R, C, L, diode

EXPERIMENT NO. 1

AIM: Identification, symbolic representation and testing of various electronics components.

APPARATUS: PN Junction, Zener diode, LED, multimeter, transistor

THEORY:

Some of Electronic components used in electronic circuits are: - Diodes, Transistors, LED'S Pho- to diodes, IC'S, Rectifying bridges.

Diodes

Diodes are usually made from semiconductor materials, Silicon and Germanium being the most common. In electronics, a diode is a two-terminal electronic component that conducts electric current in only one direction. The term usually refers to a semiconductor diode, the most common type today. Diodes are fabricated from semi-conducting material. They have two leads: cathode (k) and an anode (A). The most important property of all diodes is their resistance is very low in one direction and very large in the opposite direction.

When a diode is placed in a circuit and the voltage on the anode is higher than the cathode, it acts like a low value resistor and current will flow. If it is connected in the opposite direction it acts like a large value resistor and current does not flow. In the first case the diode is said to be "forward biased" and in the second case it is "reverse biased." The symbolic representation of di- ode is shown in below figure 1.

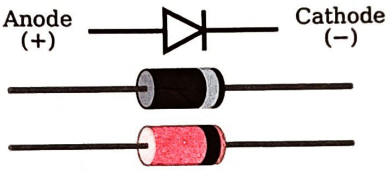


Fig 1. Symbolic representation of diode

The unidirectional behaviour of diode is called rectification, and is used to convert alternating current to direct current. However, diodes can have more complicated behaviour than this simple on- off action. These are exploited in special purpose diodes that perform many different functions. For example, specialized diodes are used to regulate voltage (Zener diodes), to electronically tune radio and TV receivers (varactor diodes), to generate radio frequency oscillations (tunnel diodes), and to produce light (light emitting diodes).

Testing of Diode using Multimeter:

Diodes can be tested using a multi meter. It is normally the resistance of the diode in both forward and reverse directions that is tested. There are however a number of points to remember when testing diodes. Digital Multimeters can test diodes using one of two methods:

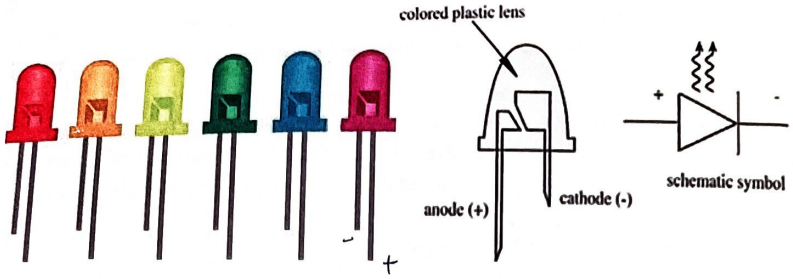


Fig 4. Types of LED & symbol

The cathode lead is identified on the body by a flat-spot on the side of the LED. The cathode lead is the shorte lead. LED can be tested in a similar way as that of p-n junction diode.

Zener Diode: => allowed reverse bias only some ✓ current ⇒ then it will be ~~normal~~ stop current

A Zener diode is a silicon diode that is optimized to conduct when it is reverse-biased. This article presents ways to identify one.

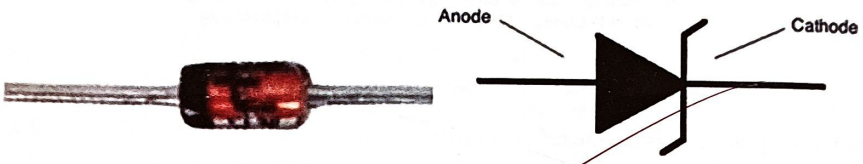


Fig 5. Zener diode and its symbol

A Zener diode is a silicon diode that is optimized to work in what is known as the breakdown region. This mean they are able to conduct when they are reverse-biased. This is unlike normal diodes, which will self-destruct. Zener diode's breakdown voltages can range from 2 to 200 volts, making it useful in a variety of applications.

One popular usage is that of a voltage regulator. This is due to the Zener's ability to maintain constant output voltages when there are current changes in the circuit. This makes Zener's ideal as inputs to other circuits, as voltage references for op-amps.

Testing of Zener diode using multimeter

1)Anode-Cathode Diode Resistance Test:

Using multimeter select the resistance function place the positive probe on the anode of the diode and the negative probe on the cathode of the diode (the black strip), as shown Figure 6 below. The diode hundred thousands of ohms should read a moderately low resistance, maybe a few Meter may read around 450kΩ.

2) Cathode-A

Using the sa multimeter i the diode example, t high. A hea resistance in

Testing of
A second te the Zener d of the Zene

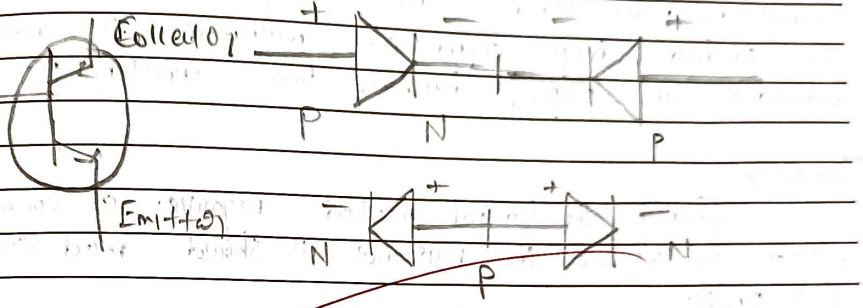
As shown i

PROCEDURE:

Diode Testing:

1. Keep Multimeter Knob at testing point
2. Connect Multimeter positor terminal to anode
3. Connect Common terminal to multimeter to Cathode terminal
4. Multimeter Shows Same readings then the diode is in Working Condition

Transistor Testing:



1. Transistor is a two diode terminology
2. This is represented by three terminal of transistor emitter and Collector
3. It is of two types PNP and NPN
4. To test tranistor Whether it is in PNP or no. Select multimeter knob at diode testing point

Collector multimeter Common terminals of transistor and positive terminal of multimeter is Connected to other of remaining two terminal. If multimeter Shows reading then transistor is PNP

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tive lead once
low resistance
most like forward

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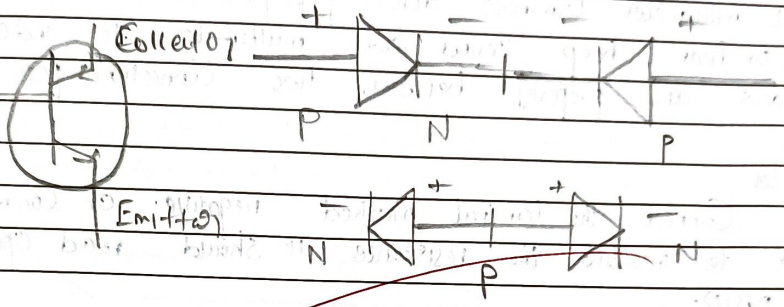

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Collector multimeter Common terminals of transistor and positive terminal of multimeter is Connected to other of remaining two terminal. If multimeter Shows reading then transistor is PNP

Connect multimeter positive terminal to middle terminal of the transistor and Negative to either of two Sides of terminals when it shows Some reading then the transistor is NPN

Continunity Check

It is used to find Connections between Component on PCB
Keep multimeter knob at speaker x diode Symbol
Connect multimeter terminals across pcb path
If u hear beep Sound from multimeter it indicates Connections are properly between two Connection pcb

Transistor:

Connect the terminal marked negative or Common to Collector to measure the resistance it Should read open Circuit It is pNp.

