BRAIN INTERNATIONAL SCHOOL

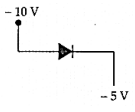
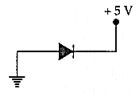
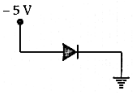
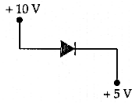
PRACTICE PAPER-1 (2026-27)

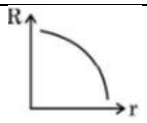
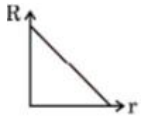
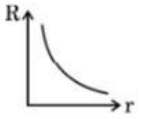
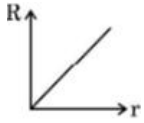
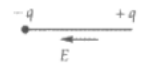
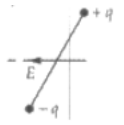
SUBJECT – PHYSICS (042)

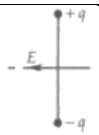
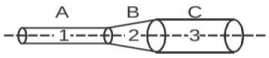
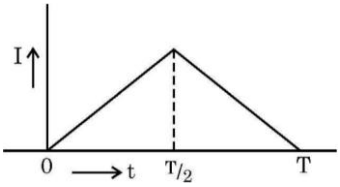
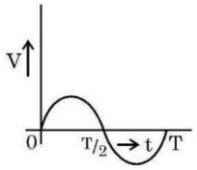
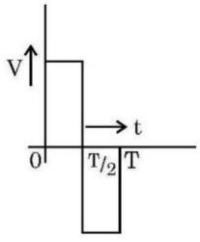
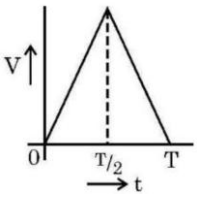
Time: 3 Hr	**Class – XII**	**M.M 70**

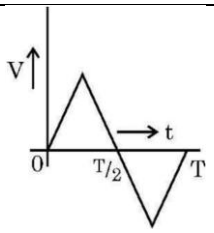
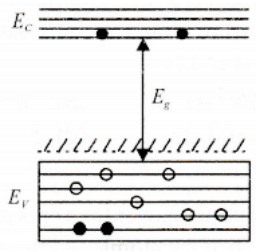
General Instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study-based questions of four marks each and **Section E** contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
6. Use of calculators is not allowed.

	SECTION A	
1	Which of the following p - n junction is forward biased? a)  b)  c)  d) 	**[1]**
2	The correct graph showing the variation of the resistance (R) of a cylindrical metal wire as a function of its radius (r), keeping its length and temperature constant, is:	**[1]**

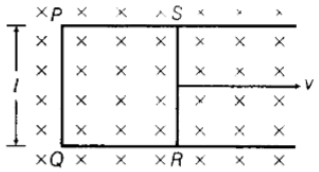
	a)  b)  c)  d) 	
3	A biconvex lens of glass having refractive index 1.47 is immersed in a liquid. It becomes invisible and behaves as a plane glass plate. The refractive index of the liquid is a) 1.47 b) 1.62 c) 1.51 d) 1.33	**[1]**
4	The susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetising field. The material is a: a) diamagnet b) superconductor c) paramagnet d) ferromagnet	**[1]**
5	In which of the states shown in the figure, is potential energy of an electric dipole maximum? a)  b)  c) 	**[1]**

	d) 	
6	A long, straight, hollow conductor (tube) carrying a current has two sections A and C of unequal cross - section joined by a conical section B. 1, 2 and 3 are points on a line parallel to the axis of the conductor at certain distance. The magnetic fields at 1,2 and 3 have magnitudes B_1, B_2 and B_3 :  a) $B_1 < B_2 < B_3$ b) $B_1 = B_2 \neq B_3$ c) $B_1 = B_2 = B_3$ d) B_2 cannot be found unless the dimensions of the section B are known	**[1]**
7	The alternating current I in an inductor is observed to vary with time t as shown in the graph for a cycle.  Which one of the following graphs is the correct representation of wave form of voltage V with time t ? a)  b)  c) 	**[1]**

