2-5 Referred Values: -

F2=F2e

$$\frac{0.9\ M2\ I2\ KW2\ T2}{e} = \frac{0.9\ M1\ I1\ KW1\ T1}{e}$$

$$I2e = \left(\frac{m2kw2T2}{m1kw1T1}\right) I2 = \frac{I2}{Ki} = I1$$

S2=S2e

$$m1E2I2 = m1E2S\ I2S = m1E2S\left(\frac{M2KW2T2}{M1KW1T1}.I2\right)$$

$$E2e = \frac{KW1T1}{KW2T2}.E2 = Ke\ E2 = E1$$

$$I2^2R2 = I2^2e\ R2e \quad ,m2\ I2^2R2 = m1\ I2e\ R2e$$

$$R2e = \frac{m2}{m1}\frac{I2^2}{I2e^2}.R2 = \frac{m2}{m1}(ki)(ki).R2$$

Where

$$Ke = \frac{m2}{m1}(ki)$$

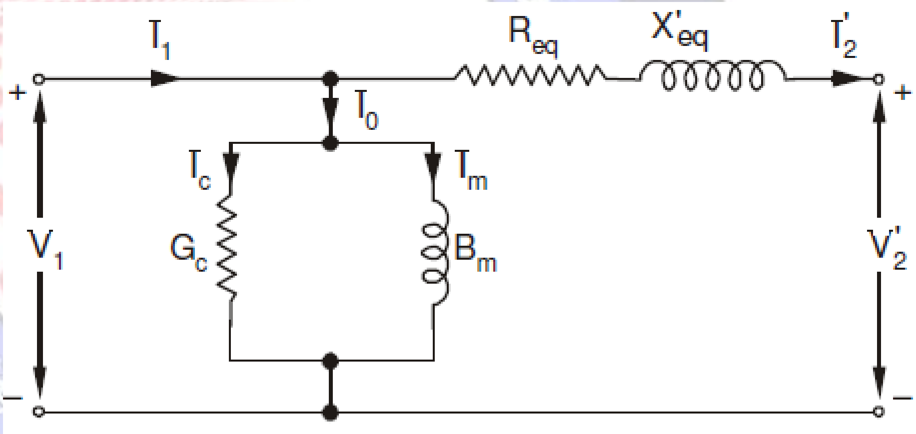
$$\therefore R2e = Ke\ Ki\ R2$$

$$\frac{M2\ I2^2\ X2}{2} = \frac{M1\ I2e^2 X2}{2}$$

$$X2e = \frac{m2}{m1}\left(\frac{I2}{I2e}\right)^2 X2$$

$$= \left(\frac{m2}{m1}ki\right) ki\ X2$$

$$= ke\ ki\ X2$$



In general, ke=ki=k then

$$I2e = \frac{I2}{K} \qquad ,E2e = E2k \qquad ,R2e = k^2R2 \quad ,X2e = k^2x2$$

For squirrel-cage motor.

