

**VELLORE DISTRICT
COMMON HALF YEARLY EXAMINATION- DEC- 2025
+2 PHYSICS KEY ANSWER**

NOTE:

1. Answer written with Blue or Black ink only to be evaluated.
2. Choose the most suitable answer in Part A from the given alternatives and write the option code and the corresponding answer.
3. For answer in Part-II, Part-III and Part-IV like reasoning, explanation, narration, description and listing of points, students may write in their own words but without changing the concepts and without skipping any point.
4. In numerical problems, if formula is not written, marks should be given for the remaining correct steps.
5. In graphical representation, Physical variables for X-axis and Y-axis should be marked.

TOTAL MARKS - 70

PART - I

Answer all the questions:

15 X 1 = 15

Q.No	OPTION	ANSWERS
1	c	+ Z direction
2	b	0.5 Ω
3	c	$\frac{Q}{\sqrt{2}}$
4	a	8.80 X 10^{-17} J
5	a	$\frac{\mu_0 I}{4r} \otimes$
6	a	10^{45}
7	c	Sky wave propagation
8	b	10 cm
9	d	$\frac{2h}{\pi}$
10	d	polarisation
11	c	0010
12	c	Albert Einstein
13	a	Less than 10^{-9} s
14	d	1.2 F
15	c	3 X 10^6 Vm^{-1}

PART II

Answer any six questions (Question No. 24 is compulsory)

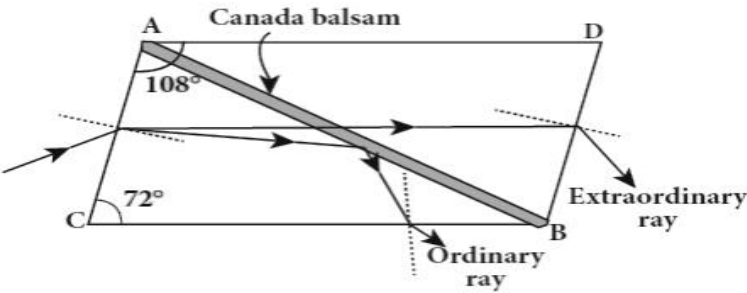
6 X 2 = 12

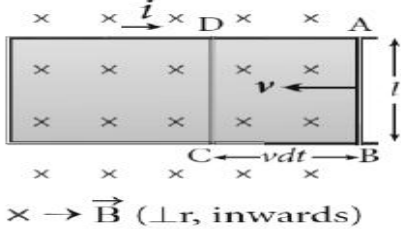
Q.No			
16	$\left[\begin{array}{l} \chi_{m,x} = \frac{ \vec{M} }{ \vec{H} } = \frac{500}{1000} = 0.5 \\ \chi_{m,y} = \frac{ \vec{M} }{ \vec{H} } = \frac{2000}{1000} = 2 \end{array} \right]$ <p>Material y can be easily magnetised</p>	1 1	2
17	<p>If a conductor has cavity, then whatever the charges at the surfaces or whatever the electrical disturbances outside, the electric field inside the cavity is zero.</p> <p>A sensitive electrical instrument which is to be protected from external electrical disturbance is kept inside this cavity. This is called electrostatic shielding. (e.g) Faraday cage</p>	1 + 1	2
18	For a steady current, frequency $f = 0$. So $X_C = \infty$. Thus a capacitive circuit offers infinite resistance to the steady current.		2
19	<p>When a beam of plane polarised light of intensity I_0 is incident on an analyser, the intensity of light transmitted from the analyser varies directly as the square of the cosine of the angle θ between the transmission axes of polariser and analyser.</p> <p>$I = I_0 \cos^2 \theta$ (equation only)</p>	1	2
20	<p>Optical path of a medium is defined as the distance d' light travels in vacuum in the same time it travels a distance d in the medium.</p> <p>$d' = n d$ (equation only)</p>	2 1	2
21	When an electric current is passed through a circuit of a thermocouple, heat is evolved at one junction and absorbed at the other junction. This is known as Peltier effect.		2
22	<p>Black holes are end stage of stars which are highly dense massive object. It has very strong gravitational force such that no particle or even light can escape from it.</p> <p>Its mass ranges 20 times mass of the sun to 1 million times mass of the sun.</p> <p>Every galaxy has black hole at its centre. (Any two)</p>	1 + 1	2
23	For a given metallic surface, the emission of photo electrons takes place only if the frequency of incident light is greater than a certain minimum frequency called Threshold frequency		2
24	$2\pi r = n \lambda$ $2 \times 3.14 \times 13.25 \text{ \AA} = 5 \times \lambda$ $\lambda = 16.64 \text{ \AA}$	1 $\frac{1}{2}$ $\frac{1}{2}$	2

