Experiment: 1.3

RI-CIRCUIT

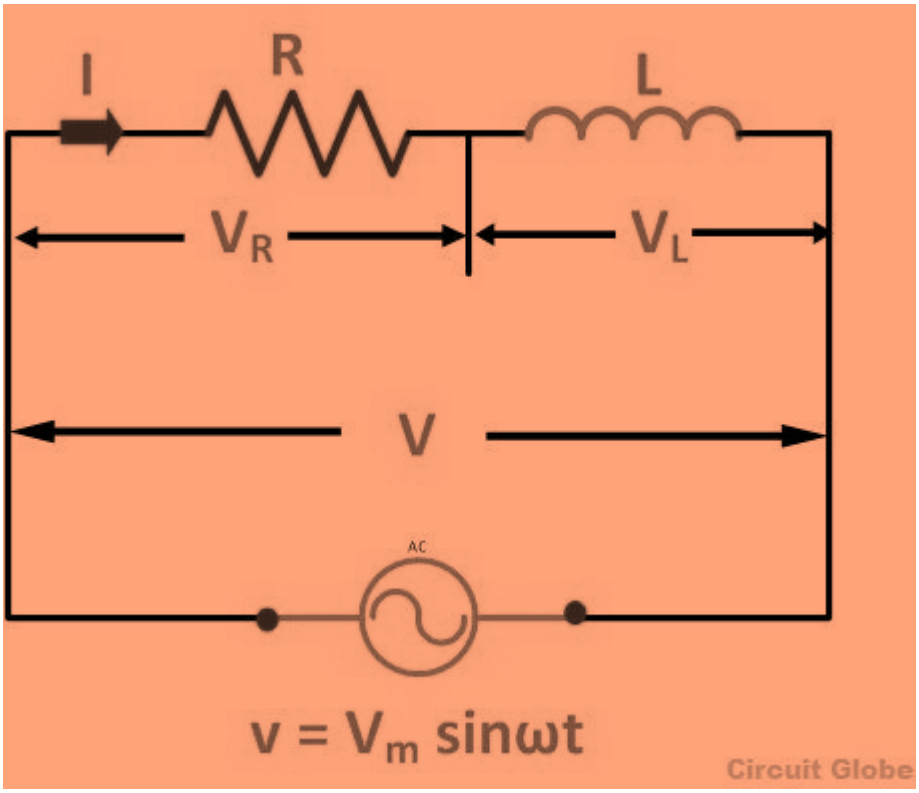
Student Name: Rajdeep Jaiswal **UID: 20BCS2761**
Branch: CSE btech **Section/Group: 26B**
Semester: Second
Subject Name: BEEE LAB

1. Aim: To study the voltage-current relationship in an R-L series circuit and to determine the power factor of the circuit.

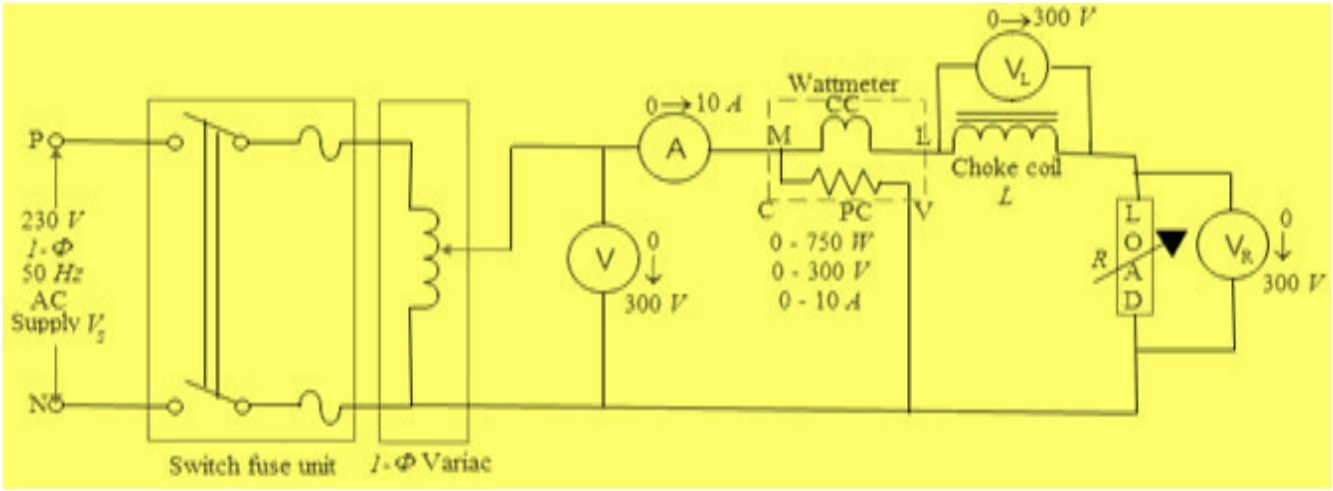
2 Apparatus:

