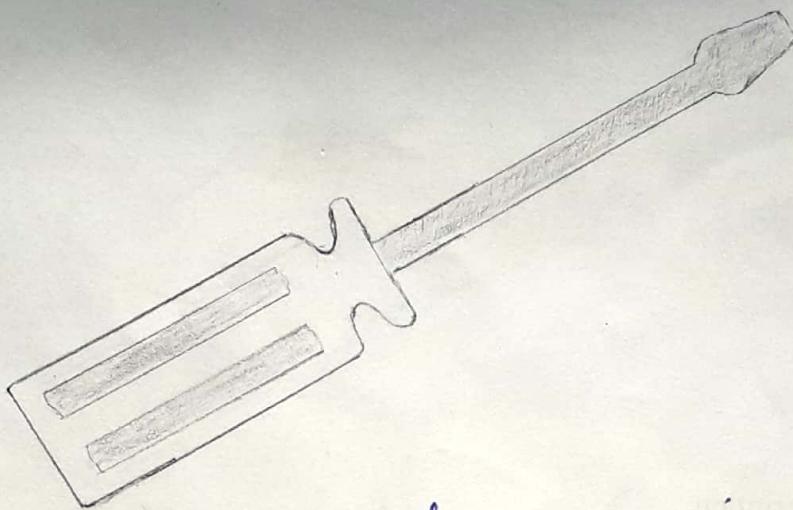
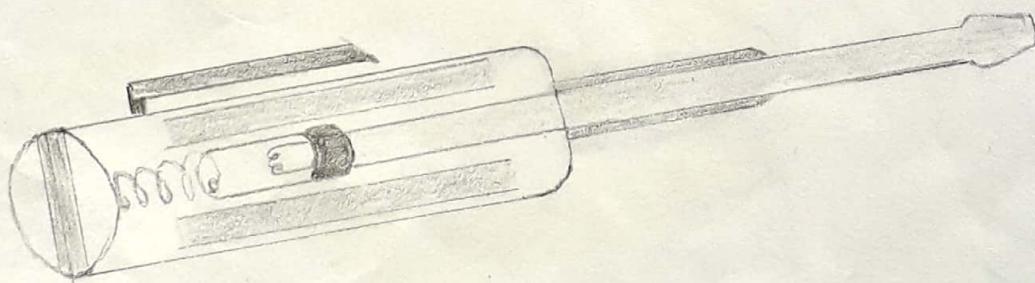


**ASSIGNMENT No.1**

Draw/sketch the listed tools and wiring accessories in the spaces given below and explain their working and uses as well.

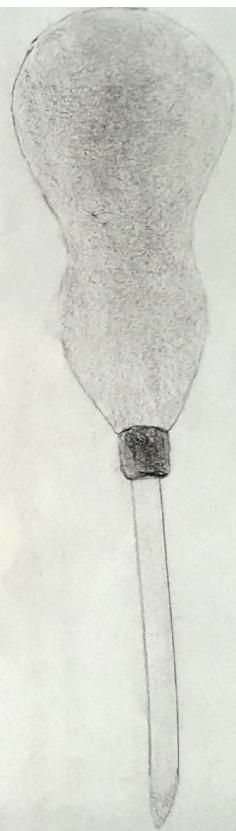
**Screw Driver****Description**

A screw driver is used to loosen, tighten, insert or remove screws. It is also used to rotate it by tip.

**Phase Tester****Description**

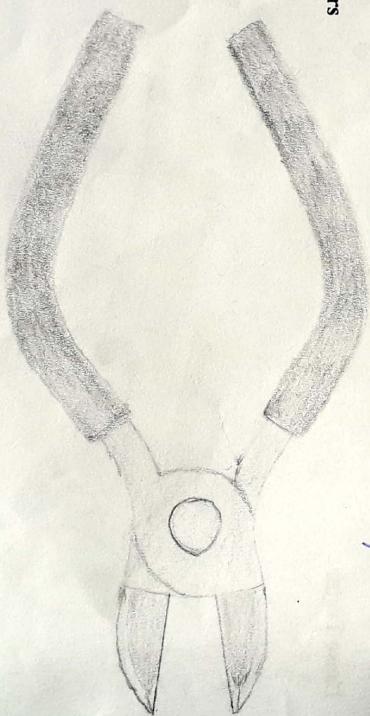
This is the device which is used to detect passage of current. It also a screw. Light is lit when current passes.

Bradawl



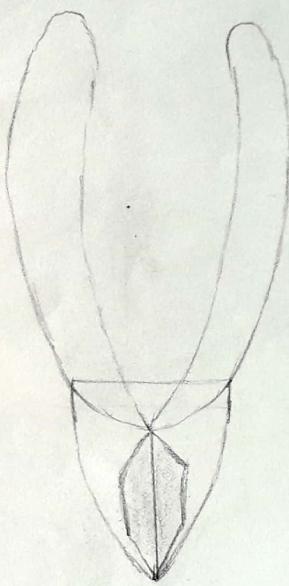
Description  
This is used to make indentation in wood or other material for insertion of nail screw.  
Blade is applied as pressure.

Pair of pliers



Description  
Pliers are used to hold object tightly. Also used for bending of other substances. Its handle is squeezed.

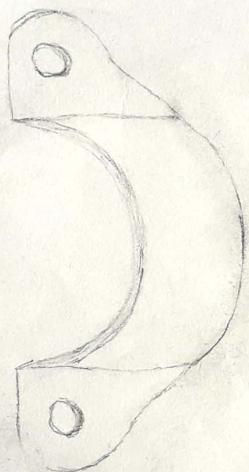
## Wire Cutter



## Description

This is used to cut wires and also to remove covering or insulations on wires. Similar to pliers. - but different use.

## PVC Saddle



## Description

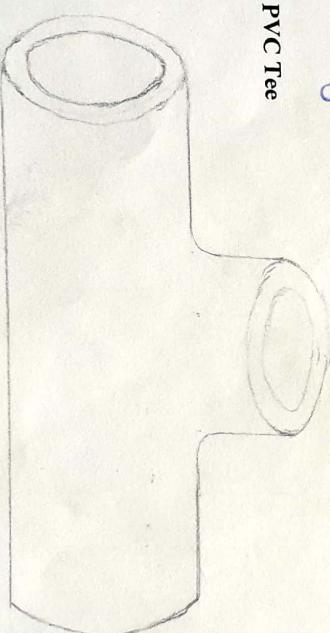
A PVC saddle can be used to add thing in PVC pipe. It can be fitted on ends of pipes by simply rotating it along pipe.

**PVC Conduit**

**Description**  
It can be used 'ENT' inside wall  
incased in concrete. They are light  
weight commonly and quite strong.

They are used to encase.

PVC Tee



**Description**

PVC Tee joins three pieces of  
same size of pressure pipe to  
form a 'T' junction. It is  
easy to fit it at ends.

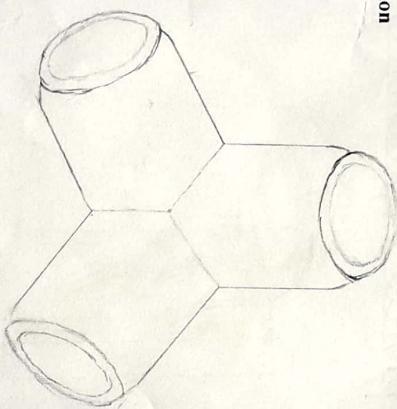
## PVC Bend



## Description

As it is impractical to bend a pipe, a PVC bend is used whenever a bend in a pipe is needed.

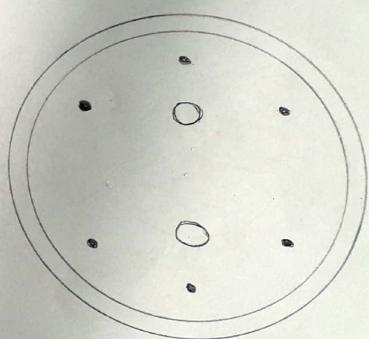
## Three way PVC Inspection



## Description

This is also used to make a sort of 'T' in many pipes. The pipes may carry water, wire or other things which is to be needed.

PVC Round Block

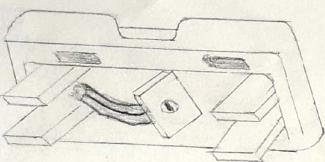


Description  
It often used in a network of wires.

It can encase multiple junctions of wires in a network.

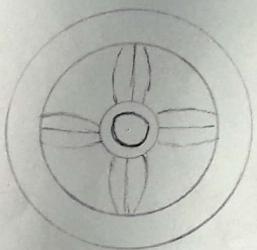
Also protect junction from water.

Kit Kat Fuse

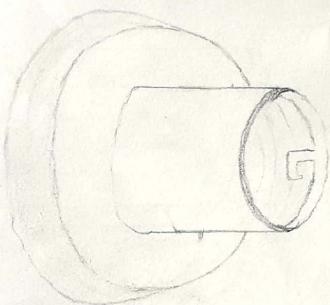


Description

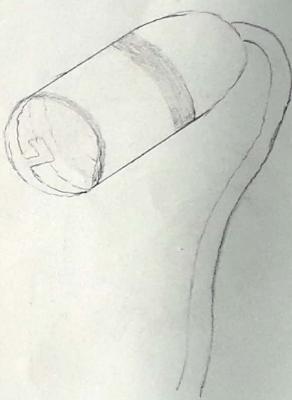
This is commonly used in many circuits to protect excess of current if large current passes through kit kat

**Ceiling Rose****Description**

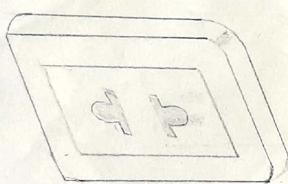
This is a decorative element which affixed to ceiling from a light fitting is often suspended. It also includes of junc. box.

