Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 01

Experiment Name: Familiarization with some electrical components, equipments and measuring instruments.

Submitted by:

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Session: 2023-2024

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 01

Experiment Name: Familiarization with some electrical components, equipments and measuring instruments.

Objectives :

(i) To familiarize with some electrical measuring instruments.
(ii) To know about some electrical components.

Description :

1. Definition of ammeter : Ammeter is an instrument used to measure either direct or alternative current in amperes.

Rating of an ammeter : Usually an ammeter has range of 0-3 ampere. But in our lab there is a rating of the ammeter which is 0-1 ampere.

Construction of an ammeter : Ammeter is made of with the iron element consists of a moving vane attached to a pointer and a fixed vane surrounded by a coil. There is a rotor with a coil wound inside the ammeter, when the current flows through the ammeter, the coil and the rotor will have the properties of a magnet. The higher the current flow, the stronger the magnetic field of the coil and the rotor.

Classification of ammeter : An ammeter can be classified based on :

1. Working Principle :

- Moving Coil Ammeter (MC): Measures DC current using a magnetic field.
- Moving Iron Ammeter (MI): Measures both AC and DC currents, using a magnetic field to move iron.
- Electrodynamometer Ammeter: Measures both AC and DC with high accuracy using interacting magnetic fields.

2. Range:

- Low-Range Ammeter: Measures small currents.
- High-Range Ammeter: Measures large currents.

3. Design:

- Digital Ammeter: Displays current in a numerical format.
- Analog Ammeter: Displays current using a needle and scale.

4. Application:

- Shunt Ammeter: Uses a shunt resistor for measuring high currents.
- Clamp Ammeter: Measures current without direct contact, often for AC current.

Operating Principle of Ammeter:

1. Magnetic Effect of Current: Ammeter works based on the magnetic effect of electric current.

2. Current Division: The total current is divided between the shunt resistor (low resistance) and the galvanometer.

3. Shunt Resistor: The shunt bypasses most of the current to protect the sensitive galvanometer.

4. Needle Deflection: A small fraction of the current flows through the galvanometer, causing its needle to deflect.

5. Proportional Reading: The deflection is directly proportional to the total current in the circuit, which is the calibrated and displayed.

Symbol of ammeter: The unit of ammeter is Ampere. The ammeter measures current in ampere. The symbol of ammeter is (A).

Figure: Symbol of ammeter

Applications of ammeter:

1. Current Measurement: Used to measure current in circuits.

2. Appliance Monitoring: Checks the current drawn by devices.

3. Battery Testing: Measures charging and discharging current.

4. Circuit Troubleshooting: Detects faults like short circuits or overloads.

5. Industrial Use: Monitors current in machines and equipment.

6. Power Systems: Ensures balanced load distribution in power networks.

7. Educational Use: Used in schools and labs for experiments and learning.

2. Definition of voltmeter: A voltmeter measures the voltage (potential difference) between two points in a circuit and is connected in parallel.

Rating of voltmeter: The rating range of a voltmeter typically spans from (0-10)V to (0-1000)V, depending on the device's design and application. However, the voltmeter we have in our lab has a rating of (0-5)V.

Construction of a voltmeter: A voltmeter is an instrument used to measure voltage in a circuit. It consists of:

(i) Galvanometer: Detects small voltages with a deflecting needle.

(ii) Series Resistor: Expands the voltage range and limits current to the galvanometer.

(iii) High Internal Resistance: Prevents current draw from the circuit.

(iv) Display/Pointer: Indicates the voltage value.

(v) Protective Casing: Encases the internal components and provides connection terminals.

Classification of voltmeter: Voltmeters can be classified as:

(i) Based on Working Principle:

□ Electromechanical Voltmeter: Uses a galvanometer to measure voltage.

□ Electronic Voltmeter: Uses electronic components for accurate measurements.

2. Based on Display:

□ Analog Voltmeter: Shows voltage with a moving needle.

□ Digital Voltmeter: Displays voltage in numeric form.

3. Based on Measurement Range:

□ Low-Range Voltmeter: Measures low voltages.

□ High-Range Voltmeter: Measures high voltages.

4. Based on Power Supply:

□ Battery-Operated: Powered by a battery.

□ Power Line-Operated: Powered by the circuit being tested.

Operating Principle of voltmeter: The operating principle of a voltmeter is as follows:

1. Measurement of Potential Difference: A voltmeter is used to measure the potential difference (voltage) between two points in an electrical circuit.

2. Connection in Parallel: It is connected in parallel across the two points where the voltage is to be measured.

3. High Internal Resistance: The voltmeter is designed with a very high internal resistance to minimize the

current drawn from the circuit, preventing any significant alteration to the circuit's voltage.

4. <u>Voltage Display</u>: The voltmeter displays the voltage across the points using either a needle on a scale (analog) or a digital readout (digital voltmeter).

<u>Symbol of voltmeter</u>: The unit of voltmeter is volt. The voltmeter measures the voltage across the circuit is in volt. The symbol of volt is Ⓥ.

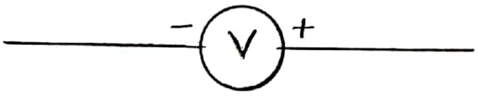


Figure: Symbol of voltmeter

<u>Applications of voltmeter</u>: A voltmeter is used to measure the electrical potential difference (voltage) between two points in a circuit. Key applications include:

1. Measuring voltage across components (e.g., resistors, capacitors).
2. Troubleshooting electrical circuits by detecting abnormal voltage levels.
3. Testing battery voltage to ensure proper charge.
4. Monitoring power supplies for proper voltage output.
5. Calibrating electrical equipment in labs or industries.
6. Ensuring correct voltage in control systems in industrial automation.

3. **Definition of wattmeter:** A wattmeter is an instrument used to measure electrical power (in watts) in a circuit. It works by combining measurements of voltage, current and the power factor.

Rating of wattmeter: The wattmeter's rating typically ranges from 100V to 600V for voltage, 1A to 50A for current, and a few watts to several megawatts for power, depending on the application. However, the wattmeter we have in our lab has a rating of (0-120) watt.

Construction of a wattmeter: A wattmeter consists of the following key components:

(i) **Current Coil:** Connected in series with the load to measure current.

(ii) **Voltage (Potential) Coil:** Connected in parallel with the load to measure voltage.

(iii) **Fixed Coil:** Often the current coil, which produces a magnetic field proportional to current.

(iv) **Moving Coil:** Often the potential coil, which interacts with the fixed coil to produce torque proportional to power.

(v) **Scale and Pointer:** Display the power reading in watts.

(vi) **Spring and Damping Mechanism:** Ensure stable and accurate readings by controlling the pointer movement.

The interaction between the coils generates a deflection proportional to the power consumed.

Classification of Wattmeters:

(i) By Principle of Operation:

- Electrodynamic: Uses interaction between fixed and moving coil; accurate and used in labs.
- Induction: Operates via electromagnetic induction; suitable for AC power measurement.
- Electronic: Employs electronic components for precise power measurement.
- Digital: Provides digital, real time, and highly accurate readings.

(ii) By type of Circuit:

- Single-phase: Measures power in single-phase circuits.
- Three-phase: Measures power in three-phase systems using 2 or 3 elements.

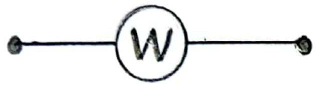
(iii) By Usage:

- Portable: Lightweight and used for field measurements.
- Stationary: Fixed in position for continuous monitoring.

Operating Principle of Wattmeter:

The operating principle of a wattmeter is based on the dynamometer principle, where the interaction of magnetic fields from two coils generates a torque proportional to power. The current coil (CC) carries the load current. The voltage coil (VC) measures the voltage across the load. The deflecting torque is proportional to $P = VI\cos\phi$, representing the real power in the circuit.

Symbol of wattmeter: The unit of wattmeter is watt. Wattmeter measures the power in watt. The symbol of watt is Ⓦ.



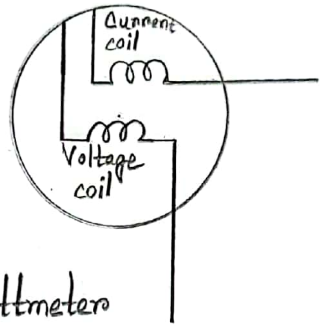


Figure: Symbol of wattmeter

Applications of Wattmeter:

1. **Measurement of Power:** Used to measure real power (active power) in AC and DC circuits.

2. **Efficiency Testing:** Used in electrical equipment like motors, transformers and generators.

3. **Load Analysis:** Monitors power consumption in industrial and residential systems.

4. **Power Factor Determination:** Helps in evaluating the power factor of a circuit.

5. **Energy Audits:** Used in energy management systems for accurate power monitoring.

4. **Definition of multimeter:** A multimeter is an instrument used to measure voltage, current and resistance along with other electrical parameters in circuits.

Rating of multimeter: A multimeter typically measures voltage (0-1000V DC, 0-750V AC), current (up to 10A), and resistance (up to 20 MΩ), with ranges varing by model. However, the ranges may also vary depending on its capabilities.

Construction of a Multimeter:

1. Display: LCD or LED screen for numerical readings.
2. Rotary Switch: Selects measurement type (e.g., voltage, current, resistance).
3. Test Probes: Red (positive) and black (negative) insulated wires.
4. Terminals:
   - COM: Common terminal for the black probe.
   - V/Ω: For voltage and resistance.
   - mA/10A: For current measurements.
5. Internal Circuitry:
   - Microcontroller: Processes signals.
   - ADC: Converts analog to digital signals.
   - Precision Resistors and Diodes: For accuracy and protection.
   - Capacitors: Stabilize readings.
6. Power Source: Usually a 9V battery.
7. Protection: Fuses and MOV for overcurrent and surge protection.
8. Housing: Insulated plastic case for durability.

This construction allows the multimeter to measure electrical parameters accurately and safely.

Classification of Multimeters:

1. Based on Display:

- Analog Multimeter: Uses a pointer and scale; suitable for detecting fluctuations but less accurate.
- Digital Multimeter: Features a digital display for precis and easy readings.

2. Based on Functionality:

- Basic Multimeter: Measures voltage, current and resistance.
- Advanced Multimeter: Includes additional features like capacitance, frequency, and diode testing.
- True RMS Multimeter: Measures AC signals accurately, even non-sinusoidal waveforms.
- Auto-Ranging Multimeter: Automatically selects the range for measurements.
- Manual Ranging Multimeter: Requires manual range selection.

3. Based on Portability:

- Handheld Multimeter: Compact and portable for fieldwor
- Bench Multimeter: Larger, high-precision, for lab or industrial use.

4. Based on Usage:

- General-Purpose Multimeter: For everyday electrical tasks.

