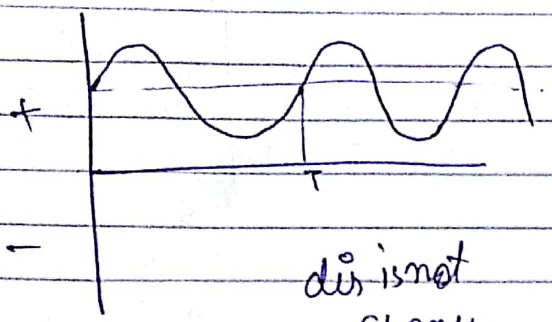
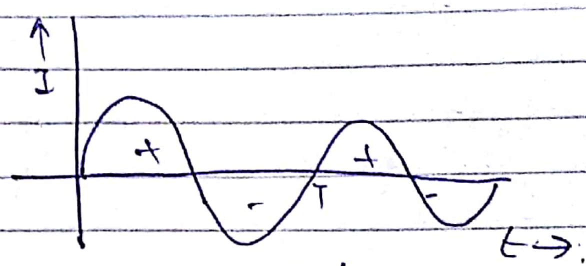
Alternating current (AC)

Time varying periodic current is said to be alternating if
1) its amplitude is const.
2) its alternate half cycles are (+ve) & (-ve)



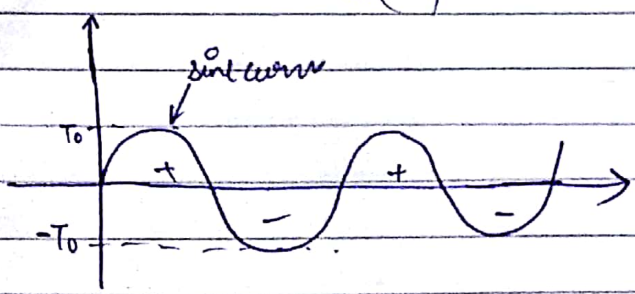
dis is not changin

AC (X)



amplitud is changing

AC (X)



AC (✓)

$I = I_0 \sin \omega t$

$\omega = 2\pi f$ ← frequency

I_0 = peak value / amplitude

T = time period

$\left(f = \frac{1}{T}\right)$

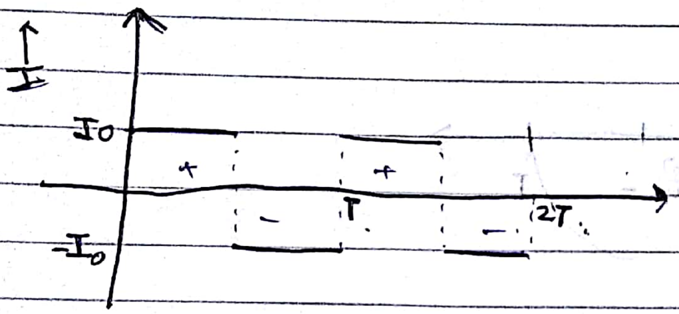
Average value of current $= \frac{2I_0}{\pi}$

alternating voltage

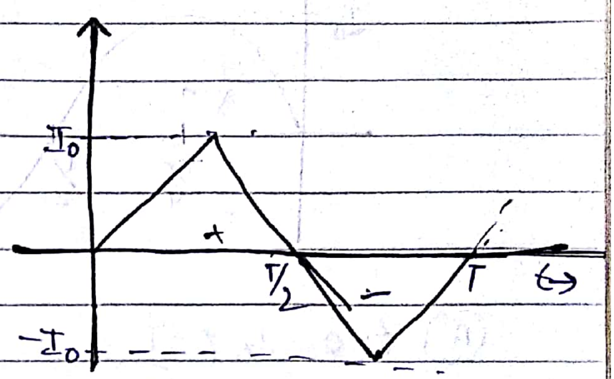
$$V = V_0 \sin \omega t$$

$$\boxed{V = V_0 \sin(\omega t + \phi)}$$

ϕ = phase const.



complex AC → V



complex AC – V.

Average value of current (in a time interval)

$$I_{avg} = \frac{\int_{t_1}^{t_2} I \cdot dt}{(t_2 - t_1)} = \frac{\text{total charge flow}}{\Delta t}$$

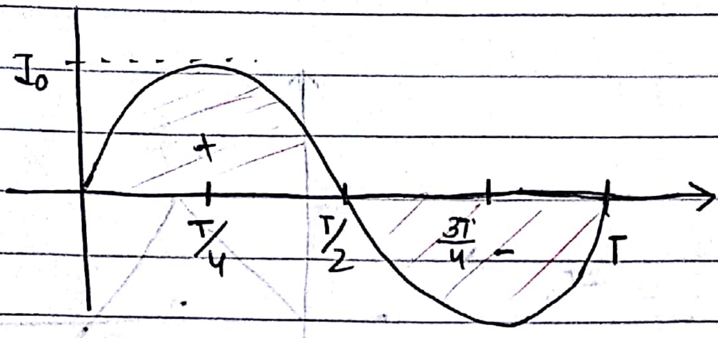
i.e. $I = I_0 \sin \omega t$

$t = 0$ to $t = \frac{T}{2}$

$$I_{avg} = \frac{\int_{t_1}^{t_2} I_0 \sin \omega t}{\left(\frac{T}{2} - 0\right)} = \frac{\int_0^{T/2} I_0 \sin \omega t}{T/2}$$

as $\omega = \frac{2\pi}{T}$

$= \frac{2I_0}{\pi}$ Ans



(A) $t=0$ to $t=\frac{T}{2}$ $\qquad \frac{2I_0}{\pi}$

(B) $t=\frac{T}{2}$ to $t=T$ $\qquad -\frac{2I_0}{\pi}$

(C) $t=\frac{T}{4}$ to $t=\frac{3T}{4}$ $\qquad I_{av}=0$

(D) $t=0$ to $t=T$ $\qquad I_{avg}=0$

in one time period or in one cycle

$$I_{RMS} = \frac{I_0}{\sqrt{2}}$$

Root mean Square Value I_{RMS} or (effective value)

$$I_{RMS} = \sqrt{\langle I^2 \rangle}$$

$$I = I_0 \sin \omega t$$

$$\rightarrow I^2 = I_0^2 \sin^2 \omega t$$

$$\rightarrow \langle I^2 \rangle = \frac{\int_0^t I_0^2 \sin^2 \omega t}{T} = \frac{I_0^2 \int_0^t \sin^2 \omega t}{T}$$