**Batten Type Lamp Holder****Description**

This is a simply lamp holder. A lamp is fitted into it and it is fixed on a wall. A electric connection also made.

**Pendant Type Lamp Holder****Description**

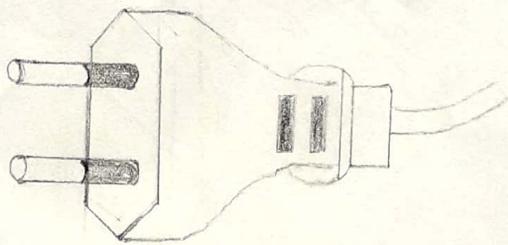
This is a lamp holder in which light source i.e. bulb is fitted and it can not be fixed with wall. And with current.

**Two Pin Socket****Description**

This is mostly used in circuit which attached to two pin socket. It produces as input electricity to each having switch.

This is used for different portable electrical appliances. The wires of electrically connected portables have terminals of two pins.

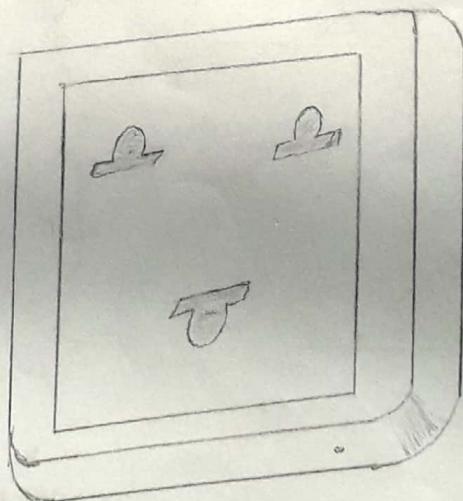
Description



Two Pin Plug

A three pin socket is usually used in electric appliances that consume a large amount of current.

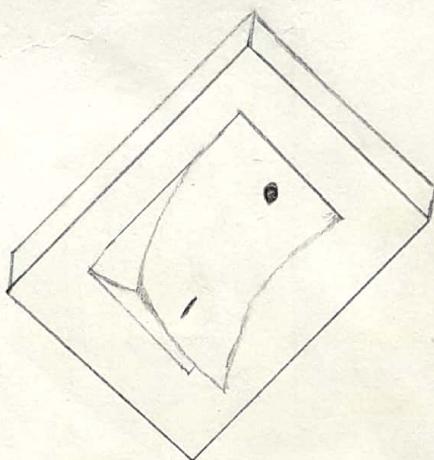
Description



Three Pin Socket

Current flow is caused by the action of the contacts and the electrical insulation and to turn on & off different ways switching are used.

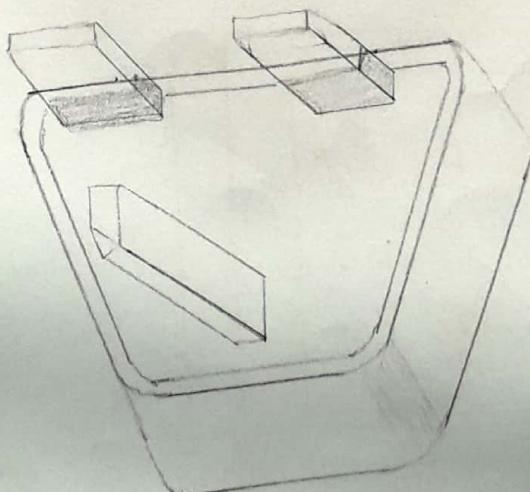
Description



One way Switch (SPST):

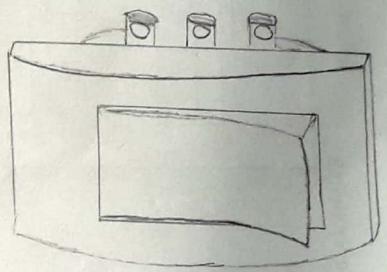
It is used along a three pin socket & provides connections to ground besides connecting to live & neutral electric wires.

Description



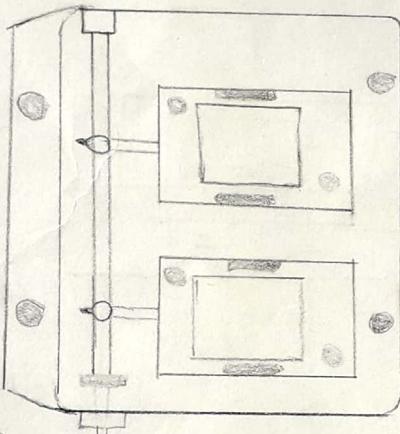
Three Pin Plug

ELECTRIC SHOP MANUAL



Description  
Two way switch is used to obtain two or more switches in diff. locations to control one lamp. SPDT can be two way or three way.

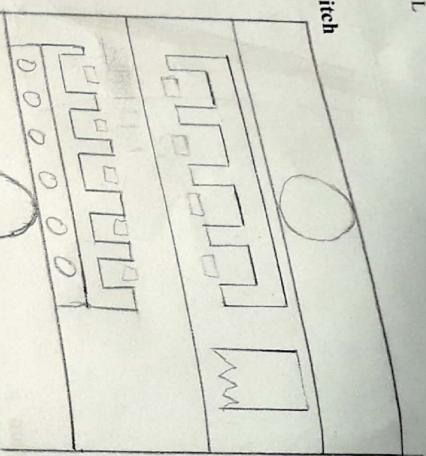
Two Pole Main Switch



Description

A two pole main switch is capable of controlling current flow to two circuits with the help of switches.

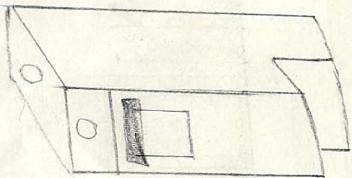
## Two Pole Changeover switch



Description  
It is wired into your electrical

distribution board (DB) which allows  
it to power everything or just  
specific circuits if wired.

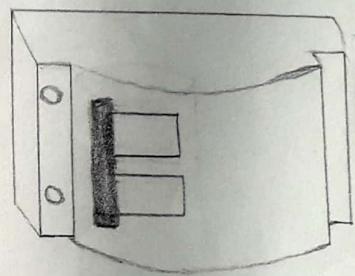
## Single Pole circuit breaker



Description  
It is used with a typical 120V

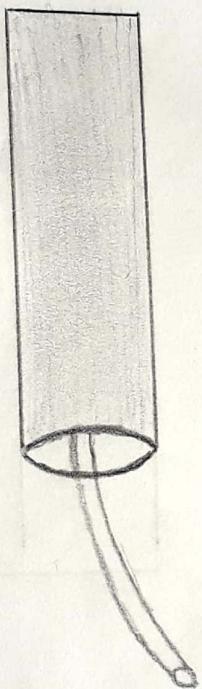
circuit one hot wire and one  
neutral wire. It commonly used  
in houses & buildings.

## Two Pole circuit breaker



**Description**  
It is also called a folder. It takes up a space of single pole breaker. It connects two hot wires.

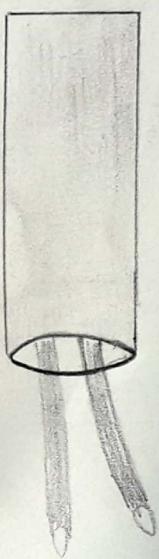
Single Core Cable



Description

These cables are widely used for domestic purposes. These cables are very high current wires.

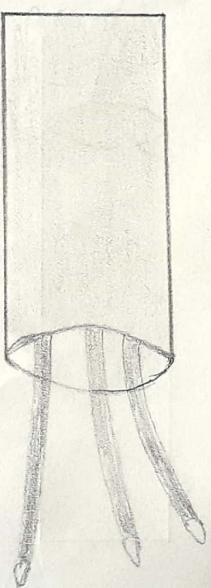
Two Core Cable



Description

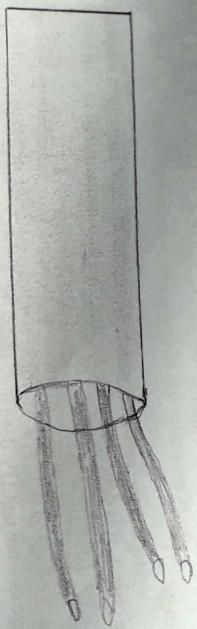
This type of cable is used to connect appliances which are double insulated. The cables only cores being live & neutral.

Three Core Cable



Description

This cable has three cores, live core, neutral core & Earth core. The earth & neutral ones are insulated.

