HIGHER SECONDARY MODEL EXAMINATION - FEB - 2025

PHYSICS

HSE II

SY 624

Section A (Any 5)

1) Coulomb ② 10V

3) $\varepsilon = Blv$

4) Current due to change in electric field.

5) +25 cm (Hint → $P = \frac{1}{f} = P_1 + P_2$
$= 7 + -3$
$= +4$
$f = \frac{1}{P} = \frac{1}{+4} = +0.25m$)

6) +13.6 eV

7) $\left(\frac{A_1}{A_2}\right)^{1/3}$ (Hint $R \propto A^{1/3}$)

Section B (Any 5)

8) Constantan (or) Manganin
High resistivity and low temperature coefficient of resistivity.

9) statement or $\int \vec{B} \cdot d\vec{A} = 0$

10) $V_p = 2200V$ $I_p = 5A$, $N_p = 4000$
$V_s = 220V$

$\frac{V_p}{V_s} = \frac{N_p}{N_s} \Rightarrow N_s = \frac{V_s \times N_p}{V_p}$

$= \frac{220 \times 4000}{2200} = 400$

For Ideal transformer, $P_i = P_o$

$V_p I_p = V_s I_s$

$I_s = \frac{V_p I_p}{V_s}$

$= \frac{2200 \times 5}{220}$

$= 50A$

11) a) Radiowaves
b) IR

12) Constructive,

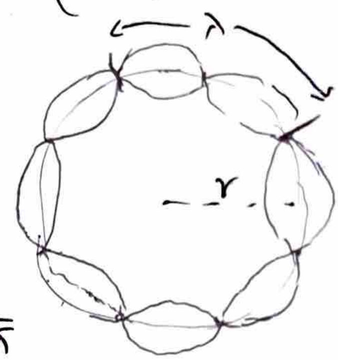
Path difference $= n\lambda$
phase difference $= 2n\pi$

Destructive

$p.d = (2n+1)\frac{\lambda}{2}$

phase dif $= (2n+1)\pi$

13) $2\pi r = n\lambda$



Bohr →

$L = n\frac{h}{2\pi}$

$mvr = n\frac{h}{2\pi}$

$pr = \frac{nh}{2\pi}$

$\frac{2\pi r}{n} = \frac{h}{p}$

$\boxed{\lambda = \frac{h}{p}}$

14) a) Difference between mass of the nucleus and total mass of nucleons.

$\Delta M = (Z M_p + (A-Z)M_n) - M_N$

b) $B.E = \Delta M c^2$

Section C (Any 6)

