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Department of Mechatronics Engineering

GE3271 ENGINEERING PRACTICES LABORATORY MANUAL

Prepared By

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VISION AND MISSION OF THE INSTITUTION

VISION
To become a world-class institution for engineering education by imparting quality education that meets global standards, cultivating students who are academically excellent, possess a positive attitude, are ethically sound and socially committed.
MISSION
❖ To enhance academic excellence by educating students in engineering principles, thereby upgrading their knowledge and skills
❖ To empower students with a positive attitude and creative thinking to develop innovative techniques in engineering
❖ To educate and cultivate dedicated learners with ethical values who are socially responsible

VISION AND MISSION OF MECHATRONICS ENGINEERING DEPARTMENT

VISION
To achieve excellence in Mechatronics Engineering through quality education and industry collaboration by integrating mechanical, electronics, computer, and control systems, thereby developing professionally competent, innovative, and socially responsible engineers to contribute in the field of automation, robotics, and smart manufacturing..
MISSION
❖ To strengthen a learner-centric and industry-integrated environment by imparting technical knowledge and practical skills in Mechatronics Engineering, including automation, robotics, IoT, and intelligent systems
❖ To equip learners with industry-relevant tools, problem-solving abilities, and innovative thinking to address real-world engineering challenges across interdisciplinary domains
❖ To nurture learners with professional ethics, leadership qualities, communication skills, and entrepreneurial skills ensuring lifelong learning and adaptability to evolving industrial demands.

GE3271 ENGINEERING PRACTICES LABORATORY

L T P C

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OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.

2. Wiring various electrical joints in common household electrical wire work.

3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.

4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,

b) Planing

c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

WOOD WORK STUDY:

a) Studying joints in door panels and wooden furniture

b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket

b) Staircase wiring

c) Fluorescent Lamp wiring with introduction to CFL and LED types.

d) Energy meter wiring and related calculations/ calibration

e) Study of Iron Box wiring and assembly

f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)

g) Study of emergency lamp wiring/Water heater 24

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES

WELDING WORK

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.

b) (simple)Drilling.

c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.

b) Assembling a household mixer.

c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

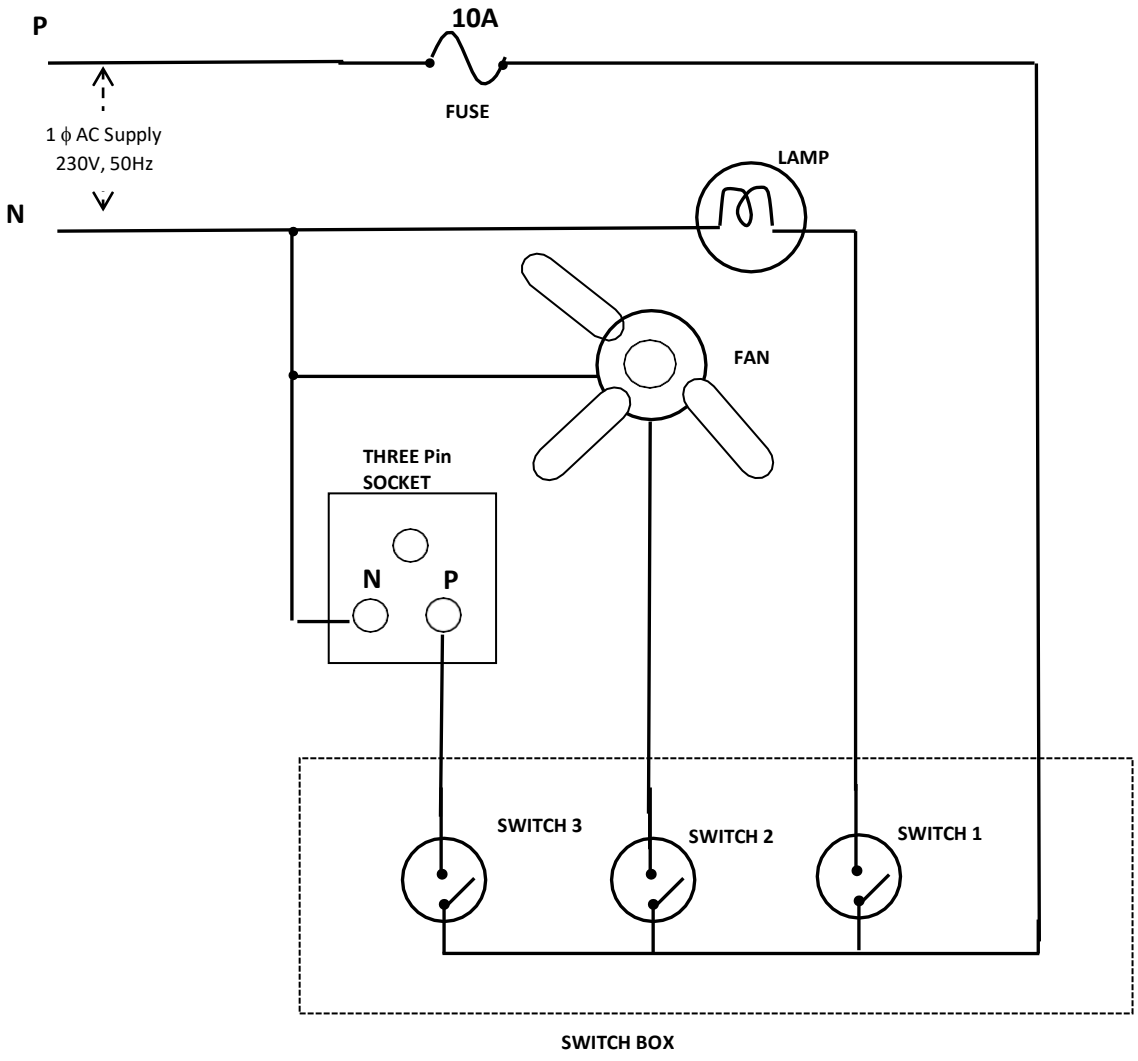
a) Study an elements of smart phone..

