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Chapter -1

1.1 Introduction

Traditionally following types of lamps are used to convert electrical energy into light energy.

1) Incandescent Lamp: Incandescent lamp uses tungsten filament. When current is passed through filament a light is produced. The filament is enclosed in an evacuated glass bulb filled with a gas such as argon, krypton, or nitrogen that helps increase the brilliance of the lamp and also helps the prevent the filament from burning out.
   Intensity of light is measured by unit Lumens and Incandescent light gives approximately 200 luminous flux (lm) light by 25W lamp. They are commonly used as light source.
2) Compact Fluorescent Lamp (CFL) : This is also known as an energy saving light bulb, is a type of fluorescent lamp that fits into a standard light bulb socket or plugs. CFLs have a longer rated life and use less electricity. CFLs typically save enough money in electricity costs to make up for their higher initial price within about 500 hours of use. A 15 W CFL produce the same amount of light as a 60 incandescent bulb (approximately 900 lumens or 60 lumens per Watt).
3) Neon Lamp: A neon lamp is a gas discharge lamp containing primarily neon gas at low pressure. The term is also used for similar devices filled with other noble gases, usually to produce different colors. A small electric current which may be AC or DC, is passed through the tube, causing it to grow orange – red.
4) Light Emitting diode (LED): LEDs are special diodes that emit light. LED devices are becoming popular because they consume very less power than other light device. LEDs have been used in electronics circuit for long time. They are available in red, yellow, green and multicolor and mainly used as indicators in electronic devices.
   But the new technological makes it possible to have white LEDs. Super bright LEDs made it possible to get more light with very low power consumption. Therefore now LEDs find its use as a light source.
   LEDs are so far used in digital display , indicator on electronic instruments like TV, Computer. But now they started finding application in making bulb, torch, and emergency lamps, traffic signal, street lights and so on.

1.2 LED

LEDs are diode, which emits photons which gives lights when current is passed through them. Since it does not required heating of filament or gas, it does not have the problem of burning out.
LED are shown by following symbol -

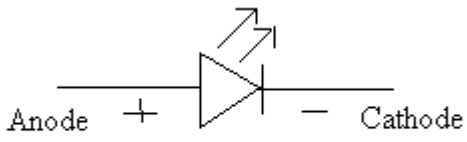
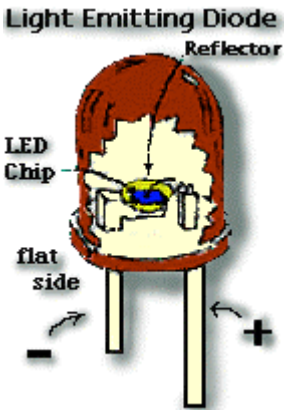


figure:- circuit symbol



{ Draw sketch }

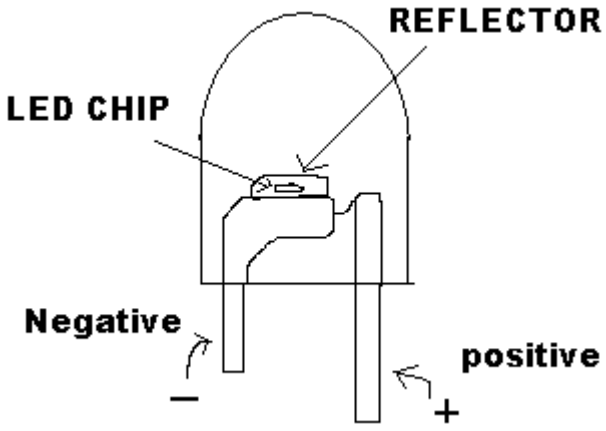


Figure: - Light Emitting Diode (LED)

Polarity of LED is indicated by size of its leads. Lead with longer lead is positive and lead with short length is negative.

1.3 Light comparison table

Following is the comparison of various lighting option. It is clear shows white LED(WLED) are the most energy efficient and durable option.

Sr. No.	Lamp type	Home made kerosene	Incandescent	Compact Fluorescent	WLED
1	Efficiency (Lumens/watt)	0.03	5-18	30-79	25-50
2	Rated Life (Hours)	Supply of kerosene	1000	6500-15000	50000
3	Durability	Fragile& Dangerous	Very Fragile	Very Fragile	Durable
4	Power consumption	0.04-0.06 Liters/hour	5W	4W	1W

(Source:- www.users.tpg.com.au/users/robkemp/Power/ConsumptionTables.htm www.thrive.in)

Advantages of using LED:

1) A Range of colors: - LED are available in variety of colours like a violet, blue, yellow, green, orange, red and white.
2) Efficiency: - LED consumes very less energy they are very efficient than incandescent bulb.
3) Low maintenance: - LED does not necessarily need maintenance. Their rated life is 10000 hrs.
4) Durability: - LEDs are extremely resistance to shock, vibration, mechanical and Assembly completely sealed making them water proof.
5) The low operation voltage of LEDs eliminated sparks.

Disadvantage

1) The viewing angle is less.
2) Direct viewing into LED may damage you eyes.

CHAPTER 2

2. Basic Electric Concepts

This chapter will introduce you to basic electric concepts such as current, voltage, ohm's, power; AC and DC power supply etc.

2.1 Current

The amount of electrical charge (current) flowing through the conductor is called Current. The unit of current is called the ampere (abbreviated amp or A). Symbolized with an I

Types of Current: There are two types of current.

1) Direct current and
2) Alternating Current.

1) Direct current (DC): DC current always flow in one direction and its direction and rating always remain the same is called Direct Current.
The current we get from the cells or batteries is DC Current. It has fixed polarities i.e +ve and –ve terminals.

2) Alternating Current (AC): The electric current whose direction and rating is always changing is called A.C. The number of such changes in one second is called frequency. In India we get 50 HZ frequency. Polarity of AC is changing continuously.

Measuring current.

Remember following steps, while measuring currents.

1) Please checks if you have selected appropriate scale of current on multi-meter.following are 0.1A= 100MA
1000 micro Amp. (UA) = 1 Mili Ampere (MA)
1000 Mili Ampere (MA) = 1 Ampere.
1000 Ampere (A) = 1Kilo Ampere (KV)

2) The current is always measured in series.

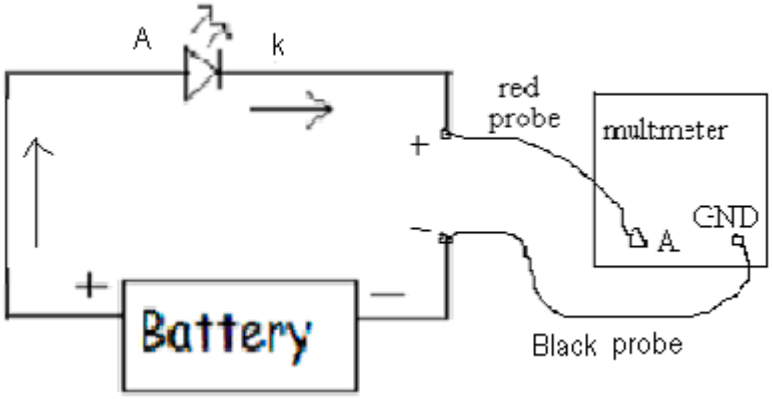


Figure 2.4 current measure

3) Ensure multi-meter switch is on DC current position, then connect red probe of multi-Meter to positive terminal and black probe to other terminal as shown in the figure.

2.2 Voltage

Voltage is defined as the amount of energy required to move a unit of electrical charge (current) from one place to another. Voltage is represented by symbol V. We get 230V AC supply in our homes. Standard pencil cell batteries used in the torch/radio are 1.5V DC.

Measuring voltage.

Remember following steps, while measuring voltage.

1) Please check if you have selected appropriate scale of voltage on multi-meter. Following are

1000 Micro Volt (V) = 1 Mili Volt (MV)
1000 Mili Volt (MV) = 1 Volt (V)
1000 Volt (V) = 1 Kilo Volt (KV)

These above values are indicated on multi-meter. The high voltage values are used in Power station.

2) The voltage is always measured in parallel or across the load.

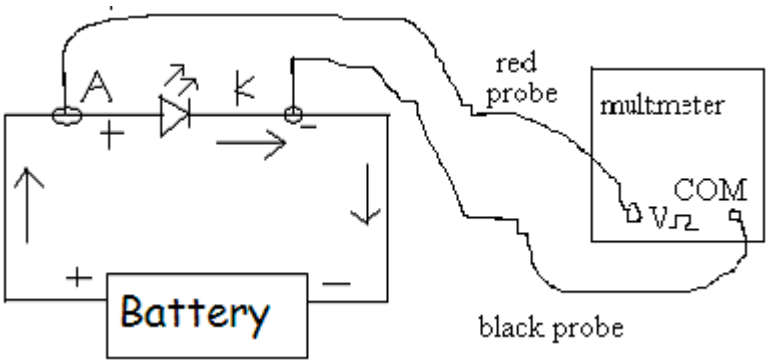


Figure 2.5 voltage measure

3) Ensure multi-meter switch is on DC voltage position, then connect red probe of multi-Meter to positive terminal and black probe to other terminal as shown in the figure.

2.3 Resistor:

Resistor is electrical devices that act to limit current flow in the circuit and at the same time lower voltage levels within circuits.

The resistor represent by (R)

The symbol of a resistor used in circuit is shown below

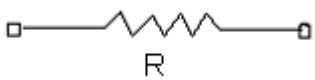


Figure: - circuit symbol

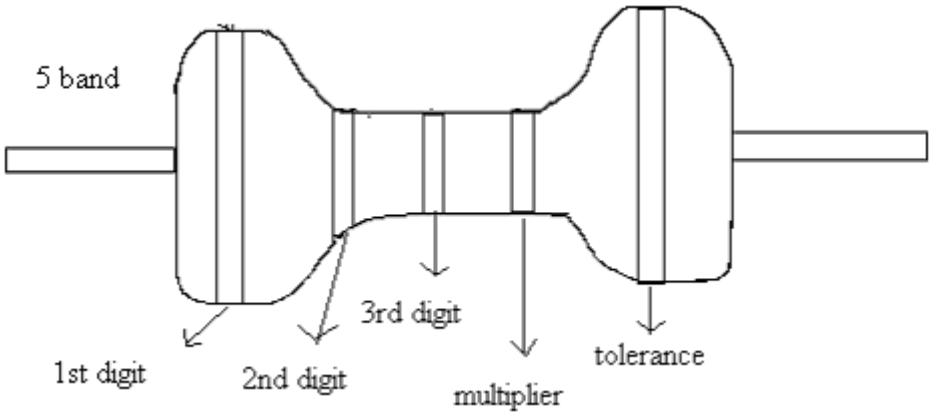


Figure: - 2.6 photo of resistor {{ Show actual photo of resistor)

The unit of resistor shown Ω = ohm

Resistors are very small in size. Their value is indicated by color codes printed on it. Resistors are used in electronic circuits to limit current as well as voltage. If more Voltage or current than design parameters are applied then electronic device may get damaged. To protect device resistor is used.

2.4 Ohm's Law

Ohm found out that the current flowing through the conductor is directly proportional to the voltage applied to it. The relation between voltage and current flowing through it is shown by the formula. V=IR

I= V/R

R=V/I

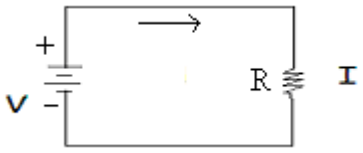


Figure 2.7: - ohm's law concept

Ohms law is useful to find out the unknown parameter in the circuit if the value of any two of the three (V, I, R) is known.