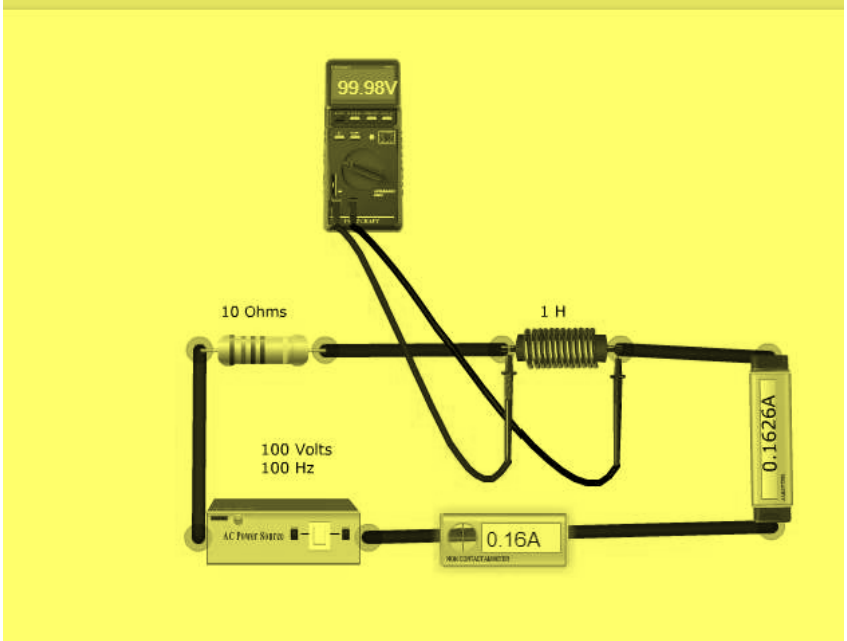
Sr. No.	Equipment name	Specifications and range	Quantity in No.
1.	1-Ø AC supply	230 V	1
2.	1-Ø Variac	0 – 270 V, 15 A	1
3.	AC wattmeter	0 – 300 V, 5 A, 750 W	1
4.	AC analog ammeter	0 – 5 A	1
5.	AC analog voltmeter	0 – 300 V	1
6.	Variable resistive load	230 V, 1 kW	1
7.	Variable inductive load	230 V	1
8.	Connecting wires	As per requirement	

3 THEORY: An AC series circuit consisting of a resistor and an inductor is shown in Fig.1. I is the current flowing through the resistor and the inductor. The voltage drop across the resistor and the inductor is VR and VL respectively. The phasor sum of these two voltages will be equal to the applied voltage V as shown in Fig.2. In a resistive circuit, the voltage and current are in phase. In a purely inductive circuit, the current lags the voltage by 90 degrees.



