KARNATAKA SCHOOL EXAMINATION AND ASSESMENT BOARD

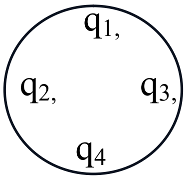
II PUC EXAMINATION – 3

JUNE/JULY - 2024

Subject : **PHYSICS** Subject Code : **33**

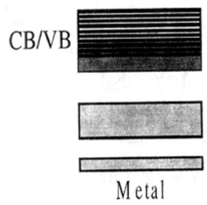
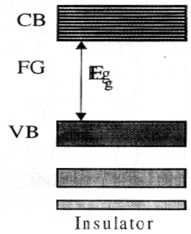
MODEL ANSWER

1.	b) only torque	1M
2.	b) $V\neq 0$ and E=0	1M
3.	d) mobility	1M
4.	c) $\mu_0 \in_0=\frac{1}{c^2}$	1M
5.	b) both statement I and II are correct and II statement is the correct explanation of I	1M
6.	d) energy	1M
7.	b) electrical inertia	1M
8.	d) impedance	1M
9.	c) Maxwell	1M
10.	a) using objective of larger diameter. **Grace** (Out of syllabus question)	1M
11.	b) control the intensity of light	1M
12.	c) only statement I and II are correct	1M
13.	b) nucleus	1M
14.	d) thermonuclear fusion	1M
15.	c) number of free electrons are equal to the number of holes	1M
16.	Circular	1M
17.	AC generator	1M
18.	Diffraction	1M
19.	Independent	1M
20.	Silicon	1M
	PART – B	
21.	Electric flux through a closed surface is $\frac{1}{\varepsilon_0}$ times total charge enclosed by the surface	1M

	Let q_1, q_2, q_3, q_4 …….. be the charges enclosed by the surface **Or**  The electric flux through closed surface is $\varphi_E = \frac{1}{\varepsilon_0}(q_1 + q_2 + q_3 + q_4 + \ldots\ldots)$	1M
22.	$E = -\frac{dV}{dX}$ $E = -\frac{d(ax - bx^2)}{dx} = -a + 2bx$	1M 1M
23.	$\vec{F} = q\,[\vec{E} + (\vec{v} \times \vec{B})]$	1M
	q =point charge , v=velocity E= electric field B= magnetic field	1M
24.	Magnetisation of a sample is the net magnetic moment acquired per unit volume of the sample.	1M
	SI unit $A\,m^{-1}$	1M
25.	a) When area vector is parallel to the direction of magnetic field **OR** When the surface is perpendicular to the magnetic field.	1M
	b) When area vector is perpendicular to the direction of magnetic field . **OR** When the surface is parallel to the magnetic field. **OR** $\varphi = BAcos\theta$, *where* θ is the angle between magnetic field and area vector. Maximum for $\theta = 0^0$ and minimum for $\theta = 90^0$	1M
26.	a) 1 b)0	1M 1M
27.	used in (1) RADAR system, (2) aircraft navigation, (3) in speed guns to time fast balls,	1M + 1M

	(4) automobiles, (5) microwave ovens *Other applications can write *write any two, each carry one mark	
28.	$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$	1M
	$P = P_1 + P_2$	1M

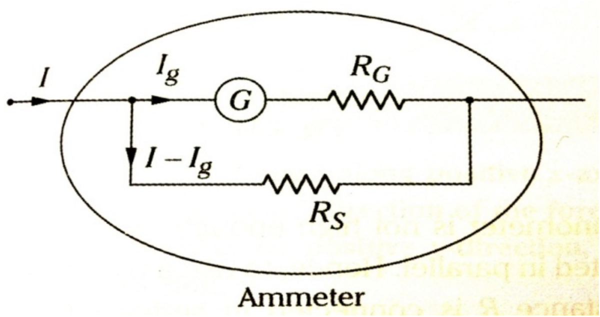
29. (1M + 1M)

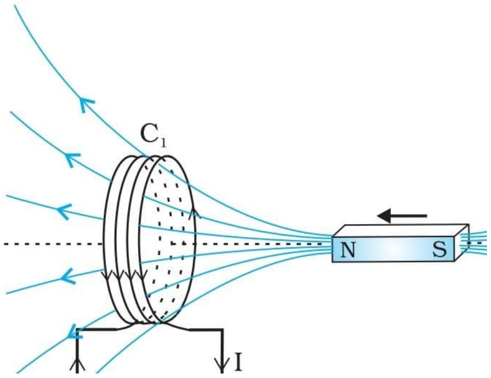
	Conductors	Insulators
1.		
2.	VB and CB are overlapped. Hence forbidden gap is small.	Forbidden gap is very large
3.	At room temperature Valence band and CB are partially filled	At room temperature VB is full & CB is empty.

