PHYSICS – Code No. 042
SAMPLE QUESTION PAPER
CLASS – XII (2025 – 26)

Time Allowed: 3 hours **Maximum Marks: 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 two question in Section B, one question in Section C 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.
(7) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2 N^{-1} m^{-2}}$
viii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

SECTION A		
Q.No.	**Question**	**Marks**
1.	If a charged hollow sphere and a solid sphere of aluminum and copper of equal radii are in electrostatic equilibrium, then which of the following statements is true? (A) Both the spheres are having equal charges. (B) The hollow sphere will have more charge than solid sphere at its surface. (C) The aluminum sphere will have more charge on its surface than copper sphere. (D) If hollow sphere is also made up of aluminum then it will have more charge.	1

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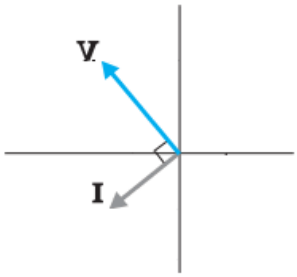
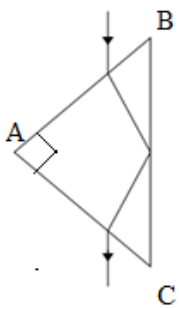
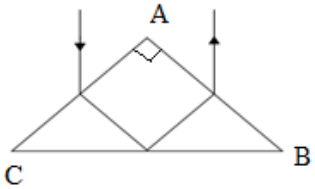
2.	A coil contains N turns of insulated copper wire of diameter d and resistivity ρ wound on a cylinder of diameter D. What is the total resistance between the two ends of the coil of copper wire?(given: D>>d) (A) $\frac{4\rho ND}{d^2}$ (B) $\frac{8\rho ND}{d^2}$ (C) $\frac{2\rho ND}{d^2}$ (D) $\frac{12\rho ND}{d^2}$	1
3.	If the phasor diagram for a device connected to AC supply is as shown in the fig, then which of the following statements is true?  (A) When the frequency of the AC source is increased than the impedance of the device decreases. (B) This device behaves as conducting wire when connected across DC source. (C) When the frequency of the AC source is decreased than the impedance of the device decreases. (D) D. This device stores energy in the form of magnetic potential energy.	1
4.	Which of the following statement is true for the radio waves and the gamma rays? (A) The energy of gamma rays is lesser than that of the radio waves. (B) The frequency of the radio waves is higher than that of gamma rays. (C) The radio waves and the gamma rays have the same energy. (D) The energy of radio waves is lesser than that of the gamma rays.	1
5.	A glass prism has internal angles of 45°, 45° and 90°. The glass has a critical angle of 45°. Which of the following ray diagrams depicts the possible path the of light through the prism? (A) (B)  	1

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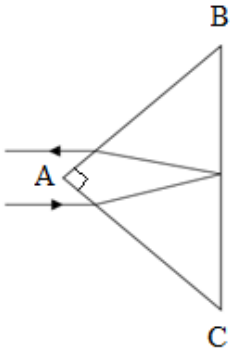
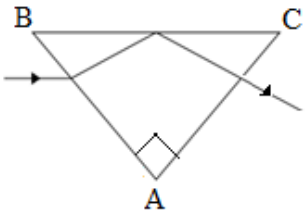
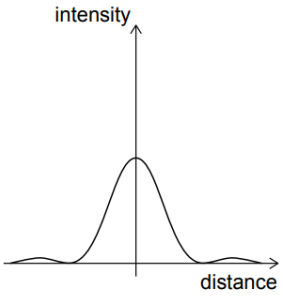
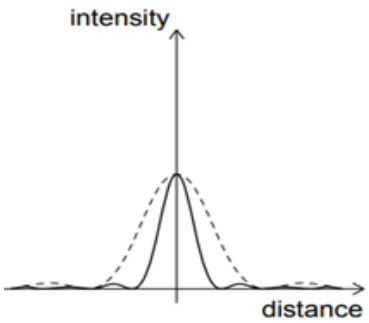
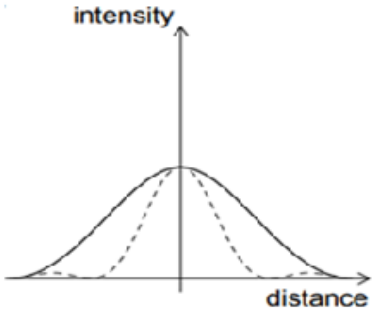
	(C)  (D)  **For VI-Candidates** Light passes from a certain medium into air. The critical angle of the given medium is Θ, which of the following expressions gives the speed of light in the given medium? Where c is the speed of light in air. (A) $\frac{1}{c\sin\theta}$ (B) $\frac{\sin\theta}{c}$ (C) $\frac{c}{\sin\theta}$ (D) $c\sin\theta$	
6.	The light from a monochromatic source is incident on a single slit and the resulting diffraction pattern is viewed on a screen. The graph shows the variation of the intensity with the distance on the screen.  The width of slit is increased keeping the intensity of the source the same. Which of the following graphs is correct? (The original curve is shown with a dashed line.) (A)  (B)  	1

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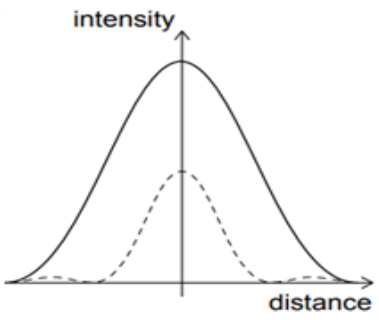
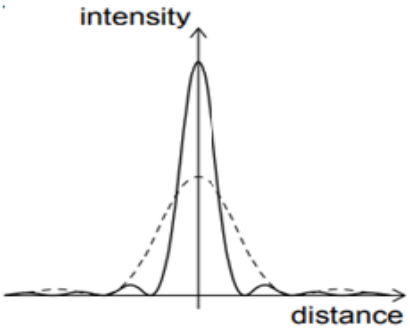
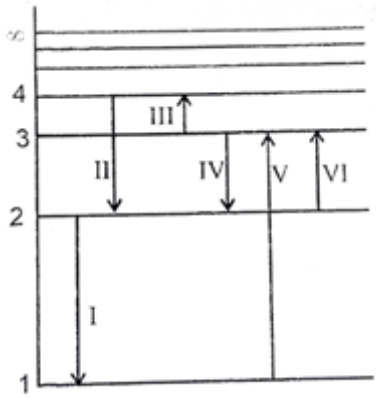
	(C)  (D)  **For VI-Candidates** The phenomenon of superposition of two waves, resulting in redistribution of energy is known as…… (A) diffraction (B) interference (C) reflection (D) refraction	
7.	Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength?  (A) I (B) III (C) IV (D) VI	1
	(for V.I. Candidates) Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength? I — From 4^{th} orbit to 2^{nd} orbit. II — From 2^{nd} orbit to 1^{st} orbit. III — From 3^{rd} orbit to 4^{th} orbit. IV — From 3^{rd} orbit to 2^{nd} orbit. V — From 1^{st} orbit to 3^{rd} orbit. VI — From 2^{nd} orbit to 3^{rd} orbit. (A) I (B) III (C) IV (D) VI	