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

TOTAL : 60 PERIODS

CONNECTION DIAGRAM:



Ex. No: 1 BASIC SWITCH BOARD WIRING WITH LAMP, FAN AND THREE PIN SOCKET

Date :

AIM

To set up a model switch board wiring using switches, fuses, three pin socket , fan and lamps

APPARATUS REQUIRED:

Sl. No	Description	Range / Size	Quantity
1.	One way Switch	230V / 5A	3
2.	Lamp	230V / 60W	1
3.	PVC box	6” x 4”	1
4.	PVC pipe	$^{3}/_{4}^{"}$	As req.
5.	Copper wire	$^{1}/_{18}$	As req.
6.	Lamp Holder	230V / 5A	1
7.	PVC bends, clamps and screws	$^{3}/_{4}^{"}$	As req.
8.	PVC Junction box	1 way	1
9.	Fuse Unit	230V /10A	1
10.	Fan	-	1
11.	Three Pin Socket	-	1

PRECAUTIONS

1. Ensure that power is switched off, before the connections are being made.
2. Live wire should always be controlled with switch.
3. Don’t use neon tester as screw driver.
4. Joints in wire are made with proper insulation.

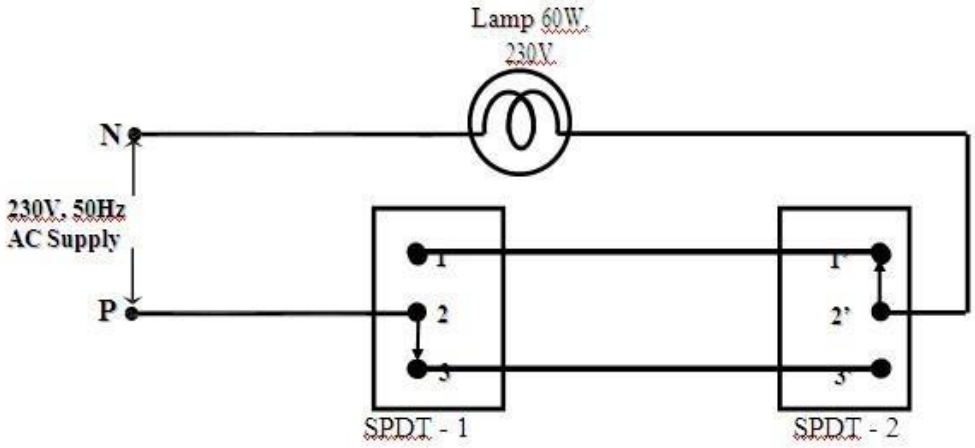
PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. Given electrical accessories like switch, fuse, indicator and energy meter were fixed with the help of screws.
3. Given electrical accessories were connected by using copper wire.
4. Connections were checked before giving supply.
5. Performance of the given model house wiring was tested.