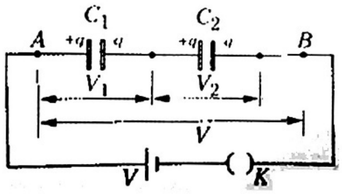
- Write any two each carry one mark
- Other difference can be written

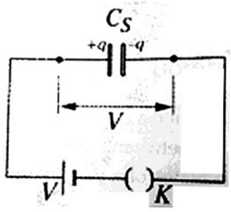
PART - C

30.	1. charge is quantized. 2. charges are conserved. 3. charges are additive in nature. (Each carry one mark)	
31.	The workdone in bringing a point charge q_1 from infinity to a given point in the absence of electric field $W_1 = 0$.	1M
	The amount of work done in bringing a point charge q_2 from infinity a point ,which is at a distance r from q_1 is $W_2 = V(r)\, q_2$	1M
	Work done = potential energy = $W_1 + W_2 = \frac{q_1 q_2}{4\pi\epsilon_0}\frac{1}{r}$	1M

32.	1. length of conductor. 2. area of cross section of conductor 3. temperature 4. Nature of material. • Write any three each carry one mark	1M + 1M + 1M
33.	**<u>Conversion of Galvanometer into Ammeter</u>**  <u>A galvanometer can be converted into an ammeter by connecting a small resistance in parallel to the galvanometer.</u> • The small resistance connected in parallel to the galvanometer to convert it into an ammeter is called shunt. • Let galvanometer of resistance R_G to be converted into ammeter is connected in parallel to a small resistance S. • I_g be the current required to give full scale deflection. then • p.d across R_G = p.d across R_S $I_g R_G = (I - I_g) R_S$ $R_s = \frac{I_g R_G}{(I - I_g)}$	1M 1M 1M
34.	1. They start from north pole and ends at south pole 2. They are continuous and closed. 3. They do not intersect each other . 4. They are crowded at strong field and farther apart in a weak magnetic field **(write any three each carry one mark)**	1M + 1M + 1M

35.	 1.When north pole of magnet is moved towards the coil, the galvanometer shows deflection. When north pole of magnet is moved away from the coil, the galvanometer deflection in opposite directions. Galvanometer also shows deflection, when keeping magnet stationary and coil is moved. Deflection is more in the galvanometer, when magnet is pulled or pushed faster. These observations concludes that, an emf is induced in the coil only there is relative motion between coil and magnet.	1M 1M 1M
36	1. The object should be in denser medium. **OR** Light must travel from denser medium to rarer medium. 2. The angle of incidence must be greater than critical angle **Critical angle :** It is the angle of incidence in denser medium for which the angle of refraction is 90^0	1M 1M 1M
37	1 It is applicable only for hydrogen atom 2. Bohr's model fails to explain intensities of specral lines. 3.It fails to explain fine structure 4.It fails to explain spilting of spectral lines in electric and magnetic field (any three ,each carry 1M)	1M 1M 1M
38	$R= R_0 A^{\frac{1}{3}}$ $R= 1.2\times 10^{-12} (125)^{1/3}$ $=1.2\times10^{-12} \times 5$ $=6 \times10^{-12}$ m	1M 1M 1M

<table>
<tr><td></td><td>PART - D</td><td></td></tr>
<tr><td>39.</td><td>a)




Consider two capacitor of capacitance C_1 and C_2 of charge Q is connected in series.
Let V_1 and V_2 be potential difference across C_1 and C_2 respectively.
From definition, $V = V_1 + V_2$
$V = \frac{Q}{C_1} + \frac{Q}{C_2}$
$\frac{V}{Q} = \frac{1}{C_1} + \frac{1}{C_2}$
$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2}$ OR $C_S = \frac{C_1 C_2}{C_1 + C_2}$</td><td>1M

