Objective: - To determine the efficiency and voltage regulation of a single phase transformer by load test.

Apparatus Used: - One 1-Φ transformer, one 1-Φ auto-transformer, one voltmeters (0-300V), one ammeters (0-10A), one wattmeter (0-10A, 0-300V), one 1-Φ load and connecting wires.

Theory: - In a practical transformer there are two types of losses:

      (1)   Cu loss

      (2)   Core/Iron loss.

Therefore output of a transformer is always less than input of the transformer.

Here transformer is loaded with a variable resistive load. Input to the transformer can be found out by using a wattmeter and output can also be measured by a wattmeter or with the help of voltmeter and ammeter.

Input power to transformer   = Reading of wattmeter

Output power from transformer = V_2I_2 $[\because Cos\Phi_2 = \text{load P.F} = 1]$

      % efficiency η   = (Output Power / Input Power) × 100%

              = (V_2I_2 / W_1) × 100%

Voltage regulation(V.R) is the change in the magnitude of secondary voltage from no load to desired load. This change is expressed as a percentage of the no load voltage.

$$\% \text{ V.R.} = \frac{\text{No load voltage - Desired (any) load voltage}}{\text{No load voltage}} * 100 \ \%$$

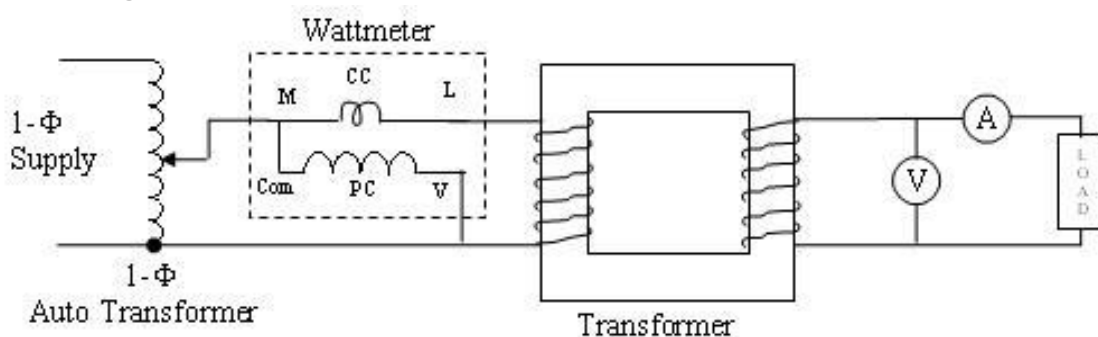$$= \frac{E_2 - V_2}{E_2} * 100 \ \%$$

     where :- E_2 = No load voltage

              V_2 = Any load voltage

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This voltage regulation is because of resistance and leakage reactance of the transformer.

Circuit Diagram:-

Observation table:-

S.No.	Input power W_1	Output voltage V_2	Output current I_2	$\eta = \dfrac{V_2 I_2}{W_1} * 100$	$\%VR = \dfrac{E_2 - V_2}{E_2} * 100$

Calculation:-

$$\text{Multiplying Factor (M.F.)} = \frac{VI\,Cos\Phi}{Full\,scale\,deflection(FSD)} \qquad \cos\Phi = 1$$

Result: - Efficiency and voltage regulation has been calculated at different load and shown in the table.

**Precautions:-**

1. Make sure that auto transformer is at zero position.
2. The main switch should be at off position before doing the connections.

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3. All connection should be tight and clean.
4. The reading in instruments should not exceed from their permissible limit.
5. Don't touch the necked terminals as voltage is high.
6. Always wear shoes when working in the lab. Avoid wearing loose clothes, hanging chains etc.
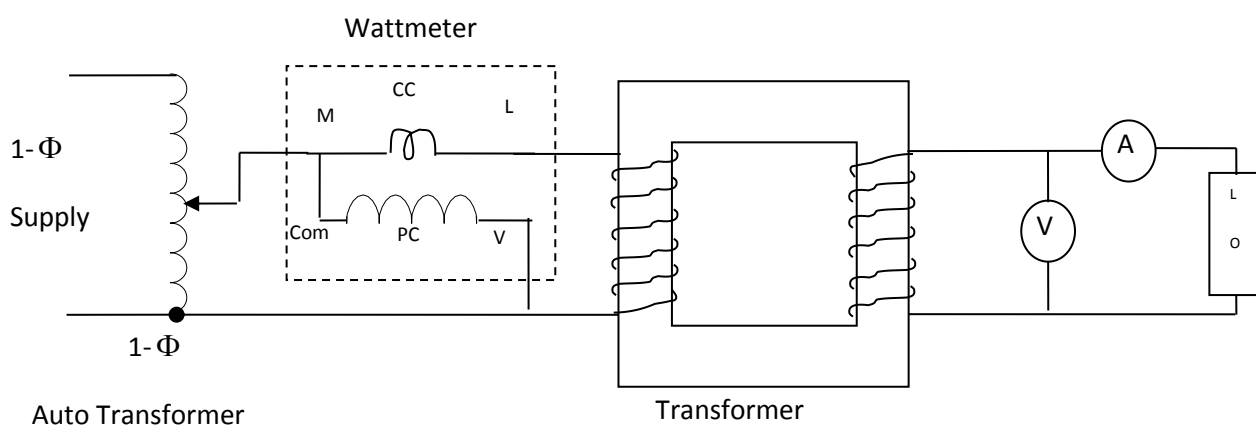
Answer the following questions:

Q1. Distinguish between iron and copper loss. Explain eddy current. Is friction losses present in transformer?

Q2. Why transformers have highest efficiency among all other types of electrical machines?

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