DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI- 6
HIGHER SECONDARY SECOND YEAR EXAMINATION - MARCH – 2024

PHYSICS KEY ANSWER

NOTE:

1. Answers 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 their corresponding answer.
3. For answers in Part – II , Part – III , 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 : **15×1=15**

Q.NO	OPTION	TYPE-A	Q.NO.	OPTION	TYPE-B
1	a	Photo Voltaic action	1	c	1.1 eV
2	c	900 Vm^{-1}	2	c	480 W
3	c	480 W	3	a	$Q/\sqrt{2}$
4	a	3	4	d	3750 A^0
5	c	Polarisation	5	d	6 μF
6	a	$Q/\sqrt{2}$	6	a	Photo Voltaic action
7	d	$3/\pi\ P_m$	7	d	Its Wavelength
8	d	Its Wavelength	8	c	900 Vm^{-1}
9	b	$\pi/4$	9	d	$3/\pi\ P_m$
10	a	More than before	10	b	$\pi/4$
11	d	6 μF	11	a	More than before
12	d	3750 A^0	12	a	3
13	a	Plane polarized	13	c	Polarisation
14	a	Albert Einstein	14	a	Plane polarized
15	c	1.1 eV	15	a	Albert Einstein

PART-II

Answer any **Six** Questions : Q.No. **24** is Compulsory. **6×2=12**

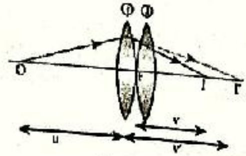
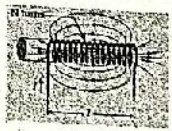
Q.No	ANSWER	MARKS	
16	The Phenomenon of lagging of magnetic induction behind the magnetic field.	2	2
	(or)		
	Hysteresis means 'lagging behind'	1	
17	When a beam of plane polarized light of Intensity I_o is incident on an analyser, the intensity of light I transmitted from the analyser varies directly as the square of the cosine of the angle θ between the transmission axes of polarizer and analyser.	2	2
	(or)		
	$I = I_o \cos^2 \theta$ (Equation only)	1	
18	Electric potential at a point is equal to the work done by an external force to bring a unit positive charge with constant velocity from infinity to the point in the region of the external Electric field.	2	2
	(or)		
	$V_p = -\int_{\infty}^{p} \vec{E}.\vec{dr}$ (or) $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$	1	
19	$\varepsilon = \frac{d\phi}{dt}$	½	2
	$= \frac{4 \times 10^{-3}}{0.4}$	½	
	$= 10 \times 10^{-3} V \, (or) \, 10 mV$	1	
	(If unit is not mentioned reduce ½ mark)		
20	1. Thermo electric generators 2. In automobiles to increase fuel efficiency 3. Thermocouples and thermopiles (Any two points)	2	2
21	$\lambda = \frac{0.6931}{T_{\frac{1}{2}}}$	½	2
	$= \frac{0.6931}{5.01 \times 24 \times 60 \times 60}$	½	
	$= 1.6 \times 10^{-6} s^{-1}$	1	
	(or)		
	$\lambda = \frac{0.6931}{T_{\frac{1}{2}}}$	½	
	$= \frac{0.6931}{5.01 \, days}$	½	
	$= 0.1383 \, days^{-1}$	1	
	(If unit is not mentioned reduce ½ mark)		

22	Electromagnetic waves are non-mechanical waves which move with speed equals to the speed of light in vacuum. (or) If any one property of electromagnetic waves is mentioned	2 1	2
23	Biasing means providing external energy to charge carriers to overcome the barrier potential and make them move in a particular direction. Two types of biasing 1) Forward bias 2) Reverse bias (or) The application of suitable DC Voltages across the transistor terminals is called biasing. Modes of biasing 1) Forward active 2) Saturation 3) Cut off	1 1 1 1	2
24	$P = \frac{1}{f}$ $P = \frac{1}{1.5}$ (or) $\frac{1}{150\times10^{-2}}$ (or) $P = \frac{10}{150}$ P = 0.67 D (or) $P = \frac{2}{3}$ D (If unit is not mentioned reduce ½ mark)	½ ½ 1	2

PART III

Answer Any **Six** Questions : Q.No. **33** is Compulsory **6×3=18**

Q.No	Answer	Marks	
25	Atomic number decreases by one and mass number remains same ${}^{A}_{Z}X \rightarrow {}_{Z-1}^{A}Y + e^{+} + \nu$ $P \rightarrow n + e^{+} + \nu$ (or) Explanation ${}^{22}_{11}Na \rightarrow {}^{22}_{10}Ne + e^{+} + \nu$ (or) Sodium is converted into neon through β^{+} decay (or) any other correct example	1 ½ ½ 1	3
26	$I = neAV_d$ (or) $V_d = \frac{I}{nAe}$ $= \frac{0.2}{8.4\times10^{28}\times1.6\times10^{-19}\times0.5\times10^{-6}}$ $V_d = 0.03\times10^{-3} ms^{-1}$ (If unit is not mentioned reduce ½ mark)	1 1 1	3