2.5 Power

Electrical power is defined as the rate at which electrical energy is supplied to a circuit or consumed by a load. The equation for calculating the power delivered to the circuit or consumed by a load was derived to be

Power (W) = Voltage (V)* Current (I)

P = V*I

The electric potential difference (V) and the current (I)

Power is the rate at which work is done or energy is transformed. The power is calculated using formula. (CHECK ..)

Power is measured in Wattage. It is represented by P.

1000W = 1 Kilo Watt (KW)

1000KW= 1 Mega Watt (MW)

If 100W is printed on the bulb that means that is consumes 100W power per hour.

W = V*I

100 = 230*I

I = 100/230

= 0.44 A

2.6 Capacitor

Function of capacitor is to store the electrical energy and give it again to the circuit, whenever required. When voltage is given to the capacitor and capacitor stores charge, on its plate. One side stores positive charge and other plate stores negative charge

The symbol for a capacitor is shown below.

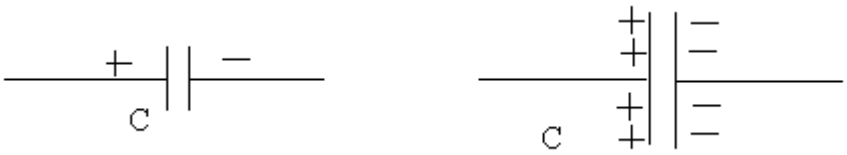
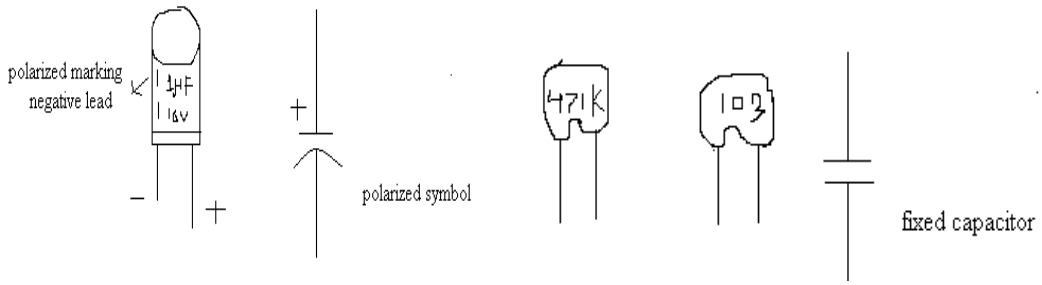


Figure: - 2.8 capacitor symbol

The capacity of capacitor to store electric charge is known as capacitance. It is denoted by C. Capacitance is measured in Farad, but Farad is very large unit. The smaller units are Micro Farad (uF), Neno Farad (nF), and Pico Farad (PF). The value of capacitor is printed on it.

Polarity of capacitors can be identified by negative sign printed on the capacitor. It can be identified from the length of its lead. Longer lead indicated positive terminal and shorter lead negative terminal. In ceramic capacitors polarities are not pre defined, you can connect any terminal to any leads.



Electrolytic Ceramic

Applications

Capacitors are used for following purposes in LED circuits

1) They are used to store temporary charge for providing voltage to electronic project.
2) It blocks the flow of DC voltage and permits the flow of AC voltage.
3) It bypasses (grounds) the unwanted frequencies in emergency lights.

2.7 Diode

Diode is a device which allows flow of current only in one direction. When positive voltage is given to the anode and negative voltage given to the cathode, the diode is in forward bias and this means diode will allow current to flows. When we give negative voltage to anode then diode is in reverse bias condition this means diode restricts flow of current.

The symbol of diode is given below.

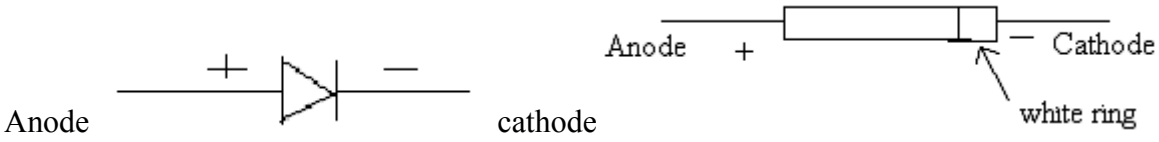


Figure 2.9: circuit symbol

Negative terminal of diode is indicated by white ring.

Testing diode on multi-meter

Diode gives voltage drop of 0.6V. Follow following steps to test diode on multimeter

i) Select 'diode' position on multi-meter.

ii) Connect red probe of multi-meter to positive terminal (anode) of diode and black probe of multi-meter to negative terminal of the diode. If we get 0.6volt on multimeter, then diode in working condition.

Application:

Diode are used in circuits to convert ac voltage to dc voltage e.g.: ac/dc power supply, voltage regulator circuit, voltage shifting circuit, voltage limiting circuit and voltage multiplier circuits etc.

Battery connection:

1) Series connection

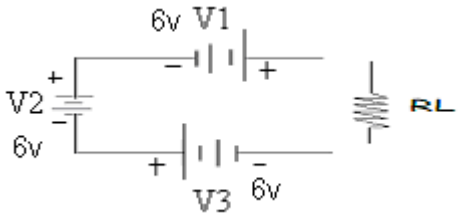


Figure2.12: - battery connect in series

Two or more batteries are connected in series to get more voltage. In this connection voltage increases but current flowing through the circuit remains constant.

V= v1+v2+v3+…….

The one cell voltage is 1.5v; if we connect three cells in series then we get total voltage as

given below.

V=v1+v2+v3
= 1.5+1.5+1.5
= 4.5 volts

This is total out put voltage from series circuit.

2) Parallel connection

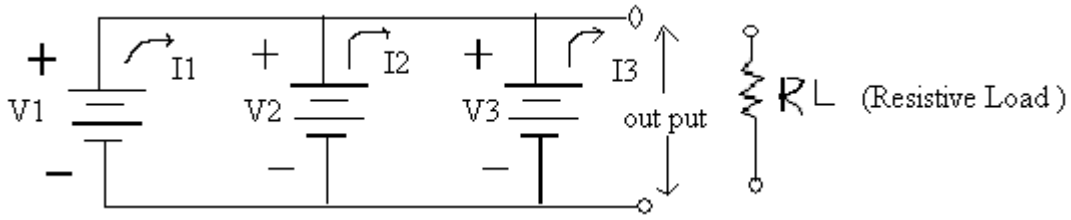


Figure 2.13: - battery connect in parallel form

When two or more batteries are connected in parallel form as shown in the figure. Then voltage remains the same. Current flowing through the circuit increases

I= I1+I2+I3 ……

2.8 Electric Circuits

An electric circuit can be categorized as Basic circuits, parallel circuits and series and parallel combination circuits.

1) Basic Circuits:-

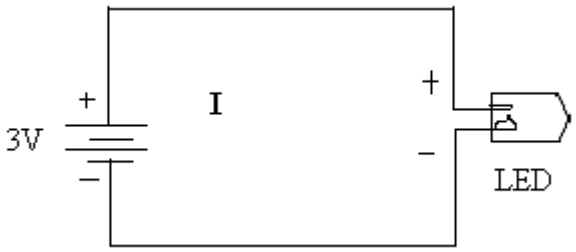


Figure 2.14: - LED connect on battery

When the 3v battery is connected to the single load/LED then the current will flow from positive terminal through load to the negative terminal of battery. Suppose you don't connect load (LED) to the battery then current will not flow from the battery.

2) Series Circuit:-

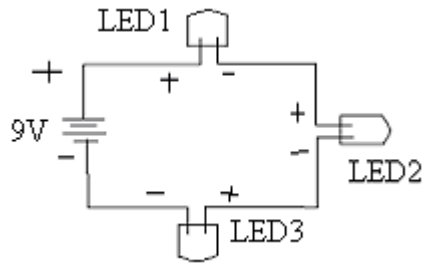


Figure 2.15: - increase voltage level

A load are connected one after the other to forms a series circuit. The current flowing through all loads in a series will be the same. Series connection needs more voltage.

Parallel Circuits:-

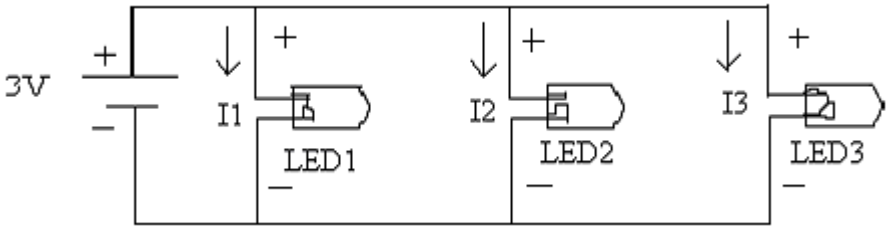


Figure 2.16: - increase current capacity

When LED bulb/load are connected in parallel they will glow brightly with same voltage but more current will be drawn from the battery and battery will get discharged fast. The current from the battery will get divided equally into each of the three branches in this arrangement. This means three times the amount of current will flow from the battery. i.e I = I1 + I2 + I3

Combination of series and parallel:-

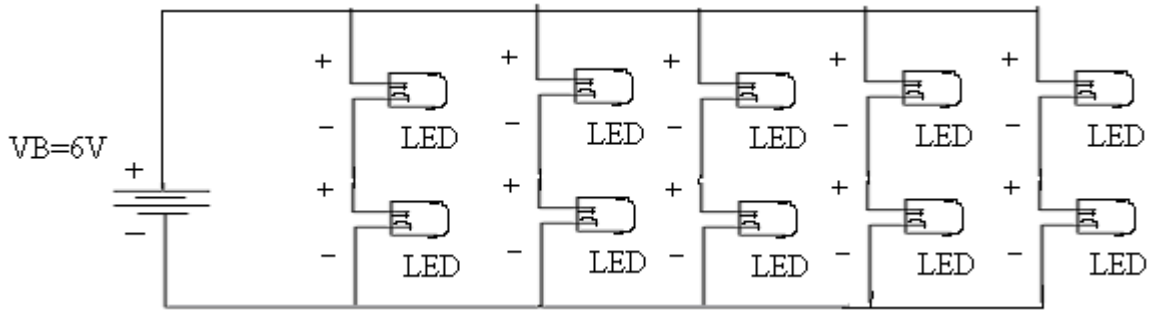


Figure 2.17 LED connect in series and parallel combination

In combines both features of series and parallel circuits. These all circuits explained above will depend on our need. The type of application connected to the battery will decide how fast the battery gets discharged.

CHAPTER 3

LED Lighting units

After studying basic electrical terms and electronics component needed to make LED lighting units. We will learn to assemble LED lights. These chapters will introduce you with standard LED circuits tested at vigyan ashram. You can purchase components as per the part list and starts manufacturing LED lights. You will need following tools before starting assembling LEDs.

1) soldering gun 25 W
2) Flux
3) Soldering wire
4) Cutter
5) Wire striper
6) Multimeter

Remember circuits given in the chapter are made with a objective that local electrician from village can assemble LED lights himself. He can also make decorative items based on application of LEDs.