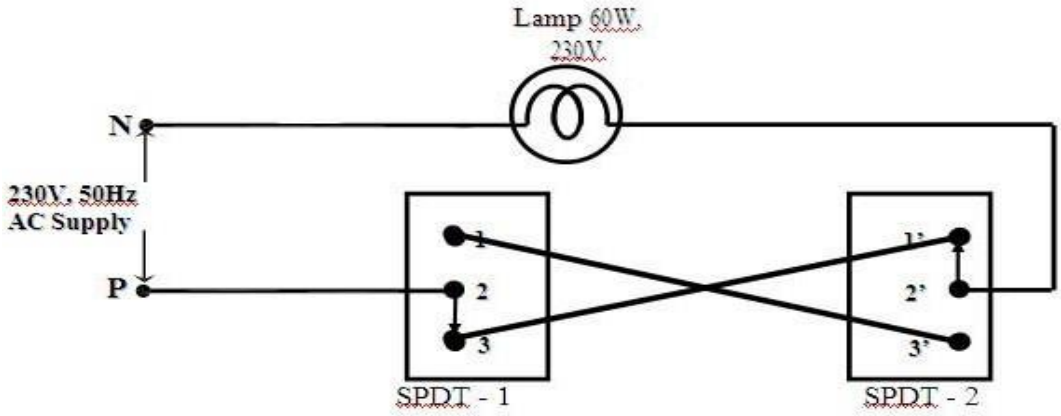
RESULT

Thus the set-up of model house wiring using switch, fuse, lamp, fan and three pin socket was successfully connected and was tested.

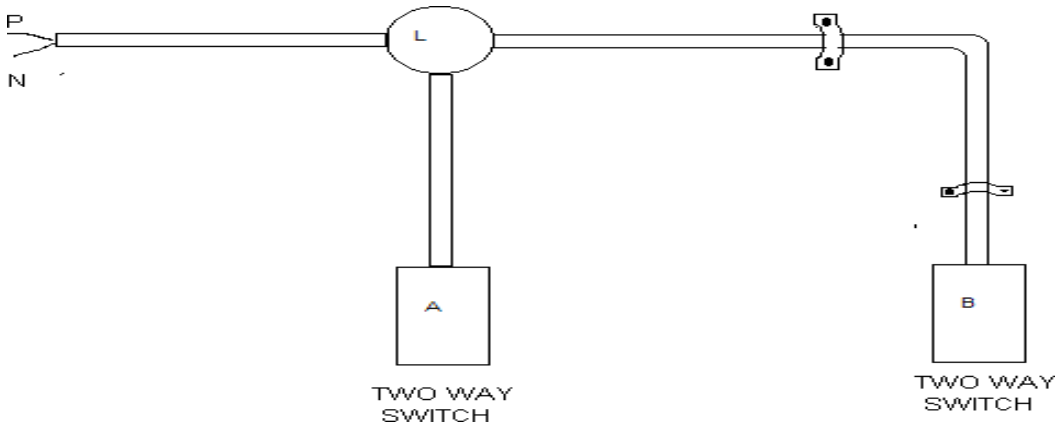
CIRCUIT DIAGRAM (STRAIGHT CONNECTION):



CIRCUIT DIAGRAM (CROSS CONNECTION):



LAYOUT DIAGRAM:



Ex. No.: 2

STAIRCASE WIRING

Date :

AIM

To set up a staircase wiring, to control a lamp.

APPARATUS REQUIRED

Sl. No	Description	Range / Size	Quantity
1.	Two way Switch	230V / 5A	2
2.	Lamp	230V / 60W	1
3.	PVC box	4” x 4”	2
4.	PVC pipe	$^{3}/_{4}^{"}$	As req.
5.	Copper wire	$^{1}/_{18}$	As req.
6.	Lamp holder	230V / 5A	1
7.	PVC bends, clamps and screws	$^{3}/_{4}^{"}$	As req.
8.	PVC junction box	3 way	1

TRUTH TABLE

STRAIGHT CONNECTION			
SL.NO.	**SPDT 1**	**SPDT 2**	**LAMP CONDITION**
1			
2			
3			
4			

CROSS CONNECTION			
SL.NO.	**SPDT 1**	**SPDT 2**	**LAMP CONDITION**
1			
2			
3			
4			

PRECAUTIONS

1. Live wire should always be controlled with switch.
2. Don’t use neon tester as screw driver.
3. Joints in wire are made with proper insulation.

