testing circuits

9. **Breadboard :**

A breadboard is a solderless device used for temporary prototype with electronics and test circuits can be inter connected by inserting their leads or terminals into the holes and making connections through wires were appropriate.

The breadboard has a stripe of metal under the board and connect the holes on the top of the board. The metal strips are laid out as they are kept.

It is the bread and butter of DIY electronic breadboards, allow beginners to get acquinted with circuits without the need of soldering. Typically string clips are rated for 1 amp of 5V and 0.33A at 15V. The edge of the board has male and female notches. So. boards can be clipped together to make large board.

Conclusion: Following experiment helped us to be familiar with basic electronic devices and their functioning as well as some of their applications.

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7. Digital storage oscilloscope: A digital storage oscilloscope (DSO) captures, stores and analyzes the electrical signal by converting them into digital format. The digital signal can be stored in memory and processed using digital techniques.
DSO feature ability to store waveform display them on high resolution screen, and provide advanced measurement and signal processing capabilities.
Working:
They work by converting an analog signal into digital format storing it in memory, processing it with digital technique and displaying processed signal for analysis.

8. Multimeter :
A multimeter or a multitester, also known as VOM (volt-ohm-milliammeter) is an electric measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure, current and resistance. Analog multimeters are used as micrometer and with moving pointer to display reading.
Properties:
Any meter will load the circuit under test to some extent. For e.g., a multimeter using a moving coil with full scale deflection current 50 μA the highest sensitivity commonly available.
Test leads are flexible, insulated wires (red for +ve, black for -ve) that plug into DMM. They serve as the conductor from the item being tested to the multimeter. The probe tips on each lead are used for

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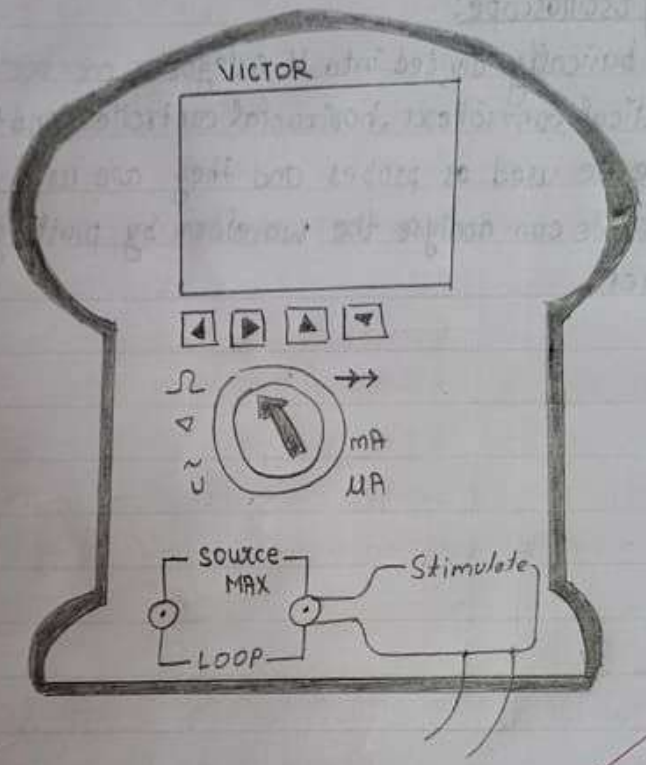

Fig 1.6 Multimeter

5. Transistors: It is a three terminal semiconductor device, consisting of p-n junction formed by sandwiching a thin layer of n-type semiconductor. This type of semiconductor is known as 'p-n-p' transistor. On the other hand, when a layer of p-type semiconductor is sandwiched between two layers of n-type semiconductor material, it is known as 'n-p-n' transistor.

6. Function generator: A function generator is a signal source that has the capacity of producing different types of waves form such as sine wave, square wave, triangular wave. The frequency of such waveforms may be adjusted from a fraction of Hertz to several hundred kHz.

(a) Sine wave:
A function generator normally have the capacity to produce a standard waveform (sine) wave output. This is the standard waveform that oscillates between two levels with a standard sinosoidal shape.

