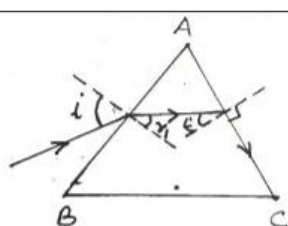
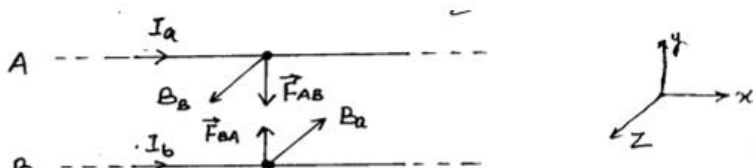
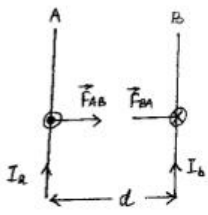
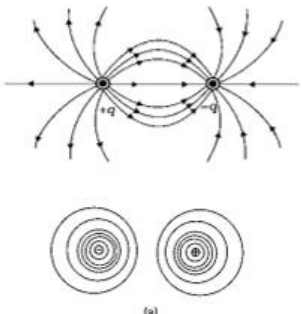
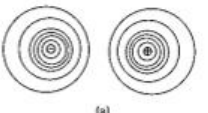


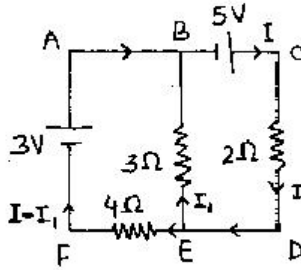
MARKING SCHEME: PHYSICS (042)			
Session: 2025–26			
Code: 55/ 2 /2			
Q. No.	VALUE POINTS/EXPECTED ANSWERS	Marks	Total Marks
SECTION – A			
1.	(B) $\frac{-2q^2}{3\pi\epsilon_0}$	1	1
2.	(C) $V_1 > V_2 > V_3$	1	1
3.	(A) $\frac{1}{n^2}$	1	1
4.	(D) The final potential of the system equals $\frac{1}{4\pi\epsilon_0} \frac{(q_1 + q_2)(r_1 + r_2)}{r_1 r_2}$	1	1
5.	(C) $\frac{v}{5}$	1	1
6.	(D) Acceleration of the magnet remains uniform as it moves through the loop.	1	1
7.	(C) III	1	1
8.	(D) Nickel	1	1
9.	(C) z-axis	1	1
10.	(C) 1 mA	1	1
11.	(C) $\text{Wbs}^{-2}, \text{Wbs}^{-1}$	1	1
12.	(D) $\frac{1}{\sqrt{3}}$	1	1
13.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)	1	1
14.	(C) Assertion (A) is true but Reason (R) is false	1	1
15.	(B) Both assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A)	1	1
16.	(D) Assertion (A) is false and Reason (R) is also false.	1	1
SECTION – B			
17.	Calculating the length of the image 2 $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ $\frac{1}{v_1} = \frac{1}{f} - \frac{1}{u_1}$	$\frac{1}{2}$	