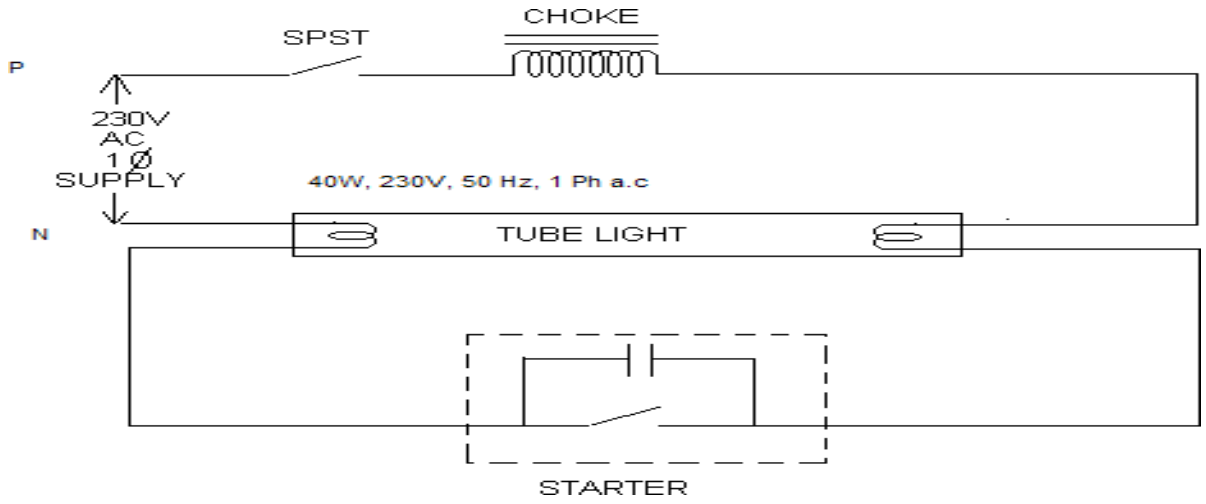
PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. By using drilling machine, necessary materials were fixed in the layout board.
3. One end of the lamp holder was connected to neutral point and another point was connected at the centre of the two-way switch B.
4. The centre of the switch A was connected to the phase line.
5. The point 1 of switch A was connected to point 3 of A was connected to 1 of B.
6. The given lamp was fixed on the lamp holders.
7. Controlling the switches, the circuit was checked and the results were tabulated.

RESULT

Thus the setup of staircase wiring was constructed, tested and the results were tabulated

CONNECTION DIAGRAM FOR FLOURESCENT LAMP



Ex. No.: 3 **FLOURESCENT LAMP WIRING**

Date :

AIM

To set up a fluorescent lamp, LED wiring, controlled by a switch.

APPARATUS REQUIRED

Sl. No.	Description	Range / Size	Quantity
1.	One way Switch	230V / 5A	1
2.	Fluorescent Lamp	230V / 60W	1
3.	Choke	-	1
4.	Tube base	4 feet	1
5.	Copper wire	$^{1}/_{18}$	As req.
6.	Starter	Glow type	1
7.	Screws	$^{1}/_{2}$"	As req.
8.	Tube side holder	-	2
9.	Starter holder	-	1

PRECAUTIONS

1. Live wire should always be controlled with switch.
2. Don’t use neon tester as screw driver.
3. Joints in wire are made with proper insulation.

