Page No. 2
Date: / /20

Experiment-01

Wiring of flourescent tube lamb for staircase lighting system.

Objectives:

1) To understand the function of choke in a flourescent lamp.
2) To understand the function of starter in a flouro scent lamp.
3) To understand the lightning phenomenon of a flourescent lamp.
4) To perform the wiring connection of flourescent lamp including choke and starter
5) To understand the function and connection of two way switches
6) To perform the wiring connection of flourescent lamp indwing choke, sources and two way surface switches for staircase lightning

Brief theory:

→ Flourescent lamps work by ionizing mercury vapours in a glass tube.
→ This causes electrons in the gas to emit protons at UV frequencies.
→ This UV light is converted into standard visible light using a phosphor coating on the inside of the tube.
→ Here we connect an ballast and on switch and the supply is series as shown.

Teacher's Signature .....

→ Then we connect the flourescent tube and the starter across it.

- When we switch on the supply, full voltage comes across the lamp and as well as across the starter through the ballast but at the instant, no discharge happens i.e no lumen from the lamp.
- At that full voltage first the glow discharge is established in the starter. This is because the electrode gap in the neon bulb of starter is much lesser than that of the flourescent lamp.
- Then gas inside the starter get ionized due to this full voltage and heats the bimetallic strip. That causes to bend the bimetallic strip to connect to the fixed contact. Now, current starts flowing through starter. Although, the ionization potential of the neon is more than that of argon and but still due to small electrode gap, a high voltage gradient appears in the neon bulb and hence, glow discharge gets started in the starter.
- As soon as the current starts flowing through the touched contacts of the neon bulb of the starter, the voltage across the neon bulb of the starter, the voltage across the neon bulb gets reduced since the current causes the voltage across the inductor (ballast). There will be no voltage across the neon bulb of the starter. There will be no more gas discharge taking place and hence bimetallic strip gets cooled and breaks away from the fixed contact. At the time of

Teacher's Signature .....

breaking of the contacts in the neon bulb of the starter, the current gets interrupted and hence at that moment, a large voltage surge comes across the inductor (ballast).

$$V = L \frac{di}{dt}$$

where, L is the inductance of the inductor and $\frac{di}{dt}$ is the rate of change of current.

- This high valued surge voltage comes across the fluorescent lamp (tube light) electrodes and strikes penning mixture (mixture argon gas and mercury vapour)
- Gas discharge processes get started and continues and hence current again gets path to flow through the flourescent lamp tube (tube light) itself. During discharging of penning gas mixture the resistance offered by the gas is lower than the resistance of the starter.
- The discharge of the mercury atoms produces UV radiation which in turn excites the phosphorous powder coating to radiate visible light.
- Starter gets inactive during glowing of flourescent lamp (tubelight) because no current passes through the starter in that condition.

Result and discussion:

The staircase lightning system by connecting flour

Teacher's Signature .....

scent lamp by two way switches has been established.
→ In addition, functions of the choke, starter and two way switches has also been understood and practically done.

Precautions!
→ Make sure all connections are proper and no unwanted parts are connected.
→ Avoid loose connection.
→ Fuse is proper rating according to load and connected before switches.
→ Main supply is off while making connections to switches.
→ Load is connected after the switches, not before the switches.

Teacher's Signature .....

1

Experiment-①

Wiring of flourescent tube lamp staircase lighting systems.

Equipment requirement

S.NO.	Name of equipment	Specifications	Quantity
1.	MCB or fuse	250V, 50Hz, 5A	1
2.	switches	Two-way, 250V, 5A	2
3.	Flourescent lamp with filling	40 watts, 230V	1
4.	connection wire	P.V.C 2 mm copper cable	As per requirement

Circuit diagram:

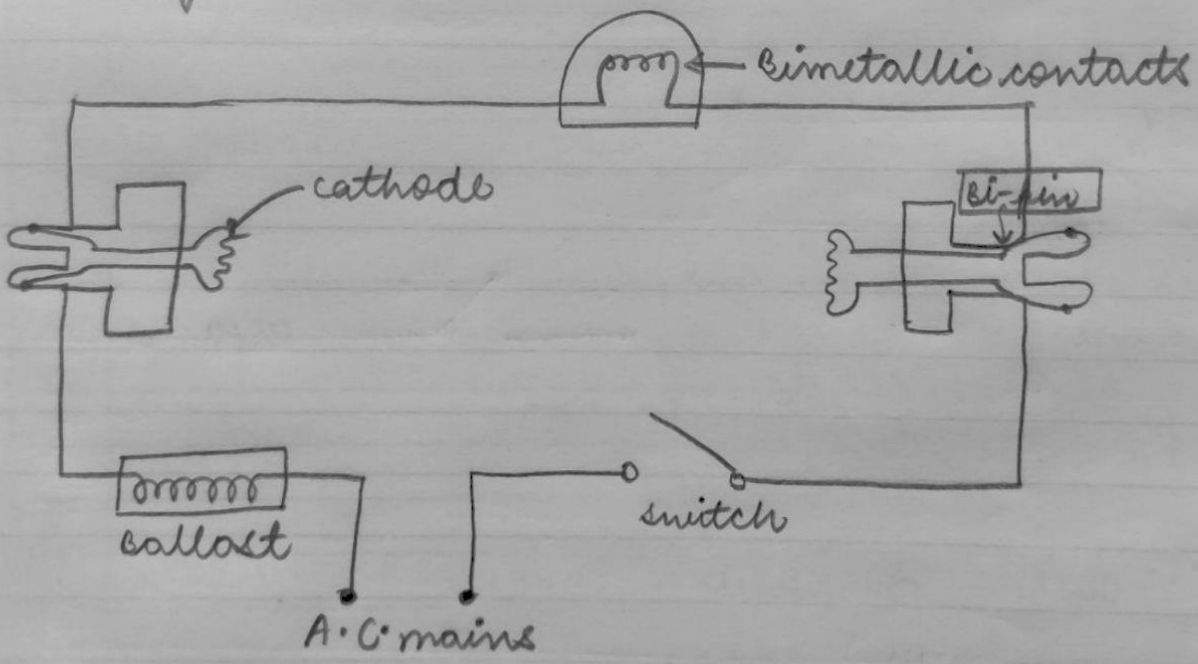


figure-1: Connecting diagram of a flourescent tube

Circuit diagram:

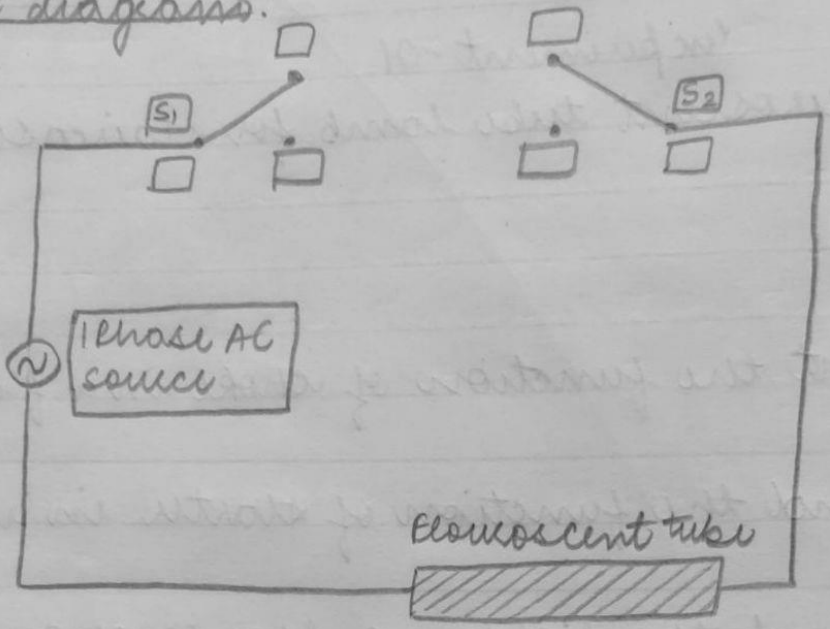


Fig:- circuit diagram of staircase lightning system using flourescent tube

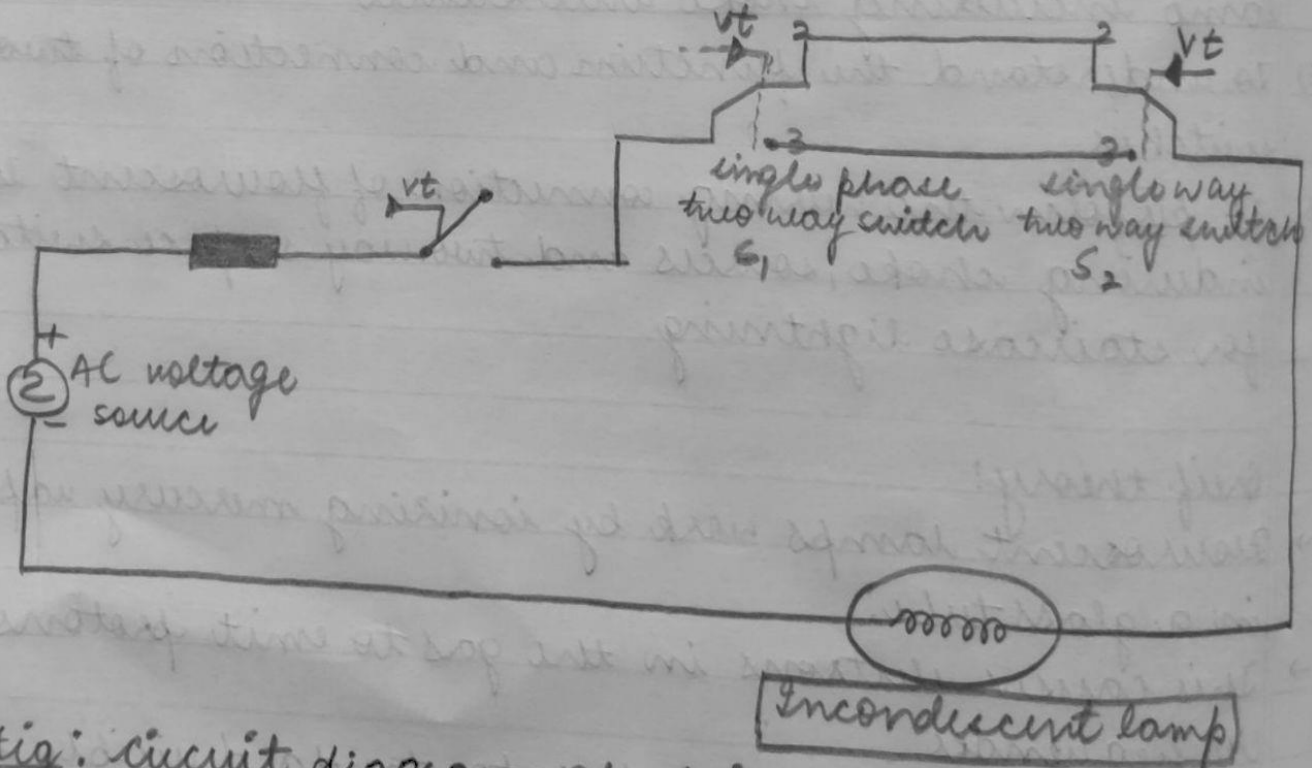


Fig: circuit diagram of staircase lightning system using Incondescent lamp.

Observation:

→ After completing the wiring connection of flourescent lamp and using choke, startle and two way switches the requirements of staircase lightning must be met.

→ The loads (light) present states changes to the opposite state, if light was at ON condition then it became off, if light was at off condition then it becomes on.

S.No of possible combinations	Switch S_1	Switch S_2	Load / LAMP
1	Contact L-2	Contact L-2	ON
2	Contact L-2	Contact L-3	OFF
3	Contact L-3	Contact L-2	ON
4	Contact L-3	Contact L-2	OFF

→ By above operational combinations of switches, requirements of staircase lightning is met.

Results and discussions:

→ The staircase lightning system by connecting flourescent lamp by two way switches has been established.

→ In addition, functions of the choke, starter and two way switches has been also understood and practically done.

Experiment-02

To assemble adjustable voltage power supply by soldering electric components.

Objectives:

→ To check the components to be used in adjustable voltage power supply.
→ To assemble the circuit for adjustable voltage power supply on solderless bread board.
→ To assemble the circuit for adjustable voltage power supply on printed circuit board (PCB) by soldering the electronic components.
→ To observe the operation and performance of the soldered adjustable voltage power supply circuit.