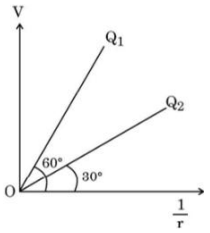
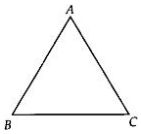
	d) 	
8	According to Gauss's law for magnetism, a) $\int \vec{B}.\overrightarrow{ds} = \mu_0$ b) $\int \vec{B}.\overrightarrow{ds} = 0$ c) $\oint \vec{B}.\overrightarrow{ds} = \mu_0$ d) $\oint \vec{B}.\overrightarrow{ds} = 0$	**[1]**
9	The idea of secondary wavelets for the propagation of a wave was first given by: a) Newton b) Fresnel c) Huygens d) Maxwell	**[1]**
10	The electric charge always resides: a) at the centre of charged conductor b) randomly all over the charged conductor c) on the outer surface of a charged conductor d) at the interior of a charged conductor	**[1]**
11	In the energy band diagram of a material as given below, the open circles and filled circles denote holes and electrons respectively. The material is a/an  a) insulator b) p - type semiconductor c) n - type semiconductor	**[1]**

	d) metal	
12	A beaker is filled with water(refractive index$\frac{4}{3}$) upto a height H. A coin is placed at its bottom. The depth of the coin, when viewed along the near normal direction, will be a) $\frac{4H}{3}$ b) H c) $\frac{H}{4}$ d) $\frac{3H}{4}$	**[1]**
13	**Assertion (A):** The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies. **Reason (R):** The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
14	**Assertion (A):** Electrostatic force is a conservative force. **Reason (R):** In an electrostatic field, the work done between two points per unit positive charge depends on the path followed. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
15	**Assertion (A):** For identical coherent waves, the maximum intensity is four times the intensity due to each wave **Reason (R):** Intensity is proportional to the square of amplitude. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**

16	**Assertion (A):** At resonance, LCR series circuit has a minimum current. **Reason (R):** At resonance, in LCR series circuit, the current and emf are not in phase with each other. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
	SECTION B	
17	Light with an energy flux of 18 W/cm^2 falls on a non - reflecting surface at normal incidence. If the surface has an area of 20 cm ^{2} , find the average force exerted on the surface during a 30 - minute time span.	**[2]**
18	A semiconductor has the electron concentration 4×10^{12} cm $^{-3}$ and the hole concentration 7×10^{13} cm $^{-3}$. Is the substance n - type or p - type? Also calculate the conductivity of this semiconductor. Given electron mobility = 2,2000 cm ^{2} V $^{-1}$ s $^{-1}$ and hole mobility = 150 cm ^{2} V $^{-1}$ s $^{-1}$.	**[2]**
19	Use de - Broglie's hypothesis to write the relation for the radius of nth Bohr orbit in terms of Bohr's quantization condition of orbital angular momentum.	**[2]**
20	A neutral point is found on the axis of a bar magnet at a distance of 10 cm from its one end. If the length of the magnet be 10 cm and B_H = 0.3 G, find the magnetic moment of the magnet. **OR** A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic north - south direction. Null points are found on the axis of the magnet at 14 cm from the centre of the magnet. The earth's magnetic field at the place is 0.36 G and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null–point (i.e., 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and opposite to the horizontal component of earth's magnetic field.)	**[2]**
21	A galvanometer of resistance 16Ω shows full scale deflection for a current of 4 mA. How will you convert it into a voltmeter to measure a voltage up to 3 V? **OR** A rectangular loop of sides 25 cmand 10 cmcarrying a current of 15 Ais placed with its longer side parallel to a long straight conductor 2.0 cmapart carrying a current of 25A.What is the net force on the loop?	**[2]**
	SECTION C	
22	Two batteries of emf's3 V & 6 V and internal resistances 0.2Ω & 0.4Ω are connected in parallel. This combination is connected to a 4Ω resistor. Find: 1. the equivalent emf of the combination 2. the equivalent internal resistance of the combination	**[3]**