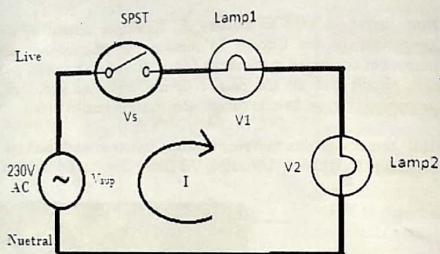
**Four Core Cable****Description**

This is used to wire items such as extraction fans when they are controlled by pilots or humidity defectors.

## BASIC ELECTRICAL WIRING CIRCUITS

### 1- Series Lamps controlled by single 1-way switch

This Circuit contains two Lamps labeled as L<sub>1</sub>, L<sub>2</sub> and a 1-way Switch. Switch is connected in Series of AC Voltage Source and Lamps are also in Series with each other and with Switch as well. In Series connection of Circuit Components only one terminal of each Component is connected directly with each other and rest of terminals are connected with other Components. In Series connection same amount of Current flows through each of the Component but applied Voltage is divided with respect to their resistances, offered by them in flow of Current. When switch is open (Off) state both Lamps will remain off and at close (On) state both Lamps will glow with lesser brightness.



Two Series Lamps controlled by 1-way Switch

Switch(s) State	Voltage (V)			Current (A)	Power (W)		
	V <sub>Sup</sub>	V <sub>1</sub>	V <sub>2</sub>		Source	P <sub>1</sub>	P <sub>2</sub>
Switch opened	230	0	0	0	0	0	0
Switch closed	230	130	110	0.2	48	26	22

- 28 -

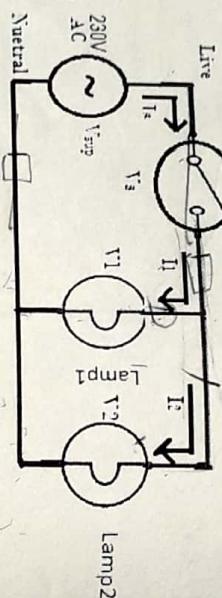
### Observations/ Findings:

When the two lamps are connected in series with supply voltage is divide across the lamps. Bulbs glow with low brightness when switch is closed & don't glow when switch is open.

## 2- Parallel Lamps controlled by single 1-way switch.

This Circuit contains two Lamps labeled as L<sub>1</sub>, L<sub>2</sub> and a 1-way Switch. Switch is connected in Series of AC Voltage Source but Lamps are connected in parallel with each other. In parallel connection of Circuit Components both terminals of each Component is connected directly with each other. In parallel connection Voltage across each Component will be same but current divides in these Components. When Switch in open (Off) state both Lamps will remains off and at close (On) state of Switch both Lamps will glow with their full brightness.

SPST



Parallel Lamps controlled by single Switch

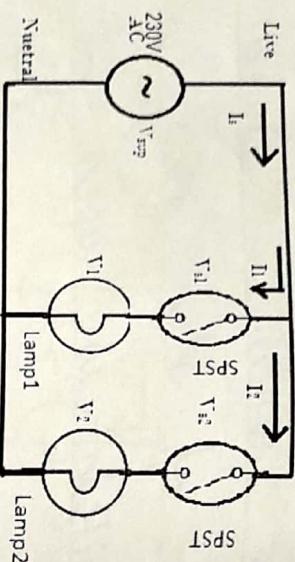
Observations/ Findings:

The two lamps are connected parallel fashion. so both the bulb glows with max. brightness when the switch is placed and none of them glow when switch is open.

Switch(s) State	Voltage (V)		Current (A)		Power (W)		
	V <sub>sup</sub>	V <sub>1</sub>	V <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	Source Power P <sub>1</sub>	P <sub>2</sub>
Switch opened	240	0	0	0	0	0	0
Switch closed	240	240	240	0.9	0.4	0.4	0.4

### 3- Parallel Lamps having separate control

This Circuit contains two Lamps labeled as L1, L2 and two 1-way Switches S1, S2. S1 is connected in Series of L1 and S2 is connected in Series of L2. When both of Switches are closed (On) both of Lamps become in parallel with each other and glow with their full brightness. In case of S1 is closed (On) and S2 is open (Off) L1 will glow and L2 remains Off and vice versa for S1 is open (Off) and S2 is closed (On).



Two Lamps having Separate Control

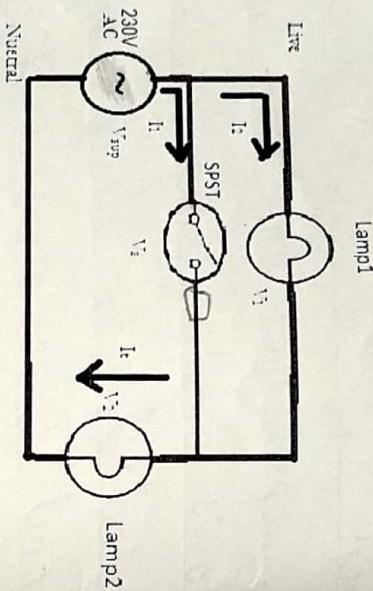
Switch(s) State	Voltage (V)		Current (A)		Power (W)			
	V <sub>Sup</sub>	V <sub>1</sub>	V <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	Source	P <sub>1</sub>	P <sub>2</sub>
Both Sw open	240	0	0	0	0	0	0	0
Sw1 open Sw2 close	240	0	240	0.4	0	0.4	96	0
Sw1 close Sw2 open				0.4	0.4	0	96	96
Both Sw close	240	240	240	0.9	0.4	0.4	216	96

Observations/ Findings:

Lamps are in parallel fashion when both switch are open none of the bulb glows when S<sub>1</sub> is closed and S<sub>2</sub> is open. The only 1st bulb glows. Similarly, when S<sub>1</sub> is opened & S<sub>2</sub> closed only second bulb glows with max. brightness when both switches are closed bulb glows.

#### 4- Test Board Circuit with 1-way switch

In this Circuit two Lamps labeled as L1, L2 and one 1-way Switch is connected with AC Voltage Source in such a way that Sw is in parallel with L1. When Sw is at open (Off) state L1 and L2 become in Series and both of them will glow with their lesser brightness. When Sw is at close (On) state L1 becomes short and only L2 will glow.



Test Board Circuit with 1-way Switch

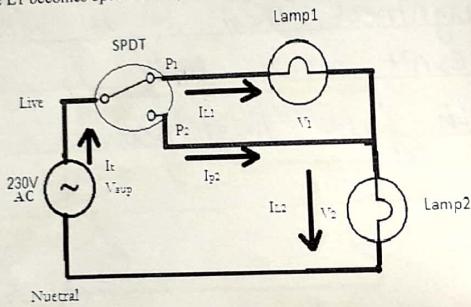
Observations/ Findings:

When switch is open both bulb glows with the less brightness. When S. is closed, L1 doesn't glow only L2 glow with full brightness.

Switch(s) State	Voltage (V)			Current (A)			Power (W)		
	V <sub>Sup</sub>	V <sub>1</sub>	V <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>t</sub>	Source	P <sub>t</sub>	P <sub>1</sub>
Switch opened	240	130	110	0.2	0.4	96	48	44	
Switch closed	240	0	240	0.4	0	0.4	96	0	46

**5- Test Board Circuit with 2-way switch**

In this Circuit two Lamps labeled as L1, L2 and one 2-way Switch is connected with AC Voltage Source in such a way that P1 is connect with L1 and P2 is connected with common terminal of L1 and L2. When Sw is at P1 state L1 and L2 connected in Series and both of them will glow with their lesser brightness. When Sw is at P2 state L1 becomes open and only L2 will glow.



Test Bard with 2-way Switch

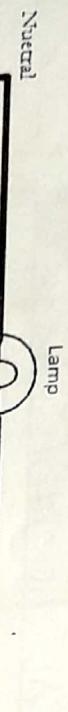
Switch(s) State	Voltage (V)			Current (A)			Power (W)		
	V <sub>Sup</sub>	V <sub>1</sub>	V <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>T</sub>	Source	P <sub>1</sub>	P <sub>2</sub>
P1 close	240	120	120	0.4	0.4	0.4	96	48	48
P2 close	240	0	240	0	0.4	0.4	96	0	96

## Observations/ Findings:

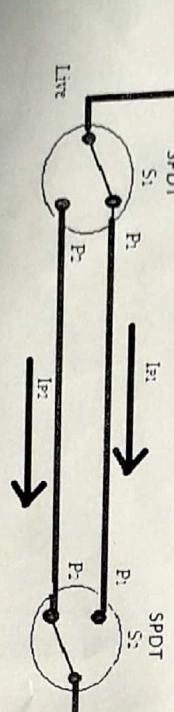
When the switch is upward then both lamps will glow with their less brightness. When switch is at P<sub>2</sub> position lamp 2 glows with full brightness.

### 6- Stair case Circuit

In this Circuit a Lamp and two 2-way Switches are connected with AC Voltage Source. When both of Switches are at P1 or P2 States Circuit will conduct and Lamp will glow. When these Lamps are in their alternate states means S1 is at P1 and S2 is at P2 then Circuit does not conduct and Lamp remains off in that case. This Circuit is known as Stair Case Circuit because it is implemented in the stairs of houses and buildings.



Observations/ Findings:  
When both switches are at some position then lamp will glow but when they are at alternative position the lamp will not glow.