PART III

Answer any six questions (Question No. 33 is compulsory:)

6 X 3 = 18

25	<p>Properties of electromagnetic waves. (Any three points)</p> <p>Electromagnetic waves are produced by any accelerated charge.</p> <p>Electromagnetic waves do not require any medium for propagation.</p> <p>So electromagnetic wave is a non-mechanical wave.</p> <p>Electromagnetic waves travel with the speed of light in vacuum or free space.</p> <p>Electromagnetic waves are not deflected by electric field or magnetic field.</p> <p>Electromagnetic waves can exhibit interference, diffraction and polarization.</p> <p>Electromagnetic waves carry energy, linear momentum and angular momentum.</p>	1+ 1 + 1	3
26	<p>Nicol Prism</p> <p>Diagram + Explanation</p>  <ul style="list-style-type: none"> ➤ For this calcite crystal. ➤ The refractive index for ordinary ray = 1.658 ➤ The refractive index for the extraordinary ray = 1.486 ➤ The refractive index of canada balsam = 1.523 	1 1/2	3
27	<p>Advantages and limitations of amplitude modulation (AM).</p> <ul style="list-style-type: none"> ❖ Advantages of AM : <ol style="list-style-type: none"> i. Easy transmission and reception. ii. Lesser bandwidth requirements. iii. Low cost. ❖ Limitations of AM <ol style="list-style-type: none"> i. Noise level is high . ii. Low efficiency. iii. Small operating range. 	1 1/2	1 1/2

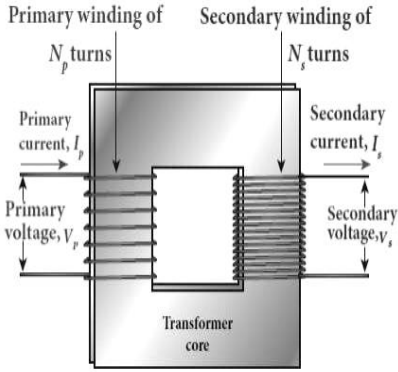
28	<p>Energy stored in capacitor .</p> <ul style="list-style-type: none"> ❖ The work done to transfer 'dQ' amount of charge $dW = V dQ = \frac{Q}{C} dQ$ ($V = \frac{Q}{C}$) ❖ The total work done to charge a capacitor, $W = \int_0^Q \frac{Q}{C} dQ = \frac{Q^2}{2C}$ ❖ This work done is stored as electrostatic energy of the capacitor, $U = \frac{Q^2}{2C}$ (or) $U = \frac{1}{2} CV^2$ 	1 1 1	3
29	<p>Biot savart law (statement or Equation)</p> <p>Diagram</p> <p>$dB \propto I$ $dB \propto dl$ $dB \propto \sin \theta$ $dB \propto \frac{1}{r^2}$</p> <p>$dB \propto \frac{I dl \sin \theta}{r^2}$ (OR) $dB = \frac{\mu_0}{4\pi} \frac{I dl \sin \theta}{r^2}$</p> <p>In vector notation $\vec{dB} = \frac{\mu_0}{4\pi} \frac{I \vec{dl} \times \hat{r}}{r^2}$</p>	1 1/2 1	3
30	<p>Diagram + Explanation</p> <p>When an energetic electron penetrates into the target atom and removes the electrons in K-shell and create a vacancy in it. So the electrons from outer orbits (L,M,N,O.) jump to fill up the vacancy in K-shell.</p>	2 1	
31	<p>Diagram + Explanation</p>  <p>$\times \rightarrow \vec{B}$ ($\perp r$, inwards)</p> <ul style="list-style-type: none"> ➤ Changing area enclosed by loop $dA = l dx = lv dt$ ➤ Changing magnetic flux link with loop $d\phi_B = B lv dt$ ➤ Magnitude of the induced emf $\mathcal{E} = \frac{d\phi_B}{dt} = B lv$ 	1 1/2 1/2 1	3
32	<p>Diagram + Explanation</p> <ul style="list-style-type: none"> ➤ By Snell's law in product form, $n_1 \sin i = n_2 \sin r$ ➤ As the angles are small, $n_1 \tan i = n_2 \tan r$ ➤ $\frac{d'}{d} = \frac{n_2}{n_1}$ $d' = \frac{n_2}{n_1} d$ ➤ For air ; $n_1 = n$, $n_2 = 1$, 	1 1/2 1/2	3

