ANNEXURE-A

DAV PUBLIC SCHOOLS, ODISHA ZONE
HALF YEARLY EXAMINATION(2023-24)

SUBJECT : PHYSICS (SET-1) **CLASS :XII**

Time: 3 hours **Max. Mark:70**

BLUE PRINT OF QUESTION PAPER

S.L NO.	**Name of the Chapters**	**Marks Allotted in syllabus**	**MCQ& AR 1mark**	**SA-I 2 marks**	**SA-II 3 marks**	**CB 4 marks**	**LA 5 marks**	**Total Marks**
1	Electric charges & Fields	31	2 [2MCQ]	1	1		1	12
2	Electrostatic potential & Capacitance		1 [1MCQ]	1	1	1		10
3	Current electricity		4 (3MCQ+1-AR)	1	1			9
4	Moving charges & Magnetism	34	2 (1MCQ+1-AR)	1	1		1	12
5	Magnetism & Matter		1 [1MCQ]		1			04
6	Electromagnetic induction		2 [2MCQ]	1		1		08
7	Alternating current		2 (1MCQ+1-AR)		1		1	10
8	Electromagnetic Waves	05	2 (1MCQ+1-AR)		1			05
Total		**70**	$1\times 16 = 16$	$2 \times 5 = 10$	$3 \times 7 = 21$	$4 \times 2 = 8$	$5 \times 3 = 15$	**70**

ANNEXURE-B

DAV PUBLIC SCHOOLS, ODISHA ZONE

HALF YEARLY, EXAMINATION(2023-24)

SUBJECT: PHYSICS (SET-1) **CLASS : XII**

Time: 3 hours **Max.Marks:70**

QUESTION WISE ANALYSIS

Q.NO.	CHAPTERS	**FORMS OF QUESTION**	**MARKS ALLOTTED**	**(R) ,(U) , (A) , (Analyzing, Evaluating , Creating)**
1	Electric charges & Fields	MCQ	1	U
2	Electric charges & Fields	MCQ	1	A
3	Electrostatic potential & Capacitance	MCQ	1	U
4	Current electricity	MCQ	1	A
5	Current electricity	MCQ	1	U
6	Current electricity	MCQ	1	R
7	Moving charges & Magnetism	MCQ	1	U
8	Magnetism & Matter	MCQ	1	R
9	Electromagnetic Induction	MCQ	1	A
10	Electromagnetic Induction	MCQ	1	A
11	Alternating Current	MCQ	1	A
12	Electromagnetic Waves	MCQ	1	R
13	Current electricity	MCQ (AR)	1	Analyse
14	Moving charges & Magnetism	MCQ(AR)	1	Analyse
15	Alternating Current	MCQ (AR)	1	Analyse
16	Electromagnetic Waves	MCQ(AR)	1	Analyse
17	Electric charges & Fields	SA-I	2	R+ U
18	Electrostatic potential & Capacitance	SA-I	2	U
19	Current electricity	SA-I	2	A
20	Moving charges & Magnetism	SA-I	2	R + U
21	Electromagnetic Induction	SA-I	2	Analyse
22	Electric charges & Fields	SA-II	3	U
23	Electrostatic potential & Capacitance	SA-II	3	A
24	Current electricity	SA-II	3	U
25	Moving charges &Magnetism	SA-II	3	C
26	Magnetism & Matter	SA-II	3	U
27	Alternating current	SA-II	3	E
28	Electromagnetic waves	SA-II	3	A
29	Electromagnetic Induction	CB	4	A + E + C
30	Electrostatic potential & Capacitance	CB	4	A + E + C
31	Electric charges & Fields	LA	5	R+U+A
32	Moving charges & Magnetism	LA	5	A+E+C
33	Alternating current	LA	5	A+ U +C
TOTAL			70	

Remembering &Understanding:	**27Marks**	**38%**
Application:	**22Marks**	**32%**
Analyzing, Evaluating & Creating	**21Marks**	**30%**
TOTAL	**70Marks**	**100%**