Brief theory and circuit design:

→ Variable supply is used in many practical systems for example audio amplifier, oscillations, Regulated power supply soon.
→ Different kinds of IC's or MOSFET can be used to regulate voltage power supply.
→ Examples 7805 Regulator IC, LM317T positive voltage regulator or IRF3205 MOSFET. In our circuit, we are using 7805 Regulator IC.
→ Initially, the primary of the 230V to 12V step down transformer is connected to the AC mains supply while the secondary is connected to a bridge rectifier the output of bridge rectifier is filtered out using

Teacher's Signature .....

a capacitor and it given to the 7805 voltage regulator IC.A0 22μf capacitor is connected between INPUT and comm. while a 0.1μf capacitor is connected b/w INPUT and COMM. while a 0.1μf capacitor is connected between OUTPUT and COMM. A 470Ω resistor is connected between the COM and OUT. A rotary switch is used to switch b/w output. resistors are connected to the switch, 100Ω, 220Ω, 230Ω, and 470Ω

operation principle:

→ A simple project where a variable voltage power supply from fixed voltage Regulator is implemented here. The main principle behind the working of the project is very simple. Connect two resistors R_1 and R_2 as shown in the image below one b/w the output and GND Pin and the other between GND PIN and GND of power supply.

→ The amount of current flowing through R_2 is a combined of current through R_1 and standby current of 7805. Depending on the output but voltage requirement; we can calculate the value of this resistor and finally the output voltage can be calculated as follows:-

$$\rightarrow V_{out} = V_{REG} + R_2 * \left(\frac{1}{R_1 + I_3}\right)$$

$$\Rightarrow V_{out} = V_{REG} + R_2 * \left(V_{REG}/R_1 + I_3\right)$$

Teacher's Signature .....

→ where V_{REG} = 5 V (for 7805) and I_3 = standby current of 7805
→ Based on the above calculations, you can get anywhere b/w 5V and 12V using a 7805 Regulator from 12V supply.

How to calculate value of Resistance for different voltage:
→ Imagine that the resistor which is attached between the common and the output terminal of regular has a I value of 470Ω. This implies that the value of current is 10.6 mA (as V=5V further more V=IR)
→ Among the rotary switch and ground there is some amount of sound by current of 2.5 mA approx. Hence, about 13.1 mA of overall current is available.
→ Now assume that from the circuit, we need 5V to 12V with the regulator output, we directly get 5V minimum. while if there is a need of 12V, then b/w com and output 5V is available and for the rest 4V are need to select the approx. value of the resistor. Here, V=7V, I=13.1 mA. Therefore R=543Ω

Procedures:
→ Turn off the main supply.
→ Solder all the components according to the circuit diagram
→ Turn on main supply.
→ Connect different resistors to get different valued outputs.

Teacher's Signature .....

Precautions:

→ Make sure all the components are proper and no unwanted parts are connected.
→ Avoid loose connections.
→ Diode, capacitor, resistor and all other components must be of specified values and well soldered.
→ Main supply is off while making all connections.
→ When switching from one resistor to other, the load will get 12V so. before switching, make sure that the load is disconnected (or you can completely switch off the power supply, make a switch and then, switch on the power supply)

Result and discussion:

→ A.C voltage will be fed to bridge converter from here converted DC will fed to voltage regulator IC which with help of its in-built characteristics allow us to have variable output according to our necessities.
→ Based on above circuit a range of variable output voltage power can be achieved.

Teacher's Signature .....