	3. the current drawn from the combination	
23	The maximum kinetic energy of the photoelectrons emitted is doubled when the wavelength of light incident on the photosensitive surface changes fromλ_1 to λ_2 . Deduce expressions for the threshold wavelength and work function for the metal surface in terms of λ_1 and λ_2 .	**[3]**
24	Draw the circuit diagram of a full wave rectifier using two p - n junction diodes. Explain its working and show input and output voltage variations.	**[3]**
25	1. Plot a graph showing the variation of potential energy of a pair of nucleons as a function of their separation. Also indicate the regions where the force is (i) attractive and (ii) repulsive. 2. Write two characteristic properties of nuclear force.	**[3]**
26	The ground state energy of hydrogen atom is - 13.6eV 1. What is the potential energy of an electron in the 3^{rd} excited state? 2. If the electron jumps to the ground state from the 3^{rd} excited state, calculate the wavelength of the photon emitted.	**[3]**
27	Deduce an expression for the mutual inductance of two long coaxial solenoids but having different radii and different number of turns. **OR** Figure shows a rectangular conducting loop PQRS inwhich arm RS of length I is movable. The loop is kept ina uniform magnetic field B directed downward perpendicular to the plane of the loop. The arm RS is moved with a uniform speed v.  Deduce an expression for 1. the emf induced across the arm RS 2. the external force required to move the arm and 3. the power dissipated as heat.	**[3]**
28	In Young's double slit experiment, the separation between the two slits is 1.0 mm and the screen is 1.0 m away from the slits. A beam of light consisting of two wavelengths 500 nm and 600 nm is used to obtain interference fringes. Calculate: 1. the distance between the first maxima for the two wavelengths. 2. the least distance from the central maximum, where the bright fringes due to both the wavelengths coincide.	**[3]**
	SECTION D	
29	**Read the text carefully and answer the questions:** In an electromagnetic wave both the electric and	**[4]**

	magnetic fields are perpendicular to the direction of propagation, that is why electromagnetic waves are transverse in nature. Electromagnetic waves carry energy as they travel through space and this energy is shared equally by the electric and magnetic fields. Energy density of an electromagnetic waves is the energy in unit volume of the space through which the wave travels. 1. The electromagnetic waves propagated perpendicular to both $\vec{E}$ and $\vec{B}$. The electromagnetic waves travel in the direction of a) $\vec{E} \cdot \vec{B}$ b) $\vec{B} \times \vec{E}$ c) $\vec{B} \cdot \vec{E}$ d) $\vec{E} \times \vec{B}$ 2. Fundamental particle in an electromagnetic wave is a) proton b) photon c) phonon d) electron 3. Electromagnetic waves are transverse in nature is evident by a) polarisation b) diffraction c) reflection d) interference 4. For a wave propagating in a medium, Name the property that is independent of the others. a) wavelength b) all these depend on each other c) velocity d) frequency	
30	Electrostatics deals with the study of forces, fields and potentials arising from static charges. Force and electric field, due to a point charge is basically determined by Coulomb's law. For symmetric charge configurations, Gauss's law, which is also based on Coulomb's law, helps us to find the electric field. A charge/a system of charges like a dipole experience a force/torque in an electric field. Work is required to be done to provide a specific orientation to a dipole with respect to an electric field. 1. The figure shows the variation of potential V with $\frac{1}{r}$ for two point charges Q_1 and Q_2 , where	**[4]**

	V is the potential at a distance r due to a point charge. Find $\frac{Q_1}{Q_2}$. (1)  2. An electric dipole of dipole moment of 6×10^{-7} C - m is kept in a uniform electric field of 10^{4} N/C such that the dipole moment and the electric field are parallel. Calculate the potential energy of the dipole. (1) 3. An electric dipole of dipole moment$\vec{p}$ is initially kept in a uniform electric field $\vec{E}$ such that $\vec{p}$ is perpendicular to $\vec{E}$. Find the amount of work done in rotating the dipole to a position at which $\vec{p}$ becomes antiparallel to $\vec{E}$. (2)	
	SECTION E	
31	1. Draw a labelled ray diagram of an astronomical telescope to show the image formation of a distant object. Write the main considerations required in selecting the objective and eyepiece lenses in order to have large magnifying power and high resolution of the telescope. 2. A compound microscope has an objective of focal length 1.25 cm and eyepiece of focal length 5 cm. A small object is kept at 2.5 cm from the objective. If the final image formed is at infinity, find the distance between the objective and the eyepiece. **OR** 1. Write two points of difference between an interference pattern and a diffraction pattern. 2. a. A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30^{o} . Calculate the speed of light through the prism.  b. Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.	**[5]**
32	Derive an expression for the electric potential at a point due to an electric dipole. Mention the contrasting features of electric potential of a dipole at a point as compared to that due to a single charge. **OR** 1. Derive the expression for the energy stored in parallel plate capacitor. Hence, obtain the expression for the energy density of the electric field. 2. A fully charged parallel plate capacitor is connected across an uncharged identical capacitor.	**[5]**

