:- A 10KVA, single - phase Transformer for 2000/400V at no load, has $R_1 = 5.5\Omega$, $X_1 = 12\Omega$, $R_2 = 0.2\Omega$, $X_2 = 0.45\Omega$. Determine the approximate value of the secondary v/g at full load, 0.8 pf (lagging), when the primary applied v/g is 2000V.

Sol^n:- $\frac{T_1}{T_2} = \frac{E_1}{E_2} = \frac{2000}{400} = 5$; $R_{e2} = R_2 + R_1\left(\frac{T_2}{T_1}\right)^2 = 0.42\Omega$

$X_{e2} = 0.93$; $KVA = \frac{V_2 I_2}{1000} \rightarrow$; $\boxed{I_2 = 25A}$

$\because \cos\phi_2 = 0.8$

$\sin\phi_2 = 0.6$

$$E_2 = E_1 \cdot \frac{T_2}{T_1} \simeq V_1 \frac{T_2}{T_1} = 2000 \times \frac{1}{5} = 400V$$

By KVL

$$E_2 = V_2 + I_2 R_{e2} \cos\phi_2 + I_2 X_{e2} \sin\phi_2$$

$$\therefore V_2 = 400 - 8.4 - 13.95 = 377.65V$$

A Transformer has 2 percent resistance and 5% reactance. Find its v/g regulation at full load, 0.8 pf lagging

$$VR = R_{epu} \cos\phi_2 + X_{epu} \sin\phi_2$$

$$= 0.02 \times 0.8 + 0.05 \times 0.6 = 0.046 pu = 4.6\%$$

a) At full

Q. A single phase, 100 KVA, 2000/200V, 50Hz transformer has an impedance drop of 10% & resistance drop of 5%. Calculate the (a) regulation at full load 0.8pf lagging (b) the value of the power factor at which regulation is zero.

Sol^n

$$\% \text{ Imp drop} = \frac{I_2 Z_{e2}}{V_2} \times 100 = 10$$

$$I_2 Z_{e2} = \frac{10 V_2}{100} = 20V$$

$$\% \text{ Resistance drop} = \frac{I_2 R_{e2}}{V_2} \times 100 = 5$$

$$I_2 R_{e2} = \frac{5 \times V_2}{100} = 10V$$

$$I_2 X_{e2} = \sqrt{(I_2 Z_{e2})^2 - (I_2 R_{e2})^2}$$

$$= \sqrt{20^2 - 10^2} = 17.32 V$$

a) Approximate VR at lagging Pf

$$= \frac{I_2 R_{e2} \cos\phi_2 + I_2 X_{e2} \sin\phi_2}{V_2}$$

$$= 0.0919 \text{ pu}$$

b) at leading pf for zero VR (leading)

$$= \frac{I_2 R_{e2} \cos\phi_2 - I_2 X_{e2} \sin\phi_2}{V_2} = 0$$

$$\tan\phi_2 = \frac{I_2 R_{e2}}{I_2 X_{e2}} = \frac{10}{17.32} = \frac{1}{\sqrt{3}} = \tan 30°$$

$\cos\phi_2 = \cos 30$
$= 0.866$ leading

Scanned by CamScanner

Sol^n:- $S = 100\,kVA = 100 \times 10^3\ VA$

$P_{cfl} = 1200W$, $P_i = 960W$

$$\eta = \frac{m\, S \cos\phi_2}{m\, S \cos\phi_2 + P_i + m^2 P_{cfl}}$$

Where $m = \frac{\text{given load}}{\text{full load}}$

a) At full load $m = 1$, $\cos\phi_2 = 1$

$$\eta = \frac{1 \times 100 \times 10^3 \times 1}{1 \times 100 \times 10^2 \times 1 + 960 + (1)^2\, 1200}$$

$$\eta = .9788\ pu$$

b) At half load $m = \frac{1}{2}$; $\cos\phi_2 = 0.8$

$$\eta = \frac{\frac{1}{2} \times 100 \times 10^3 \times 0.8}{\frac{1}{2} \times 100 \times 10^3 \times 0.8 + 960 + \frac{1}{(2)^2} \times 1200}$$

$$= 0.9694\ pu = 96.94\%$$

c) at 75% full load $m = \frac{75}{100}$, $\cos\phi_2 = 0.7$

$$\eta = 96.98\%$$

d) $S_M = S_{fl}\sqrt{\frac{P_i}{P_{cfl}}} = 100\sqrt{\frac{960}{1200}} = 89.44\ kVA$

e) Max^m η $(P_i = P_c)$ at .85 p.f $\eta_M = \frac{S_M \cos\phi_2}{S_M \cos\phi_2 + 2P_i} = 97.13\%$

Scanned by CamScanner