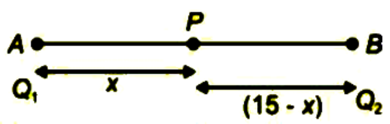
ANNEXURE-C

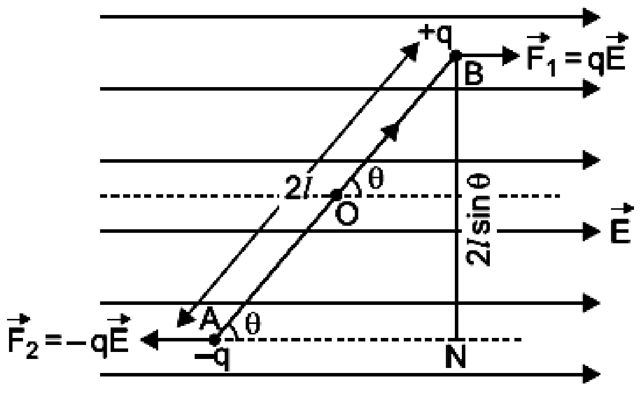
DAV PUBLIC SCHOOLS, ODISHA ZONE

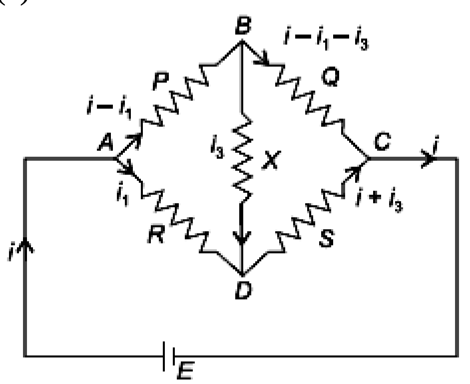
HALF YEARLY EXAMINATION (2023-24)

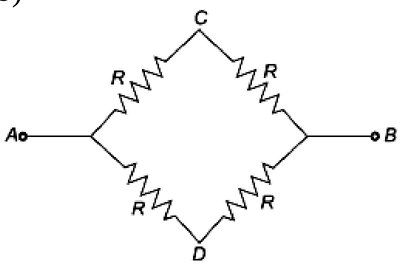
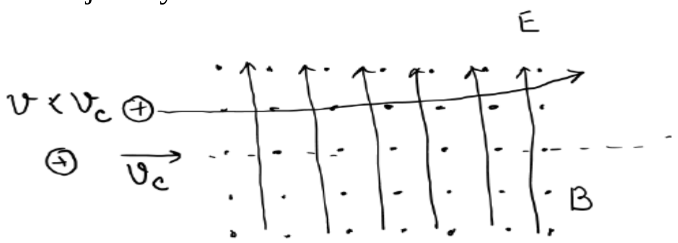
SUBJECT :PHYSICS (SET-1) **CLASS : XII**

MARKING SCHEME

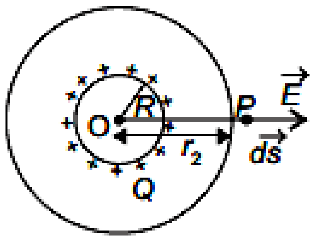
Q. NO.	VALUE POINTS	MARKS ALLOTTED	PAGE NO. OF NCERT TEXT BOOK (OLD BOOK)
	SECTION-A		
1	(c)	1	17
2	(c)	1	47
3	(a)	1	74
4	(b)	1	98
5	(a)	1	129
6	(a)	1	98
7	(d)	1	135
8	(d)	1	192
9	(a)	1	230
10	(d)	1	212
11	(c)	1	248
12	(c)	1	282
13	**(c)**	1	104
14	(b)	1	138
15	(a)	1	222
16	(a)	1	277
	SECTION-B		
17	The uniform charge −Q will be induced on inner surface of the shell and +Q will be induced on outer surface. This is follows from conservation of charge and no static charges reside in the interior of a metal in electrical equilibrium. Using Gauss's law the field at P_1: $E.4\pi\, r_1^2 = Q/\epsilon_0$ Where Qen=+Q, charge inside Gaussian surface of radius r_1 . Thus, $E = Q/4\pi\epsilon_0\, r_1^2$	1 1	39
18.	 $\frac{1}{4\pi\epsilon_0}\left[\frac{3\times10^{-8}}{x\times10^{-2}}-\frac{2\times10^{-8}}{(15-x)\times10^{-2}}\right]=0$ where x is in cm. That is, $\frac{3}{x}-\frac{2}{15-x}=0$ which gives $x = 9$ cm. **OR**	0.5 1 0.5 1.5	58 65

