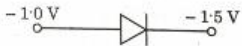
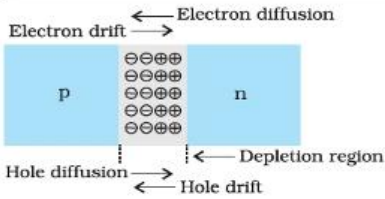
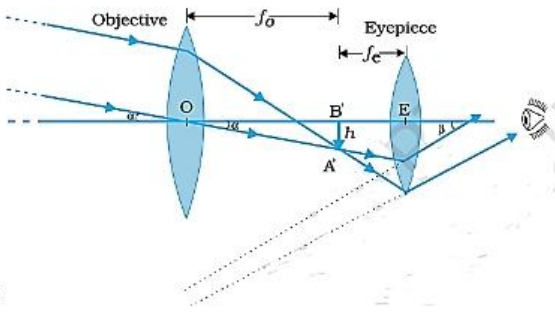
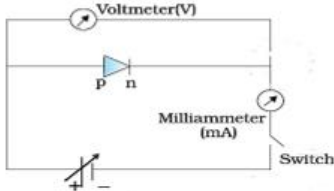
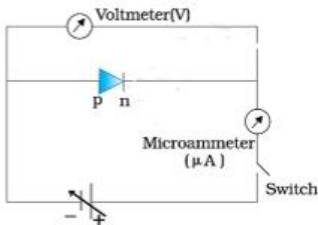
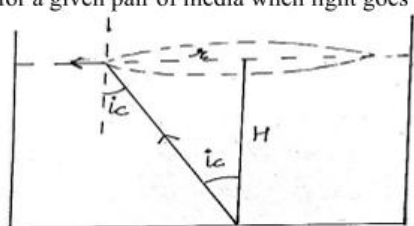


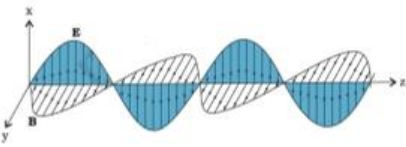
MARKING SCHEME: PHYSICS (042)			
Session: 2025–26			
Code: 55/3/2			
Q No.	VALUE POINTS/EXPECTED ANSWERS	Marks	Total Marks
SECTION A			
1.	(A) $2n\pi$	1	1
2.	(B) $\frac{4}{3}$	1	1
3.	(A) 30 cm	1	1
4.	(C) 2	1	1
5.	(C) 160 cm	1	1
6.	(D) 2.0 eV	1	1
7.	(D) 63 V	1	1
8.	(B) 	1	1
9.	(C) 100 Ω	1	1
10.	(A) $2.0 \times 10^8 \text{ ms}^{-1}$	1	1
11.	(D) Both wavelength of incident radiation and work function of the surface.	1	1
12.	(B) $-\frac{R}{\mu-1}$	1	1
13.	(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of the Assertion (A).	1	1
14.	(D) Both Assertion (A) and Reason (R) are false.	1	1
15.	(D) Both Assertion (A) and Reason (R) are false.	1	1
16.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1	1
SECTION B			
17.	Calculation of de Broglie wavelength. 2 $\lambda = \frac{h}{\sqrt{2m K.E}}$ $= \frac{6.63 \times 10^{-34}}{\sqrt{2 \times 1.6 \times 10^{-27} \times 150 \times 1.6 \times 10^{-19}}}$ $= 2.3 \times 10^{-12}$ $= 2.3 \text{ pm}$	$\frac{1}{2}$ 1 $\frac{1}{2}$	2

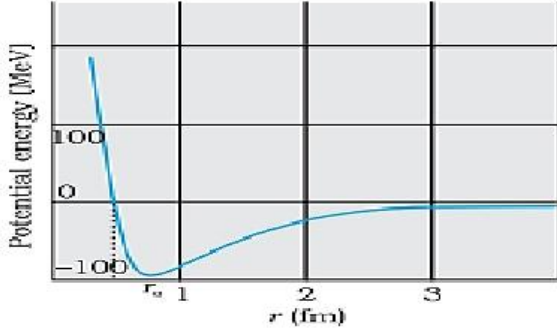
18.	Explaining two processes during formation of p-n junction 2  Diffusion: During the formation of p-n junction, due to concentration gradient across p and n sides, holes diffuse from p-side to n-side and electrons diffuse from n-side to p-side. This process is called diffusion. Drift: As diffusion continues, a depletion region consisting of the immobile ions get created. Due to its field, an electron moves from p-side to n-side and a hole moves from n-side to p-side. This motion is called drift which is opposite to diffusion process.	1	
19.	(a) Finding potential difference between points B and C. 2 $I = \frac{\varepsilon_{net}}{R_{net}}$ $= \frac{2}{4}$ $= 0.5 \text{ A}$ $V_{BC} = -\varepsilon_2 - Ir_2$ $= -4 - (0.5 \times 3)$ $= -5.5 \text{ V}$ OR (b) Finding i) Resistance of the resistor 1 ii) Terminal voltage of the battery 1 i) $IR = \varepsilon - Ir$ $R = \frac{21 - (3 \times 3)}{3}$ $= 4\Omega$ ii) $V = IR$ $= 3 \times 4$ $= 12 \text{ V}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

