

# JADAVPUR UNIVERSITY

Faculty of Engineering & Technology

... Electronics ... Engg. Laboratory

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Class (SE-VG1) Sec A1 Roll No 002310501030

Date of Experiment 18/12/2023 Date of Submission 8/1/2024

Marks Obtained ..... Signature of Examiner .....

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Experiment No. 01-A

Commence at 11:00 AM

Completed at 2:00 PM

Name of Teacher concerned

TITLE: Familiarization of various electric components and devices

OBJECT :

Title:- Familiarization of various electric components and devices.

Electric Components:-

Generally electric components are classified into two types:-

- Passive components - Not capable of processing an electrical signal such as amplification, oscillation, modulation, etc but aid the active components in functioning. The behaviour of them are Linear.  
E.g. - resistor, capacitor, inductor, transformer.
- Active components - Components which process when signal passes through it. This process may be amplification, modulation, frequency conversion etc. Their behaviour is non-linear.  
E.g. - transistors and diodes

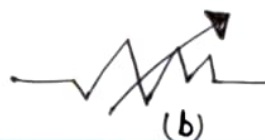
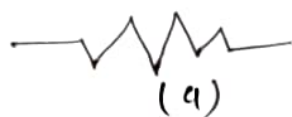
An electronic circuit becomes an electric circuit when it has one or more active component(s). However, an active component all alone cannot perform any useful function.

Resistors:-

A resistor is a device which provides a force opposing the charge-flow in a circuit. This opposing force is called resistance ( $R$ ), measured in ohms ( $\Omega$ ). It is of two types:-

- Fixed value resistor:- Carbon resistor, wire-wound resistance
- Variable resistor:- Potentiometer

Symbols:-

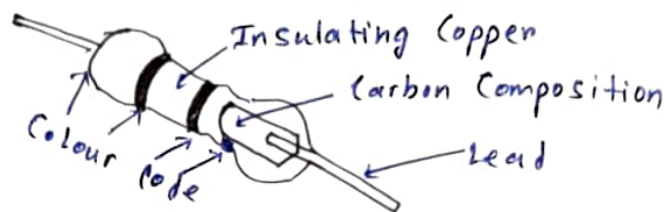


### A. Carbon Resistor

Carbon resistors are fixed value resistors, mainly made up of carbon-clay composition covered with a plastic case. The Lead is made of tinned copper.

#### (i) Identification of resistance value :-

Value of resistor of a particular carbon resistor can be identified from the colour code on its body.



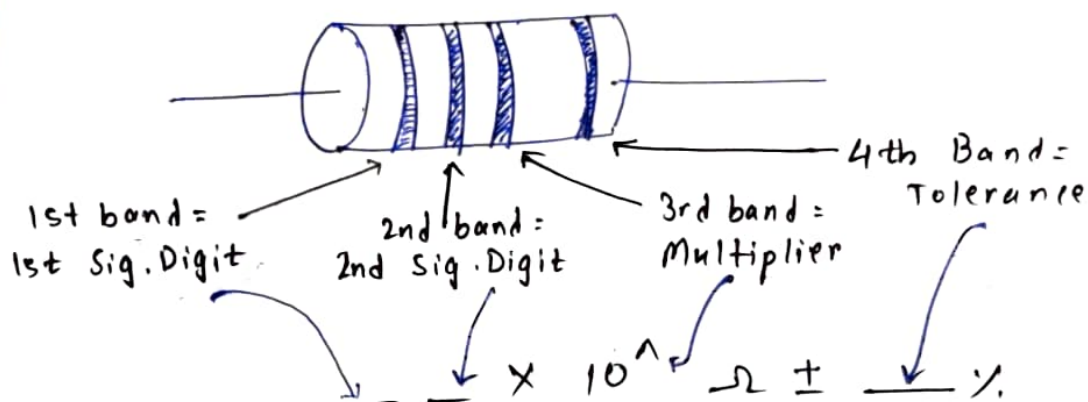
#### (ii) Codes of resistance:

Colour Code →

Colour	Black	Brown	Red	Orange	Yellow	Green	Blue	Violet	Grey	White
Number	0	1	2	3	4	5	6	7	8	9

Tolerance Level code →

Colour	Golden	Silver	No colour
Tolerance	$\pm 5\%$	$\pm 10\%$	$\pm 20\%$

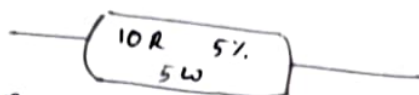


### B. Wire-wound resistance

Type of fixed value resistors made by winding a thin metal alloy wire (Nichrome) or similar wire onto an insulating ceramic former in the form of a spiral helix similar to the film resistors.