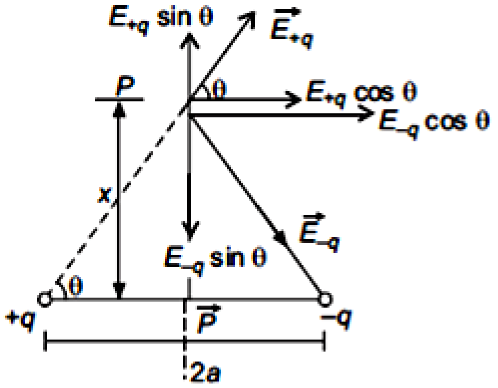
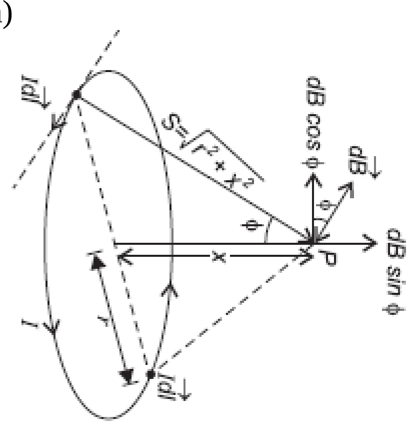
	(a) $U = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r} = 9\times10^9 \times \frac{7\times(-2)\times10^{-12}}{0.18} = -0.7$ J. (b) $W = U_2 - U_1 = 0 - U = 0 - (-0.7) = 0.7$ J.	0.5	
19	The cells are connected in the opposite direction, therefore net emf in the circuit is $E = E_1 - E_2 = 6 - 4 = 2$ V Hence current in the circuit is $I = E/R+r = 2/10 = 0.2$ A P.D. across $E_1 = 6 - 0.2 \times 2 = 5.6$ V P.D. across $E_2 = V_{AB} = 4 + 0.2 \times 8 = 5.6$ V Point B is at higher potential.	 0.5 0.5 0.5 0.5	110
20	$\frac{mV^2}{r} = qVB$ $\Rightarrow r = \frac{mV}{qB}$ $\nu = \frac{V}{2\pi r}$ $\nu = \frac{VqB}{2\pi mV}$ $\nu = \frac{qB}{2\pi m}$	0.5 0.5 0.5 0.5	138
21.	(a) To obtain a large deflection, one or more of the following steps can be taken: (i) Use a rod made of soft iron inside the coil C_2, (ii) Connect the coil to a powerful battery, and (iii) Move the arrangement rapidly towards the test coil C_1. (b) Replace the galvanometer by a small bulb, the kind one finds in a small torch light. The relative motion between the two coils will cause the bulb to glow and thus demonstrate the presence of an induced current.	 1 (Any one step) 1	206
	SECTION-C		
22	(a) 	0.5	31