(b) Square wave:
A square wave is relatively easy for a function generator to produce. It consists of a signal moving directly b/w high and low level.

(c) Triangular wave:
This form of signal linearly moves between a high and low points.

(d) Saw-tooth wave:
This is a triangular waveform but with a rise edge of waveform faster or slower.

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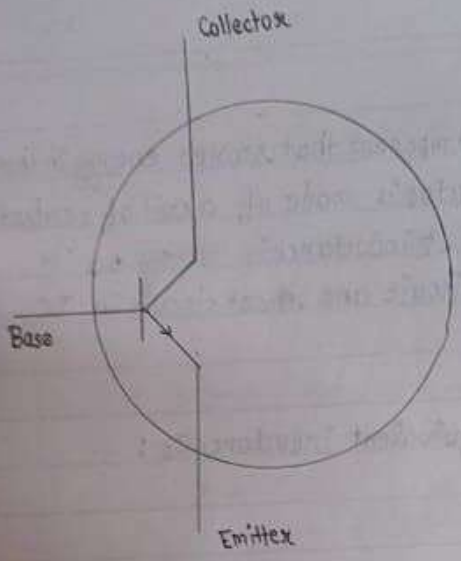
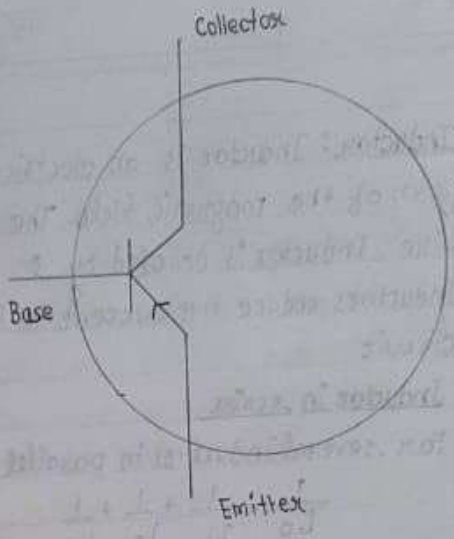


n-p-n Transistor



p-n-p Transistor

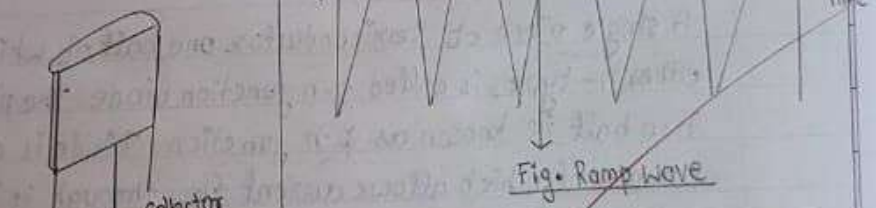


Fig. Ramp wave

Fig. Square wave

Fig 1.5 Transistors

3. **Inductor:** Inductor is an electrical component that stores energy in the form of the magnetic field. The inductor is made of a coil of conducting wire. Inductor is denoted by 'L'. Unit of inductance is 'Henry' or 'H'. Inductors reduce the current in AC circuit and short circuit in DC circuit

Inductor in series

For several inductors in parallel, equivalent inductance is:

$$\frac{1}{L_p} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

4. **Diode:** A diode is a two terminal electrical component with asymmetrical conductance. It has low (ideally zero) resistance to current flow in one direction, and high (ideally infinite) resistor in other.

P-N Junction diode:

A single piece of semiconductor one half of which is p-type and other n-type, is called p-n junction diode. The plane dividing the two halt is known as p-n junction. Diode is also an electronic component which allows current flow through it in one direction but not in opposite direction. The current flows through a diode when the negative. The main function of a diode is "rectification".

Zener diode: It is a reverse biased heavily doped p-n junction diode, which is operated in the breakdown region. It is used for meter protections and as a voltage regulator.

