Solution Q.P. Code :- 09869

Electrical Machines - I

Sem : IV

Electronic & Electrical Engg.

Q 2 (B) Given : 5 KVA , 200 V/400 V , 50 Hz transformer

O.C. Test on L.V. side

$V_0 = 200\,V$ , $I_0 = 1.25\,A$, $W_i = 150\,W$

$W_i = V_0 I_0 \cos\phi_0$

$\cos\phi_0 = 0.6$

$I_m = I_0 \cos\phi_0 = 0.75$

$I_c = I_0 \sin\phi_0 = 1$

$\therefore R_c = \frac{V_0}{I_c} = \frac{200}{1} = 200\,\Omega$

$X_m = \frac{V_0}{I_m} = \frac{200}{0.75} = 266.66\,\Omega$

S.C. Test on H.V. Side

$W_{cu} = I_1^2 R_{01}$

$\therefore R_{02} = \frac{175}{(12.5)^2} = 1.12\,\Omega$

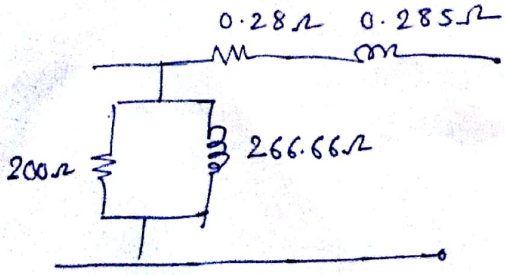
$Z_{02} = \frac{20}{12.5} = 1.6\,\Omega$

$X_{02} = \sqrt{Z_{01}^2 - R_{01}^2} = 1.14\,\Omega$

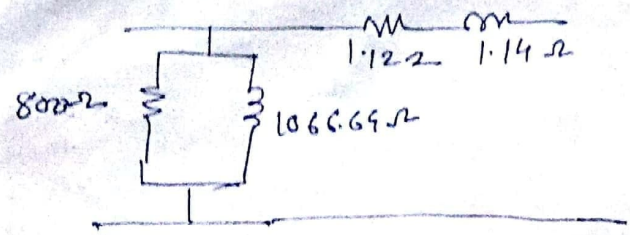
Referred to L.V.

$R_{01} = \frac{R_{02}}{K^2} = 0.28\,\Omega$ $\quad K = \frac{V_2}{V_1} = \frac{400}{200} = 2$

$X_{01} = \frac{X_{02}}{K^2} = 0.285\,\Omega$



Referred to H.V.




Q 3

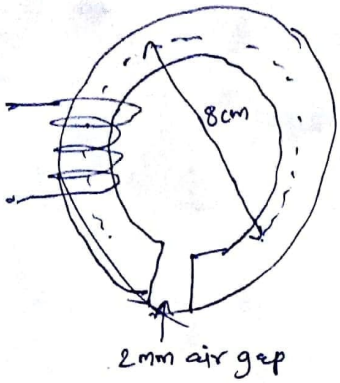
B)

ring diameter $D = 8\,cm$

length of iron $= \pi D - l_g$

$$l_i = \pi (8 \times 10^{-2}) - 2 \times 10^{-3}$$

$$= 0.2493\ m$$




$$a = \frac{\pi}{4} d^2 = \frac{\pi}{4} (1 \times 10^{-2})$$

$$= 7.853 \times 10^{-5}\ m^2$$

∴ (i) Total mmf $= NI = 400 \times 3.5$

$$= 1400\ AT$$

(ii) Total reluctance

$$S_T = S_i + S_g$$

$$= \frac{l_i}{\mu_0 \mu_r a} + \frac{l_g}{\mu_0 a}$$

$$= 23.0737 \times 10^6\ AT/wb$$

(iii) Total flux

$$\Phi = \frac{mmf}{reluctance} = \frac{NI}{S_T}$$

$$= \frac{1400}{23.0737 \times 10^6}$$

$$= 6.067 \times 10^{-5}\ Wb$$

(iv) Flux density $= \frac{\Phi}{a} = \frac{6.067 \times 10^{-5}}{7.853 \times 10^{-5}} = 0.7725\ wb/m^2$