DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603 203

Title of Experiment	: **4. LOAD TEST ON SINGLE PHASE TRANSFORMER**
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Register Number	: RA2011004010051
Date of Experiment	: 25th May 2021

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
Total		**50**	

Staff Signature

PRE-LAB QUESTIONS

1. **Explain the working principle of transformer.**

The basic principle on which the transformer works is Faraday's Law of Electromagnetic Induction or mutual induction between the two coils. The working of the transformer is explained below. The transformer consists of two separate windings placed over the laminated silicon steel core.

The winding to which AC supply is connected is called primary winding and to which load is connected is called secondary winding. It works on the alternating current only because an alternating flux is required for mutual induction between the two windings.

2. **What are the main parts of a transformer?**

There are three basic parts of a transformer:

1. an iron core which serves as a magnetic conductor,
2. a primary winding or coil of wire and
3. a secondary winding or coil of wire.

The primary is usually referred to as the input; the secondary as the output.

3. **What are the types of transformers?**

There are various types of transformers. The main types being, Step-Up and Step-Down Transformers. Other that this, there are various types of transformers such as,

1. Power transformer.
2. Distribution transformer.
3. Instrument transformer.
4. Current transformer.
5. Potential transformer.
6. Single and Three Phase transformer.

4. What is the meaning of KVA rating of transformer?

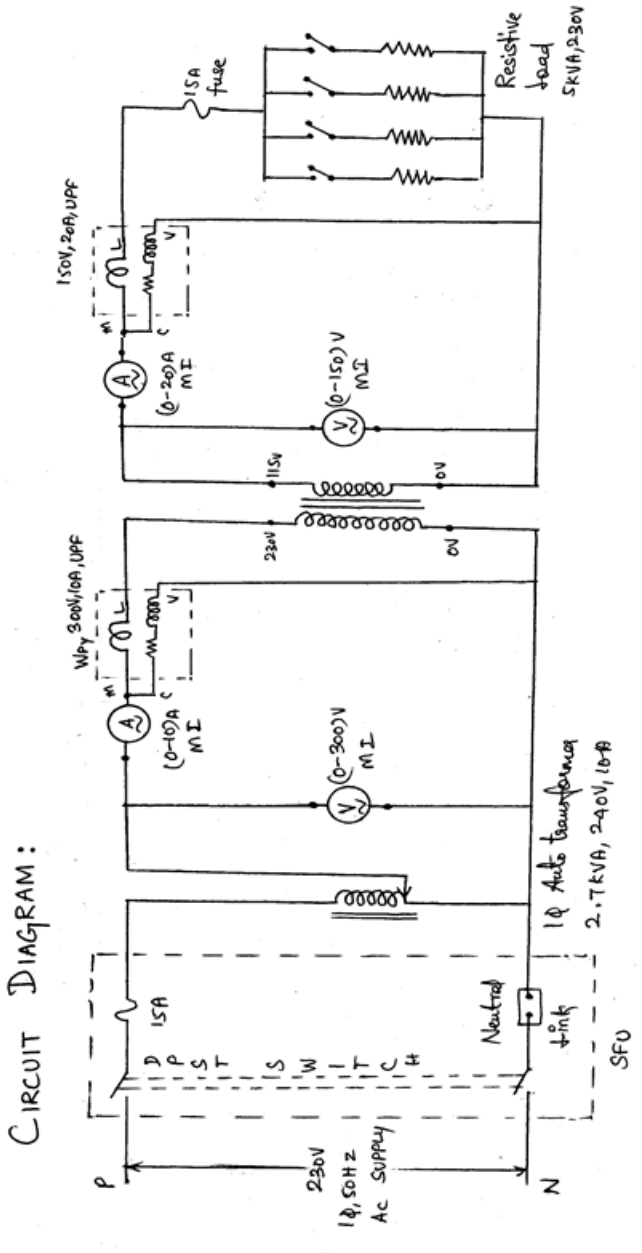
kVA stands for Kilovolt-Ampere and is the rating normally used to rate a transformer. The size of a transformer is determined by the kVA of the load. In many circumstances the power required by the load is equivalent to the rating of the transformer expressed in either VA or kVA. For example a 1KW (1000 Watts) load would require a 1kVA transformer @ unity power factor.

