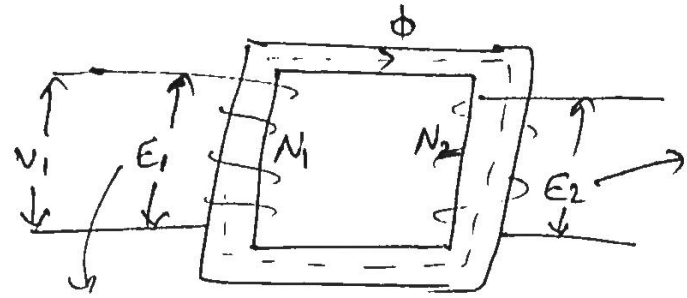
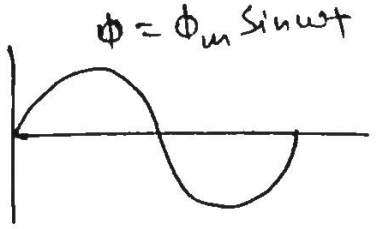
$\left(\phi = \frac{}{5}\right)$





Emf eqn

$$\phi = \phi_m \sin\omega t \quad --(1)$$

$$e_1 = -N_1 \frac{d\phi}{dt}$$

$$e_1 = -N_1 \frac{d}{dt}(\phi_m \sin\omega t)$$

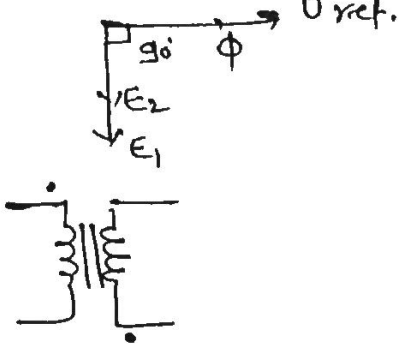
$$= -N_1 \phi_m \cos\omega t \cdot \omega$$

$$= \underbrace{N_1 \phi_m \omega}_{\hookrightarrow \text{max. v.}} \sin(\omega t - 90^\circ)$$

$$e_{1(rms)} = \frac{N_1 \phi_m \omega}{\sqrt{2}}$$

$$= \frac{2\pi f N_1 \phi_m}{\sqrt{2}}$$

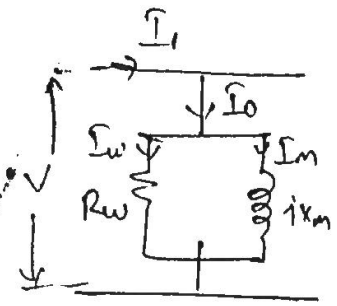
$$\boxed{E_1 = \sqrt{2}\,\pi f N_1 \phi_m}$$



$\left(E_1 = 4.44 f \phi_m N_1\right)$ & Same for $\left(E_2 = 4.44 \phi_m f N_2\right)$

$$\left\{\begin{array}{l} E_1 = 4.44 f B_m A N_1 \\ E_2 = 4.44 f B_m A N_2 \end{array}\right\} \quad [\because \phi = B \cdot A]$$

No-load operation:



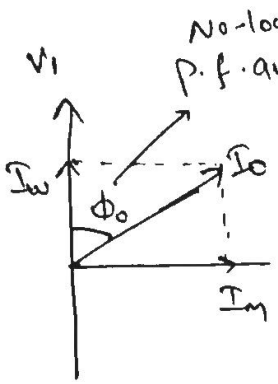
$I_o \rightarrow$ No load Current

$I_w \rightarrow$ Wattful Content/Current (loss Component)

$I_m \rightarrow$ Magnetization Content/Current (Responsible for to set mag. flux)

$I_1 = I_o =$ 2 to 5% of $I_{f.L.}$

$\vec{I_o} = \vec{I_w} + \vec{I_m}$



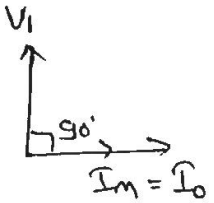
$\rightarrow \left\{ \phi_o \rightarrow > 75^\circ \text{ \& } < 90^\circ \right\}$

$\rightarrow$ No-load p.f. is very low $\rightarrow$ (.2 or .3)

Ideal Transformer

$\rightarrow \infty$ Permeability of Core.

It means negligible Current required to Magnetize the Circuit.



Note:

In Ideal X-mer ϕ_o will be 90°.

But in normal X-mer (75° – 90°).

(~~55° to 75°~~)

IDEAL Transformer:

which has following Properties:

1) Primary & Secondary winding resistances are negligible
2) Core has high Permeability (μ)
3) leakage flux & leakage Inductance are Zero.
4) There are no losses due to resistance, hysteresis and eddy Currents. ~~loss~~ and efficiency is 100%

Transformer ON No-load

* At No-load Primary Winding is open-circuited & Secondary Current is Zero.
* When An Alternating Voltage is applied to Primary, a Small Current I_0 flow in the Primary.

I_0 → is called no-load Current of transformer.

It has two Components I_μ & I_w.

→ I_μ ⇒ is called magnetizing Component, It magnetizes the Core, It set up the flux in Core & therefore I_μ is in Phase with Φ_m.
(I_μ → magnetizing Component, also Called reactive or wattless Component of no-load Current).

→ I_w ⇒ I_w Supplies the hysteresis & eddy Current losses in the Core & the negligible I^2R loss in the Primary winding. I_w also Called Active Component or wattless Component of no-load Current. It is in the Phase with the applied voltage V_1. the no-load Current I_0 is Small of the order of 3 to 5% of rated Current of Primary