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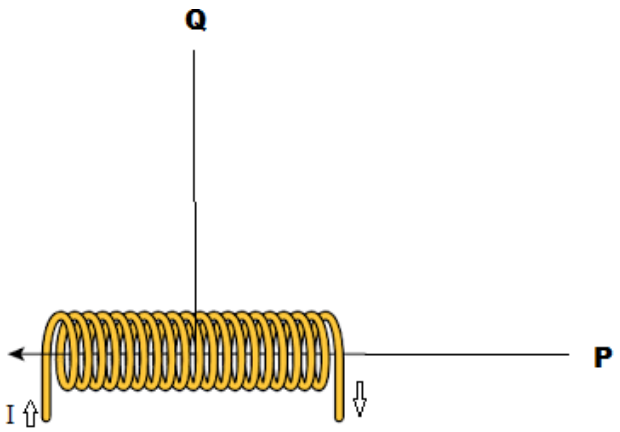
8.	A charged particle is projected along the axis of a current carrying loop. Which of the following statements is true? (A) The acceleration of the charged particle will depend on the velocity with which it is projected. (B) The acceleration of the charged particle will depend on the magnitude of the current passing through the coil. (C) The acceleration of the charged particle will depend on the radius of the coil. (D) The charged particle will move with constant velocity.	1
9.	Two small identical magnets are allowed to fall freely one through a vertical solenoid of 20 m made up of copper and another in air through the same vertical distance. The time taken by the two magnets to fall will be (A) same in both the cases. (B) more for the magnet falling in air. (C) more for the magnet falling through the solenoid. (D) infinite.	1
10.	The emf generated by an AC generator is given by $V=V_o \sin \omega t$, where ω is angular frequency of armature of generator. What will be the emf if the angular frequency is doubled (A) $V=V_o \sin 2\omega t$ (B) $V=2V_o \sin \omega t$ (C) $V=2V_o \sin 2\omega t$ (D) $V=V_o \sin \omega t$	1
11.	The ratio of the nuclear densities of two nuclei having the mass numbers 8 and 27 is (A) 8:27 (B) 3:2 (C)2:3 (D) 1:1	1
12.	When we move magnetic compass from point P to Q then which of the following statement is true  	1

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	(A) The deflection of the magnetic needle at P and Q will be in the same direction. (B) The deflection of the magnetic needle at P and Q will be in the opposite directions. (C) The deflection of the magnetic needle at P and Q will be perpendicular to each other. (D) The deflection of the magnetic needle at P and Q will be inclined at 45^o with respect to each other.	
	For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. (B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (C) Assertion is true but Reason is false. (D) Both Assertion and Reason are false.	
13.	**Assertion (A):** Total energy of an electron in hydrogen atom is negative. **Reason (R):** The centripetal force is provided by electrostatic force.	1
14.	**Assertion (A):** The critical angle of light passing from glass to air is minimum for violet colour. **Reason (R):** The wavelength of blue light is greater than the light of other colours.	1
15.	**Assertion (A):** Two light sources emitting waves of similar wavelengths are coherent. **Reason (R):** Two light sources emitting waves having zero or constant phase difference are known as coherent sources.	1
16.	**Assertion (A):** For three point charges to be in equilibrium, they must be collinear. **Reason(R):** One of the three charges must have different polarity than rest of the two.	1
	SECTION B	
17.	The amplitude of the magnetic field of a plane electromagnetic wave propagating along positive X axis in vacuum is 510 nT$\hat{k}$ and its angular frequency is 60 x 10^6 rad/sec. Write the expression for the electric field $\left(\vec{E}\right)$.	2
18.	The following graph shows the potential difference across the terminals of a cell against its load current.	2

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	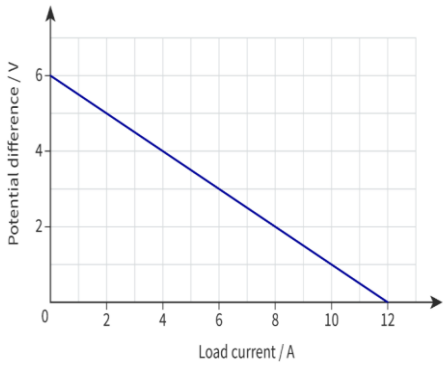 Find, (I) the emf of the cell and (II) the internal resistance of the cell. **For VI candidates** Find the relation between internal resistance, emf, external resistance and the total current in the circuit ?	
19.	A charge q is placed inside a sphere of radius 'a' filled with water and another charge 2q is placed inside cube of side '2a' which is vacuumed inside. Find the ratio of the flux linked with the sphere to that linked with the cube. (Take relative permittivity of water as 80)	2
20(I)	Write an expression for the magnetic force per unit length between two parallel thin current carrying wires. Hence define one ampere. **OR**	2
20(II)	Draw a diagram representing the behaviour of magnetic field lines for a (A) diamagnetic & (B) paramagnetic substance. **For VI-Candidates** Sate Gauss's law of magnetism? Hence find the magnetic flux linked with the sphere enclosing a current carrying solenoid?	2
21(I)	How does the impact parameter affect the trajectory of a α – particles scattered by a heavy nucleus? What is the value of impact parameter for head on collision of α – particles with the nucleus? **OR**	2
21(II)	Plot a graph showing variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$, where V is accelerating potential for a particle of mass m and charge q. Obtain the slope of this graph.	