Stair Case Circuit

Switch(s) State	Voltage (V)			Current (A)		Power (W)	
	V <sub>Sup</sub>	V <sub>L</sub>	I <sub>P1</sub>	I <sub>P2</sub>	I <sub>t</sub>	Source	P <sub>L</sub>
Both Sw closed with P1	240	240	0.4	0	0.4	96	96
Sw1 closed with P1 & Sw2 closed with P2	240	0	0	0	0	0	0
Sw1 closed with P2 & Sw2 closed with P1	240	0	0	0	0	0	0
Both Sw closed with P2	240	240	0	0.4	0.4	96	96

Switch(s) State	Voltage (V)				Current (A)			Power (W)		
	V <sub>Sup</sub>	V <sub>1</sub>	V <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>t</sub>	Source	P <sub>1</sub>	P <sub>2</sub>
Sw1 open & Sw2 close with p1	230	0	0	0	0	0	0	0	0	0
Sw1 open & Sw2 close with p2	230	115	115	0.4	0.4	0.4	0.4	9V	46	46
Sw1 closed & Sw2 close with p1	230	230	230	0.45	0.45	0.45	0.45	20V	103.5	103.5
Sw1 closed & Sw2 close with p2	230	230	0	0.4	0	0.4	0.4	9V	9V	0

**Observations/ Findings:**

When  $S_1$  is open &  $S_2$  at  $P_1$ , no lamp glow.  $S_1$  open &  $S_2$  at  $P_2$ , both lamps will glow in parallel fashion.

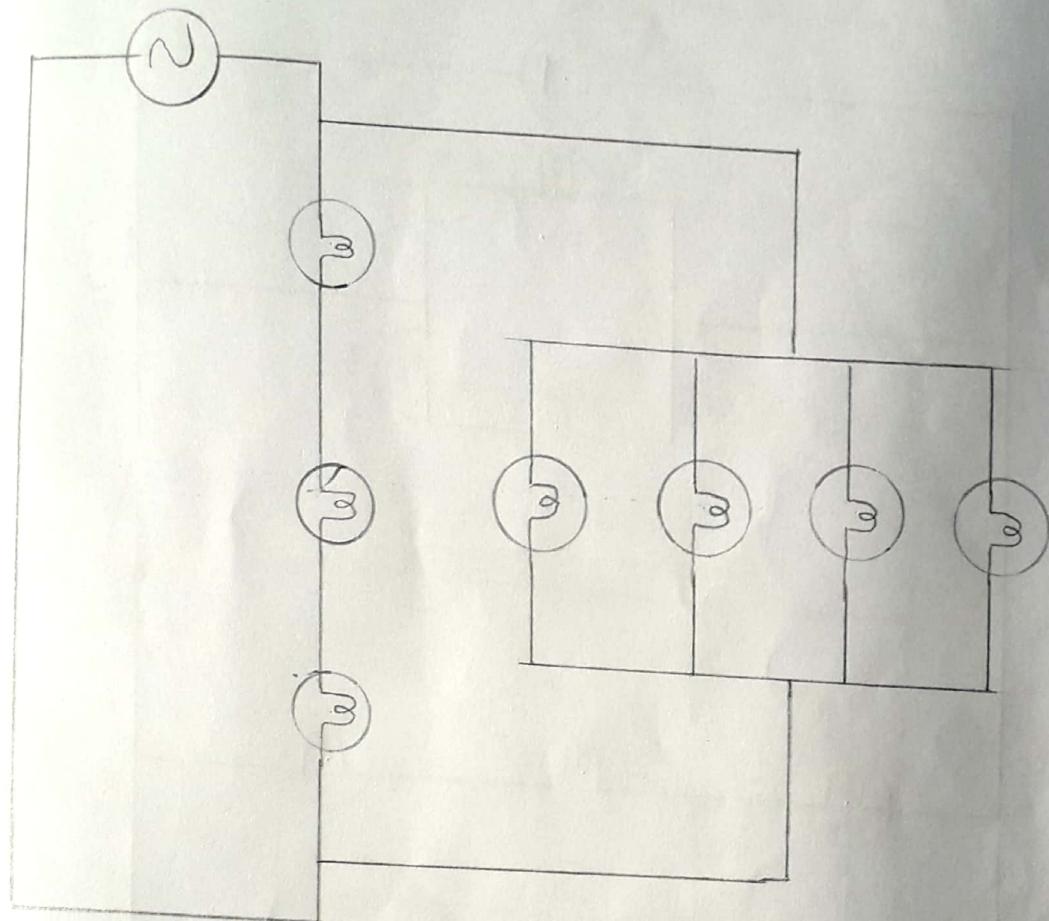
$S_1$  is closed,  $S_2$  at  $P_1$ , both lamps glows in parallel fashion.

When  $S_1$  closed,  $S_2$  at  $P_2$ , only  $P_1$  glows,  $S_2$  becomes short.

**ASSIGNMENT No.2**

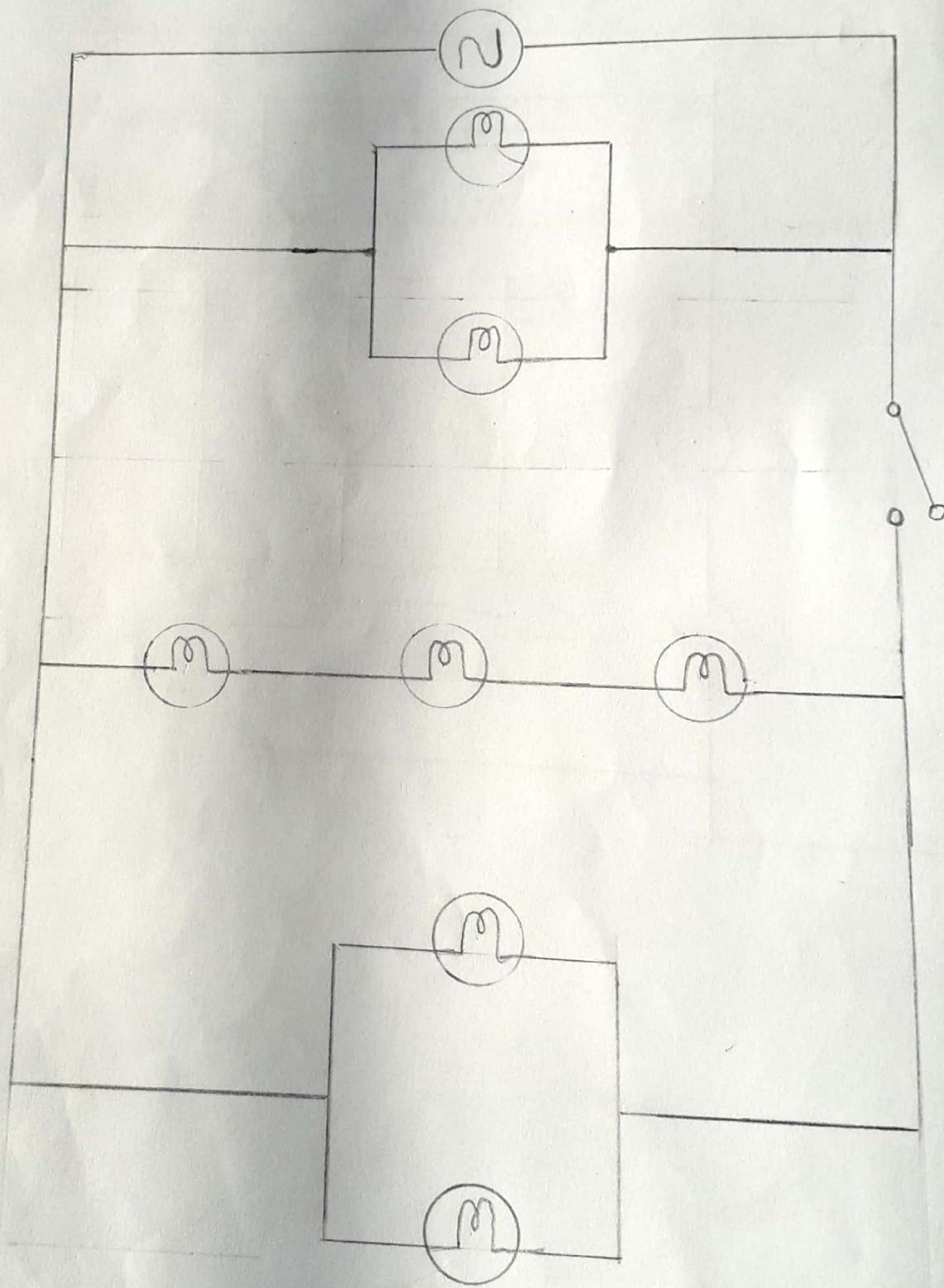
**Q1.** Draw the schematic diagram of seven Electric lamps controlled by single 1-way switch in such a way that whenever:

- **Switch is open** none of Electric lamp should glow
- **Switch is close** three of them should glow in series fashion whereas four should glow in parallel fashion