Colour Coding resistor

Hold the resistor So the tolerance band is on the right Starting from the left note the Colour of band in Sequence
use a resistor Colour Code there to identify the first 3 band Colours & their Corresponding values
Use the fourth band's Colour to determine the multiplier
The multiplier is the number of Zeros that follow the four 3 band's
By the following formula we Can get the value
1st digit value x 100 + 2nd digit value x 10 x 3rd digit value x multiplier

CONCLUS
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diode

Questions:
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2. Wh
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CONCLUSION:

By performing above experiment we can conclude that identification symbolic representation & testing of semiconductor diode. Zener diode, LED, transistor and Studiod using digital multimeter

Questions:

1. **Explain Thyristor in Brief.**
2. **What is difference in NPN & PNP Transistor?**
3. **Write application of Diode, Transistor, FET.**

1. Thyristor is a solid state semiconductor device with four layers of alternating as an N-type materials. It acts exclusively as a bistable switch on codition. When the gate recives a currents triggers & continuinity. to conduct until voltage across the devices is reversed biased until voltage is removed

2. NPN Transistor

Transistor in which 2N-type layers are separated by one p-type layer

→ Negative - positive - Negative

Current is from Collector to emitter

PNP Transistor

Two blocks of p-types semiconductor are separated by one block of N-type semi-conductor.

positive - Negative - positive

3 Application of Diodes

Rectifying a voltage, Such as turning the Ac into DC voltage Regulation, Signals isolation, temperature. Sensors Clamping & limiting

Applications of transistors

Transistors are used in digital & analog Current or a Switch used in signal amplification device cellular phones would be one of the most widely used it can also be used as power regulations & Ic Controller.

Applications of FET:

low noice, amplifier buffer amplifier Cascodes amplifier analog switch clapper multimeter, Current limiter phase Shift Oscillation

=) green, blue, black, black brown

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Multimeter → Black → com &

Resistor Colour Code

Colour	Digit	multiplier	Tolerance %
Black	0	10^0	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
none			20.

BBROY goes to bombay via Jaipur, my india

orange
BBOG — Gold
Brown Black

$11 \times 10^3 \pm 5\ \%$

EXPERIMENT NO. 2

AIM: Study of Digital Multimeter and Measurement of voltage, current, frequency, phase difference, power, power factor for single phase supply using Digital Multimeter.

APPARATUS: Digital multimeter, Bread board, resistor and Connecting wires.

THEORY:

Introduction

A Multimeter is an instrument which measures electrical parameters such as AC or DC voltage, cur- rent, a resistance. A Multimeter combines a voltmeter, an ammeter, and an ohmmeter. The two main kinds of Multimeter are analog and digital.

A digital Multimeter has an LCD screen that displays the value of the parameter being measured. In anal Multimeter, a needle moves through a graduated scale the pointer reading shows the value of the paramet measured.

Digital Multimeters

Digital Multimeter (DMM) has a digital or liquid crystal display (LCD), where measurement readings appea numerical values. The DMM has a rotatory knob or selector switch allows to select the unit and range measurement. We must first set the dial to the appropriate measurement. There are three or four termina available on the multi-meter, one is common, second is volt or resistance, third and fourth terminal is for curre measurement.

The various electrical parameters can be measured by selecting the required function and selecting the prop range. Key process that occurs within a digital multimeter for any measurement that takes place is that of voltag measurement. All other measurements are derived from this basic measurement. One of the most widely use ADC in digital multimeter is known as the successive approximation register or SAR. Some SAR ADCs ma only have resolution levels of 12 bits, but those used in test equipment including DMMs generally have 16 bi or possibly more dependent upon the application.

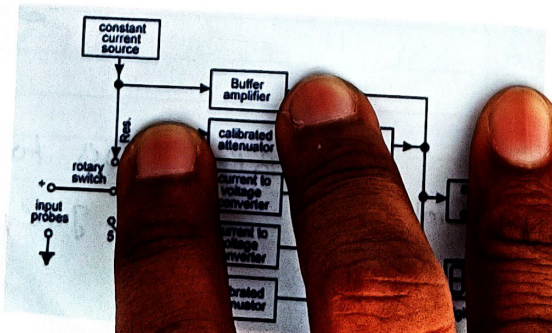

Fig 1. Bloc Digita

For the measure
in the position-
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To measure A
position-2. The
proportional D
indirectly meas
probes. Keep th
V converter an
display in Amp

The DC currer
switch in posit
the voltage in

To measure D
The voltage is
digital display

step = 1

take 3
R1 = 1
R2 = 3
R3 = 2

Take e

Rth = 7

step =

Vth = 4

Now.

Front Panel Des

Probes:-
colour p

For the measurement of resistance Connect an unknown resistor across its input probes. Keep rotary switch in the position-1The proportional current flows through the resistor, from constant current source. According to Ohm's law voltage is produced across it. This voltage is directly proportional to its resistance. This voltage is buffered and fed to A-D converter, to get digital display in Ohms

To measure AC voltage Connect an unknown AC voltage across the input probes. Keep rotary switch in position-2. The voltage is attenuated, if it is above the selected range and then rectified to convert it into proportional DC voltage. It is then fed to A-D converter to get the digital display in Volts.AC current is indirectly measured by converting it into proportional voltage. Connect an unknown AC current across input probes. Keep the switch in position-3. The current is converted into voltage proportionally with the help of I-V converter and then rectified. Now the voltage in terms of AC current is fed to A-D converter to get digital display in Amperes.

The DC current is also measured indirectly. Connect an unknown DC current across input probes. Keep the switch in position-4. The current is converted into voltage proportionally with the help of I- V converter. Now the voltage in terms of DC current is fed to A-D converter to get the digital display in Amperes.

To measure DC voltage Connect an unknown DC voltage across input probes. Keep the switch in position-5. The voltage is attenuated, if it is above the selected range and then directly fed to A-D con- verter to get the digital display in Volts.