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SECTION C		
22.	With the help of circuit diagram explain working of the full wave rectifier.	3
23.	(I) The current I_1 in a wire is getting divided in two wires with currents I_2 and I_3 at a junction in a circuit.The currents in the three wires are related by $I_1 = I_2 + I_3$. (A) State the fundamental law from which this relation is derived. (B) Explain the validation of law of conservation of energy in Kirchhoff's voltage law? (II) How the balancing condition gets affected if you are interchanging the galvanometer and the cell in the Wheat stone bridge?	3
24.	A fast-moving neutron collides with the nucleus of Plutonium (Pu), thereby producing Xenon (Xe) and Zirconium (Zr) along with neutrons. (I) Write the nuclear fission reaction. (II) Find the energy released in the above nuclear reaction. Given atomic masses: m $(^{239}_{94}Pu) = 239.052157$u, m $(^{103}_{40}Zr) = 102.926597$u, m $(^{134}_{54}Xe) = 133.905040$u & m $(^{1}_{0}n) = 1.00866$u.	3
25.	A compound microscope consists of an objective lens of focal length 0.82 cm and an eyepiece lens of focal length 2.9 cm. An object is placed 0.91 cm from the objective lens. The image is formed at the near point (25 cm) from the eye. (I) Calculate that the angular magnification of the microscope. (II) Draw the ray diagram of compound microscope in normal adjustment.	3
26.	Draw the reflected wave front for a plane wave front incident on a plane reflecting surface. Hence verify the laws of reflection using Huygen's principle. **For VI Candidates** (I) Define wave front? (II) Define wavelet? (III) What will be the shape of the wave front intercepted by a large reflecting type telescope on earth, due to a star far-away from our solar system?	3

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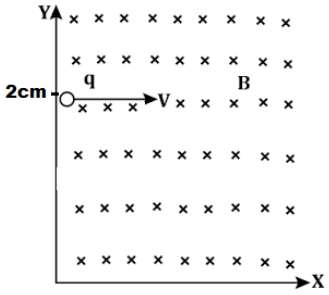
27(I)	If a point sized object having charge 1C and mass 1g is projected with velocity of $2\hat{\imath}$ m/s from a point (0,2cm,0) in the region of magnetic field -0.1$\hat{k}$ T which spreads in the first quadrant.  (A) What will be the shape of the path followed by the given charged particle? (B) At what point it will cross the X-axis? (C) What will be the kinetic energy of particle when it will enter in the fourth quadrant? **OR**	3
27(II)	A solenoid has a core of material with relative permeability 200. The windings of the solenoid are insulated from the core and carry a current of 1A. If the number of turns is 2000 per metre, calculate (A) magnetic intensity, (B) magnetic field & (C) magnetisation	3
28.	A conducting coil of 50 turns and area $\frac{5}{\pi}$ cm^2 is rotating along the axis of solenoid of length 50cm and 2000 turns, carrying current of 5 A. What will be the value of maximum emf generated?	3
	SECTION - D	
29	When an external voltage is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased. The applied voltage mostly drops across the depletion region and the voltage drop across the p-side and n-side of the junction is negligible. When an external voltage is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. The applied voltage mostly drops across the depletion region.	1 Mark each

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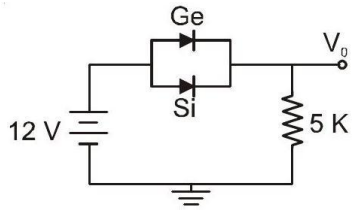
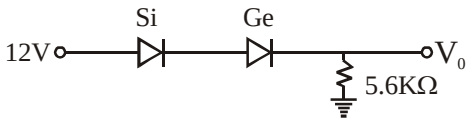
(I) Ge and Si diodes start conducting at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of V_0 changes by (assume that the Ge diode has large breakdown voltage)



(A) 0.2 V (B) 0.4 V

(C) 0.6 V (D) 0.8 V

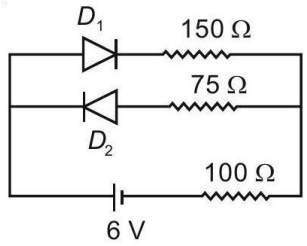
(II.) The value of V_0 and I_d for the network are :



(A) 13 V, 2.32mA (B) 11.7 V, 2.08mA

(C) 11.3V, 2.01mA (D) 11V, 1.96mA

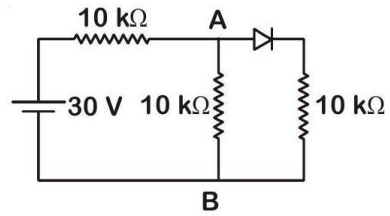
(III.) The circuit shown below contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is 6 V, the current through the 100Ω resistance (in amperes) is



(A) 0.036 (B) 0.020

(C) 0.030 (D) 0.027

(IV) In the figure, potential difference between A and B is



(A) Zero (B) 5 V

(C) 10 V (D) 15 V

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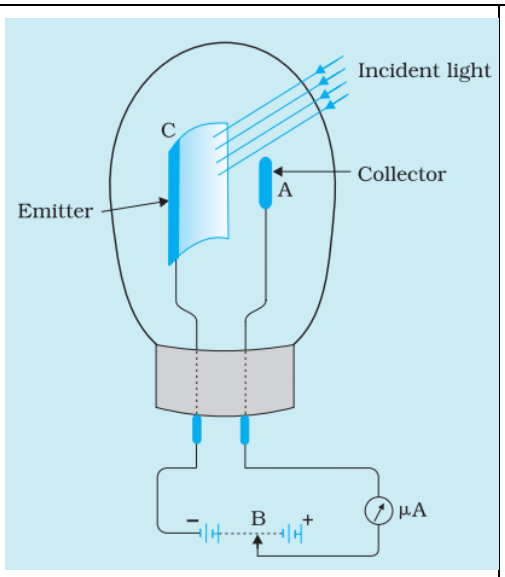
30.	Photoelectric effect is phenomenon of the ejection of electrons when the radiation of suitable frequency is made to fall on the surface of a metal. When light of suitable wavelength falls on the emitter C given in the diagram, the photoelectrons are emitted. These photoelectrons are drawn to the collector A. The photoelectric current of the order of a few microamperes can be normally obtained from the device given in figure. The device given converts a change in intensity of illumination into a change in photocurrent. This current can be used to operate control systems and in light measuring devices. The devices are made up of metals with low ionization enthalpies, for example platinum whose work function is 6.35 eV. 	
	(I) If infrared radiation of 3 x 10^{11} Hz is used as incident radiation, determine the reading of microammeter? Justify mathematically.	2
	(II) In the given diagram, if terminal B is shifted towards the left then how will it affect the reading of the microammeter? **(for V.I. candidates)** (II) If the supplied voltage is decreased, then what will be effect on the reading of the microammeter?	1
	(III) Plot a graph showing this variation in reading of micrometre on shifting the terminal B towards the right. **(for V.I. candidates)** (III) If the intensity of incident radiation is doubled, by what factor will the kinetic energy change?	1
SECTION E		
31(I)	(A) A dielectric slab of thickness t, is introduced between the plates of parallel plate capacitor of area A and separation d (where t<d). Find an expression for the capacitance with the dielectric slab. (B) A copper sphere of capacitor C is dropped in ocean. Will the capacitance of the sphere increase, decrease or remain same? Justify. (C) A capacitor is connected across a source of potential difference V and then the separation 'd' between the plates is increased using insulating stick. Plot 'V' vs 'd' graph for the given capacitor.	2+2+1