9

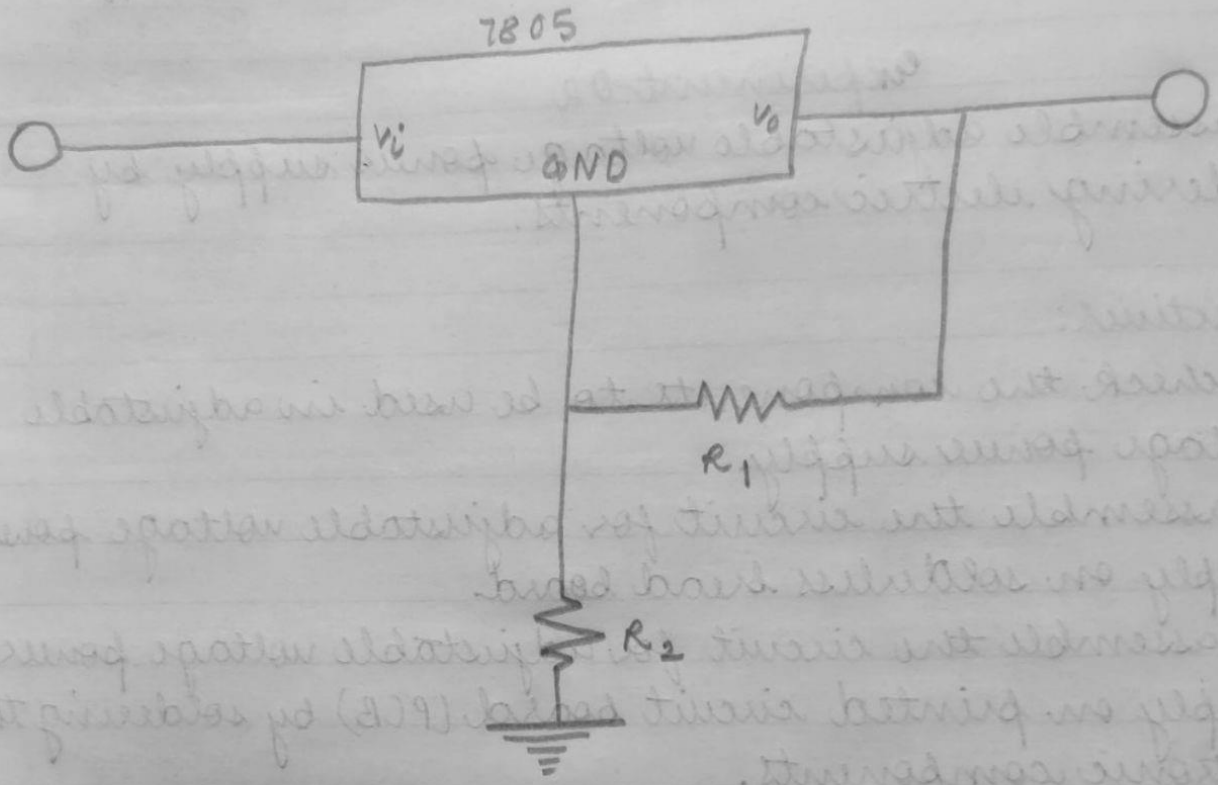
Experiment - ②

To assemble adjustable voltage power supply by soldering electronic components.

