiates energy at the rate of 1*mW* and its wavelength is 632.8 *nm*. The intensity of focussed beam will be

(a) $1.5\times10^{13}\ W/m^2$ (b) $2.5\times10^9\ W/m^2$ (c) $3.5\times10^{17}\ W/m^2$ (d) None of these

78. An electric field of 300 V/m is confined to a circular area 10 cm in diameter. If the field is increasing at the rate of 20 V/m-s, the magnitude of magnetic field at a point 15cm from the centre of the circle will be

(a) $1.85\times10^{-15}\ T$ (b) $1.85\times10^{-16}\ T$ (c) $1.85\times10^{-17}\ T$ (d) $1.85\times10^{-18}\ T$

79. A lamp emits monochromatic green light uniformly in an directions. The lamp is 3% efficient in converting electrical power to electromagnetic waves and consumes 100W of power. The amplitude of the electric field associated with the electromagnetic radiation at a distance of 10m from the lamp will be

(a) 1.34 V/m (b) 2.68 V/m (c) 5.36 V/m (d) 9.37 V/m

80. A point source of electromagnetic radiation has an average power output of 800 W. The maximum value of electric field at a distance 4.0 m from the source is

(a) 64.7 V/m (b) 57.8 V/m (c) 56.72 V/m (d) 54.77 V/m

81. A lamp radiates power P_0 uniformly in all directions, the magnitude of electric field strength E_0 at a distance r from it is

(a) $E_0=\frac{P_0}{2\pi\varepsilon_0 cr^2}$ (b) $E_0=\sqrt{\frac{P_0}{2\pi\varepsilon_0 cr^2}}$ (c) $E_0=\sqrt{\frac{P_0}{4\pi\varepsilon_0 cr^2}}$ (d) $E_0=\sqrt{\frac{P_0}{8\pi\varepsilon_0 cr}}$

82. The wave impedance of free space is

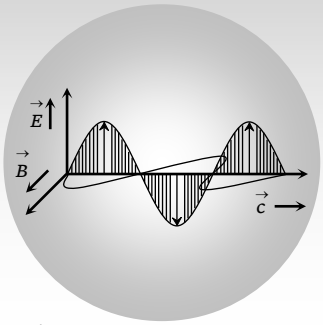
(a) Zero (b) 376.6 Ω (c) 33.66 Ω (d) 3.76 Ω

83. The transmitting antenna of a radio-station is mounted vertically. At a point 10 km due north of the transmitter the peak electric field is $10^{-3}\,Vm^{-1}$. The magnitude of the radiated magnetic field is

(a) $3.33\times10^{-10}\ T$ (b) $3.33\times10^{-12}\ T$ (c) $10^{-3}\ T$ (d) $3\times10^{5}\ T$

84. A wave is propagating in a medium of electric dielectric constant 2 and relative magnetic permeability 50. The wave impedance of such a medium is

(a) 5 Ω (b) 376.6 Ω (c) 1883 Ω (d) 3776 Ω



Answer Sheet

Assignments

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	a	a	a	c	a	b	b	d	b	d	a	c	a	d	c	b	a	a	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	a	b	c	a	d	a	b	d	c	c	c	c	c	b	a	a	d	d	b
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	b	d	c	d	b	c	d	b	b	c, d	a	d	c	c	c	d	a	b,d	d
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
d	b	a	b	d	c	c	a	c	c	a	a	d	d	b	d	b	d	a	d
81	82	83	84																
b	b	b	c																