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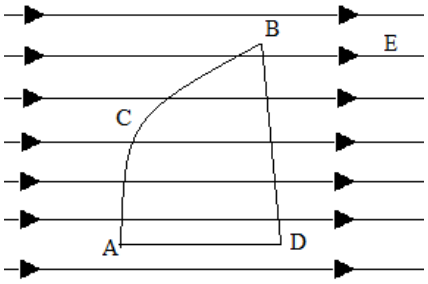
	For VI Candidates (C) A capacitor is connected across potential difference V and is then separation between plates 'd' is increase using insulating stick. Will the energy stored in capacitor increase or decrease? Justify **OR**	
31 (II)	(A) If a charge of 1μC is placed at the origin and another charge of 3 μC placed at the point (20m,0m,0m) in an external uniform electric field of 40V/m $\hat{\imath}$ with the electric potential at origin to be zero. Find the electrical potential energy of system. (B) If one charge particle is moved from A to C To B and another charge particle of equal magnitude is moved from A to D to B, In uniform external magnetic field. Than for which charge particle more work will be needed? (use fig for reference)  (C) Electrostatic potential is constant throughout the volume of conductor has the same value on its surface why? **For VI candidates** (C) If A charge particle is taken from A to B from two different path one path has resistance of 10Ω and another has capacitance of 3μF. work done by which path will be more.	3+1+1
32(I)	(A) Derive lens maker's formula. (B) Equi-convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 10cm? **OR**	3+2
32(II)	(A) Define angle of deviation in a prism? (B) Obtain the relation A+δ=i+e for a prism where A is the angle of prism, δ is the angle of deviation, i is the angle of incidence and e is the angle of emergence. Write this relation for the minimum deviation? (C) Write the condition for minimum deviation.	1+3+1

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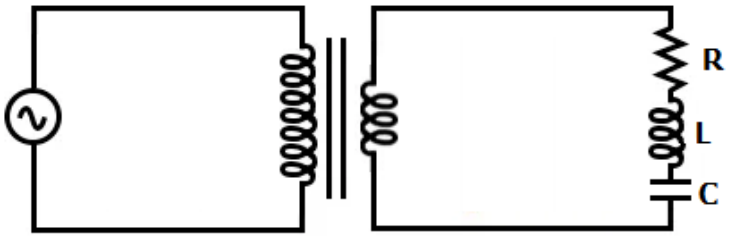
33(I)	(A) State the working principle of a moving coil galvanometer? What modification is required in the galvanometer to make its scale linear? (B) If a galvanometer of resistance 49.5Ω has range of 0.05A. What will be the value of resistance needed to convert it in ammeter of range 5A? (C) How these two resistors should be connected to galvanometer in both cases? **OR**	2+2+1
33(II)	(A) An input potential V_{in}=200 Sin $100\pi t$ V is provided to an ideal transformer having 1000 turns in primary coil and 100 turns in secondary coil as shown in figure. The load circuit has a resistance of 4Ω, a capacitive reactance of 2Ω and an inductive reactance of 6Ω.  Find: (i) the output voltage across the load circuit (ii) the current flowing through the load circuit (iii) the power supplied to the load circuit by the transformer (B) State the working principle of a transformer and explain how it is a key component in the transfer of electrical power over long distances.	3+2

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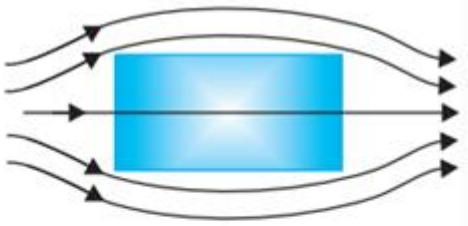
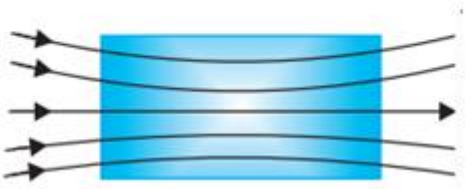
PHYSICS – Code No. 042
MARKING SCHEME
CLASS – XII (2025 – 26)