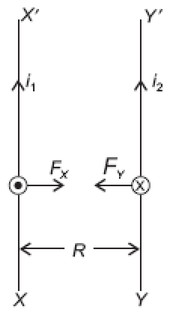
	Net force on electric dipole in uniform electric field is F = $F_1 - F_2 = qE - qE = 0$. Thus there is no translational motion. (b) Torque on the dipole $\tau = F\ (2l \sin\theta) = qE\ 2l \sin\theta$ $\vec{\tau} = \vec{p} \times \vec{E}$ The direction of torque is perpendicularly into the plane of paper.	1 1 0.5	
23	(a) Q = n q (b) $\frac{4}{3}\pi R^3 = n\frac{4}{3}\pi r^3 \Rightarrow R = n^{1/3} r$ If potential of a small drop, $V = \frac{Q}{C}$; then potential of a big drop, $V' = \frac{nQ}{n^{1/3}C} = n^{2/3} V$ (c) Capacity of each droplet, $C = 4\pi\varepsilon_0 r$ Capacity of a big drop, $C' = 4\pi\varepsilon_0 R = 4\pi\varepsilon_0\, n^{1/3} r = n^{1/3}\, C$ OR (a) $V = \frac{KQ}{r}$ $Q = \frac{V}{K\left(\frac{1}{r}\right)}$ $\frac{Q_1}{Q_2} = \frac{\tan\theta_1}{\tan\theta_2} = \frac{\tan 60^0}{\tan 30^0} = 3:1$ (b) $\frac{Q_1}{4\pi\epsilon_0 R_1} = \frac{Q_2}{4\pi\epsilon_0 R_2}$ $\frac{Q_1}{Q_2} = \frac{R_1}{R_2}$ $\frac{\sigma_1}{\sigma_2} = \frac{Q_1}{Q_2}\left(\frac{R_1}{R_2}\right)^2 = \frac{R_2}{R_1}$ => $\frac{\sigma_2}{\sigma_1} = \frac{R_1}{R_2}$	0.5 0.5 1 1 0.5 1 0.5 1	54
24	(a)  Take loop *ABDA*, $P(i - i_1) + Xi_3 - Ri_1 = 0$	0.5 0.5	118

	Take loop BCDB $Q(i - i_1 - i_3) - S(i_1 + i_3) - Xi_3 = 0$ $Q(i - i_1) - Qi_3 - Si_1 - (S + X)i_3 = 0$ As in balanced state, $i_3 = 0$, $P(i - i_1) = Ri_1$ $Q(i - i_1) = Si_1$ $\frac{P}{Q} = \frac{R}{S}$ (b)  $R_{AB} = \frac{(2R)(2R)}{4R} = R\,\Omega$ **OR** (a) Circuit Diagram (b) Net emf = (N-2) E (c) $R_{eff} = R + Nr$ $i = \frac{(N-2)E}{R + Nr}$	0.5 0.5 1 1 1 0.5 0.5	113
25	**E** = E **j** and **B** = B **k** Force on positive ion due to electric field $\mathbf{F_e} = qE\mathbf{j}$ Force due to magnetic field $\mathbf{F_B} = q(\mathbf{v_c} \times \mathbf{B})$ For passing undeflected, $\mathbf{F_e} = -\mathbf{F_B}$ $qE\mathbf{j} = -q(\mathbf{v_c} \times B\mathbf{k})$ This is possible only if $q\mathbf{v_c} \times B\mathbf{k} = qv_cB\mathbf{j}$ or $\mathbf{v_c} = (E/B)\mathbf{i}$ The trajectory would be as shown.  Justification: For positive ions with speed $v < v_c$ Force due to electric field $F'_e = qE = F_e$	0.5 0.5 0.5 0.5	140