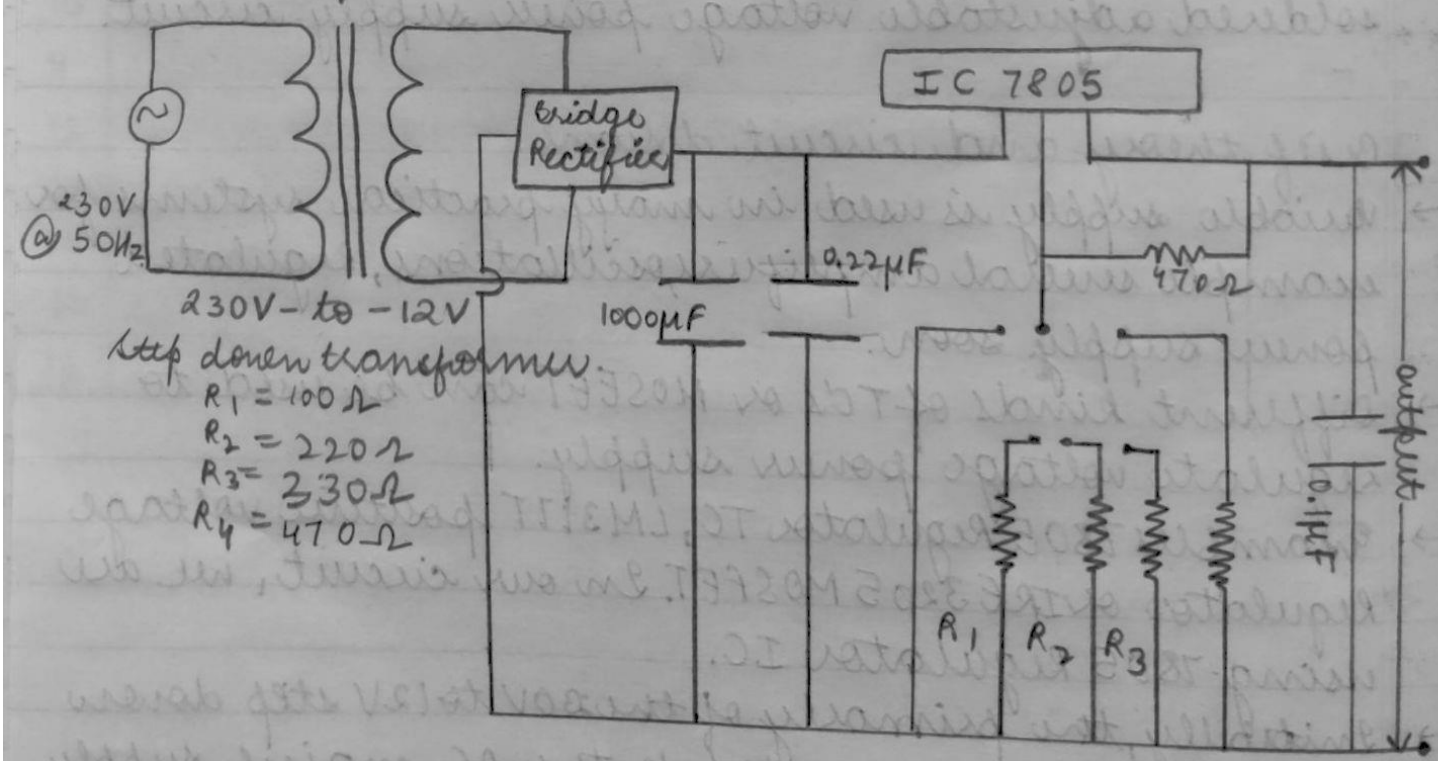
Objectives:

S.No	Name of Appliance	specifications	Quantity
1	Bridge rectifier	—	1
2	Resistor	470 Ω, 0.5W	2
3	Resistor	100 Ω, 0.5W	1
4	Resistor	220 Ω, 0.5W	1
5	Resistor	330 Ω, 0.5 Ω	1
6	Capacitor	0.1 μF, 20V	1
7	Capacitor	0.22 μF, 20V	1
8	Capacitor	1000 μF; 20V	1
9	Transformer	230/12V	1
10	Regulator	7805	1
11	Solderless Bread Board	Medium size	1
12	soldering iron/Automatic soldering	—	1
13	Printed circuit Board (PCB)	Small size	1
14	soldering flux	—	1
15	De-soldering pump	—	1
16	Connecting wires	—	As per need

11



circuit diagram:



Observation table:

S.NO	Resistance value (Ω)	Output voltage (calculated)	Output voltage (measured)
1.	470	5V	4.97
2.	543	7V	6.95
3.	611	8V	7.96

Experiment-03

To open, disconnect and reconnect internal wiring system of Domestic Electrical Appliances

Objectives:

→ To understand the operations and working principles of various domestic appliances.
→ To understand the electrical specifications and ratings of domestic for their safe operation.
→ To study the internal parts and components of domestic electrical appliances.
→ To identify the types of motors, used in the appliances and study the motors, construction and working principle
→ To understand the internal and external wiring system of domestic electric appliances.
→ To learn the disconnection and re-connection of internal wiring of the domestic electrical appliances.

Domestic electrical Appliances

No.	Name of Appliance	Electrical motor used	Specifications
1.	Ceiling fan	capacitor start capacitor run(SCR)-induction motor.	230V, 50 W, AC-1 phase, 50Hz, sweep 1200mm.
2.	Table fan	capacitor start capacitor run (SCR)-induction motor.	220V/230V, 55W, AC-1 phase, 50Hz, 1350rpm

Teacher's Signature .....