Procedure write standard procedure for making circuit

i) We are given label in part list all type of component such as Resistor R, Capacitor C, Diode D, and LED L.
ii) Take components as per given part list.
iii) Identify polarity of all components and then mount on Printed Circuit Board (PCB) as per given circuit diagram.
iv) Soldering procedure :
   a) Clean the lead
   b) Apply flux
   c) Take metal
   d) Point to solder (with carefully)
   e) Soldering wire, remover insulating cover with the help of pliers.
v) To fit the casing and switch properly in the unit. Look at the circuit and shape of casing carefully. Standard casing can be purchased from market or from Vigyan Ashram. Standard PCBs for the LEDs are available with Vigyan Ashram.

3.1: Emergency Lamp

Introduction

This circuit consumes very less power than CFL lamp and incandescent lamp. The lamp takes 8 hours for battery to get charged and gives 28 hrs backup.

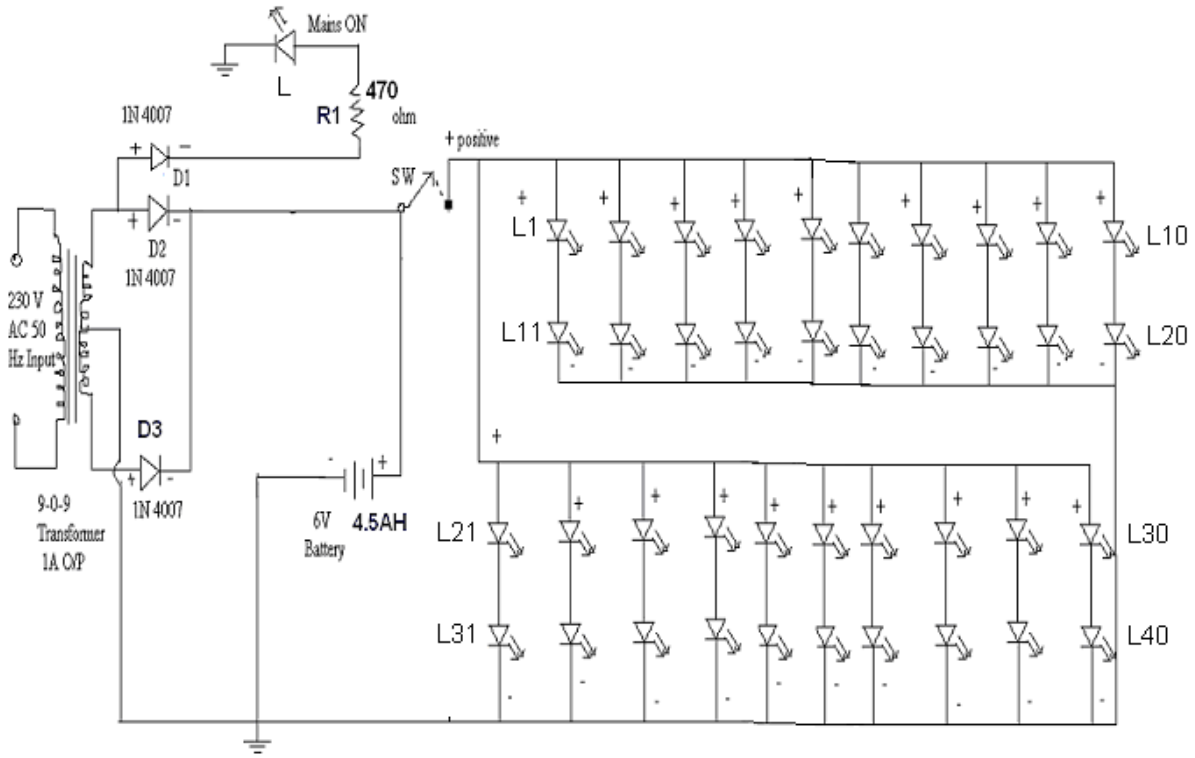


Figure 3.1: - Emergency Lamp

Part list

Component name	Value	Quantity
Diode D1 –D3	1N 4007	3
LED L1- L40	White BBR 5MM	40
Resistor R1	470 ohm	1
Switch	SPST	1
Battery	6v (4.5AH) Sealed lead acid battery	1
Transformer	9-0-9 v and 1 Ampere output	1
PCB	Circle and square shape	1
LED L	Green	1
Wire	Multistand	2 meter

Working of emergency lamp

(Give good photo separately with LEDs on)

In the emergency lamp 9v charger is used for charging of battery the 6v battery not become charging 6v their need 9v charger, at the same time it indicates mains ON. In the lamp single pole single throw (SPST) switch is used for switching lamp ON. This lamp is designed to give 28 hrs backup.
It is advisable not to charge battery more than 6 hours because that affects battery life or there are more chances for damage of battery.

Features

1) It is operates on 6V (4.5AH) battery.
2) Low power consumption. Consumes up to 1.5watt.
3) It gives backup for 28 hours.
4) It can be used by hawkers who do business in late evening.

Power calculation For Emergency Lamp

Total LEDs used in emergency lamp are 40.
Given Input voltage V = 6V
Current drawn {measured on multimeter reading} I = 0.24A
P = V*I
P = 6V * 0.24 A
P = 1.5 W
Power consumed by emergency lamp is 1.5 W.

3.2: LED AC Lamp

Introduction

This lamp uses two circuits, one converts AC voltage into DC voltage and second is LEDs circuit. One disadvantage of this circuit is 20 LEDs are in series and if one gets burnt then whole circuit stops functioning. It can be used as a night lamp or as a light source in place kerosene lantern is used. This lamp can be used directly into 230V AC sockets.

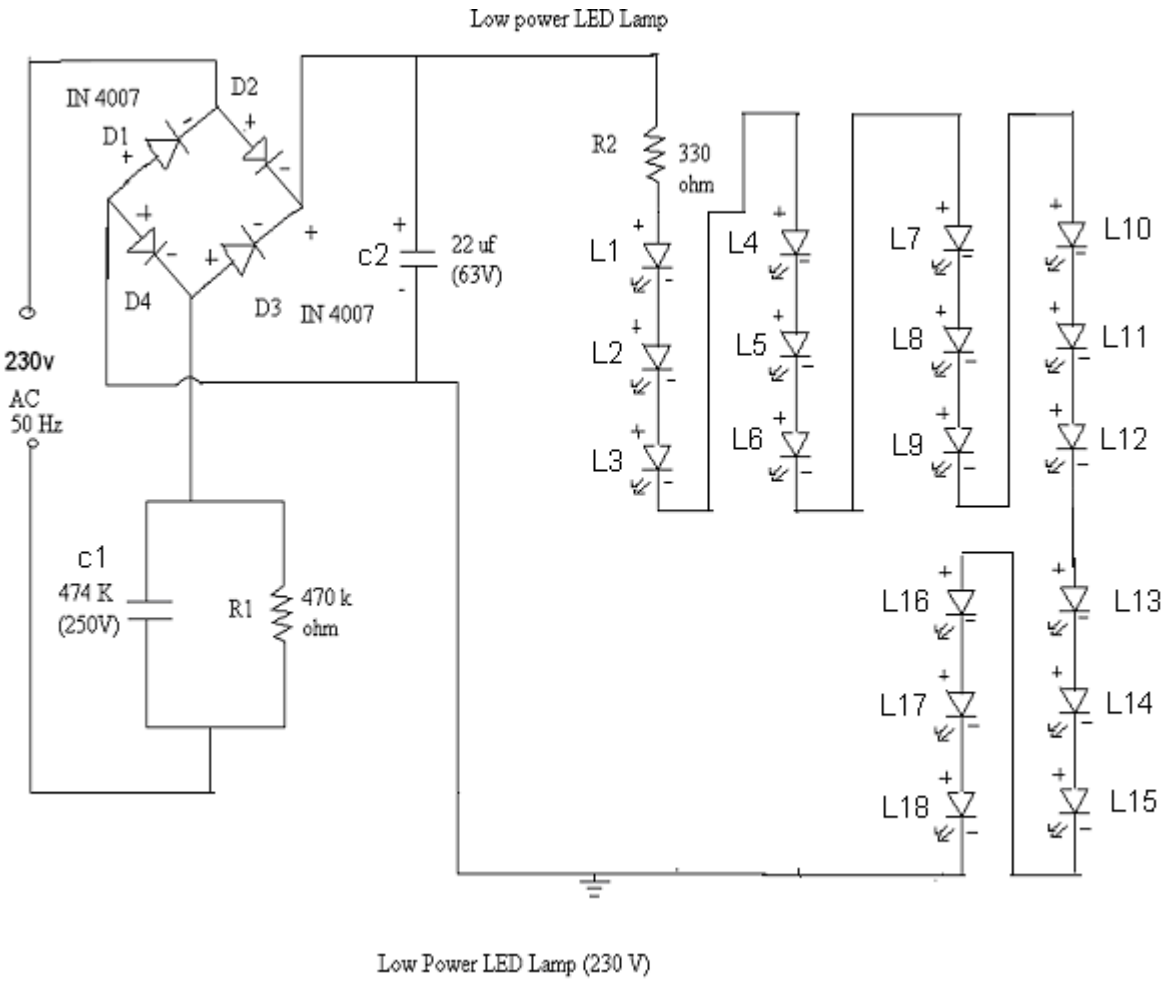


Figure 3.2: low power LED lamp operate 230v.

Part List

Sr.No	Component name	Value	Quantity
1	LED L1- L18	White BBR 5MM	18
2	Diode D1 to D4	1N4007	4
3	Capacitor C1 C2	 474k (250v) 22Uf (63v)	 1 1
4	Resistor R1 R2	 470k0hm 330 ohm	 1 1
5	PCB	Circle and square shape	1
6	Wire	Multistand	1

Working:-

((Use good picture }}

230 volt AC input is given to the circuit. Current and voltage is reduced and is given to diode bridge circuit. The diode bridge circuit's main function is to its convert AC voltage into DC voltage and that DC volt is given to LED. The LEDs are connected in combination of series and parallel.

Features

1) It operates on 230v AC.
2) Low power consumption up to 3 watt.

Application:

1) Use as night lamp.
2) Also use in toilet.
3) More use full at the time of loadsheding in rural areas.

3.3: DC Lamp Using 12v

This lamp can be used on 12V batteries and used in solar application. At Vigyan ashram we have installed these lamp systems using on 12 v and 7.5AH battery .we get backup up to 21hrs for two lamps. It consumes 2 W powers.