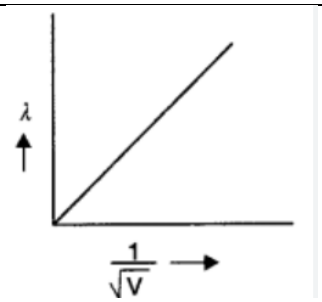
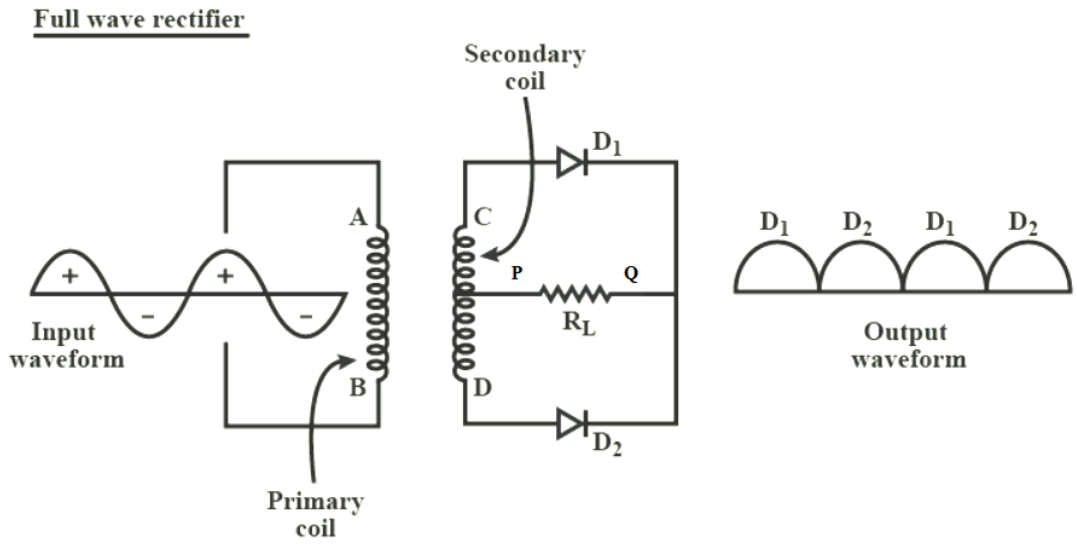
SECTION A		
Q.No	**Questions**	**Marks**
1.	**Answer: (A)** Both are having equal charges For two bodies to be in equilibrium, both should have same potential(V). As V=$\frac{C}{q}$ Where C of sphere is $4\pi\varepsilon_o r$. Which is independent of all the factors mentioned in options.	1
2.	**Answer: (A)** Diameter of copper wire d, Diameter of cylindrical iron is D No.of turns N,(D>>d) Length=N x Circumference of cylinder L= NπD R= $\frac{\rho L}{A} = \frac{\rho N \Pi D}{d^2\frac{\Pi}{4}}$ R=$\frac{4\rho ND}{d^2}$	1
3.	**Answer: (A)** When the frequency of the AC source is increased than the impedance of the device decreases. As in phasor diagram current leads the voltage, so given appliance is capacitor.	1
4.	**Answer: (D)** The energy of radio waves is lesser than that of the gamma rays. Since the frequency of radio waves is less than gamma waves. E = hν Hence, energy of radio waves is less than gamma waves	1

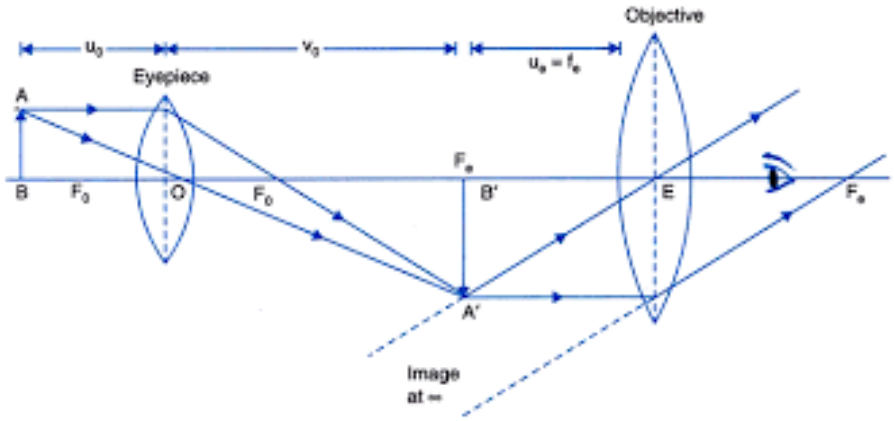
5.	**Answer: (A)** Total Internal reflection ***<u>For VI- Students</u>*** **Answer: (D)** $\frac{v_1}{c} = \frac{Sin\Theta_c}{sin\,90}$ cSinΘ	1
6.	**Answer: (D)** Slit width increases hence amplitude will increase, so intensity will also increase. ***<u>For VI- Students</u>*** **Answer: (B)** Interference	1 1
7.	**Answer: (C)** IV Transition III, V, VI corresponds to absorption of energy. Maximum emitted wavelength corresponds minimum energy difference. $\Delta E_I > \Delta E_{II} > \Delta E_{IV}$ Therefore, maximum emitted wavelength corresponds to transition IV. ***<u>For VI- Students</u>*** Transition III, V, VI corresponds to absorption of energy. Maximum emitted wavelength corresponds minimum energy difference. $\Delta E_{II} > \Delta E_I > \Delta E_{IV}$ Therefore, maximum emitted wavelength corresponds to transition IV.	1
8.	**Answer: (D)** The charged particle will move with constant velocity. As charge particle is moving parallel to magnetic field, there will be no acceleration.	1

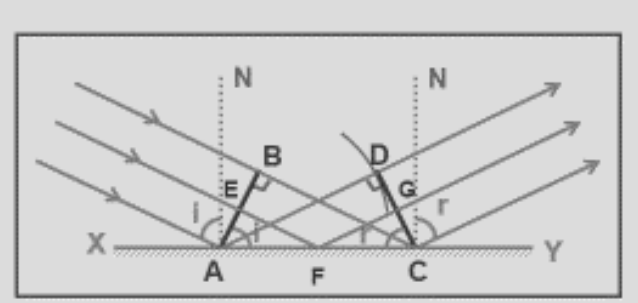
9.	**Answer: (C)** more for the magnet falling through the solenoid. Emf will be induced in solenoid due to motion of magnet through it. As per Lenz's law induced emf will oppose the motion of magnet.	1
10.	**Answer: (C)** $V=2V_o \sin 2\omega t$ As $V= NBA\omega \sin \omega t$	1
11.	**Answer: (D)** 1:1 Nuclear density does not depend on mass number.	1
12.	**Answer: (B)** The deflection of the magnetic needle at P and Q will be in the opposite directions. As magnetic field at equator is antiparallel to magnetic field at pole.	1
13.	**Answer: (B)** both Assertion and Reason are true but Reason is not the correct explanation of Assertion.	1
14.	**Answer: (C)** Assertion is true but Reason is false.	1
15.	**Answer: (D)** both Assertion and Reason are false	1
16.	**Answer: (B)** both Assertion and Reason are true but Reason is not the correct explanation of Assertion. If three point charges are in equilibrium then forces acting on each charges should be linearly opposite.	1