$$m2 = \frac{s2}{p2} \qquad ,T2 = 0.5 \quad ,Kw2 = 1$$

2-6 Phasor Diagram: -

for ideal motor

$E2 \rightarrow E1 \rightarrow \emptyset m$ Z1=0 pcu≠0

$\mathrm{E1} = \mathrm{E2} \quad at\ S = 1$

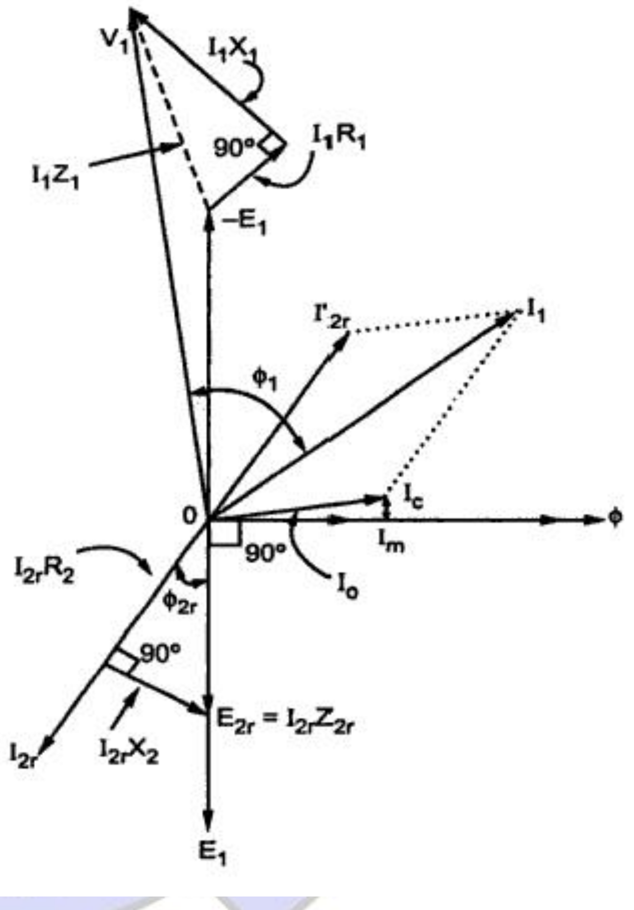
F1=-F2 , I1=-I2 ,IM=0

-FOR ACTUAL MOTOR

Excitation mmF Fe=F1+F2

Ie=I1+I2e , *Ie=Io* ,Ie=Im+Ii -*Fig.1*

V1=-E1+I1(R1+Jx1) -*Fig.2*



$v2 = -E2S + I2e\ Z2S$

$= -SE1 + I2e(R2e + JSX2e)$

$= -E1 + I2e\left(\frac{R2e}{s} + jx2e\right)$

$\frac{R2e}{s} = \frac{R2e}{s} + R2e - R2e$

$= R2e + \left(R2e\ \frac{1-S}{S}\right)$

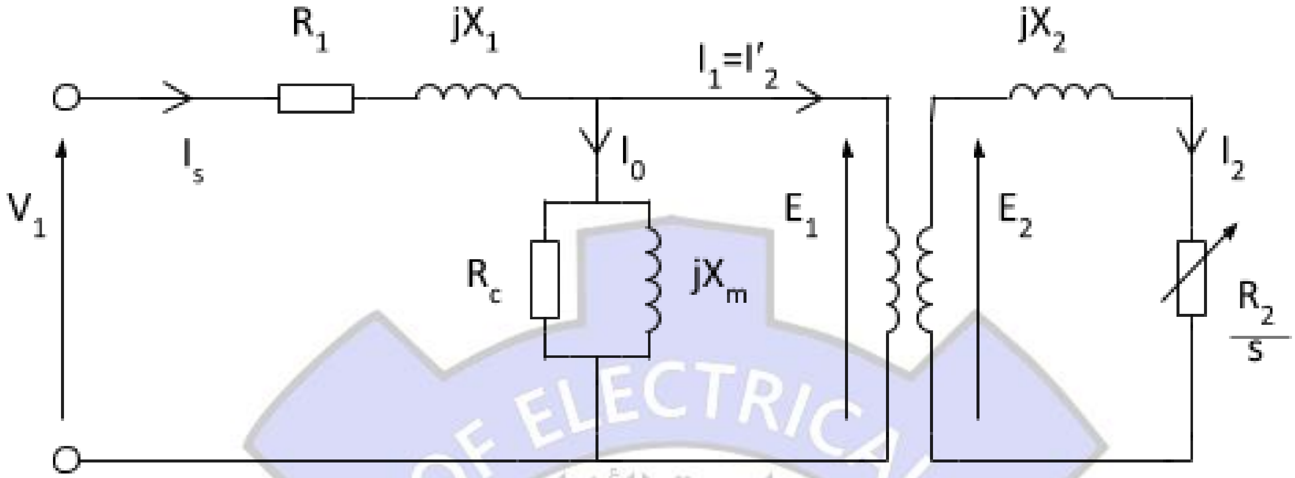
$I2e^2\frac{R2e}{s} = I2e^2\ R2e + I2e^2\ R2e\ \frac{1-s}{s} = pcu2e + pm$