5. Internal Components :

- ADC : Converts analog signals to digital for display.
- Switching Mechanism : Directs input to the appropriate measuring circuit.
- Range Selector : Ensures accuracy for different measurement ranges.

Symbol of Multimeter :

Symbol	Symbol function	Symbol	Symbol function
V ~	AC Voltage	∿	AC Current
A ⎓	DC Current	Ω	Ohms
V ⎓	DC Voltage	KΩ	Kiloohms
mV	Millivolts	MΩ	Megaohms
mA	Milliamps	─▶├─	Diode Test
μA	Microamps	┤(	Capacitance Test

Applications of Multimeter :

1. Voltage Measurement : For AC/DC circuits.
2. Current Measurement : To check current flow.

3. Resistance Measurement : For resistors and circuits.
4. Continuity Testing : To detect open or closed circuits.
5. Diode Testing : For functionality and polarity checks.
6. Capacitance Measurement : For capacitors (in DMMS).
7. Frequency Measurement : For AC signals.
8. Battery Testing : To evaluate voltage levels.
9. Circuit Troubleshooting : Identifying faults.
10. Temperature Measurement : Using probes (advanced models).

Used in electronics, maintenance and troubleshooting tasks.

5. Definition of LCR meter : An LCR meter measures inductance (L), capacitance (C) and resistance (R) of electronic components by applying an AC signal and analyzing the response. It is a measuring instrument.

Rating of an LCR meter : The rating range of an LCR meter typically includes :

- Inductance (L) : 0.01 μH to 100H.
- Capacitance (C) : 1 pF to 100 μF.
- Resistance (R) : 0.01 mΩ to 100 MΩ.
- Test Frequency : 100 Hz to several MHz.

Construction of LCR meter : An LCR meter includes an oscillator to generate AC signals, a measurement circuit to detect responses, a microprocessor to process data, a display for results, and a user interface for settings and controls. These components work together to measure inductance, capacitance and resistance.

Classification of LCR meter: LCR meter can be classified into:

(i) Portability: Handheld (portable) and Benchtop (stationary precise).

(ii) Measurement Frequency: Low-frequency (fixed) and high-frequency (variable).

(iii) Functionality: Basic (L, C, R) and Advanced (including impedance, Q, D, phase angle).

(iv) Application: General-purpose and specialized (for specific uses).

Operating principle of LCR meter: An LCR meter applies an AC signal to the resulting component under test, measures the resulting voltage and current and calculates the inductance (L), capacitance (C), or resistance (R) based on the response. The result is displayed on the screen.

Symbol of LCR meter: An LCR meter is a triple-function testing tool that can be used to gain measurements of inductance (symbol L), capacitance (symbol C) and resistance (symbol R).

Applications of LCR meter: An LCR meter is used to measure inductance (L), capacitance (C) and resistance (R). Its key applications include:

1. **Component Testing:** Ensures quality and identifies component values.

2. **Circuit Design:** Aids in selecting and analyzing components.

3. **Troubleshooting:** Diagnoses faults in electronic devices.
4. **R&D:** Studies material properties and optimizes designs.
5. **Education:** Supports teaching and labratory experiments.
6. **Quality Assurance:** Verifies components in power electronics.

6. **Definition of rheostat:** A rheostat is a device that adjusts electrical current by varying resistance in a circuit.

Rating of a rheostat: Rheostat is used to raise or lower the resistance of circuit and correspondingly to increase or decrease the current flowing. In our lab, the range of rheostat is $(0-322)\Omega$.

Construction of rheostat: Similar to potentiometer, a rheostat has three terminals, two fixed and one moving. Also this moving terminal slides over a resistive path. The resistive path can be any type of resistive material such as carbon composition resistor, wire-word resistor, conductive plastic resistor and ceramic resistor.

Classification of rheostat: Rheostats are classified into:
1. Linear Rheostat: Slider moves along a straight resistive element; used in labs.

2. Rotary Rheostat: Slider rotates on a circular resistive element; used in dimmers and motors.

3. Preset Rheostat: Small, fixed adjustments for calibration in electronic devices.

Operating Principle of rheostat: The operating principle of a rheostat is based on Ohm's Law: $V = I \times R$.
When a rheostat is connected to a circuit, adjusting its slider changes the resistance (R). As resistance increases, the current (I) flowing through the circuit decreases, and vice versa. By varying the resistance, the rheostat controls the amount of current in the circuit, thereby adjusting the power delivered to devices like motors or lights.

Symbol of a rheostat: The symbol of a rheostat is the same as normal resistor symbol including an arrow.
The unit of a resistor is ohm (Ω).

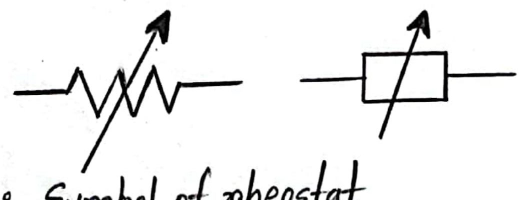


Figure: Symbol of rheostat

Applications of rheostat:
1. Light Dimmers: Adjusts brightness.
2. Motor Speed Control: Varies motor speed.

3. Volume Control : Adjusts audio volume.
4. Labratory Use : Controls current in experiments.
5. Heating Devices : Regulates temperature by controlling current.

7. Definition of inductor : An inductor is a passive electrical component that stores energy in a magnetic field when current flows through it. It resists changes in current and is commonly used in circuits for filtering, energy storage and signal processing.

Rating of an inductor : The rating range of an inductor includes inductance (measured in Henries, H), current rating (Amperes, A), DC resistance (Ohms, Ω), saturation current, voltage rating (Volts, V), frequency range and quality factor (Q). These ratings define the inductor's performance such as energy storage, current handling and efficiency.

Construction of inductor : An inductor consists of a wire coil would around a core (either air, iron, ferrite). The wire is insulated to prevent short circuits and leads are attached for electrical connections. The core material enhances the inductance by concentrating the magnetic field.

Classification of inductor : Inductors are classified by:

1. Core Material :
- Air Core : No magnetic core, for high frequencies.
- Iron Core : Uses iron for increased inductance.
- Ferrite Core : For high-frequency and small-size.

applications.

2. Construction :

- Fixed : Constant inductance.
- Variable : Adjustable inductance.

3. Applications :

- Power Inductors : Used in power supplies.
- RF Inductors : For radio frequencies.
- Chokes : Filter high-frequency signals.

Operating Principle of inductor: The operating principle of an inductor is based on electromagnetic induction. When current flows through the coil, it creates a magnetic field. The inductor resists changes in current by generating a voltage that opposes the change, according to Lenz's Law. This property allows inductors to store energy, filter signals and smooth out current variations.

Symbol of inductor : The symbol for an inductor is a series of loops on a zigzag line, typically labeled with "L".

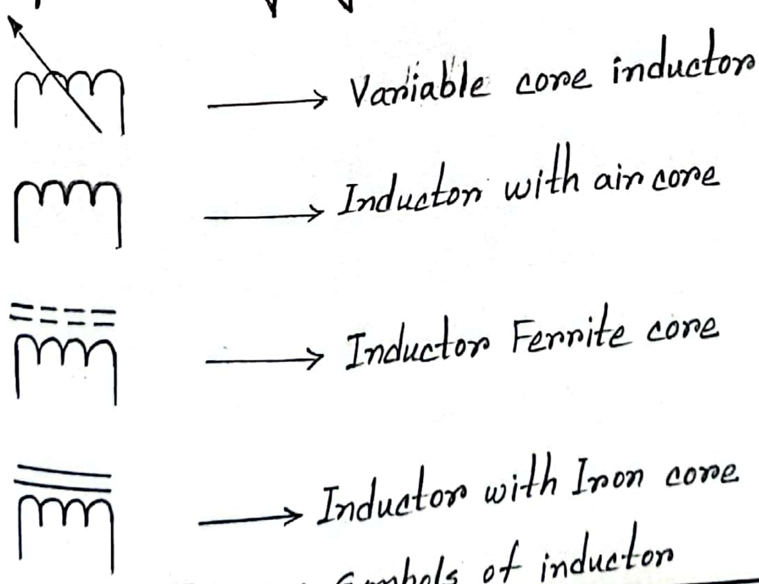


Figure : Symbols of inductor

Applications of inductor: Inductors are used in:

1. Power Supplies: Energy storage in converters and regulators.

2. Filters: To block or pass specific frequencies.

3. Transformers: For voltage step-up or step-down.

4. Chokes: To block high frequency noise.

5. RF Circuits: For tuning and signal processing.

6. Energy Storage: In systems like flyback transformers.

8. Definition of capacitor: A capacitor is an instrument used to store potential energy.

Rating of capacitor: Capacitors have capacitance ratings from 1pF to several farads and voltage ratings from 1.5V to over 1000V, depending on the type and application. However, the capacitor we have in our lab has a rating of 100pF to 11.111 μF.

Construction of capacitor: A capacitor consists of two conductive plates separated by a dielectric material, which stores charge and blocks current. Construction varies by type, using ceramics, films, electrolytes or porous materials as the dielectric.

Classification of capacitor:

1. **Fixed Capacitors:** Capacitance is constant. Common types include:

- Ceramic: Small, used in high-frequency circuits.
- Film: Stable, used in precision applications.
- Electrolytic: High capacitance, used in power supply filtering.
- Tantalum: Compact and reliable, used in low-voltage circuits.
- Supercapacitors: Very high capacitance, used for energy storage.

2. **Variable Capacitors:** Capacitance can be adjusted.

- Trimmer: Small adjustments in circuits.
- Tunable: Used in tuning radio and oscillators.

Operating Principle of capacitor: A capacitor operates by storing energy in the electric field created between its two conductive plates when a voltage is applied. The dielectric material between the plates prevents direct current flow while allowing alternating current to pass, enabling energy storage and release in circuits.

Symbol of capacitor: The symbol for a capacitor is two parallel lines that are close together but not touching. The lines can be flat or curved.

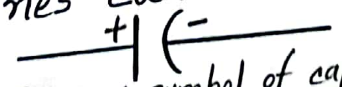


Figure: symbol of capacitor

Applications of capacitor :

(i) Energy storage
(ii) Filtering (in power supplies)
(iii) Coupling / decoupling (signal processing)
(iv) Timing circuits (in oscillators)
(v) Tuning (radios and transmitters)
(vi) Power factor correction
(vii) Voltage stabilization (in voltage regulators)

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 02

Experiment Name: Study of series circuit.

Submitted by:

Name: Rifa Zaman Fyruze
Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 02

Experiment Name : Study of series circuit.

Objectives :

(i) To measure voltage drop in each bulb connected in series.

(ii) To measure the current of the series circuit.

(iii) To identify which bulb will be brightest bulb.