	Show that the energy stored in the combination is less than the energy stored initially in the single capacitor.	
33	1. Draw a labelled diagram of a step - down transformer. State the principle of its working. 2. Express the turn ratio in terms of voltages. 3. Find the ratio of primary and secondary currents in terms of turn ratio in an ideal transformer. 4. How much current is drawn by the primary of a transformer connected to 220 V supply when it delivers power to a 110 V - 550 W refrigerator? **OR** 1. Describe, with the help of a suitable diagram, the working principle of a step - up transformer. Obtain the relation between input and output voltages in terms of the number of turns of primary and secondary windings and the currents in the input and output circuits. 2. Given the input current 15 A and the input voltage of 100 V for a step - up transformer having 90% efficiency, find the output power and the voltage in the secondary if the output current is 3 A.	**[5]**

BRAIN INTERNATIONAL SCHOOL

PRACTICE PAPER-2 (2026-27)

SUBJECT – PHYSICS (042)

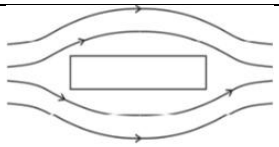
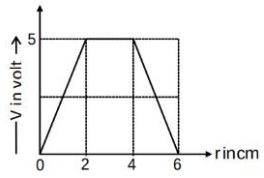
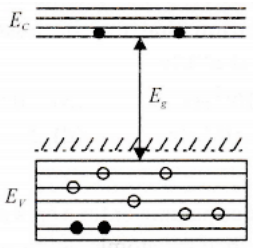
Time: 3 Hr	**Class – XII**	**M.M 70**

General Instructions:

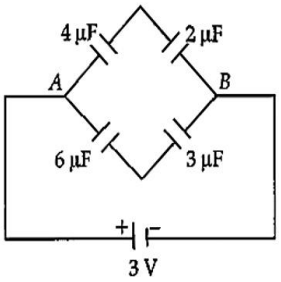
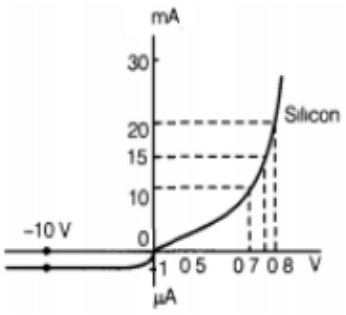
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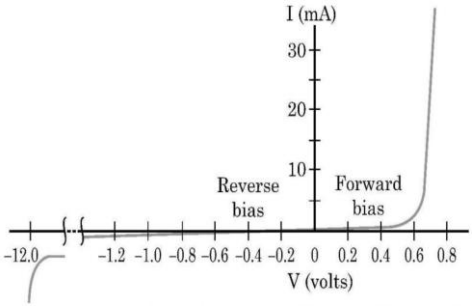
	SECTION A	
1	When trivalent impurity is mixed in a pure semiconductor, the conduction is mainly due to a) holes b) protons c) electrons d) positive ions	**[1]**
2	The SI unit of mobility of charge carriers is: a) Ωm b) m s^{-1} V $^{-1}$ c) Ωs^{-1} d) m^2 V $^{-1}$ s $^{-1}$	**[1]**
3	Magnifying power of a compound microscope is high if a) both objective and eye - piece have long focal lengths	**[1]**