15) Derivation, $E_{axial} = \frac{1}{4\pi\varepsilon_0}\frac{2P}{r^3}$

16) a) $Q = Q_1 + Q_2 + Q_3$

$C_p V = C_1 V + C_2 V + C_3 V$

$C_p = C_1 + C_2 + C_3$

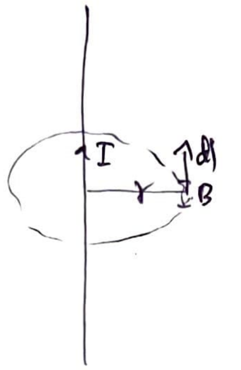
b) $C_p = 3C$

17) $\oint \vec{B} \cdot \vec{dl} = \mu_0 I_e$

$\int B \, dl = \mu_0 I$

$B \times 2\pi r = \mu_0 I$

$B = \frac{\mu_0}{2\pi} \frac{I}{r}$



18) Diamagnetic

$\chi_m \rightarrow$ small, negative

$\mu < \mu_0$

Para

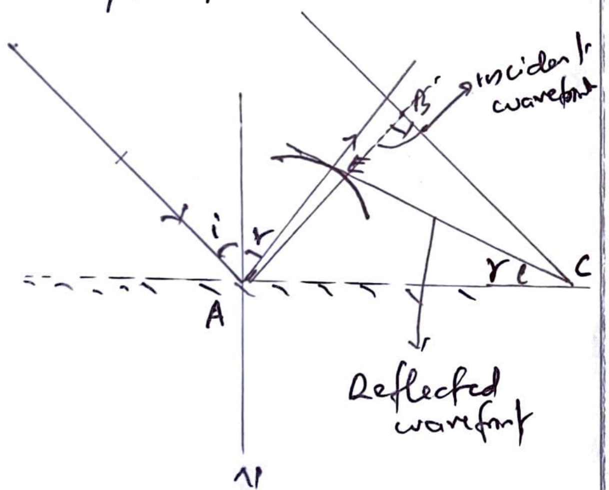
$\chi_m \rightarrow$ small, +ve

$\mu > \mu_0$

Ferro $\chi_m \rightarrow$ large, +ve

$\mu >> \mu_0$

19)



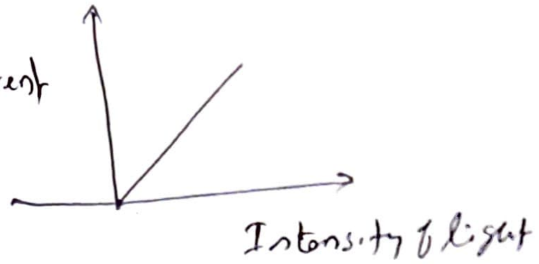
AB is an incident wavefront and EC is the reflected wavefront. AB advance to the point C from B with a speed V.

$\therefore BC = Vt$

AE also equal Vt

Now $\triangle$les EAC and BAC are congruent. which implies $\hat{i} = r$ is the law of reflection.

20)



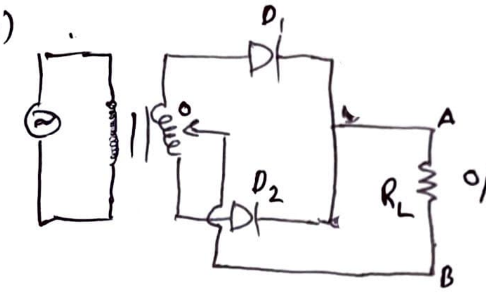
$\phi_0 = 2.14 \, eV$

$\phi_0 = h\nu_0 = 2.14 \times 1.6 \times 10^{-19} J$

$\nu_0 = \frac{2.14 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}}$

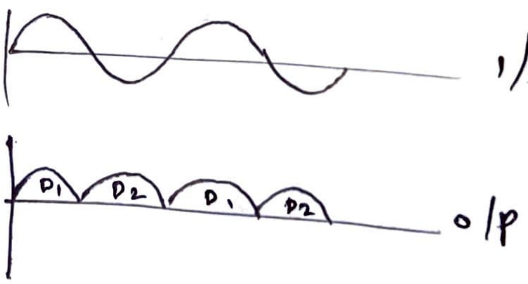
$= 0.516 \times 10^{15} Hz$

21)



During +ve half cycle of ac input, D_1 is forward biased and D_2 is reverse biased and D_1 will conduct. current flows from A to B.

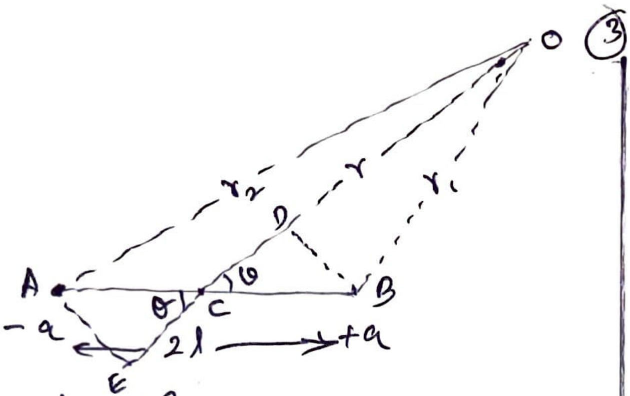
During -ve half cycle, D_1 is reverse biased and D_2 is forward biased, D_2 will conduct. current again flows from A to B.