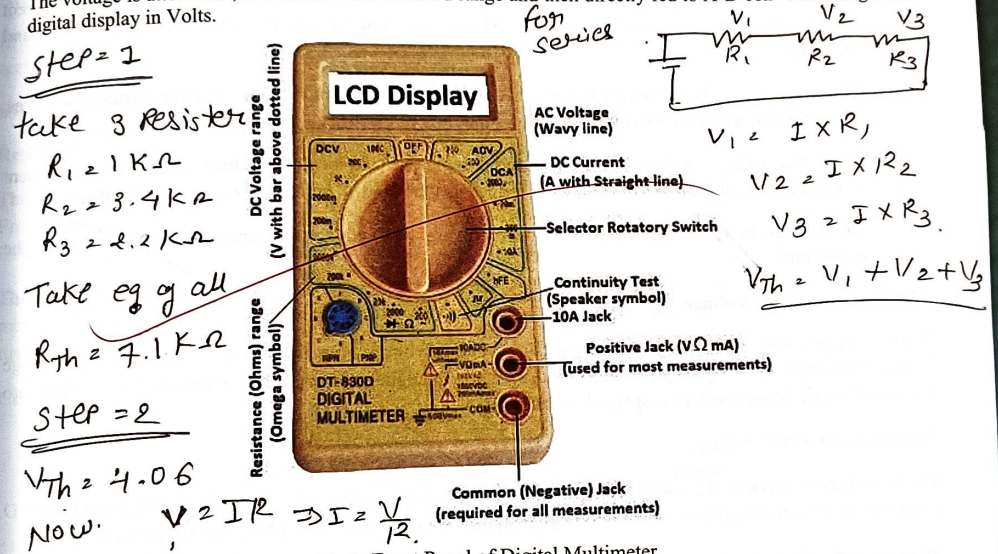


Fig 2. Front Panel of Digital Multimeter

Front Panel Description of Digital Multimeter:

Probes:- All the multimeters has two probes, one of Red colour and another of Black colour. The Black colour probe is used as common or negative probe while Red probe is used as Positive probe.

...vy line.

...ement of D.C. Current; the range of cur- rent ...d for special test related to amplification and ...

...of some electrical and electronics de- vices ...ric current or not.

...lock of multimeter used for measurement ... represents range of Kilo- ohm.

...Voltage represented by a bad above the ...

...nverted into small signal using voltage ...ter. It converts the analog signal into ...

... signal. Then it is given to A to D ...played on the display.

...converter) in which it will flow ...nal to the current. This voltage ...g signal into digital signal. The ...

...according to the

In multimeters ranges for AC / DC voltage, AC /DC current (mA & A) ranges, resistance ranges are mentioned. Auto and manual option is also present to read out parameters.

Accuracy:

In digital multimeters accuracy is usually specified in terms of percentage of reading plus a percent- age of full scale value, sometimes expressed in counts rather than percentage terms. Standard port-

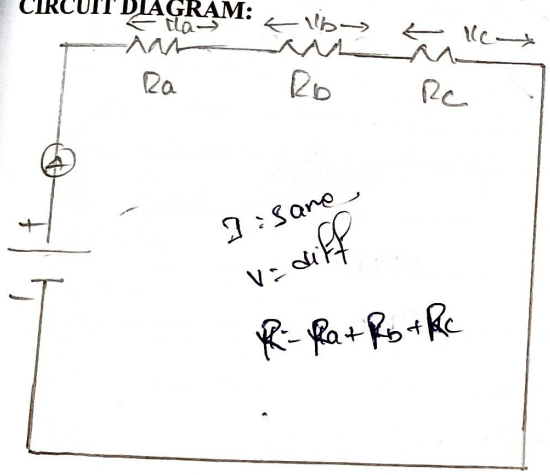
able digital multimeters are specified to have an accuracy of typically 0.5% on the DC voltage rang- es.

Resolution:

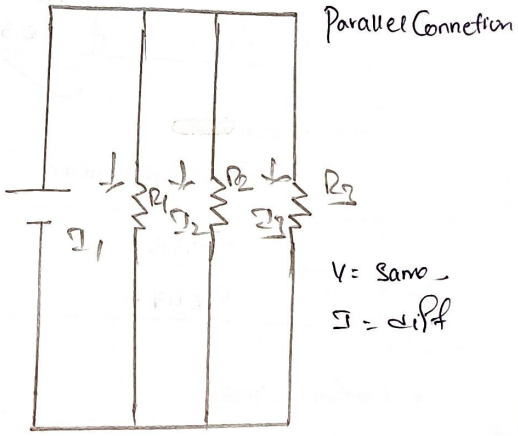
The resolution of a multimeter is the smallest part of the scale which can be shown, which is scale dependent. For example, a multimeter that has a 1 mV resolution on a 10 V scale can show changes in measurements in 1mV increments.

The resolution of a multimeter is often specified in the number of decimal digits resolved and dis- played. If the most significant digit cannot take all values from 0 to 9 is often termed a fractional dig- it. For example, a multimeter which can read up to 19999 (plus an embedded decimal point) is said to read 4½ digits.

CIRCUIT DIAGRAM:



Series Connections



$I = I_1 + I_2 + I_3$

OBSERVATION TABLE:

- **Measurement of Resistor**

Sr. No.	Theoretical Value	Practical Value
1.	10 K	9.78
2.	10 K	9.86
3.	10 K	9.72

- **Measurement of Voltage:**

	Theoretical Value	Practical Value
Va	3.4V	3.40V
Vb	3.4V	3.43V
Vc	3.4V	

- **Measurement of Current:**

	Theoretical Value	Practical Value
Ia	0.34mA	0.35mA
Ib	0.34mA	0.35mA
Ic	0.34mA	0.35mA

- **Testing of Transistor:**

Transistor IC number	PNP/NPN
C547B	NPN
C547B	PNP

- **Continuity Check:**

Observation:

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CONCLUSION:

With the
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Questions:

1. Why c
2. In the
3. What
4. When

1) Multimeter
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2. The
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The 3
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displaye

Example:
ac

Observation:

While checking the Continunity of any Circuit if the Circuit is close d we Can hear a beep Sound and if it is open no Sound will be Come.

CONCLUSION:

With the help of digital multimeter we Can measure different electrical parameters with exact Value of applications.