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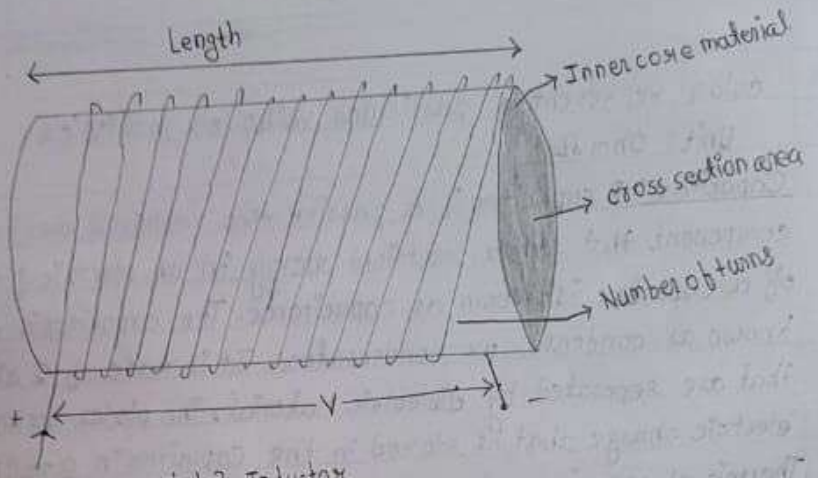

Fig 1.3 Inductor

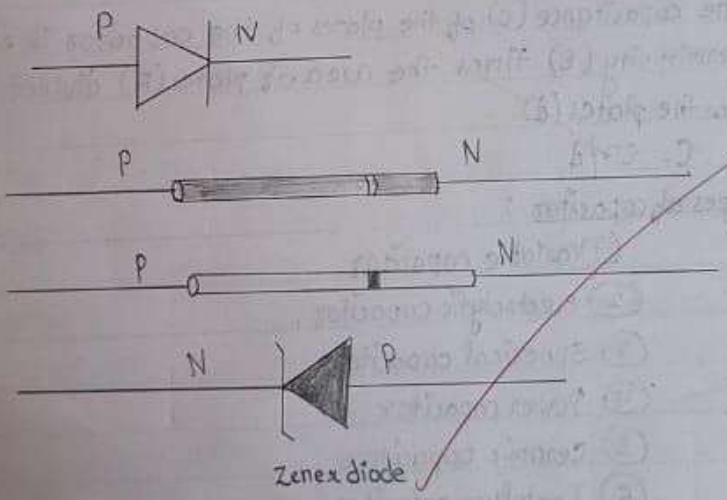

Fig 1.4 Diodes

color represent a particular value or multiplier.
Unit: Ohm Ω

2. Capacitor: A capacitor is a passive two terminal electronic component that stores electrical energy in an electric field. The effect of a capacitor is known as capacitance. The capacitor is originally known as condenser or condensator. It is made of 2 close conductors that are seperated by dielectric material. The plates accumulate electric charge that is stored in the capacitor in a voltage of 1 volt The unit of capacitance is "Farad". The capacitor disconnects current in DC and short circuit in AC.

Capacitance of plates of capacitor:
The capacitance (C) of the plates of the capacitor is equal to the permittivity (ε) times the area of plates (A) divided by the gap b/w the plates (d)

$C = \varepsilon A / d$

Types of capacitor:
1. Variable capacitor
2. Electrolytic capacitor.
3. Spherical capacitor
4. Power capacitor
5. Ceramic capacitor
6. Tantalum capacitor.
7. Mica capacitor.

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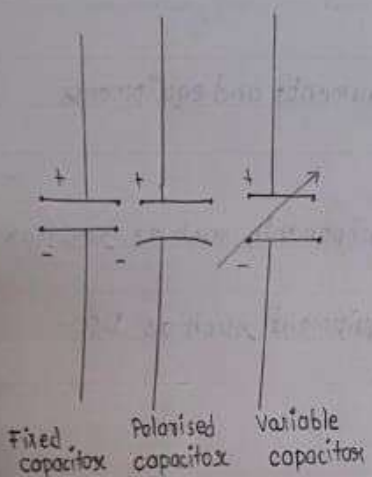

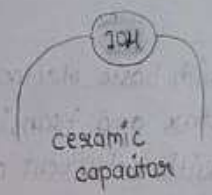

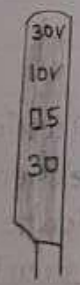

Fig 1.2 Types of capacitors

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Aim: Study of electronic component, instruments and equipments.