$$= \frac{I_0^2}{2}$$

$$\left\{ \langle \sin^2 \omega t \rangle, \langle \cos^2 \omega t \rangle = \frac{1}{2} \right\}$$

$$\rightarrow \sqrt{\frac{I_0^2}{2}}$$

$$\boxed{\frac{I_0}{\sqrt{2}} = I_{RMS}}$$

Ques → Find root mean Sq value of current $I = 3 + 4 \sin \omega t$ in 0 to t tim

$$I^2 = (3 + 4 \sin \omega t)^2$$

$$= 9 + 16 \sin^2 \omega t + 24 \sin \omega t$$

$$\langle I^2 \rangle = \int_0^t 9 + 16 \sin^2 \omega t + 24 \sin \omega t$$

$$= \frac{9t^2}{2} + \frac{16}{2} + \frac{24}{2} = \frac{9t^2}{2} + 8 + 12$$

$$\cancel{RMS = \sqrt{\frac{19+9t^2}{2}}}$$

$$\langle I^2 \rangle = \langle 9 \rangle + 16\langle \sin^2\omega t \rangle + 24\langle \sin\omega t \rangle$$

$$= 9 + 16\,\frac{1}{2} + 0$$

$I_{RMS} = \sqrt{17}$ A. Ans

Q- Find the effective value of current in a ckt.

$$I = 2\sin 100\pi t + 2\cos(100\pi t + 30^\circ)$$

$$\cancel{I^2 = 4\sin^2 100\pi t + 4\cos^2(100\pi t + 30^\circ)}$$

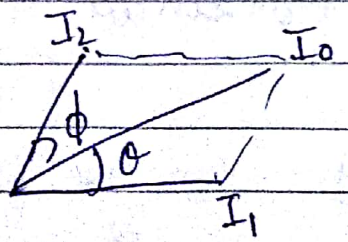
$$\cancel{\langle I^2 \rangle = \frac{4}{2} +}$$

As we know.

$$I = I_1 \sin\omega t + I_2 \sin(\omega t + \phi)$$

$$\boxed{I = I_0 \sin(\omega t + \theta)}$$

$$I_0 = \sqrt{I_1^2 + I_2^2 + 2I_1I_2\cos\phi}$$



$I = 2\sin 100\pi t + 2\sin(100\pi t + 30 + 90)$

$I_1 = I_2 = 2.$ $\phi = 120^\circ$

$I_0 = ?$

$$\boxed{I_{RMS} = \frac{I_0}{\sqrt{2}}}$$

$I_0 = \sqrt{2^2 + 2^2 + 2\times2\times2\times\cos 120}$

$= \sqrt{8 + 8\cos 120}$

$= \sqrt{8 - \frac{1}{2}\times 8} = \sqrt{4}$

$I_0 = 2$

$= \frac{2}{\sqrt{2}} = \sqrt{2}$ Ans

$\cos 120$

$\cos(180-60)$

$8\cos 120$

$(180-60)$ $-\frac{1}{2}$

$$\boxed{I_{RMS} = \frac{I_0}{\sqrt{2}}}$$ Ans $= \sqrt{2}$ Ans

Power delivered in AC circuit

$V = V_{max}\sin\omega t$

$I = I_{max}\sin(\omega t + \phi)$

when ϕ = phase diff current & Voltage.

Instantaneous power

$\sin(\omega t + \phi)$

$P_t = VI$

$= V_m I_m \sin\omega t \cdot [\sin\omega t\cos\phi + \cos\omega t\sin\phi]$

V

$= V_m I_m \cos\phi \, \sin^2\omega t + \frac{1}{2} V_m I_m \sin\phi \, \sin 2\omega t$

$\frac{1}{2}$

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cos ϕ is power factor

Average power in one cycle

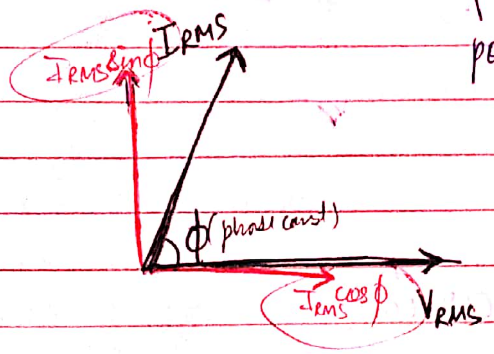
$$P_{avg} = \frac{1}{2} V_m I_m \cos\phi$$

$$= \frac{V_m}{\sqrt{2}} \times \frac{I_m}{\sqrt{2}} \cos\phi$$

$$\boxed{\langle P \rangle = V_{rms} \times I_{RMS} \cos\phi}$$ *

$\langle P \rangle = I_{rms} V_{rms} \cos\phi$

power factor



Component

$I_{RMS} \sin\phi$ is called wattless current.

(jo koi power produce nhi कर रहा है)

Representation of AC Source

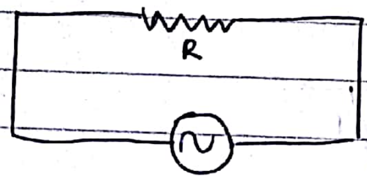
$V = V_m \sin\omega t$

RMS value → or 220V 50Hz

effective value

~~At~~ Different AC circuit

1) Circuit containing only resistance. (pure resistive circuit)



$V = V_m \sin \omega t$

current in resistance $I = \frac{V}{R} = \frac{V_m \sin \omega t}{R}$

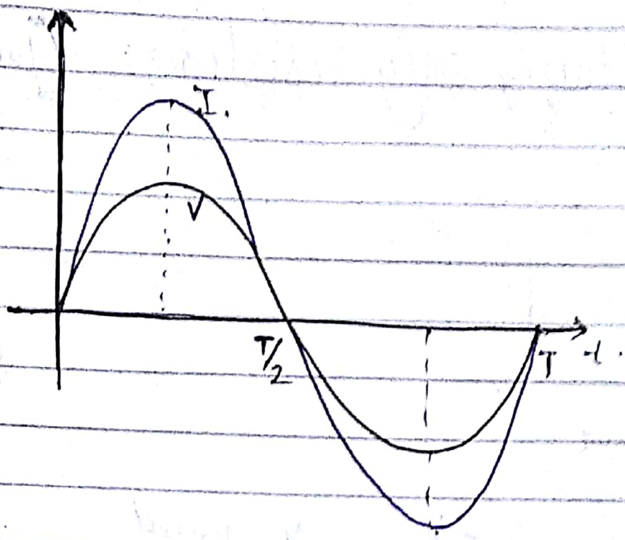
$$\boxed{I = I_0 \sin \omega t}$$

$\frac{V_0 \sin \omega t}{R}$

$V = I_0$

A-C → all solved examples till pure resistance Ex 1 → Part I Sec A, Sec B | Part II Sec A Sec B