	due to magnetic field $F'_B = qvB < F_B$ since $v < v_c$ Now forces are unbalanced, and hence, ion will experience an acceleration along **E**. Since initial velocity is perpendicular to E, the trajectory would be parabolic.	 0.5 0.5	
26	(a) PQ_1 and PQ_2 (b) (i) PQ_3, PQ_6 (stable); (ii) PQ_5, PQ_4 (unstable) (c) PQ_6 Reason: $\mathbf{B}_P = -\frac{\mu_0}{4\pi}\frac{\mathbf{m}_P}{r^3}$ (on the normal bisector) $\mathbf{B}_P = \frac{\mu_0 2}{4\pi}\frac{\mathbf{m}_P}{r^3}$ (on the axis)	0.5 + 0.5 0.5 + 0.5 0.5 0.5	181
27	(a) Angular frequency at resonance $\omega_r = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{5\times 80\times 10^{-6}}} = 50$ rad/s (b) Current at resonance $I_{rms} = \frac{V_{rms}}{R} = \frac{240}{40} = 6$ A (c) V_{rms} across capacitor $V_{rms} = I_{rms}\ X_C$ $= 6\times\frac{1}{50\times 80\times 10^{-6}} = \frac{6\times 10^6}{4\times 10^3} = 1500$ V	 1 1 1	266
28	$E_y = E_0\cos(\omega t - kx)$ N/C $\therefore E_0 = 4\times 10^5$ N/C, $\omega = 3.14\times 10^8$ rad s^{-1}, $k = 1.57$ rad.m^{-1} (a) $v = \frac{\omega}{k} = \frac{3.14\times 10^8}{1.57}$ m/s $= 2\times 10^8$ m/s (b) $\mu = \frac{c}{v} = \frac{3\times 10^8}{2\times 10^8} = 1.5$ (c) $\frac{E_0}{B_0} = c \Rightarrow B_0 = \frac{E_0}{c} = \frac{4\times 10^5}{3\times 10^8}$ T $= 1.33\times 10^{-3}$ T	 1 1 1	287
	SECTION-D		
29	(i) (c) (ii) (b) (iii) (a) (iv) (b) **OR** (iv) (d)	1 1 1 1 1	222, 244

30	(i) (c) (ii) (d) (iii) (b) (iv) (a) **OR** (iv) (b)	1 1 1 1 1	73,81
	SECTION-E		
31	(a) Gauss's Law states that the net outward flux through any closed surface is equal to $\frac{1}{\epsilon_0}$ times the charge enclosed by the closed surface. (i) When the point *P* is inside the shell. In this case, the Gaussian surface lies inside the spherical shell and hence no charge is enclosed by it. $\oint \vec{E}.\vec{ds} = \frac{1}{\varepsilon_0}\times 0 = 0$ or *E* = 0, i.e. there is no electric field inside a charged spherical shell. (ii) When the point *P* lies outside the shell At every point of this shell, the $\vec{E}$ and $\vec{ds}$ are directed outwards in the same direction, i.e. θ = 0.  $\therefore \quad \oint \vec{E}\vec{ds} = \oint E.ds = E\oint ds = E \times 4\pi r_2^2 \quad ...(i)$ Also, by Gauss's law $\oint \vec{E}\vec{ds} = \frac{1}{\varepsilon_0}.Q \quad ...(ii)$ From (*i*) and (*ii*), we get $E \times 4\pi r^2 = \frac{1}{\varepsilon_0}.Q \Rightarrow E = \frac{1}{4\pi\varepsilon_0}.\frac{Q}{r^2} \quad [\because r = r_2]$ (b) $q = \epsilon_0\phi = \epsilon_0(\phi_R + \phi_L)$ $= \epsilon_0(4a^3 - 2a^3) = 2\epsilon_0 a^3$ **OR**	0.5 0.5 0.5 1.5 1+1	39,35

