Q1. 21 January Shift 1

The electric field in a plane electromagnetic wave is given by :
$E_y = 69 \sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right] \mathrm{V/m}$.
The expression for magnetic field associated with this electromagnetic wave is ____ T.
(1) $B_z = 2.3 \times 10^{-7} \sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right]$
(2) $B_z = 2.3 \times 10^{-7} \sin\left[0.6 \times 10^3 x + 1.8 \times 10^{11} t\right]$
(3) $B_y = 69 \sin\left[0.6 \times 10^3 x + 1.8 \times 10^{11} t\right]$
(4) $B_y = 2.3 \times 10^{-7} \sin\left[0.6 \times 10^3 x - 1.8 \times 10^{11} t\right]$

Q2. 21 January Shift 2

An electromagnetic wave of frequency 100 MHz propagates through a medium of conductivity, $\sigma = 10 \mathrm{mho/m}$. The ratio of maximum conduction current density to maximum displacement current density is ____.
$\left[\text{Take } \frac{1}{4\pi\epsilon_o} = 9 \times 10^9 \mathrm{Nm^2/C^2}\right]$

Q3. 22 January Shift 1

The electric field of a plane electromagnetic wave, travelling in an unknown nonmagnetic medium is given by, $E_y = 20 \sin\left(3 \times 10^6 x - 4.5 \times 10^{14} \mathrm{t}\right) \mathrm{V/m}$ (where x, t and other values have S.I. units). The dielectric constant of the medium is ____ (speed of light in free space is 3×10^8 m/s)

Q4. 22 January Shift 2

A laser beam has intensity of 4.0×10^{14} W/m^2. The amplitude of magnetic field associated with beam is ____ T.
(Take $\epsilon_o = 8.85 \times 10^{-12} \mathrm{C^2/Nm^2}$ and $c = 3 \times 10^8$ m/s)
(1) 18.3 (2) 1.83 (3) 5.5 (4) 2.0

Q5. 23 January Shift 1

Match List - I with List - II.

List - I Relation	List - II Law
A. $\oint \vec{E} \cdot \overrightarrow{dl} = -\frac{d}{dt} \oint \vec{B} \cdot \overrightarrow{da}$	I. Ampere's circuital law
B. $\oint \vec{B} \cdot \overrightarrow{dl} = \mu_0 \left(I + \epsilon_0 \frac{d\phi_E}{dt} \right)$	II. Faraday's laws of electromagnetic induction
C. $\oint \vec{E} \cdot \overrightarrow{da} = \frac{1}{\epsilon_0} \int_V \rho dv$	III. Ampere - Maxwell law
D. $\oint \vec{B} \cdot \overrightarrow{dl} = \mu_0 I$	IV. Gauss's law of electrostatics

Choose the correct answer from the options given below :

(1) A-II, B-III, C-I, D-IV (2) A-II, B-III, C-IV, D-I

(3) A-I, B-IV, C-III, D-II (4) A-IV, B-I, C-II, D-III

Q6. 23 January Shift 1

The equation of the electric field of an electromagnetic wave propagating through free space is given by :

$E = \sqrt{377} \sin \left(6.27 \times 10^3 t - 2.09 \times 10^{-5} x\right) \mathrm{N/C}$

The average power of the electromagnetic wave is $\left(\frac{1}{\alpha}\right) \mathrm{W/m^2}$. The value of α is ____

(Take $\sqrt{\frac{\mu_0}{\varepsilon_o}} = 377$ in SI units)

Q7. 23 January Shift 2

The ratio of speeds of electromagnetic waves in vacuum and a medium, having dielectric constant $k = 3$ and permeability of $\mu = 2\mu_0$, is

(μ_0 = permeability of vacuum)

(1) 36 : 1 (2) 3 : 2 (3) 6 : 1 (4) $\sqrt{6}$: 1

Q8. 24 January Shift 1

Match the LIST-I with LIST-II

	List-I		List-II
A.	Radio-wave	I.	is produced by Magnetron valve
B.	Micro-wave	II.	due to change in the vibrational modes of atoms
C.	Infrared-wave	III.	due to inner shell electrons moving from higher to lower energy level
D.	X-ray	IV.	due to rapid acceleration of electrons

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-I, D-III (2) A-IV, B-I, C-II, D-III

(3) A-IV, B-III, C-I, D-II (4) A-II, B-IV, C-III, D-I

Q9. 28 January Shift 1

The electric field of an electromagnetic wave travelling through a medium is given by

$\vec{E}(x,t) = 25\sin\left(2.0\times10^{15}t - 10^{7}x\right)\hat{n}$

then the refractive index of the medium is ____.

(All given measurement are in SI units)

(1) 1.5 (2) 1.2 (3) 1.7 (4) 2

Q10. 28 January Shift 2

A plane electromagnetic wave is moving in free space with velocity $c = 3\times10^{8}\ \text{m/s}$ and its electric field is given as $\vec{E} = 54\sin(kz-\omega t)\hat{j}\ \text{V/m}$, where $\hat{j}$ is the unit vector along y-axis. The magnetic field vector $\vec{B}$ of the wave is:

(1) $+1.8\times10^{-7}\sin(kz-\omega t)\hat{i}\ \text{T}$ (2) $1.4\times10^{-7}\sin(kz-\omega t)\hat{k}\ \text{T}$

(3) $-1.8\times10^{-7}\sin(kz-\omega t)\hat{i}\ \text{T}$ (4) $1.4\times10^{-7}\sin(kz-\omega t)\hat{i}\ \text{T}$

ANSWER KEYS

1. (1) **2.** 1800 **3.** 4 **4.** (2) **5.** (2) **6.** 2 **7.** (4) **8.** (2)

9. (1) **10.** (3)