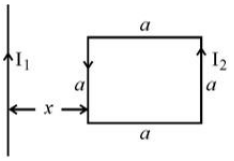
	b) the objective has a long focal length and eye - piece has a short focal c) the objective has a short focal length and the eye - piece has a long focal d) both objective and eye - piece have short focal lengths	
4	Which of the following is a diamagnetic substance? a) Copper chloride b) Sodium c) Gadolinium d) Sodium chloride	**[1]**
5	The potential on the hollow sphere of radius 1 mis 1000 V, then the potential at $\frac{1}{4}$ m from the centre of the sphere is: a) 250 V b) 500 V c) 1000 V d) Zero V	**[1]**
6	A circular loop of radius r, carrying a current I lies in y - z plane with its centre at the origin. The net magnetic flux through the loop is: a) zero b) directly proportional to r c) inversely proportional to r d) directly proportional to I	**[1]**
7	A coil has 100 turns, each of area $0.05m^2$ and total resistance 1.5Ω . It is inserted at an instant in a magnetic field of 90 mT, with its axis parallel to the field. The charge induced in the coil at that instant is: a) 3.0 mC b) 0.45 C c) 1.5 C d) 0.30 C	**[1]**
8	The magnetic field lines near a substance are as shown in the figure. The substance is:	**[1]**

	 a) Copper b) Sodium c) Iron d) Aluminium	
9	In a wave, the path difference corresponding to a phase difference of ϕ is: a) $\frac{\lambda}{2\pi}\phi$ b) $\frac{2\pi}{\lambda}\phi$ c) $\frac{\lambda}{\pi}\phi$ d) $\frac{\pi}{\lambda}\phi$	**[1]**
10	The variation of potential with distance r from a fixed point is shown in Figure. The electric field at $r = 1\ cm$, is:  a) $5\ V/cm$ b) $-1/5\ V/cm$ c) $1/5\ V/cm$ d) $-5\ V/cm$	**[1]**
11	In the energy band diagram of a material as given below, the open circles and filled circles denote holes and electrons respectively. The material is a/an  a) insulator	**[1]**

	b) p - type semiconductor c) n - type semiconductor d) metal	
12	The focal length of a concave mirror in air is f . When the mirror is immersed in a liquid of refractive index $\frac{5}{3}$, its focal length will become a) $\frac{3}{5}f$ b) $\frac{2}{3}f$ c) $\frac{5}{3}f$ d) f	**[1]**
13	**Assertion (A):** If frequency of incident light is doubled, the kinetic energy of photoelectron is also doubled. **Reason (R):** The kinetic energy of photoelectron is directly proportional to frequency of incident light. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
14	**Assertion (A):** Electric field is always normal to equipotential surfaces and along the direction of decreasing order of potential. **Reason (R):** Negative gradient of electric potential is electric field. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
15	**Assertion (A):** If the whole apparatus of Young's experiment is immersed in liquid, the fringe width will decrease. **Reason (R):** The wavelength of light in water is more than that of air. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.	**[1]**

	c) A is true but R is false. d) A is false but R is true.	
16	**Assertion (A):** Transformers are used only in alternating current sources, not in direct current. **Reasons (R):** Only a.c. can be stepped up or down by means of transformers. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
	SECTION B	
17	Find the total charge stored in the network of capacitors connected between A and B as shown in figure: 	**[2]**
18	The V - I characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at 1. I_D = 15 mA and 2. V_D = - 10V 	**[2]**
19	An electron in Bohr model of hydrogen atom makes a transition from energy level - 1.51 eV to - 3.40 eV. Calculate the change in the radius of its orbit. The radius of orbit of electron in its ground state is$0.53\overset{o}{A}$.	**[2]**
20	A bar magnet of magnetic moment$2.5JT^{-1}$ lies aligned with the direction of a uniform magnetic field of 0.32 T. 1. Find the amount of work done to turn the magnet so as to align its magnetic moment (i)	**[2]**