Questions:

1. **Why does my multimeter not go to zero in the ac volts mode?**
2. **In the accuracy specification (1% of reading + 3 counts), what does the counts mean?**
3. **What is the difference in the Min/Max and Peak modes on multimeters?**
4. **When I short my test leads together in the resistance mode, it does not read zero. Why not?**

1) Multimeter does not go Zero in the A·C Volt mode becomes of settings range, Polarity Sensing like kutting the nodes into klong terminal

2. The 1% of reading refers to the Percentage of deviation from the actual Value of the measurment. It Says how much meter reading of transmitting output Can differ from the ideal Value based on an established reference Standard As the input level decreases the allowed error decrease The 3 Count representing a fixed amount of additive error. In digital meters, Count refer to the least Significant digits displayed on the meter

Example: Suppose we have 0.5V Signal on 1V range with accurance of 3% ±5 Counts

3% of reading = 0.03 × 0.5 = 0.015V

5 Counts = 5 × 10·0V = 0.05V

Total allowable error is ±0.015V ± 0.05 = ±0.065V

3) Min, Max MODES ON MULTIMETER

As the name impiles it Captures the highest & lowest readings that the multimeter from the time Min/Max record was started

It helps you to keep track of external values over a time

PEAK TIME:

It is designed to keep Capture intermediate transient even that occurs on a mopitorned Signal. It focusses on the highest value reached in a very short duration. It focusses on instantaneous peaks.

4) When you short your test leads together in resistance mode it's Common for multimeter to not red exactly Zero because

1. Test lead Resistance; They might have Small resistance
2. The Sharp ~~Resistance~~; probe tips make better electrical Contact than the side of Probes
3. Most multimeters do not automatically Compenatee for the test lead resistance
4. The internal voltage reference in the multimeter may not be, Stable when the battery is low. Away ensure the multimeter has fresh battery or is adequately powered

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EXPERIMENT NO. 3

AIM: Understanding of working and specifications of CRO and Function generator.

APPARATUS: CRO, function generator, resistor, Capacitor, Diode

THEORY:

Introduction to CRO

The cathode ray oscilloscope is a versatile laboratory instrument. If a laboratory has only CRO in it, other measuring instruments may not be required. This is the importance of CRO in scientific laboratories. With it we can measure, AC/DC voltage, AC/DC current, resistance, phase and phase difference between two or more waveforms, relative frequency of a waveform, observe the amount of noise present on a signal, etc.

In addition, CRO is also useful to observe the shape of waveform or signal and observe its real time progression on time axis. The waveform displayed on it, is observed with respect to x-y axes or co- ordinate system. The screen of CRO is plotted in terms of a measuring scale, known as graticule. Us- ing this scale, the amplitude and wavelength of waveform can be accurately measured in centimetres and then converted into required unit.

Basic working principle of CRO

The cathode ray is a beam of electrons which are emitted by the heated cathode (negative electrode) and accelerated toward the fluorescent screen. The assembly of the cathode, intensity grid, focus grid, and accelerating anode (positive electrode) is called an electron gun. Its purpose is to generate the electron beam and control its intensity and focus. Between the electron gun and the fluorescent screen are two pair of metal plates - one oriented to provide horizontal deflection of the beam and one pair oriented to give vertical deflection to the beam. These plates are thus referred to as the horizontal and vertical deflection plates. The combination of these two deflections allows the beam to reach any portion of the fluorescent screen. Wherever the electron beam hits the screen, the phosphor is excited and light is emitted from that point. This conversion of electron energy into light allows us to write with points or lines of light on an otherwise darkened screen. Some important terms before going into the details of functional block diagram of CRO.

Y-input: It is the main input of CRO, to which the input signal is connected. The waveform of this input signal is displayed on the screen of CRT.

Vertical attenuator1: It consists of RC voltage divider, which is marked on the CRO front panel as Volt/div control knob. Thus the 'gain' of CRO can be controlled with Volt/div knob.

Vertical amplifier: It is a set of preamplifier and main vertical amplifier. The input attenuator sets up the gain of vertical amplifier.

Delay line: The delay line delays the striking of electron beam on the screen. It synchronizes the arrival of the beam on screen when time base generator signal starts sweeping the beam horizontally. The propagation delay2 produced is about 0.25msec.

generated by repeatedly charging and discharging a capacitor from a constant current source. This produces a linearly ascending or descending voltage ramp. As the output voltage reaches upper and lower limits, the charging and discharging is reversed using a comparator, producing the linear triangle wave. By varying the current and the size of the capacitor, different frequencies may be obtained. Saw tooth waves can be produced by charging the capacitor slowly, using a current, but using a diode over the current source to discharge quickly - the polarity of the diode changes the polarity of the resulting saw tooth, i.e. slow rise and fast fall, or fast rise and slow fall.

A 50% duty cycle square wave is easily obtained by noting whether the capacitor is being charged or discharged, which is reflected in the current switching comparator output. Other duty cycles (theoretically from 0% to 100%) can be obtained by using a comparator and the saw tooth or triangle signal. Most function generators also contain a non-linear diode shaping circuit that can convert the triangle wave into a reasonably accurate sine wave by rounding off the corners of the triangle wave in a process similar to clipping in audio systems.

A typical function generator can provide frequencies up to 20 MHz RF generators for higher frequencies are not function generators in the strict sense since they typically produce pure or modulated sine signals only.

Function generators, like most signal generators, may also contain an attenuator, various means of modulating the output waveform, and often the ability to automatically and repetitively "sweep" the frequency of the output waveform (by means of a voltage- controlled oscillator) between two operator-determined limits. This capability makes it very easy to evaluate the frequency response of a given electronic circuit.

Specifications

Typical specifications for a general-purpose function generator are:

- Produces sine, square, triangular, saw-tooth (ramp), and pulse output. Arbitrary waveform generators can produce waves of any shape.
- It can generate a wide range of frequencies.
- Good frequency stability analogue generators & digital generators.
- Maximum sine wave distortion of about 1% for analogue generators.
- AM or FM modulation may be supported.
- Output amplitude up to 10 V peak-to-peaks.
- Amplitude can be modified, usually by a calibrated attenuator with decade steps and continuous adjustment within each decade.
- Some generators provide a DC offset voltage, e.g. adjustable between -5V to +5V.
- An output impedance of 50 Ω.

PROCEDURE:

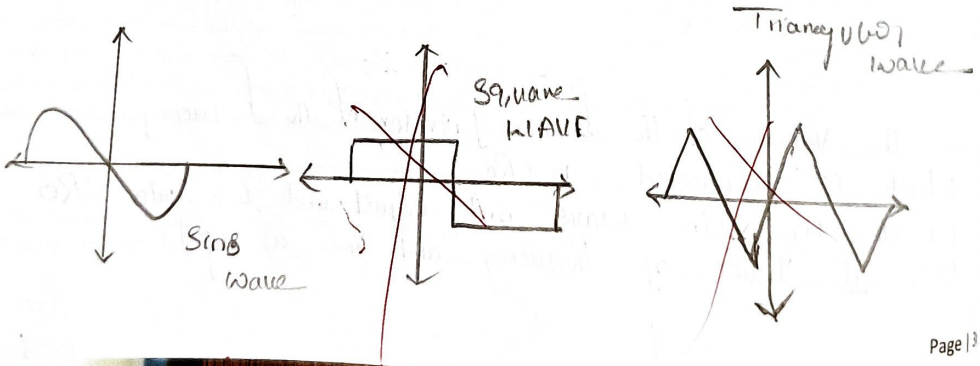
Set the Values of the function generator of the frequency which is Connected to CRO
let it in sine wave and adjust and look into CRO
Note the Values of frequency and time as input

function generator
4. Now note the reading of the output from CRO of amplitude and frequency
5. Now set in the square and measure same input
6. Set the function generator same to triangle and note the values