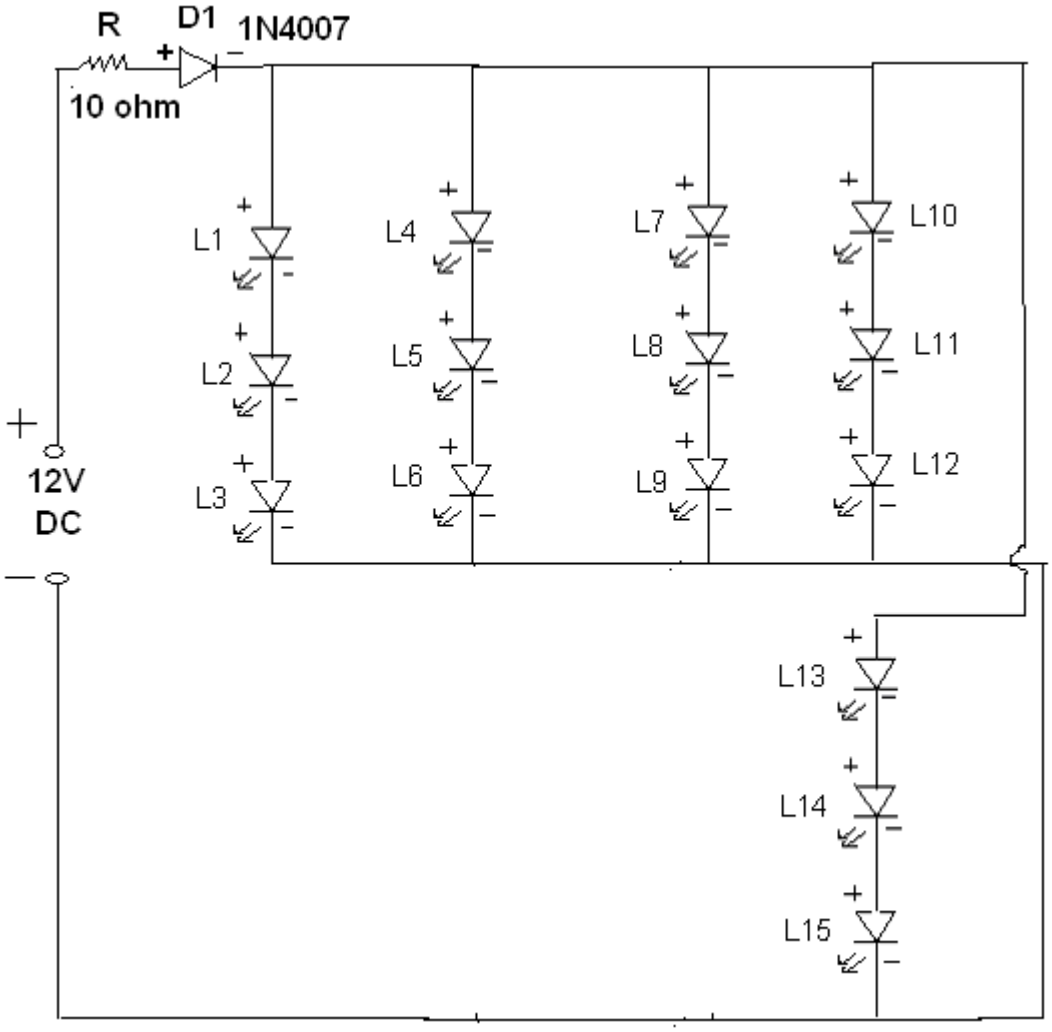


Figure 3.3: DC lamp operate 12v

Part List

Sr.No	Component name	Value	Quantity
1	LED L1-L15	White BBR 5MM	15
2	Diode D1	1N4007	1
3	Lead acid Battery	12v (7.5AH)	1
4	PCB	Circle diameter 1.75”	1
5	Wire	multistand	1
6	Resistor R	10 ohm	1

3.4 : DC lamp using 6v

The input 6v is given to the parallel and series combination of LED. This circuit does not need diode because one LED requires 3v therefore two LED in series connection require 6v. When one lamp is connected to the battery we can get a backup of 54 hours. This system gets fully charged in 8 hours. The circuits consumes to 0.5Watt power.

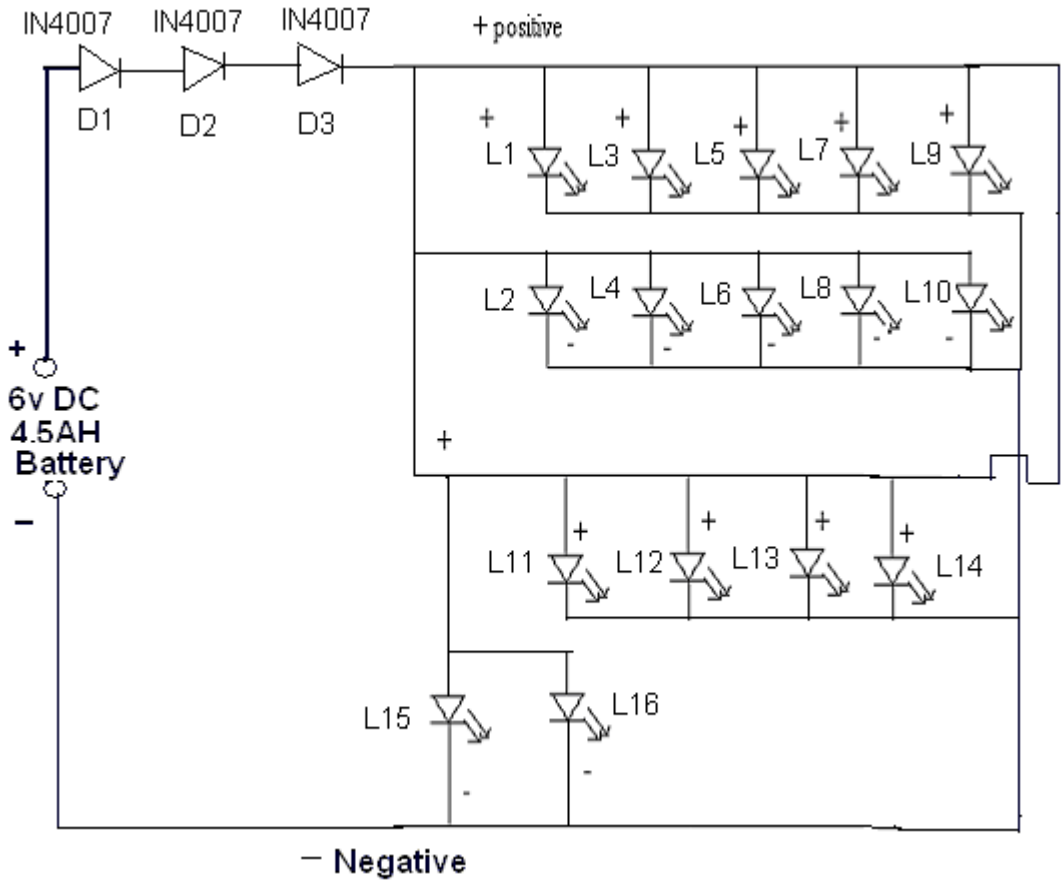


Figure 3.4:- DC lamp operate on 6v battery

Part List

Sr.No	Component name	Value	Quantity
1	LED L1-L16	White BBR 5MM	16
2	Lead acid battery	6v & 4.5AH	1
3	PCB	Circle diameter 1.7”	1
4	Wire	Multistand	½”
5	Diode D1-D3	IN4007	3

3.5: DC Lamp using 9v battery

Input 9v is given to the series and parallel combination of LED circuit. These circuits do not need diode. The three LEDs are connected in series; therefore input voltage required is 9v. The number of LEDs connected in series depends upon battery voltage. This lamp light can run continuously about 50 hours and consumes up to 0.8w power.

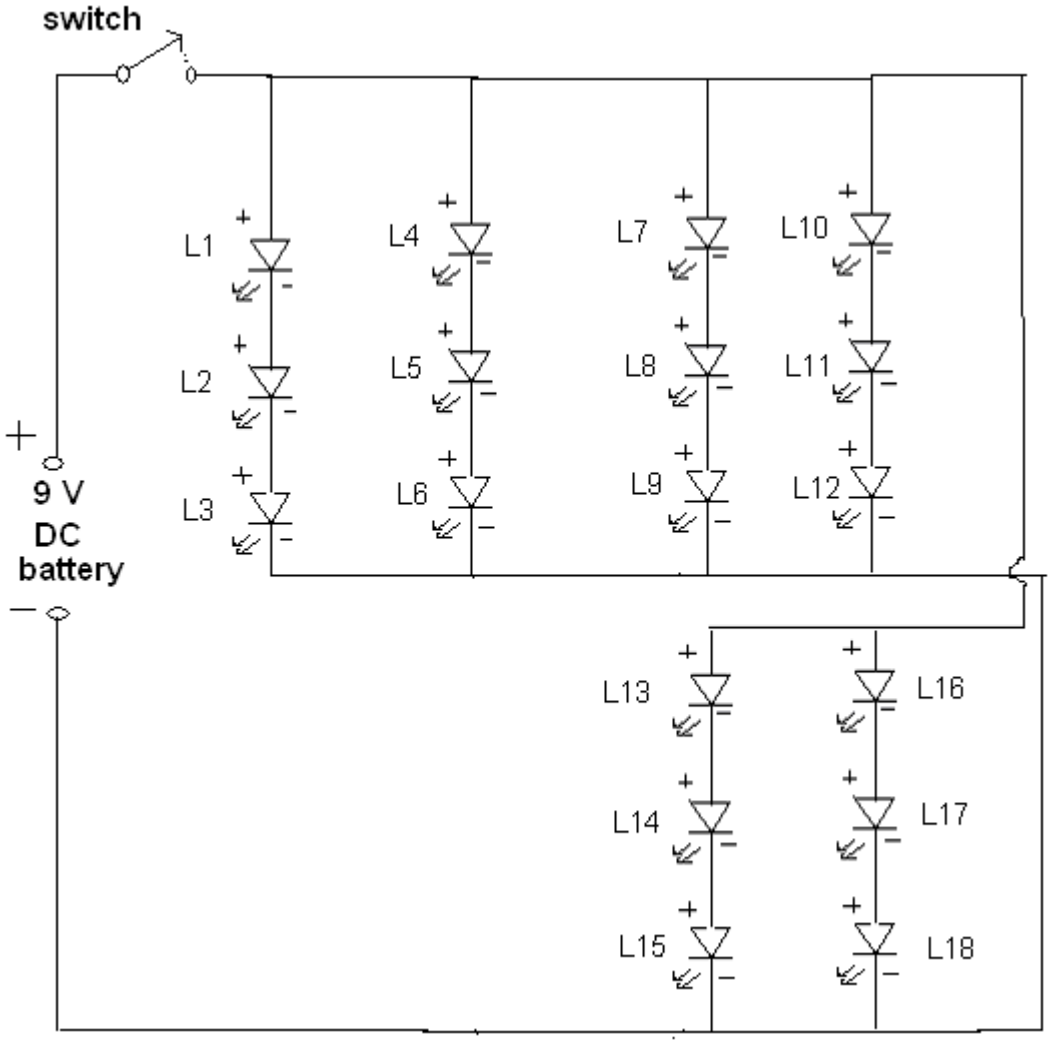


Figure 3.5: 9v DC lamp

Part List

Sr.No	Component name	Value	Quantity
1	LED L1-L18	White BBR 5MM	18
2	PP3 battery	9v	1
3	PCB	Circle diameter 1.7”	1
4	Wire	Multistand	½”
5	Switch	SPST	1

3.6 Torch

Introduction

This torch use for general purpose. This torch use two cells, if we want more brightness then connect three cells and one diode connect in series. With two cells we get 3V supply and with three cells, we can get 4.5V supply. Torch works continuously for 50 hrs.