Apparatus required :

Name	Rating	Quantity
AC Supply Source	220-240V	
Ammeter	0-3A	1
Voltmeter	0-300V	1
Bulb	(40,60,100)W, -220V	3
Switch		1
Connecting wires as required		

Circuit diagram :

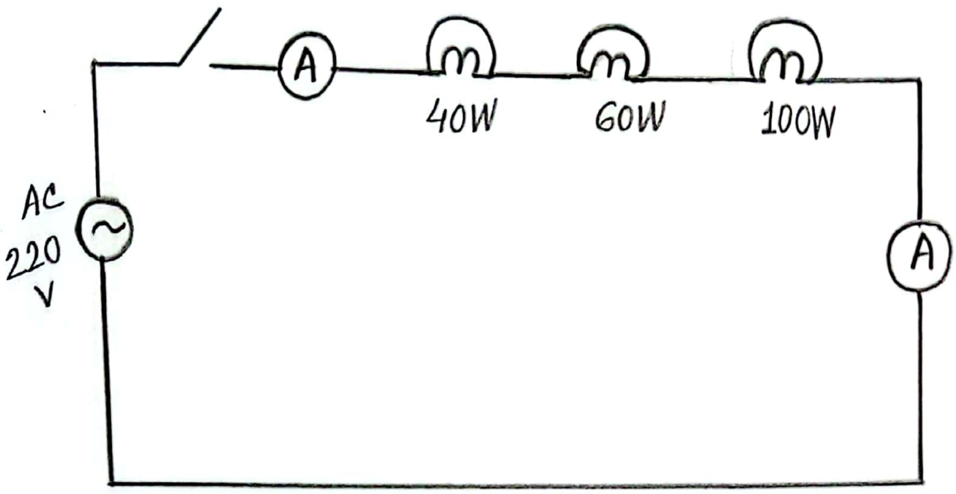


Figure : Series circuit

From this circuit, we can see there is an AC voltage source which value is 220V. We can also see there is an ammeter connected in series with the three bulbs. The three bulbs are also connected in series. We know that, the current will be always same in series circuit. But the voltage is changed in series circuit. So we will find different voltage in each bulb and sum of these voltage will be equal to the main voltage of the circuit.

Experimental data :

From our experiment in lab, we find the voltage across the circuit is

$$V = 201.1 V$$

The value of current in the circuit is

$$I = 0.43 A$$

The voltage drop for each bulb,

$$V_{40} = 125.1\,V$$

$$V_{60} = 61\,V$$

$$V_{100} = 15\,V$$

In series circuit, the sum of the voltage drop is equal to the main voltage of the circuit.

$$\therefore V = V_{40} + V_{60} + V_{100}$$

$$= (125.1 + 61 + 15)\,V$$

$$= 201.1\,V$$

Calculation:

We know that,

$$V = IR$$

$$\therefore R = \frac{V}{I}$$

$$= \frac{201.1}{0.43} \quad [\text{Here}, V = 201.1\,V \text{ and } I = 0.43\,A]$$

$$= 467.67\,\Omega$$

$\therefore$ Equivalent resistance is $R = 467.67\,\Omega$

$$\therefore R_{40} = \frac{V_{40}}{I} = \frac{125.1}{0.43} = 290.93\,\Omega$$

$$R_{60} = \frac{V_{60}}{I} = \frac{61}{0.43} = 141.86\,\Omega$$

$$R_{100} = \frac{V_{100}}{I} = \frac{15}{0.43} = 34.88\,\Omega$$

$\therefore$ R_{40}, R_{60}, R_{100} resistances are in a series connection. So the equivalent resistance is

$$R_T = R_{40} + R_{60} + R_{100}$$

$$= (290.93 + 141.86 + 34.88)\,\Omega$$

$$= 467.67\,\Omega$$

Now,

$$V_{40} = IR_{40}$$

$$= (0.43 \times 1210)\,V$$

$$= 520.3\,V$$

$$V_{60} = IR_{60}$$

$$= (0.43 \times 806)\,V$$

$$= 346.58\,V$$

$$V_{100} = IR_{100}$$

$$= (0.43 \times 484)\,V$$

$$= 208.12\,V$$

Which bulb will be the brightest:

We know that, $P = VI$

The power output of the three bulbs in the series circuit are,

$$P_{40} = V_{40} I = (520.3 \times 0.43)\,W = 223.729\,W$$

$P_{60} = V_{60} I = (346.58 \times 0.43)W = 149.0294W$

$P_{100} = V_{100} I = (208.12 \times 0.43)W = 89.4916W$

So, we are getting highest power output for P_{40}. which is 223.729W. So the bulb of 40W power will be the brightest bulb.

Result and discussion:

My result is good enough. But there is some differences between my result and the ideal value. Because when I measure the voltage, there are some disturbance in the AC voltage source. Consequently, some changes in my result has been occured.

Conclusion:

By this experiment I have learnt about series circuit. I have also learnt the current flows in series circuit is always same but the voltage drop between each bulb will be different. And that's why the most voltage droping bulb gaining the maximum power, consequently that bulb will be the brightest bulb that we have learnt.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 03

Experiment Name: Study of parallel circuit.

Submitted by:

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Roll: 230234
Session: 2022-2023
1st Year 1st Semester
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Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 03

Experiment Name : Study of parallel circuit.

Objectives :

(i) To measure the current of different bulbs which are connected in parallel.

(ii) To measure the voltage of the parallel circuit.

(iii) To identify that which bulb will be brightest bulb.

Apparatus Required :

Name	Rating	Quantity
AC Supply Source	220-240 V	
Ammeter	0-3A	1
Voltmeter	0-300V	1
Bulb	(40, 60, 100)W-220V	3
Switch		4
Connecting wires are required		

Circuit Diagram :

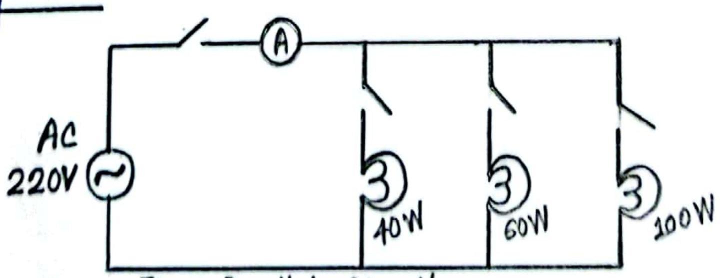


Fig : Parallel Circuit

In this circuit, we can see there is an AC voltage source of 220V and the ammeter is in series connection with the three bulbs. Where the bulbs are in parallel connection. We know in parallel circuit the voltage always will be same but the current will be different for each bulb. The sum of the current will be equal to main current across the circuit.

Experimental Data :

From our experiment in lab, we find the voltage in circuit is

$$V = 210.2\,V$$

also the current is $I = 0.08\,A$

This is a parallel circuit, the current for each bulb,

$$I_{40} = 0.003\,A$$

$$I_{60} = 0.010\,A$$

$$I_{100} = 0.067\,A$$

In parallel circuit the sum of the currents is equal to the main current of the circuit. So,

$$I = (I_{40} + I_{60} + I_{100})$$
$$= (0.003 + 0.010 + 0.067)\,A = 0.08\,A$$

Calculation :

We know that, $V = IR$

$$\therefore R = \frac{V}{I}$$
$$= \frac{210.2}{0.08}\,\Omega = 2627.5\,\Omega$$

$\therefore$ The equivalence resistance is $R_T = 2627.5\,\Omega$

$$\therefore R_{40} = \frac{V}{I_{40}} = \frac{210.2}{0.003} = 70066.67\,\Omega$$

$\therefore R_{60} = \dfrac{V}{I_{60}} = \dfrac{210.2}{0.010} = 21020\Omega$

$\therefore R_{100} = \dfrac{V}{I_{100}} = \dfrac{210.2}{0.067} = 3137.31\,\Omega$

$\therefore$ R_{40}, R_{60}, R_{100} are in parallel connection. So, the equivalence resistance is,

$$R_T = \left(R_{40}^{-1} + R_{60}^{-1} + R_{100}^{-1}\right)^{-1}$$

$$= \left\{(70066.67)^{-1} + (21020)^{-1} + (3137.31)^{-1}\right\}^{-1}$$

$$= 2627.5\,\Omega$$

Now,

$I_{40} = \dfrac{V}{R_{40}} = \dfrac{210.2}{70066.67}\,A = 0.003\,A$

$I_{60} = \dfrac{V}{R_{60}} = \dfrac{210.2}{21020}\,A = 0.010\,A$

$I_{100} = \dfrac{V}{R_{100}} = \dfrac{210.2}{3137.31}\,A = 0.067\,A$

$I_T = I_{40} + I_{60} + I_{100} = (0.003 + 0.010 + 0.067)\,A = 0.08\,A$

$\therefore V = I_T \times R_T = (0.08 \times 2627.5)\,V = 210.2\,V$

Which bulb will be the brightest:

We know that, $P = VI$

We see, power out is the multiplication of voltage and current. So, the power output for the three bulbs in the parallel circuit are,

$P_{40} = VI_{40}$
$= (210.2 \times 0.03)\,W$
$= 0.6306\,W$

$P_{60} = VI_{60}$
$= (210.2 \times 0.010)\,W$
$= 2.102\,W$

$P_{100} = VI_{100}$
$= (210.2 \times 0.067)\,W$
$= 14.0834\,W$

We are getting maximum power output from P_{100}. So, this bulb is the brightest bulb.

Result and Discussion:

My result is good enough. But there is some differences between my result and the ideal value. Because when I measure the current there are some resistance in wires consequently some changes in my result has been occured.

Conclusion:

From the experiment I have learnt about parallel circuit. I have also learnt the voltage will be always same in parallel circuit but the current is not same for the bulbs.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 04

Experiment Name: Verification of Ohm's law.

Submitted by:

Name: Rifa Zaman Fynuze

Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Experiment No : 04

Experiment Name : Verification of Ohm's law.

Objectives :

(i) To verify Ohm's law experimentally.

(ii) To verify the relationship between current, voltage and resistance in a circuit.

Introduction :

Ohm's law states that at constant temperature the voltage across a resistor is directly proportional to the current flowing through the resistor.