OBSERVATION TABLE:

Input Signal	Input value (from Function generator)			Measured value (from CRO)		
	Amplitude	Time	Frequency	Amplitude	Time	Frequency
Sine wave	2	2	925 HZ	3.2	5.2 ms	100 HZ
Square wave	2	2	101 HZ	4.6	4.2 ms	100 HZ
Triangular wave	2	2	625 HZ	4.4	8 ms	100 HZ

To Observe & Draw waveform of Lissajous Pattern:



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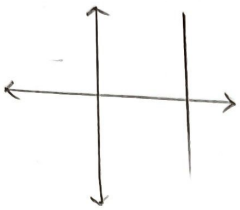
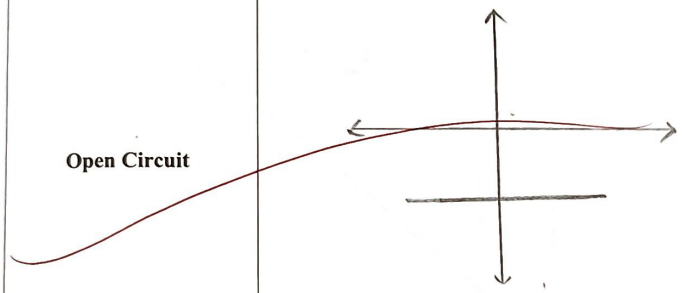
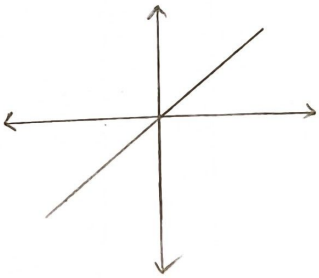
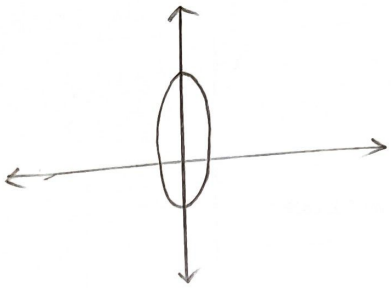
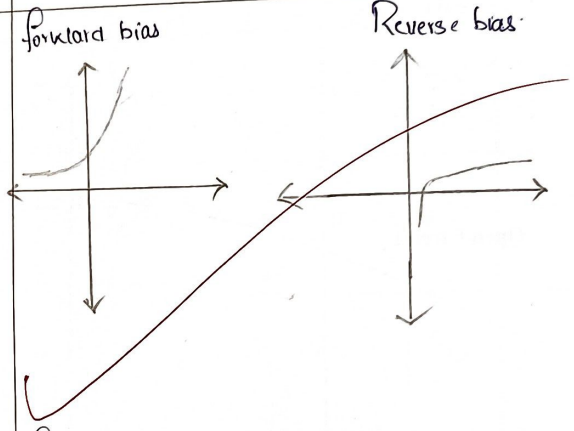
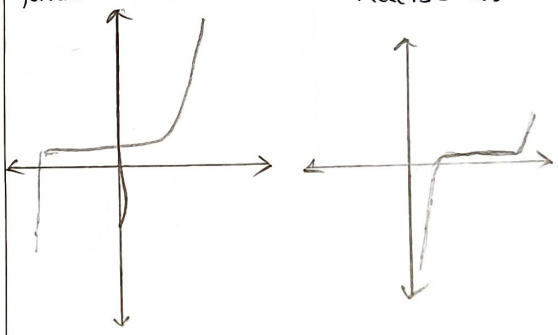
Draw the Output

Draw the Output pattern using Component Tester in CRO:

Short Circuit	
Open Circuit	
Resistor	

Capacitor	
Diode	
Zener Diode	

Parul® University

CALCULATION:

1. SINE WAVE

Time peri

X Time / c

T =

f = 1/T

Amplitude

(M

Vi

SQUARE k

TRIANGU

CALCULATION:

1. SINE WAVE

Time period (T) = (No. of divisions Covered by the waveform in x-axis) x (Time / div knowb position)

$T = 5.4 \times 2 \times 1 = 10.8\text{ms}$

$\boxed{T = 10.8\text{ ms}}$

$f = \frac{1}{T} = \frac{1}{10.8} = 0.0925\text{ KHz} \neq f = 925\text{ Hz}$

Amplitude

(No of divisions Covered by the waveform in y axis) x (Volt / div knowb)

$V_{RP} = 2.2 \times 2 = 4.4V$ Amplitude 4.4V

SQUARE WAVE

$T = 4.8 \times 2 \times 1 = 9.6\text{ms}$ $f = \frac{1}{T} = \frac{1}{9.6} = 0.104\text{KHz}$

$T = 9.6\text{ms}$ $\boxed{f = 104\text{Hz}}$

Amplitude $= 4.6 \times 2 = 9.2V$

TRIANGULAR WAVE

$T = 8 \times 2 \times 1 = 16\text{ms}$

$f = \frac{1}{16} = 0.0625\text{ KHz}$

Amplitude $= 4.4 \times 2 = 8.8$

Amplitude $= 8.8V$.

CONCLUSION:

The experiment provided in Sights into the Operational principles and specifications of a CRO and functional generator, offering a practical understanding of their functions and limitations.

Questions:

1. **What is Lissajous Pattern.**
2. **Compare analog & Digital CRO.**
3. **Write specifications of Function Generator & CRO.**

1. A Lissajous pattern is a pattern that appears on a screen when a sinsodial signal is applied to the horizontal and vertical coils of an oscilloscopic patterns shape indicates the phase difference between signals

2. Analog CRO:

The oldest type of oscilloscope, analog CRO's work by deflecting an electron beam in a cathode ray tube.

Digital CRO:

They are more common than analog CRO's They use an analog to digital Converter (Adc) to Convert measured voltage into digital information.

Signal quantity: Analog signals are often having lower frequency signals than the digital signals.

~~Shortage~~

Storage:

Analog CROs have no storage memory. So they can only manage and analyse signals in terms as where as, The digital CROs in are superior for fundamental waveform visualization.

↳ Easy of use: Analog CROs are often easier to use than digital CROs especially for engineers

3. Specifications of function generator:

produce wave of many waveform
It can generate wide range of frequency
good frequency stability
Amplitude can be modified

Specifications of CROs

Dual Channel
Convert & facility in both channel
Triggering Capability
Band ⟶ width upto 30MHZ.

