Name → Hamza

ID → 13042

Sub → Electrical Machine

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D/p → Electrical

QNO 1

Given data:

$L = 55\ cm$

$a = 150\ cm^2$

$turn = 200$

$H = 115\ A \cdot turns/m$

Required (a) How much current required to produce 0.012 Wb of Flux in the core?

(b) What is the core's relative permeability at that current level? ($4\pi \times 10^{-7}\ H/m$)

(c) What is its reluctance?

Solution:

First Required Flux density in the core is:

$$B = \Phi/A = \frac{1012}{0.015} = 0.8T$$

We have $H = 115\ A \cdot turns/m$

The MMF Needed to produce

(2)

$F = Ni = HI_c$

$F = 115 \times 0.55 = 6325$ A-turn

$\Rightarrow$ $\boxed{F = 63.25 \text{ A-turns}}$

(a) Now current required is:

$I = F/N = \frac{6325}{200}$

$\Rightarrow$ $\boxed{I = 0.316 \text{ Amp}}$

(b) Core permeability is:

$\mu = B/H = 0.8/115$

$\mu = 0.00696$ H/m

Now relative permeability is

$\Rightarrow$ $\mu_r = \frac{\mu}{\mu_0} = \frac{0.00696}{4\pi \times 10^{-7}} = 5540$

(c) Reluctance of the core is

$R = F/\Phi = \frac{6325}{0.012} = 5270$ AT/Wb

$\Rightarrow$ $\boxed{R = 5270 \text{ A turns/wb}}$ Ans.

Q2: Voltage and Impedance Relationship with turn Ratio for an ideal transformer:-

Answer

For ideal transformer, all the flux is confined to the iron core and thus links the primary and secondry.

$$E_{RMS} = 4.44 f N \Phi_{max} = 4.44 f N B_{max} A$$

Then

$$E_p = 4.44 f N_p \Phi_{max}$$

$$E_s = 4.44 F N_s \Phi_{max}$$

$$\frac{E_p}{E_s} = \frac{N_p}{N_s} = a$$

$a \Rightarrow$ Turn Ratio

for step down transformer, the primary side has more turns secondry, therefore $a > 1$

for step up transformer, the primary side has fewer turns secondry, therefore $a < 1$

Now Apply Ohm's law

(4)

$$Z_L = \frac{V_s}{I_p}$$

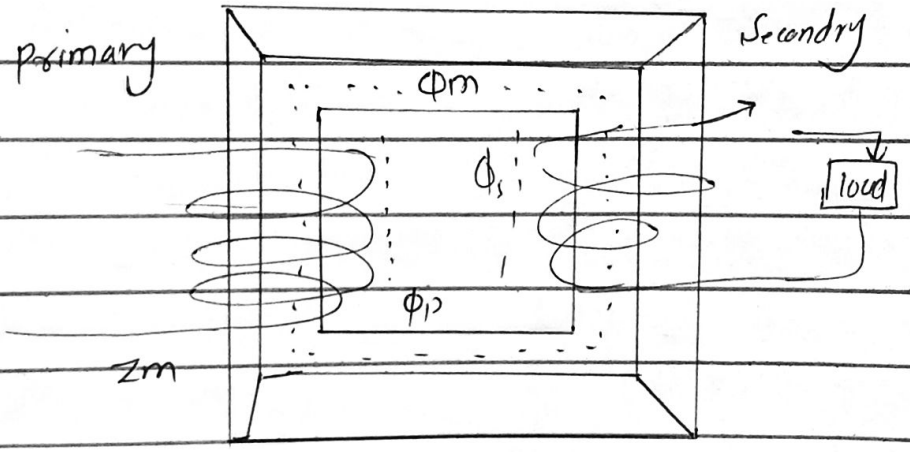
$$\text{Recollect} = \frac{I_p}{I_s} = \frac{V_s}{V_p} = \frac{N_s}{N_p} = \frac{1}{a}$$

Now

$$Z_L = \frac{\frac{V_s}{a}}{aI_p} = \frac{V_p}{a^2 I_p} = \frac{Z_m}{a^2}$$

$$\Rightarrow \boxed{Z_m = a^2 Z_L}$$

The reflected impedance



END.

Q3 Answer:-

Power Factor:-

Power factor is the ratio of the actual electrical power dissipated by an AC circuit to the product of the r.m.s values of current and voltage.

OR

The ratio of the real power absorbed by the load to the apparent power flowing in the circuit and is a dimensionless number in the closed interval of -1 to 1.

Real power:-

The power which is actually consumed or utilised in an AC circuit is called True power or active or Real power. It is measured in KilO watt.

Active power is the real power consumes by the load.

Apparent Power:-

The combination of reactive power and true power is called apparent power and it is the product of a circuit's voltage and current, without reference to phase angle. Apparent power measured in unit of Volt-Amp (VA).

Reactive Power:-

Reactive power is the product of voltage and current and the sine of the angle between them.

Reactive power is measured in VAR.