4 Circuit Diagram:





5 Steps for experiment:

1. Connect the circuit as shown in circuit diagram
2. Vary the 1- AC supply voltage with the help of 1- variac shown in circuit diagram
3. Switch on the resistive load by switching various lamps in resistive lamp banks and vary the tapings of the choke coils.
4. Take readings of V_s, I, V_L, V_R, and P.
5. Increase resistive and inductive load by switching and repeat the procedure as stated in steps 1 to 4.
6. Take at least 5 sets of readings and record the readings in Table.
7. Calculate impedance of the circuit, the impedance of coil, the internal resistance of the coil, the inductive reactance of coil, and the inductance of coil and power factor from readings.

6 Calculations/Theorems /Formulas used etc

W =VI Cosφ

Power factor, Cosφ = [W/(VI)]

Therefore, φ = Cos-1[W/(VI)]

Circuit solved

$$I_1 = \frac{E_1}{R_1 + j\,w\,L_1}$$

$$I_1 rms = \frac{E_1 rms}{\sqrt{R_1^{\,2} + (w\,L_1)^{\,2}}}$$

$I_1 rms = 19.1\ mA$

$Phi I_1 = -89.9\ °$

$$U_1 = \frac{E_1}{1 + j\,\frac{w\,L_1}{R_1}}$$

$$U_1 rms = \frac{E_1 rms}{\sqrt{1 + \left(\frac{w\,L_1}{R_1}\right)^{2}}}$$

$U_1 rms = 19.1\ mV$

$Phi U_1 = -89.9\ °$

$$U_2 = \frac{E_1}{1 - j\frac{R_1}{w L_1}}$$

$$U_2rms = \frac{E_1rms}{\sqrt{1 + \left(\frac{R_1}{w L_1}\right)^2}}$$

$U_2rms = 12.0\ V$

$PhiU_2 = 91.2\ m°$

7. Observations/Discussions:

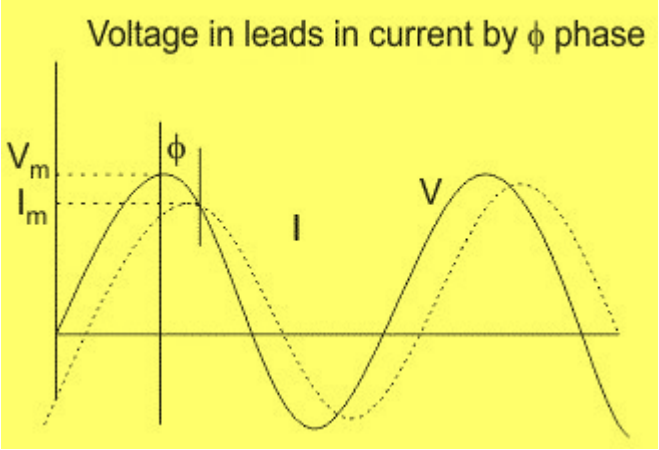
Sr. No.	Supply voltage (V)	Current (I)	Power(P)	Power factor
1	50V	0.23A	10W	0.86
2	100V	0.37A	30W	0.81
3	150V	0.57A	75.4W	0.86

Percentage error (if any or applicable):

N/A

Result/Output/Writing Summary:

The calculated and graphical values of phase angle, power, and power factor of series are calculated.



CONCLUSION: In case of pure resistive circuit, the phase angle between voltage and current is zero and in case of pure inductive circuit, phase angle is 90° but when we combine both resistance and inductor, the phase angle of a series RL circuit is between 0° to 90°.

10 Graphs (If Any): Image/Soft copy of graph paper to be attached here

N/A

Learning outcomes (What I have learnt):

1. How to work with AC voltage source
2. How to use wattmeter
3. how to calculate power factor
4. The voltage-current relationship in an R-L series circuit and to determine the power factor of the circuit.

Evaluation Grid:

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Worksheet completion including writing learning objectives/Outcomes.(To be submitted at the end of the day).		10
2.	Post Lab Quiz Result.		5
3.	Student Engagement in Simulation/Demonstration/Performance and Controls/Pre-Lab Questions.		5
	Signature of Faculty (with Date):	Total Marks Obtained:	