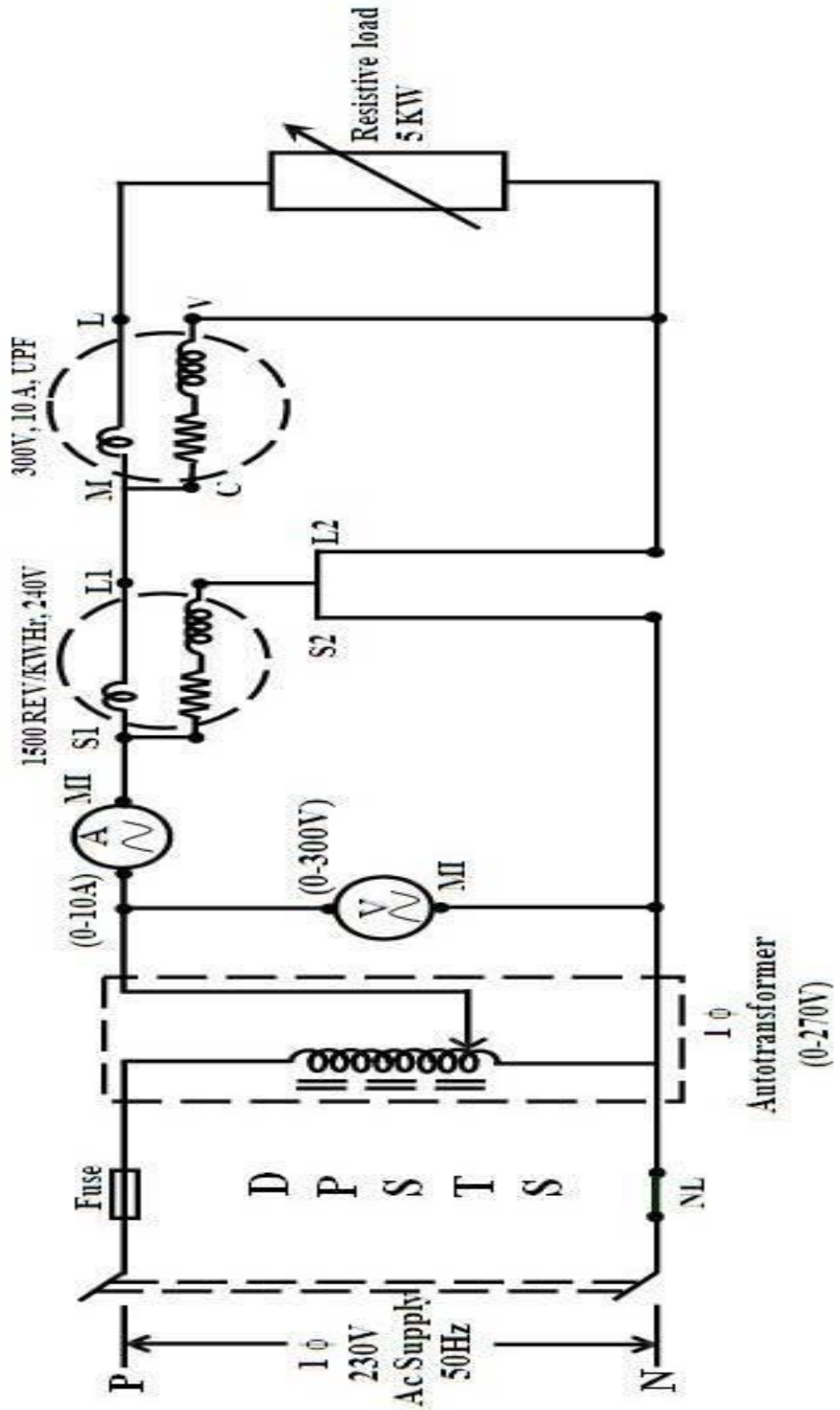
PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. Fluorescent tube accessories like starter holder, holder for tube and choke were fitted in the tube base with the help of screws.
3. Finally the tube was fixed in the tube holder.
4. Supply was given to the circuit and the glow of lamp was identified after fine adjustment of the lamp.
5. For connecting LED type light, connect directly with supply line.

RESULT:

Thus the set-up of fluorescent lamp wiring was completed and testedsuccessfully.

CIRCUIT DIAGRAM



Ex. No.: 4 **ENERGY METER WIRING AND RELATED CALCULATIONS/ CALIBRATION**

DATE :

AIM

To measure the energy consumed by an electrical load using single phase energy meter.

APPARATUS REQUIRED

Sl. No	Description	Range / Type	Quantity
1	Single phase Energy meter	1500 rev / kWh, 240V, 50Hz	1 No
2	Wattmeter	300V, 10A, UPF	1No.
3	Voltmeter	(0-300)V, MI	1No.
4	Ammeter	(0-10)A, MI	1No.
5	Load	Resistive, 5kW	1No.
6	Wires	1 / 18 SWG	As per requirement

PRECAUTIONS

1. Ensure that power is switched off, before the connections are being made.
2. Live wire should always be controlled with switch.
3. Don't use neon tester as screw driver.
4. Joints in wire are made with proper insulation.
5. When starting an auto transformer, it should be in minimum position.