$I = I_m \sin \omega t$



phase difference

$\phi = 0$

$\xrightarrow{\quad} I_m$

$\xrightarrow[V_m]{\quad}$

& $I_m = \frac{V_m}{R}$

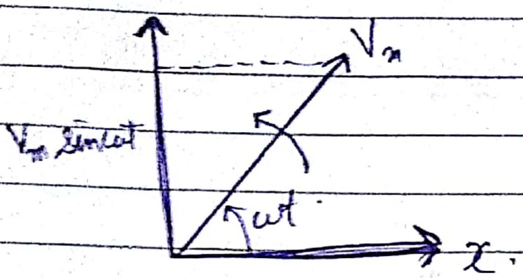
$I_{rms} = \frac{V_{rms}}{R}$

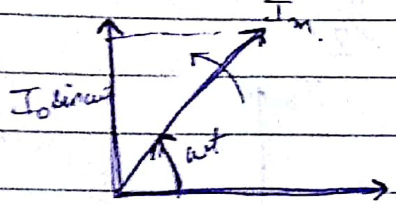
Average power

$\langle P \rangle = V_{RMS} I_{RMS} \cos\phi$ or $V_{RMS} I_{RMS} \cos 0°$

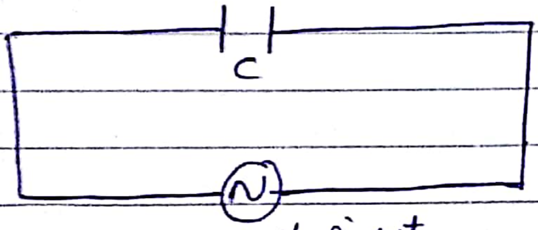
$$\boxed{\langle P \rangle = I_{RMS}^2 \cdot R}$$

Note → Phaser diagram





Circuit containing only Capacitor



$V = V_m \sin\omega t$

charge on plates of capr $\quad q = CV$

$$= CV_m \sin\omega t \quad \text{——— (1)}$$

$$I = \frac{dq}{dt}$$

$$= \frac{d(CV_m \sin\omega t)}{dt} = CV_m\omega\cos\omega t$$

$$\left(\frac{V_m}{X_C}\right)\cos\omega t$$

$$\boxed{I = I_m \cos\omega t} \qquad \boxed{X_C = \frac{1}{\omega C}\ \Omega}$$

Capacitance resistance

current & voltage are not in same phase

phase diff $= \frac{\pi}{2}$

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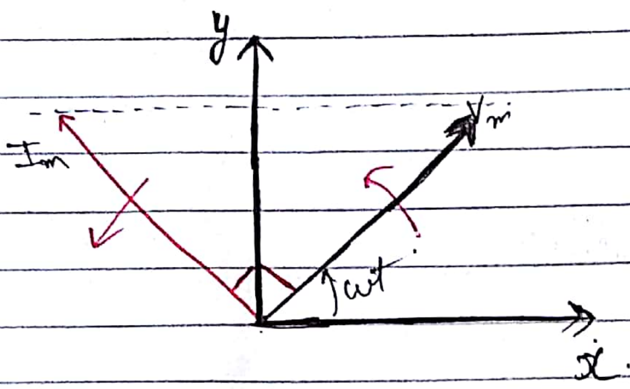
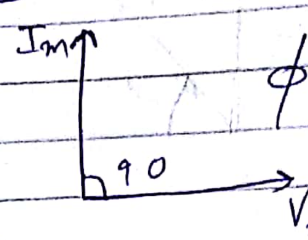
$$\boxed{I = I_m \sin\left(\omega t + \frac{\pi}{2}\right)}$$

~~Im cosωt~~

Current leads Voltage by angle $\pi/2$





$\phi = 90$

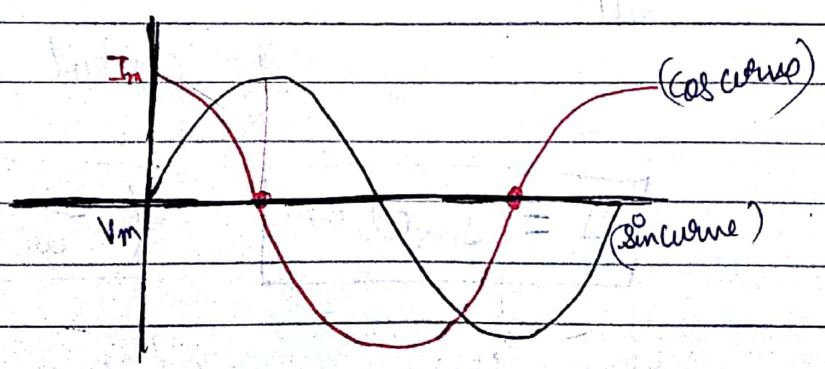
I_m ye 90 aage rahega V_m se

Note – $I_m = \frac{V_m}{X_C}$

$I_{rms} = \frac{V_{rms}}{X_C}$ (Same phase) but $I \neq \frac{V}{X_C}$ b/c I & V are not in same phase.

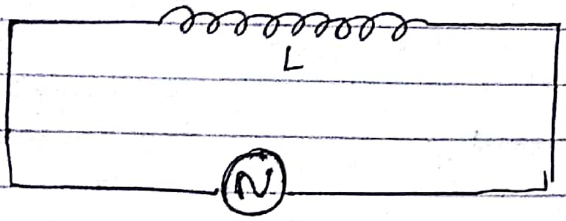
$$\boxed{\langle P_{avg} \rangle = V_{rms} I_{rms} \cos 90 = 0}$$

no power consumed.



jab ek max hai to dusra 0 ho & viceversa

Circuit containing only inductor



$V = V_m \sin\omega t$

$$L\frac{dI}{dt} = V_m \sin\omega t$$

$$\int dI = \int \frac{V_m}{L} \int \sin\omega t \, dt$$

$$I = \frac{V_m}{\omega L}(-\cos\omega t) + C_{(\text{const of integration})}$$

$\boxed{I = -V_m \cos\omega t \quad X_L \rightarrow \text{inductive resistance}}$