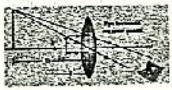
Q.No	Answer	Marks	Total
27	Diagram with Explanation $\frac{1}{v'} - \frac{1}{u} = \frac{1}{f_1}$ $\frac{1}{v} - \frac{1}{v'} = \frac{1}{f_2}$ $\frac{1}{v} - \frac{1}{u} = \frac{1}{f_1} + \frac{1}{f_2}$ $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ 	1 ½ ½ ½ ½	3
28	The deflection produced per unit current flowing through the galvanometer. Current sensitivity of galvanometer increased by 1. Increasing number of turns N 2. Increasing magnetic induction B 3. Increasing the area of the coil A 4. decreasing couple per unit twist of the suspension wire K (or) (Equation only : $I_s = \frac{\theta}{I}$ (or) $\frac{NAB}{K}$ (or) $\frac{I}{G}$)	1 4×½	3
29	$N = \frac{\text{概}}{E} = \frac{P\lambda}{hc}$ $= \frac{50 \times 10^{-3} \times 640 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}}$ $N = 1609.8 \times 10^{14} s^{-1}$ (or) $N = 1.61 \times 10^{17} s^{-1}$ (If unit is not mentioned reduce ½ mark)	1 1 1 1	3
30	Diagram (or) explanation $B = \mu_0 ni$ (or) $\phi_B = BA = (\mu_0 ni)A$ $N\phi_B = \mu_0 n^2 Al\, i$ $N\phi_B = L\, i$ $L = \mu_0 n^2 Al$ (or) $L = \mu n^2 Al$ 	1 ½ ½ ½ ½	3

<table>
<tr><td>31</td><td>
<table>
<tr><th></th><th>Interference</th><th>Diffraction</th></tr>
<tr><td>1</td><td>Equally spaced bright and dark fringes</td><td>Central bright is double the size of other fringes</td></tr>
<tr><td>2</td><td>Equal intensity for all bright fringes</td><td>Intensity falls rapidly for higher order fringes</td></tr>
<tr><td>3</td><td>Large number of fringes are obtained</td><td>Less number of fringes are obtained</td></tr>
</table>
</td><td>3×1</td><td>3</td></tr>
<tr><td>32</td><td>Diagram (or) explanation

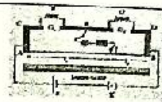
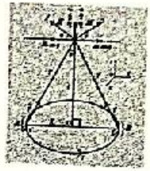
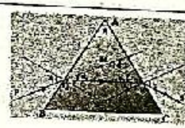
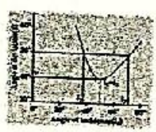
$\phi_E = \oint \vec{E}.\vec{dA}$ (or) $\phi_E = \oint E\, dA \cos\theta$
$\phi_E = \oint EdA$ (or) $\phi_E = E\oint dA$
$\phi_E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2} \times 4\pi r^2$ (or) $E = \frac{Q}{4\pi\varepsilon_0 r^2}$ and $\oint dA = 4\pi r^2$
$\phi_E = \frac{Q}{\varepsilon_0}$</td><td>½
½
½
½
1</td><td>3</td></tr>
<tr><td>33</td><td>$E_g = \frac{hc}{\lambda}$ (or) $\lambda = \frac{hc}{E_g}$
$\lambda = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{1.875 \times 1.6 \times 10^{-1}}$
$\lambda = 660nm$ (If unit is not mentioned reduce ½ mark)
Red colour light is emitted</td><td>½
½
1
1</td><td>3</td></tr>
</table>

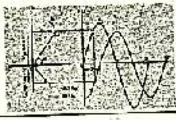
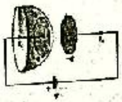
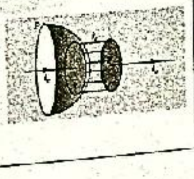
PART – IV

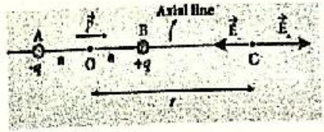
Answer all the Questions 5×5=25

<table>
<tr><th>Q. No</th><th colspan="2">ANSWER</th><th colspan="2">Marks</th></tr>
<tr><td>34
(a)</td><td>Simple microscope
Explanation
Near point focusing - Diagram
Explanation
Upto $m = 1 + \frac{D}{f}$
Normal focusing - Diagram
Explanation
Upto $m = \frac{D}{f}$</td><td>

</td><td>1
½
½
1
½
½
1</td><td>5</td></tr>
<tr><td></td><td colspan="2">(OR)</td><td></td><td></td></tr>
</table>

