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	: RA2111050010001
Date of Experiment	: 23-11-2021

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**

   Answer: A transformer consists of two electrically isolated coils and operates on Faraday's principal of “mutual induction”, in which an EMF is induced in the transformers secondary coil by the magnetic flux generated by the voltages and currents flowing in the primary coil winding.

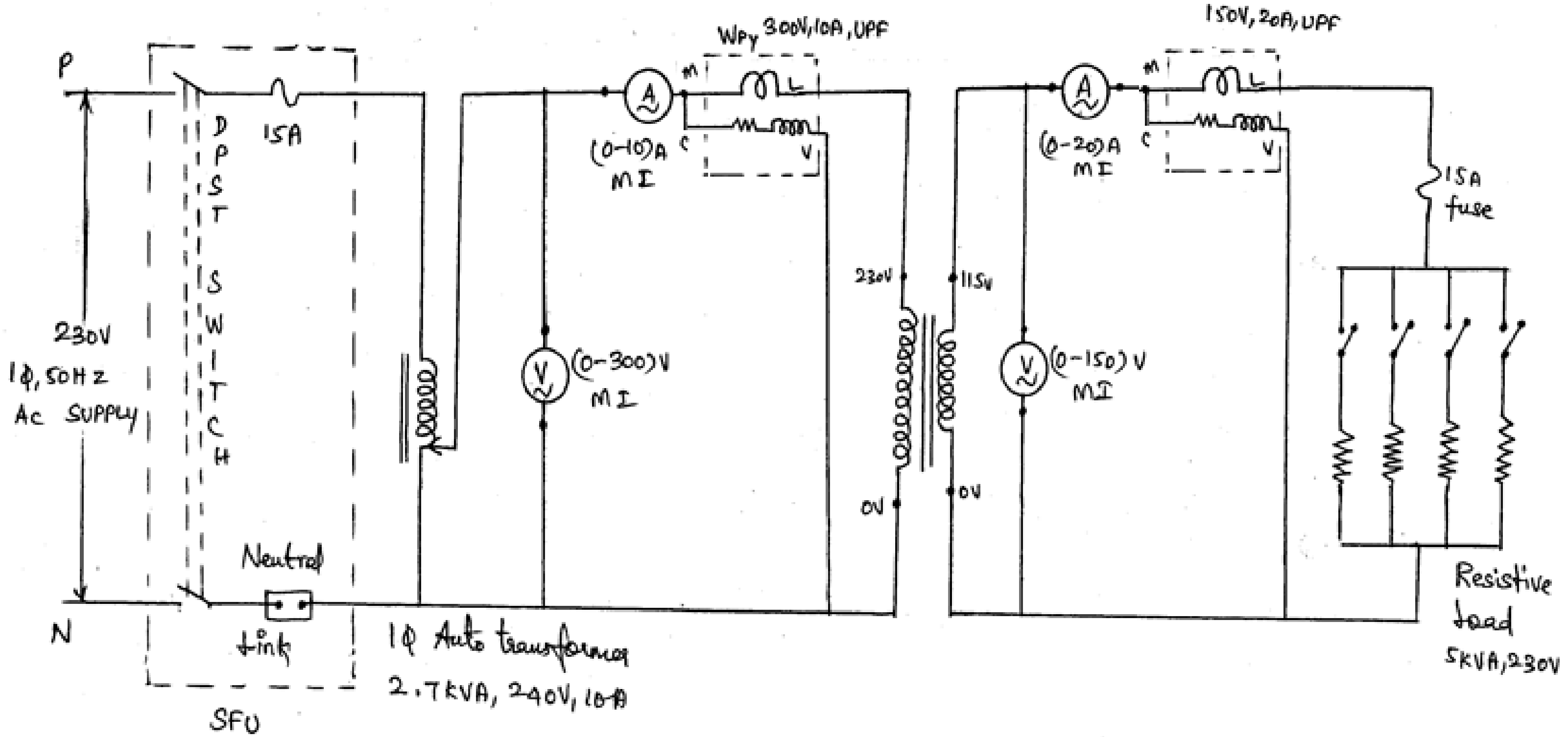
2. **What are the main parts of a transformer?**
   Answer:
   ● an iron core which serves as a magnetic conductor.
   ● a primary winding or coil of wire and.
   ● a secondary winding or coil of wire.