	(a)  $\vec{E} = -(E_{+q} + E_{-q}) \cos\theta \hat{p}$ $\vec{E} = -\frac{2qa}{4\pi\varepsilon_0(x^2+a^2)^{3/2}}\hat{p}$ $\vec{E} = -\frac{\vec{p}}{4\pi\varepsilon_0(x^2+a^2)^{3/2}}$ For x >>a $\vec{E} = -\frac{1}{4\pi\epsilon_0}\frac{\vec{P}}{x^3}$ (b) $\vec{F} = k\frac{q_1q_2}{r^2}\hat{r}$ $r = \sqrt{2}a$ $\hat{r} = \frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}$ $\vec{F} = k\,q.\frac{2q}{(\sqrt{2}a)^2}\left(\frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}\right) = \frac{kq^2}{\sqrt{2}a^2}(\hat{\imath}+\hat{\jmath})N$	1 1.5 0.5 2	28,16
32	(a)  $\lvert\vec{dB}\rvert = \frac{\mu_0}{4\pi}\frac{Idl\sin 90^\circ}{S^2}$ $dB = \frac{\mu_0}{4\pi}\frac{Idl}{S^2} = \frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)} (\because S = \sqrt{r^2+x^2})$ The direction of $\vec{dB}$ is perpendicular to the plane containing $\vec{S}$ and $\vec{dl}$. We resolve $\vec{dB}$ into rectangular components $dB\cos\phi$ and $dB\sin\phi$.	1	145

	Thus, total magnetic field is given by $B = \int dB \sin\phi = \int \frac{\mu_0 I dl \sin\phi}{4\pi(r^2+x^2)}$ $B = \frac{\mu_0 I}{4\pi(r^2+x^2)} \frac{r}{(x^2+r^2)^{1/2}}.2\pi r$ $= \frac{\mu_0 I r^2}{2(r^2+x^2)^{3/2}}$	2	
	(b)Since the total length of the wire used remains the same, N×πd=N′×π(2d) N′=N / 2 Hence the ratio of the magnetic moments=M/M′	1	
	=INA/IN′A′ =NA/N′A′=Nd ^{2}/N′d′^{2} = 2 M′/M = 1/2	1	
	OR		
	(a) 	0.5	154
	The magnitude of magnetic field at each point on Y′ due to current i_1 in XX′ is given by $B_1 = \frac{\mu_0}{2\pi} \cdot \frac{i_1}{R}$	0.5	
	$F_Y = i_2 B_1 l = i_2 \frac{\mu_0}{2\pi} \cdot \frac{i_1}{R} \cdot l$ Force per unit length of YY′ is given by $\frac{F_Y}{l} = \frac{\mu_0}{2\pi} \cdot \frac{i_1 i_2}{R}$	0.5	
	Similarly		

<table>
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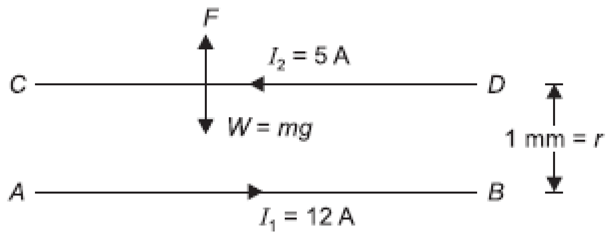
$$\frac{F_X}{l} = \frac{\mu_0}{2\pi} \cdot \frac{i_1 i_2}{R}$$

The force is attractive in nature.

The *ampere* is the value of that steady current which, when maintained in each of the two very long, straight, parallel conductors of negligible cross-section, and placed one metre apart in vacuum, would produce on each of these conductors a force equal to 2×10^{-7}newtons per metre of length.

(b)



$$F = \frac{\mu_0}{4\pi} \cdot \frac{2I_1 I_2}{r} = mg$$

$$m = \frac{\mu_0}{4\pi} \cdot \frac{2I_1 I_2}{rg}$$

$$m = \frac{10^{-7} \times 12 \times 5 \times 2}{1 \times 10^{-3} \times 10}$$

$$m = 12 \times 10^{-4}\ \text{kg-m}^{-1}$$

The direction of current in wire *CD* will be opposite to the direction of current in wire *AB*.