The resistance of a wire bound resistor is mentioned on its body.



### C. Potentiometer

It is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

Symbols-



American Standard



International Standard

(Potentiometer Symbol)

### Identification of max. resistance of potentiometers

The max. value of resistance that some particular potentiometer can achieve is mentioned on its body. For e.g. - if a potentiometer has max. R of  $2\text{ k}\Omega$ , it means the resistance can be varied from 0 to maximum of  $2\text{ k}\Omega$ .

### Capacitors/Condenser

It is a passive two-terminal electrical component used to store energy electrostatically in an electric field. They can be of diff. types-

- (i) Electrolytic (ii) Non-electrolytic

Symbols-



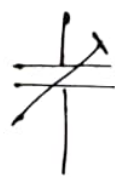
Fixed non-electrolytic



Fixed electrolytic (ANSI)



Fixed electrolytic (DIN)



Preset



Variable

A. Mica Capacitor - This is a special type of capacitor made by coating of two sides of a small porcelain or ceramic disc with silver and is then slacked together to make the capacitor.

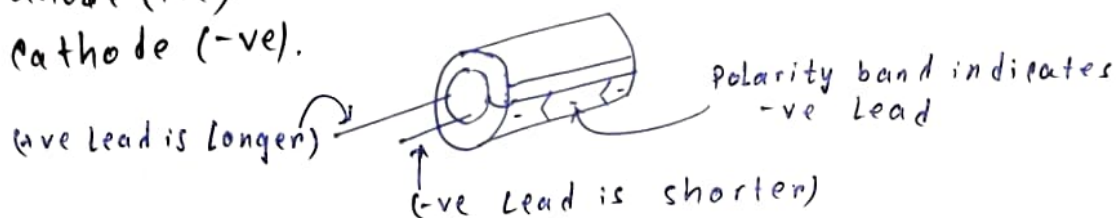
(i) Determination of capacitance value

In case of this type of capacitor, a three-digit code is printed onto their body which represents the capacitance value in picofarad (pF) units. The first two digits are abscissa while third digit is ~~abscissa~~ exponent.

E.g. - If code printed on the body of mica capacitor be 154, then  $C = 15 \times 10^4 \text{ pF} = 0.15 \mu\text{F}$

(ii) Identification of Polarity

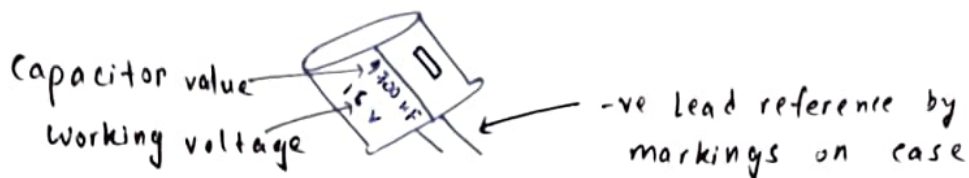
A very easy way to determine the polarity is to compare the lengths of cathode & anode lead. The anode (+ve) terminal lead is longer in size than cathode (-ve).



B. Electrolytic Capacitor - These types of capacitors are mostly used when a very large capacitance values are used.

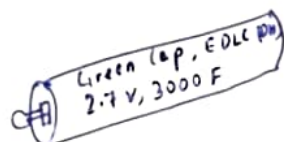
(i) Identification of capacitance value and polarity

For electrolytic capacitors, the value of the capacitance is mentioned onto its body. Polarity determination method is same as mica capacitor. Also, the polarity is marked clearly with a -ve sign to indicate the -ve terminal & this polarity must be followed.



