1 Experiment No. 2

2 Experiment Title

3 Objective

The objectives of this lab are as follows:

- content...

4 Theory

5 Required Apparatus

6 Circuit Diagram

7 Data Table

No of Obs.	Voltmeter Reading in Volts (V)	Ammeter Reading in Ampere (A)	Wattmeter Reading in Watt (W)	Resistance $R = \frac{W}{I^2}$ (Ω)	Impedance $Z = \frac{V}{I}$ (Ω)	Reactance $X_L = \sqrt{Z^2 - R^2}$ (Ω)	Inductar $L = \frac{X}{2\pi}$ (H)
1.	100	0.2	2	50	502	499.5	1.589
2.	150	0.45	4.4	21.72	333.33	332.6	1.058
3.	200	0.625	7	17.92	526.31	319.49	1.017

8 Calculations

The following calculations were performed for each observation to determine the electrical parameters: Resistance (R), Impedance (Z), Reactance (X_L), and Inductance (L). The frequency of the circuit was maintained at $f = 50\,\text{Hz}$.

1. For $V = 100\,\text{V}$, $I = 0.2\,\text{A}$, $W = 2\,\text{W}$ and $f = 50\,\text{Hz}$

   (a)

   $$X_L = \sqrt{Z^2 - R^2} = \sqrt{500^2 - 50^2} = \sqrt{250000 - 2500} = \sqrt{247500} \approx 497.5\,\Omega$$

   (b)

   $$L = \frac{X_L}{2\pi f} = \frac{497.5\,\Omega}{2\pi \times 50\,\text{Hz}} \approx \frac{497.5}{314.16} \approx 1.585\,\text{H}$$

2. for $V = 150\,\text{V}$, $I = 0.45\,\text{A}$ $W = 4.4\,\text{W}$ and $f = 50\,\text{Hz}$

   (a)

   $$X_L = \sqrt{Z^2 - R^2} = \sqrt{333.33^2 - 21.72^2} \approx \sqrt{110639.33} \approx 332.6\,\Omega$$

(b)

$$L = \frac{X_L}{2\pi f} = \frac{332.6\,\Omega}{2\pi \times 50\,\text{Hz}} \approx \frac{332.6}{314.16} \approx 1.058\,\text{H}$$

3. For $V = 200\,\text{V}$, $I = 0.625\,\text{A}$, $W = 7\,\text{W}$ and $f = 50\,\text{Hz}$

(a)

$$X_L = \sqrt{Z^2 - R^2} = \sqrt{320^2 - 17.92^2} \approx \sqrt{102078.8736} \approx 319.49\,\Omega$$

(b)

$$L = \frac{X_L}{2\pi f} = \frac{319.49\,\Omega}{2\pi \times 50\,\text{Hz}} \approx \frac{319.49}{314.16} \approx 1.017\,\text{H}$$

8.0.1 Average Inductance

$$\bar{L} = \frac{L_1 + L_2 + L_3}{3} = \frac{1.585\,\text{H} + 1.058\,\text{H} + 1.017\,\text{H}}{3} = \frac{3.66\,\text{H}}{3} = 1.22\,\text{H}$$

9 Result

The average inductance is approximately $\bar{L} = 1.22\,\text{H}$.

9.1 Discussion

$$\boldsymbol{R = \frac{W}{I^2}(\Omega)}$$

$\boldsymbol{Z = \frac{V}{I}(\Omega)}$

$\boldsymbol{Z = \sqrt{X^2 - R^2}}$

$\boldsymbol{L = \frac{X}{2\pi f}(H)}$