(b)	Diagram Explanation $\frac{P}{Q} = \frac{R}{S} = \frac{r.AJ}{r.JB}$ $\frac{P}{Q} = \frac{AJ}{JB} = \frac{l_1}{l_2}$ $P = Q.\frac{l_1}{l_2}$		1 1 1 1 1	5
35 (a)	Diagram Explanation of Diagram and component splitting $d\vec{B} = \frac{\mu_0}{4\pi}\frac{\vec{Idl} \times \hat{r}}{r^2}$ (or) $dB = \frac{\mu_0}{4\pi}\frac{Idl \sin\theta}{r^2}$ If $\theta = 90°$ $dB = \frac{\mu_0}{4\pi}\frac{Idl}{r^2}$ From $\vec{B} = \frac{\mu_0 I}{4\pi}\int\frac{dl}{r^2}\sin\emptyset\,\hat{k}$ upto $\vec{B} = \frac{\mu_0 I}{2}\frac{R^2}{(R^2+Z^2)^{3/2}}\hat{k}$ (OR) $\vec{B} = \frac{\mu_0 NI}{2}\frac{R^2}{(R^2+Z^2)^{3/2}}\hat{k}$ $Z = 0, \vec{B} = \frac{\mu_0 NI}{2R}$		1 ½+½ 1 1 1	5
	(OR)			
(b)	Diagram and Explanation upto $d = (i_1 + i_2) - (r_1 + r_2)$ upto $d = (i_1 + i_2) - A$ If $i_1 = i_2 = i$, $r_1 = r_2 = r$ (or) Graph $i = \frac{A+D}{2}$ $r = \frac{A}{2}$ By applying in Snell's law $n = \frac{si\left(\frac{A+D}{2}\right)}{\sin\left(A/2\right)}$	 	1 1 ½ ½ 1 1	5

36 (a)	Diagram Photon energy = work function+kinetic energy (or) Explanation $h\nu = \emptyset_0 + \frac{1}{2}mv^2$ At $\nu = \nu_0$ (threshold frequency), Kinetic energy of electron is Zero $h\nu_0 = \emptyset_0$ $h\nu = h\nu_0 + \frac{1}{2}mv^2$ (or) Equivalent Equation		1 1 1 1 1	5
	(OR)			
(b)	Diagram and Explanation $V = V_m \sin \omega t$ $\varepsilon = -L\frac{di}{dt}$ $di = \frac{V_m}{L}\sin\omega t\, dt$ $i = \frac{V_m}{\omega L}\sin(\omega t - \pi/2)$ (or) upto $i = I_m \sin(\omega t - \pi/2)$ Current lags behind voltage by $\pi/2$ or 90^0 Phasor Diagram and wave Diagram	 	1 1 ½ 1 ½ ½+½	5
37 (a)	Merits • Decrease in noise [or] increase in signal noise ratio • Operating range is large • High transmission efficiency • Broad bandwidth • Better quality (Any Three) Limitations • Requires wider channel • FM transmitter and receiver are more complex • Costly • Compared to AM, FM covers less area (Any Two)		3×1 2×1	5
	(OR)			
(b)	Diagram or explanation $\oint \vec{B}.\overrightarrow{dl} = \mu_0 i_c$ Diagram or explanation $\oint \vec{B}.\overrightarrow{dl} = 0$ Diagram or explanation $\phi_E = \oint \vec{E}.\overrightarrow{dA} = EA = \frac{q}{\varepsilon_0}$ upto $i_d = \varepsilon_0 \frac{d\phi_E}{dt}$ or definition of displacement current $\oint \vec{B}.\overrightarrow{dl} = \mu_0(i_c + i_d)$ (or) $= \mu_0 i_c + \mu_0\varepsilon_0 \frac{d\phi_E}{dt}$ (or) $= \mu_0 i_c + \mu_0\varepsilon_0 \frac{d}{dt}\oint \vec{E}.\overrightarrow{dA}$	  	1 1 1 1 1	5

38 (a)	Diagram and Explanation		1	
	$\vec{E}_+ = \frac{1}{4\pi\epsilon_0}\frac{q}{(r-a)^2}\hat{p}$ $\vec{E}_- = \frac{-1}{4\pi\epsilon_0}\frac{q}{(r+a)^2}\hat{p}$		1	
	$\vec{E}_{Tot} = \vec{E}_+ + \vec{E}_-$		½	5
	Upto $\vec{E}_{Tot} = \frac{q}{4\pi\epsilon_0}\left[\frac{4ra}{(r^2-a^2)^2}\right]\hat{p}$		1	
	$\vec{E}_{Tot} = \frac{2\vec{P}}{4\pi\epsilon_0 r^3}$		1	
	$\vec{p} = 2aq\hat{p}$		½	
	(OR)			
(b)	**Nuclear reactor** Nuclear reactor is a system in which nuclear fission takes place in a self-sustained controlled manner.		2	
	Moderator It is a material used to convert fast neutrons into slow neutrons. Eg: water, D_2O, graphite (any one)		1	
	Control rods It is used to control the rate of the reaction. (or absorb excess neutrons produced in a reaction) Eg: Cadmium or Boron (any one)		1	5
	Cooling System Absorbs the heat – transfers to heat exchanger – steam produced – rotates turbine – produces electricity. Eg: water, heavy water, liquid sodium. (any one)		1	