Experiment – 1 (EE19BTECH11041)

Aim :-

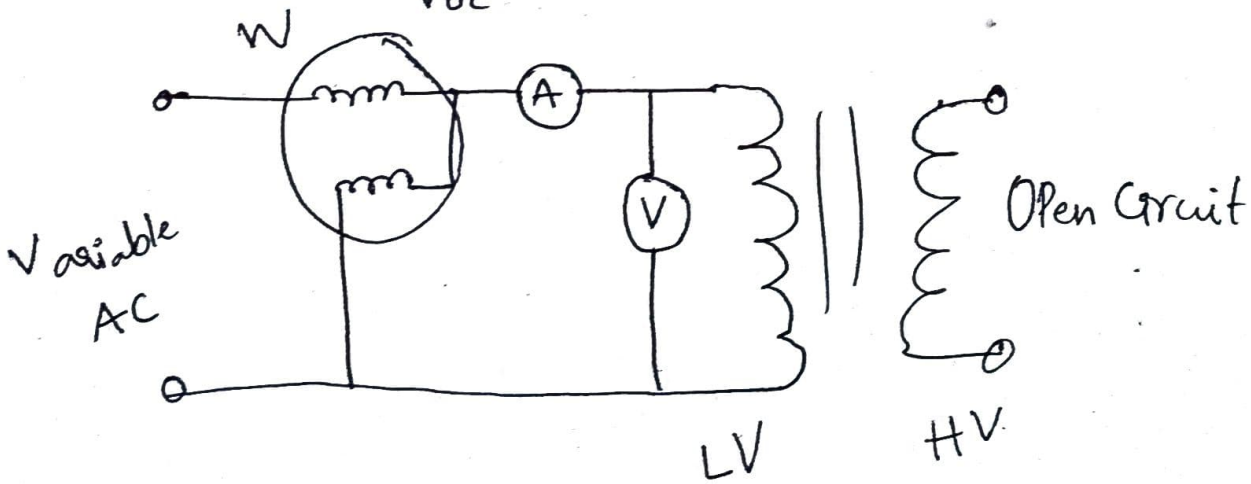
The Objective of this experiment is to determine the values of R, X, B_m, G_i through short circuit and open circuit test as well as to verify the equivalent circuit representation through load test.

Procedure :-

Open Circuit test :-

1. Apply rated voltage on the LV side.
2. Note down the Voltmeter, ammeter and wattmeter reading (indicated by V_{oc}, I_{oc} and P_{oc}, respectively)
3. Determine G_i and B_m (LV side) by using the formula

$$G_i = \frac{P_{oc}}{V_{oc}^2}, \quad y = \frac{I_{oc}}{V_{oc}}, \quad B_m = \sqrt{y^2 - G_i^2}$$



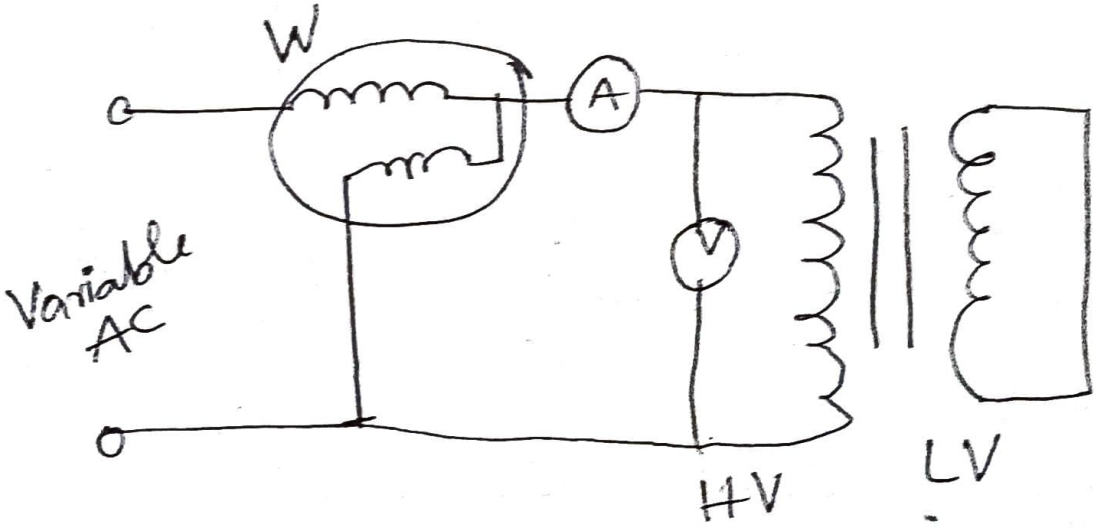
Short Circuit Test

(1) Establish rated Current on the HV side by adjusting the input voltage.

