Single Phase Transformation B-H Loop

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Contents

1 B-H Loop

1.1 Aim

To study the constructional details of a single phase transformer and to display the B-H curve for the core material used, on the oscilloscope for different no load input voltages.

1.2 Apparatus Required

1. 1-Phase Transformer of identical ratings
2. 1-Phase Auto-transformer
3. Low Power-factor Watt-meter
4. AC Ammeter
5. AC Voltmeter
6. Digital Storage Oscilloscope (DSO1052B)

1.3 Theory

The primary current is proportional to the field 'H' when an alternating current is applied to the primary winding with the secondary left open. and the induced electromagnetic field in the secondary winding is proportional to the rate of flux change (or flux density B). This is due to:

$$H \propto I \tag{1}$$

If now a signal proportional to the primary current is applied to the horizontal

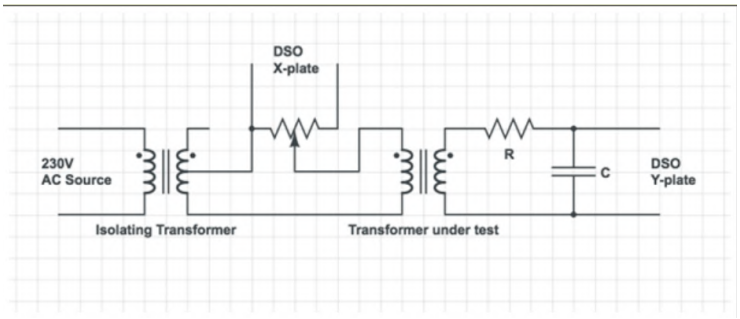


Figure 1: Circuit Diagram

or 'X' plates of the oscilloscope and a signal is applied to the vertical or 'Y' plates of oscilloscope, a B-H curve is seen on the oscilloscope.

1.4 Breadboard Setup

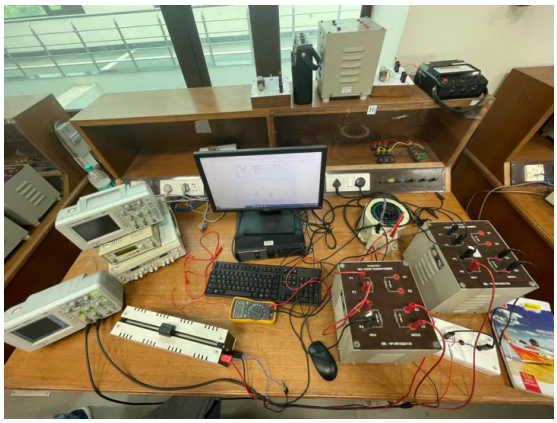
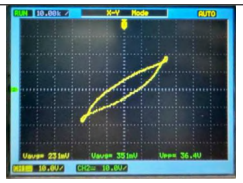


Figure 2: Breadboard connections

1.5 Observations

Image	V_{Input}(V)	Resistance(Ω)
	150	285.5
	120	285.5
	120	164.6
	150	164.6

2 Sources Of Error

- Resistance of wires not taken into account, and also giving rise to inconsistency due to increase in resistance due to heating.
- Change in the connections while circuit is closed.
- Loose Connections.
- Scale of multi-meter not appropriate for measurements

3 Precautions

- Make the connections neat and tight.
- Wear proper shoes and use insulated tools.
- Don't leave the switch on for long continuous periods of time.

4 Concluding Remarks

On the DSO, the B-H curve for various no load input voltages (thus varying flux densities) can be examined by altering the input supply voltage through auto-transformer or by changing the rheostat. We notice the following:

- The B-H Loop behaves as expected in case 1. The Magnetic Field lags the Magnetic Intensity, similar to a generic hysteresis loop.
- In Cases 2 and 3, we kept the auto-transformer voltage constant at 120 V but altered the rheostat values to 285.5Ω and 164.5Ω, respectively, and observed that the voltage across the capacitor varies dramatically but the B-H Loop breadth nearly stays constant.
- In Cases 3 and 4, we kept the rheostat resistance constant, = 164.6Ω, but increased the auto-transformer voltage to 150 V. We can see that both B and H values are changing currently.