3.	Mixer-Juicer-grinder	Universal motor	220/240V, 500W, AC 1-phase, 50Hz, 30min,
4.	Electric iron (dry)	—	230V, 450W, AC, 1 phase, 50Hz.
5.	Electric iron (steam)	—	230V, 1200W, AC, 1-phase, 50Hz

construction and working principle of Domestic Electrical Appliances

→ ceiling fan

- single phase capacitor run and start induction motor, rated at 230V ± 10% at a frequency of 50Hz is generally employed in ceiling fan.
- The starting torque relies on sine of angle among starting winding and running winding current. Thus capacitor is used to generate needed phase shift among these current and therefore to generate needed phase high starting torque and will be connected in series with starting winding.
- The capacitor and starting winding will be in circuit through out running as well and therefore enhance the power factor.
- The motor speed is given by $N_s = \frac{120 \times f}{P}$

where f is the supply frequency (50Hz) and P is number of poles.

Teacher's Signature .....

→ Table fan

- The working principle of a table fan is similar to that of a ceiling fan. The motors used in both table fan and ceiling fan are identical.
- Ceiling fans draw a stationary armature and the motor moves in the counter-clockwise direction. The motor is stationery and the armature moves to give motion to the fan blades.
- The speed of a table fan is 1200 rpm to 1350 rpm. The ceiling fans have a range of 270 to 400 rpm.

→ Mixer-Juicer-Grinder

- Series DC motor (universal motor) is used in most mixer-grinders.
- The stator is made of laminated steel. There are usually two poles on the stator, field coils are wound on each pole.
- The rotor, also called armature made of laminated steel has slots and is tightly fitted with the shaft.
- There are two brushes that make contact with two commitator segments at a particular instant.
- Field winding in the stator and rotator windings are connected in series through the rotor commutator.

→ Electric iron (Dry)

- This works on the basis that the combination of heat and pressure removes wrinkles.

Teacher's Signature .....

- The principal of electrical iron is that when current is passed through a coil, the coil gets red hot & transfers the heat to the base plate through conduction.
- Two types of electric irons.
  - Automatic
  - Non-automatic

→ Electric iron (steam)

- Steam iron is similar to dry iron, with better features like - to generate steam and make ironing faster.
- Steam irons have some maintenance issues due to clogging.
- Steam iron has to be cleaned and maintained regularly to ensure its proper working.

→ Procedure:

1) Carefully observe the name, plates of domestic appliances one by one and note down the specifications.
2) Identify the external parts and their role in a particular appliance.
3) Identify the types of motor, used in an appliance when it is opened. Also, identify the internal parts and their role.
4) Understand the constructions, internal wiring, working, principle and operation of the appliances.
5) Observe the internal and external wiring scheme to get idea of disconnection and re-connection.

Teacher's Signature .....

Conclusions:

1) The working principles and operations of ceiling fan, table fan, mixer-juicer-grinder, steam iron and dry iron have been studied.
2) The motors used in the appliances and their electrical specifications given in the appliance nameplate, have been thoroughly observed.
3) The internal and external wiring concepts have been deeply understood.

Precautions:

1) Never connect the appliances with the supply.
2) Do not play with the appliances and their other parts and accessories.
3) Properly, hold the appliances while monitoring the name plate and internal.

Teacher's Signature .....

17

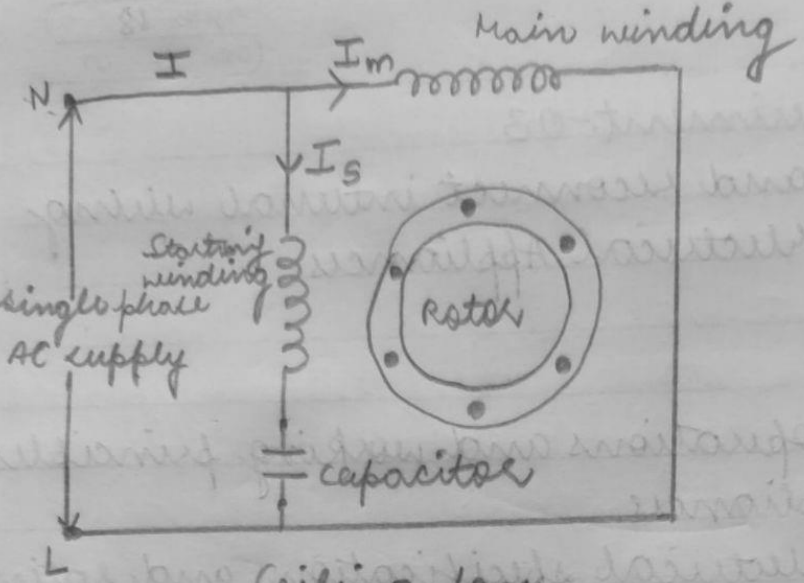
Experiment-3

To open, disconnect and reconnect internal wiring system of domestic electrical Appliances

