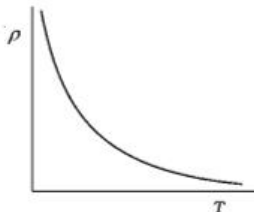
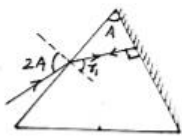


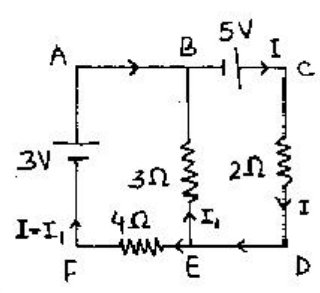
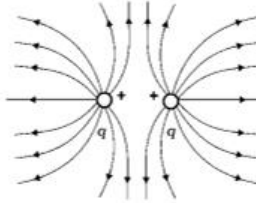
MARKING SCHEME: PHYSICS (042)			
Session: 2025–26			
Code: 55/ 2 /3			
Q. No.	VALUE POINTS/EXPECTED ANSWERS	Marks	Total Marks
SECTION – A			
1.	(D) $\frac{1}{\sqrt{3}}$	1	1
2.	(C) Wbs^{-2}, Wbs^{-1}	1	1
3.	(C) 1 mA	1	1
4.	(D) The final potential of the system equals $\frac{1}{4\pi\epsilon_0} \frac{(q_1 + q_2)(r_1 + r_2)}{r_1 r_2}$	1	1
5.	(A) South	1	1
6.	(C) Copper	1	1
7.	(D) $\frac{m}{n} = \frac{\beta}{\alpha} = c$	1	1
8.	(C) is repelled by loop A	1	1
9.	(D) 2.1×10^{-34} Js	1	1
10.	(C) n^3	1	1
11.	(A) 2.21×10^{-35} kg	1	1
12.	(B) 5.4J	1	1
13.	(C) Assertion (A) is true but Reason (R) is false	1	1
14.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)	1	1
15.	(D) Assertion (A) is false and Reason (R) is also false.	1	1
16.	(B) Both assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A)	1	1
SECTION – B			
17.	Finding the ratio λ_a/λ_p (i) For same kinetic energy 1 (ii) For same accelerating potential 1 (i) $\lambda = \frac{h}{\sqrt{2mK}}$ $\frac{\lambda_a}{\lambda_p} = \sqrt{\frac{m_p}{m_a}} = \sqrt{\frac{m}{4m}}$ $= \frac{1}{2}$ (ii) $\lambda = \frac{h}{\sqrt{2mqV}}$ $\frac{\lambda_a}{\lambda_p} = \sqrt{\frac{m_p q_p}{m_a q_a}} = \sqrt{\frac{m}{4m} \cdot \frac{e}{2e}}$ $= \frac{1}{2\sqrt{2}}$	1/2 1/2 1/2 1/2	2

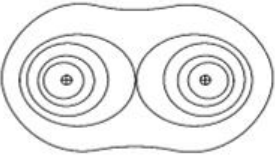
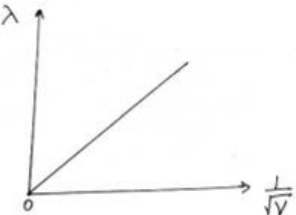
	$= \frac{6 \times 500 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}}$ $= 18 \text{ mm}$ Alternatively : $n\lambda_1 = (n + 1)\lambda_2$, we get $n=5$ $y_s^{\max} = \frac{n_2 \lambda_2 D}{d} = \frac{5 \times 600 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}} = 18 \text{ mm}$	1/2		HOME
20.	(a) • Giving cause of using manganin as wire-wound standard resistors. $\frac{1}{2}$ • Calculating the temperature $\frac{1}{2}$ (b) • Explaining the dependence of a semiconductor on temperature $\frac{1}{2}$ • Showing on a plot (graph) $\frac{1}{2}$ (a) • Manganin (an alloy) exhibit a very weak dependence of resistivity with temperature $R_2 = R_1[1 + \alpha(t_2 - t_1)]$ $1.25R_1 = R_1[1 + 0.004(t_2 - 27.5)]$ $t_2 = 90^\circ\text{C}$ $\frac{1}{2}$ (b) • The resistivity of semiconductors decreases with increasing temperature. $\frac{1}{2}$ •  $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2	HOME
21.	• Tracing the ray diagram. 1 • Finding relation between the refractive index and angle of prism. 1  From Snell's Law $n_1 \sin i = n_2 \sin r$ $A = r_1 + r_2$ $A = r_1 \quad \because r_2 = 0$ $1 \times \sin 2A = n \times \sin A$ $2 \sin A \cos A = n \times \sin A$ $n = 2 \cos A$	1 $\frac{1}{2}$ $\frac{1}{2}$	2	

