VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603203

Department of Electrical and Electronics Engineering

LAB MANUAL

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LIST OF EXPERIMENTS

ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ADDITIONAL EXPERIMENTS

1. Measurement of Voltage, Current, Power and Power Factor using RL load
2. CFL (Compact Fluorescent Lamp), LED (Light Emitting Diode) Lamp and BLDC (Brushless DC) Fan Wiring.

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Ex.No: 1
Date:

Residential House Wiring Using Switches, Fuse, Indicator, Lamp and Energy Meter

Aim:

To Construct House wiring using switches, fuse, indicator, lamp and Energy Meter.

Apparatus Required:

S.No	Apparatus Name	Range / Type	Quantity
1	SPST Switch (Single Pole Single Through)		
2	Fuse		
3	Indicator		
4	Lamp		
5	Fan		
5	Energy meter		
6	Connecting wires		

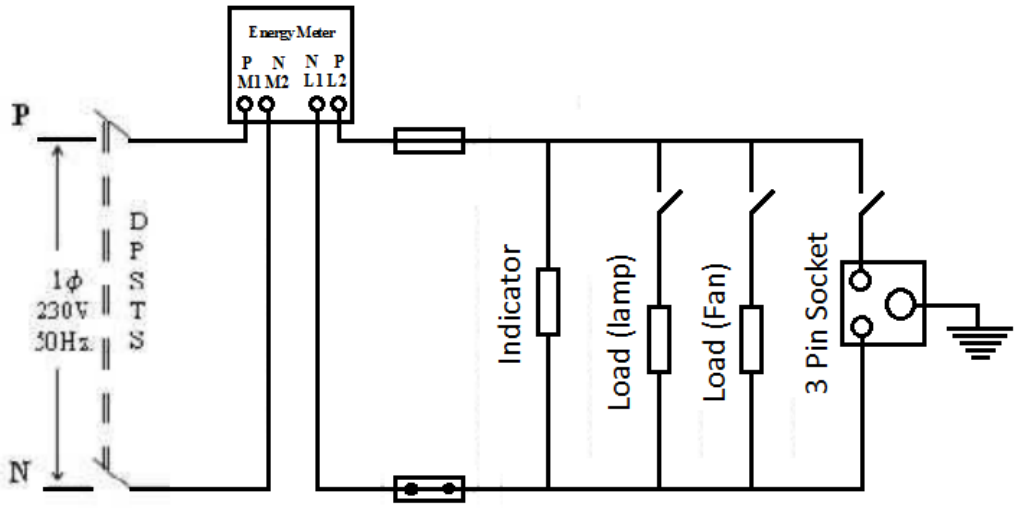
Theory:

Conductors, switches and other accessories should be of proper capable of carrying the maximum current which will flow through them. Conductors should be of copper or aluminum. In power circuit, wiring should be designed for the load which it is supposed to carry. Wiring should be done on the distribution system with main and branch distribution boards at convenient centers. Wiring should neat, with good appearance. Wires should pass through a pipe or box, and should not twist or cross. The conductor is carried in a rigid steel conduit conforming to standards or in a porcelain tube.

Procedure:

1. Study the given wiring diagram.
2. Make the location points for energy meter, fuse, indicator, main switch box, Switch board, lamp and ceiling rose.
3. Draw the lines for wiring on the wooden board.
4. Place the wires along with the line and fix.
5. Fix the lamp holder, Switches, Ceiling rose, Socket in marked positions on the wooden board.
6. Connect the energy meter and main switch box in marked positions on the wooden board.
7. Give a supply to the wires circuit.
8. Test the working of light and socket.

Circuit Diagram:



Name Plate Details

Load :

Indicator	: P_1=____W, V=230V;	I_1=____A;	Switch: Nil
Lamp	: P_2=____W, V=230V;	I_2=____A;	Switch:
Fan	: P_3=____W, V=230V;	I_3=____A;	Switch:
3 Pin Socket	: P_4=____W, V=230V;	I_4=____A;	Switch:

Full Load	:P=_____W;	I=___A	

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Result :

Ex.no:2
Date:

Fluorescent Lamp Wiring

Aim:

To make and check the fluorescent lamp wiring.