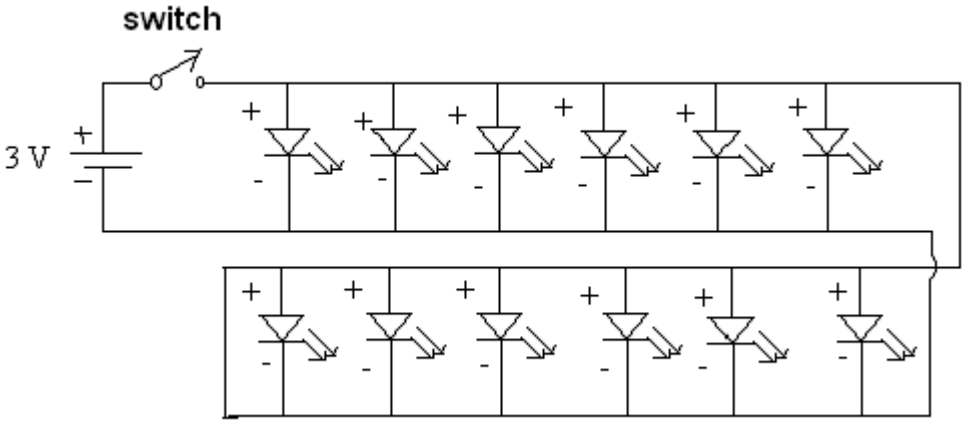


Figure : parallel connection for torch

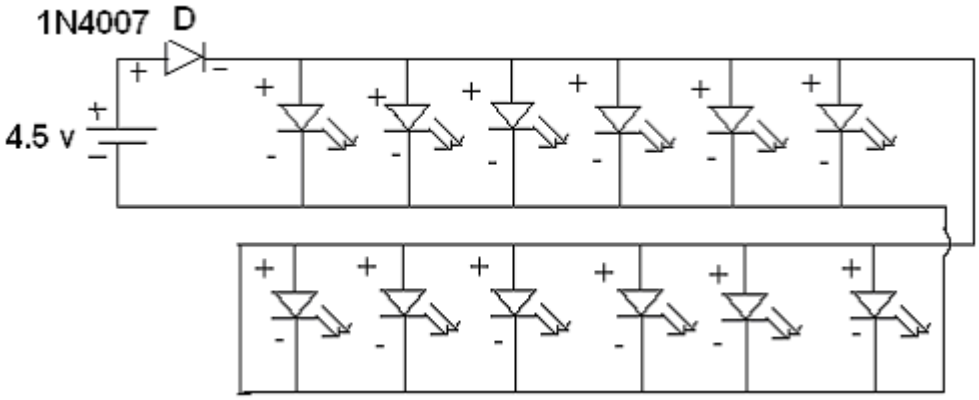


Figure 3.6: parallel connection for torch

Part list

For two cells (3V)

Sr.No	Component name	Value	Quantity
1	LED	White BBR 5mm	12
2	Cell	1.5v	2
3	PCB	1.5” diameter	1
4	Wire	Multistand	½ meter

For three cells (4.5V)

Sr.No	Component name	Value	Quantity
1	LED	White BBR 5mm	12
2	Cell	1.5v	3
3	PCB	1.5” diameter	1
4	Wire	Multistand	½ meter
5	Diode D	1N4007	1

Features

1) It operates on 3V and 4.5v.
2) Low power consumption. It Consumes up to 0.8 watt.
3) It gives backup for 52 hours.

3.7: Torch using Series connection

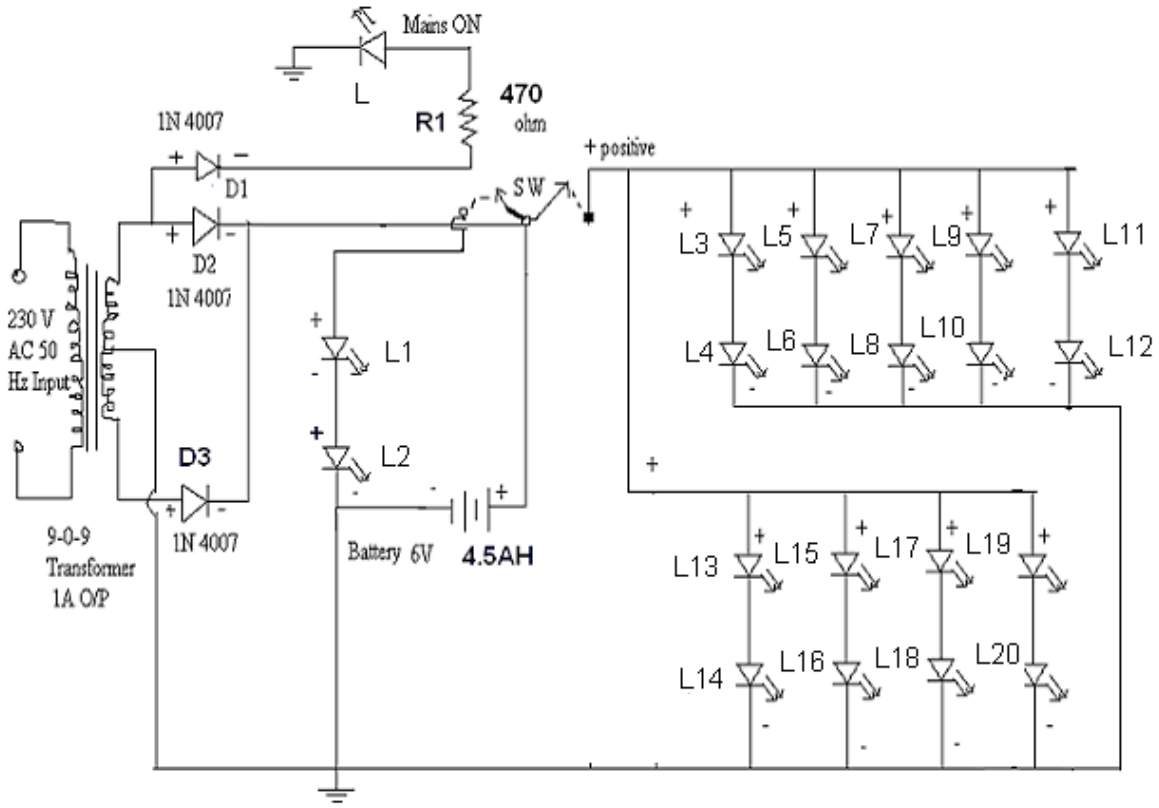


Figure 3.7: torch using series and parallel connection

Part list

Component name	Value	Quantity
Diode D1-D3	1N 4007	3
LED L1-L20	White BBR 5MM	20
Resistor R1	470 ohm	1
Switch	SPDT	1
Lead acid Battery	6v (4.5AH)	1
Transformer	9-0-9 v and 1 Ampere output	1
PCB	Circle and square shape	1
LED L	Green	1
Wire	Multistand	2 meter

Features

1) It operates on 6v lead acid battery.
2) Backup of 25 hrs.
3) It is consumes 0.7watt power.

3.8: Small torch Using 9v battery

Photo not clear / dark

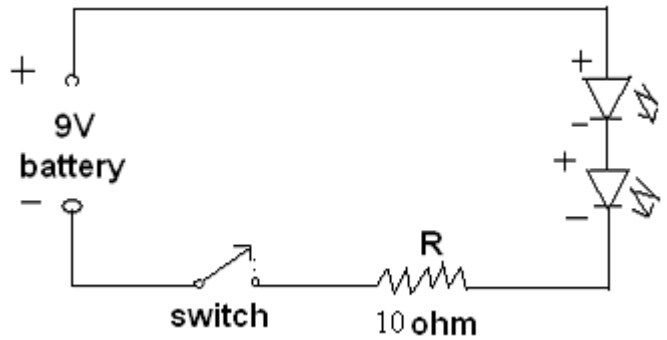


Figure 3.8 :- torch using 9v battery

Part list

Sr. No.	Component Name	Value	Quantity
1	LED (White)	10 mm	2
2	Dry battery	9v	1
3	Resistor	22 ohm	1
4	Switch	SPST	1
5	Plastic box	---	1

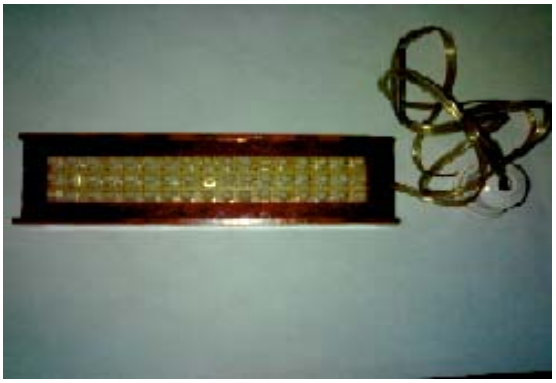
Feature:-

1) It continuously runs for 50 hrs.
2) It takes very less power up to 0.8w.

3.9: LED strip

LED strip can be used as tube light or it can also be used as lights for two wheelers. While assembling you can make a LED strip with all LEDs connected in series. Care should taken while doing the connections. Positive of one LED should not be connected to positive of other LED in series connection. Secondly, you can make AC to DC converter circuit. Also carefully observe the diode and capacitor polarity while mounting them on PCB board as per given circuit diagram.

22uf and 160v capacitor is used in the circuit to increase voltage level and give this to 51 LEDs. This is very important thing in this circuit. One drawback of the circuit is that if one LED gets burned in the circuit then the whole strip will not work. That time you have to check every single LED to detect faulty one.



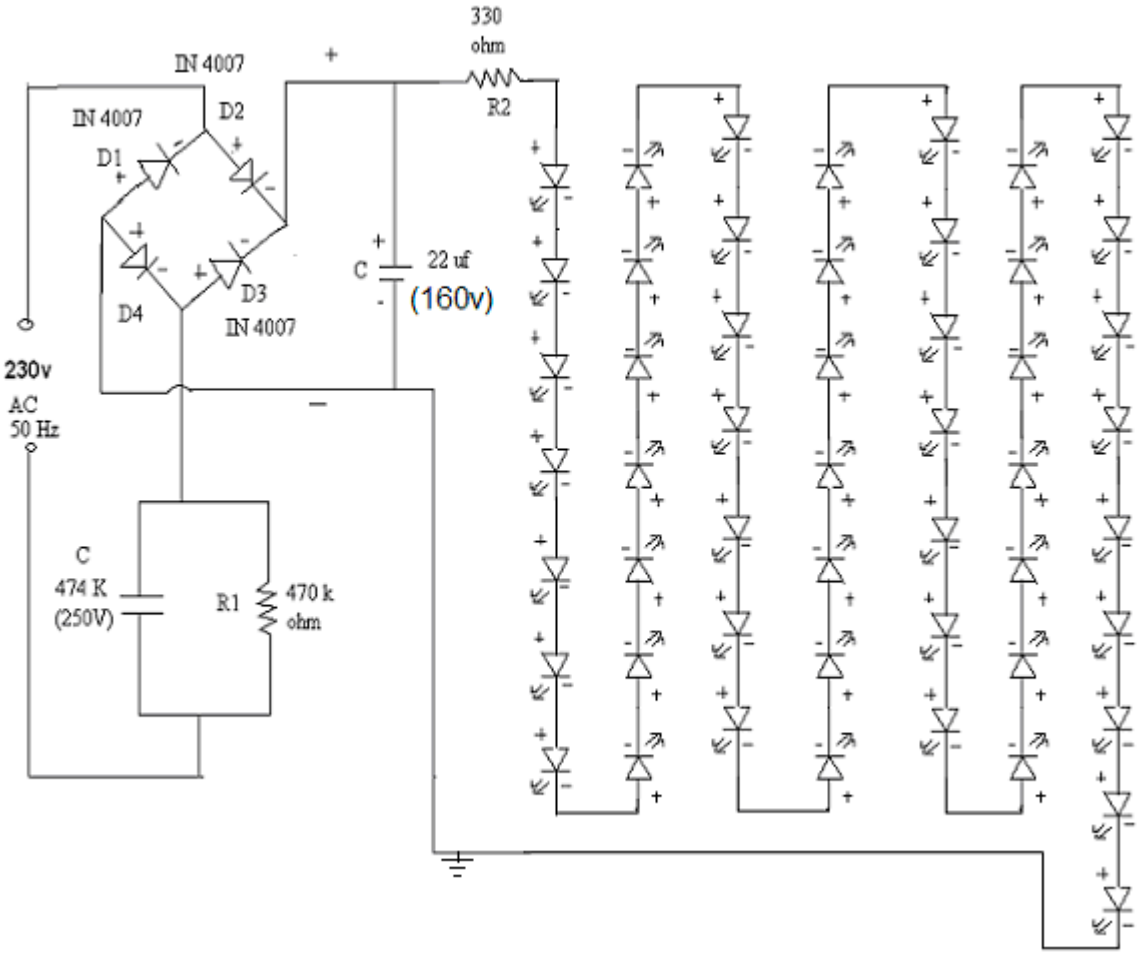


Figure 3.9:- LED strip operate on 230 volt.