SECTION – C			
22.	(i) - Defining mutual inductance of a pair of coils. - Writing SI unit 1 1/2 (ii) Obtaining an expression for mutual inductance. 1 1/2		
	(i) It is the ratio of the magnetic flux linked with a coil to the current flowing in the neighbouring coil. Alternatively: It is the ratio of magnitude of induced emf in a coil to the rate of change of current in the neighbouring coil. Note: Award (1/2) mark if a student writes $M = \frac{\phi}{I}$ OR $M = \frac{ \varepsilon }{di/dt}$ SI unit: henry(H) Or Tm^2A^{-1} Or WbA^{-1} or VsA^{-1} (ii) If current I is setup through the solenoid, the magnetic field inside at its center $B = \mu_0 nI$ Flux linked with the circular loop of radius $r (< R)$ $\phi_B = BA$ $\phi_B = (\mu_0 nI)(\pi r^2)$ Mutual Inductance $M = \frac{\phi_B}{I}$ $M = \mu_0 n\pi r^2$ OR - Deducing the expression for force acting on conductor B and showing the direction of force. - Writing the expression for force acting on conductor A - Showing that Newton's third law is obeyed	1	
		1/2	
		1/2	
		1/2	
		1/2	
		1	
Note: Deduct 1/2 mark if direction of force on conductor B is not shown.			

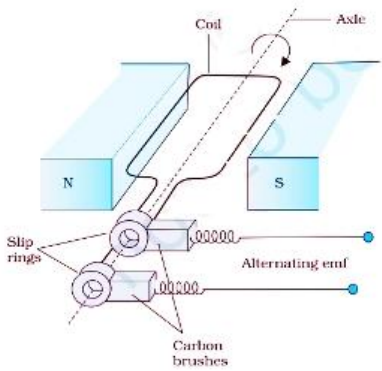
	Magnetic field due to current carrying conductor A at all points along the conductor B $\vec{B}_a = \frac{\mu_0 I_a}{2\pi d} (-\hat{k})$ Force experienced by a segment of length L of conductor B $\vec{F}_{BA} = I_b \vec{L} \times \vec{B}_a$ $\vec{F}_{BA} = I_b L \left(\frac{\mu_0 I_a}{2\pi d} \right) [\hat{i} \times (-\hat{k})]$ $\vec{F}_{BA} = \frac{\mu_0 I_a I_b L}{2\pi d} \hat{j}$ Similarly $\vec{F}_{AB} = \frac{\mu_0 I_a I_b L}{2\pi d} (-\hat{j})$ $\vec{F}_{BA} = -\vec{F}_{AB}$ It follows Newton's third law Alternatively: $B_a = \frac{\mu_0 I_a}{2\pi d}$ Vertically inward $F_{BA} = I_b L B_a = \frac{\mu_0 I_a I_b L}{2\pi d}$ directed towards A $F_{AB} = I_a L B_b$ $F_{AB} = \frac{\mu_0 I_a I_b L}{2\pi d}$ It is equal in magnitude to F_{BA} but directed towards the conductor 'B'. Thus $\vec{F}_{BA} = -\vec{F}_{AB}$ Thus, they follow Newton's third law. Note: Award 1 mark for the diagram if the directions are not indicated in diagram but written	1/2 1/2 1/2 1/2 3	HOME HOME
23.	Deriving an expression for the magnetic field 3 The magnitude of magnetic field (dB) due to current element Idl is $dB = \frac{\mu_0}{4\pi} \frac{I d\vec{l} \times \vec{a} }{a^3}$ $dB = \frac{\mu_0}{4\pi} \frac{I dl}{(r^2 + x^2)^{3/2}}$	1/2 1/2	