1M

1M</td></tr>
<tr><td></td><td>(b)
1. Potential on each point of equipotential surface is constant (potential difference between any two points on equipotential surface is zero)
2. Work done to move point charge on equipotential surface is zero .
3. Electric field at every point on equipotential surface is perpendicular to surface
4. No two equipotential surface intersect each other .
5. Equipotential surfaces are closer in the strong electric field and farther apart in the region of weak electric field. (any two each carry 1M)</td><td>1M
+
1M</td></tr>
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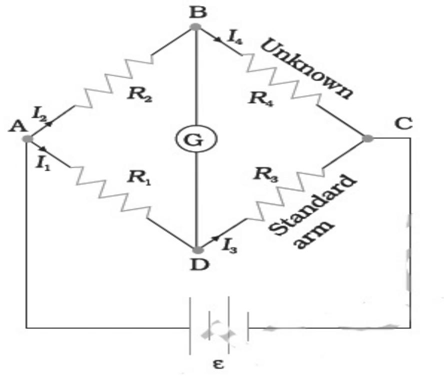
40.



1M

It consists of four resistors of resistances R_1, R_2, R_3 and R_4 connected in the form of a quadrilateral ABCD as shown in Fig.

- A galvanometer of resistance G is connected across one diagonal (BD) and a cell of emf E is connected across the other diagonal (AC).
- The network is said to be electrically balanced if the current through the galvanometer is zero.
- The condition for balance can be derived using Kirchhoff's laws.

Applying KVL, for loop ABDA

$I_2R_2 - I_gG - I_1R_1 = 0 \longrightarrow (1)$

Applying KVL, for loop BCDB, 1M

$(I_2 + I_g)R_4 - (I_1 - I_g)R_3 + I_g G = 0 \longrightarrow (2)$

The network is balanced if $I_g = 0$ 1M

Using Ig = 0 in the above equations we get,

Equation (1) becomes 1M

$I_2R_2 - I_1R_1 = 0$

$I_1R_1 = I_2R_2 \longrightarrow (3)$

Equation (2) becomes

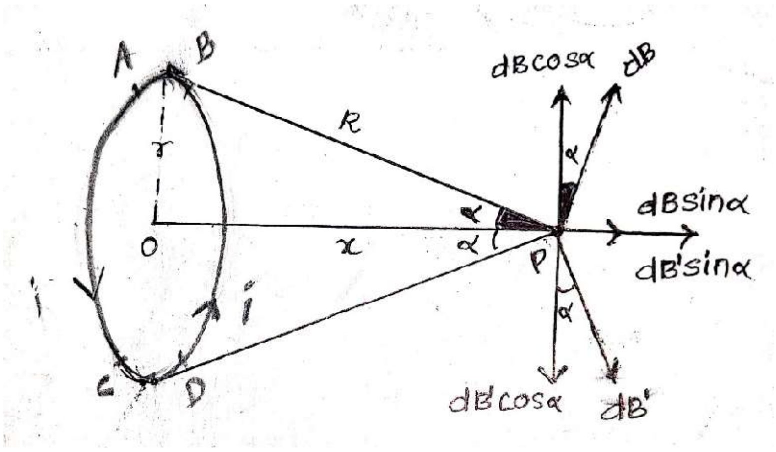
$I_2R_4 - I_1R_3 = 0$

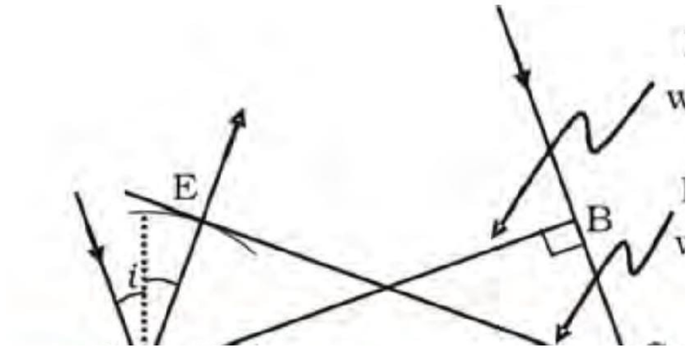
$I_1R_3 = I_2R_4 \longrightarrow (4)$

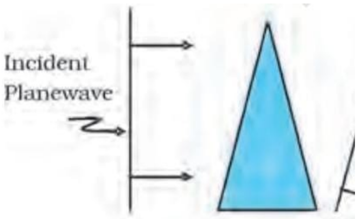
Divide equation (3) by (4)