The Current that passes through transformer windings will determine the Copper Losses, whereas Iron Losses, Core Losses or Insulation Losses depends on voltage.

5. What is the necessity of the load test for a transformer?

Load test used to determine the performance of transformer at various loads, to find out its efficiency and regulation. In this method, a resistive load is connected to the transformer and it's loaded up to the rated current.

CIRCUIT DIAGRAM:



Experiment No. 4 **Date : 25th May 2021**	**Load test on single phase transformer**

Aim:

To conduct the load test on the given a single phase transformer for finding the efficiency and its regulation.

Apparatus Required:

S.NO	APPARATUS	RANGE	TYPE	QUANTITY
1.	Voltmeter	(0-150)V (0-300) V	MI MI	1 1
2.	Ammeter	(0-10)A (0-20) A	MI MI	1 1
3.	Wattmeter	150V,20A 300V,10A	UPF UPF	1 1
4.	Auto transformer	240 V, 2.7 KVA,10A		1

Formula Used:

1.Percentage Regulation = $(V_{o2}-V_o)/V_{o2}*100$

Where V_{o2} = Secondary voltage on no load

V_o = Secondary voltage at a particular load

2. Power factor = $Pout/V_2*I_2$

Where Pout = Secondary wattmeter readings in Watts

V_2 = Secondary voltage in Volts

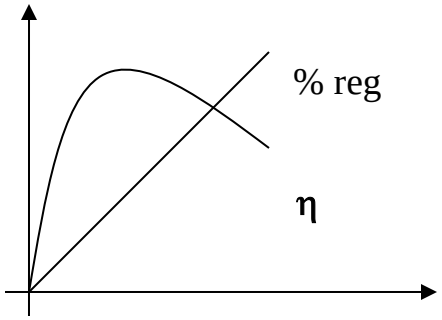
I_2 = Secondary current in Amps

3. Percentage efficiency = Pout/Pin*100

Where Pout = Secondary wattmeter readings in Watts

Pin = Primary wattmeter readings in Watts.

Model Graph:



Procedure

1.Connections are given as per the circuit diagram.

2.Verify whether the autotransformer is kept at zero voltage position.

3.By closing the DPST switch, 230V,1ϕ,50HZ AC supply is given to the transformer.

4.At no load, the readings from the meters are noted down.

5.The load is applied to the transformer in steps upto 125% of the rated value of the primary

Current by using rheostatic load..

6.The corresponding values from the meters are tabulated for different loads.

7.Then the load is removed gradually, auto transformer is brought to its minimum position and

the supply is switched off.

8.From the recorded values, the regulation, power factor and efficiency are calculated.

TABULATION:

S. No	Primary Voltage V_1 (V)	Primary Current I_1 (A)	Secondary Voltage V2 (V)	Secondary Current I_2 (A)	% Regulation %	η %
1.	240	483.6 mA	119.81	962.4 mA	0.058	99.3
2.	240	961.2 mA	119.24	1.92	0.53	99.2
3.	240	1.44	118.20	2.87	1.4	98.1
4.	240	1.92	116.65	3.80	2.6	96.1

Model Calculation:

(1)

V_{o_2} – Secondary Voltage on no load

$V_{o_2} = 119.88$ V.

To find the percentage regulation and Percentage efficiency of the transformer at various loads.

1. Percentage Regulation = $\frac{V_{o_2} - V_o}{V_{o_2}} \times 100$.

where V_o = Secondary Voltage at particular load.

2. Percentage Efficiency = $\frac{P_{out}}{P_{in}} \times 100$.

Single Load:

Percentage Regulation = $\frac{119.88 - 119.81}{119.88} \times 100$

$= 0.058$ %

Percentage efficiency = $\frac{P_{out}}{P_{in}} = \frac{119.81 \times 962.4 \times 10^{-3}}{240 \times 483.6 \times 10^{-3}} = 99.3$ %

(2)

Two Loads:

Percentage Regulation = $\frac{119.88 - 119.24}{119.88} \times 100 = 0.53\ \%$

Percentage Efficiency = $\frac{119.24 \times 1.92}{240 \times 961.2 \times 10^{-3}} \times 100 = 99.2\ \%$

Three Loads:

Percentage Regulation = $\frac{119.88 - 118.20}{119.88} \times 100 = 1.4\ \%$

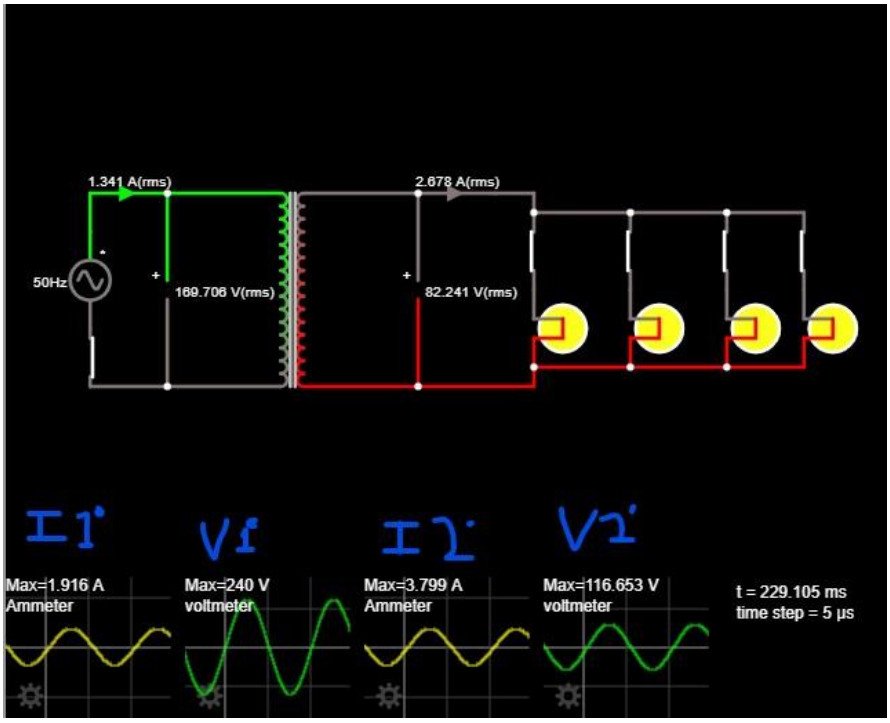
Percentage Efficiency = $100 \times \frac{118.20 \times 2.87}{240 \times 1.44} = 98.1\ \%$

Four Loads:

Percentage Regulation = $\frac{119.88 - 116.65}{119.88} \times 100 = 2.6\ \%$

Percentage efficiency = $\frac{116.65 \times 3.80}{240 \times 1.92} \times 100 = 96.1\ \%$

Result:



POST LAB QUESTIONS

1. **What will happen if a DC voltage is given to the transformer primary?**

A constant dc source connected to the primary of transformer will have zero EMF. The constant current creates zero induced emf. As a result transformer primary will behave as a short circuit and heavy current will flow through the primary which will, in turn, burn the windings.

2. **What are the losses in a transformer?**

There are different kinds of losses that will be occurred in the transformer such as iron, copper, hysteresis, eddy, stray & dielectric. The copper loss mainly occurs due to the resistance in the transformer winding whereas hysteresis losses will be occurred due to the magnetization change within the core.

3. **How can we minimize the core losses in a transformer?**

Due to the constantly changing magnetic fields, there is a loss of current in the core. One easy solution for how to reduce eddy current losses in the transformer is to make the core by stacking thin sheets together. This will decrease the eddy current and hence the losses made by it too.

4. **What is meant by eddy current losses?**

When an alternating magnetic field is applied to a magnetic material, an emf is induced in the material itself according to Faraday's Law of Electromagnetic induction. Since the magnetic material is a conducting material, these EMFs circulate current within the body of the material.

These circulating currents are called Eddy Currents. They will occur when the conductor experiences a changing magnetic field.

As these currents are not responsible for doing any useful work, and it produces a loss (I^2R loss) in the magnetic material known as an Eddy Current Loss. Similar to hysteresis loss, eddy current loss also increases the temperature of the magnetic material.

5. **How hysteresis loss can be reduced?**

Hysteresis losses can be reduced by using material that has less area of the hysteresis loop. Hence, high grade or silica steel can be used for designing the core within a transformer because it has extremely less area of the hysteresis loop.