If the voltage across a resistor V and the current flowing through the resistor is I, then according to Ohm's law,

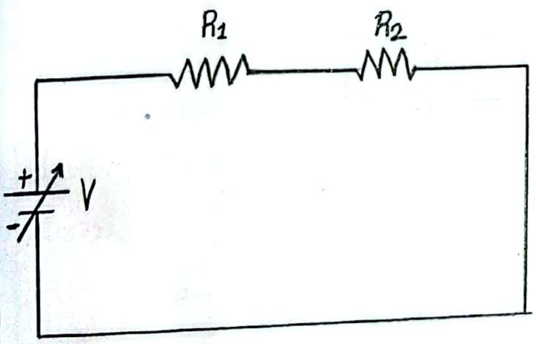
$$V \propto I$$
$$V = IR$$

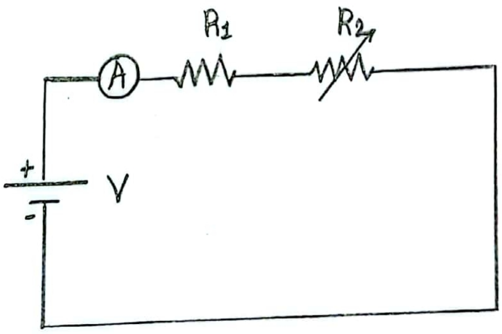
Where R is a proportional constant and it is called the resistance of the conductor which is constant at constant temperature. The resistance has ability to resist the flow of current.

Apparatus required :

Name	Rating	Quantity
Signal generator	0-50V	1
Rheostate		
Ammeter	0-10A	1
Voltmeter	0-500V	1
Connecting wire		As required

Circuit Diagram :





Experimental Data :

Table-1 :

When the value of resistance is constant.

Voltage (V)	Current (uA)
5.1	6.2 uA
10	16.4 uA
15	26.6 uA
19.1	34.7 uA
25	46.2 uA

Table-2:

When the voltage value is constant.

Current (μA)	Resistance (Ω)
50.4 μA	101 KΩ
60.2 μA	80.8 KΩ
69.8 μA	69.4 KΩ
78.6 μA	59.62 KΩ
90.6 μA	50.5 KΩ

Question:

What is the limitations of Ohm's law?

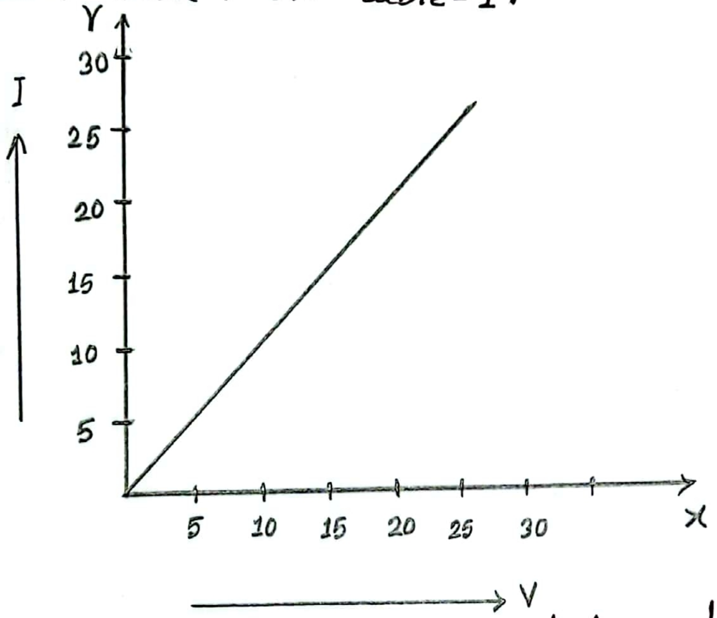
Answer:

Ohm's law is limited in its applicability to materials that exhibit a linear relationship between voltage and current. It does not held for non-linear materials such as semi-conductors, where the resistance changes with voltage. Additionally, Ohm's Law assumes constant temperature, but resistance can vary with temperature, making it inaccurate in such cases. At high frequencies, the law also fails to account for reactive components like inductance and capacitance, which affect current and voltage. Finally, at very small scales, quantum effects become significant, causing deviations from Ohm's Law.

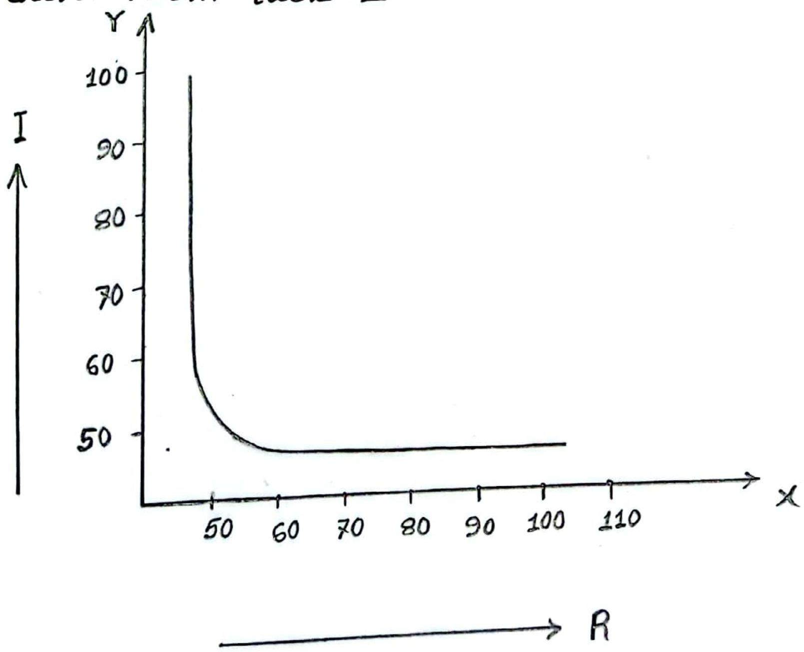
Calculations and analysis:

Current through resistor, $I = \dfrac{\text{voltage across the resistor (V)}}{\text{value of Resistance (R)}}$

I-V characteristic curve on a graph by putting experimental data from table-1.



I-R characteristic curve on a graph by putting experimental data from table-2.



Result :

We get a linear graph from our experimental data. It indicates that the experiment is done correctly and our experimental data is suitable for Ohm's Law experiment.

Discussion :

Based on the data collected and slope calculated in the current vs voltage graph of the rheostat, the experimental value of the resistance was almost accurate and so that the experiment was successfully accomplished.

Pabna University of Science and Technology

পাবনা বিজ্ঞান ও প্রযুক্তি বিশ্ববিদ্যালয়

PABNA UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 05

Experiment Name: Measurement of power by wattmeter.

Submitted by:

Name: Rifa Zaman Fyruze
Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 05

Experiment Name : Measurement of power by wattmeter.

Objectives :

(i) To be familiar with wattmeter.

(ii) To know about the measuring system of the meter.

(iii) To measure power of a circuit by the meter.

Introduction :

Wattmeter is used to measure the voltage value or power of circuit there are two types of coil in wattmeter.

They are :

(i) Current coil (C.C)

(ii) Potential coil (P.C)

Current coil measures the current and the potential coil measures the voltage drop of circuit. C.C must be connected in series in circuit and P.C. must be connected across the current coil as load. The thickness of C.C. is heavy and C.C. has fewer turn number. Fewer turn number causes decrement of induced voltage. The thickness of P.C. is not heavy and P.C. has larger turn numbers. Larger turn number causes increment of induced voltage. Rating of a wattmeter means what is the maximum and minimum limit of measuring value of a wattmeter.

Apparatus Required :

Name	Rating	Quantity
(i) Wattmeter		1
(ii) Load	100W–240V 200W–240V	2
(iii) Connecting wire		as required

Circuit Diagram :

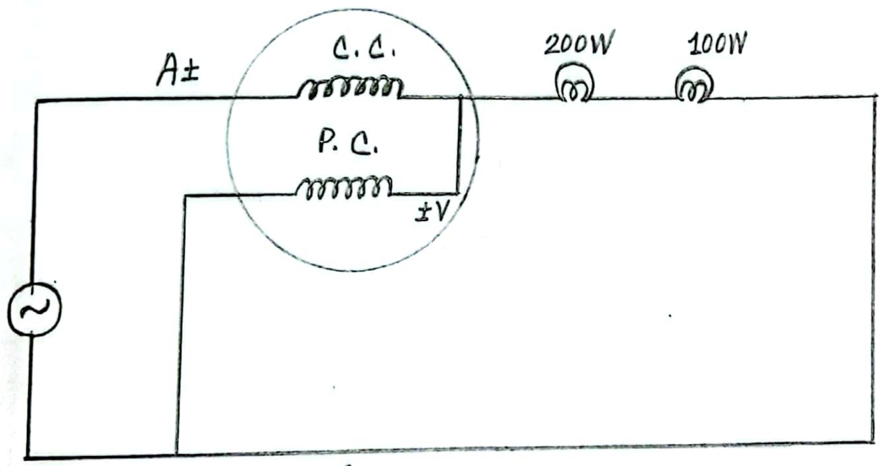


fig-1

Considering the 100W load :

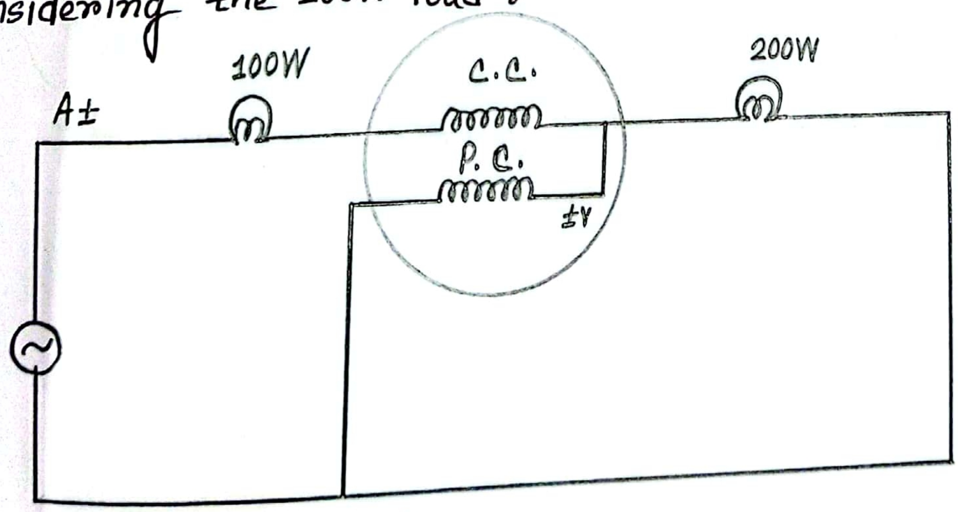


fig-2

Considering the 200W load :