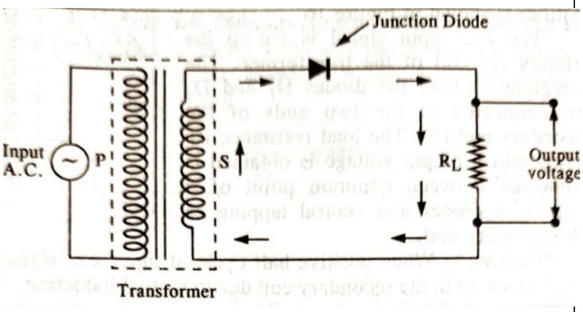
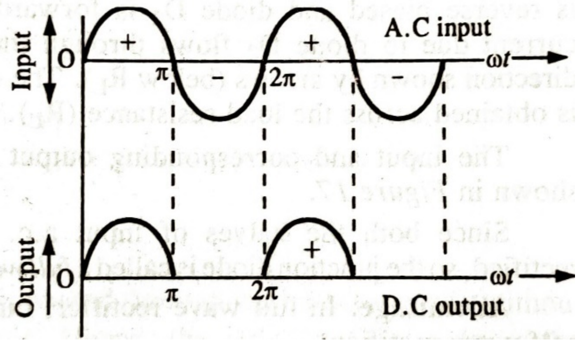
$$\frac{I_1R_1}{I_1R_3} = \frac{I_2R_2}{I_2R_4}$$

Thus, $\frac{R_1}{R_3} = \frac{R_2}{R_4}$ 1M

41.	 Consider a circular coil of 'n' turn and radius 'r' carrying a current I as shown in figure. The plane of the coil is perpendicular to the plane of paper so that its axis lies on the plane of the paper. Let 'P' be a point on the axis of the coil at a distance 'x' from the centre 'O' of the coil. Consider two diametrically opposite current element AB and CD of length 'dl'. Let R be the distance between current element and the point 'P'. From fig. $R^2 = r^2 + x^2 \longrightarrow (1)$ According to Biot- Savart's law, the magnetic field at point 'P' due to current element 'AB' is given by $dB = \frac{\mu_0}{4\pi}\frac{Idl\sin\theta}{R^2} \longrightarrow (2)$ $\because \theta = 90^o$, we have $\sin 90^o = 1$, and $R^2 = r^2 + x^2$ $\therefore dB = \frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)} \longrightarrow (3)$	1M
	The field resolved into two rectangular components as horizontal component of dB. i.e. Along Px is dB sin α. The vertical component of dB i.e., along PY is dB cos α. The magnetic field at 'P' due current element CD is dB'. Let dB' is resolved into two rectangular components as horizontal and vertical.	1M

	The horizontal component of dB i.e., along PX' = dB' sinα. The vertical component of dB' i.e. along PY' = dB' cos α. The vertical components of dB' to current element AB and CD are equal in magnitude but opposite in direction hence cancel each other. The horizontal components of dB due to current element AB and CD add up. ∴ The resultant field at P is B'=2 dBsinα for complete coil.	1M
	B= ΣB' B = Σ2dB sinα $= \Sigma 2\left[\frac{\mu_0 Idl}{4\pi(r^2+x^2)} sin\, \alpha\right]$	1M
	From fig , $sin\, \alpha = \frac{r}{R} = \frac{r}{(r^2+x^2)^{1/2}}$ $B = \Sigma 2\left[\frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)}\frac{r}{(r^2+x^2)^{1/2}}\right]$ $= \left[\frac{\mu_0}{4\pi} I\Sigma 2dl \frac{r}{(r^2+x^2)^{3/2}}\right]$ Since, $\sum 2dl = 2\pi r$ B $= \frac{\mu_0}{4\pi} I.2\pi r \frac{r}{(r^2+x^2)^{3/2}}$ B $= \frac{\mu_0}{4\pi}\frac{2\pi I.r^2}{(r^2+x^2)^{3/2}}$	1M
42.		1M
	Distance travelled by the incident ray in time t is (BC) = vt ----→ (1) Distance travelled by the reflected ray in time t is (AE) = vt ----→ (2) From equation (1) and Equation (2) BC = AE ----→ (3) From Δ[le]ABC	1M