Part List

Sr.No	Component name	Value	Quantity
1	LED	White BBR 5MM	51
2	Diode D1 to D4	1N4007	4
3	Capacitor C1 C2	 474k (250v) 22Uf (63v)	 1 1
4	Resistor R1 R2	 470k0hm 330 ohm	 1 1
5	PCB	Circle and square shape	1
6	Wire	multistand	1

1> LED microcontroller
2> Mobile charger

3.10 mobile chargers using pedal power

In rural areas are more loadsheding therefore people can't get time to charger mobile properly .we have to make mobile charger using pedal power. We use dynamo of 12v and 500mA output. The 12v output to step down up to 5.9v and with 400mA this out put given to the cell phone battery.

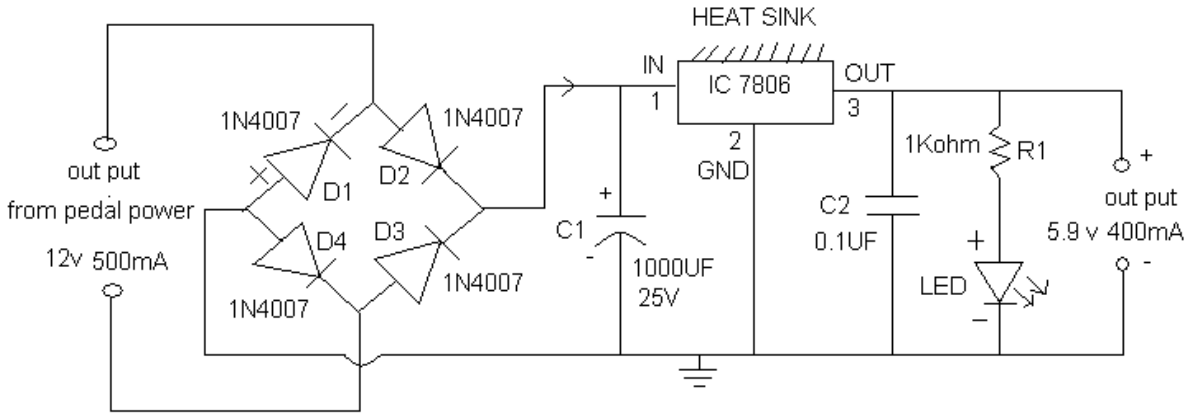
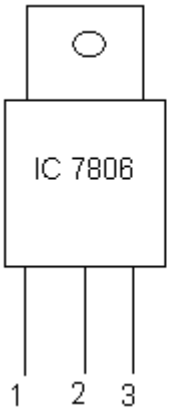


Figure: - mobile charger using pedal power

Pin configuration of IC 7806



pin :

1 INPUT

2 OUT PUT

3 Ground (GND)

Part list

Sr.No	Component name	Value	Quantity
1	LED	White BBR 5MM	1
2	Diode D1 to D4	1N4007	4
3	Capacitor C1 C2	 1000uf (25v) 0.1uf	 1 1
4	Resistor R1	1 k0hm	 1
5	PCB	Square 1.5*2''	1
6	Wire	multistand	½ meter
7	IC (Voltage regulator)	7806	1
8	Dynamo or (12v ac motor)	12v& 500mA	1

Features:-

1) You can charge battery without grid power.
2) Battery charge within 1 hr.
3) Output from circuit is 5.9v with 400mA.

Chapter - 4

CHARGING SYSTEM

Different sources of power can be used to power LED lights. Following are common sources of power to charge batteries for DC lights can be charged using :-
1) Grid Power 2) Solar Power 3) Pedal Power 4) Wind Power .

4.1 Grid Power

Electric supply from Electricity Company is 230V AC. But all electronics component needs DC supply. To charge batteries from 230AC , a charging circuit is required to convert 230v AC into DC.

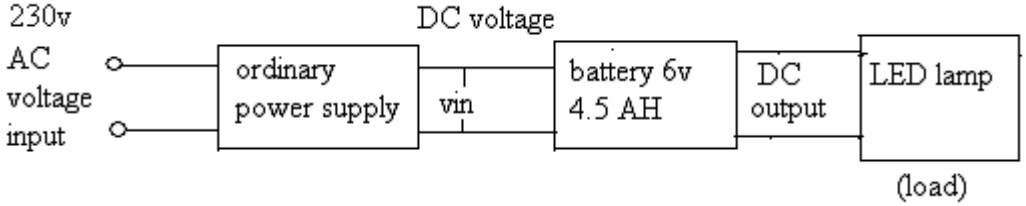


Figure 4.1: - Battery charge using grid power

4.2 Solar Power

Batteries can be charged using solar panel. This system is very use full for remote areas tribal areas.

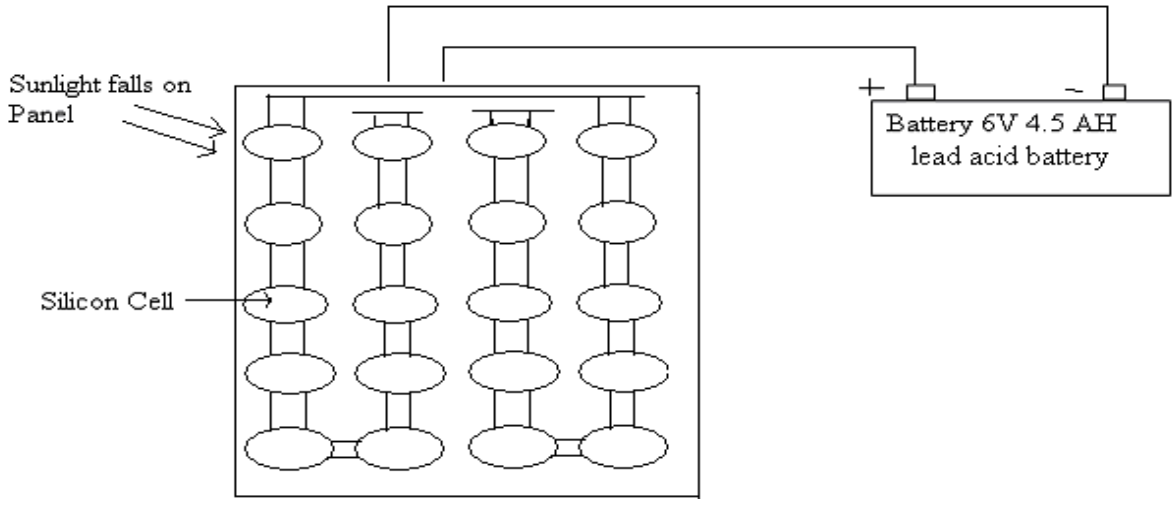


Figure 4.2:- Block Diagram of Charge battery from solar Panel

Selection of solar panel {{CHECK}}

You should be known battery current and voltage then selection of solar panel.

For example: - consider battery voltage is V= 6V & battery current capacity I= 4.5AH.
By thumb rule battery should be charged at following charging rate.

Table : Different battery charging current rate

Sr.no	Battery type	Battery voltage	Battery current rating	Cutoff voltage	Over charge voltage	Battery charging current rate
1	Seal lead acid	6v	4.5 AH	5.2V	6.4V	750mA
2	Seal Lead acid	12v	7.5 AH	10.2V	12.4V	1 AMP
3	Lead acid	12v	32AH	10.2V	12.4V	3 AMP
4	Lead acid	12v	65 AH	10.2V	12.4V	5 AMP
5	AA (alarm cell)	1.5V	180mAH	-	1.6V	30mAMP
6	Polymer (mobile battery)	3.6v	720mAH	2.1V	3.8V	180mAMP
7	PP3 (use in multi meter)	9v	800mAH	7.2V	9.4V	180mAH

To select solar panel. Calculate power need to be generated by the solar panel.
For 6 V, 4.5 AH battery, charging current recommended is 750mA.

Power (P) = battery voltage * battery charging current rate

Power P= V*I = 6 v*750mA

= 4500mw approximately is 5 watt.

We need 5w solar panel for 6v battery.

4.3 pedal power

A normal human being is capable of generating 60W of power. In the past it was not feasible to use human power to light filament lamps. Since it requires more power . But since LED consumes very little power, its possible to use human power for lighting application.

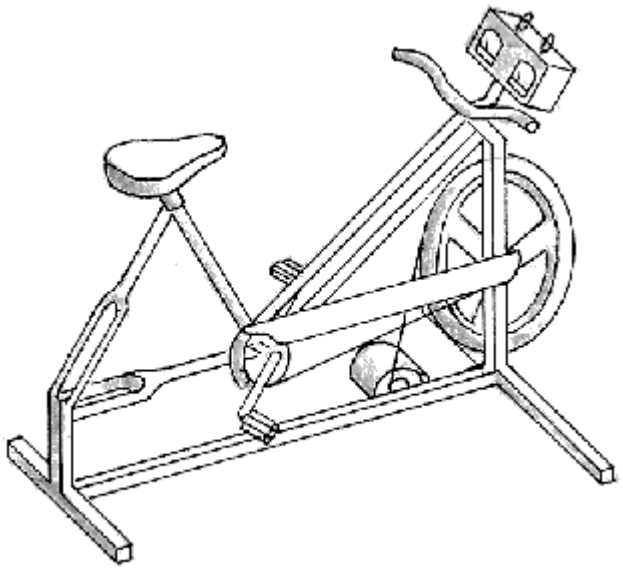


Figure 4.3: - pedal power generator

A Permanent Magnet Generator of 1200-1500 RPM, 6Amp, 12V is suitable for installing on monowheel cycle as shown in the figure. A flywheel is attached to the front wheel to take of variations in pedaling. Such generators can be ordered from Vigyan ashram.
AC alternators used in the automobiles requires high RPM and due to induction it becomes heavier to pedal them. Therefore they are not directly suitable for this application.

A cycle dynamo which can be fitted on normal bicycle gives 6W and 0.5Amp. It can be used for small power application.