FORMULA USED

Theoretical Energy Consumption(True Energy) = $\frac{V \times I \times t}{1000 \times 3600}$ in kWh

Practical Energy Consumption(Measured Energy) = $\frac{No.\ of\ Revolutions}{Meter\ Constant}$ in kWh

Where,

V – Voltage in volt

I – Current in ampere

t – Time in seconds

TABULATION :

Energy Meter Constant = _____

Multiplication Factor = _____

Sl. No	Supply Voltage V	Load Current I (A)	Wattmeter Reading P (W)		Time t (sec)	True Energy (kWh)	Measured Energy (kWh)
			OBS	ACT			

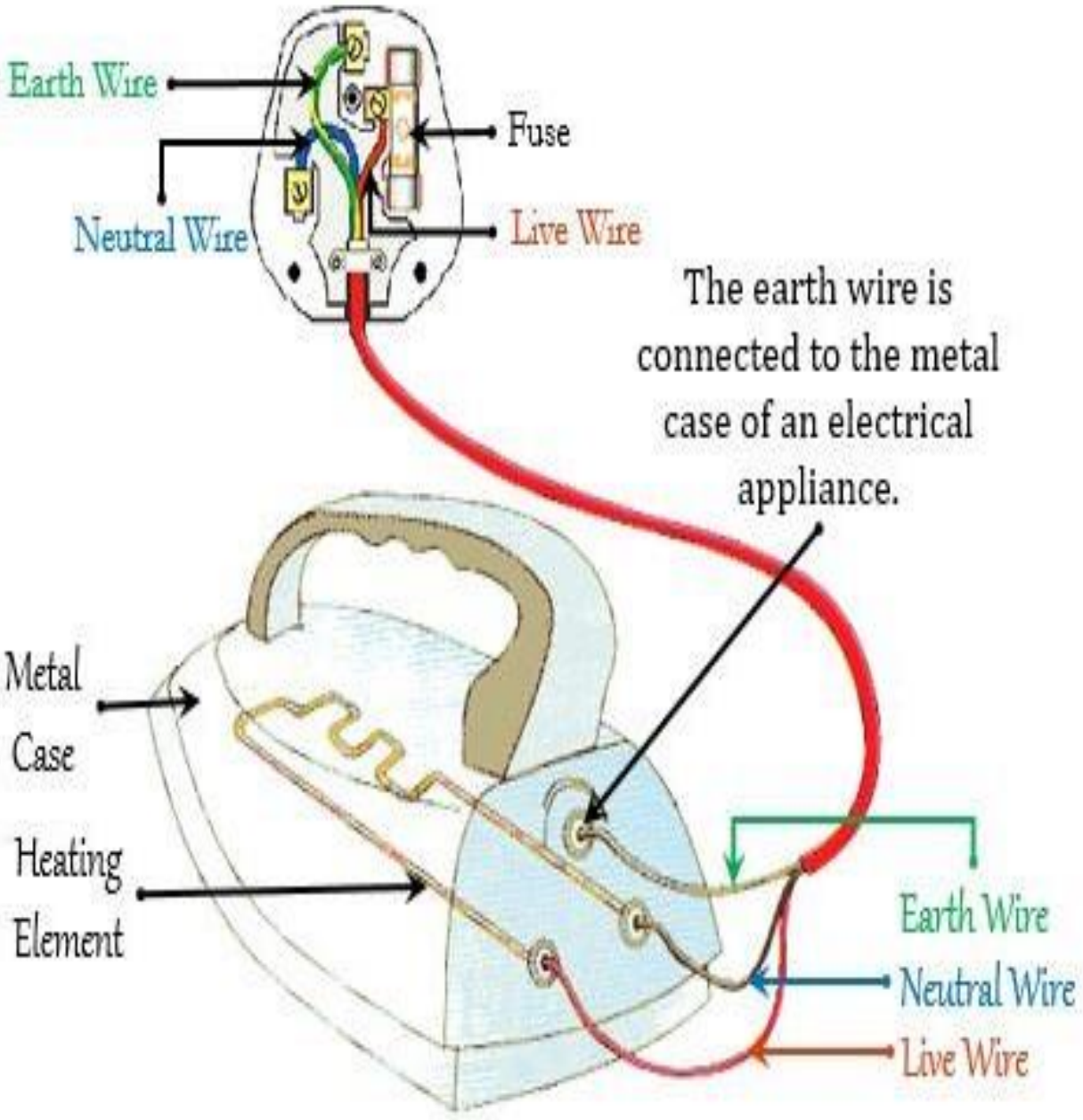
PROCEDURE

1. Connection was made as per the circuit diagram.
2. Proper connection was checked before giving the supply.
3. After that, load was gradually increased by using taping switches and corresponding voltmeter, ammeter and energy meter disc revolutions were noted.
4. After successful completion of the experiment, the applied load was gradually reduced.
5. Finally, power supply switch was switched off and the circuit was disconnected.