Apparatus Required:

S.no	Apparatus Name	Range / Type	Quantity
1	Fluorescent Lamp		
2	Lamp Holder		
3	Switch		
4	Starter		
5	Choke		
6	Connecting wires		

THEORY:

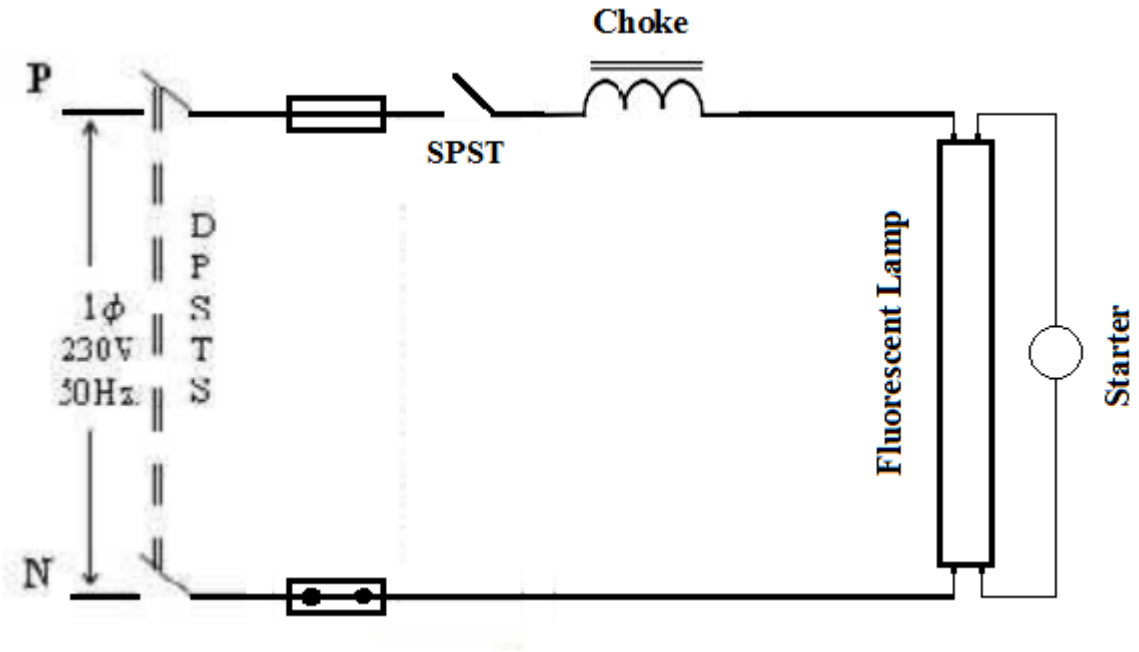
Fluorescent lights are the most commonly used high source for illumination in houses, industries, commercial organizations and public utility services. A fluorescent lamp is a low pressure mercury and public utility services. A fluorescent discharge lamp with internal surface coated with suitable fluorescent material. This lamp consists of glass tube provided at both ends with caps having two pins and oxide coated tungsten filament. Tube contains argon or krypton gas to facilitate starting with small quantity of mercury under low pressure. Fluorescent material, when subjected to electro-magnetic radiations of particular wavelength produced by the discharge through the mercury vapor, gets excited and in turn gives out radiation at some other wave length which falls under visible spectrum. Thus, the secondary radiations from fluorescent powder increase the efficiency of the lamp. Fluorescent lights in India are generally made either 61cm long 20 W rating or 122 cm ling 40 W rating.