3. **What are the types of transformers?**
   Answer:
   ● Laminated core.
   ● Toroidal
   ● Autotransformer.
   ● Variable autotransformer.
   ● Induction regulator.
   ● Polyphase transformer.
   ● Grounding transformer.
   ● Phase-shifting transformer.

4. **What is the meaning of KVA rating of transformer?**
   Answer: 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. ... 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?**
   Answer: The purpose of load test is to determine the parallel operation and calculate the efficiency, thermal stability and dynamic stability of power transformer through measuring the short circuit l.

CIRCUIT DIAGRAM:



Experiment No. 4 Date :	**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 = $(V_1-V_2) /V_1*100$

Where V_2 = Secondary voltage on no load

V_1 = 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

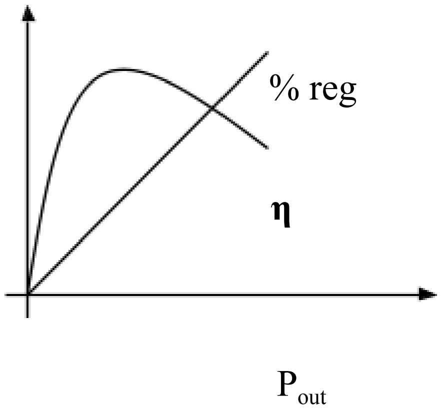
I_2 = Secondary current in Amps

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,1\ ,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)	Primary Wattmeter W_1 (W)	Secondary Voltage V2 (V)	Secondary Current I_2 (A)	Secondary Wattmeter W_2 (W)	Power Factor Cosθ	% Regulation %	η %
1	230	3.3	759	114.8	4.86	558.635	1	0.13	73.56
2	230	2.91	669.3	114.8	3.55	407.895	1	0.13	60.94
3	230	2.38	547.5	114.9	2.43	279.182	1	0.13	51.0
4	230	1.95	448.5	114.9	1.18	135.570	1	0.14	30.22

Model Calculation:

Case 1) All switches are kept closed

Primary Wattmeter W_1 = V*I

= 230 * 3.3 = 759W

Secondary Wattmeter W_2 = V *I

= 114.8 * 4.86 = 558.635

Power Factor = Pout/V_2*I_2

= 558.365/114.89*4.86

= 1

Percentage Regulation = (V_1-V_2) /V_1*100

= [(115.05-114.89)/115.05] *100

= 0.130%

Percentage Efficiency = Pout/Pin*100

= (558.365/759) *100

= 73.56%

Case 2) When 3 switches are closed

Primary Wattmeter W_1 = V*I

$= 230 * 2.91 = 669.3W$

Secondary Wattmeter $W_2 = V *I$

$= 114.9 * 3.55 = 407.895W$

Power Factor = $Pout/V_2*I_2$

$= 407.895/114.9*3.55$

$= 1$

Percentage Regulation = $(V_1-V_2) /V_1*100$

$= [(115.05-114.9)/115.05] *100$

$= 0.130\%$

Percentage Efficiency = Pout/Pin*100

$= (407.895/669.3) *100$

$= 60.94\%$

Case 3) When 2 switches are closed

Primary Wattmeter $W_1 = V*I$

$= 230 * 2.38 = 547.4W$

Secondary Wattmeter $W_2 = V *I$

$= 114.8 * 2.43 = 279.182$

Power Factor = $Pout/V_2*I_2$

$= 279.182/114.9*2.43$

$= 1$

Percentage Regulation = $(V_1-V_2) /V_1*100$

$= [(115.05-114.9)/115.05] *100$

$= 0.130\%$

Percentage Efficiency = Pout/Pin*100

$= (279.182/547.4) *100$

$= 51.00\%$

Case 4) When 1 switch is closed