20.	Drawing labelled diagram of astronomical telescope. 1½ Writing expression for magnifying power. ½  $m = \frac{f_o}{f_e}$	1½ ½	2	HOME
21.	Explanation ½ Mass defect ΔM ½ Binding energy (E) ½ Relation between ΔM and E 1 The difference in mass of a nucleus and its constituents is called mass defect. If a certain number of neutrons and protons are brought together to form a nucleus of a certain mass and charge, the energy released is called as binding energy. $E_b = \Delta M c^2$ $= [Zm_p + (A - Z)m_n] - M] c^2$	½ ½ ½ ½	2	HOME
SECTION C				
22.	Explanation of Forward biasing 1½ Explanation of Reverse biasing 1½ Forward biasing  The p-side of the diode is connected to positive terminal and the n-side is connected to the negative terminal of the battery. Reverse biasing	1 ½		

	 The p-side of the diode is connected to negative terminal and n-side is connected to the positive terminal of the battery.	1	
23.	Defining critical angle for a pair of media 1 Obtaining expression for radius r of the surface 2 Critical angle: The angle of incidence corresponding to the angle of refraction 90° for a given pair of media when light goes from denser to rarer medium.  $\sin i_c = \frac{1}{\mu} = \frac{r}{\sqrt{r^2 + H^2}}$ $\mu^2 r^2 = r^2 + H^2$ $(\mu^2 - 1)r^2 = H^2$ $r = \frac{H}{\sqrt{\mu^2 - 1}}$	1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
24.	(a) Calculating the magnitude of external torque 2 Effect on torque if circular coil is replaced by planar coil 1 $\tau = NIBA \sin \theta$ $= 30 \times 6 \times 1 \times 3.14 \times (8 \times 10^{-2})^2 \times \sin 60^\circ$ $= 90 \times 64 \times 3.14 \times 1.73 \times 10^{-4}$ $= 3.13 \text{ Nm}$ Torque will remain the same. OR (b) Finding the radius of circular path 2 Mentioning condition for which the particle i) describes helical path $\frac{1}{2}$ ii) goes straight undeviated $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1	

	$K.E = \frac{q^2 B^2 r^2}{2m}$ $r = \frac{\sqrt{2 \times K.E. \times m}}{qB}$ $= \frac{\sqrt{2 \times 8 \times 1.6 \times 10^{-19} \times 10^6 \times 6.4 \times 10^{-27}}}{3.2 \times 10^{-19} \times 0.5}$ $= \frac{12.8 \times 10^{-20}}{1.6 \times 10^{-19}}$ $= 8 \times 10^{-1} \text{m}$ $= 80 \text{ cm}$ (i) Particle enters the magnetic field at angle $0^\circ < \theta < 90^\circ$ (Alternatively) If a component of velocity is parallel or antiparallel to the magnetic field and another component is perpendicular to the magnetic field. (ii) Particle moves parallel or antiparallel to the magnetic field.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$		HOME
25.	(a) Identification of elements $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ (b) Finding Phase angle $\frac{1}{2}$ Power factor $\frac{1}{2}$ Current $\frac{1}{2}$ a) X – Resistor $\frac{1}{2}$ Y – Inductor $\frac{1}{2}$ Z – Capacitor $\frac{1}{2}$ b) Phase angle = $\phi = 0^\circ$ $\frac{1}{2}$ $\tan \frac{\pi}{4} = \frac{X_L}{R}$ $X_L = R$ $\tan \frac{\pi}{4} = \frac{X_C}{R}$ $X_C = R$ $\tan \phi = \frac{X_L - X_C}{R}$ $= 0$ $\phi = 0^\circ$ Power factor = $\cos \phi$ $\frac{1}{2}$ $= \cos 0^\circ$ $= 1$ $\frac{1}{2}$ Current in the circuit is maximum.		3	HOME