SECTION B		
17.	Given, $B_o = 510$ nT $= 510 \times 10^{-9}$ T $\omega = 60 \times 10^6$ rad/sec $E_o = cB_o = 153$ N/C $k = \omega/c = 20 \times 10^{-2}$ rad/m $E = E_o \sin(\omega t - kz)$ $E = 153 \sin(60 \times 10^6 t - 20 \times 10^{-2} x)$ N/C	1 1
18.	(I) E.m.f of the cell is 6V, As when load current is zero potential difference becomes equal to emf of the cell. (II) Explanation: The internal resistance of a cell can be determined as the negative slope of its voltage–current graph. First, we can determine the slope by choosing two points on the line: $\textbf{Slope} = \frac{0-6}{12-0} = -0.5$ This means that the internal resistance must be 0.50 ohm (Ω). **For VI-Candidates** E = V + v = IR + Ir (where V is potential drop in the external circuit and v is potential drop in the cell) Or, E = I (R + r) Or, I = E / (R + r) This is the relation.	1 1 1 1
19.	From Gauss's theorem $Ø = \frac{q}{\varepsilon_r \varepsilon_o}$ [Where ε_r is relative permittivity of medium inside Gaussian surface] For sphere, $Ø_{sphere} = \frac{q}{\varepsilon_{water} \varepsilon_o}$ ……..(i) For cube $Ø_{cube} = \frac{2q}{\varepsilon_o}$ ……(ii) Dividing (i) by (ii) $\frac{Ø sphere}{Ø cube} = \frac{1}{2\varepsilon_{water}} = \frac{1}{160}$	½ ½ 1

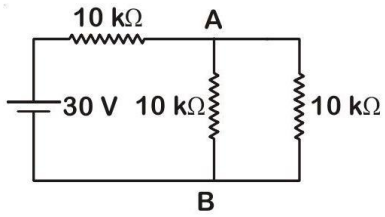
20. (I)	$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi r}$ (I_1 is the current in first wire and I_2 is the current in second wire) Thus we define ampere as the current flowing in each conductor separated by a unit distance so that one conductor applies a force of 2×10^{-7} N on a unit length of another parallel conductor. **Or**	1 1
20 (II)	 (a)  (b) **For VI-Candidates** Gauss's law for magnetism is: The net magnetic flux through any closed surface is zero. Hence magnetic flux linked to given sphere will also be zero.	1 1 1 1
21A.	Smaller is the impact parameter, larger is the angle at which α – particles scatters. Larger is the impact parameter, α – particles scatter less keeping its original trajectory. For head on collision, the value of impact parameter is zero. **OR**	1 1

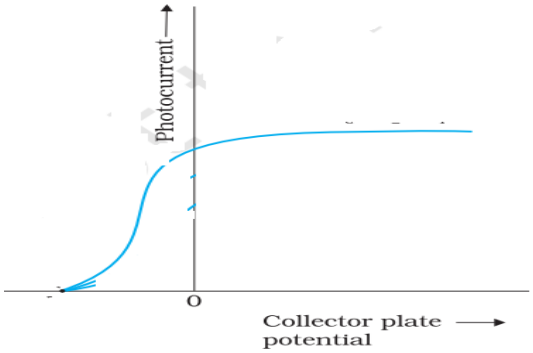
21B.	 $\lambda=\frac{h}{mv}$ $\lambda=\frac{h}{\sqrt{2mqV}}$, comparing this equation with y = mx slope= $\frac{h}{\sqrt{2mq}}$.	1 1
	SECTION C	
22.	In the full wave rectifier:D_1 and D_2 are pn junction diode which allow current to pass only in forward biasing. During odd half cycle the diode D_1 will be forward biased hence potential at the Q will be more then Potential at P and during this cycle D_2 will not permit current through it. During even half cycle the diode D_2 will be forward biased hence potential at the Q will be more then Potential at P and during this cycle D1 will not permit current through it. Hence we will get DC as output as shown in diagram. 	1 2
23.	(I) (A)Conservation of electric charge (B) KVL is obeys law of conservation of energy as it is supplied voltage is equal to the voltage across each component in the loop. (OR) algebraic sum of voltages equal to zero. (II) No change in balancing condition is observed.	1 1 1

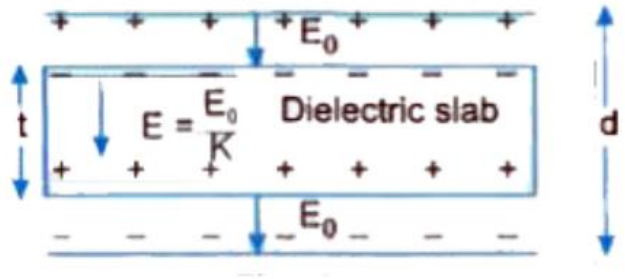
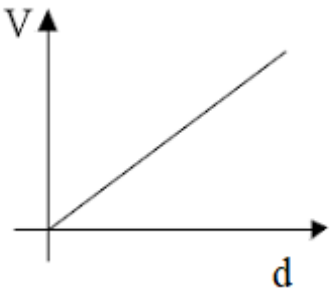
24.	A fast-moving neutron collides with the nucleus of Plutonium (Pu), thereby producing Xenon (Xe) and Zirconium (Zr) along with neutrons. (I) Nuclear fission reaction. $^{239}_{94}Pu + {}^{1}_{0}n \rightarrow {}^{134}_{54}Xe + {}^{103}_{40}Zr + 3\ {}^{1}_{0}n$ (II) Δm = [m ($^{239}_{94}Pu$) + m ($^{1}_{0}n$)] - [m ($^{134}_{54}Xe$) + m ($^{103}_{40}Zr$) + 3 m ($^{1}_{0}n$)] = [239.052157 + 1.00866] - [133.905040 + 102.926597 + 3 X 1.00866] = 240.060817 – 239.857617 = 0.2032 amu Q value = Δmc^2 = 0.2032 x 931.5 MeV = 189.2808 MeV	1 1 1
25.	(I) $\frac{1}{v_0} = \frac{1}{f_0} - \frac{1}{u_0}$ v_0= 8.3 cm Angular magnification M=m_0xm_e M= $\frac{v_0}{u_0}(\frac{D}{f_e}+1)$ M= - $\frac{8.3}{0.91}$ X ($\frac{25}{2.9}+1$) M= -87.7 (II)  	1 1 1