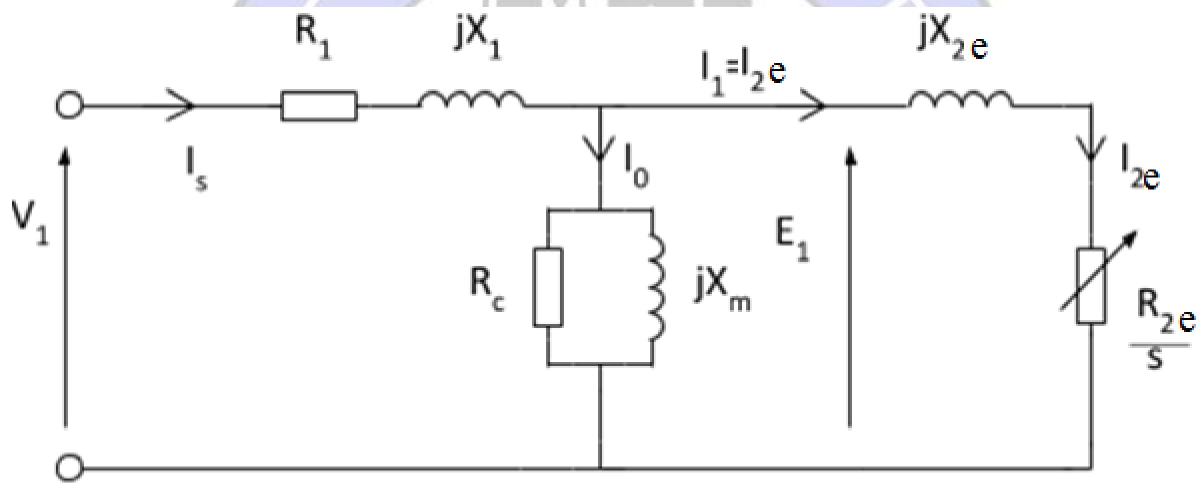
2-7 Equivalent Circuit: -

$E1 = IeZe \quad ;\ E1 \propto Ie \quad ; Ze = Exitation\ impedance$

$$Ye = \frac{1}{ze} = \frac{1}{Ri} + \frac{1}{jXm} = Gi - jBm = Admittance$$

$Gi = conductance\ , Bm = susceptance$





$$Ie = \frac{Ei}{Ze} = E1\,\gamma e = E1\,Gi - jE1Bm$$

$$Ie = Ii + Im$$

We have: -

