 VELLORE DISTRICT

Quarterly Examination Sept - 2024

XII - PHYSICS

Marks : 70

ANSWER KEY

M. ARUN
PGT - PHYSICS
GBHSS - KATPADI-07

Part - I Choose the correct answer: $15 \times 1 = 15$

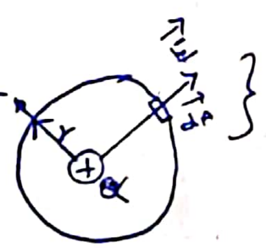
1. a) 2 A
2. c) $\frac{Q}{\sqrt{2}}$
3. b) magnetic field
4. c) More than before
5. c) uniformly charged Infinite plane
6. c) $N m^2 C^{-1}$
7. a) In phase and perpendicular to each other
8. a) an accelerating charge
9. c) 480 W
10. b) Yellow - violet - orange - silver
11. b) It's wavelength
12. c) refraction
13. a) 0.833
14. c) $\sqrt{\frac{2q^3B^2V}{m}}$
15. b) 45°

Part - II Answer any 6 Questions (Q.no 21 : compulsory) $6 \times 2 = 12$

			Marks
16.	Corona Discharge: Leakage of charges from the sharp edge of the conductor		2
17.	Any two differences.	1 + 1 mk	2
18.	Biot - Savart law. If Equation only $dB = \frac{\mu_0}{4\pi}\frac{Idl\sin\theta}{r^2}$ ----→	1 mk	2
19.	Q - factor: Q - factor = $\frac{\text{voltage across L (or) C at resonance}}{\text{Applied voltage}}$ (or) Q-factor = $\frac{1}{R}\sqrt{\frac{L}{C}}$ Equation only	1 mk	2
20.	Electric field lines never intersect Justify		2
21.	$I = \frac{q}{t} = \frac{ne}{t}$ (or) $n = \frac{It}{e}$	1 mk	2
	$'n' = \frac{32 \times 1}{1.6 \times 10^{-19} C}$	½ mk	
	$n = 20 \times 10^{19} = 2 \times 10^{20}$ electrons	½ mk	

22	IR Radiation two uses:		2 mk
	* It's used to provide electrical energy to statellites	1 mk	
	* It's used to produce dehydrated fruits	1 mk	
23.	Two conditions for total Internal reflection		2 mk
	* light must travel from denser to rarer medium	1 mk	
	* Angle of incidence in denser medium must be greater than critical angle ($i > i_c$)	1 mk	
24	$X_L = L\omega = L \times 2\pi f$		2 mk
	$= 2 \times 3.14 \times 1000 \times 0.4$		
	$= 2512\,\Omega$	1 mk	
	$V = I X_L$		
	$= 6 \times 10^{-3} \times 2512$		
	$= 15.072$ (RMS)	1 mk	

part - III Answer any 6 Question (Q.No 30 is compulsory) $6 \times 3 = 18$

25.	Any three Differences	1+1+1	3 mk
26.	Resistor in Series		3 mk
	Diagram + Explanation	1 mk	
	$V = V_1 + V_2 + V_2$	½ mk	
	$IR_S = IR_1 + IR_2 + IR_3$	½ mk	
	$R_S = R_1 + R_2 + R_3$	1 mk	
27.	Gauss law from Coulomb's law		3 mk
	Diagram + Explanation	1 mk	
	$\Phi_E = E \oint dA$; $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$; $\oint dA = 4\pi r^2$ 	1 mk	
	$\Phi_E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2} \times 4\pi r^2$; $\Phi_E = \frac{Q}{\varepsilon_0}$	1 mk	
28	properties of Dia, para and ferromagnetic (Any one properties of each magnetic material)	1+1+1	3 mk