In order to make a Fluorescent light self starting, electronic choke is connected in the circuit. When switch S is closed, full supply voltage appears across the electrodes which are enclosed in a glasses bulb filled with argon gas. This voltage causes discharge in the argon gas with consequent heating of the electrodes. Due to this heating, the electrode in the starter which is made of bimetallic strip, bends and closes contact of the starter. At this stage, the choke, the filaments of the tube and the starter become connected in series across the supply. A current flows through the filaments and heats them. Meanwhile the argon discharge in the starter tube disappears and after a cooling time, the electrodes of starter cause a sudden break in the circuit. This causes a high value of induced EMF in the choke. The induces EMF in the choke is applied across the Fluorescent light electrodes and is responsible for initiating a gaseous discharge because initial heating has already created good number of free electrons in the vicinity of electrodes

Procedure

1. Make connections as shown in the Figure.
2. Assemble the fluorescent light accessories like starter holder, holder for tube and chock in the fitting base with the help of screws.
3. Fixed in the holder to light it and switch ON the supply the lamp will glow.
4. Switch off the supply

Circuit Diagram



Name Plate Details

Load :

Fluorescent Lamp : P=____W, V=230V; I=____A; Switch: I___A, 230V.

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Result:

Ex. No: 3

Date:

Staircase Wiring

Aim:

To control the status of the given lamp by using 2 two – way switches

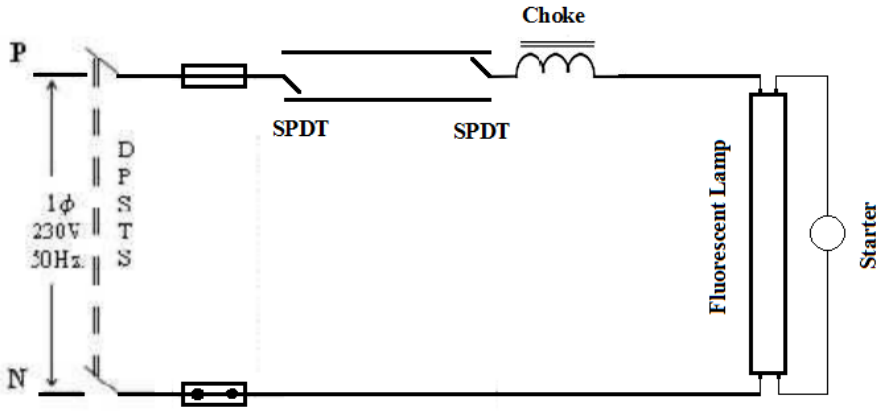
Apparatus Required:

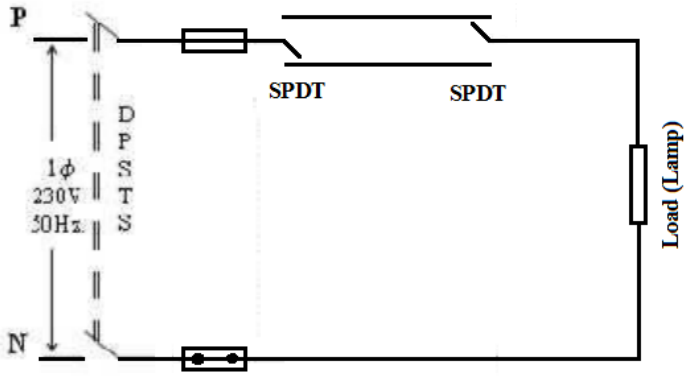
S.No	Apparatus Name	Range / Type	Quantity
1	SPDT Switch		
2	Lamp		
3	Connecting wires		

Procedure:

1. Place the accessories on the wiring board as per the circuit diagram.
2. Place the P.V.C pipe and insert two wires into the P.V.C pipe.
3. Take one wire connect one end to the phase side and other end to the middle point of SPDT switch 1
4. Upper point of SPDT switch 1 is connected to the upper point of SPDT switch2.
5. Lower point of SPDT 1 is connected to the lower point SPDT switch2.
6. Another wire taken through a P.V.C pipe and middle point of SPDT switch 2 is connected to one end of the lamp holder.
7. Another end of lamp holder is connected to neutral line.
8. Screw the accessories on the board and switch on the supply.
9. Circuit is tested for all possible combination of switch position.

Circuit Diagram:





Name Plate Details

Load:

Fluorescent Lamp : P=____W, V=230V; I=____A; Switch:_____.

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Result :

Thus the staircase wiring was done using two way switch

Ex. No: 4

Date:

Measurement of Voltage, Current, Power and Power Factor using R load

Aim:

To measure power in a single phase AC circuit using wattmeter by R load.