$$v1 = -E1 + I1Z1$$

$$v1 = Ie\ Ze + I1Z1$$

$$0 = -E1 + I2e\ Z2es = Ie\ Ze + I2e\ Z2es$$

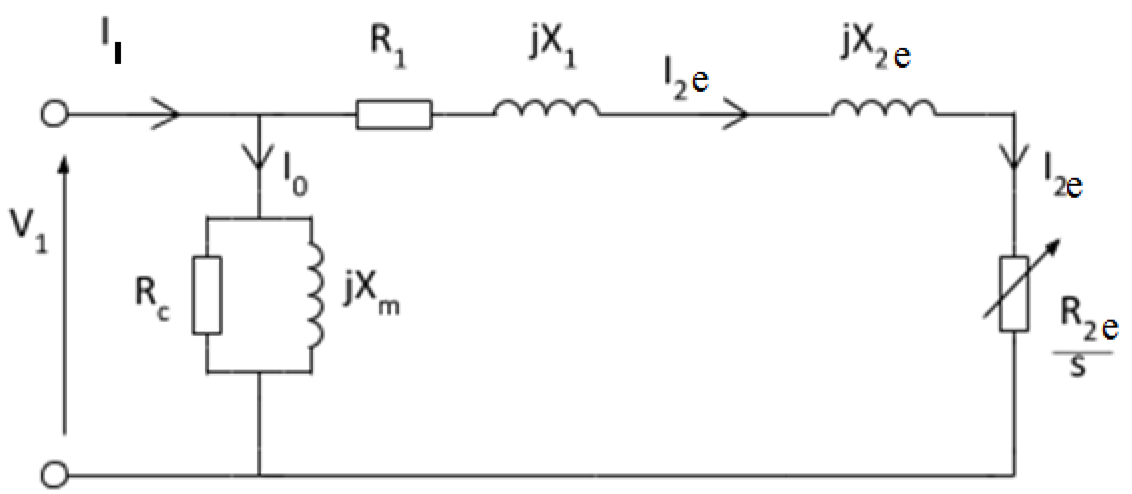
$$I2e = Ie - Ii$$

By use this equation we will have

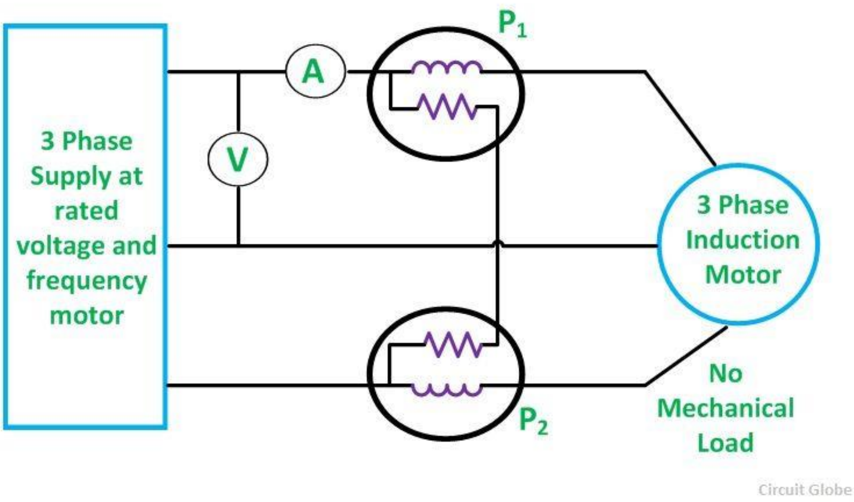
$$Ie = I1\frac{z2e}{ze + z2es}$$

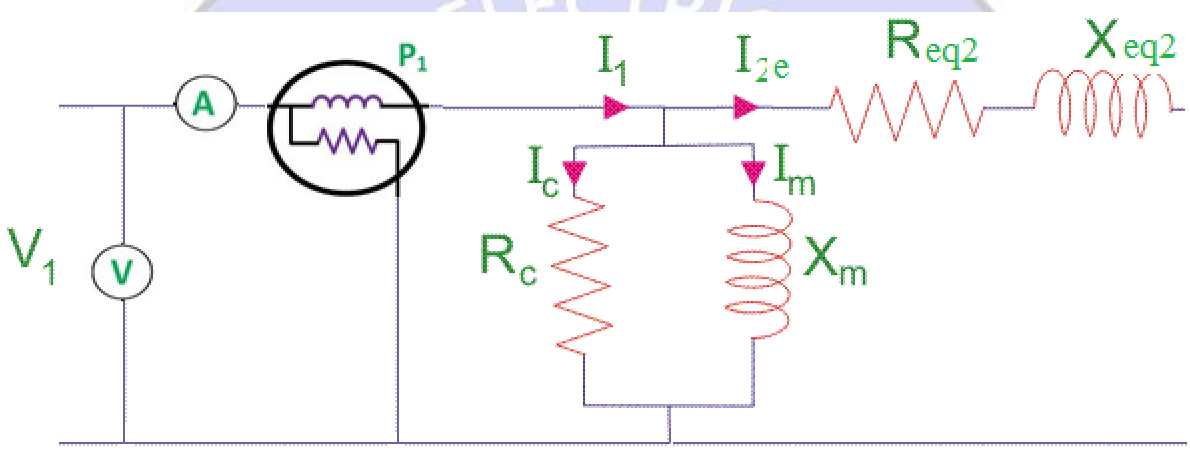
$$V1 = I1\left(Z1 + \frac{Z2es.Ze}{Ze + Z2es}\right) = I1Zt$$