	normal to the field direction, and (ii) opposite to the field direction. 2. What is the torque on the magnet in above cases (i) and (ii)? **OR** A bar magnet of magnetic moment M is aligned parallel to the direction of a uniform magnetic field B. What is the work done, to turn the magnet, so as to align its magnetic moment: 1. opposite to the field direction and 2. normal to the field direction?	
21	Two long, straight, parallel conductors carry steady currents in opposite directions. Explain the nature of the force of interaction between them. Obtain an expression for the magnitude of the force between the two conductors. Hence define one ampere. **OR** How is a galvanometer converted into a voltmeter and an ammeter? Draw the relevant diagrams and find the resistance of the arrangement in each case. Take resistance of galvanometer as G.	**[2]**
	SECTION C	
22	1. What are majority and minority charge carriers in an extrinsic semiconductor? 2. A p - n junction is forward biased. Describe the movement of the charge carriers which produce current in it. 3. The graph shows the variation of current with voltage for a p - n junction diode.  Estimate the dynamic resistance of diode at $V = -0.6$ volt.	**[3]**
23	Define electric flux. Is it a scalar or a vector quantity? A point charge q is kept at a distance of $\frac{d}{2}$ directly above the centre of a square of side d. Use Gauss' law to obtain the expression for the electric flux through the square. If the point charge is now moved to a point at a distance ' d ' from the centre of the square and the side of the square is doubled, explain how the electric flux through the square will be affected.	**[3]**
24	1. What is photoelectric effect? 2. Using the photon picture of light, show how Einstein's photoelectric equation can be	**[3]**

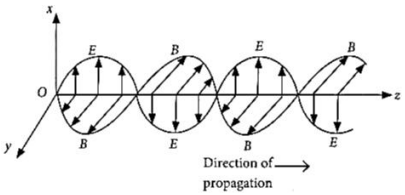
	established. 3. What is the photo - electric effect? Write Einstein's photoelectric equation. Explain how it enables us to understand the a. linear dependence, of the maximum kinetic energy of the emitted electrons, on the frequency of the incident radiation. b. existence of a threshold frequency for a given photoemitter. c. independence of the maximum energy of emitted photo - electrons from the intensity of incident light.	
25	1. Differentiate between 'nuclear fission' and 'nuclear fusion'. Briefly discuss one example of each. 2. Draw a graph of potential energy between a pair of nucleons as a function of their separation.	**[3]**
26	The energy of a hydrogen atom in the first excited state is - 3.4 eV. Find: 1. the radius of this orbit. (Take Bohr radius = $0.53\mathring{A}$) 2. the angular momentum of the electron in the orbit. 3. the kinetic and potential energy of the electron in the orbit.	**[3]**
27	1. Definemutual inductance and write its S.I. unit. 2. A square loop of side **a** carrying a current I_2 is kept at distance x from an infinitely long straight wire carrying a current I_1 as shown in the figure. Obtain the expression for the resultant force acting on the loop.  **OR** A metallic rod of length land resistanceR is rotated with a frequencyν , with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radiusl, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere. 1. Derive the expression for the induced emf and the current in the rod. 2. Due to the presence of the current in the rod and of the magnetic field, find the expression for the magnitude and direction of the force acting on this rod. 3. Henceobtain the expression for the power required to rotate the rod.	**[3]**
28	In Young's double slit experiment, the slit separation is 1 mm and the screen is 1 m away from the slits. For a monochromatic light of wavelength 500 nm, find	**[3]**

1. the distance of third minima, and
2. the distance of second maxima,

from the central maxima.

SECTION D

29 **Read the text carefully and answer the questions:** A stationary charge produces only an electrostatic field while a charge in uniform motion produces a magnetic field, that does not change with time. An oscillating charge is an example of accelerating charge. It produces an oscillating magnetic field, which in turn produces an oscillating electric fields and so on. The oscillating electric and magnetic fields regenerate each other as a wave which propagates through space. **[4]**



1. Magnetic field in a plane electromagnetic wave is given by $\vec{B}$ = B $_0$ sin (kx + ω t) $\hat{j}$ T

   Expression for corresponding electric field will be (Where c is speed of light.)

   a) $\vec{E}$ = - B $_0$ c sin (kx - ω t) $\hat{k}$ V/m

   b) $\vec{E} = \frac{B_0}{c}$ sin (kx + ω t) $\hat{k}$ V/m

   c) $\vec{E}$ = - B $_0$ c sin (kx + ω t) $\hat{k}$ V/m

   d) $\vec{E}$ = B $_0$ c sin (kx + ω t) $\hat{k}$ V/m

2. The electric field component of a monochromatic radiation is given by $\vec{E}$ = 2E $_0$ $\hat{\imath}$ cos kz cos ω t. Its magnetic field $\vec{B}$ is then given by

   a) $\frac{2E_0}{c}\hat{j}$ sin kz sin ω t

   b) $\frac{2E_0}{c}\hat{j}$ cos kz cos ω t

   c) $-\frac{2E_0}{c}\hat{j}$ sin kz sin ω t

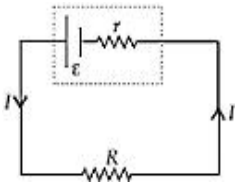
   d) $\frac{2E_0}{c}\hat{j}$ sin kz cos ω t