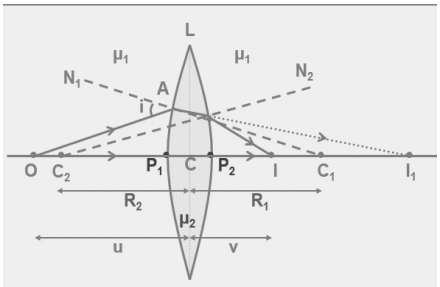
26.	 AB – Incident wavefront CD – Reflected wavefront XY – Reflecting surface	1
	If c be the speed of light, t be the time taken by light to go from B to C or A to D or E to G through F, then $t=\frac{EF}{C}+\frac{FG}{C}$ $t=\frac{AF\ Sin\ i}{C}+\frac{FC\ Sin r}{C}$ $t=\frac{AC\ Sin\ r+AF(Sin\ i-Sin\ r)}{C}$	
	For rays of light from different parts on the incident wavefront, the values of AF are different. But light from different points of the incident wavefront should take the same time to reach the corresponding points on the reflected wavefront. So, t should not depend upon AF. This is possible only if sin i – sin r = 0. i.e. sin i = sin r or i = r Hence proved.	1 1
	<u>For VI candidates</u> (i) A wavefront is the locus of points (wavelets) having the same phase of oscillations (ii) Each point on a wavefront acts as a fresh source of disturbance of light known as wavefront. (iii) Planer.	1 1 1
27. (I)	As charge particle is moving perpendicular to magnetic field it will follow circular trajectory in clock wise direction. Magnetic force will act as centripetal force. Given: Q=1C; $M=10^{-3}$kg; v=2m/s & $B=-0.1T\hat{k}$	

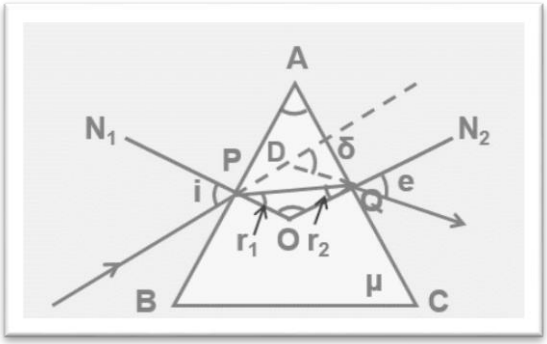
	Radius of trajectory is given by R= $\frac{mv}{qb}$ = 2cm (A) Quarter Circle (B) It will cross the X axis at 2cm. (C) As work done by B is on charge particle is zero it's kinetic energy(K) will remain same K= $\frac{1}{2}mv^2$ Or, K = $\frac{1}{2}x10^{-3}x2^2J = 2 \times 10^{-3}J$	 1 1 1
27 (II)	Given: μ_r=200 I=1A N=200turn/m (A) H=nI Or,H=2000/m X 1A=2 X 10^3A/m (B) B= $\mu_o\mu_r$H Or, B=200 x 4π x 10^{-7}x 2 X 10^3A/m Or, B= 0.50T (C) Magnetisation is given by M=(μ_r -1)H=199 x 10^3 A/m Or,M = 1.99 x 10^5 A/m	 1 1 1
28.	Given: No of turns of coil N_c=50 Area of coil= $\frac{5}{\pi}$ cm^2=$\frac{5}{\pi}$ x $10^{-4}m^2$ For solenoid: N_s=2000, L=0.5m, n = N/L=4000turns/m, I= 5A	

	Magnetic field due to solenoid 'B'=μ_onI Or,B=4000 x 4π x 10^{-7} x 5 T Or,B= 8π x 10^{-2} T	1
	Flux linked to coil $\emptyset_B$=$N_c\vec{B}.\vec{A}$ Or, $\emptyset_B$=N_cBA cosωt	1
	Emf $\varepsilon = \frac{d\emptyset_B}{dt}$ = N_cBAω sin ωt *Or,* ε_{max} = N_cBA *Or,* ε_{max} = 50 x 8π x 10^{-2} T x $\frac{5}{\pi}$ x $10^{-4}m^2$ *Or,* ε_{max} = 2Mv	1
	SECTION - D	
29.	(I) (B) Voltage drop across diode will change from 0.3 to 0.7 V. Value of V_0 changes by 0.4 V.	1
	(II) (D) 11V, 1.96Ma $V_0 = E - V_{si} - V_{Ge} = 12.07 - 0.3 = 11V$ $I_d = V_0/R = 11/5.6 \times 10^{-3} = 1.96$ Ma	1
	(III) (B) $I = \frac{6}{50+150+100} = \frac{6}{300}$ A = 0.02 A	1
	(IV) (C)  Here the diode is in forward bias. So we replace it by a connecting wire. $V_a - V_b = \frac{l}{2} \times 10$ $= \frac{30}{15 \times 2} \times 10$ V = 10 V	1

30.	(I) If infrared radiation is used as incident radiation, determine the reading $W_o = h\nu_o$ Threshold frequency, $\nu_o = \frac{Wo}{h} = \frac{6.35 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}} = 1.5 \times 10^{15}$ hz Frequency of infrared radiation < threshold frequency (ν_o) , hence no emmision of photoelectrons will take place, therefore reading of the microammeter = 0 (II) Photoelectric current decreases with decrease in potential. At some stage, for a certain potential of plate A, all the emitted electrons are stopped by the plate A and the photoelectric current becomes zero. (III)  **(for V.I. candidates)** No change in Kinetic Energy.	1 1 1 1 1
	SECTION E	
31. (I)	(A) In absence of dielectric slab, the capacitance of parallel plate capacitor is given by $C = \frac{A\varepsilon_0}{d}$ When a dielectric slab of thickness t(t < d) is introduced between the plates without touching the plates , the electric field in air $E_o = \frac{\sigma}{\varepsilon_0}$ (σ *is charge density given by* $\frac{q}{A}$) but on account of polarisation of dielectric the electric field inside the dielectric changes to $E = \frac{Eo}{K}$ If potential difference between the plates of capacitor be V. now , then clearly	½

	$V= E_o(d-t) + Et;$ Or, $V= E_o(d-t) + \frac{Eo}{K} t;$ Or, $V= E_o(d-t+\frac{t}{k})= \frac{\sigma}{\varepsilon_0} (d-t+\frac{t}{k})$ Or, $V=\frac{q}{A\varepsilon_0} (d-t+\frac{t}{k})$	1 ½
		
	(B) Capacitance of sphere will Increase. Justification: As $C=\frac{q}{V}$ & $V=\int \vec{E}.\vec{dl}$ As, electric field will decrease, due to polarization of water. Resulting in decrease in potential. Hence, capacitance of sphere will increase	1 1
	(C) 	1
	For VI Candidates (C) energy stored in capacitor will decrease. Justification Energy=$\frac{Q^2}{2C}$ When separation is increased capacitance will increase and charge will remain same.	

