THE HASHMITE UNIVERSITY
ELECTRICAL ENGINEERING DEPARTMENT
ELECTRICAL MACHINES LAP

Lab Sheet

Single Phase Transformer I.

Group number:	**Students ID:**
1-Moslem Naji Othman	**1733045**
2-Essa Taiseer AL-hoor	**1830278**
3	
4	
5	
6	
7	

Single Phase Transformer- (I)

A) Open Circuit Test:-

Table 2-A

Applied voltage (V_1)	No load current ($I_1 = I_m$)	Open side voltage (V_2)	No load input power (W_o)	Calculated				
				$cos\,\theta_o$	I_{rc}	I_{xm}	R_c	X_m
115V	0.17	230	10	0.512	0.087	0.083	1.3K	1.39K
90V	0.11	180	6	0.303	0.033	0.0767	2.7K	1.173K
70V	0.08	142	4	0.714	0.006	0.0023	1.225K	3.06K
50V	0.07	103	2	0.571	0.04	0.03	1.251K	1.665K

Results:

1. Find the no load currents, I_{rc}, I_{xm}, $cos\,\theta_o$, R_c and X_m **at the rated voltage (115V)**.

   $I_{rc} = I_1 \times cos\,\theta_o = 0.087\text{A}$

   $I_{xm} = I_1 \times sin\,\theta_o = 0.083\text{A}$

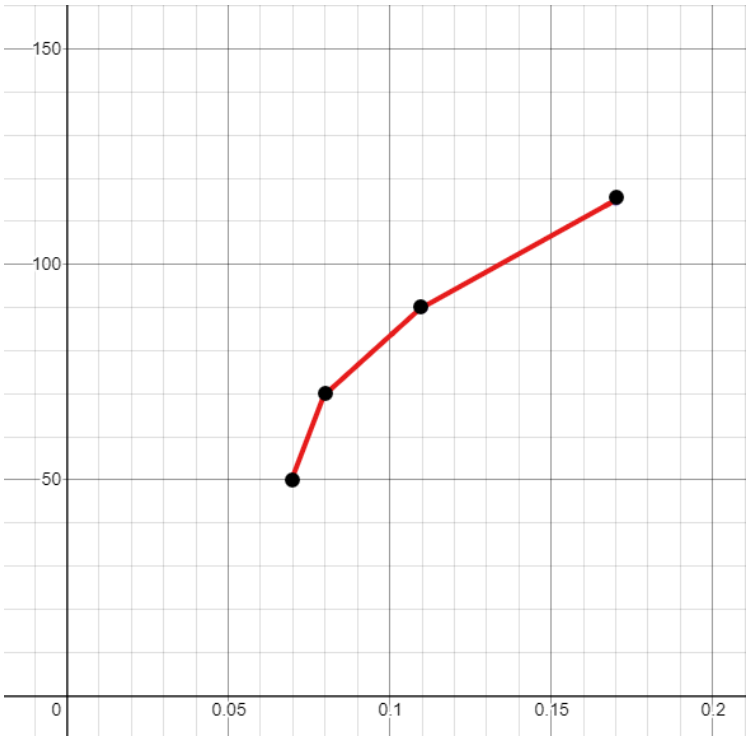
   $Z_1 = R_c + jX_m$

   $Z_1 = \frac{V_1}{I_1} = 676.5\Omega$

   $R_c = \frac{Z_1}{cos\,\theta_o} = 1.3\text{K}\Omega$

   $X_m = \frac{Z_1}{sin\,\theta_o} = 1.39K\Omega$

2. Plot the applied voltage V_1 against I_m.



Questions:

1. Why does the wattmeter in no load test read the iron losses only?
   Because the voltage across the windings depends on the iron losses as a result of that voltage during no-load test approximately the rated voltage and the reason why we do not calculate copper loss because there is one current will flow magnetization current (no load)

2. Why the no load test is usually done with supply given to the low voltage side?

1- High accuracy in low rating instruments.
2- No high rating instruments.
3- LV need less rated voltage than HV.

B) Turns Ratio Test:-

Depending on the measured values of V_1 and V_2 in Table 2-A, calculate the ratio: V_1/V_2 .

Applied voltage (V_1)	Open side voltage (V_2)	V_1/V_2
115V	230V	0.5
90V	180V	0.5
70V	142V	0.493
50V	103	0.485

Questions:

1. How does the transformer change the voltage from one value to the other?

   By using Faraday's induction law that states:
   $V_s = -N_s \frac{\Delta \Phi}{\Delta t}$
   N_s: number of loops in the secondary coil
   $\frac{\Delta \Phi}{\Delta t}$: rate of change of magnetic flux

2. What is the voltage ratio? Is it same for all condition?
   It is the ratio between the primary and secondary voltage.
   No, because there is a ratio error that caused by leakage inductance, copper loss and inter winding capacitance.

C) Polarity Test:-

Read the value of the voltage V from supply side and the voltage V_1 between the other open terminals of the windings.

V = 30 V_1 = 11

If $V < V_1$ then, the polarity is additive.

If $V > V_1$ then, the polarity is subtractive.

The polarity of the tested transformer is subtractive.

Questions:

1. What is meant by the additive polarity of transformer?

   It is a condition that happens when the applied voltage less than the voltage between the primary and secondary.

2. Explain the importance of polarity test on transformer?

   To make sure that we connect the same polarity windings and not the opposite ones because when we connect in the opposite it will lead us to a short-circuit and damage the machine.

D) Measuring the Resistances of the Transformer Windings: -

Table 2-B

Winding	R_x
High voltage side 0V-220V	5.56
High voltage side 0V-160V	4
Low voltage side 110 V	2.25

Conclusions:

1-we can calculate from OC test applying voltage and the current and the iron loss.
2-from ratio test we can know how much voltage we get in the secondary side.
3-from polarity test we can avoid machine corruption.
4-we measure the resistance to make sure that each circuit is wired properly and all connections are tight and to make sure it’s in phase-to-phase.