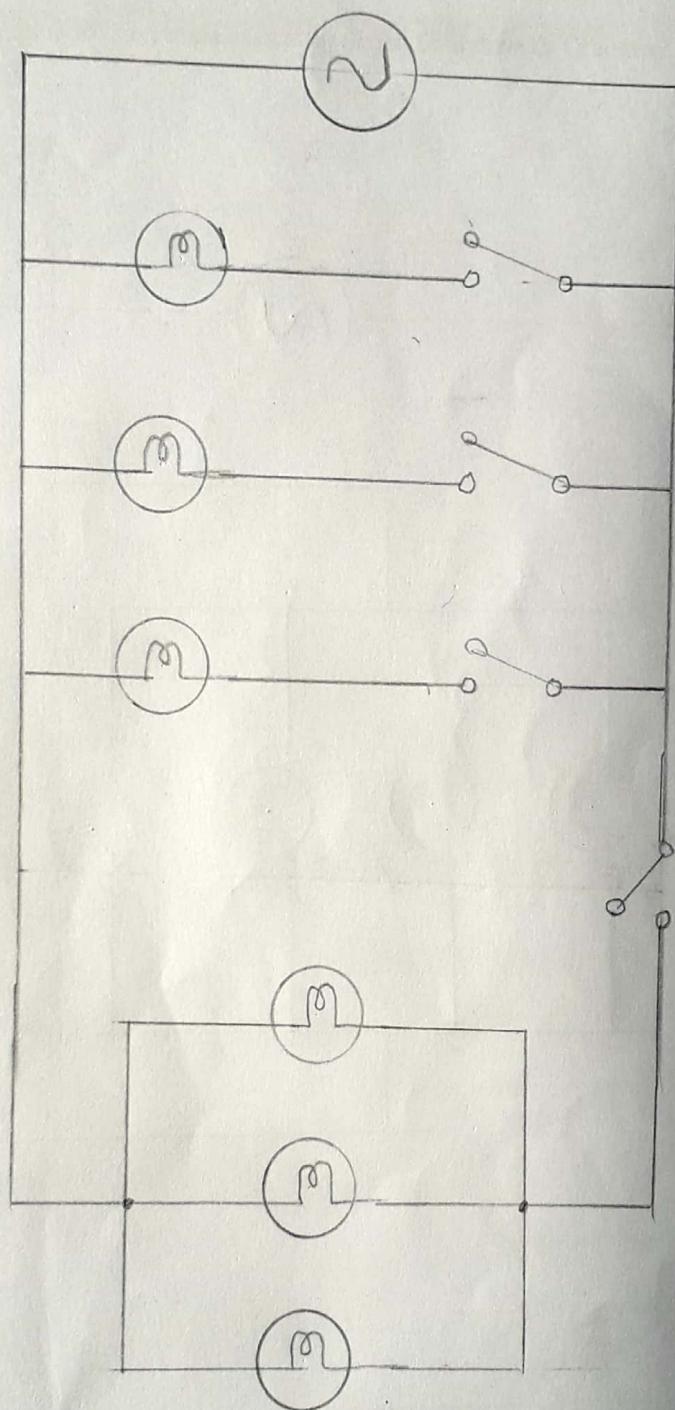
**Q2.** Draw the schematic diagram of seven Electric lamps controlled by single 1-way switch in such a way that whenever:

- **Switch is open** two of Electric lamps should glow in parallel fashion
- **Switch is close** three of them should glow in series fashion whereas four should glow in parallel fashion



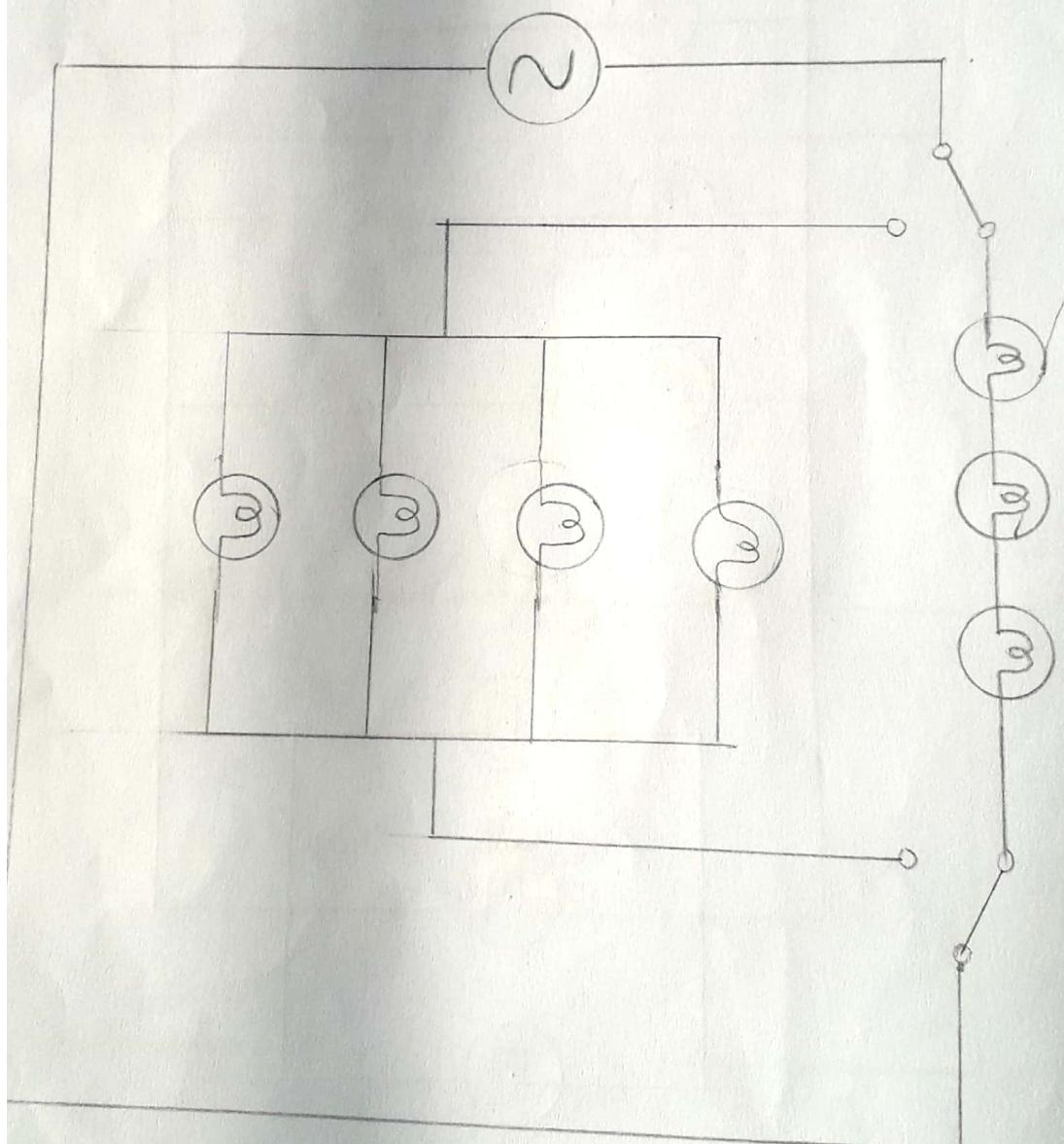
**Q3.** Draw the schematic diagram of seven Electric lamps controlled by four switches in such a way that:

- Three of electric lamps should control separately
- Rest of them should control from 4<sup>th</sup> switch in parallel fashion



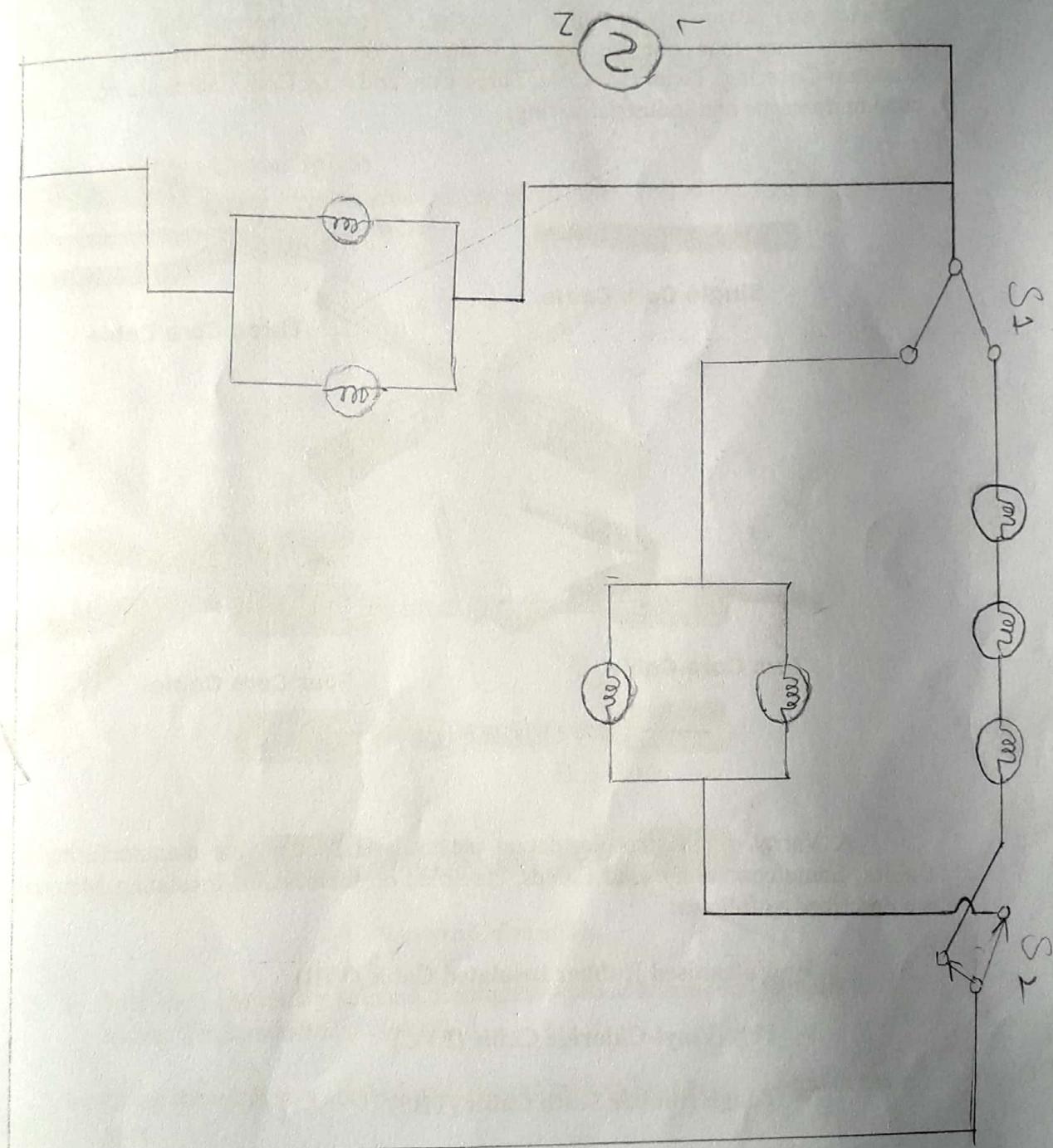
**Q4.** Draw the schematic diagram of seven Electric lamps controlled by two switches in such a way that whenever:

- **Switch S1 & switch S2 are upward** three of the electric lamps should glow in series fashion
- **Switch S1 & switch S2 are downward** four of the electric lamps should glow in parallel fashion
- **Switch S1 & switch S2 are at alternate state** none of lamp should glow



**Q5.** Draw the schematic diagram of seven Electric lamps controlled by two switches in such a way that whenever:

- **Switch S1 is upward & switch S2 is downward** three of the electric lamps should glow in series fashion and two of them should glow in parallel fashion
  - **Switch S1 is downward & switch S2 are upward** four of the electric lamps should glow in parallel fashion
  - **Switch S1 & switch S2 are at same** two of them should glow in parallel fashion



## ELECTRICAL WIRING LAB WORK

In Electrical wiring lab work we have to implement single phase wiring by using PVC surface conduit wiring system. In this wiring system we have to install conduits on the surface of wooden board. In single phase wiring red and black cables is used. Red cables are used as phase cables where as black cables are used as neutral cables. All switches should be connected with the phase of power supply.

### Apparatus

List all the tools & wiring accessories, required to perform the lab work.

- 1- PVC Band
- 2- Batten Lamp Holder
- 3- Electric lamps
- 4- PVC pipes
- 5- PVC saddle
- 6- PVC round
- 7- Plices
- 8- Screws
- 9- Braddle
- 10- SPST switch
- 11- Wire cutter
- 12- Screw driver.
- 13- Ceiling Rose
- 14- PVC box
- 15- PVC inception box.

procedure

1- Fix the PVC saddle on the wooden surface of board.

2- Insert pipes into saddles simply by pushing pipes into saddles.

3- Use PVC inception box and PVC bend to split connection

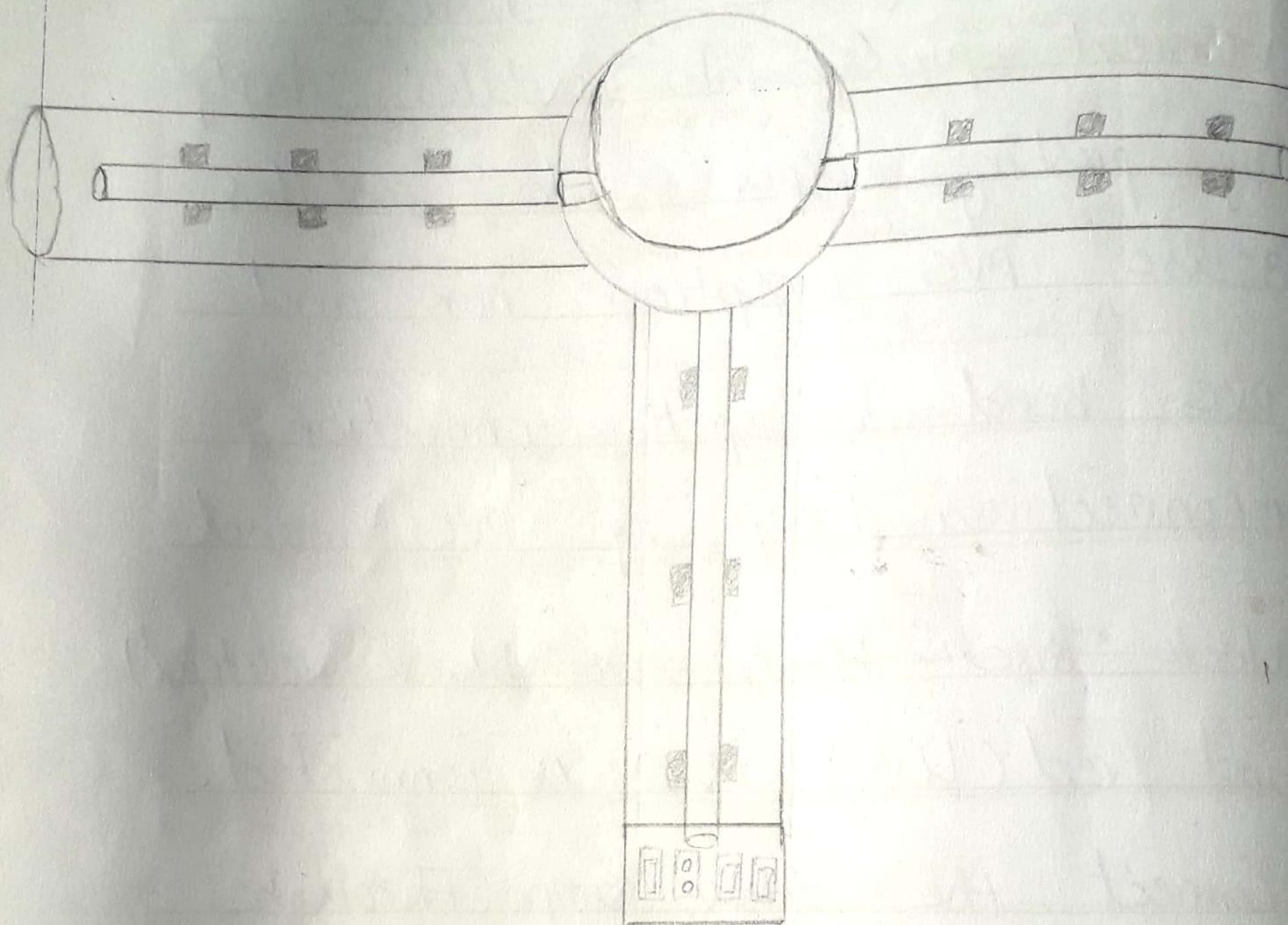
4- Connect a lamp by PVC round

block such that two black(neutral) and red(live) wire is connected.

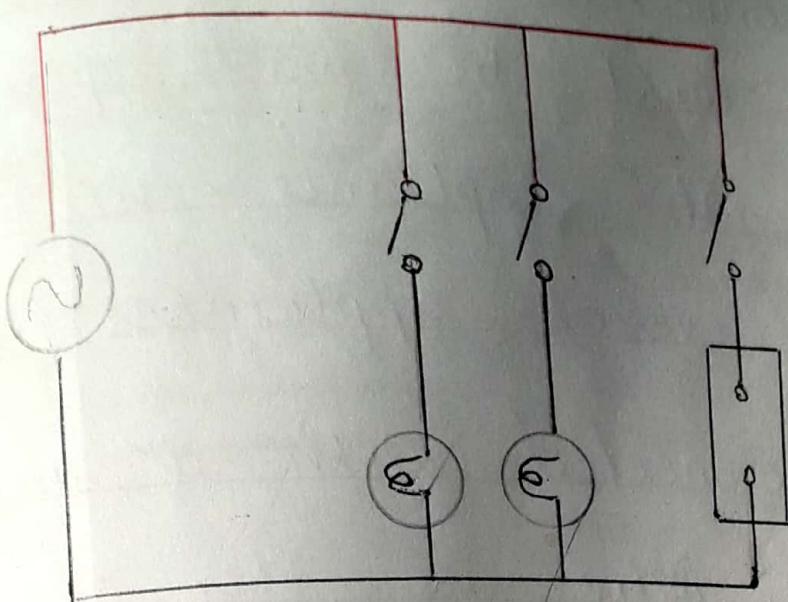
5- Connect the other lamp through pendant lamp holder with red and black wires

6- Connect the red(live) wire to separate switches on switch board and connect the one back.