Approximate Equivalent cct



***No –load test**





Vo, Po, Io

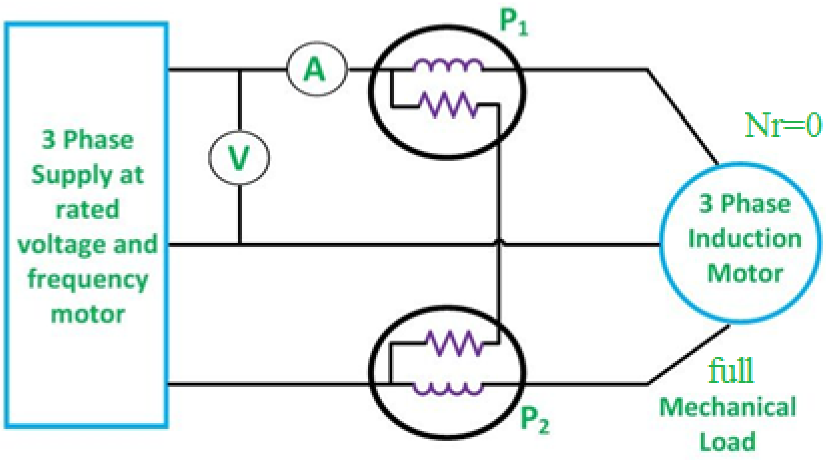
$$I1 = Io \quad ,V1 = Vo \quad ,Ie = I1 = Io$$

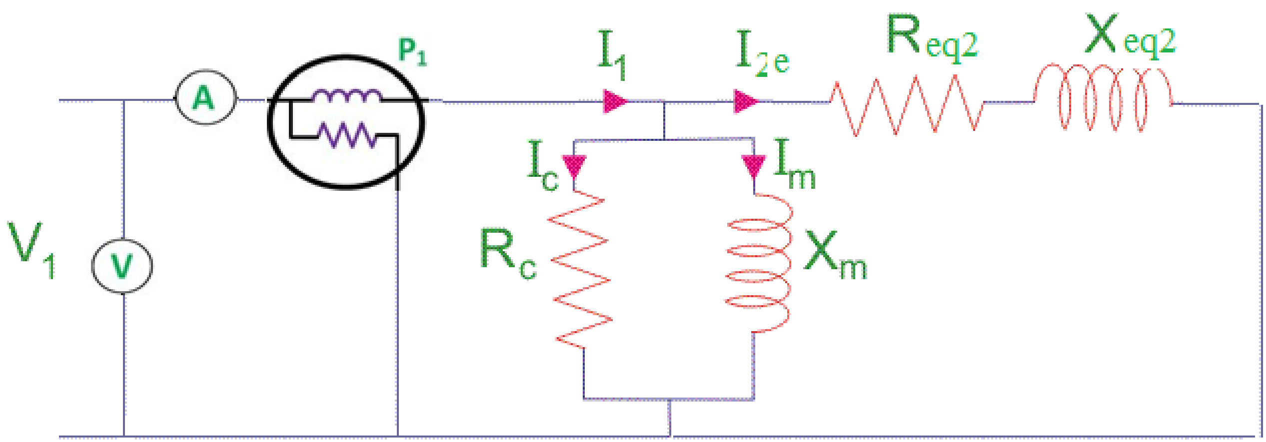
$$Po = vo\, Ii = vo(vo\, Gi) = vo^2 Gi$$

$$Gi = \frac{po}{vo^2} \qquad ; \qquad Ii = vo\, Gi$$

$$Im = \sqrt{Io^2 - Ii^2} \qquad ; \qquad Bm = \frac{Im}{vo}$$

<u>*short –circuit test</u>





vsc, Isc, psc

$$zsc = z1 + z2e \quad = Rsc + jXsc = \frac{vsc}{Isc}$$

$$Rsc = \frac{Psc}{{I_{sc}}^2} = R1 + R2e$$

$$Xsc = X1 + X2e = \sqrt{Zsc^2 - Rsc^2}$$

$$R2e = Rsc - R1$$

$$X2e \cong X1 = \frac{Xsc}{2}$$