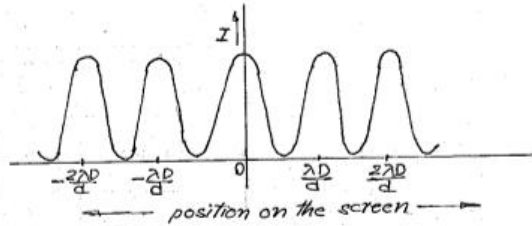
	The components of the magnetic field perpendicular to the x-axis ($dB_{\perp}$) are summed over and get cancelled. The components of the magnetic field along the x-axis contribute towards the net magnetic field $B_x = \int dB \cos \theta$ $= \int \frac{\mu_0}{4\pi} \frac{I dl}{(x^2 + r^2)} \cdot \frac{r}{\sqrt{x^2 + r^2}}$ $\vec{B} = B_x \hat{i} = \frac{\mu_0 I r^2}{2(x^2 + r^2)^{3/2}} (\hat{i})$ For N number of turns, net magnetic field $\vec{B}_{net} = \frac{\mu_0 N I r^2}{2(x^2 + r^2)^{3/2}} (\hat{i})$	1/2 1/2 1/2 1/2	3
24.	(a) Identifying • Isotopes 1/2 • Isotones 1/2 (b) • Writing dependence of size of nucleus on its mass number (A) 1/2 • Proving that density of nucleus is independent of A 1 1/2 (a) • Isotopes: $^{12}_6\text{C}$, $^{14}_6\text{C}$ • Isotones: $^{198}_{80}\text{Hg}$, $^{197}_{79}\text{Au}$ (b) • Size of nucleus $\propto A^{1/3}$ Alternatively: $R = R_0 A^{1/3}$ • Suppose m is the average mass of a nucleon, density of nucleus $\rho = \frac{\text{Mass}}{\text{Volume}}$ $\rho = \frac{mA}{\frac{4}{3}\pi(R_0 A^{1/3})^3}$ $\rho = \frac{3m}{4\pi R_0^3} = \text{constant}$	1/2 1/2 1/2 1/2 1/2	3
25.	(a) Explaining the statement 1 (b) Finding the current through 3Ω resistor in the circuit 2 (a) Electric current is a scalar quantity because it does not obey law of vector addition.	1	

	The current with an arrow is only to signify the direction of conventional current. Alternatively: Current do not follow the law of vector definition. The current through an area of cross-section is given by the scalar product of two vectors. $I = \vec{j} \cdot \vec{\Delta S}$ (b)  In Loop ABEFA $3 + 3I_1 - 4(I - I_1) = 0$ $4I - 7I_1 = 3 \dots \dots \dots (1)$ In loop BCDEB $5 - 2I - 3I_1 = 0$ $2I + 3I_1 = 5 \dots \dots \dots (2)$ Solving equations (1) and (2), we get Current through 3Ω resistor is $I_1 = \frac{7}{13} \text{ A}$ Note: Award full marks if a student solves by another appropriate current distribution in the circuit.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
26.	(a) Drawing for two equal positive charges • Electric field lines 1 • Equipotential surfaces 1 (b) Explaining that electric field need not be a constant over each point of an equipotential surface. 1 	1	

	 Note: Award full credit (2 marks) if any student draws both in the same diagram (b) Different points on an equipotential surface might be at different distances from the source charge, so the electric field will not be constant at all points as shown in the above diagram.	1		
27.	Naming the electromagnetic waves and writing their wavelength range (i) Also known as 'heat waves'. $\frac{1}{2} + \frac{1}{2}$ (ii) Used in LASIK eye surgery. $\frac{1}{2} + \frac{1}{2}$ (iii) Used to destroy cancer cells. $\frac{1}{2} + \frac{1}{2}$ (i) Infrared waves Wavelength range: 1mm to 700 nm (ii) Ultraviolet rays Wavelength range: 400 nm to 1nm (iii) Gamma rays Wavelength range: $<10^{-3}$ nm	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$		3
28.	(a) Deducing an expression for de Broglie wavelength 2 (b) Plotting a graph for a particle showing variation of de Broglie wavelength λ with $\frac{1}{\sqrt{V}}$ 1 (a) Let charged particle is accelerated by potential difference V. $\frac{1}{2}mv^2 = qV$ $v = \sqrt{\frac{2qV}{m}}$ De Broglie wavelength $\lambda = \frac{h}{mv}$ $\lambda = \frac{h}{m\sqrt{\frac{2qV}{m}}}$ $\lambda = \frac{h}{\sqrt{2mqV}}$ (b) 	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$		3