Primary Wattmeter $W_1 = V*I$

$= 230 * 1.95 = 448.5W$

Secondary Wattmeter $W_2 = V *I$

$= 114.8 * 1.18 = 135.570$

Power Factor = $Pout/V_2*I_2$

= 135.570/114.9*1.18

= 1

Percentage Regulation = $(V_1-V_2)/V_1*100$

= [(115.05-114.9)/115.05] *100

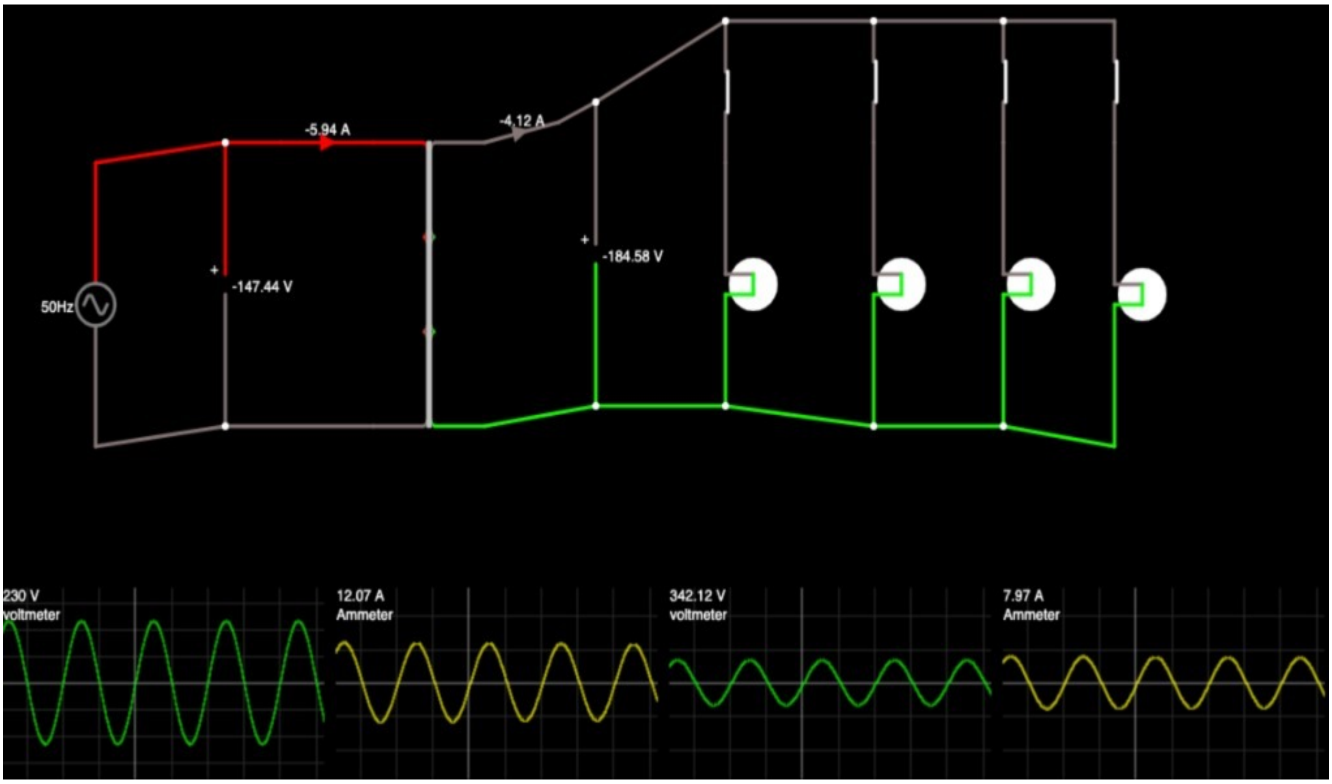
= 0.139%

Percentage Efficiency = Pout/Pin*100

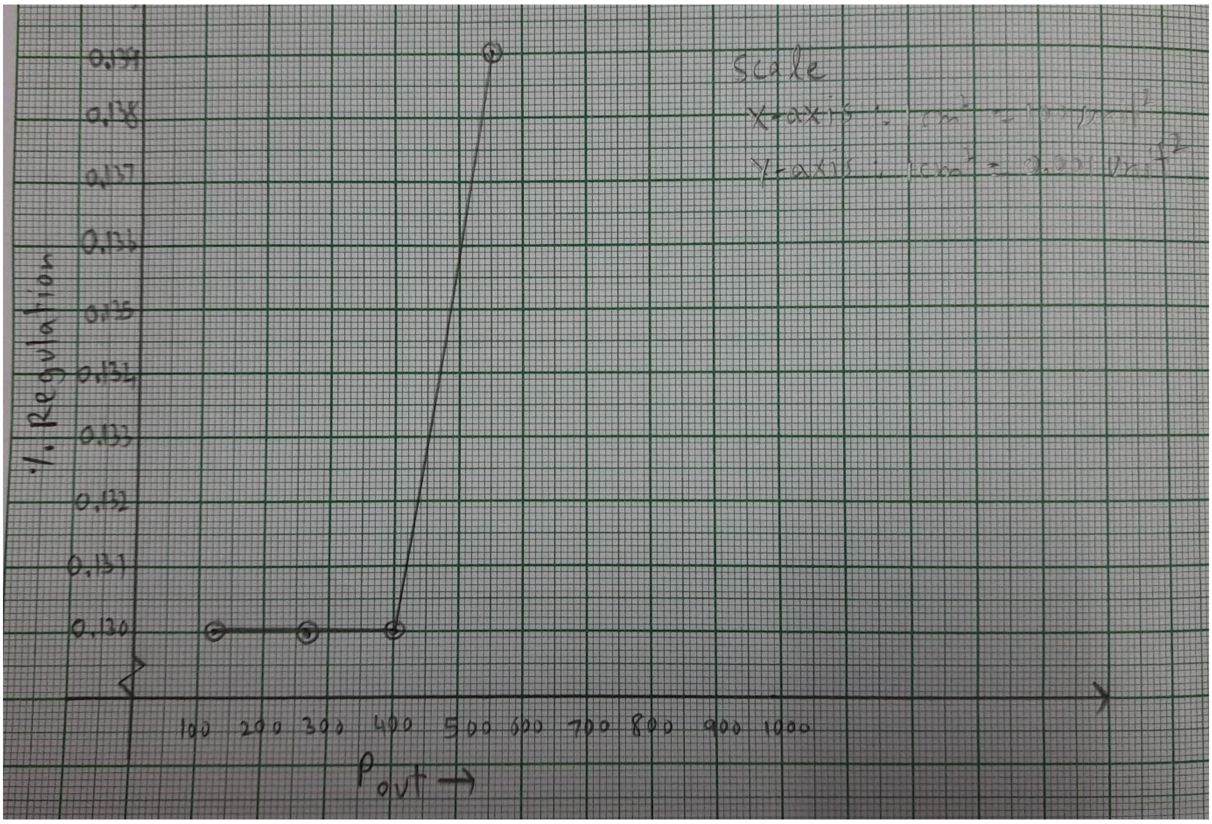
= (135.570/448.5) *100

= 30.22%

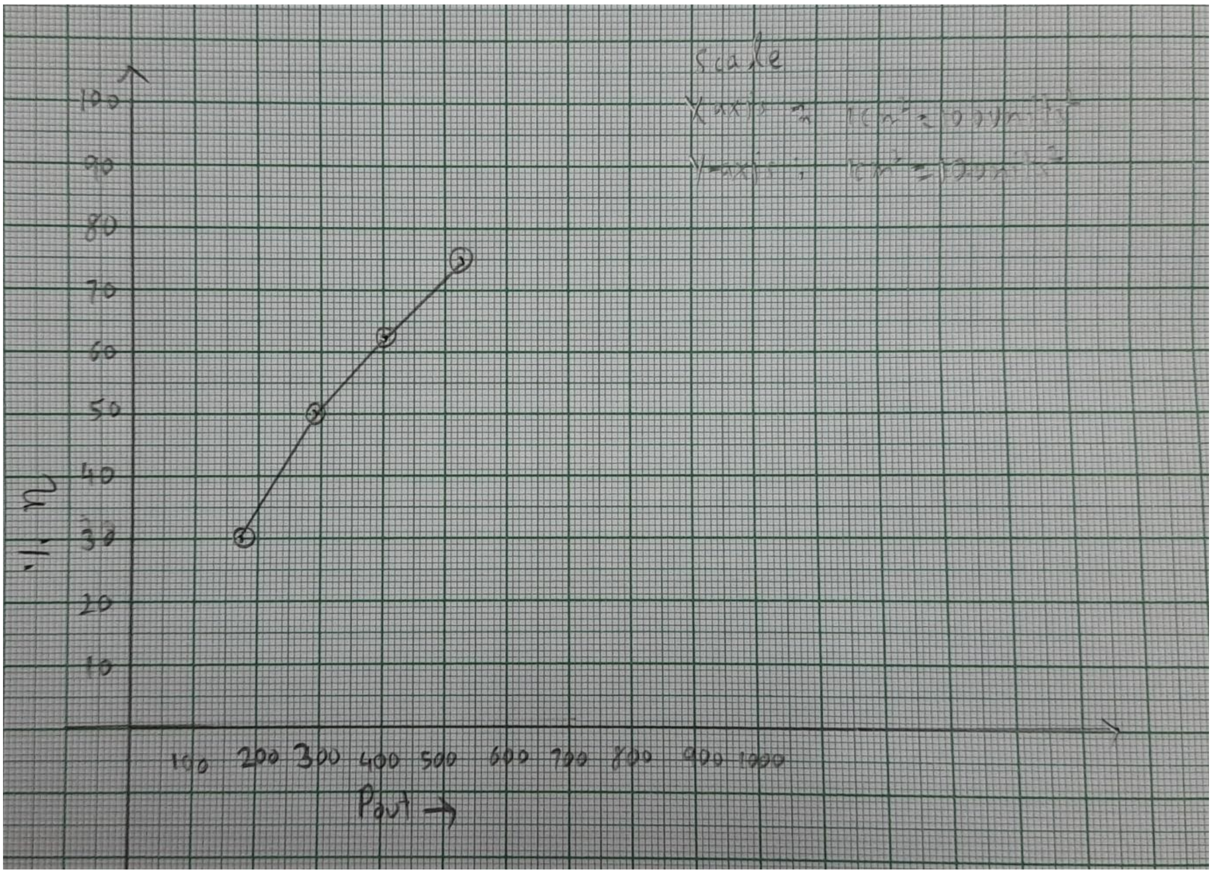
Simulation:



Graph:



Scale
% Regulation
0.139
0.138
0.137
0.136
0.135
0.134
0.133
0.132
0.131
0.130
100 200 300 400 500 600 700 800 900 1000
Pout →



Result

The graph from the circuit and the manual calculation match are shown in the graph.

POST LAB QUESTIONS

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

   Answer: A Transformer cannot be operated on the DC source or never connected to DC supply. If a rated dc voltage is applied to the primary of the transformer, the flux produced in the transformer core will not vary but remain constant in magnitude

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

   Answer: They include heat losses and eddy currents in the primary and secondary conductors of the transformer. Heat losses, or I 2R losses, in the winding materials contribute the largest part of the load losses. They are created by resistance of the conductor to the flow of current or electrons.

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

   Answer: Core losses majorly include Hysteresis loss and eddy current loss. Eddy Current loss can be reduced by increasing the number of laminations. The laminations provide small gaps between the plates. As it is easier for magnetic flux to flow through iron than air or oil, stray flux that can cause core losses is minimized.

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

   Answer: Eddy current loss is conductive I2R loss produced by circulating currents induced in response to AC flux linkage, flowing against the internal resistance of the core.

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

   Answer: Hysteresis loss can be reduced by using material having least hysteresis loop area. hence silicon steel or high-grade steel is used for manufacturing of a transformer core as it is having very less hysteresis loop area. Hysteresis losses can be reduced by increasing the number of lami-nation.