13/03/24

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EXPERIMENT NO. 4

AIM: To understand working and specifications of DC regulated Power supply.

APPARATUS: Connecting wires, Experiment kit, Voltmeter, Power supply

THEORY:

Introduction

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters.

Some types of power supplies are:-

- D.C. power supply
- A.C. power supply.
- Switched-mode power supply
- Uninterruptible power supply.

D.C power supply

1) Linear regulator

The function of a linear voltage regulator is to convert a varying DC voltage to a constant, often specific, lower DC voltage. In addition, they often provide a current limiting function to protect the power supply and load from over current (excessive, potentially destructive current).

A constant output voltage is required in many power supply applications, but the voltage will vary with changes in load impedance and will also vary with changing input voltage. To overcome this, some power supplies use a linear voltage regulator to maintain the output voltage at a steady value, independent of fluctuations in input voltage and load impedance. Linear regulators can also reduce the magnitude of ripple and noise present appearing on the output voltage.

2) Regulated A.C.to D.C. power supply

A regulated power supply is an embedded circuit; it converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into DC. Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits. The output from the regulated power supply may be alternating or unidirectional, but is nearly always DC.

Construction and working of regulated D.C power supply

PROCEDURE:

Ensure power is off before Connecting any Component
Connect the Power Supply to a wave Output and turn it on
Set the voltage output knob on the Power supply to a specific value.
Solowly adjust the Voltage knob on the power supply and observe the Corresponding change in voltage reading on the multimeter

As you increase the applied voltage the output voltage also increases upto 5v and remain same (or) Constant

Observation Table:

SNO	Applied voltage	Vout
1.	1V	0V
2.	2V	0V
3.	3V	0.07V
4.	4V	0.08V
5.	5V	0.48V
6	6V	4.95V
7	7V	4.95V
8	8V	4.95V
9	9V	4.95V
10.	10V	4.95V.

OBSERVATION TABLE:

IC	IDEAL VALUE	PRACTICAL VALUE
7805	+5V	5.06V
7905	-5V	5.699V
7812	+12V	11.976V
7912	-12V	11.8379V

CONCLUSION:

By performing this experiment it is observed that the output voltage for this input values varies later on after 5V input applied voltage it will remain constant.

Questions:

1. **What is the use of filter circuit in voltage regulator?**
2. **What is Heat Sink?**
3. **What is SMD component?**

1. The use of the filter circuit in voltage regulator is to filter the current and to remove the AC through the capacitor to the everything and to provide pure DC circuits

2. A heat sink is a passive heat exchanger that transfers heat generated by an electronics or mechanical device to a fluid medium often air or a liquid coolant This process allows the device temperature to be regulated

3. Surface mount device: Surface mount technology is a method for producing electronic circuit in which the component are mounted or proud directly onto the surface of PCB. An electronics device so made is called a surface mount device. An SMD component is usually smaller than its hole. Counter Part because it has either smaller lead of various style, flat Constants or no leads at all, short pins. a matrix of solid balls on terminals on the bay of the Component.

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EXPERIMENT NO. 5

AIM: Understanding soldering techniques and practicing proper soldering and de-soldering.

APPARATUS: Soldering gun, Soldering wire, de soldering wire & gun, flux.

THEORY:

PROCEDURE OF SOLDERING:

Soldering is a process in which two or more metal items are joined together by melting and then flowing a filler metal into the joint—the filler metal having a relatively low melting point. Soldering is defined as "the joining of metals by a fusion of alloys which have relatively low melting points". In other words, you use a metal that has a low melting point to adhere the surfaces to be soldered together. Soldering is more like gluing with molten metal than anything else. Soldering in electronics is a method of joining components permanently to a printed circuit board (PCB). Soldering is also a must have skill for all sorts of electrical and electronics work.

Tools required for soldering

1) Soldering Iron

temperature controlled soldering iron with stand and sponge is required. It may be between 15 Watts.Soldering iron & gun are shown in figure 1.

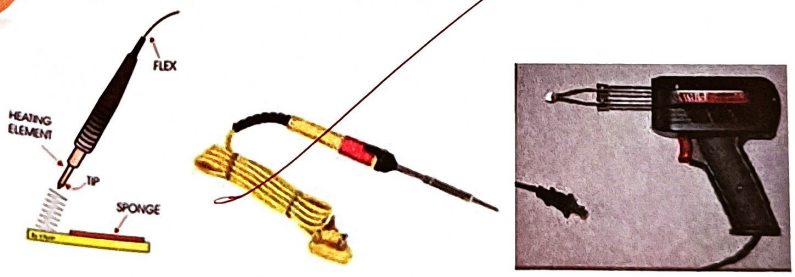

Fig 1. Soldering iron & Soldering gun

2)Solder Wire

An alloy of tin and lead called solder (63% tin and 37% lead), is normally used to bind a component pin/leg to the copper track of a circuit. Some modern solders do not contain lead, due to environmental concerns and its potential toxic nature. Lead is poisonous under certain circumstances. However, lead free solders require a higher melting point, as they have an increased tin content. Solder wire is shown in figure 2.

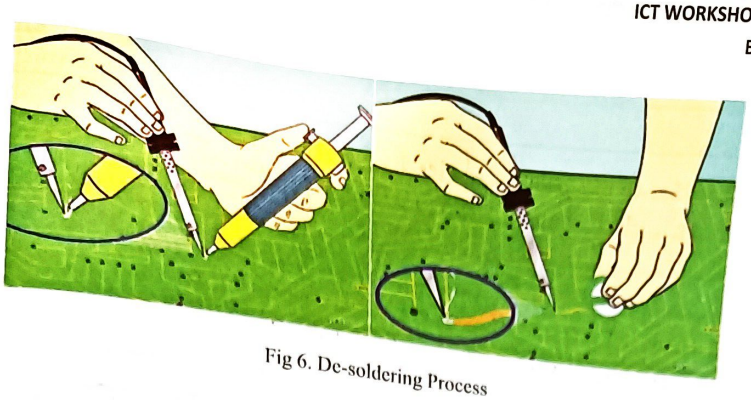

Fig 6. De-soldering Process

3) While applying vacuum, move the tip around the pin to get all the solder of around the pin out. At this time, you can also feel pin moves freely, so you know pin is free from circuit board.

4) When you can hear air flow sound from hole, you should be done. Stop applying vacuum and remove the gun from the pin. Inspect hole and pin.

5) When de-soldering is done, the parts to be removed should move freely. If it doesn't, find which pin is still has solder left, and re-apply fresh solder to it and try de- soldering process again.

CONCLUSION:

By performing the above experiment we understand the soldering techniques and practicing proper soldering and desoldering work.