{ current of AC का avg value of 1 cycle is '0'. thus C की भी '0' होता है }

Avg value of current $= \langle I \rangle = 0$

$\therefore \boxed{C = 0}$

$\boxed{X_L = \omega L}$

$$\boxed{I = I_m \sin\left(\omega t - \frac{\pi}{2}\right)}$$

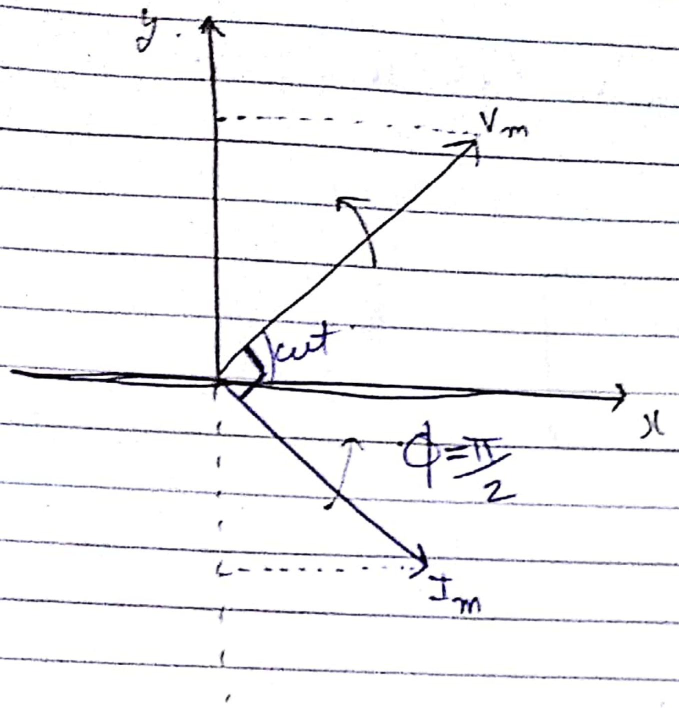
$\because I_m = \frac{V_m}{X_L}$

$$I = -\frac{V_m}{X_L}\cos\omega t$$

$\boxed{X_L = \omega L}$

inductive resistance

now phasor diagram



Avg Power $= 0$.

$$\boxed{\langle P \rangle = 0}$$

Note →

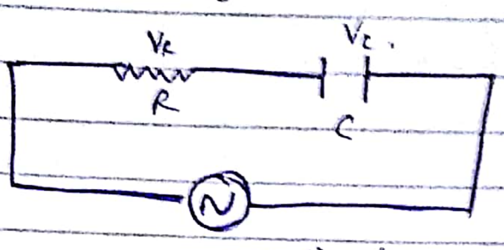
$$I_m = \frac{V_m}{X_L}$$

$$I_{RMS} = \frac{V_{RMS}}{X_L}$$

$$I \neq \frac{V}{X_L}$$

{ & V & I are not in same phase. phase diff }

Circuit containing a resistor and a capacitor



$V = V_m \sin \omega t$

Inst. voltage -

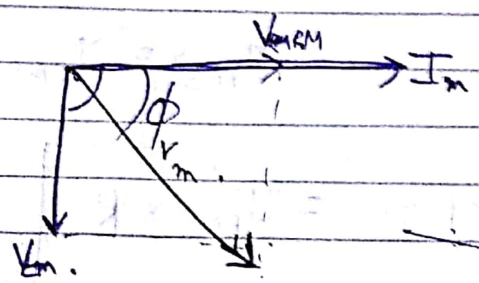
$$V = V_R + V_C$$

phasor diagram

$$\begin{cases} V_{m(R)} = I_{m(R)} R \\ V_{m(C)} = I_{m(C)} X_L \end{cases}$$

$$\cancel{V_{RM}} = \cancel{I_m R}$$

$$\cancel{V_{CM}} = \cancel{I_m X_C}.$$



$$\cos\phi = \frac{V_{RM m}}{V_m} = \frac{R \times \cancel{I_m}}{\cancel{I_m} \times Z}$$

$$\boxed{\cos\phi = \frac{R}{Z}}$$

$$V_m = \sqrt{(V_{RM})^2 + (V_{CM})^2}$$

$$\sqrt{I_m^2 R^2 + I_m^2 X_C^2}.$$

$$\left(\frac{V_m}{I_m}\right) = \sqrt{R^2 + X_C}.$$

$$\boxed{Z = \sqrt{R^2 + X_C^2}}$$

impidence

$$\therefore Z = \frac{V_m}{I_m} = \frac{V_{RMS}}{I_{RMS}}$$

$$V_{RMS} = \sqrt{V_{(RMS)R}^2 + V_{(RMS)C}^2}$$

(charge pra discharg hoa disch higa tab tak current aay ese hi chalta rhey.)

~~of phase diff~~

$$I \neq \frac{V}{Z}$$

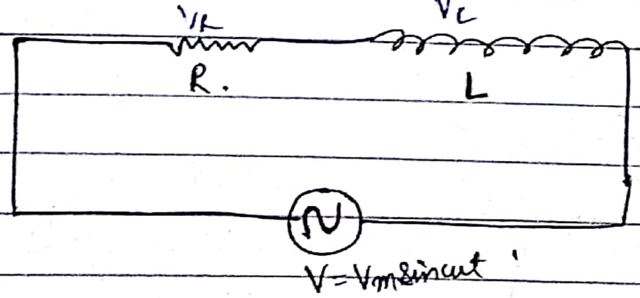
Average power $\langle P \rangle = V_{rms} I_{rs} \cos\phi$

$$= V_{rms} I_{rms} \left(\frac{R}{Z}\right)$$

$$= (I_{rms} \times \cancel{Z}) I_{rms} \times \left(\frac{R}{\cancel{Z}}\right)$$

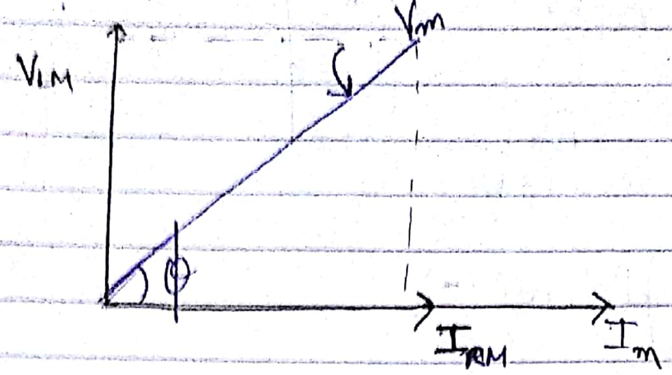
$$\boxed{\langle P \rangle = I^2_{rms} \times R}$$