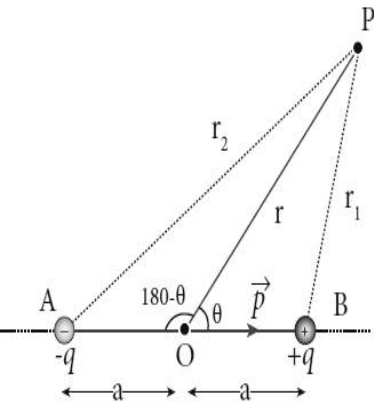
	Then apparent depth $d' = \frac{d}{n}$ (or) $d - d' = d \left(1 - \frac{1}{n}\right)$ Upto	1	
33	$H = I^2 R t$ $= 25 \times 10 \times 300 = 75000 \text{ J or } 75 \text{ kJ}$	1 2	3

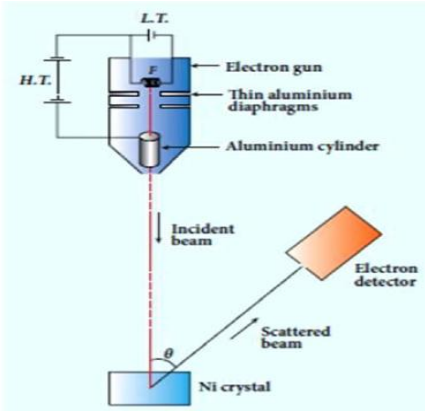
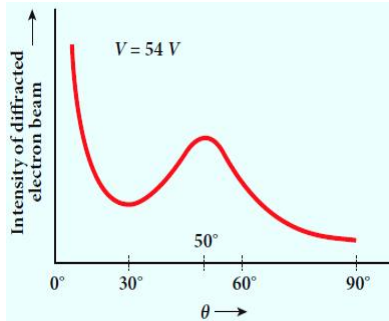
PART IV

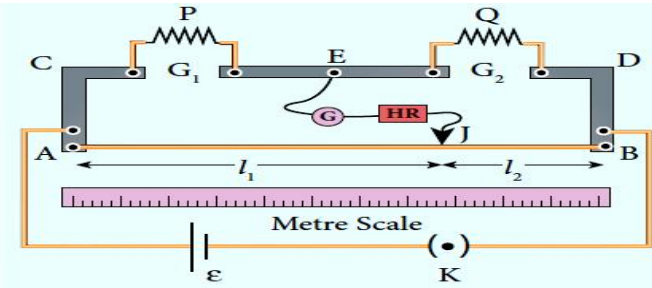
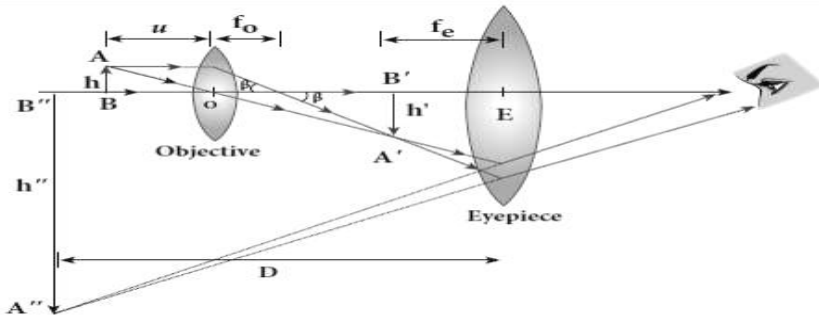
Answer All the questions:

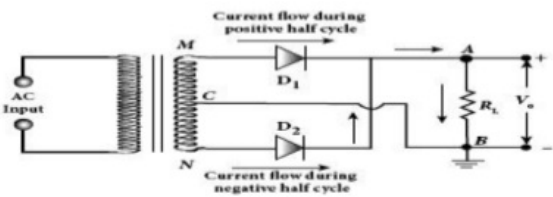
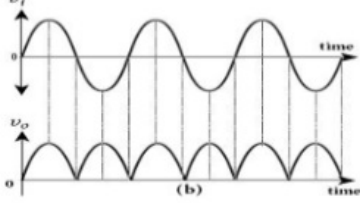
5 X 5 = 25

34 (a)	<p>Construction and working of a transformer.</p> <p>Principle : Mutual induction between two coils.</p> <p>Diagram + Construction</p>  <p>Working</p> $V_P = \epsilon_P = -N_P \frac{d\phi_B}{dt}$ $V_S = \epsilon_S = -N_S \frac{d\phi_B}{dt}$ $\frac{V_S}{V_P} = \frac{N_S}{N_P} = K$ $V_P V_S = V_S i_S$ $\frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{i_P}{i_S} = K$ <p>$K > 1$ step up transformer, $K < 1$ step down transformer (Upto)</p>	1/2 1 1 2 1/2	5
34 (b)	<p>Energy expression for hydrogen atom using Bohr model.</p> $U_n = -\frac{Z^2 m e^4}{4 \epsilon_0^2 h^2 n^2}$ $K E_n = \frac{Z^2 m e^4}{8 \epsilon_0^2 h^2 n^2}$ $U_n = -2 K E$ $E_n = K E_n + U_n$ $E_n = K E_n - 2 K E_n = -K E_n = -\frac{Z^2 m e^4}{8 \epsilon_0^2 h^2 n^2}$ <p>For hydrogen atom ($Z=1$) and substitute the known value</p> $E_n = -\frac{13.6}{n^2} \text{ eV}$	1 1 1/2 1/2 1 1	5

<p>35 (a)</p>	<p>Expression for electrostatic potential due to electric dipole. Diagram + Explanation</p>  $V_1 = \frac{1}{4\pi\epsilon_0} \frac{q}{r_1}$ $V_2 = \frac{-1}{4\pi\epsilon_0} \frac{q}{r_2}$ $V = V_1 + V_2$ $V = \frac{q}{4\pi\epsilon_0} \left(\frac{1}{r_1} - \frac{1}{r_2} \right)$ $\frac{1}{r_1} = \frac{1}{r} \left(1 + \frac{a \cos \theta}{r} \right) \text{ and } \frac{1}{r_2} = \frac{1}{r} \left(1 - \frac{a \cos \theta}{r} \right) \text{ Upto}$ $V = \frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2} \quad (\because p = 2aq)$ <p>(or)</p> $V = \frac{1}{4\pi\epsilon_0} \frac{\vec{p} \cdot \vec{r}}{r^2}$	<p>1</p> <p>2 1/2</p> <p>1 1/2</p>	<p>5</p>
<p>35 (b)</p>	<p>Lens maker formula. Diagram + Explanation</p> <p>For single spherical surface</p> $\frac{n_2}{v} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R}$ <p>For refracting surface (1), the light goes from n_1 to n_2.</p> $\frac{n_2}{v'} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R_1}$ <p>For refracting surface (2), the light goes from n_2 to n_1</p> $\frac{n_1}{v} - \frac{n_2}{v'} = \frac{(n_1 - n_2)}{R_2}$ $\frac{n_1}{v} - \frac{n_1}{u} = (n_2 - n_1) \left[\frac{1}{R_1} - \frac{1}{R_2} \right] \text{ Upto}$ <p>If the object is at infinity, image is formed at the focus. $u = \infty$, $v = f$ $n_2 = n$ and $n_1 = 1$ (air)</p> $\frac{1}{f} = (n - 1) \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ </div> <p style="text-align: right;">Upto</p>	<p>1</p> <p>2</p> <p>2</p>	<p>5</p>