Aim of experiment:

(a) To get familiar with basic electronic components such as resistor, capacitor, inductor and transistor.

(b) To get familiar with instrument and equipment such as DSO, DMM, FG.

Requirements:

Resistor, capacitor, diodes, transistors, DMM, function generator.

Theory:

1. **Resistor:** A resistor is a passive two terminal electrical component that implement electrical resistance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor terminals. The relationship is given by

$$V = IR.$$

The electrical behaviour of a resistor obey Ohm's law for constant resistor. However, some resistor are sensitive heat, light or other variables. Most are color coded.

Resistors are broadly classified into

① Fixed resistor

② Variable resistor.

Color coding: The resistors are coded with different colours. Each

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Colox	Significant figuxes			Multiply	Tolexance	Temp. coeff.
Black	0	0	0	$\times 10^0$		2.5(U)
Bxown	1	1	1	$\times 10^1$	1(F)	100(S)
Red	2	2	2	$\times 10^2$	2	50(R)
oxange	3	3	3	$\times 10^3$		15(P)
Yellow	4	4	4	$\times 10^4$		25(Q)
Gueen	5	5	5	$\times 10^5$	0.5(D)	20(Z)
Blue	6	6	6	$\times 10^6$	0.25(C)	10(Z)
Violet	7	7	7	$\times 10^7$	0.1(B)	5(M)
Gxey	8	8	8	$\times 10^8$	0.05(A)	1(K)
White	9	9	9	$\times 10^9$		
Gold				$\times 10^{-1}$	5(J)	
Silvex				$\times 10^{-2}$	10(K)	
					20(M)	

Table 1.1

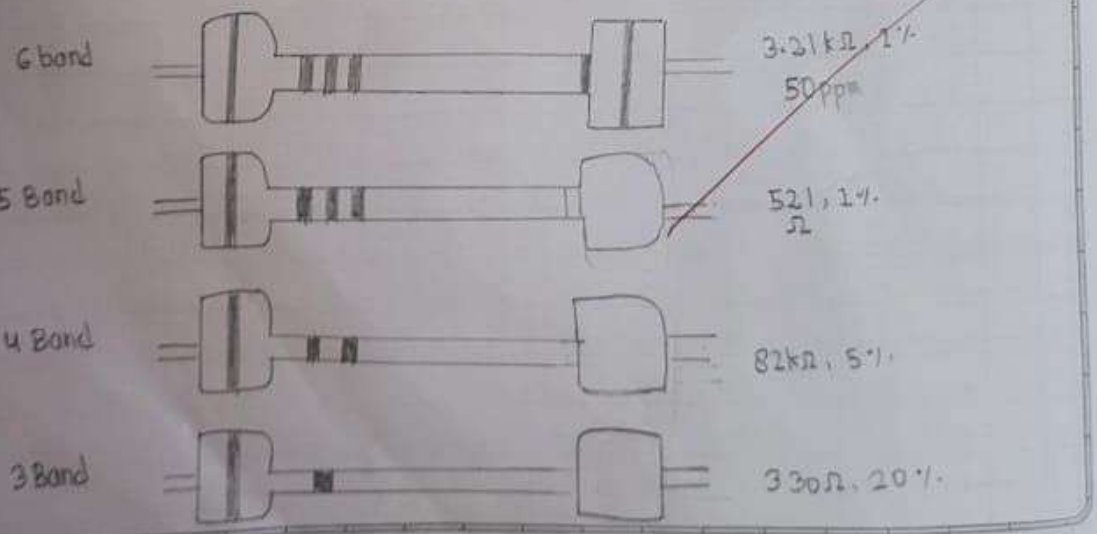

Fig 1.1