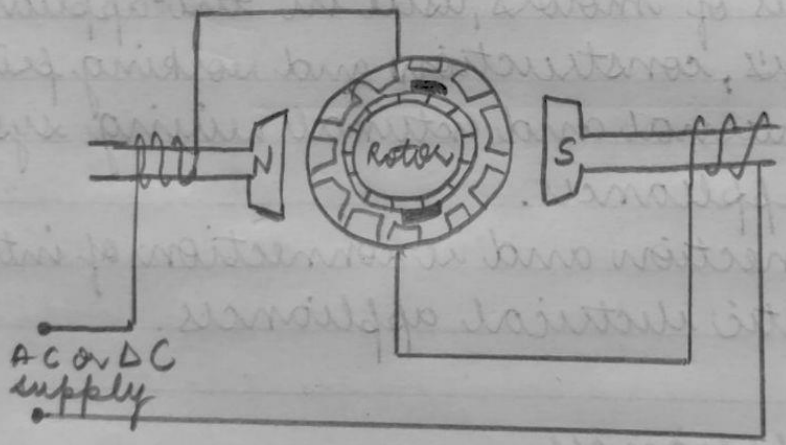
Requirements:

S.NO.	Name of Appliance	Electric motor used	Specifications
1)	ceiling fan	CSCR-induction motor	230V, 50W, AC, 1-phase, sweep 1200mm, 50Hz
2)	Table fan	CSCR-induction motor	220/230V, 55W, AC, 1-phase 50Hz, 1350 rpm
3)	Mixer-juicer-grinder	Universal motor	220/240V, 500W, AC, 1-phase 50Hz, 30 min
4)	Electric iron (Dry)	—	230V, 450W, AC, 1-phase, 50Hz
5)	Electric iron (steam)	—	230V, 1200W, AC, 1-phase 50Hz

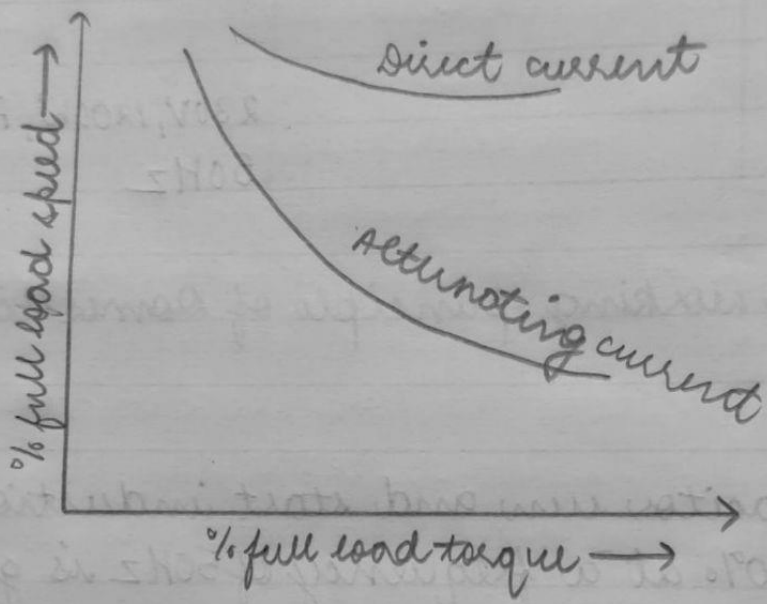
19



Ceiling fan



Mixer juicer - grinder


Direct current
Alternating current
% full load speed
% full load torque

Results:

→ The working principles and operations of stated appliance have been studied.

→ The motor used has been thoroughly observed.