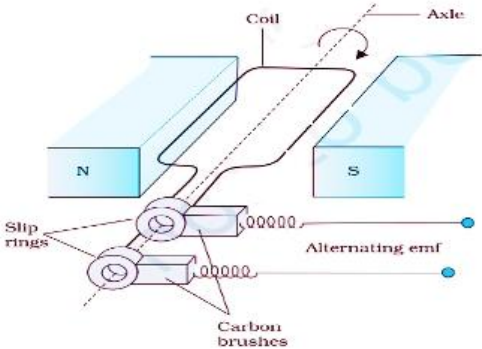
	$= \frac{1}{(-20)} - \frac{1}{(-25)}$ $v_1 = -100\text{cm}$ $\frac{1}{v_2} = \frac{1}{(-20)} - \frac{1}{(-30)}$ $v_2 = -60\text{ cm}$ Length of the image $L = v_1 - v_2 = 40\text{cm}$ OR Calculating the least distance of coincidence of bright fringes 2 $n_1 \lambda_1 = n_2 \lambda_2$ $\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1}$ $\frac{n_1}{n_2} = \frac{600}{500} = \frac{6}{5}$ $y_6^{\max} = n_1 \frac{\lambda_1 D}{d}$ $= \frac{6 \times 500 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}}$ $= 18\text{ mm}$ Alternatively : $n\lambda_1 = (n+1)\lambda_2$, we get $n=5$ $y_5^{\max} = \frac{n_2 \lambda_2 D}{d} = \frac{5 \times 600 \times 10^{-9} \times 1.8}{0.3 \times 10^{-3}} = 18\text{ mm}$	1/2 1/2 1/2 1/2	2
18.	Calculating the temperature 2 $R_2 = R_1[1 + \alpha(t_2 - t_1)]$ $1.2R_1 = R_1[1 + 2.0 \times 10^{-4}(t_2 - 27)]$ $0.2 = [2.0 \times 10^{-4}(t_2 - 27)]$ $t_2 = 1027^\circ\text{C}$	1/2 1/2 1/2 1/2	2
19.	Finding the angle of incidence 2 $\sqrt{2}(\sin i_c) = 1$ $(\sin i_c) = \frac{1}{\sqrt{2}}$ $i_c = 45^\circ$ $r_1 + r_2 = A \text{ (Here } r_2 = i_c)$ $r_1 = A - i_c$ 	1/2 1/2	

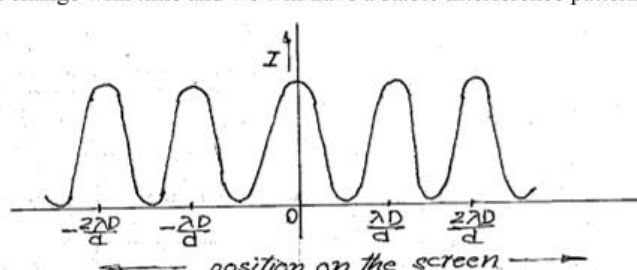
SECTION – C			
22.	- Defining mutual inductance of a pair of coils. 1 - Writing SI unit $1/2$ - Obtaining an expression for mutual inductance. $1\frac{1}{2}$		
(i)	It is the ratio of the magnetic flux linked with a coil to the current flowing in the neighbouring coil. Alternatively: It is the ratio of 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 $M = \frac{ \epsilon }{di/dt}$ SI unit: henry(H) Or Tm^2A^{-1} Or WbA^{-1} or VsA^{-1}	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. $1\frac{1}{2} + 1/2$ - Writing the expression for force acting on conductor A $1/2$ - Showing that Newton's third law is obeyed $1/2$		
	 Note: Deduct $1/2$ mark if direction of force on conductor B is not shown.		

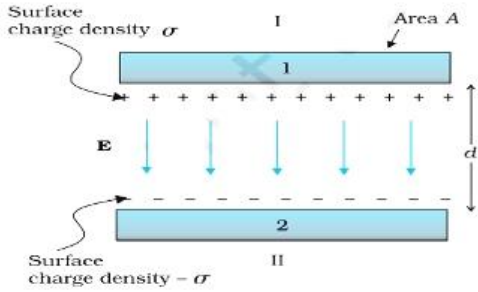
	Magnetic field due to current carrying conductor A at all points along the conductor B $\vec{B}_a = \frac{\mu_0 I_a}{2\pi d} (-\hat{k})$ Force experienced by a segment of length L of conductor B $\vec{F}_{BA} = I_b \vec{L} \times \vec{B}_a$ $\vec{F}_{BA} = I_b L \left(\frac{\mu_0 I_a}{2\pi d} \right) [\hat{i} \times (-\hat{k})]$ $\vec{F}_{BA} = \frac{\mu_0 I_a I_b L}{2\pi d} \hat{j}$ 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: $B_a = \frac{\mu_0 I_a}{2\pi d} \quad \text{Vertically inward}$ $F_{BA} = I_b L B_a = \frac{\mu_0 I_a I_b}{2\pi d} L \quad \text{directed towards A}$ $F_{AB} = I_a L B_b$ $F_{AB} = \frac{\mu_0 I_a I_b L}{2\pi d}$ It is equal in magnitude to F_{BA} but directed towards 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 direction are not indicated in diagram but written 	1/2 1/2 1/2 1/2		HOME
23.	Calculating de Broglie wavelength 3 Total energy of electron in second excited state of hydrogen atom $E_n = \frac{-13.6}{n^2} \text{eV}$ $E_3 = \frac{-13.6}{3^2} \text{eV}$ $E_3 = -1.51 \text{eV}$ $\therefore$ Kinetic energy of electron in this state, $K = 1.51 \text{eV}$ de Broglie wavelength $\lambda = \frac{h}{\sqrt{2mK}}$ $= \frac{6.6 \times 10^{-34}}{\sqrt{2 \times 9 \times 10^{-31} \times 1.51 \times 1.6 \times 10^{-19}}}$ $\lambda \approx 10^{-9} \text{m} = 1 \text{nm}$	1/2 1/2 1/2 1/2 1/2	3	HOME