Section D (Any 3)

22) a

b)



$V_1 = \frac{1}{4\pi\varepsilon_0}\frac{-q}{r_2}$

$V_2 = \frac{1}{4\pi\varepsilon_0}\frac{+q}{r_1}$

$V = V_1 + V_2 = \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$ —(1)

$r_1 = r - DC$

$r_2 = r + CE$

Δles. BDC and AEC ⇒ $DC = CE = l\cos\theta$

$r_1 = r - l\cos\theta$; $r_2 = r + l\cos\theta$

$V = \frac{q}{4\pi\varepsilon_0}\left[\frac{1}{r - l\cos\theta} - \frac{1}{r + l\cos\theta}\right]$

$= \frac{q}{4\pi\varepsilon_0}\left[\frac{2l\cos\theta}{r^2 - l^2\cos^2\theta}\right]$

$r^2 - l^2\cos^2\theta \simeq r^2$, $q \times 2l = p$

$\therefore V = \frac{1}{4\pi\varepsilon_0}\frac{p\cos\theta}{r^2}$

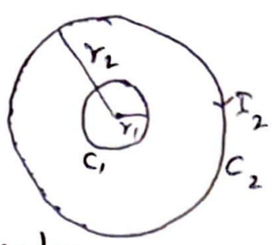
(23) a) Statement (OR) $\Sigma I = 0$

b) Figure,

Derivation, $\frac{R_1}{R_2} = \frac{R_3}{R_4}$

(24) a) Definition

b)



Magnetic field due to C_2 at the centre,

$B_2 = \frac{\mu_0 I_2}{2r_2}$ | $B = \frac{\mu_0 I}{2r}$

Magnetic flux linked with C_1,

$\phi_1 = B_2 \cdot A_1$

$= B_2 A_1$

$= \frac{\mu_0 I_2}{2r_2} \times \pi r_1^2$ —(1)

where $\phi_1 = M_{12} I_2$

Mutual inductance, $M_{12} = \frac{\phi_1}{I_2}$

$= \frac{\mu_0 \pi r_1^2}{2r_2}$

25) a) Ray diagram.

b) $f_o = 144$ cm

$f_e = 6$ cm

(For normal setting)

$m = \frac{f_o}{f_e} = \frac{144}{6} = 24$

$L = f_o + f_e = 144 + 6$

$= 150$ cm

Section E (Any 3)

26) a) 1) True

2) True (Hint → proof of Gauss' law)

b) Derivation, $E = \frac{\sigma}{2\varepsilon_0}$

27) a) Explanation with figure

b) By connecting a large resistance in series with the galvanometer.

(c) $S_I = \frac{\phi}{I} = \frac{NAB}{C}$

28) a) $X_c = \frac{1}{C\omega} = \frac{1}{C \times 2\pi f}$

$= \frac{1}{15 \times 10^{-6} \times 2 \times 3.14 \times 50}$

$= 212.31\ \Omega$

b) $V_{rms} = 220\ V$

$I_{rms} = \frac{V_{rms}}{X_C} = \frac{220}{212.31} = 1.036\ A$

$I_0 = I_{rms} \times \sqrt{2}$

$= 1.036 \times \sqrt{2} = 1.46\ A$

c) Let $E = E_0 \sin \omega t$ be the applied voltage.

Then, $q = CE$

$= CE_0 \sin \omega t$

$I = \frac{dq}{dt} = CE_0 \frac{d}{dt}(\sin \omega t)$

$= CE_0 \cos \omega t \times \omega$

$= C\omega E_0 \sin(\omega t + \pi/2)$

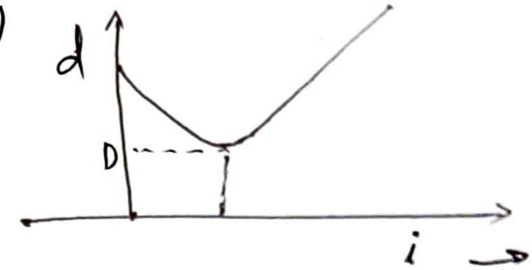
$I = \frac{E_0}{(1/C\omega)} \sin(\omega t + \pi/2)$

$I = I_0 \sin(\omega t + \pi/2)$

29) Derivation,

a) $n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin(A/2)}$

b)



Lalan. V. M
HSST physics
GBHSS Mavelikkara
9496520070