<p>36 (a)</p>	<p>Magnetic field at a point along the axis of a circular coil carrying current. Diagram + Explanation</p> $dB = \frac{\mu_0}{4\pi} \frac{I dl \sin \theta}{r^2} = \frac{\mu_0}{4\pi} \frac{I dl}{r^2} \quad [\because \theta = 90^\circ]$ $\vec{B} = \int d\vec{B} = \int dB \sin \phi \hat{k}$ $\sin \phi = \frac{R}{(R^2 + Z^2)^{1/2}} \quad ; \quad r^2 = (R^2 + Z^2)$ $\vec{B} = \frac{\mu_0 I}{2} \frac{R^2}{(R^2 + Z^2)^{3/2}} \hat{k}$ <p>If the circular coil contains N turns</p> $\vec{B} = \frac{\mu_0 NI}{2} \frac{R^2}{(R^2 + Z^2)^{3/2}} \hat{k}$ <p>The magnetic field at the centre of the coil [$\because z = 0$]</p> $\vec{B} = \frac{\mu_0 IN}{2R} \hat{k}$	<p>1 + 1/2</p> <p>1</p> <p>Upto 1 1/2</p> <p>1</p>	<p>5</p>
<p>36 (b)</p>	<p><u>Davisson - Germer Experiment</u> Diagram</p>  <p>Explanation</p> <p>Graphical explanation</p>  $\lambda = \frac{12.27 \text{ \AA}}{\sqrt{V}} = 1.67 \text{ \AA}$ <p>Value agrees with experimentally observed wavelength 1.65 \AA</p>	<p>1</p> <p>2</p> <p>1</p> <p>1/2</p> <p>1/2</p>	<p>5</p>

<p>37 (a)</p>	<p>Determination of unknown resistance using metre bridge. Diagram + Explanation</p>  $\frac{P}{Q} = \frac{R}{S} = \frac{rAJ}{rJB}$ $\frac{P}{Q} = \frac{AJ}{JB} = \frac{l_1}{l_2}$ <p>Unknown resistance $P = Q \frac{l_1}{l_2}$</p> <p>Specific resistance of the material of the wire</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> $\rho = \frac{PA}{l} = \frac{P\pi r^2}{l}$ </div>	<p>2</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1</p>	<p>5</p>
<p>37 (b)</p>	<p>Compound microscope Diagram + Explanation</p>  $m_0 = \frac{h'}{h} = \frac{L}{f_0}$ $m_e = 1 + \frac{D}{f_e}$ $m = m_0 m_e = \left(\frac{L}{f_0}\right) \left(1 + \frac{D}{f_e}\right)$ $m_e = \frac{D}{f_e}$ <p>The total magnification 'm' in normal focusing is,</p> $m = m_0 m_e = \left(\frac{L}{f_0}\right) \left(\frac{D}{f_e}\right)$	<p>2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>	<p>5</p>

<p>38</p> <p>(a)</p>	<p>Maxwell equations in integral form</p> $\oint_S \vec{E} \cdot d\vec{A} = \frac{Q_{enclosed}}{\epsilon_0}$ $\oint_S \vec{B} \cdot d\vec{A} = 0$ $\oint_l \vec{E} \cdot d\vec{l} = - \frac{d\Phi_B}{dt}$ $\oint_l \vec{B} \cdot d\vec{l} = \mu_0 i_c + \mu_0 \epsilon_0 \frac{d}{dt} \oint_S \vec{E} \cdot d\vec{A}$ <p>Explanation</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>5</p>
<p>38</p> <p>(b)</p>	<p>Construction and working of a full wave rectifier.</p> <p>Construction</p> <p>Working</p>   <p>Efficiency (η) of full wave rectifier is $\eta = 81.2 \%$.</p>	<p>1</p> <p>1 1/2</p> <p>1 + 1</p> <p>1/2</p>	<p>5</p>