26.	(a) Depicting the variation of electric and magnetic field 1 Writing two important characteristics $\frac{1}{2} + \frac{1}{2}$ (b) Showing $\frac{1}{\sqrt{\epsilon_0 \mu_0}}$ gives velocity of Electromagnetic wave in free space 1 (a)  Characteristics of Electromagnetic wave. (i) Electric and magnetic fields are perpendicular to each other. (ii) Speed of Electromagnetic wave in free space or vacuum is equal to $3 \times 10^8 \text{ ms}^{-1}$. (iii) Electric and magnetic fields are in same phase. (iv) Electromagnetic waves are transverse in nature. (v) Electromagnetic waves can travel in vacuum. (any two) (b) $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ $= \frac{1}{\sqrt{4\pi \times 10^{-7} \times \frac{1}{4\pi \times 9 \times 10^9}}}$ $= \sqrt{9 \times 10^{16}}$ $= 3 \times 10^8 \text{ m/s} = \text{Velocity of electromagnetic wave in free space.}$	1	$\frac{1}{2} + \frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	3
27.	Difference between nuclear fission and nuclear fusion 1 Example of each with nuclear reaction 1+1 Nuclear fission is decay of heavy nucleus into two or more intermediate mass fragments whereas in nuclear fusion, light nuclei fuse into a heavier nucleus. Nuclear Fission: ${}_0^1\text{n} + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + 3{}_0^1\text{n}$ Nuclear Fusion: ${}_1^1\text{H} + {}_1^1\text{H} \rightarrow {}_1^2\text{H} + e^+ + \nu + Q$	1	1	1	1	3

28.	Drawing the plot for variation of potential energy with separation of nucleons 2 Showing i) Attraction for $r > r_0$ 1/2 ii) Repulsion for $r < r_0$ 1/2		
	 From the above plot, potential energy is minimum at distance r_0. Therefore, (i) the force is attractive for $r > r_0$. (ii) the force is repulsive for $r < r_0$ (Note: Give full credit for this part if student depicts attractive and repulsive force in the graph)	1	
		1/2	3
		1/2	
	SECTION D		
29.	(i) (A) $\frac{1}{2}$ (ii) (D) 2 (iii) (D) Particle 1 revolves anticlockwise while particle 2 revolves clockwise (iv) (a) (A) 1s (b) (B) $p_1 = p_2$ OR	1	
		1	
		1	
		1	4
30.	(i) (D) $2\mu\text{F}$ (ii) (C) 0.2 A (iii) (A) 2V (iv) (a) (B) $4\mu\text{C}$ (b) (C) remain the same OR	1	
		1	
		1	
		1	4

SECTION E			
31.	(a)		
(i) Effect on glow of bulb when (I) Iron bar is inserted ½ Justification ½ (II) Frequency of source is decreased ½ Justification ½ (ii) Calculating (I) Impedance of the circuit 1 (II) rms value of current 1 (III) Power Factor 1			
(i) (I) Brightness of the bulb decreases		½	
As iron bar is inserted, inductive reactance of the coil increases. Larger fraction of applied AC voltage appears across inductor, leaving less voltage across the bulb.		½	
(Alternatively) $L' = \mu_r L$, L increases, $X_L = \omega L$ increases, current decreases.			
(II) Brightness of the bulb increases.		½	
As frequency of the source decreases, inductive reactance of coil decreases. Less fraction of applied AC voltage appears across inductor. Hence higher voltage appears across the bulb.		½	
(Alternatively) $X_L = \omega L$, ω decreases, X_L decreases, current increases.			
(ii) $V = 280 \sin(100\pi t)$			
$X_L = 100 \pi \times \frac{5}{\pi} = 500 \Omega$			
$X_C = \frac{10^6}{100\pi \times \frac{50}{\pi}} = 200 \Omega$			
(I) $Z = \sqrt{R^2 + (X_L - X_C)^2}$		½	
$= \sqrt{(400)^2 + (300)^2}$			
$= 500 \Omega$		½	
(II) $I_{\text{rms}} = \left(\frac{V_0}{Z\sqrt{2}} \right) = \frac{280}{500 \times 1.4}$		½	
$= 0.4 \text{ A}$		½	
(III) Power factor $= \cos \phi = R/Z$		½	
$= 400/500$			
$= 0.8$		½	

OR

(b)

(i)	Statement of Lenz's law	1
	Explanation	1
(ii)	Writing dimensional formula	1
	Calculating self-inductance of coil	2

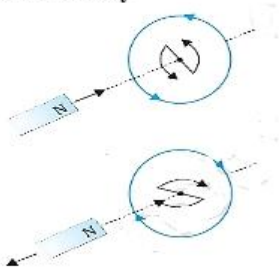
(i) The polarity of induced emf is such that it tends to produce a current which opposes the change in magnetic flux that produces it.