Circuit containing a resistor & Inductor



Inst voltage $\boxed{V = V_R + V_L}$

Phasor diagram



$V_{RM} = I_M \times R$

$V_{LM} = I_M X$ (max voltage across L)

$$\tan\phi = \frac{V_{LM}}{V_{RM}} = \frac{X_L}{R}$$

$$V_M = \sqrt{(V_{RM})^2 + (V_{LM})^2}$$

$$\tan\phi = \frac{X_L}{R}$$

$$\frac{V_M}{I_M} = \sqrt{R^2 + (X_L)^2}$$

$$\boxed{\cos\phi = \frac{R}{Z}}$$

$$\boxed{Z = \sqrt{R^2 + X_L^2}}$$

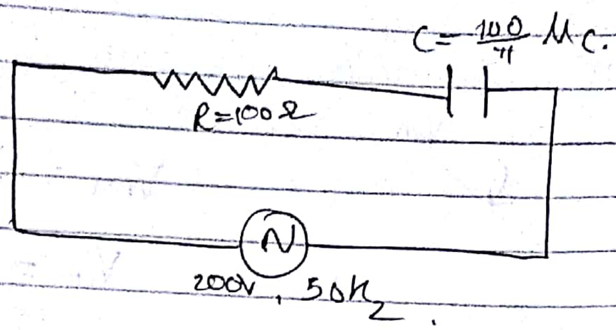
impedance

$$V_{rms} = \sqrt{(V_{rms})_R^2 + (V_{rms})_L^2}$$

V_{rms} across R V_{rms} across L

NOTE →

Q.-



Calculate 1) Impedance (Z).
2) I_{RMS}
3) $(V_{RMS})_R$ & $(V_{RMS})_C$
4) Power factor
5) Power ~~across R~~, ~~power across C~~ & $\langle P \rangle$.
$\langle P_R \rangle$, $\langle P_C \rangle$, $\langle P \rangle$

6) if $V = 200\sqrt{2} \sin(2\pi 50t + 30^\circ)$

then find $I(t)$, $V_R(t)$, $V_C(t)$.

1) $X_C = \frac{1}{\omega C} = \frac{1}{2\pi (f)_{50}} = \frac{1}{2\pi(50) \times \frac{100}{\pi} \times 10^{-6}}$

$X_C = 100\ \Omega$

$Z = \sqrt{R^2 + X_C^2}$

$= 100\sqrt{2}\ \Omega$

2) $I_{RMS} = \frac{V_{RMS}}{Z} \Rightarrow \frac{200}{100\sqrt{2}} \Rightarrow \sqrt{2}\ A.$

3). $(V_{RMS})_R$ = ~~IR~~ $I_{RMS} \cdot R$.

$\sqrt{2}\times 100$

$= 100\sqrt{2}$ V

$(V_{RMS})_C \Rightarrow I_{RMS}\times X_C$

$= \sqrt{2}\; 100$

$100\sqrt{2}$ V

4) Power factor. $\cos\phi = \frac{R}{Z}$.

$= \frac{100}{100\sqrt{2}} = \frac{1}{\sqrt{2}}$

$\phi = 45^\circ$

5). $\langle P_C \rangle = 0$, $\langle P_R \rangle = I_{rms}^2 R$ $\qquad \langle P \rangle = 200W$

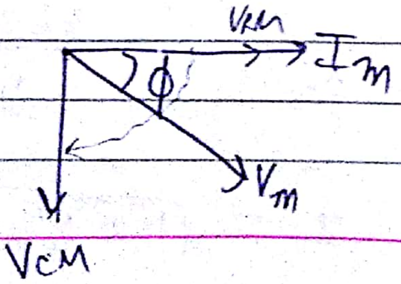
no power consp

$= (\sqrt{2})^2 \times 100$

$= 200W$.

6) $V = \underbrace{200\sqrt{2}}_{V_m} \sin(2\pi(50)t + 30)$. ye upar wale questions hi ho but eq की form me

freq. VI



$\boxed{I = I_m \sin\{2\pi(50)t + 30 + 45\}}$

$\therefore I_m = \frac{V_m}{Z} = \frac{200\sqrt{2}}{100}$ $\sqrt{2}$

$\therefore V_R(t) = V_{Rm} \sin\{2\pi(50) + 30 + 45\}$

$= 200 \sin\{2\pi(50) + 75\}$

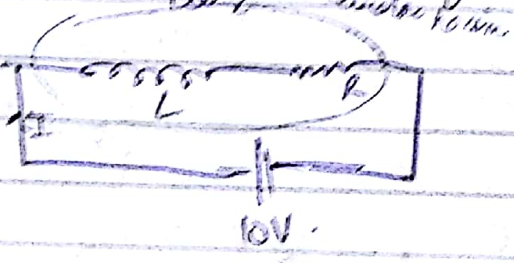
$\therefore V_L(t) = V_{Lm} \sin\{2\pi(50) + 30 + 45 - 90\}$

as 90 piche chal raha hai

$V_{Lm} \sin\{2\pi(50) + 15\}$

Qu - When an inductor coil is connected to a battery of emf 10V, 2.5A current flows in the circuit. When same coil is connected to AC source of 10V & 50Hz (r.m.s.) then current in circuit becomes 2A (r.m.s.). Find inductance of that coil.

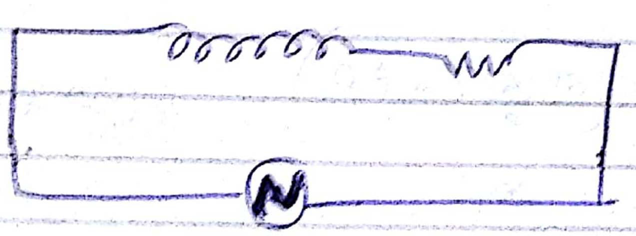
AC nahi coil + resistance



$I = \frac{10}{R} = 2.5$

$\boxed{R = 4\Omega}$

now conn to AC source



$I_{rms} = \frac{V_{rms}}{Z} \Rightarrow 2 = \frac{10}{Z}$ $Z = 5\Omega$

$= 5\Omega$

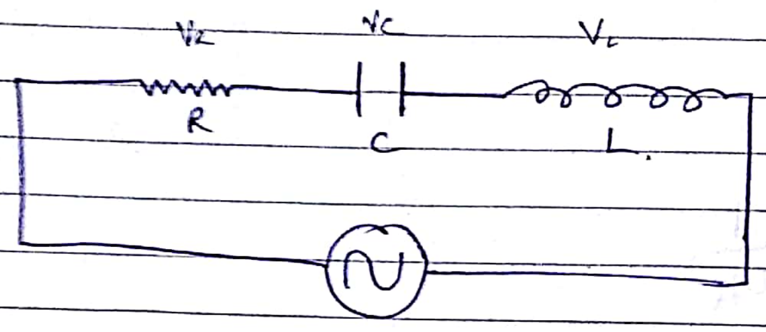
$Z = \sqrt{R^2 + X_L^2}$

$$\boxed{X_L = 3\,\Omega}$$

$X_L = 2\pi(50)L.$ as ($\omega L = X_L$)