RESULT

Thus the measurement of energy using single phase energy meter for different load conditions was calculated successfully.

WIRING DIAGRAM OF IRON BOX



Ex. No.: 5 STUDY OF IRON BOX WIRING AND ASSEMBLY

Date :

AIM:

To study of Iron Box wiring and assembly with its working principle.

REQUIREMENTS:

1. Iron box
2. Tools

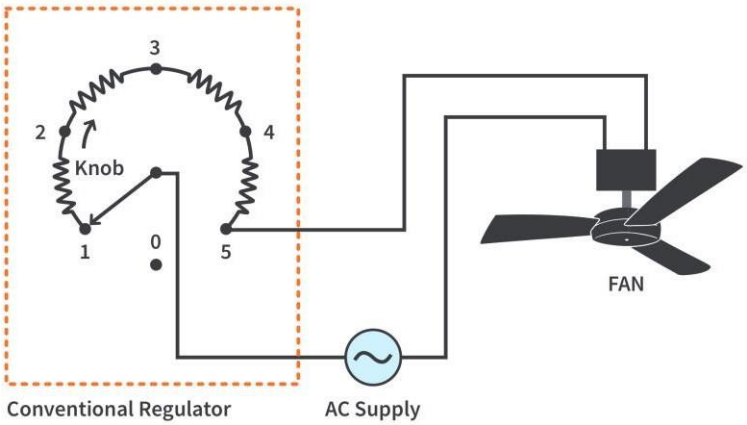
THEORY:

- The colours of three wires in a cable connected to the plug of an electric iron are:
  - Live wire - red
  - Neutral wire - black
  - Earth wire - green
- The electric wiring in houses, shops, or factories has three wires: live, neutral and earth. The first two carry electric current from the power station and the third is earthed by connecting it to the earth through a metal wire called 'Earth Wire'.
- To avoid confusion between these three wires, we follow different colour code to insulate these wires. This colour coding of wires helps us to connect the switches, plugs and other electrical components through the appropriate wire in the home wiring circuit.
- The red wire is the live wire, the black wire is neutral and the earth wire is given green insulation.

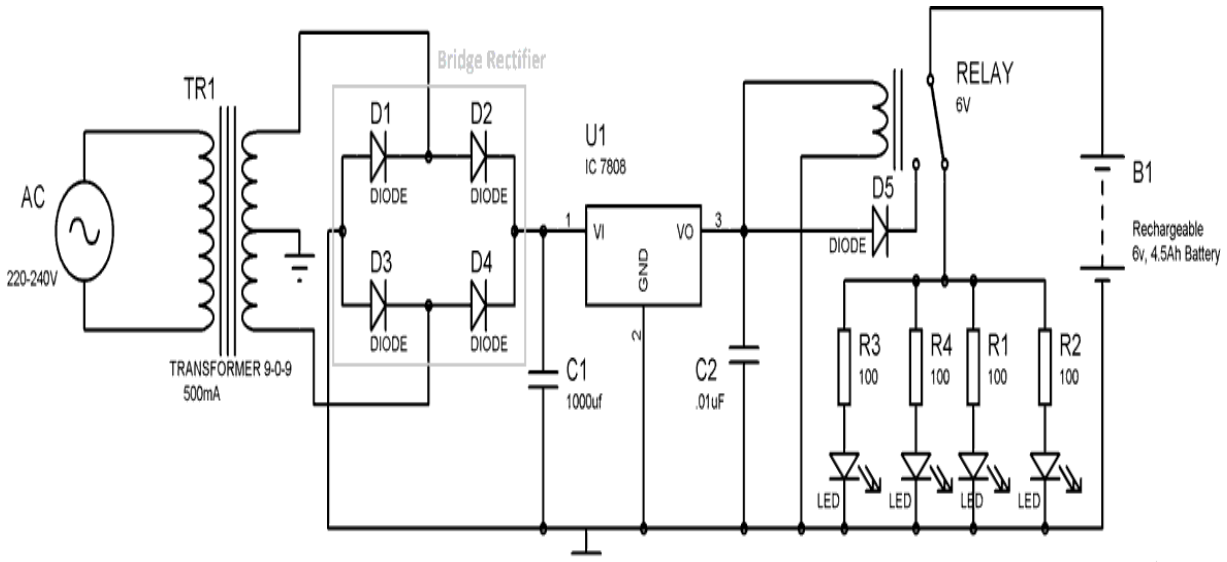
RESULT:

The iron box wiring and assembly has been studied.

