NAME: FAWAD REHMAN
ID: 5053
PAPER: Electrical Machines
INST: ENGR. SANAULLAH AHMED
Date: 21/08/2020

---

① Question No 1.

Solution:

- The required flux density in the core is

$$B = \frac{\Phi}{A} = \frac{1.012}{0.015} = 0.8T$$

→ Here the required magnetizing intensity is: H = 115 A.turns/m.

- The magnetomotive force needed to produce this magnetizing intensity is:

$$F = Ni = Hl_c = 115 \times 0.55 = 63.25 \text{ A.turns}$$

- So the required current is:

$$i = \frac{F}{N} = \frac{63.25}{200} = 0.316 \text{ Amp}$$

- The core's permeability at this current is:

$$\mu = \frac{B}{H} = \frac{0.8}{115} = 0.00696 \text{ H/m}$$

- Therefore, the relative permeability is:

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

- The reluctance of the core is:

$$R = \frac{F}{\phi} = \frac{63.25}{0.012} = 5270 \text{ A.turns/Wb}$$

Question No 2.

Solution:

Relationship b/w voltage & impedance:

* Considering ideal transformer;

$$V_1 = \frac{d\Phi}{dt} = V_1 = \frac{N_1 d\Phi}{dt}$$

$$V_2 = \frac{d\Phi}{dt} = V_2 \frac{N_2 d\Phi}{dt}$$

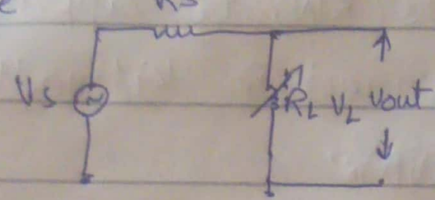
$$\frac{V_1}{V_2} = \frac{N_1 \frac{d\Phi}{dt}}{N_2 \frac{d\Phi}{dt}}$$; so we get

$$\therefore \frac{V_1}{V_2} = \frac{N_1}{N_2} = \alpha \Rightarrow \text{truns ratio}$$

→ Voltag induced $e_p = -N_1 \frac{d\Phi}{dt}$ in primary side due to source conneted on primary side is called self induced emf.

→ While voltage induced in secondary is due to ϕ travelled in core is called mutual induction. $e_s = -N_2 \frac{d\phi}{dt}$

* suppose



$V_{out} = \frac{R_L}{R_L + R_S} V_S$, $P_{out} = \frac{V_{out}^2}{R_L}$

$= \frac{\left(\frac{R_L}{R_L+R_S}\right)^2 V_S^2}{R_L}$

$P_{out} = \frac{R_L}{(R_S + R_L)^2} V_S^2$ ∵ when $R_S = R_L$, $R_L = R_S$

$P_{out} = P_{max}$

impedence of primary side

$Z_P = \frac{V_P}{I_P}$ and $Z_S = \frac{V_S}{I_S}$

we know $\frac{V_P}{V_S} = \frac{N_P}{N_S} = \alpha$

$\frac{V_P}{V_S} = \alpha$, $V_P = \alpha V_S$ — ①

For current => $I_P = I_S/\alpha$ — ②, putting values, we get

$Z_P = V_P/I_P$, $Z_P = \alpha V_S / (I_S/\alpha)$, $Z_P = \alpha^2 V_S/I_S$,

$Z_P = \alpha^2 Z_S$, $\alpha^2 = Z_P/Z_S$, so

$\alpha = \sqrt{\frac{Z_P}{Z_S}}$.

Question No 3.

Answer: **Power factor:**

Power Factor is an expression of energy efficiency, It is the ratio of working power measured in Kilowatts (KW) to apparent power measured in Kilovolt amperes (KVA).

$$\lambda = \frac{P(KW)}{S(KVA)}$$

Differences b/w Real, Apparent AND Reactive Power:

1. The actual amount of power being used, or dissipated, in a circuit is called real power and it is measured in watts and its symbol is Letter P.
2. The combination of reactive power and real power is called apparent power, and it is the product of a circuit's voltage and current, without reference to phase angle. It is measured in the units of

Volt-Amps (VA) and its symbol is S.

3. The power which flows back and forth that means it moves in both the directions in the circuit or reacts upon itself is called reactive power. It is measured in Kilo volt-ampere reactive (KVAR) or MVAR.

" The END "