$$\boxed{L = \frac{3}{100\pi}\ H}$$ Ans

Series LCR circuit

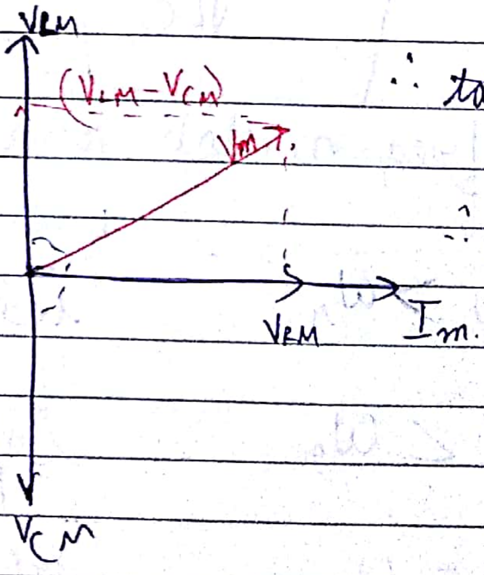


$\boxed{V = V_R + V_C + V_L}$ ~~for any instan voltag~~

Inst voltag

phasor diagram

inductor & c



$\therefore \tan\phi = \frac{X_L - X_C}{R}$

$\therefore \cos\phi = \frac{R}{Z}$

$$V_M = \sqrt{(V_{Rm})^2 + (V_{Lm} - V_{Cm})^2}$$

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

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

impedance

Condition of Resonance

if $V_{LM} = V_{CM}$

$\boxed{X_L = X_C}$ $\quad$ ($z \rightarrow$ minimum) $= R$

$z_{min} = R$

$I_m \rightarrow$ max

($I_{rms} \rightarrow$ max)

$$I_{rms} = \frac{V_{rms}}{\sqrt{R^2+(X_L-X_C)^2}}$$

$$\omega L = \frac{1}{\omega C}$$

$\omega = \frac{1}{\sqrt{LC}} \longrightarrow$ resonating angular frequency

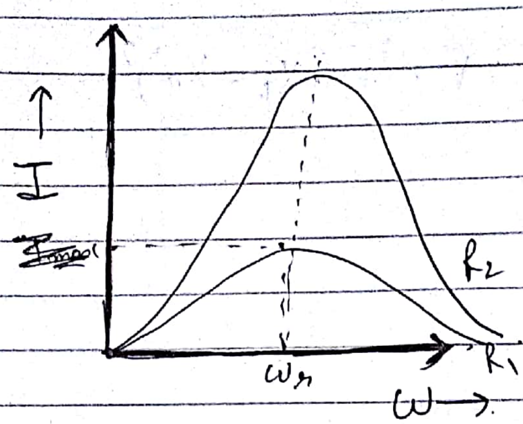
$$\boxed{\omega_r = \frac{1}{\sqrt{LC}}}$$

shm

thus freq match करने पर amplitude increases

	behaviour of circuit
1) $\omega > \omega_r$	inductive
2) $\omega < \omega_r$	capacitive
3) $\omega = \omega_r$	resistive

Q

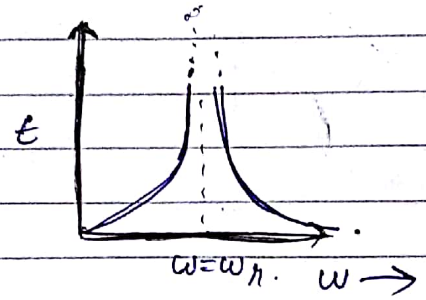


$R_2 < R_1$

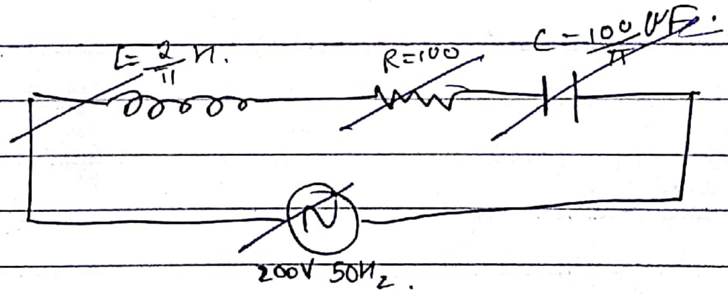
for ideal situation $R=0$.

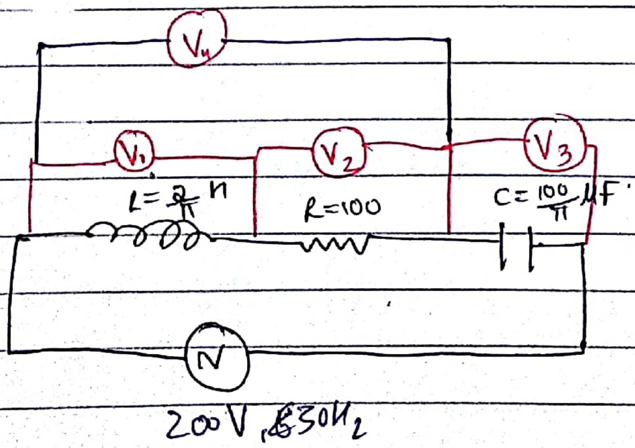
$\omega = \omega_r$. then flatten current

Resonance logo.



