KK ma'am assignment

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8.1 A 10 KVA, 200/400 V., 50 Hz, 1 phase transformer gave the following results:-

OC test (HV open) :	200 V	1.3A	120W
Sc test (LV short) :	22 V	30A	200W

Determine shunt and series branch parameters referred to Low voltage side and hence draw equivalent circuit diagram also.

= Given,

Primary voltage (V_1) = 200V (Low)
Secondary voltage (V_2) = 400V (High)
frequency (f) = 50 Hz

Now, $K = \frac{V_2}{V_1} = \frac{400}{200} = 2$

From open circuit test (done on Low voltage)

$V_0 = 200V$
$I = 1.3A$
$W = 120\ W$

Now, $W = VI\cos\phi$

$120 = 200 \times 1.3 \cos\phi$

$\therefore \cos\phi = \frac{6}{13}$

$\therefore \sin\phi = \frac{\sqrt{18^2 - 6^2}}{13} = \frac{\sqrt{183}}{13}$

$I_w = I\cos\phi$

$= 1.3 \times \frac{6}{13}$

$= 0.6A$

$I_m = 1.3 \times \frac{\sqrt{133}}{13}$

$= 1.153$

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Now,

$$R_0 = \frac{V}{I_w} = \frac{200}{0.6} = 333.333\ \Omega$$

$$X_0 = \frac{V}{I_m} = \frac{200}{1.153} = 225.448\ \Omega$$

From short circuit test (done on High Voltage)

$V_{sc} = 22V$

$I_{sc} = 30A$

$W_{sc} = 200W$

Now, $W_{sc} = I_{sc}^2 R_2$

$$R_2 = \frac{W_{sc}}{I_{sc}^2} = \frac{200}{(30)^2} = 0.222\ \Omega$$

$$Z_2 = \frac{V_{sc}}{I_{sc}} = \frac{22}{30} = 0.7333\ \Omega$$

Now,

$$X_2 = \sqrt{Z_2^2 - R_2^2} = \sqrt{(0.7333)^2 - (0.2222)^2} = 0.6985\ \Omega$$

Now, equivalent parameter referred to low voltage side (in this case primary)

$$R_2' = \frac{R_2}{k^2} = \frac{0.222}{2^2} = 0.0556\ \Omega$$

$$X_2' = \frac{X_2}{k^2} = \frac{0.6985}{2^2} = 0.1746\ \Omega$$

Now drawing equivalent circuit

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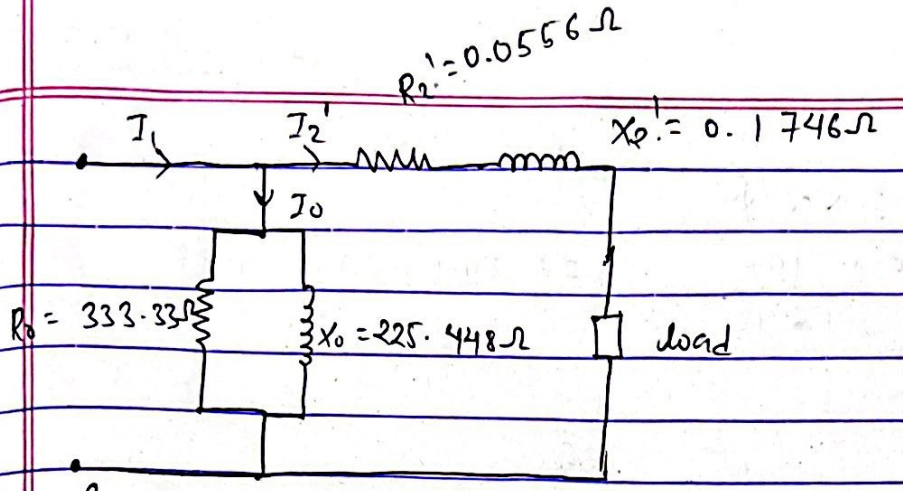

fig: Equivalent circuit referred to low voltage side.

2) The following test results were obtained on a 20kVA, 2200/220V, 50 Hz single phase transformer:-

Open-circuit test (LV side) :	220V	1.1A	125W
Short-circuit test (HV side) :	52.7V	8.4A	287W

Calculate the equivalent circuit referred to LV side and draw the equivalent circuit.

= Given,

$S = 20kVA$

Primary voltage (V_1) = 2200V (High)

Secondary voltage (V_2) = 220V (Low)

$f = 50Hz$

$$K = \frac{V_2}{V_1} = \frac{220}{2200} = 0.1$$

From open circuit test:

$V_0 = 220V$

$I_0 = 1.1 A$

$W_0 = 125 W$

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So,

$W_0 = V_0 I_0 \cos\phi$

or $125 = 220 \times 1.1 \times \cos\phi$

$\therefore \cos\phi = 0.5165 = \frac{125}{242}$ $\Rightarrow \sin\phi = \frac{\sqrt{242^2 - 125^2}}{242} = \frac{207.21}{242}$

$= 0.8562$

So,

$I_w = I_0 \cos\phi$

$= 1.1 \times \frac{125}{242}$

$= 0.5681\ A$

So,

$I_m = I_0 \sin\phi$

$= 1.1 \times 0.8562$

$= 0.9418\ A$

Thus,

$R_0 = \frac{V_0}{I_w}$ $= \frac{220}{0.5681} = 387.25\ \Omega$

$X_0 = \frac{V_0}{I_m}$ $= \frac{220}{0.9418} = 233.595\ \Omega$

From short circuit test:

$V_{sc} = 52.7V$

$I_{sc} = 8.4A$

$W_{sc} = 287\ W$

$R_2 = \frac{W_{sc}}{I_{sc}^2} = \frac{287}{(8.4)^2} = 4.067\ \Omega$

$Z_2 = \frac{V_{sc}}{I_{sc}} = \frac{52.7}{8.4} = 6.273\ \Omega$

$X_2 = \sqrt{Z_2^2 - R_2^2} = \sqrt{(6.273)^2 - (4.067)^2} = 4.777\ \Omega$

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Changing into equivalent parameters.

$R_0' = K^2 \times R_2$

$= (0.1)^2 \times 4.067$

$= 0.04067\,\Omega$

$X_0' = K^2 \times X_2$

$= (0.1)^2 \times 4.777$

$= 0.04777\,\Omega$

Drawing eqⁿ circuit