Apparatus Required:

S.No	Name of the Apparatus	Range/Type	Quantity
1.	Voltmeter		
2.	Ammeter		
3.	Wattmeter		
4.	R Load		
5.	Connecting Wires		

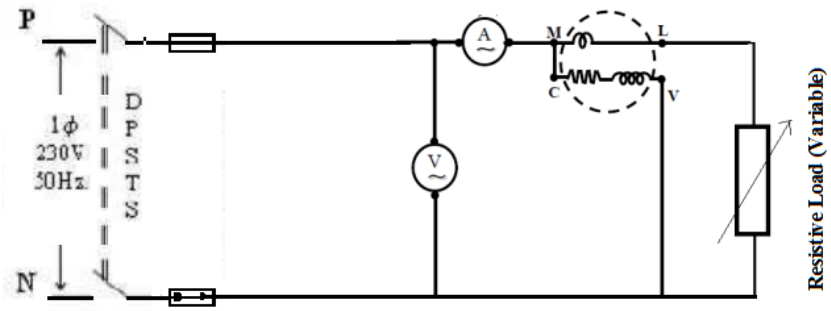
Theory:

Power in an electric circuit can be measured using a wattmeter. A wattmeter consists of two coils, namely current coil and pressure coil or potential coil. The current coil is marked as ML and pressure coil is marked as CV. The current coil measure the quantity that is proportional to the current in the circuit the pressure coil measures quantity that is proportional to the voltage in the circuit. The given wattmeter is loaded by direct loading. The ammeter is connected in series to the wattmeter. Since the same current flows in both the coils, the current and voltage across the circuit are constant. The power consumed by the load is measured using the wattmeter and calculated using the formula.

Procedure:

1. Connection is given as per circuit diagram.
2. Initially no load is applied.
3. Switching of the power supply.
4. Apply the load by adjusting R load.
5. Measure and record the values of voltmeter, ammeter and wattmeter.
6. After taking all the readings, reduce the load slowly to the minimum position.
7. Switch off the power supply.

Circuit Diagram



Name Plate Details

Load :

Load : P=____W, V=230V; I=____A;

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Observation Table:

Sl.No	Actual Load (W)	Voltage (V)	Current (A)	Power (W) Multiplication Factor=		Apparent Power (W)	Power Factor (Cosϕ)
				Observed	Actual		
1	0						
2	100						
3	200						
4	300						
5	500						
6	1000						

Real Power =V×I×Cosϕ (in Watts)

Apparent Power =V×I (in Watts)

Actual Power = Observed Wattmeter reading × Multiplication Factor.

Power Factor (Cosϕ)= Apparent Power / Actual Power

Model Calculation:

Result : Thus the power was calculated using wattmeter by R load

Ex.No:5
Date:

Measurement of Energy Using Energy meter

Aim:

To measure the energy in a single phase circuit using direct Loading.

Apparatus Required:

S.no	Name of the apparatus	Range/type	Quantity
1.	Single Phase Energy meter	Rev/kWh	
2.	Voltmeter		
3.	Ammeter		
4.	Wattmeter		
5.	Load		
6.	Connecting Wires		

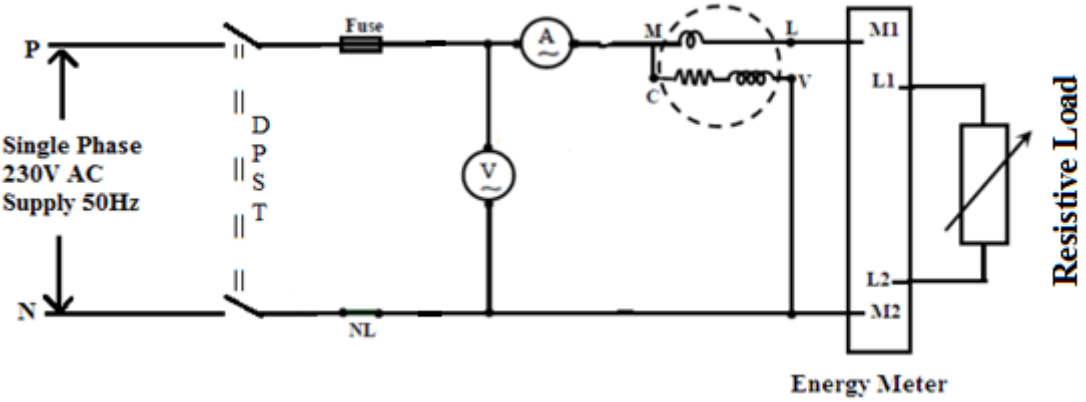
Theory:

Energy meters are integrating instruments and are used for measurement of energy in a circuit over a given time. Since the working principle of such instrument is based on electro-magnetic induction, these are known as induction type energy meter. There are two coils in an induction type energy meter, namely current coil and voltage coil. The current coil is connected in series with the load while the voltage coil is connected across the load. The aluminium disc experiences deflecting torque due to eddy currents induced in it and its rotations are counted by a gear train mechanism.

Procedure:

1. Connections are made as per the circuit diagram.
2. Supply is given to the switch by closing the DPST switch.
3. Load is switched on.
4. Time taken for five revolutions in the energy meter is noted and the Corresponding ammeter and voltmeter reading are noted.
5. The above procedure is repeated for different load current and for fixed number of revolutions.
6. Then the load is gradually released and supply is switched OFF.
7. The error is calculated and the graph is plotted between calculated energy and Percentage of error.

CIRCUIT DIAGRAM



Name Plate Details

Load :

Load : P=____W, V=230V; I=____A;

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Observation Table:

S.No	Load (W)	V (V)	I (A)	W (W)		Time in Seconds (t) (5 Revolutions)		Calculated Energy (kWh-Unit)	Observed Energy (kWh-Unit)	% Error
				Observed	Actual (P)					
1	0									
2	100									
3	200									
4	300									
5	500									

Model Calculation:

Calculated Energy= $\frac{P \times \frac{t}{3600}}{1000} kWh$

Observed Energy = $\frac{Number\ of\ Revolutions\ per\ Sec}{1500} kWh$

% of Error = $\frac{Observed\ Energy - Calculated\ Energy}{Calculated\ Energy} \times 100$

Result : Thus the power was calculated using wattmeter by RL load

EX.NO:6
DATE:

Measurement of Resistance to Earth of Electrical Equipment

AIM:

To measure the resistance to earth resistance of Electrical Equipment.

APPARTUS REQUIRED:

S.no	Name of the Apparatus	Range/type	Quantity
1.			
2.			
3.			
4.			
5.			
6.			

THEORY:

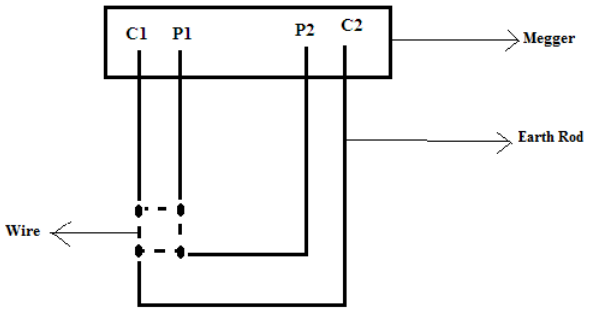
For this experiment we have to use the Megger. It is an instrument for testing the insulation resistance of the order of mega ohms.

A megger consists of an emf source and a voltmeter. The voltmeter scale is calibrated in ohms. In measurement, the emf of the self-contained source should be equal that of the source used in calibration. The deflection of the moving system depends on the ratio of the currents in the coils and is independent of the applied voltage. The value of unknown resistance can be found directly from the scale of the instrument. Figure shows detailed diagram of a megger. It consists of a hand driven dc generator a emf about 500V.the permanent dc meter has two moving coils. First one is deflecting coil and another one is controlling coil. The deflecting coil is connected to the generator through a resistor R2. The torque due to the two coils opposes each other. It consists of three terminals E (earth terminal) and L (line terminal) and G (guard wire terminal).