4.4 Battery Charger

As discussed above for charging batteries from solar/wind/grid or pedal power, we need charger. Battery charger will be different depending on the input and output voltage. The circuit's shows charger to charge batteries for grid power.

Circuit : Input 230V AC, to charge 6V battery

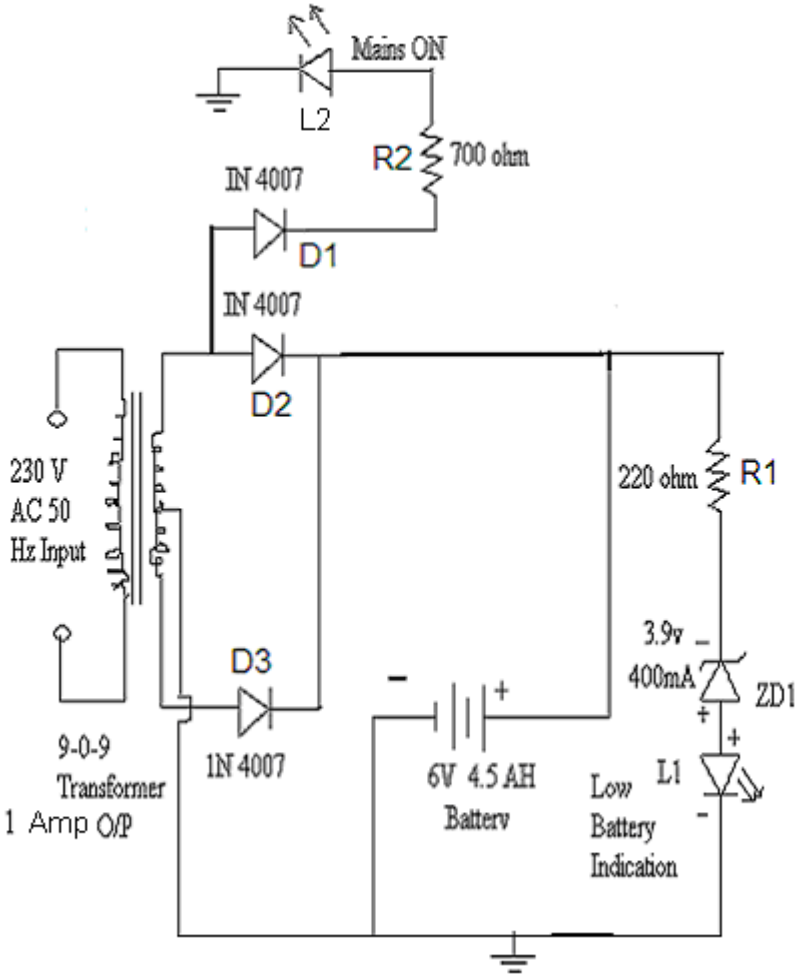


Figure 4.4:- battery charger for 6v battery.

Part list

Sr. No.	Component name	Value	Quantity
1	Diode D1-D3	1N4007	3
2	Resistors R1, R2	220 ohm, 470 ohm	1 1
3	Zener diode ZD1	3.9v 400Ma	1
4	LED L1-L2	White BBR 5mm Green 5mm	1 1
5	Transformer	9-0-9 (1A)	1
6	PCB	2*4 cm	1
7	Wire	Multistand	1 meter

In this charger transformer is used of 9-0-9v with 1A output. Feature of this charger is indicates mains ON, low battery indication. This charger is only compatible for 6v (4.5AH) batteries.

Solar panel / Pedal power ;;;

Solar panel

In the market different type of solar panel available any solar panel need power diode their meaning is current rating of diode become up to 6 Ampere, these are use for reveres current protection from battery. When current draw from solar will stop that time current supply from solar panel therefore diode need for solar panel.

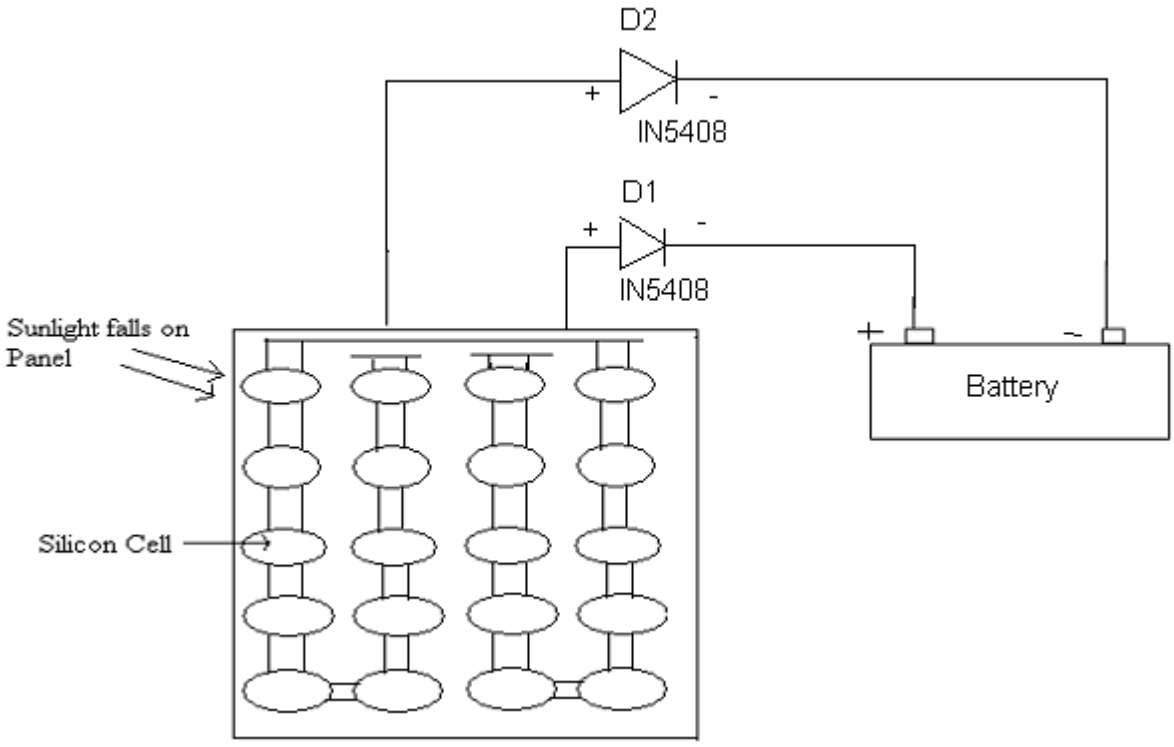


Figure: 4.5 connection for solar panel

Pedal power

If you use alternator then need power diode bridge because alternator output get AC , we required DC voltage for battery charging. The diode convert AC voltage into DC voltage. If you use DC generator then didn't need four diode only use one diode for do not reveres current flow from battery.

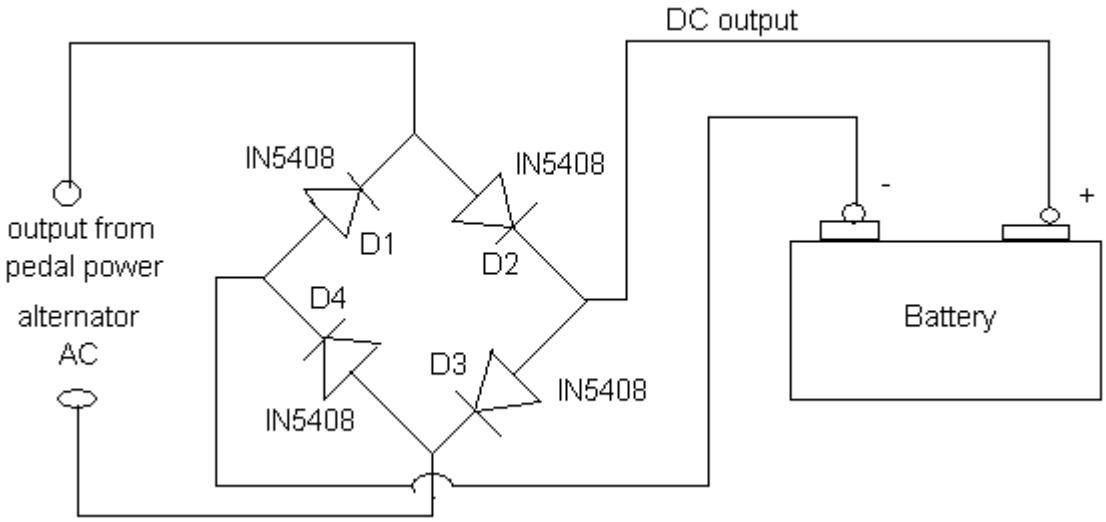


Figure: 4.6 connection for pedal power

Part list

Sr. No.	Component name	Value	Quantity
1	Diode D1-D4	1N5408	4
2	Battery	12v& 65AH	1
3	DC generator	12 v & 5A	1

Chapter 5

BATTERIES

5.1 Introduction

It is important to known basic about batteries and their maintenance. An electrochemical battery or more precisely a cell is a device which converts chemical energy into electricity energy. Dry cell or battery used in the torch or radio having one time use is example of "primary" cell. In secondary cell, the chemical reaction can be reversed repeatedly. Charging and discharging of cell is possible. Chargeable batteries are example of "secondary" cell.

Connections: Batteries can be connected in series and parallel depending on requirement of voltage and current.

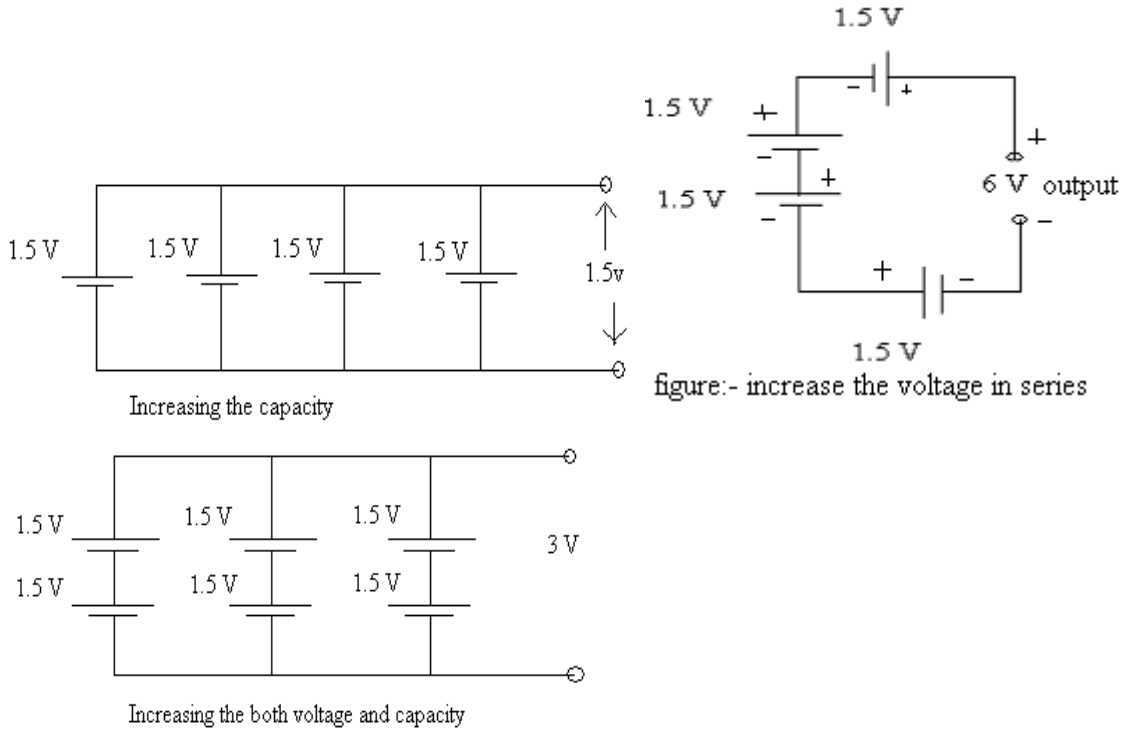


Figure 6.1 battery connect in series and parallel

5.2 Selection of Batteries

Selection of battery based on application (discuss, what about Ni Cd … ??)