(2) Note down the Voltmeter, ammeter and wattmeter reading (indicated by V_{sc}, I_{sc} and P_{sc}, respectively)

(3) Determine R and X (HV side) by using the formulae.

$$R = \frac{P_{sc}}{I_{sc}^2}, \quad Z = \frac{V_{sc}}{I_{sc}}, \quad X = \sqrt{Z^2 - R^2}$$



1-ø transformer SC test

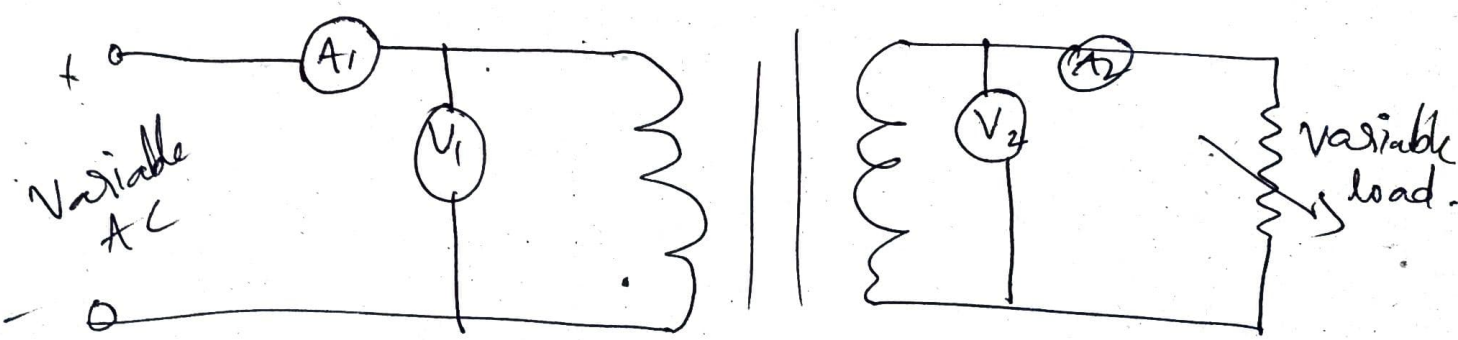
Load test :-

(1) Apply rated voltage on LV / HV side.

(2) Take the Voltmeter and Ammeter readings for different settings of the resistance Bank.

(3) For a particular setting of the resistance bank, the value of load resistance can be found from the reading of Voltmeter 2 and Ammeter 2.

(4) For a given value of load resistance and input voltage, calculate the value of I_{L1} from the equivalent circuit.



Load test

Results and Observations:

Open circuit test:

$V_{oc} = 120V$

$I_{oc} = 0.20A$

$P_{oc} = 11W$

$$G_i = \frac{P_{oc}}{V_{oc}^2} = \frac{11}{(120)^2} = 0.00076 \text{ (LV)}$$

$$Y = \frac{I_{oc}}{V_{oc}} = \frac{0.2}{120} = 0.00167 \text{ (LV)}$$

$$B_m = \sqrt{Y^2 - G_i^2} = 1.48 \times 10^{-3}$$

$$\boxed{B_m = 0.00148 \text{ (LV)}}$$

Short circuit test:

$$G_i(HV) = G_i(LV) \times \frac{1}{a^2} = \frac{1}{4} \times G_i = 0.00019 S$$

$$Y(HV) = Y(LV) \times \frac{1}{a^2} = 0.0004175 S$$

$$B_m(HV) = B_m(LV) \times \frac{1}{a^2} = 0.00037 S$$

Short circuit test

$V_{sc} = 12V$

$I_{sc} = 2.19A$

$P_{sc} = 24W$

$$R(HV) = \frac{P_{sc}}{I_{sc}^2} = \frac{24}{(2.19)^2} = 5.004\Omega$$

$$Z(HV) = \frac{V_{sc}}{I_{sc}} = \frac{12}{2.19} = 5.4795\Omega$$

$$X = \sqrt{Z^2 - R^2} = 2.2326\Omega$$

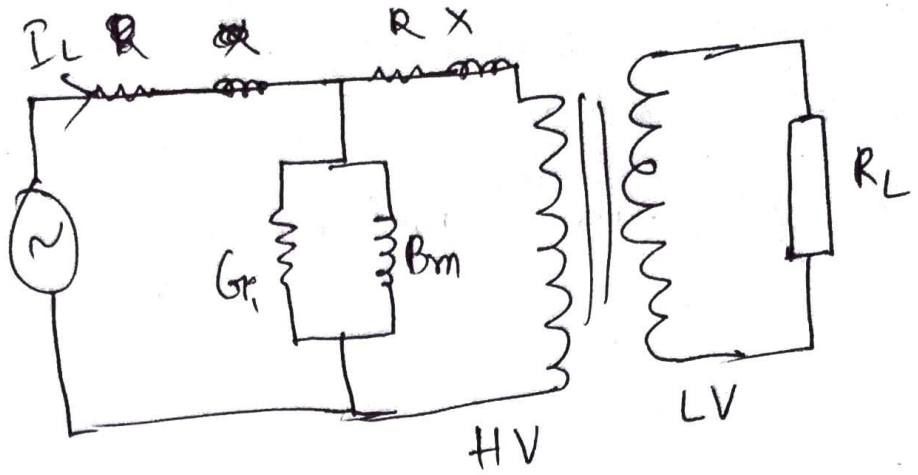
$$R(LV) = R(HV) \times \frac{1}{a^2} = 5.004 \times \frac{1}{4} = 1.251\Omega$$

$$Z(LV) = Z(HV) \times \frac{1}{a^2} = 5.4795 \times \frac{1}{4} = 1.3698\Omega$$

$$X(LV) = X(HV) \times \frac{1}{a^2} = 2.2326 \times \frac{1}{4} = 0.55815$$

Load test

Values obeserved · let's say V_1, I_1, V_2, I_2



$$R_L = \frac{V_2}{I_2}, \quad R_L' = k_L \times a^2$$
$$(LV) \qquad (HV) = \frac{V_2}{I_2} \times 4$$

$$I_{L_1} = \frac{V_{L_1}}{\left((R + R_L' + jX) \,//\, (G_i \,//\, Bm)\right)}$$

$$= \frac{V_{L_1}}{\underbrace{(R + R_L' + jX)}_{Z} \,//\, \underbrace{\left(\frac{1}{G_i - jBm}\right)}_{Y_0}}$$

$$I_{L_1} = \left(\frac{V_{L_1}}{\frac{\frac{Z}{Y_0}}{\frac{1}{Y_0} + Z}} \right)$$

Load test

$$R_L = \frac{V_2}{I_2} \qquad I_{L_1} = \frac{V_{L_1}}{\frac{Z}{Y_0}}$$

$$\frac{1}{Y_0} + Z$$

$$Z = R + R_L' + jx$$

$$Y_0 = G_i - jB_m$$

V_{L_1}	I_{L_1}	V_{L_2}	I_{L_2}	R_L (calculated)	I_{L_1} (calculated)
$\frac{400}{\sqrt{3}}$	0.67	121	1.17	103.4 Ω	0.601 A
$\frac{400}{\sqrt{3}}$	0.73	120	1.29	93.02	0.662 A
$\frac{400}{\sqrt{3}}$	0.93	120	1.70	70.5 Ω	0.85 A
$\frac{400}{\sqrt{3}}$	1.3	118	2.39	49.37 Ω	1.18 A
$\frac{400}{\sqrt{3}}$	2.15	116	4.03	28.78 Ω	1.96 A

Precautions:

(1) Before doing the experiment we should check the fuse.

(2) we need to be careful to slowly increase Voltage rather than suddenly.

(3) Same applies to load resistance.

Comments:

According to load test we can see that there is an 0.05A error when measured and Calculated. This may be due to any number of causes.