29.	Induced an emf by changing the area enclosed by the coil		
	Diagram + Explanation	1 mk	3 mk
	Changing area enclosed by loop $dA = l \cdot dx = l\,v\,dt$ $d\phi = B\,l\,v\,dt$	1 mk	
	$\varepsilon = \frac{d\phi_B}{dt} = Blv$	1 mk	
30.	$I = \frac{2R B_H}{\mu_0 N} \tan\theta$	1 mk	3 mk
	Subst: $\frac{2 \times 0.12 \times 25 \times 10^{-6} \times 1.732}{4 \times 10^{-7} \times 3.14 \times 100}$	1 mk	
	$I = 0.82 \times 10^{-1}\,A$ (or) $I = 0.082\,A$	1 mk	
31.	Maxwell's Equations in integral form		3 mk
	$\oint_S \vec{E} \cdot \vec{dA} = \frac{Q}{\varepsilon_0}$ $\oint_S \vec{B} \cdot \vec{dA} = 0$	1 mk	
	$\oint_l \vec{E} \cdot \vec{dl} = -\frac{d\phi_B}{dt}$	1 mk	
	$\oint_l \vec{B} \cdot \vec{dl} = \mu_0 i_c + \mu_0 \varepsilon_0 \frac{d}{dt} \oint_S \vec{E} \cdot \vec{dA}$	1 mk	
32.	Relation between f and R for Spherical mirror		3 mk
	Any one Diagram	1/2 mk	
	$\tan i = \frac{PM}{PC} = i$ $\tan 2i = \frac{PM}{PF} = 2i$ $\frac{1}{PF} = \frac{2}{PC}$	1 1/2 mk	
	$R = 2f$ (or) $f = \frac{R}{2}$	1 mk	
33.	$d = i_1 + i_2 - A$ $= 30^\circ + 75^\circ - 60^\circ = 45^\circ$	1 mk	3 mk
	$d = i_1 + i_2 - A$ $= 0 + 90^\circ - 60^\circ = 30^\circ$	1 mk	
	$\sin i_c = \frac{1}{n}$ $n = \frac{1}{\sin i_c} = \frac{1}{\sin 60^\circ} = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}}$ $= 1.15$	1 mk	

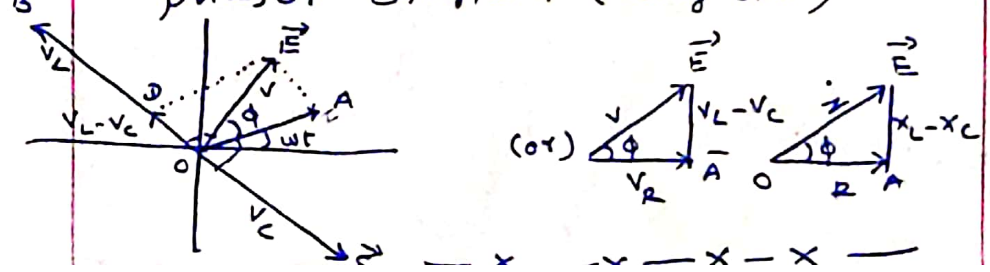
Part - IV Answer all the questions

34(a)	Axial line		5mk
	Explanation + Diagram	1mk	
	$\vec{E}_+ = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2}\hat{p}$; $\vec{E}_- = -\frac{1}{4\pi\varepsilon_0}\frac{q}{(r+a)^2}\hat{p}$ --->	1mk	
	$\vec{E}_{tot} = \vec{E}_+ + \vec{E}_-$		
	$\vec{E}_{tot} = \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{(r-a)^2} - \frac{1}{(r+a)^2}\right]\hat{p}$		
	$\vec{E}_{tot} = \frac{q}{4\pi\varepsilon_0}\left[\frac{4ra}{(r^2-a^2)^2}\right]\hat{p}$ upto -->	1½ mk	
	$\vec{E}_{tot} = \frac{1}{4\pi\varepsilon_0}\frac{2\vec{p}}{r^3}$ ∵ $\vec{p} = 2aq\hat{p}$	1½ mk	
34(b)	Fizeau's method (OR)		5mk
	Explanation + Diagram	2mk	
	Angular speed $\omega = \frac{\theta}{t} = \frac{\pi}{Nt}$ ∵ $\theta = \frac{\pi}{N}$	1mk	
	time taken $t = \frac{\pi}{N\omega}$	½ mk	
	speed of light $v = \frac{2d}{t} = \frac{2dN\omega}{\pi}$	1mk	
	$v = 2.99792 \times 10^8\ ms^{-1}$	½ mk	
35(a)	Internal resistance of a cell using voltmeter		5mk.
	Explanation + Diagram (both)	1½ mk	
	$V = IR$	1 mk	
	$V = \varepsilon - Ir$ (or) $Ir = \varepsilon - V$	1mk	
	$\frac{Ir}{IR} = \frac{\varepsilon - V}{V}$	½ mk	
	Internal resistance $r = \left(\frac{\varepsilon - V}{V}\right)R$	1 mk	