</td>
<td>0.5

1

0.5

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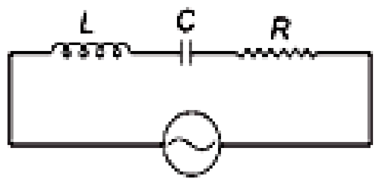
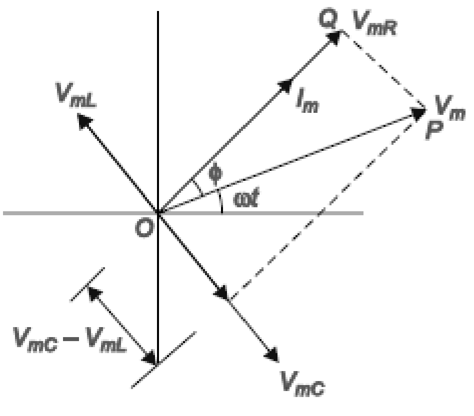


(a)



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1</td>
<td>245</td>
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On applying Pythagoras theorem, we get

$$V_m^2 = V_{Rm}^2 + (V_{Cm} - V_{Lm})^2$$

Here $V_{Rm} = I_m R$, $V_{Cm} = I_m X_C$, $V_{Lm} = I_m X_L$

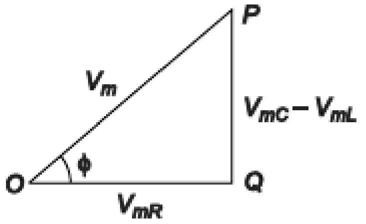
$$V_m = I_m \sqrt{R^2 + (X_C - X_L)^2}$$

$$V_m = I_m Z$$

1

where, $$Z = \sqrt{R^2 + (X_C - X_L)^2}$$

Z is called the impedance of the circuit.



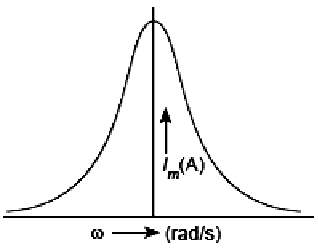
0.5

0.5

$$\phi = \tan^{-1}\left(\frac{V_{Cm} - V_{Lm}}{V_{Rm}}\right)$$

0.5

$$I = I_m \sin(\omega t + \phi)$$



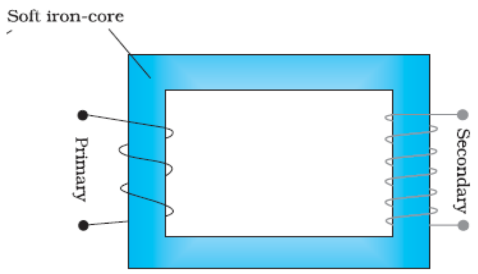
1

259

N. B.- Award marks for $X_L > X_c$

OR

(a)



0.5

0.5

Principle – Based on the principle of mutual induction

(b)

Assumptions-

1

(i) the primary resistance and current are small;

(ii) the same flux links both the primary and the secondary as very little flux escapes from the core, and

	(iii) the secondary current is small. Theory- $\varepsilon_p = -N_p \frac{d\phi}{dt}$ $\varepsilon_s = -N_s \frac{d\phi}{dt}$ But $\varepsilon_p = V_p$. If this were not so, the primary current would be infinite since the primary has zero resistance(as assumed). If the secondary is an open circuit or the current taken from it is small, then to a good approximation $\varepsilon_s = V_s$ where V_s is the voltage across the secondary. $v_s = -N_s \frac{d\phi}{dt}$ $v_p = -N_p \frac{d\phi}{dt}$ $\frac{v_s}{v_p} = \frac{N_s}{N_p}$ If the transformer is assumed to be 100% efficient (no energy losses), the power input is equal to the power output, and since $p = i\,v$, $i_p v_p = i_s v_s$ $\frac{i_p}{i_s} = \frac{v_s}{v_p} = \frac{N_s}{N_p}$ (c)The large scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up (so that current is reduced and consequently, the I^2R loss is cut down).	0.5 0.5 0.5 0.5 1	