Consider north pole of a magnet being moved towards a coil. The magnetic flux through the coil increases, hence current is induced in counter clockwise direction making the side of the coil behave as north pole causing repulsion.

If this is not the case then bringing magnet towards a coil will construct a perpetual motion machine by a suitable arrangement.

Therefore production of induced emf in a direction which opposes the change in magnetic flux follows from law of conservation of energy.

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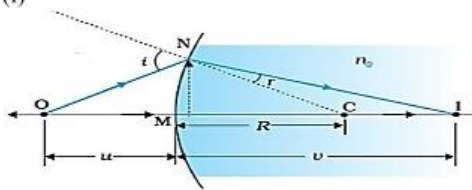
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(a)

- | | | |
|------|---|------------------------------|
| (i) | Drawing ray diagram | 1 |
| | Deriving relation between u , v , n and R | 2 |
| (ii) | Finding position and nature of image | $1\frac{1}{2} + \frac{1}{2}$ |

(i)



For small angles

$$\tan \angle NOM = \frac{MN}{MO}$$

$$\tan \angle NCM = \frac{MO}{MN}$$

$$\tan \angle NCM = \frac{MC}{MN}$$

$$\tan \angle NIM = \frac{MN}{MI}$$

$$i = \angle NOM + \angle NCM$$

$$= \frac{MN}{MO} + \frac{MN}{OC} \quad \text{-----(1)}$$

Similarly

$$r = \angle NCM - \angle NIM$$

$$= \frac{MN}{MC} - \frac{MN}{MI} \quad \text{-----}(2)$$

By Snell's law for small angles

$$1 \times i = n \times r$$

substituting i and r from (1) and (2)

$$\frac{1}{M0} + \frac{n}{MI} = \frac{n-1}{MC} \quad \text{-----}(3)$$

Using cartesian sign conventions

$$MO = -u, \quad MI = +v, \quad MC = +R$$

Substituting in (3)

$$\frac{n}{v} - \frac{1}{u} = \frac{n-1}{R}$$

(Note : Give full credit of this part if student derives the relation by forming virtual image.)

$$\text{(ii)} \quad \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{20} = \frac{1}{v} - \frac{1}{-30}$$

$$v = 60 \text{ cm}$$

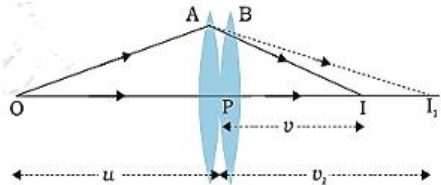
Nature of image: Real and inverted

OR

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1

 $\frac{1}{2}$ $\frac{1}{2}$ [HOME](#) $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

	(b) (i) Deriving expression for focal length of combination of lens 2 (ii) Calculating (I) Fringe width 1 (II) Distance of second dark fringe from central maximum 1 (III) Effect on immersion in water 1 (i)  For image formed by first lens A $\frac{1}{v_1} - \frac{1}{u} = \frac{1}{f_1}$ For image formed by second lens B $\frac{1}{v} - \frac{1}{v_1} = \frac{1}{f_2}$ Adding and comparing with lens formula $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ (ii) (I) $\beta = \frac{\lambda D}{d}$ $= \frac{550 \times 10^{-9} \times 2.2}{1.1 \times 10^{-3}}$ $= 1.1 \text{ mm}$ (II) $x = \frac{(2n-1)\lambda D}{2d}$ $n = 2$ $x = 1.65 \text{ mm}$ (III) Fringe width decreases (Alternatively) $\beta' = \frac{\beta}{n}$	HOME $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1	HOME 5
33.	(a) (i) (I) Identifying nature of two charges $\frac{1}{2} + \frac{1}{2}$ (II) Finding value of $\left(\frac{Q_1}{Q_2}\right)$ 1 Justification 1 (ii) Finding electrostatic potential energy 2 (i) (I) Q_1 - Positive	$\frac{1}{2}$	

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	(2)	$r_1 < x < r_2$			
		$\phi = \frac{(Q+2q)}{\epsilon_0}$		$\frac{1}{2}$	
(II)	(1)	$x > r_3$		$\frac{1}{2}$	
		$E = \frac{k(Q-q)}{x^2}$			
	(2)	$r_1 < x < r_2$		$\frac{1}{2}$	
		$E = \frac{k(Q+2q)}{x^2}$			
(III)	(1)	$\sigma = \frac{-2q}{4\pi r_1^2}$		$\frac{1}{2}$	
	(2)	$\sigma = \frac{-(Q+2q)}{4\pi r_2^2}$		$\frac{1}{2}$	5

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