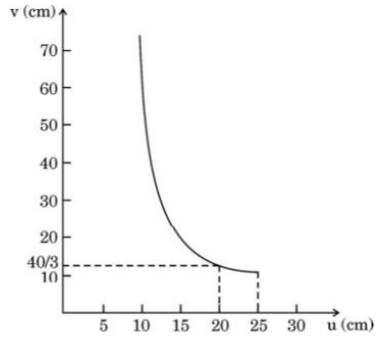
3. A plane em wave of frequency 25 MHz travels in a free space along x - direction. At a particular point inspace and time, E =(6.3$\hat{j}$) V/m. What is magnetic field at that time?

   a) 0.095μ T

   b) 0.124μ T

   c) 0.021μ T

	d) 0.089μ T 4. A plane electromagnetic wave travelling along the x - direction has a wavelength of 3 mm. The variation in the electric field occurs in the y - direction with an amplitude 66 V m^{-1} . The equations for the electric and magnetic fields as a function of x and t are respectively a) $E_y = 11\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$, $B_y = 11 \times 10^{-7}\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$ b) $E_x = 33\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$, $B_x = 11 \times 10^{-7}\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$ c) $E_y = 33\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$, $B_z = 1.1 \times 10^{-7}\cos\pi \times 10^{11}\left(t - \frac{x}{c}\right)$ d) $E_y = 66\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$, $B_z = 2.2 \times 10^{-7}\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$	
30	Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors; (i) distance between the electrodes (ii) nature and temperature of the electrolyte (iii) nature of electrodes (iv) area of electrodes.  For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as V = $\varepsilon - Ir$ 1. The terminal potential difference of two _____ of a cell is equal to emf of the cell whenI=0. 2. A cell of emfε and internal resistance rgives a current of 0.5 A with an external resistance of 12 Ω and a current of 0.25 A with an external resistance of 25 Ω . What is the value of internal resistance of the cell? 3. An external resistance Ris connected to a cell of internal resistance r, When will themaximum current flow in the external resistance? 4. Ifexternal resistance connected to a cell has been increased to 5 times, the potential difference across the terminals of the cell increases from 10 Vto 30 V. Then, find the emf of the cell.	**[4]**
	SECTION E	
31	1. Two converging lenses of focal lengths f_1 and f_2 are placed coaxially in contact. Derive the expression for the focal length of the combination using the ray diagram for the formation of the image of an object by the combination. 2. The figure shows the variation of image distance v with object distance u for a lens.	**[5]**

	a. What is the nature of the lens? b. Using the graph, find the focal length of the lens.  **OR** In Young's double slit experiment, deduce the condition for (a) constructive and (b) destructive interference at a point on the screen. Draw a graph showing a variation of intensity in the interference pattern against position x on the screen.	
32	1. Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable and unstable equilibrium. 2. Is the electrostatic potential necessarily zero at a point where the electric field is zero? Give an example to support your answer. **OR** Derive an expression for the electric potential at a point due to an electric dipole. Mention the contrasting features of electric potential of a dipole at a point as compared to that due to a single charge.	**[5]**
33	1. Describe, with the help of a suitable diagram, the working principle of a step - up transformer. Obtain the relation between input and output voltages in terms of the number of turns of primary and secondary windings and the currents in the input and output circuits. 2. Given the input current 15 A and the input voltage of 100 V for a step - up transformer having 90% efficiency, find the output power and the voltage in the secondary if the output current is 3 A. **OR** 1. Write the function of a transformer. State its principle of working with the help of a diagram. Mention various energy losses in this device. 2. The primary coil of an ideal step - up transformer has 100 turns and transformation ratio is also 100. The input voltage and power are respectively 220 V and 1100 W. Calculate a. number of turns in secondary b. current in primary c. voltage across secondary	**[5]**

	d. current in secondary e. power in secondary	