Ques →



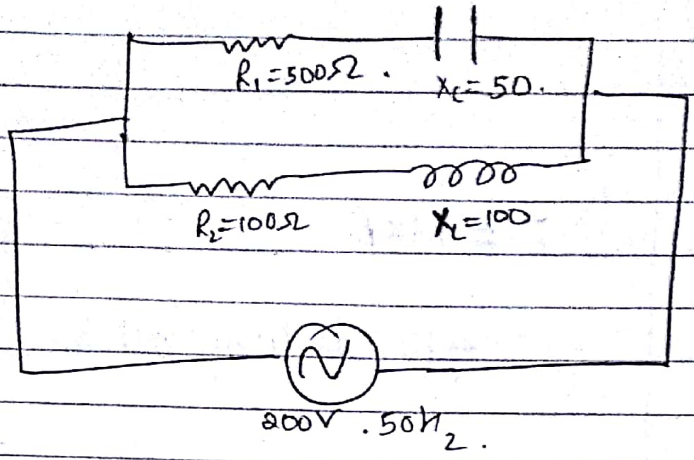


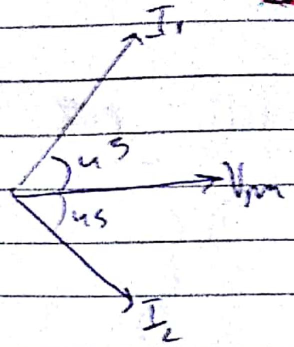
Find

1) reactance
2) Impedence
3) reading of Ac voltm V_1, V_2, V_3, V_4

LC me V lead करती है
RC me current I lead करती है

Q.





find effective current flowing through source.

upar circuit का Z_1 =

$$Z_1 = \sqrt{R_1^2 + X_C^2} = 50\sqrt{2}$$

$$I_1 = \frac{V_{RMS}}{Z_1} = \frac{200}{50\sqrt{2}} \Rightarrow 2\sqrt{2}A$$

Similar

$$Z_2 = \sqrt{R_1^2 + X_L^2} = 100\sqrt{2}$$

$$I_2 = \frac{V_{RMS}}{Z_2} = \frac{200}{100\sqrt{2}} = \sqrt{2}.A$$

then

$$I = \sqrt{I_1^2 + I_2^2}.$$

$$= \sqrt{(2\sqrt{2})^2 + (\sqrt{2})^2}$$

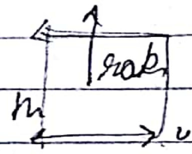
$$= \sqrt{10}\ \text{Ans}$$

DPP - 03

1) C
2) B
3) D
4) C
5) B
6) ~~A~~
7) ~~B~~ D
8) B
9) A
10) D

6) $\tau = M \times B = 0.426$

mag field ki dis me adki ruk



so coil ki plane
east-west hoga.

9) $B = \frac{\mu_0}{2\pi} \cdot \frac{2\pi I}{R}$

rel ang = aprdon
$i = F \times q$

ya velo initial lo thy $\frac{qV}{\pi r^2}$

ya mag field nest

10) $M \times B$

drea bada hoga, usko $M \times B$ ↑ hoga
phir D ki ↑ hoga

EMI discussion

H2 — jaise KVL me chalti he vaise chale

H3 — ~~$I^2R = 3$~~ heat at the m. $I^2 R = 3$

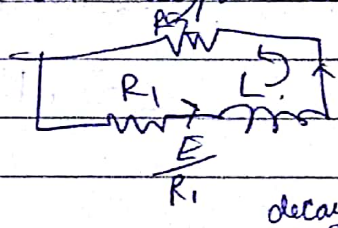
Power drawn = 5   remaining = 2.

H4 → $\frac{B^2}{2\mu_0} \times V_0$

H5 → $B = \frac{\mu_0}{4\pi} \left(\frac{eV}{r^2}\right)$ (1) $U_B = \frac{B^2}{2\mu_0}$ $\frac{nh}{2\pi}$

$$\frac{1}{4\pi\varepsilon_0}\frac{E^2}{r^2} = \frac{mv^2}{r}$$ find v & put in ①.

I8) at $t=0$, switch open niche battery part hokar.



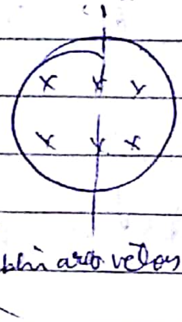
$I = \frac{E}{R_1}$

decay current hoy

decay coz $\frac{L}{R_1}$ applied then $I =$

I9) ($R=0$) superconduct. means resistan is zero

abhi flux $\phi_1 = B\pi r^2$



after isolating

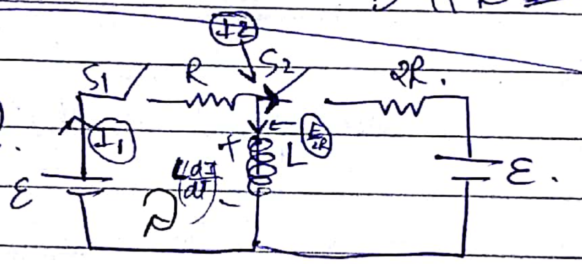
$\phi_2 = -B.\pi r^2$ (abhi area reverse t.)

in superconductor ϕ constant rehta hai & net induced emf $=0$ hota hai

$$B\pi R^2 = -B.\pi R^2 + LI$$

itna change aaya. add karenge taaki induced emf me change nahi as in superconductor me ϕ const rahi

I11)



S_2 is closed. L me ek current aayi hoy $\frac{E}{r}$ niche ki dis. me

S_1 is also closed then isme current achanak nhi badlega.

par $\frac{dI}{dt}$ to badhega

$I_1 = I_2 + \frac{E}{2r}$ bahar wale me KVL lagao do

$$I_1 = I_2 + \frac{E}{2R} \quad \text{--- (1)}$$

$$E - I_1 R - 2I_2 R - E = 0$$

$$-I_1 R = 2I_2 R \quad \text{--- (2)}$$

find I_1 & I_2

$L\left(\frac{dI}{dt}\right)$ nikalne ke liye left loop use karo KVL lagake

$$E - I_1 R - L\left(\frac{dI}{dt}\right) = 0 \quad \text{--- (2)}$$

nowt solve karo

(1) & (2) put karo $L\left(\frac{dI}{dt}\right)$ nikalo

I_3) L koho kada ho   kadi ke ROOT ECE ke Centre me ~~moveg~~ field nikalo

K2) jab start state me capacitor cha
S_2 closed & LC circuit ban gaya & nechiwala
lekar

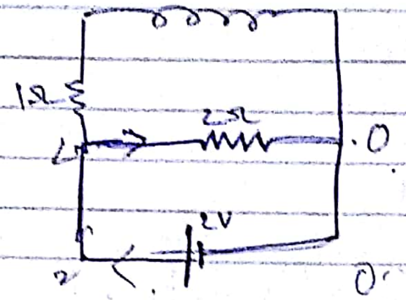
Part II

$M_1 \rightarrow (\mu_0 n^2 V) A \times l$

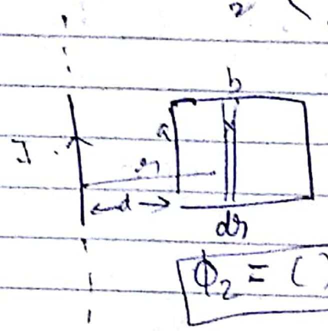
$\rightarrow I_5 \rightarrow$ just after remove | L khatam hojayega & flux bana hi ho
Current badh jayega