HOME

	Applying Pythagorean theorem, we get $V_m^2 = V_{Rm}^2 + (V_{Cm} - V_{Lm})^2$ $V_m^2 = (i_m R)^2 + (i_m X_C - i_m X_L)^2$ $I_m = \frac{V_m}{\sqrt{R^2 + (X_C - X_L)^2}} = \frac{V_m}{Z}$ Where $Z = \sqrt{R^2 + (X_C - X_L)^2}$ is impedance $\tan \phi = \frac{V_{Cm} - V_{Lm}}{V_{Rm}} = \frac{X_C - X_L}{R}$ Or $\phi = \tan^{-1} \left(\frac{X_C - X_L}{R} \right)$ (b) (i) At resonance i.e., $X_C = X_L$ (ii) When the average power consumed is zero. Alternatively: $P_{avg} = V_{rms} I_{rms} \cos \phi$ For $\phi = \pi/2$; $\cos \phi = 0$, $\therefore P_{avg} = 0$ OR (i) For ac generator • labelled diagram / construction 1 • Principle 1 • Working 1 (ii) Deducing expression for induced emf 1 (iii) Giving the times at which emf generated is maximum in terms of T 1 (i) 	1 1/2 1 1 1 1 1	HOME HOME
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	• Principle: It is based on the principle of electromagnetic induction. When the magnetic flux passing through a coil changes continuously, emf is induced. - Working: When coil is rotated in magnetic field, magnetic flux linked with it changes and emf is induced in the coil.	1	
	(ii) Flux linked with a coil at any instant of time placed in magnetic field rotating with angular speed ω $\phi_B = BA \cos \omega t$ From Faraday's law $\varepsilon = -N \frac{d\phi_B}{dt}$ $\varepsilon = NBA\omega \sin \omega t$	$\frac{1}{2}$	
	(iii) EMF generated is maximum at $\frac{T}{4}$ and $\frac{3T}{4}$	$\frac{1}{2}$	
		1	5
33.	(a) • Defining coherent sources • Necessity for observing stable interference pattern • Drawing graph showing the variation of intensity of light with the position on the screen (b) Finding the intensity of light for path difference (i) $\frac{\lambda}{4}$ (ii) $\frac{\lambda}{3}$	1	
	(a) • Two sources of light emitting waves of same frequency and constant phase or zero phase difference are said to be coherent.	1	
	• If the sources are incoherent, interference pattern will change with time. Hence the positions of maxima and minima will also vary rapidly with time and we obtain 'time averaged' intensity distribution. <u>Alternatively:</u> If the two sources are coherent then the phase difference at any point will not change with time and we will have a stable interference pattern.	1	
		1	

$$(b) (i) \quad I = 4I_0 \cos^2 \left(\frac{\phi}{2} \right)$$

$$\Delta p = \frac{\lambda}{4}$$

$$\phi = \frac{2\pi}{\lambda} \cdot \frac{\lambda}{4}$$

$$\phi = \frac{\pi}{2}$$

$$I = 4I_0 \cos^2 \frac{\pi}{4}$$

$$= 2I_0$$

1/2

1/2

$$(ii) \quad \Delta p = \frac{\lambda}{3}$$

$$\phi = \frac{2\pi}{\lambda} \cdot \frac{\lambda}{3}$$

$$\phi = \frac{2\pi}{3}$$

$$I = 4I_0 \cos^2 \frac{\pi}{3}$$

$$= I_0$$

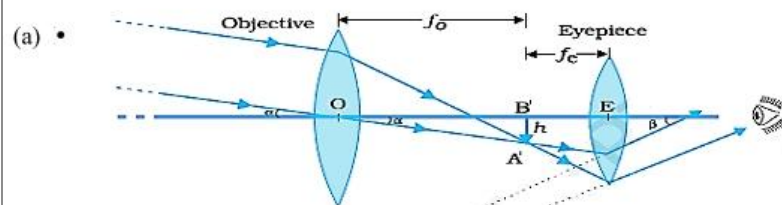
1/2

1/2

Note: Award (1/2) mark if the student writes $I = 4I_0 \cos^2 \left(\frac{\phi}{2} \right)$
OR

In OSM Q33 with Choice has been shown as Q33(a) OR Q33(b) (i) OR and 33 (b) (ii) OR for the first option and 33(a), 33(b) (i) and 33(b) (ii) for the other option.

- | | | |
|-----|--|---|
| (a) | • Drawing labelled ray diagram of refracting telescope | 1 |
| | • Deriving expression for its magnifying power | 2 |
| (b) | (i) I Giving reason for the larger aperture of objective | 1 |
| | (ii) II Writing two advantages of reflecting telescope | 1 |



1

$$\bullet \quad m = \frac{\beta}{\alpha} \approx \frac{\tan \beta}{\tan \alpha}$$

1

$$= \frac{h/f_e}{h/f_o}$$

1/2