24.	Naming the electromagnetic waves and writing their wavelength range used: (i) As a diagnostic tool in medicine $\frac{1}{2} + \frac{1}{2}$ (ii) In remote switches for TV sets $\frac{1}{2} + \frac{1}{2}$ (iii) In water purifiers $\frac{1}{2} + \frac{1}{2}$ (i) X-rays Wavelength range: 1nm to $10^{-3}nm$ (ii) Infrared waves Wavelength range: 1mm to 700 nm (iii) Ultraviolet waves Wavelength range: 400 nm to 1nm	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
25.	(i) Drawing for two equal and opposite point charges: • Electric field lines 1 • Equipotential surfaces 1 (ii) Explaining the cause of perpendicularity of electric field to the equipotential surface. 1 (i) •  •  (a) Note: Award full credit (2 marks) if any student draws both in the same diagram (ii) If the field were not normal to the equipotential surface, it would have non-zero component along the surface. To move a unit test charge against the direction of the component of the field, work, would have to be done. But this is in contradiction to the definition of an equipotential surface. Alternatively: $\Delta V = -\vec{E} \cdot \Delta \vec{l}$ $0 = -E \Delta l \cos \theta$ $\theta = 90^\circ$	1 1 1	3

	$= \int \frac{\mu_0}{4\pi} \frac{I dl}{(x^2 + r^2)} \cdot \frac{r}{\sqrt{x^2 + r^2}}$ $\vec{B} = B_x \hat{i} = \frac{\mu_0 I r^2}{2(x^2 + r^2)^{3/2}} (\hat{i})$ For N number of turns, net magnetic field $\vec{B}_{net} = \frac{\mu_0 N I r^2}{2(x^2 + r^2)^{3/2}} (\hat{i})$	$\frac{1}{2}$	$\frac{1}{2}$	3		
28.	(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. 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.	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	3

	$V_m^2 = (i_m R)^2 + (i_m X_C - i_m X_L)^2$ $I_m = \frac{V_m}{\sqrt{R^2 + (X_C - X_L)^2}} = \frac{V_m}{Z}$ 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 $\phi = \pi/2$; $\cos \phi = 0$, $\therefore P_{avg} = 0$ In OSM Q31 with Choice has been shown as Q31(a) OR Q31(b) (i) OR and 31 (b) (ii) OR for the first option and 31(i), 31(ii) and 31(iii) for the other option. OR (i) For ac generator • labelled diagram / construction • Principle • Working (ii) Deducing expression for induced emf (iii) Giving the times at which emf generated is maximum in terms of T (i)  • 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 1/2 1 1 1 1 5 1 1 1 1 1 1	HOME HOME HOME
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	(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 $\varepsilon = -N \frac{d\phi_B}{dt}$ $\varepsilon = NBA\omega \sin \omega t$ (iii) EMF generated is maximum at $\frac{T}{4}$ and $\frac{3T}{4}$	$\frac{1}{2}$ $\frac{1}{2}$ 1	HOME 5
32.	(a) - Defining coherent sources 1 - Necessity for observing stable interference pattern 1 - Drawing graph showing the variation of intensity of light with the position on the screen 1 (b) Finding the intensity of light for path difference (i) $\frac{\lambda}{4}$ 1 (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. • 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. Alternatively: 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. •  (b) (i) $I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$ $\Delta p = \frac{\lambda}{4}$ $\phi = \frac{2\pi}{\lambda} \cdot \frac{\lambda}{4}$	1 1 1	HOME