Self inductance khatam hojaye

$I_8)$ -



$J_2)$



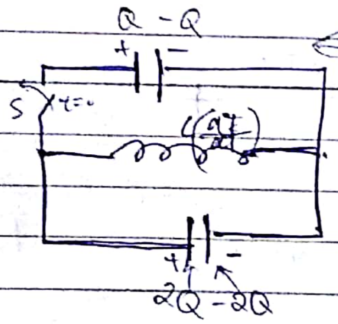
$$\boxed{\phi_2 = (\ )I_1}$$

$$\int_d^{d+b} \qquad \phi_2 = I\int_d^{d+b}$$

$$\phi_2 = I\int_d^{d+b} a\,dr\,b.$$

$$\phi_2 = I\,ab\,(d+b-d)$$

$K_2)$



$$\frac{Q^2}{2C} \qquad \frac{(2Q)^2}{2(2C)}$$

dono sum ko

charge say

dono sam ko

$2Q^2$ thi, no

potent change

thi koi nhi badlega

$V = \frac{Q}{C}$. $v = \frac{2q}{2c}$

dono

$$\frac{L\,dI}{dt} = -\frac{Q}{C}$$

$$\frac{dI}{dt} = \frac{Q}{CL}$$

donont Potent diff sum he ~~current~~ $\frac{dI}{dt} = 0$

$$\frac{Q^2}{2C} + \frac{2Q^2}{2(2C)}$$

then sari ener indctr ke paas hogi

8) $U = \frac{1}{2} L I^2$

$\frac{dU}{dt} = \frac{1}{2} L \, 2I \left(\frac{dI}{dt}\right)$

$L \times \frac{E}{R} \times (1 - e^{-t/\tau}) \frac{E}{R} \cdot \frac{R}{L} e^{-t/\tau}$

diff

$\boxed{\frac{dU}{dt} = \frac{E^2}{R}\left(e^{-t/\tau} - e^{-2t/\tau}\right)}$

rate energy stored hone ki rate learned

for max rate → diff $\frac{d^2U}{dt^2} = 0$

$\frac{-1}{\tau} e^{-t/\tau} + \frac{2}{\tau} e^{-2t/\tau} = 0$

$\underbrace{\frac{1}{\tau} e^{-t/\tau}}_{\text{ye 0 honhi sakta}} \underbrace{\left[-1 + 2e^{-t/\tau}\right]}_{\text{ye hoga} = 0} = 0$

max rate when $\boxed{e^{-t/\tau} = \frac{1}{2}}$

the $\frac{E^2}{2R} = \frac{(2)^2}{2 \times 1} = 1$

current at that instant is 1A $e^{t/\tau}$ को 1 daal do

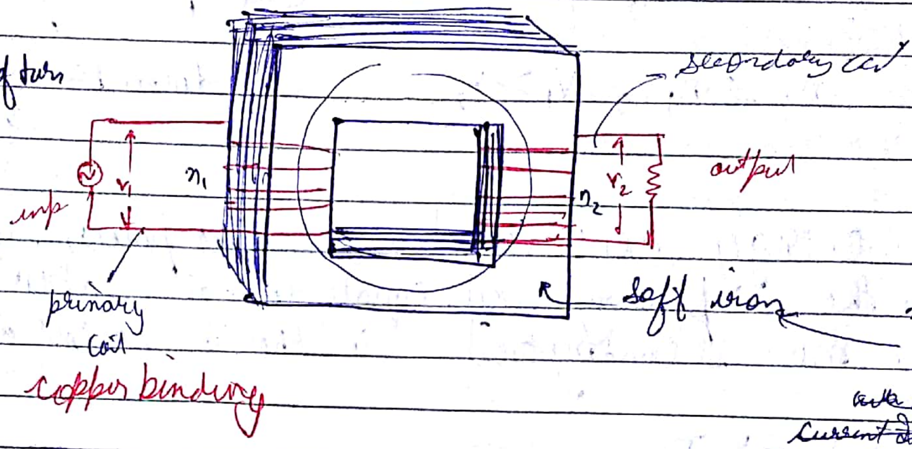
stepup → low → high voltage P S Ns > Np
stepdown → low high → low voltage P Np > Ns

Transformer

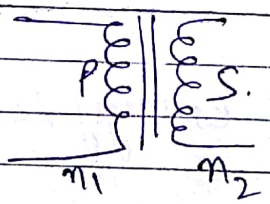
wotr (↑voltage voltage)

It works only in AC circuit.
~~It is based on.~~ Its working is based on principle of mutual induction

n_1 & n_2 = no of turns



more
Hysteresis
~~current~~
soft ~~iron~~



$$e_1 = -N_1\left(\frac{d\phi_B}{dt}\right) \qquad e_2 = -N_2\left(\frac{d\phi_B}{dt}\right)$$

$$\frac{e_2}{e_1} = \frac{N_2}{N_1} \quad (1)$$

flux per unit for primary & secondary coil is same

Scanned by CamScanner

• If primary & seconda have ~~proof~~ negligible resistance then terminal voltage across primary & secondary coil are equal to their emf respectively.

$$\boxed{\frac{V_2}{V_1} = \frac{n_2}{n_1}}$$

if $n_2 > n_1$, $V_2 > V_1$ — stepup transform

$n_2 < n_1$, $V_1 > V_2$. — step down transform

from energy considerations the power given to the primary coil equals to that taken out from the secondary coil. ie (there is no loss in energy)

$V_1 I_1 = V_2 I_2$.

Real transform always have some energy losses.

efficiency of transformers

$$= \eta\% = \frac{\text{output power}}{\text{input power}} \times 100$$

~~energy loss~~ energy loss -

1) Copper loss → energy lose in copper binding

$\underbrace{I_1^2 R_1}_{\text{primari coil energy loss}}$ $\underbrace{I_2^2 R_2}_{\text{secondary coil energy loss}}$

hen
condary

2) Iron loss → flux leakage.

all losses include in iron loss

B-4 DPP

1) D
2) B
3) B
4) A
5) C
6) A
7) D.
8) B
9) D
10) A

AC advantage
→ more economical
→ voltage can be stepped up & down.
→ can be regulated by choke coil with energy loss
→ can be transmitted to distant places
→ AC → DC converted easily by rectifier

Disadvantages
→ more fatal than DC.
→ Can't be used in electroplating
→ Skin effect → AC flows on outer skin of wire

$10^{9} \times 10^{-1} / 164$

14 × 4 = 56, 14 × 6 = 84, 14 × 7 = 98