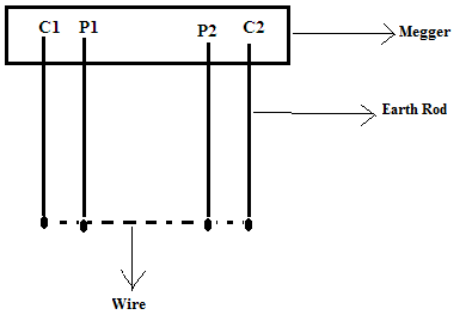
OPERATION:

When the terminals are open circuited, no current flows through the deflecting coil. The torque to the controlling coil moves the pointer to one end of the scale. When the terminals are short circuited, the torque due to the controlling coil and the pointer is deflected to the other end of the scale i.e. zero mark. In between the two extreme positions the scale is calibrated to indicate the value of unknown resistance directly. The unknown insulation resistance is the combination of insulation volume resistance and surface leakage resistance. The guard wire terminal makes the surface leakage current to bypass the instrument hence only insulation resistance is measured.

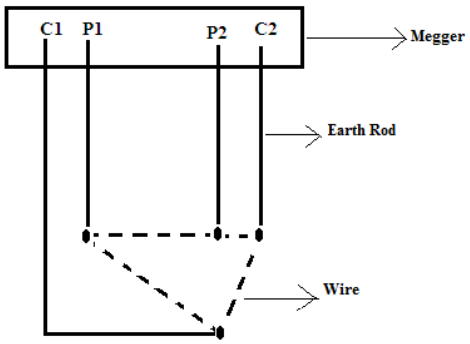
SQUARE POSITION



HORIZONTAL POSITION



TRIANGULAR POSITION



TABULATION:

S.No	Position (Distance in Meter)	Resistance (Ω)
1	**Square** C1-P1:___m, C1-P2:___m, C1-C2:___m, P1-P2:___m, P1-C2:___m, P2-C2:___m	
2	**Horizontal** C1-P1:___m, C1-P2:___m, C1-C2:___m, P1-P2:___m, P1-C2:___m, P2-C2:___m	
3	**Triangular** C1-P1:___m, C1-P2:___m, C1-C2:___m, P1-P2:___m, P1-C2:___m, P2-C2:___m	

RESULT:

Thus the earth resistance in Horizontal position = , Square position = , Triangular position = .

Ex. No: 7

Date:

Measurement of Voltage, Current, Power and Power Factor using RL load

Aim:

To measure power in a single phase AC circuit using wattmeter by RL load.

Apparatus Required:

S.No	Name of the Apparatus	Range/Type	Quantity
1.	Voltmeter		
2.	Ammeter		
3.	Wattmeter		
4.	R Load		
5.	Connecting Wires		

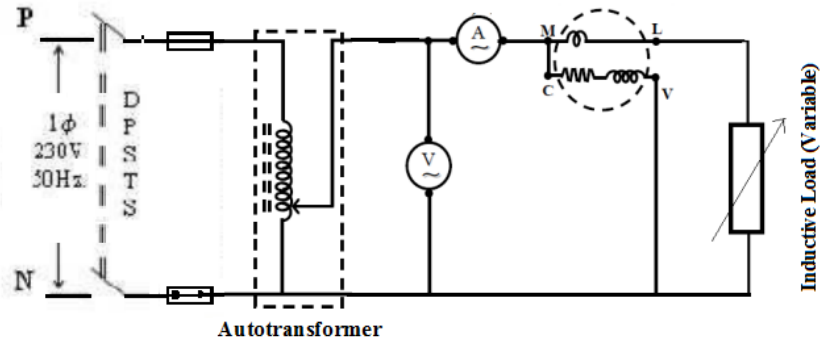
Theory:

Power in an electric circuit can be measured using a wattmeter. A wattmeter consists of two coils, namely current coil and pressure coil or potential coil. The current coil is marked as ML and pressure coil is marked as CV. The current coil measure the quantity that is proportional to the current in the circuit the pressure coil measures quantity that is proportional to the voltage in the circuit. The given wattmeter is loaded by direct loading. The ammeter is connected in series to the wattmeter. Since the same current flows in both the coils, the current and voltage across the circuit are constant. The power consumed by the load is measured using the wattmeter and calculated using the formula.