	Or	
31 (II)	(A) $U=\frac{Kq_1q_2}{r_{12}}+q_1V(r_1)+ q_2V(r_2)$ Or, $U=\frac{Kq_1q_2}{r_{12}}+q_1 (E\ r_{1-0})+ q_2(E\ r_{2-0})$ Or, $U=(\frac{9X10^9X10^{-6}X3X10^{-6}}{20} + 0 +3 \times 10^{-6} \times 40x20)$ J Or, $U=37.5 \times 10^{-4}$J (B) Work done will be same for both paths, as electric field is conservative in nature. (C) As electric field inside the conductor is zero so there will be no work needed in moving unit positive charge inside or on the surface.	1 1 1 1 1
32. (I)	(A) Lens Maker's Formula: For refraction at LP_1N, $\frac{\mu_1}{CO}+\frac{\mu_2}{CI1}=\frac{\mu_2-\mu_1}{CC1}$ (as if the image is formed in the denser medium) For refraction at LP_2N $\frac{\mu_2}{-CI_1}+\frac{\mu_1}{CI}=\frac{\mu_2-\mu_1}{CC_2}$ (as if the object is in the denser medium and the image is formed in the rarer medium) Combining the refractions at both the surfaces. $\frac{\mu_1}{CO}+\frac{\mu_2}{CI}= \mu_2-\mu_1(\frac{1}{CC_1}+\frac{1}{CC_2})$ Substituting the values with sign convections, $\frac{1}{-u}+\frac{1}{v}=\frac{\mu_2-\mu_1}{\mu_1}(\frac{1}{R_1}-\frac{1}{R_2})$  Since $\frac{\mu_2}{\mu_1}=\mu$ $\frac{1}{-u}+\frac{1}{v}=\frac{\mu_2-\mu_1}{\mu_1}(\frac{1}{R_1}-\frac{1}{R_2})$ (or)	1 1

	$\frac{1}{-u}+\frac{1}{v}=(\mu-1)(\frac{1}{R_1}-\frac{1}{R_2})$ When the object is kept at infinity, the image is formed at the principal focus. i.e. u = - ∞, v = + f. $\frac{1}{f}=(\mu-1)(\frac{1}{R_1}-\frac{1}{R_2})$ This equation is called 'Lens Maker's Formula'. (B) Refractive index of glass, μ = 1.55 Focal length of the convexo-concave lens, f = 10 cm Radius of curvature of one face of the first Convex surface = R_1 Radius of curvature of the other face of the second convex surface = $-R_1$ Therefore, R_1 = R and R_2 = -R The value of R can be calculated from Lens – Maker formula: (1/f) = (μ – 1) [(1/ R_1) – (1/ R_2)] (1/10) = (1.55 -1) [(1/R) + (1/R)] (1/10) = 0.55 x (2/R) Therefore R = (0.55 x 2 x10) =11cm Hence, the radius of curvature of the convexo-concave is 11cm **(OR)**	1 1 1
32 (II)	(A)The **angle of deviation** represents the angle by which a light ray is deviated after passing through a prism. (B) Refraction of light through prism :  In quadrilateral APOQ, A + O = 180° …….(1) In triangle OPQ, $r_1 + r_2$ + O = 180° …….(2)	1 1

	In triangle DPQ $\delta = (i - r_1) + (e - r_2)$ $\delta = (i + e) - (r_1 + r_2)$ …….(3) From (1) and (2), $A = r_1 + r_2$ From (3), $\delta = (i + e) - (A)$ $i + e = A + \delta$ Sum of angle of incidence and angle of emergence is equal to the sum of angle of prism and angle of deviation. (C) When angle of incidence increases, the angle of deviation decreases. At a particular value of angle of incidence the angle of deviation becomes minimum and is called 'angle of minimum deviation'. At δ_m, • $i = e$ and $r_1 = r_2 = r$ (say) • At minimum deviation, refracted ray become parallel to incident ray. (Award full marks if either of condition is mentioned)	1 1 1
33. (I)	(A) Torque due to current carrying coil. Modification in designing of galvanometer are (i) Poles of magnet are made spherical (ii) Iron ore is placed inside the coil. (B) Given: $R_g = 49.5\Omega$; Range=0.05A For ammeter let resistance needed be R_a. As per requirement Range x $R_g = R_a(5-0.05)$ $R_a = \frac{0.5\ X\ 49.5}{4.95} = 0.5\ \Omega$ (C) R_a will be connected in series & R_v is connected in parallel. **Or**	1 ½ ½ 1 1 1
33 (II)	(A)Given: In load circuit, $R=4\Omega$, $X_c=2\ \Omega$, $X_l=6\ \Omega$, $N_p=1000$,	

	N_s=100, V_{in}=200V$\sin 100\pi t$ (i) Output voltage Across Load Circuit $\frac{V_{out}}{V_{in}} = \frac{N_s}{N_p}$=0.1 Or, V_{out}=0.1 x 200V$\sin 100\pi t$, Or, V_{out}=20V$\sin 100\pi t$. (ii) Current flowing through load circuit As, I=$I_m\sin(\omega t+Ø)$ Where, $I_m = \frac{V_m}{Z}$, $Z=\sqrt{R^2 + ({X_c}^2 - {X_L}^2)}$ Or,$Z=4\sqrt{2}$ Ω,& $I_m = \frac{20}{4\sqrt{2}}A = \frac{5\sqrt{2}}{2}A$; $Ø = \tan^{-1}\frac{X_C - X_L}{R} = \tan^{-1} 1 = \frac{\pi}{4}$ $I=\frac{5\sqrt{2}}{2}A\sin(100\pi t+\frac{\pi}{4})$' (iii) Find the Power supplied to load circuit By the transformer. $P= \frac{V_m I_m}{2}\cos Ø$ Where, $\cos Ø=\cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}$ P=20V x $\frac{5\sqrt{2}}{2}$ Ax$\frac{1}{\sqrt{2}}$ =50W (B) Ac transformer works on the principal of ' Mutual Induction' A.C transformer can increase output potential. As P=V/I So increase in output potential results in decrease in output current, resulting in significant decrease in power loss in transmission wires between power plants and Cities. In respective cities they are stepped down.	1 1 1 1 1