Questions:

1. **Which metal is used in solder wire? Why?**
2. **What is temperature when we perform soldering.**
3. **Is there any other form of flux is available?**

1. Solder is an alloy of lead and Tin because they have low melting point.

2. The Soldering Process is carried out generally in Temperature range of 180 - 250°C

3. Yes There are Various types of Soldering Flux Formate available including liquid flux, Flux Core & flux solder paste.

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EXPERIMENT NO. 6

AIM: Demonstrate the working of Temperature Sensor

APPARTUS: Arduino UNO Board, Temperature sensor

THEORY:

A Temperature Sensor is a piece of electronic equipment that detects the temperature of its surroundings and transforms the incoming data into electronic output data to control record or signal temperature variations. There are several types of temperature sensors. Some of them need direct contact with the physical target that is being identified, which is introduced as contact temperature sensors. In contrast, others sense the temperature of the targets indirectly, which is described as non-contact temperature sensors.

Temperature Sensor Working

The fundamental working of this sensor is based on the voltage in its diode. The temperature variation is directly related to the resistance of this diode. The resistance of the diode is detected and transformed into simple and readable values of temperature such as Fahrenheit, Kelvin, or Centigrade and demonstrated in meaningful formats instead of readout values. These temperature sensors are employed to sense the internal temperature of various structures like power plants.

The fundamental principle of the temperature sensors operation is the voltage modification in the MOSFET terminals. If the voltage reduces, the temperature also decreases, according to the voltage drop between the emitter in the MOSFET and terminals of the base sensor.

LM35:

- LM35 is a temperature measuring device having an analog output voltage proportional to the temperature.
- It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry.
- The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases.
- It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C.
- LM35 gives temperature output which is more precise than thermistor output.

PERFORMANCE RESULT:

```
#include <DHT11.h>
DHT11 dht11(a);
Void setup()
{ serial.begin(9800);}
    Void loop()
{ int temperature = dt11.read temperature();
  if (temperature != DHT11::ERROR.CHECKSOH44
  Temperature != DH11::ERROR.TIMEOUT
  { serial.post.Print("temperature:");
      serial.Print in("C");
    } else {
serial.Print(DHT11::get error string (temperature));
  }
    day(10000);
}
```

CONCLUSION: A room temperature measuring instrument with an IOT based LM35 sensor works well and can be used for remote and real time monitoring of room temperature.

Q/A:

1. How does LM35 works?

LM35 sensor uses the basic principal of a diode, Where as the Temperature increases, the voltage accross a diode increases at a known rate. By precisely amplifying the voltage change; it is easy to generate an analog signal that is directly proportional to temperature.

2. What is the operational range of LM35 sensor?

The LM35 device is rated to operate over a -55°C to 150°C temperature range, while the LM35C device is rated for a -40°C to 110°C range (-10° with improved accuracy.

3. What are the pins of LM35 and how do we interface it with Arduino?

The positive voltage connects to "+Vs" and ground connects to "GND" The middle pin Vout is the analog signal output from the sensor and connects to An analog input of Arduino

4. Write the formula of converting the ADC value into Actual temperature in Celsius?

Value = (Digital value * Max ADC in) / 4095.0

5. How accurate is the LM35 sensor?

The LM35 device does not require any external calibration or trimming to provide typical accuracies of
= ± 1/4°C at room temperature and
± 3/4°C over a full -55°C to 150°C
temperature range.

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In this flow meter, for every liter of liquid passing through it per minute, it outputs about 4.5 pulses. This is due to the changing magnetic field caused by the magnet attached to the rotor shaft.
We measure the number of pulses using an Arduino and then calculate the flow rate in litres per hour (L/hr) and total volume in Litre using a simple conversion formula.

- Pulse frequency= 7.5*flow rate (ltr/min)
- Pulse frequency= [7.5*flow rate (ltr/hr)]

PROCEDURE:

- Open the Arduino IDE.
- Select the type of board from Tools -> Board -> Arduino UNO.
- Select the port from Tools -> Port -> COM.
- Connect the VCC pin YFS201 of to 5V of the Arduino board.
- Connect the GND pin of YFS201to GND of the Arduino board.
- Connect Its Analog Pin To 2 Of Arduino.
- Upload the sketch to the connection diagram

PERFORMANCE RESULT

```
const int flowSensorPin = 2;
volatile int flow pulse Count = 0;
float flow rate = 0.0;
unsigned long Start time;
void setup()
{Serial.begin(9600);
pin mode{flow.SensorPin, Input.};
attach Intercept (digital pin to interrupt (flow pin,
    Pulse Counter);
Start time = miny{
void loop ()
{unsigned long current time = m.lis();
    Unsigned long elapsed time = Current time - Start time;
    if (elapsed time >= 1000){
```


```
attach Interrupt edigitial pin to interrupt (flow sensor pin).
        Pluse counter, falling;
    Start time = current time;
}
void pulse counter () {
        flow pulse count ++;
    }
```

CONCLUSION: The YF-S201 water flow sensor is a device used The rate of liquid flow It is typically operates using a mall effect sensor to detect the rotation of a turbine within the sensor. As the liquid flows through the sensor. It causes the turbine the rotate and the sensor Translates This rotation into an electrical signal that can be measured and interpreted The functionality of the YF-201 sensor allows for accurate manitoring and measurement of water flow.

Q/A:

1. What is YFS201 sensor and how does it work?

The YF-S201 flow sensor measures 1 to 30 l/min when connected datag instruments Data Acquisition product (DI) Data logger. It allows Data instruments Data Acquisition and data logger units to acquire flow rate (L/sec) information.

2. How do you connect YFS201 sensor with Arduino UNO board?

connect YFS201 Hall effect water flow sensor VCC pins to 5V Power supply & GND to GND.

3. What are the key specifications of the sensor ?

Key specifications of the sensor ~~VCC~~ is flow rate Range, frequency flow rate, pulse Count load Capacity

4. How does the YFS201 sensor's measurement range impact the maximum flow rate that it can detect, and how can this be adjusted in the code?

The measurment range of YSF201 Sensor determines the maximum flow rate it can detect accurately if the flow rate exceeds this range the sensor might not provide reliable reading to adjust you can implement scaling factors to map the sensors output to actual flow rate.

5. What are some potential use of a YFS201 sensor and Arduino UNO in industrial automation or process control applications?

It is Commonly used for measuring liquid flow rate but with Arduino UNO it helps in flow monitoring and control in pipelines leak detections in plumbing system water level maintain in tank & reservoir.

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EXPERIMENT NO. 8

AIM: Verify the Functionality of Distance Measurement Sensor

APPARATUS: Arduino UNO Board +temperature Sensor, DHT11

THEORY: The Ultrasonic sensor or HC-SRO4 is used to measure the distance of the object using SONAR. It emits the Ultrasound at a frequency of **40KHZ or 40000 Hz**. The frequency travels through the air and strikes the object on its path. The rays bounce back from the object and reach back to the module.