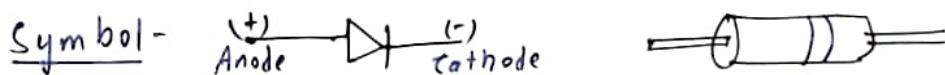
### C. Ultra - Capacitor

Also called a super-capacitor, it is an electrical component capable of holding hundreds of times more electrical charge quantity than a standard capacitor. This characteristic makes ultracapacitors useful in devices that require relatively little current and low voltage.



### Diode

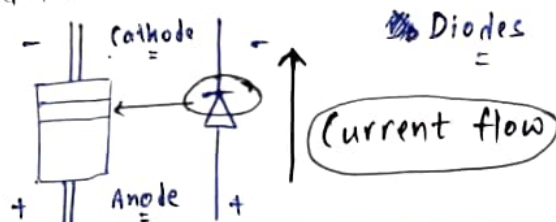
It is a two terminal electronic device allowing current to move through it in one direction with far greater ease than in the other. Diode has low (ideally zero) resistance in one direction and high (ideally infinite) resistance in the other direction.



(A) Silicon Diode :- It is made from silicon (Si) and the 'p-n' junction properties are utilized for the conduction of current (pentavalent doping agent on n-side and trivalent doping agent on p-side)

### Identification of polarity

Si diodes are covered in black plastic - cases and the cathode terminal with silver strip.





B. Germanium Diode:- Made from Ge and it conducts current in forward-biased condition, just like Si-diode.

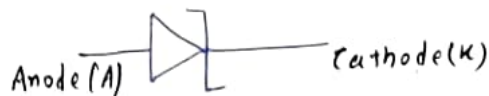
Identification of polarity

Ge diodes are generally glass diodes (kept inside glass cases). The cathode is marked with black band.



C. Zener Diode:- Also called breakdown diodes, these are specially doped PN junction diodes that allow current to flow both in forward and reverse direction, but Zener-diode is designed to act in reverse bias condition mainly.

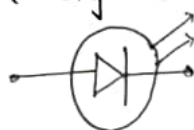
Symbol



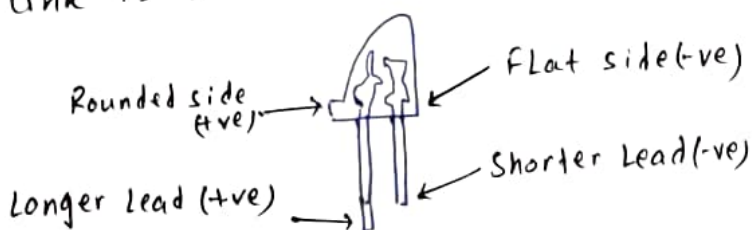
Identification of polarity:- Cathode is marked with black stripe

D. Light Emitting Diode (LED):- LEDs are a kind of p-n junction diode working in forward bias condition. The energy released by recombination of electron-hole pairs produce photon of monochromatic light.

Symbol:-



Identification of polarity:- All modern LED have their cathode (-ve) identified by either a notch or a flat spot on the body. Also, the cathode lead link is shorter than the anode lead.



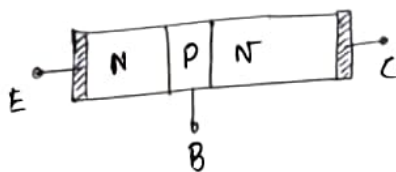
Transistor:- It is the main building block element of electronics. It is a semiconductor device used to amplify or switch electronic signals and electrical power. They can be of diff. types -

- (a) Bipolar Junction Transistor (BJT) and
- (b) Field effect Transistor (FET)

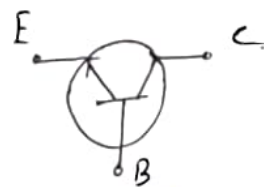
### A) BJT

It has three terminals corresponding two-three layers of semiconductor: Emitter, Base and Collector.

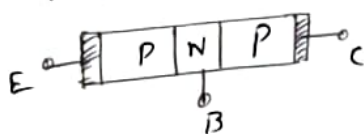
Symbol:-



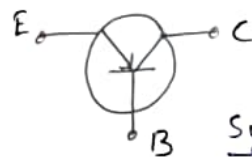
(a) NPN Transistor



Symbol



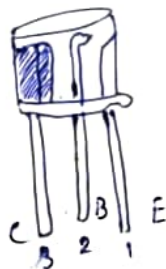
(b) PNP transistor



Symbol

Identification of emitter, base & collector: It is done by observing the position of notch. The emitter is situated closest to the notch.