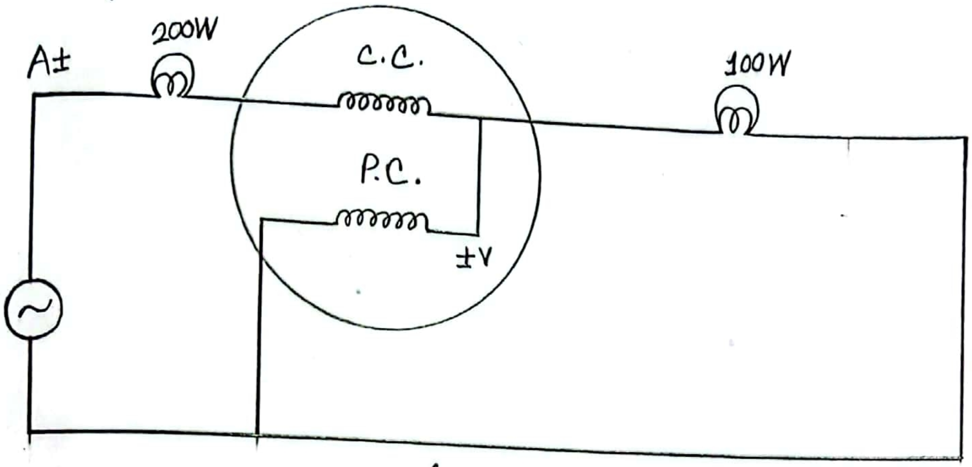


fig - 3

Experimental Data :

Load	Power P(W)	Voltage V(Volt)	Current I(A)	Total Power P_t (W)	Total Voltage V_t (Volt)
200W	9X2 = 18W	46.6V	0.370A	18+62 = 80W	46.6 + 167.5 = 214.1 Volt
100W	31X2 = 62W	167.5V			

Calculation :

Here,

$$I = 0.370A$$

$$V_{100} = 167.5 \text{ Volt}$$

$$P_{100} = V_{100} \times I$$

$$= (167.5 \times 0.370) W$$

$$= 61.975 W \simeq 62W$$

Again,

$$I = 0.370A$$

$$V_{200} = 46.6 \text{ Volt}$$

$$P_{200} = V_{200} \times I$$
$$= (46.6 \times 0.370) W$$
$$= 17.242 W \simeq 18 W$$

$$\therefore P_t = P_{100} + P_{200}$$
$$= (62 + 18) W = 80 W$$

Result and Discussion :

There is no error happened in this experiment. We get appropriate result by measuring power of loads. We find that the total power is equal to the sum of powers of loads.

Conclusion :

In this experiment the power of those loads is measured accurately. Those loads should be connected in series in the circuit for getting the absolute power.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 06

Experiment Name: Verification of superposition theorem.

Submitted by:

Name: Rifa Zaman Fyruze
Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

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Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 06

Experiment Name : Verification of superposition theorem.

Objectives : To verify the superposition theorem and determine the current following through the load resistance.

Theory :

Superposition theorem states that the voltage across or current through an element in a linear bilateral network is equal to the algebric sum of the currents and voltages produced independently by each source.

When applying the theorem it is possible to consider the effect of two sources at the same time and reduced number that have to be analyzed but in general.

Number of networks to be analyzed = Number of independent sources

So, in general it can be said that the total power delivered to a resistive element must be determined using the total current through or the total voltage across the element and cannot be determined by a simple sum of the power levels established by each source.

Required Apparatus :

1. Ammeter (1 piece ; 0-3A)
2. Resistance (3 pieces ; 10Ω, 100Ω, 150Ω)
3. DC Voltage source (10V, 5V ; 2 pieces)
4. Connecting wires (as required)

Experiment Diagram :

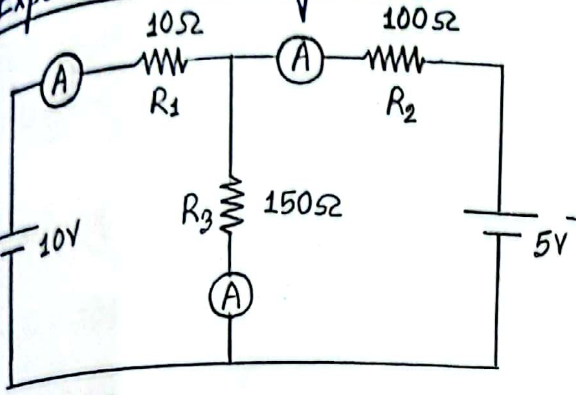

Fig-1

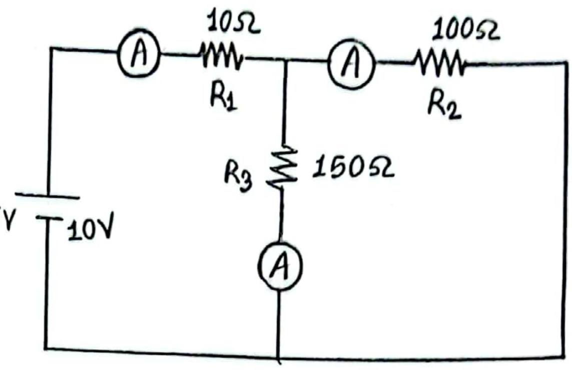

Fig-2

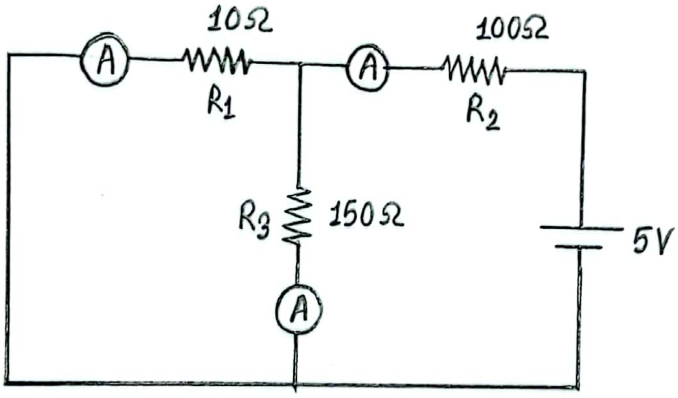

Fig-3

Experimental Data :

SL No	I_1 (mA)	I_2 (mA)	I_3 (mA)	Total I (mA)	V_1 (V)	V_2 (V)
1	0.12	0.05	0.07	0.24	10	5
2	0.14	0.10	0.10	0.37	10	0
3	0.05	0.05	0.002	0.102	0	5

Calculation:

For Fig-1: Applying mesh analysis,

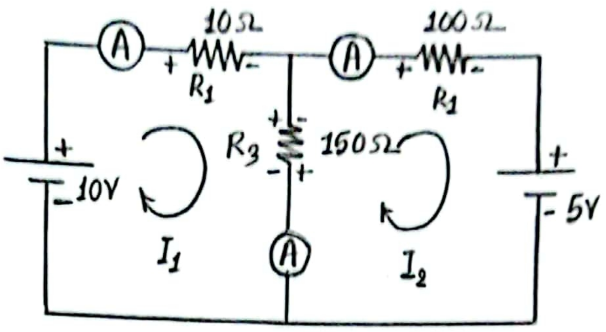

Fig-1

Mesh-1:

$-10+10I_1+150(I_1-I_2)=0$

$\Rightarrow -10+10I_1+150I_1-150I_2=0$

$\Rightarrow 160I_1-150I_2-10=0$

Mesh-2:

$150(I_2-I_1)+100I_2+5=0$

$\Rightarrow 150I_2-150I_1+100I_2+5=0$

$\Rightarrow -150I_1+250I_2+5=0$

$\Rightarrow 150I_1-250I_2-5=0$

Solving equation (i) and (ii),

$I_{10}=I_1=0.12mA$

$I_{100}=I_2=0.04mA \approx 0.05mA$

$I_{150}=I_3=I_1-I_2=(0.12-0.04)mA=0.06\approx 0.07mA$

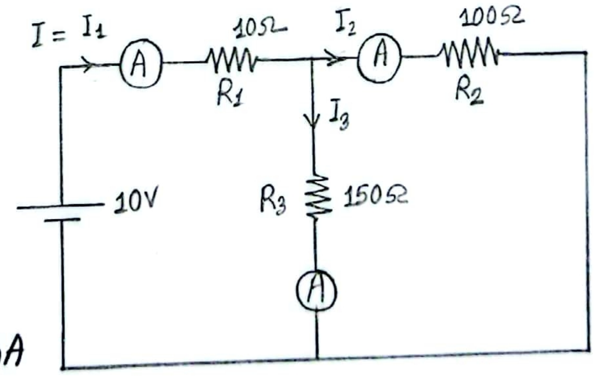

Fig-2

For Fig-2: Activing 10V

$R=(100 \| 150)+10$

$=70$

$I=I_{10}=\frac{10}{70}=0.14\approx 0.17mA$

$I_{100}=\frac{0.14\times 150}{150+100}=0.09\approx 0.10mA$

$$I_{150} = \frac{0.14 \times 100}{100+150} = 0.08 \approx 0.10\,mA$$

For fig-3 : Activing 5V,

$R = (10 \| 150) + 100\ \Omega$

$= 109.375\ \Omega$

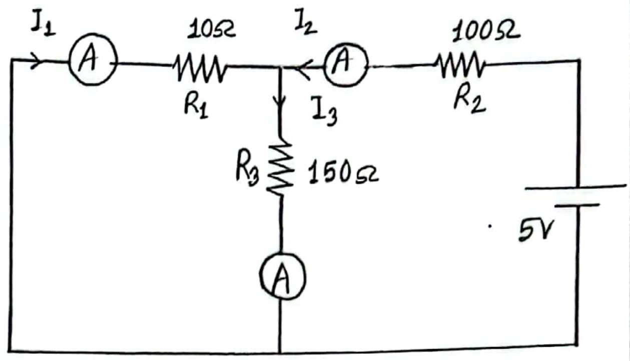

Fig-3

$$I = I_{100} = \frac{5}{109.375}$$

$= 0.05\,mA$

$$I_{10} = \frac{0.05 \times 150}{150+10} = 0.05\,mA$$

$$I_{150} = \frac{0.05 \times 10}{10+150} = 0.002\,mA$$

Result : Our experimental data is good enough for the superposition theorem.

Question : (1) What is the limitation for the superposition theorem?

Answer :

(i) Superposition theorem fails to calculate the power of the circuit.

(ii) Applicable only to linear circuit.

(iii) Applicable only for the circuits having more than one source.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 07

Experiment Name: Verification of reciprocity theorem.

Submitted by:

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Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
Pabna University of Science and Technology

Date of Experiment :

Submitted to:
Diponkar Kundu

Associate Professor & Chairman

Department of
Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 07

Experiment Name : Verification of reciprocity theorem.

Object : To verify the reciprocity theorem and determine the current following through the load resistance.

Theory :

The current at one point in a circuit due to a voltage at a second point is the same as the current at the second point due to the same voltage at the first.