	Sini = $\frac{BC}{AC}$ -----→ (4) From Δ^{le} ACE Sinr = $\frac{AE}{AC}$ From equation (3) BC = AE Sinr = $\frac{BC}{AC}$ ----→ (5) From equation (4) and (5) Sini = sinr i = r i.e., angle of incident = angle of reflection hence the proof	1M
	(b) 	2M
43.	(a) Emission of electrons from the surface of metals when a light of suitable frequency incident on it.	1M
	(b) 1. For a given photosensitive material,above threshold frequency, the photoelectric current is directly proportional to intensity of incident radiation. 2. For a given photosensitive material and frequency of incident radiation, saturation current is proportional to intensity of radiation but stopping potential is independent of its intensity. 3. For a given photosensitive material there exist cut off frequency called threshold frequency, below which no photoelectric effect takes place. 4. Above threshold frequency, kinetic energy of photo electrons increases linearly with frequency of incident radiation. 5. Photo electric effect is an instantaneous process **(write any four each carry one mark)**	

<table>
<tr><td>44.</td><td colspan="2">It is a device which converts AC into DC.</td><td>1M</td></tr>
<tr><td></td><td>Circuit diagram
</td><td>Wave form
</td><td>1M
+
1M</td></tr>
<tr><td></td><td colspan="2">• Circuit diagram one mark
• Input and output waveform one mark</td><td></td></tr>
<tr><td></td><td colspan="2"><u>Working</u> :
• AC voltage which is to be rectified is applied to primary P of the transformer, it induces a voltage in the secandary S of the transformer.
• During positive half cycle of the input, A is positive & B is negative, diode D is forward biased, hence current flows through load resistance R_L.
• During negative half cycle of the input, A is negative, B is positive, diode D is reverse bias, no current flows through load $R_{L.}$
• Thus, current flows through load resistance R_L only for one cycle of AC. Therefore this rectifies half cycle of AC, hence it is called half wave rectifier.</td><td>1M

1M</td></tr>
<tr><td>45.</td><td colspan="2">$F=\frac{Q_1Q_2}{4\pi\epsilon_0 d^2}$

$45\times10^{-3} = \frac{9\times 10^9\times 1.2\times10^{-6}\times 0.6\times 10^{-6}}{d^2}$
d = 0.3794m = 0.38m

$\frac{q}{2}= -0.3 \times10^{-6}$ C
$F= \frac{9\times 10^9\times 0.3\times10^{-6}\times 0.3\times 10^{-6}}{0.38^2}$
$F=5.63\times10^{-3}$ N</td><td>1M

1M
1M

1M

1M</td></tr>
</table>

46.	$$v_d = \frac{i}{nae}$$ $$v_d = \frac{3}{8.5\times 10^{28}\times 1.5\times 10^{-6}\times 1.6\times 10^{-19}}$$ V_d =0.147×10^{-3} ms^{-1} t = $\frac{l}{v_d}$ t = 33.3×10^3 s	1M 1M 1M 1M 1M
47.	$$\omega = \frac{1}{\sqrt{LC}}$$ $$\omega = \frac{1}{\sqrt{25.48\times 10^{-3}\times 796\times 10^{-6}}}$$ ω =222.1 $rads^{-1}$ or f=35.36 Hz I=$\frac{V}{R}$ I=$\frac{220}{10}$ I= 22 A	1M 1M 1M 1M 1M
48.	n = $\frac{sin\left(\frac{A+D}{2}\right)}{sin\left(\frac{A}{2}\right)}$ 1.532 =$\frac{sin\left(\frac{A+D}{2}\right)}{sin(30^0)}$ sin$\left(\frac{60+D}{2}\right)$ = 0.765 $$\left(\frac{60+D}{2}\right) = sin^{-1}(0.766)$$ $$\left(\frac{60+D}{2}\right) = 50^0$$ D= 40^0	1M 1M 1M 1M

PROBLEMS SOLVED BY USING ANY ALTERNATE METHOD, MARKS CAN BE AWARDED