CIRCUIT DIAGRAM



CIRCUIT DIAGRAM



Ex. No. 6 STUDY OF EMERGENCY LAMP WIRING

Date:

AIM:

To study of emergency lamp wiring with its working principle.

REQUIREMENTS:

1. Transformer- 9-0-9 500mA
2. Bridge rectifier
3. Diode- 1N4007
4. IC 7808 voltage regulator
5. Capacitor 1000uF, 0.01uF
6. Relay- 6v
7. Resistors- 100 ohm
8. LEDs- Ultra bright white LED
9. Rechargeable 6v, 4.5Ah Battery

THEORY:

Emergency light is an integral part of household electronics nowadays. We all know Emergency light is used during the power failure to light up the home. As it is used during the power failure, it should last long, hence generally bright white LEDs are used in emergency light, because they produce more light and consume less power. Emergency light is very useful and popular project in DIY section. So today we are going to build a simple and cost effective emergency light.

In this emergency light circuit, when the Power goes OFF, the emergency light activates automatically. We have used four bright white LEDs, more LEDs can be added to produce more light considering that total current consumption should not exceed the supply current. Ultra bright white LED consumes 3v and 20mA current.

CIRCUIT EXPLANATION:

We can divide this LED emergency light circuit into two parts; first part is used to drop down the 220v AC voltage into 8v regulated DC, with the help of Transformer and bridge rectifier. And second part consists of Relay and rechargeable battery, which is used to lighten the LEDs during power failure.

n the first part of the circuit we have used Transformer 9-0-9 500mA, to step down the 220 voltage into 9v. Bridge rectifier is the combination of 4 diodes which is used to remove the negative half component of AC. This process is called the Rectification. Further, 1000uF capacitor has been used for Filtration, means removing the ripples in resulted wave. And voltage regulator 7808 has been used to Regulate the DC wave, to provide the uninterrupted and smooth 8v DC supply.

The second part of the emergency light circuit consist the main functionality, that is to automatically switch ON the emergency light (Array of white LEDs) on Power Failure. We have used Relay here to automate this. A 6v, 4.5Ah rechargeable battery is connected to the Array of LEDs, through a Relay. Normally when there is no power failure, the coil of Relay remains energised and lever is attracted towards the NO (normally open) terminal and NC (normally connected) terminal remains open. In this situation LEDs are disconnected from the rechargeable battery and remains OFF, also battery is getting charge through the power supply from the transformer. A diode D5 is used to prevent the battery from flowing back.

Now when the power fails, relay coil become de-energized and lever gets connected to NC terminal, which connects the LEDs to the rechargeable battery, and LEDs array goes ON. This is how this emergency light works. Now when the power is restored back, relay gets activated and lever again connects to NO terminal which in turn disconnects the LEDs from the battery and connects battery to the transformer for charging.

Generally 6v, 4.5Ah rechargeable battery comes with Deep discharge recovery and overcharge protection mechanism, but we can use zener diode of 6.8v to protect the battery from overcharging. We can also use other rechargeable batteries like Nickel-cadmium battery (NiCad), Nickel–metal hydride battery, cell phone batteries etc. Further we can also use PNP transistor BD140 in place of Relay. PNP transistor can be used here as a switch, like it will be OFF when continuously voltage is applied to base of it, in case when power is there and it will be ON, in case of power failure which connects the LEDs to the rechargeable battery, and activates the LED emergency light.

This emergency light can also be made using LDR (light dependent resistor), in which light will automatically switch ON according to darkness, means it remains switch OFF in presence of light and switch ON in absence of light.

Applications of Emergency Light

The applications of these lights include the following. Emergency lights are used where the light turns on automatically when the power supply gets off. These are used as emergency lamps in buildings, homes, workplaces, study rooms in order to keep away from unexpected power failures. These lights are used in several industries

RESULT:

The emergency light circuit is studied and observed the operating principles along with its applications.