35(b)	Types of Emission spectrum (or)		5 mk
	Continuous emission spectrum with examples	1 ½ mk	
	Line emission spectrum with examples	2 mk	
	Band emission spectrum with examples	1 ½ mk	
	(or) only types mentioned	(or) 2 mk	
36(a)	Biot-Savart law application		5 mk
	Explanation + Diagram	1 mk	
	$\vec{dB} = \frac{\mu_0}{4\pi} \frac{I\,dl \sin\theta}{r^2} \hat{n}$	½ mk	
	$dl \sin\theta = r \cdot d\phi$; $\vec{dB} = \frac{\mu_0}{4\pi} \frac{I\,d\phi}{r} \hat{n}$	1 mk	
	$r = \frac{a}{\cos\phi}$; $\vec{dB} = \frac{\mu_0 I}{4\pi a} \cos\phi\, d\phi\, \hat{n}$; $\vec{B} = \frac{\mu_0 I}{4\pi a}(\sin\phi_1 + \sin\phi_2)\hat{n}$	1 ½ mk	
	$B = \frac{\mu_0 I}{2\pi a}$ (or) $\vec{B} = \frac{\mu_0 I}{2\pi a}\hat{n}$	1 mk	
36(b)	Working of Transformer (OR)		5 mk
	Principle : Diagram :	~~1 mk~~ ½ + ½ mk	
	$V_p = \varepsilon_p = -N_p \frac{d\phi_B}{dt}$; $V_s = \varepsilon_s = -N_s \frac{d\phi_B}{dt}$ (OR) construction	1 mk	
	$\frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{i_p}{i_s} = K$	1 mk	
	$K > 1$: $N_s > N_p$, $V_s > V_p$, $i_s > i_p$; $K < 1$: $N_s < N_p$, $V_s < V_p$, $i_s > i_p$ (OR) working	2 mk	

37 (a)	Magnification		
	Explanation + Diagram	1 mk	5 mk
	$\frac{A'B'}{AB} = \frac{PA'}{PA}$ $\frac{A'B'}{PD} = \frac{A'F}{PF}$	1 mk	
	$\frac{PA'}{PA} = \frac{PA' - PF}{PF}$ $PA = -u \quad PA' = -v \quad PF = -f$	1 mk	
	$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$	1 mk	
	Lateral magnification $M = -\frac{v}{u} = \frac{f}{f-u}$	1 mk	
37 (b)	Wheatstone bridge (OR)		5 mk
	Diagram	1 mk	
	$I_1 - I_G - I_3 = 0$ $I_2 + I_G - I_4 = 0$	1 mk	
	$I_1 P + I_G G - I_2 R = 0$ $I_3 Q - I_G G - I_4 S = 0$ (or) $I_1 P + I_3 Q - I_4 S - I_2 R = 0$	1 mk	
	$I_G = 0$ $I_1 = I_3$ $I_2 = I_4$ $I_1 P = I_2 R$ $I_3 Q = I_4 S$	1 mk	
	$\frac{P}{Q} = \frac{R}{S}$ --->	1 mk	

38(a)	**Van de graff Generator**		
	Principle : Electrostatic Induction and Action of points	1 mk	5 mk
	Diagram :	1 mk	
	Construction :	1 mk	
	Working :	1 mk	
	Reduce leakage : The machine is enclosed in a gas filled steel chamber at high pressure	½ mk	
	Uses : To accelerate positive charges for nuclear disintegration	½ mk	
38(b)	**RLC circuit** (OR)		5 mk
	Explanation + Diagram	1 mk	
	$V_R = iR$ (V_R in phase with i) $V_L = iX_L$ (V_L lead i by $\pi/2$) $V_C = iX_C$ (V_C lags i by $\pi/2$)	1 mk	
	$V = \sqrt{V_R^2 + (V_L - V_C)^2}$ $V = i\sqrt{R^2 + (X_L - X_C)^2}$ $i = \frac{V}{\sqrt{R^2 + (X_L - X_C)^2}}$ $i = \frac{V}{Z}$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ up to	1½ mk	
	$\tan\phi = \frac{V_L - V_C}{V_R} = \frac{X_L - X_C}{R}$	½ mk	
	Phasor Diagram (Any one)	1 mk	



— x — x — x — x —