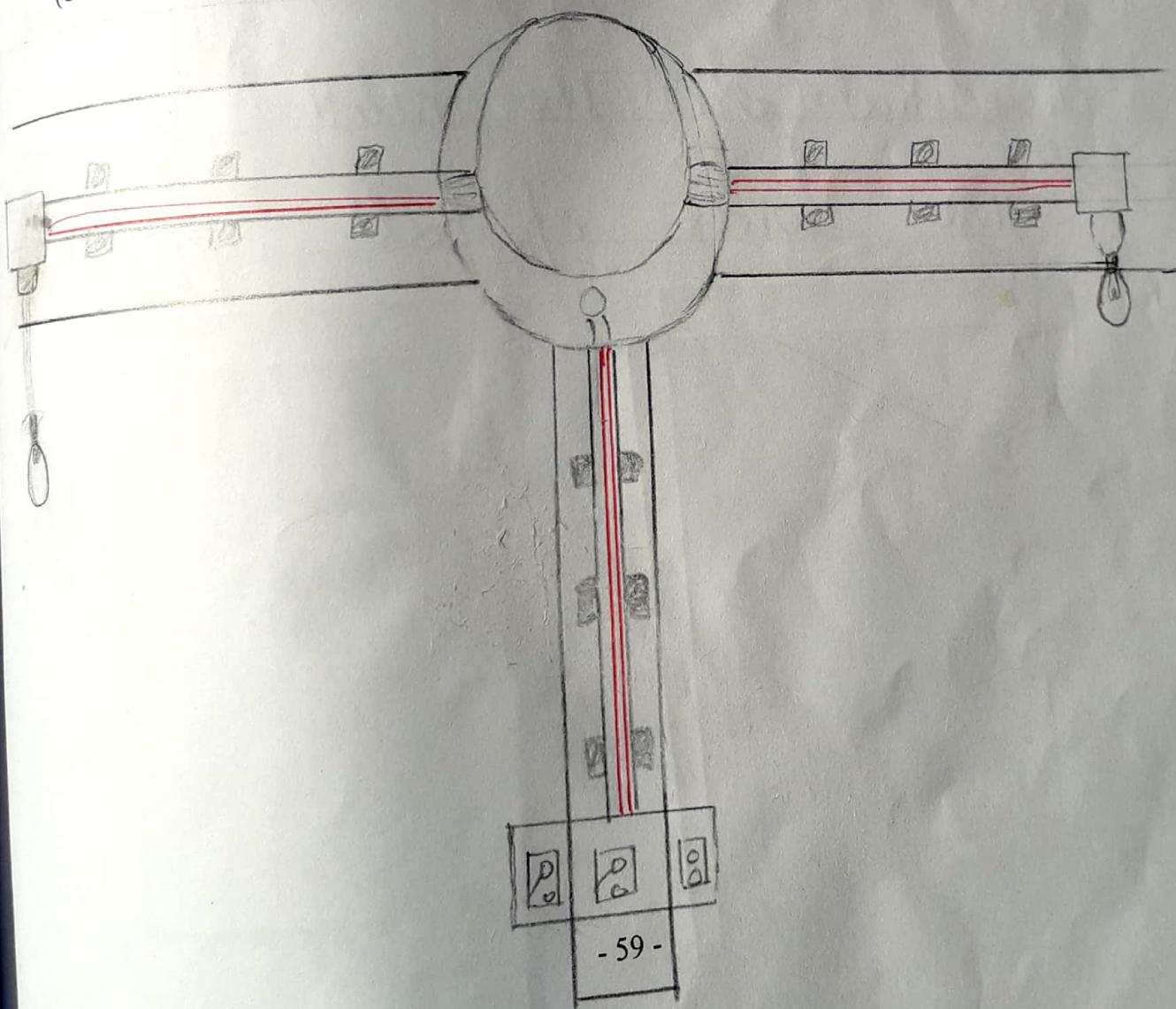
Draw the labeled conduit layout used in lab work



Draw the Circuit diagram  
(Use red ink for live connections and black for neutral connections)



Draw wiring diagram in accordance with circuit and conduit layout  
(Use red ink for live connections and black for neutral connections)

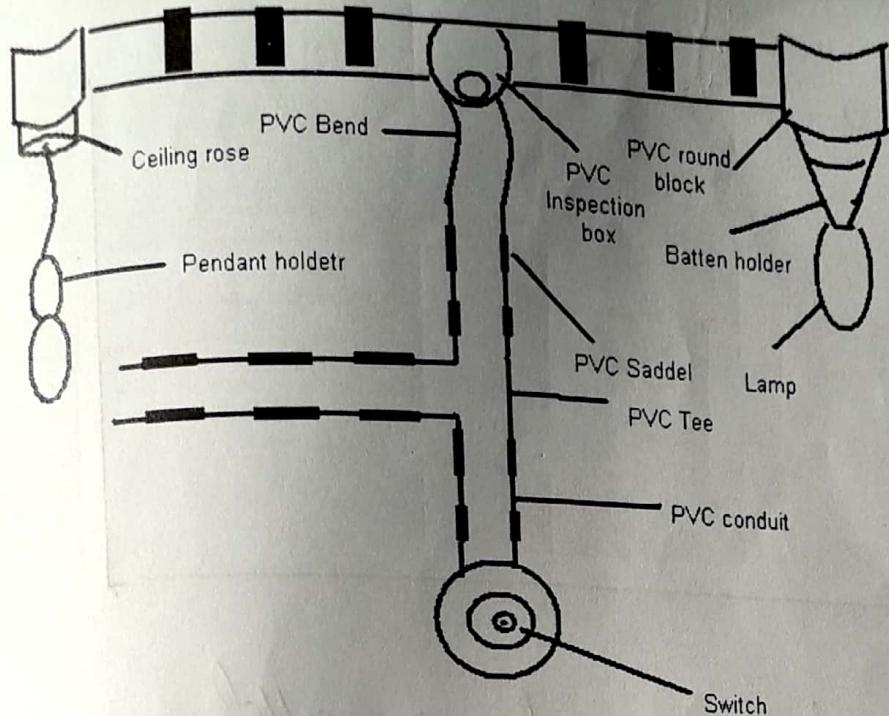


**Conclusions/findings**

The connection to live wire of source must be made separately for each appliance in wiring. But several appliances can be connected with a single neutral wire i.e. they can be connected in parallel by same neutral wire. The neutral and live wires of all appliances.

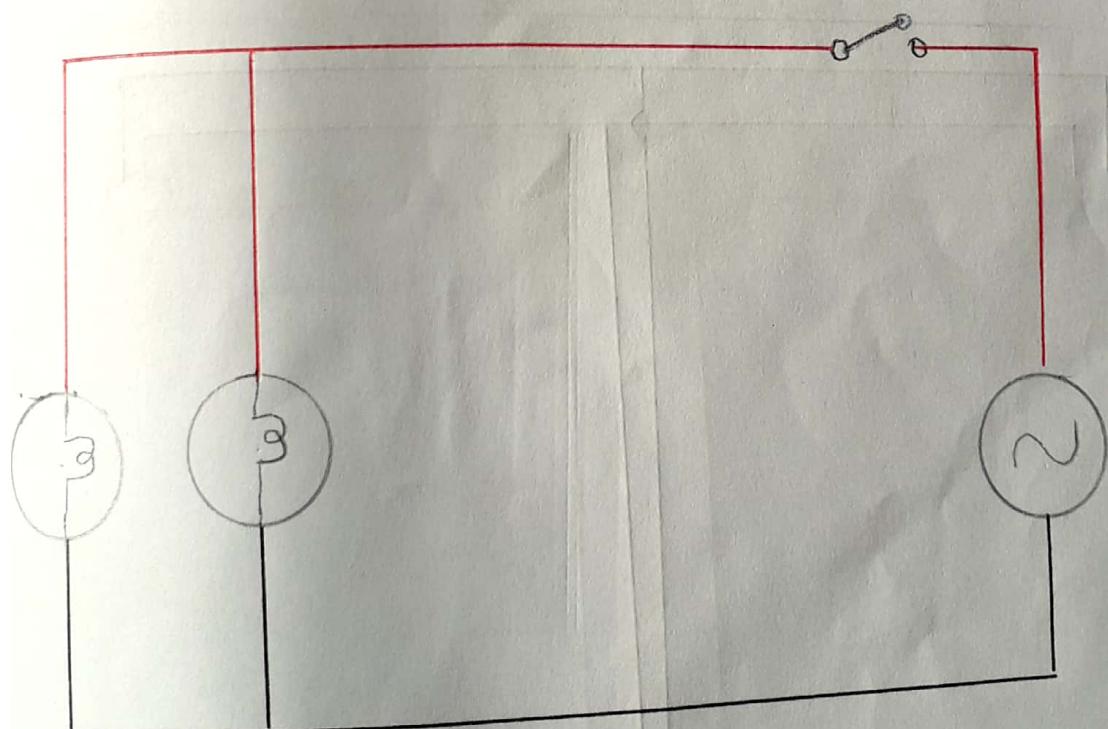
**ASSIGNMENT No.3**

Draw the circuit and wiring diagrams of series, parallel circuits using SPST switch  
and Test board circuits in accordance with following conduit layout.  
(use red ink for live connections and black for neutral connections)