Procedure:

1. Connection is given as per circuit diagram.
2. Initially no load is applied.
3. Switching of the power supply.
4. Apply the load by adjusting R load.
5. Measure and record the values of voltmeter, ammeter and wattmeter.
6. Repeat the steps 5 and 6 until the ammeter reading reaches 10A.
7. After taking all the readings, reduce the load slowly to the minimum position.
8. Switch off the power supply.

Circuit Diagram



Name Plate Details

Load :

Load : P=____W, V=230V; I=____A;

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Observation Table:

Sl.No	Actual Load (W)	Voltage (V)	Current (A)	Power (W) Multiplication Factor=		Apparent Power (W)	Power Factor (Cosϕ)
				Observed	Actual		
1	0						
2	100						
3	200						
4	300						
5	500						
6	1000						

Real Power =V×I×Cosϕ (in Watts)

Apparent Power =V×I (in Watts)

Actual Power = Observed Power × Multiplication Factor.

Power Factor (Cosϕ)= $\frac{Apparent\ Power}{Actual\ Power}$

Model Calculation:

Result : Thus the power was calculated using wattmeter by RL load.

Ex.No: 8
Date:

Residential House Wiring Using CFL, LED and BLDC Fan

Aim:

To Construct House wiring using switches, fuse, indicator, lamp and Energy Meter.

Apparatus Required:

S.No	Apparatus Name	Range / Type	Quantity
1	SPST Switch (Single Pole Single Through)		
2	Fuse		
3	Indicator		
4	Lamp		
5	Fan		
5	Energy meter		
6	Connecting wires		

Theory:

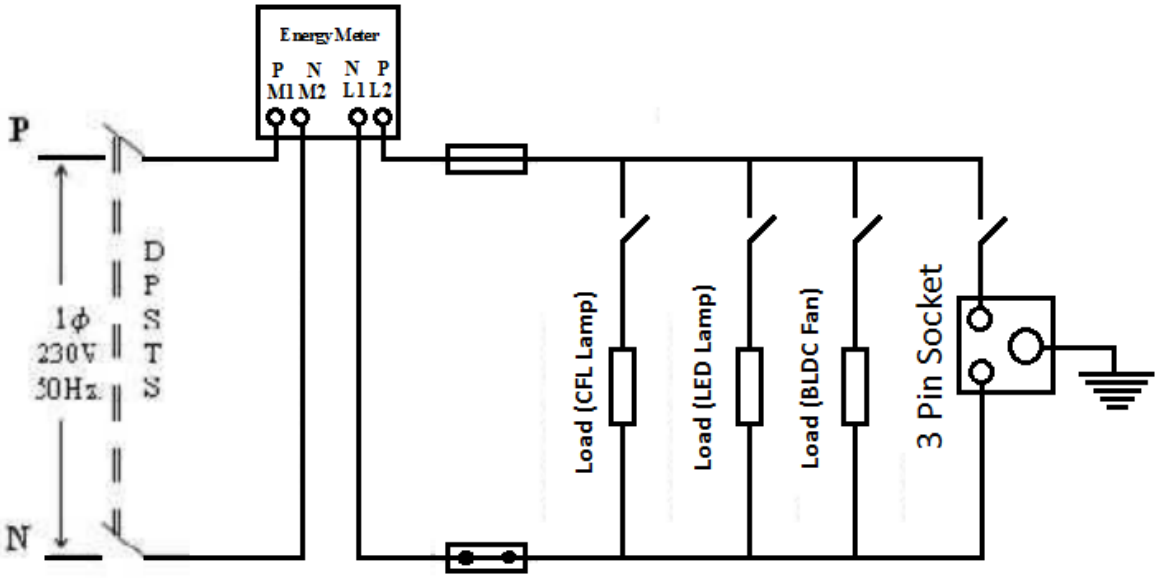
Conductors, switches and other accessories should be of proper capable of carrying the maximum current which will flow through them. Conductors should be of copper or aluminum. In power circuit, wiring should be designed for the load which it is supposed to carry. Wiring should be done on the distribution system with main and branch distribution boards at convenient centers. Wiring should neat, with good appearance.

- Wires should pass through a pipe or box, and should not twist or cross.
- The conductor is carried in a rigid steel conduit conforming to standards or in a porcelain tube.