Required Apparatus :

(i) Ammeter (1 piece ; 0-3 A)

(ii) DC voltage source (10V)

(iii) Resistance (3 pieces ; 10 Ω, 100Ω, 150Ω)

(iv) Connecting wires

Experimental Diagram :

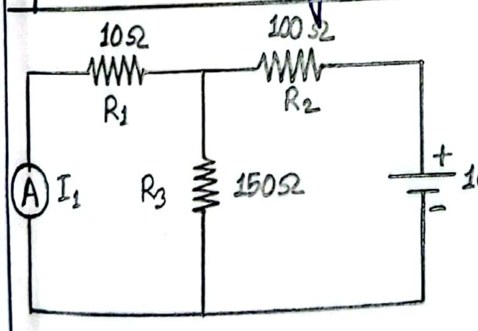

Fig-1

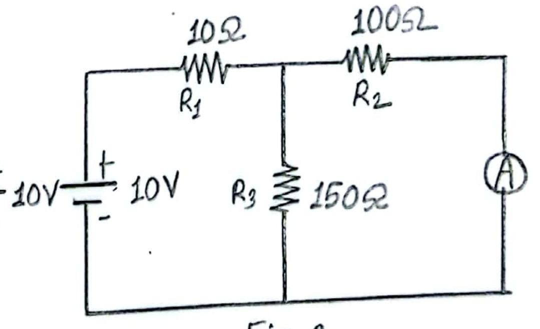

Fig-2

Experimental Data :

V_s (V)	I_1 (mA) for Fig-1	I_2 (mA) for Fig-2
10V	0.10	0.10

Calculation :

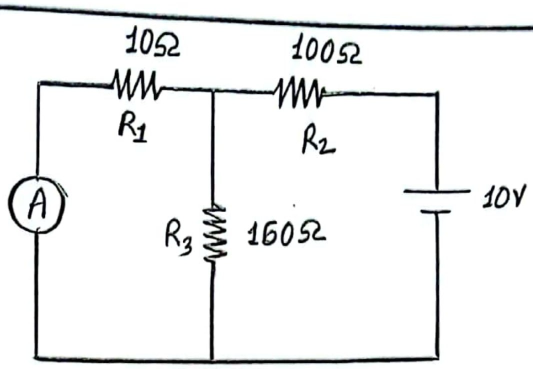

Fig-1

For Fig-1 :

$R = (10 \| 150) + 100$

$= 109.375\,\Omega$

$I = \dfrac{10}{109.375} = 0.09\,mA$

$I_1 = \dfrac{0.09 \times 150}{150 + 10} = 0.09 \approx 0.10\,mA$

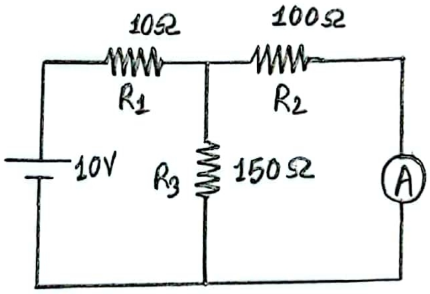

Fig-2

For Fig-2 :

$R = (100 \| 150) + 10$

$= 70\,\Omega$

$I = \dfrac{10}{70} = 0.14\,mA$

$I_2 = \dfrac{0.14 \times 150}{150 + 100} = 0.09 \approx 0.10\,mA$

Result :

Our experimental data is good enough for the reciprocity theorem.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 08

Experiment Name: Determination of circuit parameter of RLC series circuit.

Submitted by:

Name: Rifa Zaman Fyruze
Roll: 230234

Session: 2022-2023

1st Year 1st Semester
Dept. of Electrical and Electronic Engineering
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Date of Experiment :

Submitted to:
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Associate Professor & Chairman

Department of
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Pabna University of Science & Technology

Date of Submission :

Date :

Experiment No : 08

Experiment Name : Determination of circuit parameter of R-L-C series circuit.

Objectives :

(i) To determine the parameter of resistance, inductance and capacitance.

(ii) To determine the voltage across the resistor, inductor and capacitor.

(iii) To determine the power consumption by inductor.

Introduction :

Series R-L-C circuit consist of a resistance, a capacitance and an inductance connected in series across on alternating supply. Because of series circuit the current is same through all elements. The equivalent impedance is $Z = R + jX$. Here, X = reactance of the reactive element of AC circuit. In a R-L-C circuit the reactive elements are inductor and capacitor. Resistor has no reactance. The total impedance is $Z = R + j(X_L - X_C)$

$$\text{or, } |Z| \angle \tan^{-1}\left(\frac{X_L \sim X_C}{R}\right)$$

Here,

X_L = Inductive reactance

$X_L = \omega L$

X_C = Capacitive reactance

$X_C = \frac{1}{\omega C}$

The voltage drop across inductor is $V_L = IX_L$

The voltage drop across capacitor is $V_c = IX_c$

And the applied voltage is vectorically sum of all voltage drops.

Apparatus required:

Name	Rating	Requirement
AC Voltage Source	(220-240)V	
Ammeter	(0-10)A	1
Voltmeter	(0-1000)V	1
RLC meter		1
Wattmeter		1
Inductor		1
Capacitor		1
Connecting wire		as required

Circuit Diagram:

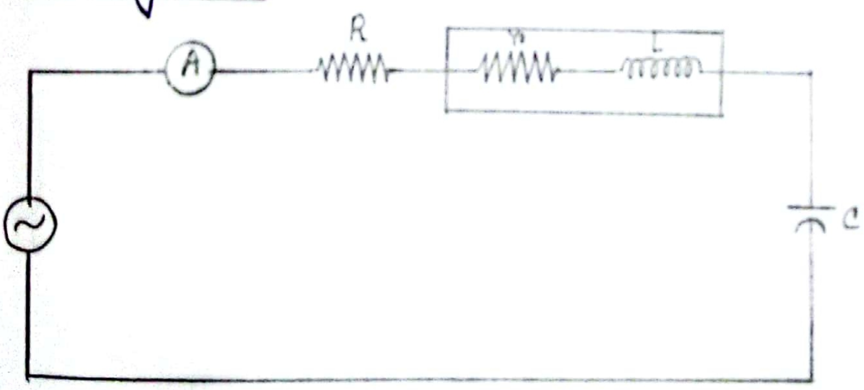


Fig-1

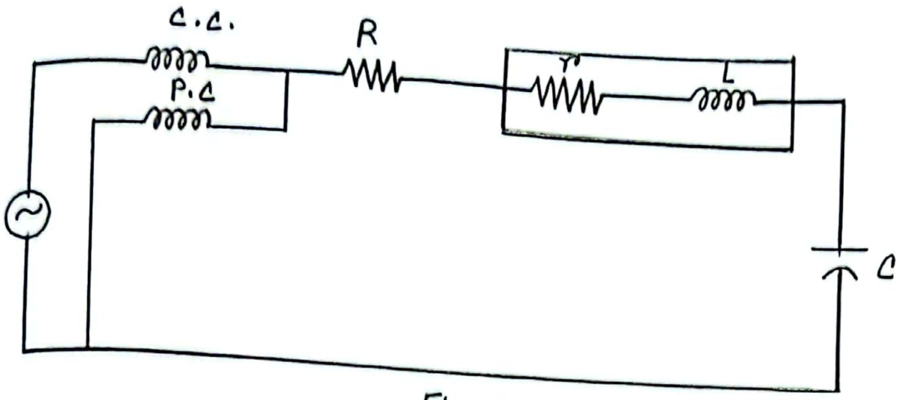


Fig - 2

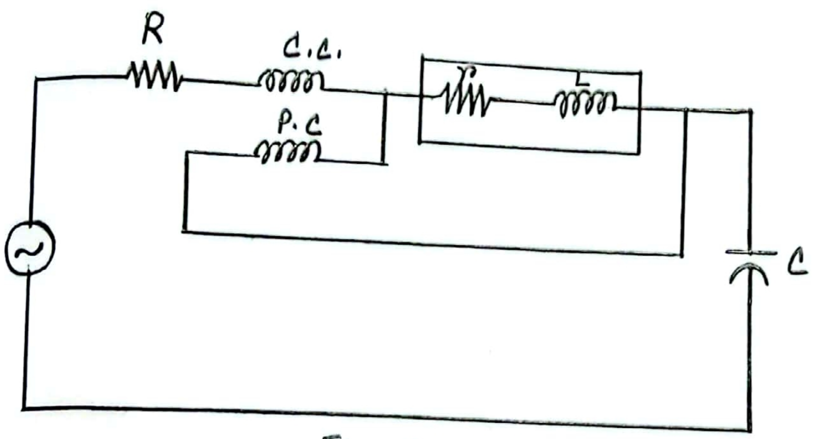


Fig - 3

Experimental Data :

V_S	I_S	V_R	V_L	V_C	P_T	P_L	P_C
240V	32.18 mA	148.3 V	190.5 V	306.5 V	64W	14W	4W

Calculation :

$$\text{Total Voltage, } V_T = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$$= \sqrt{(148.3)^2 + (190.5 - 306.5)^2}$$

$$= 188.278 \text{ V}$$

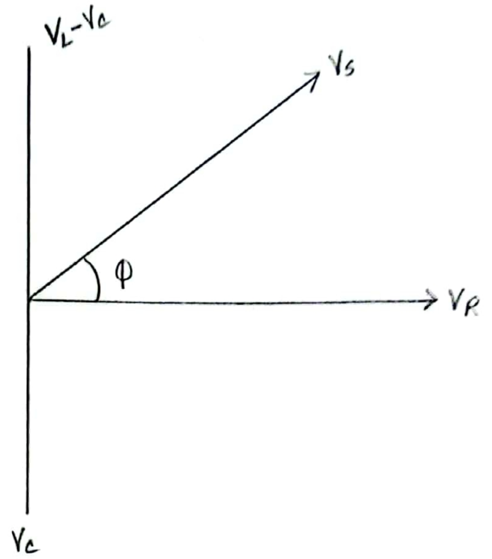
$$Z_C = \frac{V_C}{I_s}$$

$$\Rightarrow X_C = \frac{306.5}{32.18}$$

$$\Rightarrow \frac{1}{2\pi f C} = 9524.55$$

$$\Rightarrow C = 3.34 \times 10^{-7} F$$

$$\therefore C = 0.334 \mu F$$



Vector Diagram

and,

$$Z_L = \frac{V_L}{I_s}$$

$$\Rightarrow X_C = \frac{190.5}{32.18}$$

$$\Rightarrow 2\pi f L = 5919.82$$

$$\Rightarrow L = 18.84 H$$

$$R = \frac{V_R}{I_s}$$

$$= \frac{148.5}{32.18}$$

$$= 4614.66 \Omega$$

Result and Discussion:

In this experiment we faced some experimental error because we used a magnetic bauast as an inductor. It has a small amount of internal resistance and we ignore it that's why we faced error. From this experiment I have learnt about AC series circuit and also see how to react to reactive component in AC series circuit.