	(b) (i) With larger aperture even the fainter objects can be observed clearly. Alternatively: With larger aperture, the light gathering power and its resolution / resolving power increases. Alternatively: Large aperture helps in collecting more light from distant object which forms a sharper/ brighter images (ii)II • There is no chromatic aberration in a mirror. • Spherical aberration in case of parabolic reflectors is removed. • Requires less mechanical support • Cost effective • Brighter / sharper image is formed (Any two from above or any other appropriate advantages)	1		
33.	(a) Deriving an expression for capacitance of a parallel plate capacitor 3 (b) Effect on (i) Charge on each capacitor 1 (ii) Energy stored in the capacitor 1 (a)  Electric field between the plates $E = \frac{\sigma}{\epsilon_0}$ $E = \frac{q}{A\epsilon_0}$			

Potential difference		
$V = Ed$		
$= \frac{qd}{A\epsilon_0}$	1	
Capacitance		
$C = \frac{q}{V}$		
$C = \frac{A\epsilon_0}{d}$	1	
(b) (i) In parallel combination the potential difference is same across the capacitors. On insertion of dielectric slab capacitance of each capacitor becomes K (dielectric constant) times.	1	
Alternatively: $C' = KC$ Hence final charge on each capacitor becomes K times.		
Alternatively: $q' = C'V$ $q' = KCV$ $q' = Kq$		
Alternatively: $q'_1 = KC_1V = Kq_1$ $q'_2 = KC_2V = Kq_2$		
(ii) Energy stored by capacitor, $U = \frac{1}{2}CV^2$ As the capacitance becomes K times energy stored by each capacitor also increases by factor K	1	
Alternatively: $U' = KU$		
Alternatively: $U'_1 = \frac{1}{2}KC_1V^2 = KU_1$ $U'_2 = \frac{1}{2}KC_2V^2 = KU_2$		
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 as Q33(a), 33(b)(i) and 33(b)(ii) for the other option.		
(a)		
• Explanation for the time independence of average velocity.	1	
• Obtaining relation between current and average velocity.	2	
(b)		
(i) Reason for instantaneously establishment of current	1	
(ii) Finding the ratio of drift velocities	1	

	(a) • $\vec{v}_d = \frac{-eE\tau}{m}$, where τ is the average time between two successive collisions, which is constant. Distance covered by electrons between two successive collisions is almost same. $S = \frac{1}{2}at^2$ where a=constant, s=almost constant So t is constant. Alternatively At any instant some of the electrons would have spent time more than τ and some less than τ. Thus averaging over all the times we get a constant time. This way we get average velocity independent of time. • Let n is the number of free electrons per unit volume in the conductor of length L and cross-sectional area A. Total charge crossing area A in time Δt is $q = -neA \vec{v}_d \Delta t$ Where negative sign indicates direction of flow of electrons is opposite to direction of electric field. By definition electric current is opposite to flow of electrons. $\therefore I\Delta t = neA \vec{v}_d \Delta t$ $I = neA \vec{v}_d$	1	
		1	
	(b) (i) Electric field is established throughout the circuit, almost instantly causing at every point a local electron drift. As a result current is established instantaneously.	1	
	(ii) $v_d = \frac{I}{ne\pi r^2}$	1/2	
	$\frac{v_{d1}}{v_{d2}} = \left(\frac{r_2}{r_1}\right)^2$		
	$= \frac{4}{9}$	1/2	5