Procedure:

1. Study the given wiring diagram.
2. Make the location points for energy meter, fuse, indicator, main switch box, Switch board, lamp and ceiling rose.
3. Draw the lines for wiring on the wooden board.
4. Place the wires along with the line and fix.
5. Fix the lamp holder, Switches, Ceiling rose, Socket in marked positions on the wooden board.
6. Connect the energy meter and main switch box in marked positions on the wooden board.
7. Give a supply to the wires circuit.
8. Test the working of light and socket.

Circuit Diagram:



Name Plate Details

Load :

Indicator	: P_1=____W, V=230V;	I_1=____A;	Switch: Nil
Lamp	: P_2=____W, V=230V;	I_2=____A;	Switch:
Fan	: P_3=____W, V=230V;	I_3=____A;	Switch:
3 Pin Socket	: P_4=____W, V=230V;	I_4=____A;	Switch:

Full Load	:P=_____W;	I=___A	

Fuse Rating Calculation:

125% of the Full load Current (I) = $\frac{125 \times I}{100} = 1.25 \times I =$ _____ ≈ ____ Amp

Result :

Thus the House wiring was constructed using switches, fuse, indicator, lamp and Energy Meter.

Available Rating of Apparatus in Open Market

Switch:

Switch 1: I= 5A, V=230V, **Switch 2:** I=10A, V=230V, **Switch 3:** I=16A, V=230V,
Switch 4: I=20A, V=230V, **Switch 5:** I=32A, V=230V

Lamp:

Lamp 1: P= 15 W, V=230V, **Lamp 2**: P= 23 W, V=230V, **Lamp 3**: P= 28 W, V=230V,
Lamp 4: P= 40 W, V=230V, **Lamp 5**: P= 60 W, V=230V, **Lamp 6**: P=100 W, V=230V
Lamp 7: P=200 W, V=230V

Fan:

Fan 1: P= 24 W, V=230V, **Fan 2**: P= 35 W, V=230V, **Fan 3**: P= 60 W, V=230V

3 Pin Socket:

Socket 1:I= 5A, V=230V, **Socket 2**:I=16A, V=230V, **Socket 3**:I=32A, V=230V

Energy Meter:

Meter 1: I= 5A, V=230V, 1200 Revs/KWh, **Meter 2**: I=10A, V=230V, 1200 Revs/KWh
Meter 3: I=20A, V=230V, 1200 Revs/KWh

Resistive Load:

Load 1: P= 1kW, V=230V, **Load 2**: P= 2kW, V=230V, **Load 3**: P= 5kW, V=230V,
Load 4: P= 10kW, V=230V

Inductive Load:

Load 1: P= 1kW, V=230V, **Load 2**: P= 2kW, V=230V, **Load 3**: P= 5kW, V=230V,
Load 4: P= 10kW, V=230V

Watt Meter:

Meter 1: V=300V, 5A, UPF, **Meter 2**: V=300V, 5A, LPF, **Meter 3**: V=300V, 10A, UPF,
Meter 4: V=300V, 10A, LPF

Autotransformer:

Model 1: 1Phase, V=0-300V, 1kVA, **Model 1**: 1Phase, V=0-300V, 5kVA,

Voltmeter:

Meter 1:V=0-1V, **Meter 2**:V=0-10V, **Meter 3**:V=0-20V, **Meter 4**:V=0-150V, **Meter 5**:V=0-300V,
Meter 6:V=0-600V

Ammeter:

Meter 1:I=0-1A, **Meter 2**:I=0-5A, **Meter 3**:I=0-10A, **Meter 4**:I=0-15A, **Meter 5**:I=0-20A,
Meter 6:I=0-25A

Wire:

Wire 1: I= 1A, V=230V**, Wire 2**: I= 5A, V=230V,
Wire 3: I= 16A, V=230V, **Wire 4**: I= 32A, V=230V,

Fuse:

Fuse 1:I=1A, **Fuse 2**:I=2A, **Fuse 3**:I=5A, **Fuse 4**:I=10A, **Fuse 5**:I=15A, **Fuse 6**:I=20A, **Fuse 7**:I=25A