Sr.no.	Applications	Battery capacity	Name of Battery
1	Radio	l.5v	AAA Cell
2	Lamp	6v	Seal Lead acid
3	Torch	9v	PP3 battery
4	Emergency torch	6v	Seal Lead acid
5	Mobile	3.6v	Polymer

The Ni Cd (Nickel Cadmium) is material use in PP3 9v general purpose battery. The PP3 means it use for portable device.

All type of information get about battery give following link.
www.answers.com

How to select correct battery for your work.

First of all, you must get to know your device.
What is device's input voltage (V)
What is its power consumption (wattage).
What is maximum current drain (A).
What is your expected running time by a battery?

i) Decide battery voltage: Battery pack voltage must be equal or a little higher than your device voltage need. For an exact voltage, which battery pack cannot provide a DC-DC regulator circuit is used. The battery voltage need for UPS is 12v and 7.5AH, for emergency lamp is need 6v and 4.5AH etc.

ii) Decide battery packs capacity (mAh or AH) : The primary cell capacities indicated in mili Ampere hour (mAh) and secondary cell capacity indicate in Ampere Hours (AH). This indicated amount of current battery can give for one hour. For e.g. 80Amp-hr battery can give 80Amp current for 1 hr.
Battery capacity is depended on how much device's wattage and how long you need to run your device (hours).

Which can be calculated as the follows?

$$(AH) = \frac{\text{Device's wattage (W)} * \text{Time to run (Hours)}}{\text{Battery Voltage}}$$

For Example: - For calculating battery capacity to use 9 watts LED device for 10 hours with 12V battery. Battery capacity is calculated as follows:

Battery voltage is 12v,

Time = 10 hours and device's wattage = 9w.

Calculate current capacity of battery by using given formula as the follows:

$$(AH) = \frac{\text{Device's wattage (W)} * \text{Time to run (Hours)}}{\text{Battery Voltage}}$$

AH = 10 * 10 / 12

AH = 7.5

Battery of 7.5AH current capacity is required.

- Before ordering batteries you must pay attention on maximum discharging rating on the specification or description.Please don't any batteries can take any current.

- You must find out maximum discharging current of the device. If its not available it can be measured by a multi-meter.
- Maximum discharge rate printed on batteries must be higher than needed by device.

Secondary cell **primary cell**

5.3 Maintenance of Batteries

- Avoid over charge and over discharge of batteries. This will increase battery life.
- For sealed maintenance free lead acid batteries, no need to worry about distill water level only ensure you have battery protection circuit and you should keep minimum hours for battery charge.
- For normal lead acid batteries, check distill water level. The distill water level check by gravity meter.
- Insert gravity meter into battery liquid. Distill water in the battery will be absorbed by gravity meter. If distill water indicate on gravity meter 10.2mm for 12v battery then battery is discharged. If levels on gravity meter indicate 12.2mm then battery is fully charged.

- Battery life will increase if you check and maintain distill water level after every 3 month.

Safety Precautions

- According to electric appliance indication please connect battery positive pole and Negative pole correctly.
- Do not charge primary battery i.e. Dry cell.
- Do not heat or disassemble the battery even put it into fire or water.
- If finding exceptional conditions, such as leakage, crack, please stop using the battery immediately.
- Always use charger with automatic power cut-off function when battery is full.
- Never use NiMH battery charger for Li-ion battery pack, it will cause battery exploded.
- Always charge your battery with attention.

5.4 Testing of Batteries

- Overcharge
- Under charge (over discharge)

Over charge

The full charged battery voltage is 12.6v for 12v batteries. When battery voltage reach up to 12.6v then battery charging should be stopped immediately. This is maximum cut off point for fully charged battery.
For 6v batteries, their cut off voltage is 6.4v.

Over Discharge

When voltage level goes down below cut off voltage, battery is called over discharge. For 12v batteries cut off point is 10.2v. For 6v batteries cut off point is 5.2v.
Batteries should not be used below cut off point voltage.

APPENDIX

Electric Bill Calculation

To calculate electrical bill by using KWH method. KWH = Kilo Watt Hours

KW = kilo watt
H = Hour

1000 mw = 1 W
1000 W = 1 KW
Formula = 1000W * 1 H = 1 unit

Kilo Watt * Hour * Day = unit * Rate = Bill
If 1000 watt is consumed by any equipment in hour then 1 unit of electricity gets consumed.

Example: - If 4 Tube light are ON for 8 hours a day and per tube light electricity consumption is 40 W, 12 bulbs are ON for 2 hours per day and per bulb consumption is 200W
and 1 LED lamp is ON for 12 hours a day and consumes 2 W power. Then you can calculate using above data electricity bill for one month.

Per day power consumption
1) Tube lights: 4 tube lights * 40 Watt per tube * 8 hrs per day = 1280 W
2) Bulbs: 12 bulbs * 200 Watt per bulb * 2 hrs per day = 4800 W
3) LED Lamp: 1 lamp * 2 Watt per lamp * 12 hrs a day = 24 W

Total power consumption per day = 1280 + 4800 + 24 = 6104 Watt

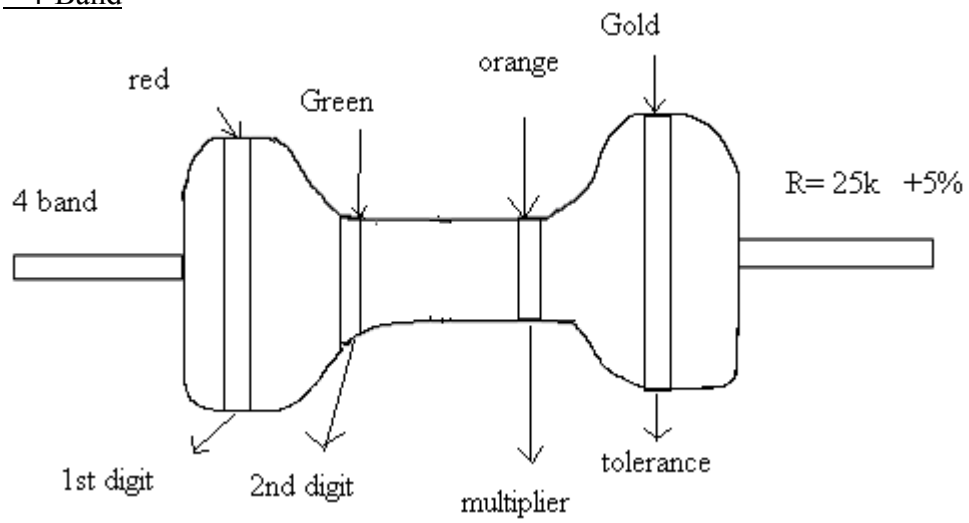
Power consumption in 30 days in a month = 6104 * 30 = 183120 watt

i.e 183120 / 1000 = 183.12 KW

Understanding Resistor Label

Metal Oxide and carbon film:

* 4-Band



How to calculate resistor value

Color	Red	Green	Orange	Gold
Values from Table	2	5	3	5%

Resistor (R) = 25*1000(1K)
= 25000
R = 25Kohm and 5% tolerance

Internet resources for the LED

The following web sites provide useful information about LED.

1) www.kwalityindia.com
2) www.globalsources.com
3) www.superbrightleds.com
4) www.ledsupply.com
5) www.eled.com
6) www.globalspec.com
7) www.howstuffwork.com
8) www.electronics-lab.com
9) www.candlepowerforums.com

Batteries Manufacturer

1) M.S. Enterprises
   Address: - 14/4 Anand Industrial Estate.
   Anand Nagar, Bhosari, Pune-26
   Tel.no.20- 27124324

2) Sanvin Enterprises
   Address: - 408/1, Gultewadi, swargate,
   Pune-Satara Road, Rune-37
   Tel.no. 20-24267182 / 24272049

Battery wholesaler

1) Alight Enterprises
   Address- 508 budhwar peth. Opp. Trao shop lane, pune.

Solar panel manufacturing

2) Ecosolar systems (India) Ltd.

   Address- 177 a/2, pune –sinhgod rd, parvati, pune-30

Tel. No. 20- 4336999/4330442

3) Machinocraft (pune) pvt. Ltd.

Address- 15/4A, vasudeo estate, pune satara rd, pune -43.
Tel. No. 020-4371457

4) Bonduct processors pvt Ltd.
Address- prerana 21, 44/2 amar soc erandwara, pune-4
Tel. No. 020- 5437843.

All type of electronic components wholesaler

1) pioneer Electronics

Address- 508 Budhwar peth, opp. Lane of Dena bank, Pune- 02

Tel. No. 020- 24458257, Fax- 24495336
Email- pioneer_tech@vsnl.net
Web - www.pioneerpune.info

2) Trinity electronics

Address- soba market, ground floor, 463/64,
Budhawar peth, near posodya vithoba mandir, pune.

Tel. No. 020- 66019647
Email- trinitieelectronic@hotmail.com

3) Gala Electronics
(VEGAKIT available)
Address: - 20, 1st floor kalpana building, 357,
lamington road, Mumbai-07

Tel. No. 022 - 23879562, 23854510, 23823550
Email- vega63@vsnl.com
Web – www.vegakitindia.com

Plastic cabinet wholesaler:-

1) Monoj trading corporation.

Address: - shop No. 14, soba market, 463 budhwar peth, pune-02.

Ph. No. : - 020-24483964, mobile: - 9822421042.

2) Hemil plastics

Address: - 1019, budhwar peth, opp. Shukarwar peth police chowki,
Lane opp. Shrinath talkies. Pune-2.

Ph. No. : - o20-24472146

4.8 comparisons

Sr.no	Luminous flux light output	Incandescent	CFL	LED Lamp
1	200 lm	25W	5-6 W	1.8-2W
2	450 lm	40W	8W	6W
3	600-700 lm	60W	14W	12W
4	950 lm	75W	18-20W	-
5	1200 lm	100W	20-25W	-
6	1600 lm	125W	26-30W	-
7	1900 lm	150W	35-42W	-

In the given table the incandescent, CPL and LED lamp light out put is same of 200 luminous flux (lm), but power consumption is different CFL consume ¼ watt power than incandescent bulb and LED lamp consume 1/3 watt power than CFL.

The 60w bulb light out put is 600 to 700 (lm) same luminous output from CFL & LED Lamp but power consumption is different.

We have made CFL at Vigyan ashram in pabal. It is features such as, when burn PL tube that time you can easily replace, the one of the component burn in CFL lamp that component can be easily available in the market.