Pabna University of Science and Technology

Department of
Electrical and Electronic Engineering
Faculty of Engineering and Technology

Course Title: Sessional on Electrical Circuit-I

Course Code: EEE-1106

Lab Report

Experiment No: 09

Experiment Name: Determination of circuit parameter of RLC parallel circuit.

Submitted by:

Name: Rifa Zaman Fynuze

Roll: 230234

Session: 2022-2023

1st Year 1st Semester

Dept. of Electrical and Electronic Engineering

Pabna University of Science and Technology

Date of Experiment :

Submitted to:

Diponkar Kundu

Associate Professor & Chairman

Department of

Electrical And Electronic Engineering

Pabna University of Science & Technology

Date of Submission :

Date:

Experiment No: 09

Experiment Name: Determination of circuit parameters of R-L-C parallel circuit.

Objectives:

(i) To determine the parameter of resistance, inductance and capacitance.

(ii) To determine the voltage across resistor, inductor and capacitor.

(iii) To determine the power consumption by inductor.

Introduction:

A parallel R-L-C circuit consists of a parallel combination in parallel with an applied current source. In parallel AC circuit the current is not same through all the branch. The equivalent impedance is $Z = R + jX$. Here, X = reactance of the reactive element of AC circuit. In R-L-C circuit the reactive elements are inductor and capacitor. Resistor has no reactance. The total impedance is $Z = R + j(X_L - X_C)$

$$\text{or, } |Z| \angle \tan^{-1}\left(\frac{X_L \sim X_C}{R}\right)$$

Here, X_L = Inductive reactance

$X_L = \omega L$

X_C = Capacitive reactance

$X_C = \frac{1}{\omega C}$

The voltage drop across inductor is $V_L = I_2 X_L$
The voltage drop across capacitor is $V_C = I_2 X_C$
And the applied voltage is vectorically sum of all voltage drops.

Apparatus required :

Name	Rating	Requirement
AC Voltage Source	(220-240)V	
Ammeter	(0-10) A	1
Voltmeter	(0-1000) V	1
RLC meter		1
Wattmeter		1
Resistor		1
Inductor		1
Capacitor		1
Connecting wire		as required

Circuit Diagram :

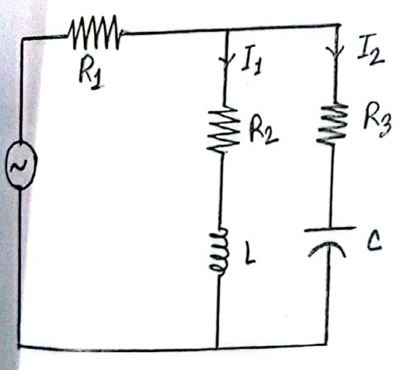


Fig-1

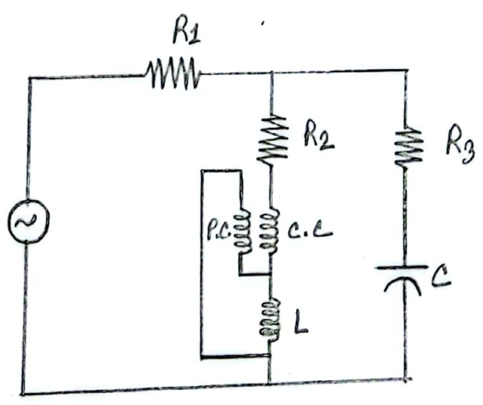


Fig-2

Experimental Data:

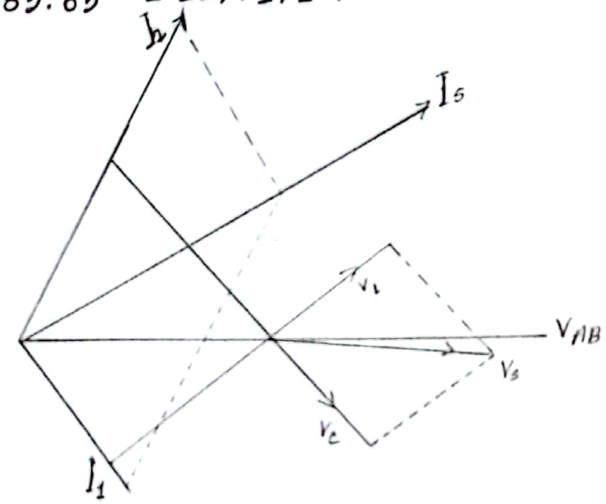
V_s	I_s	I_1	I_2	V_{R_1}	V_{R_2}	V_{R_3}	V_L	V_c	P_T	P_L	$V_{R_2}L$	$V_{R_3}C$
240 V	0.019 A	0.034 A	0.029 A	50.01	81.02	38.55	129.5	159.8	42	18	164.3	164.3

Calculation:

Total voltage, $V_T = \sqrt{V_{R_1}^2 + V_{R_2}^2 + (V_c - V_L)^2 + V_{R_3}^2}$

$= \sqrt{(50.01)^2 + (81.02)^2 + (159.8 - 129.5)^2 + (38.55)^2}$

$= \sqrt{11485.65} = 107.171\ V$



Vector Diagram

$Z_c = \dfrac{V_c}{I_2}$

$\Rightarrow X_c = \dfrac{159.8}{0.029}$

$\Rightarrow \dfrac{1}{2\pi f C} = 5510.35$

$\Rightarrow C = \dfrac{1}{2\pi f \times 5510.35}$

$\therefore C = 0.577\ \mu F$

and,

$Z_L = \dfrac{V_L}{I_1}$

$\Rightarrow X_L = \dfrac{129.5}{0.034}$

$\Rightarrow 2\pi f L = 3808.82$

$\Rightarrow L = \dfrac{3808.82}{2\pi f}$

$\therefore L = 12.124\,H$

and,

$$R_1 = \frac{V_{R_1}}{I_1}$$

$$= \frac{50.01}{0.034}$$

$$= 1470.88\,\Omega$$

$$R_2 = \frac{V_{R_2}}{I_2} = \frac{81.02}{0.029} = 2793.79\,\Omega$$

Result and Discussion :

In this experiment we faced some experimental error because we used a magnetic bauast as an inductor. It has a small amount of internal resistance and we ignore it that's why we faced error. From this experiment I have learnt about parallel ac circuit and I also see how to react to reactive component in AC parallel circuit.

Experiment No : 02

Experiment Name : Study of series circuit.

Experimental Diagram :

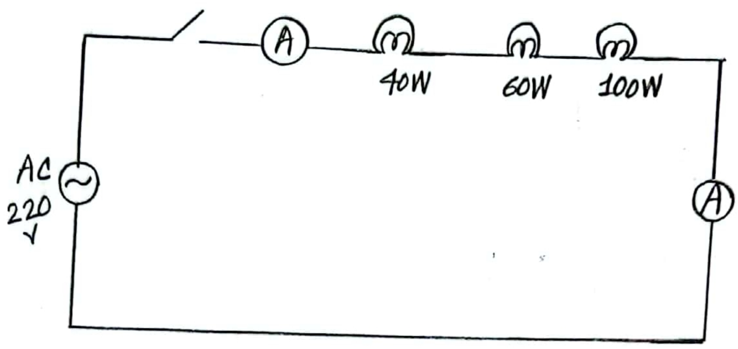


Figure : series circuit

Experimental Data :

V_T (V)	I (A)	V_{40} (V)	V_{60} (V)	V_{100} (V)
201.1 V	0.43	125.1 V	61 V	15 V

Experiment No : 03

Experiment Name : Study of parallel circuit.

Experimental Diagram :

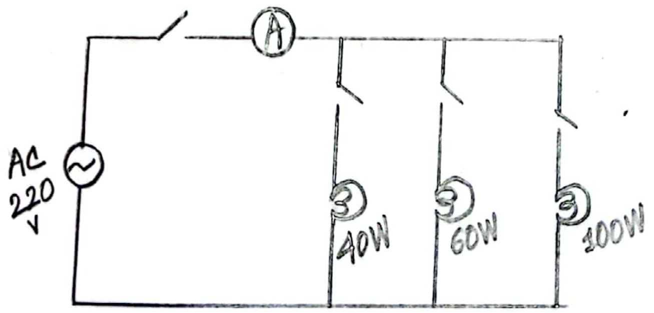


Fig : Parallel circuit

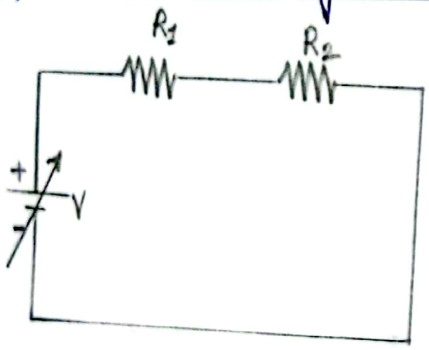
Experimental Data:

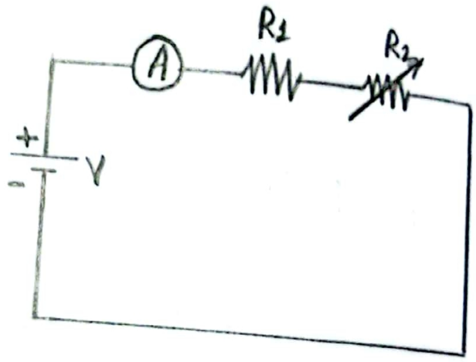
V_T (V)	I (A)	I_{40} (A)	I_{60} (A)	I_{100} (A)
210.2V	0.08A	0.003A	0.010A	0.067A

Experiment No: 04

Experiment Name: Verification of Ohm's Law.

Experimental Diagram:





Experimental Data:

Voltage (V)	Current (μA)
5.1	6.2
10	16.4
15	26.6
19.1	34.7
25	46.2

Current (μA)	Resistance (Ω)
50.4	101
60.2	80.8
69.8	69.4
78.6	59.62
90.6	50.5

Experiment No : 05

Experiment Name : Measurement of power by wattmeter.