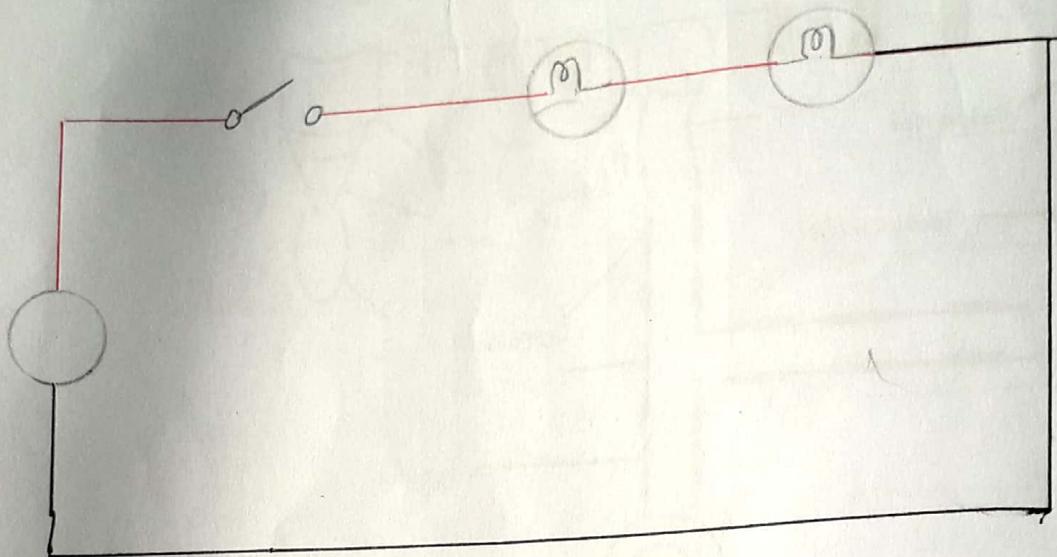


Piping layout No. 1

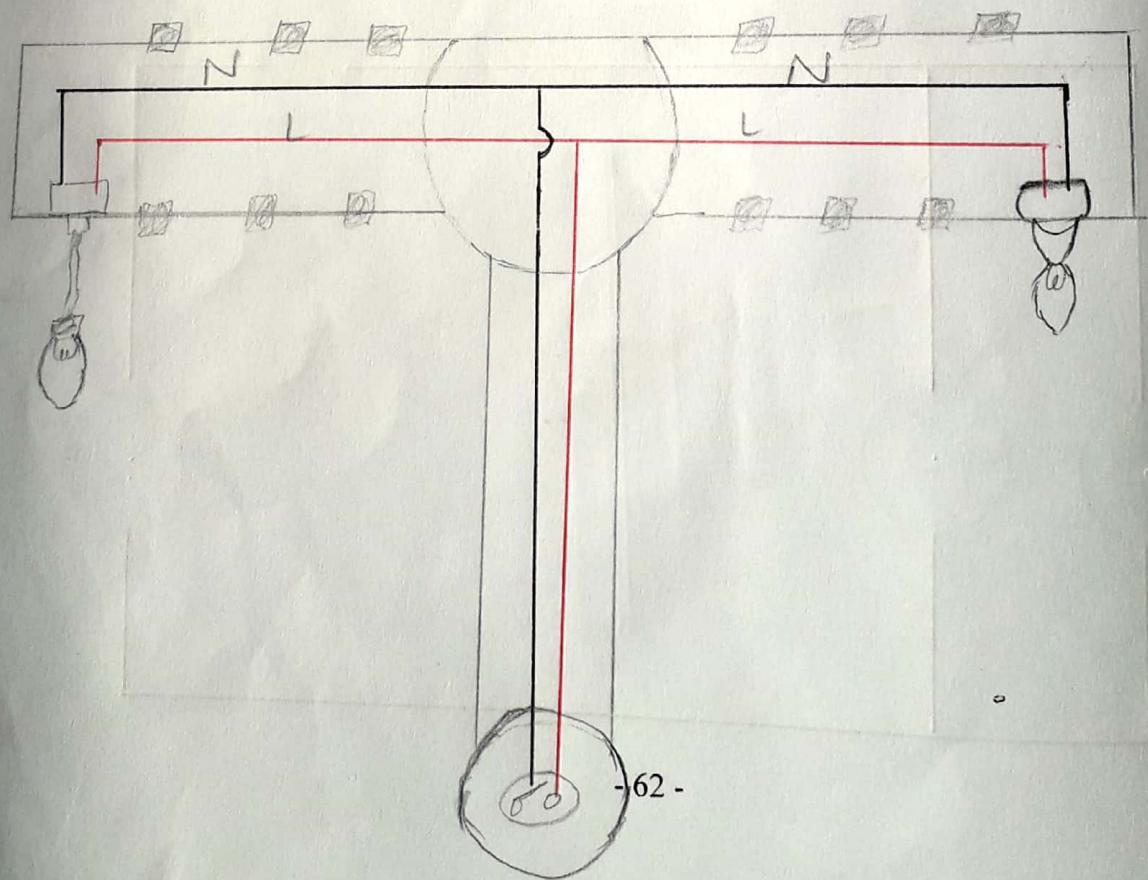
Circuit diagram of parallel circuit using SPST switch.



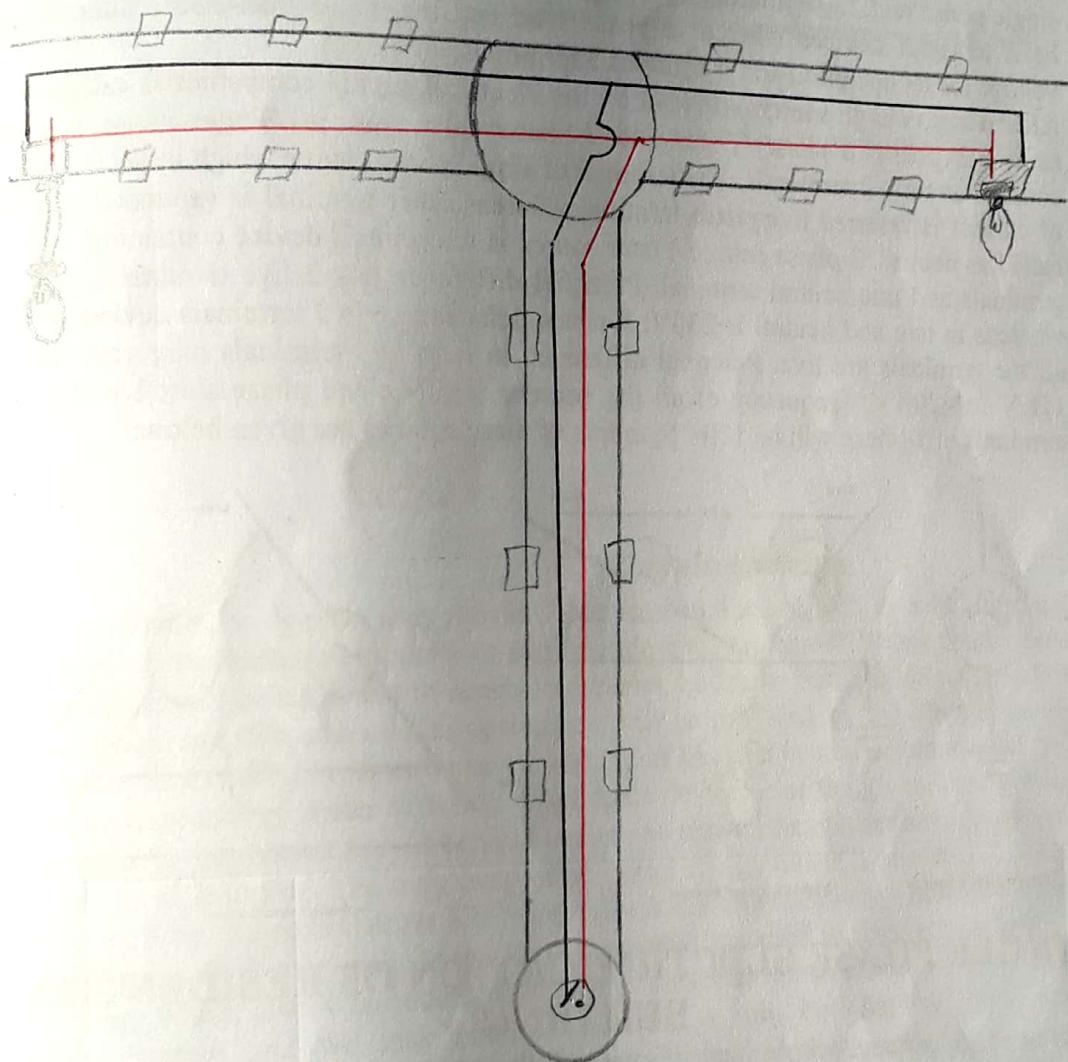
ELECTRIC SHOP MANUAL  
Circuit diagram of series circuit using  
SPST switch.



Wiring diagram of parallel circuit using SPST switch.



Wiring diagram of series circuit  
using SPST switch.



## ELECTRIC SHOP MANUAL