A better way to identify is: the collector pin is attached with an aluminium cap and shorted to the heat sink because the heat dissipation by collector is maximum. Other two pins are attached with insulated cap. Emitter will be exactly opposite to the collector.



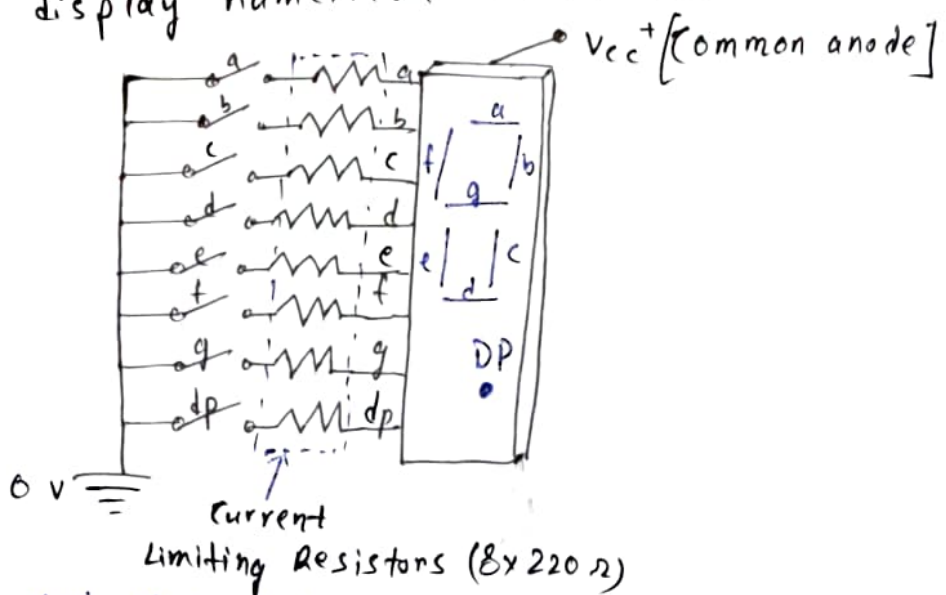


B) Power Transistor :- It is a kind of BJT, but larger in size, used in high power amplifier and power supplies. They are suited for application where a lot of power is being used. It is a junction transistor, designed to handle high current and power and also used in radio and switching circuits.



### Seven Segment Display

It consists of seven LEDs (segments) arranged in a rectangular fashion. When illuminated, the segments form a part of numerical digit (both decimal and hexadecimal). This display is an alternative to more complex dot matrix displays, widely used in digital clocks, electronic meters, basic calculators and other electronic devices that display numerical information.

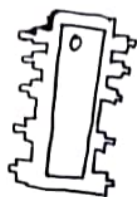


### Integrated Circuit (IC)

It is a complex layering of semiconductors, coppers and other interconnected materials to form resistors, transistors and other components. The cut and formed

combinations of these wafers are known as a die.

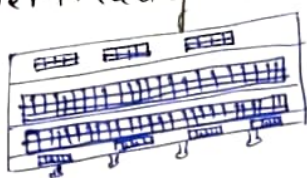
Symbol:-



Identification of pins: ICs commonly have 8, 14, 16, 18 or 28 pins. The pins are numbered from 1, starting from left side. Keeping the IC with the half-moon shaped notch fitting from the left-hand side, the pin just below the notch is pin 1. Then moving in anti-clockwise directions, pins are numbered 2, 3 and so on. The last pin is at the opposite side of pin 1.

Breadboard/Photoboard

It is a solder-less device used for temporary prototype as a construction base for electronics and test-circuits design. Here, the holes of the two rows both at the top and bottom are connected horizontally. Remaining holes are connected vertically in each column.



Multi-meter:- It can measure multiple electrical properties (voltage, R and  $I \rightarrow$  Volt ohm milliammeter (Vom)). Some feature the measurement of additional properties like temp. and volume. It is of two types-

- (a) Analog:- It uses a micro-ammeter with a moving pointer to display readings, useful for monitoring a rapidly varying value.
- (b) Digital:- They have a numeric display & more common due to low cost and high precision.