Experimental Diagram :

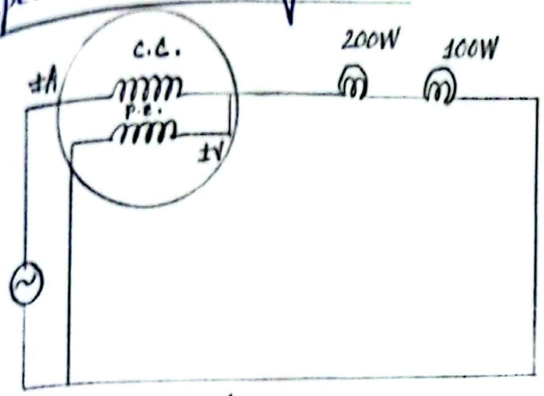


fig-1

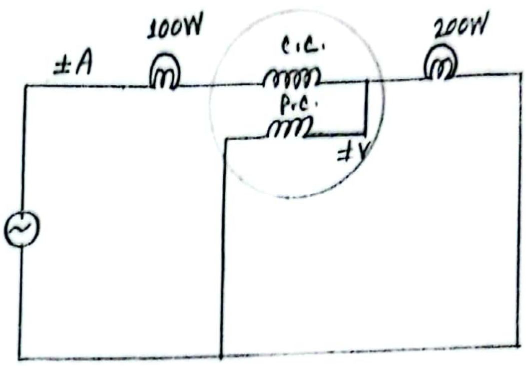


fig-2

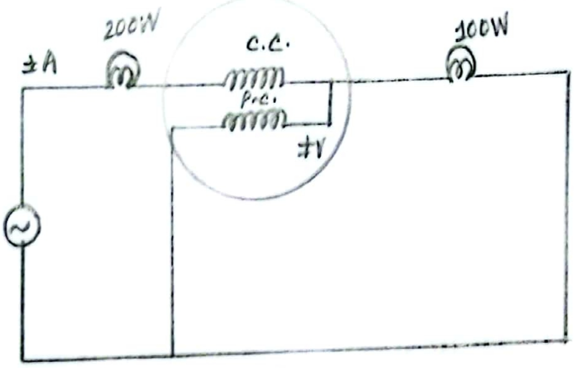


fig-3

Experimental Data :

Load	Power P(W)	Voltage V (Volt)	Current I (A)	Total Power P_t (W)	Total Voltage V_t (Volt)
200W	9×2 = 18W	46.6V	0.370A	18+62 = 80W	46.6+167.5 = 214.1 volt
100W	31×2 = 62W	167.5V			

Experiment No : 06

Experiment Name : Verification of superposition theorem.

Experimental Diagram :

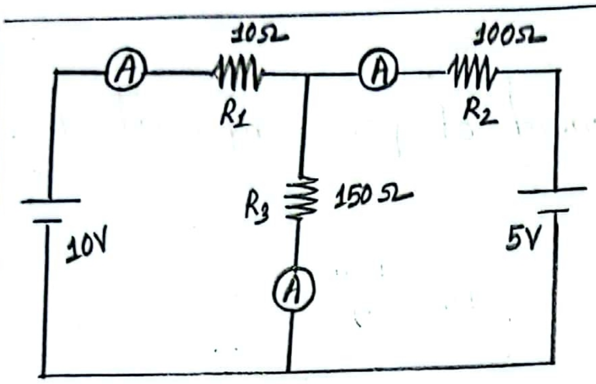


Fig-1

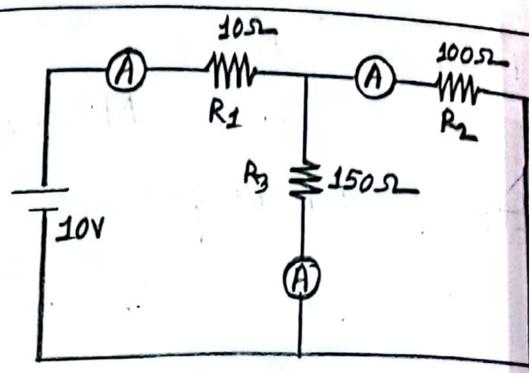


Fig-2

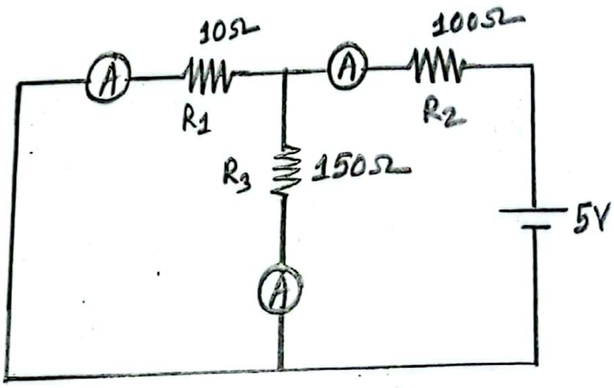


Fig-3

Experimental Data:

SL No	I_1 (mA)	I_2 (mA)	I_3 (mA)	Total I (mA)	V_1 (V)	V_2 (V)
1	0.12	0.05	0.07	0.24	10	5
2	0.14	0.10	0.10	0.37	10	0
3	0.05	0.05	0.002	0.102	0	5

Experiment No: 07

Experiment Name: Verification of reciprocity theore

Experimental Diagram:

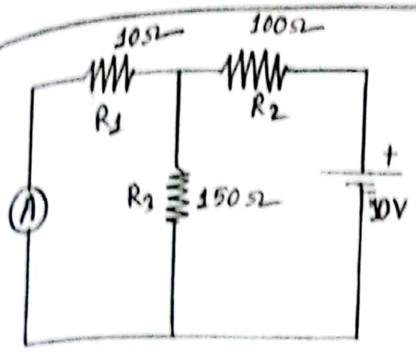


Fig-1

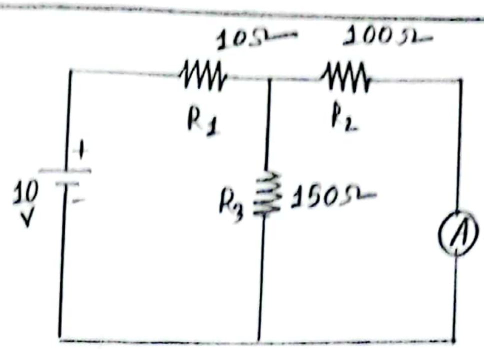


Fig-2

Experimental Data:

V_s (V)	I_1 (mA) Fig-1	I_2 (mA) Fig-2
10V	0.10	0.10

Experiment No: 08

Experiment Name: Determination of circuit parameters of R-L-C series circuit.

Experimental Diagram:

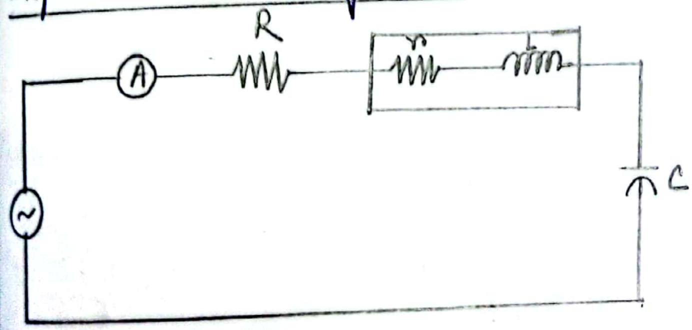


Fig-1

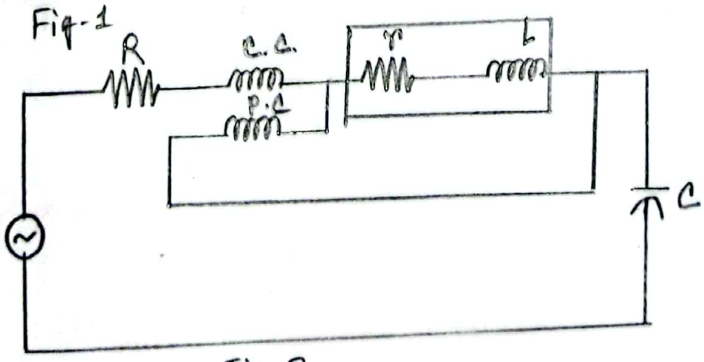


Fig-3

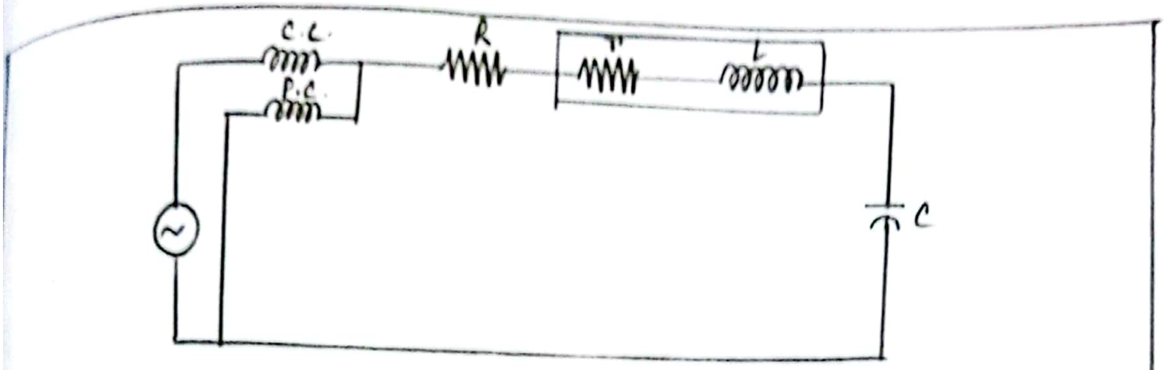


Fig-2

Experimental Data:

V_s	I_s	V_R	V_L	V_C	P_T	P_L	P_C
240V	32.18 mA	118.3 V	190.5 V	306.5 V	64W	14W	4W

Experiment No: 09

Experiment Name: Determination of circuit parameter of R-L-C parallel circuit.

Experimental Diagram:

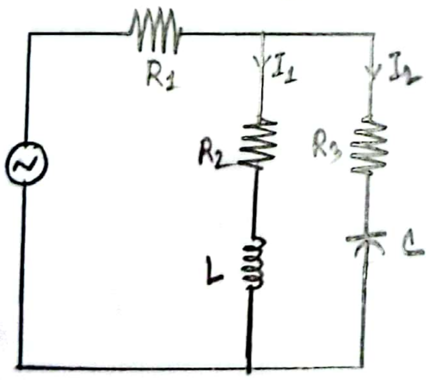


Fig-1

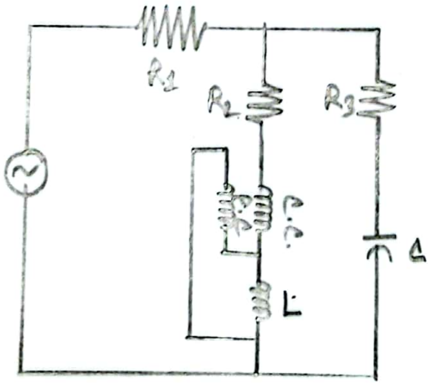


Fig-2

Experimental Data:

V_s	I_s	I_1	I_2	V_{R_1}	V_{R_2}	V_{R_3}	V_L	V_C	P_T	P_L	V_{R_2L}	V_{R_3C}
240 V	0.019 A	0.034 A	0.029 A	50.01	81.02	38.55	129.5	159.8	42	18	164.3	164.3