The four terminals of HC-SRO4 are VCC, TRIG, ECHO, and GND. The voltage supply or VCC is +5V.

We can connect the ECHO and TRIG terminal to any of the digital I/O pin on the specific Arduino board.

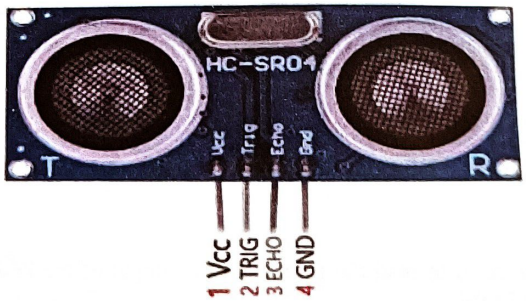
The Ultrasonic sensors work best for medium ranges.

The resolution is 0.3cm.
The medium ranges of the sensor are 10cm to 3m. It works best at this duration.
The maximum range the sensor may detect is 4.5m.

Structure And Timing Diagram Of Ultrasonic Sensor:

We will set the TRIG pin to HIGH for some time (about 3 to 100 microseconds). As soon the TRIG pin is LOW, the Ultrasonic sensor sends the pulses and sets the ECHO pin to HIGH. When the sensor gets the reflected pulses, it sets the ECHO pin to LOW. We need to measure the time for which the ECHO pin was HIGH.

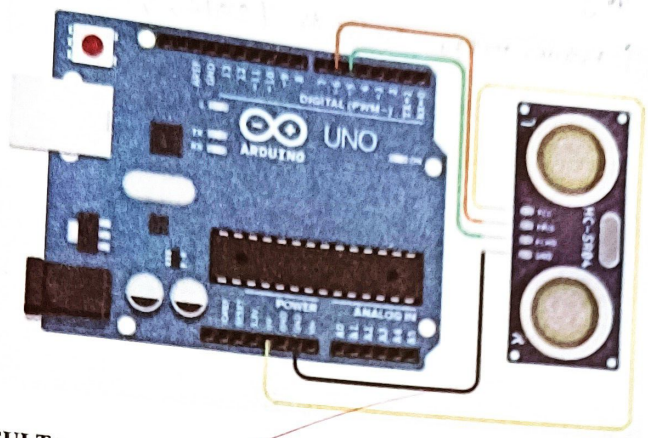
The timing diagram of the ultrasonic sensor HC-SRO4 is shown below:



We will set the TRIG pin to HIGH for some time (about 3 to 100 microseconds). As soon the TRIG pin is LOW, the Ultrasonic sensor sends the pulses and sets the ECHO pin to HIGH. When the sensor gets the reflected pulses, it sets the ECHO pin to LOW. We need to measure the time for which the ECHO pin was HIGH

- Tools -> Port -> COM.
- Connect the VCC pin of HC-SRO4 to 5V of the Arduino board.
- Connect the GND pin of HC-SRO4 to GND of the Arduino board.
- Connect the TRIG pin of HC-SRO4 to pin 9 of the Arduino board.
- Connect the ECHO pin of HC-SRO4 to pin 8 of the Arduino board.
- Upload the sketch to the sketch to the connection diagram.

CONNECTION DIAGRAM:



PERFORMANCE RESULT:

```
Const int Ping Pin = 6;
Const int echo pin = 5;
void setup ()
    long duration inches, cm;
    Pin mode (Ping Pin low);
    delay microsecond, (2);
    digital write Ping Pin, HIGH);
    delay microsecond (10);
```


```
Pin mode (echoPin, INPUT);
duration = pulseIn(echoPin,
inches = microSecond to inches (duration);
Cm = microseconds to centimeter (duration);
Serial print (inches);
Serial print (Cm);
Serial print ln();
delay (1500);}
long microsecond to inches (long microseconds)
{ return microSecond /74/2; }
long microsecond rounds to centimeter (long microseconds)
{ return micro seconds /29/2; }
```

CONCLUSION:

It can measure determine the distance of the target object by the knowing of sound and can clear clear and shiny target their measurement very sensitive to temperature and to angle to target

Q/A:

1. What is Ultrasonic Sensor and how does it works with Arduino?

The UltraSonic Sensor who has a Sender to emit the ultraSonic wave and a reciver to recieve The UltraSonic waves transmitted Ultrasonic waves travels through the air and is reflected by hitting the obj and reach the reciever from the Sender

2. Describe the pins of the Ultrasonic Sensor.

The HC-SSO4 UltraSonic Sensor Comes with four pins namely
vcc pin trigger pin echo pin ground pin

3. What is the maximum range of Ultrasonic sensor and can it detect multiple objects at once?

4. What exactly does the Ultrasonic sensor measures and how can we convert that parameter into the distance?

UltraSonic Sensor measures by Calculating the travel time and speed of sound
we Can Convert that parameter into distance by using
distance = Speed x time

5. Can Ultrasonic sensor detect the height of the object or just the distance?

UltraSonic Sensor Can measure both distance and height

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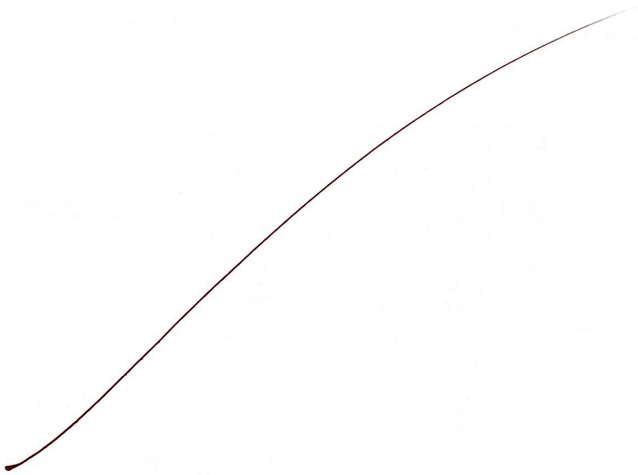
PERFORMANANCE RESULT

```
Void Setup ()
{
  Pin mode (A0, INPUT);
   Several begin (8600);
}
Void loop ()
 {
  float Val = 0.0;
   xAL = analog read (A0);
   dealy (1000);
   Serial Print (VAL);
   }
```



CONCLUSION:

The experiment demonstrated the working principle of a rain detector sensor its practical utilizing in detect rain & triggering appropiate responses.

Q/A:

1. **What are the Applications of rain detector sensor circuit?**

Automatic rain Sensing wipers
Irrigations System
Smart Home automation
Wether monitoring Stations
leak detection system.

2. **Write down the Advantages of Rain Detector sensor**

Some advantages are:
Convienence
Energy efficiency
Protection
Safety
Cost Savings

3. **Explain working principle of Rain Detector sensor**

Working principle of rain detector
Detection of water
change in Conductivity
Singhal processing
Output activation.

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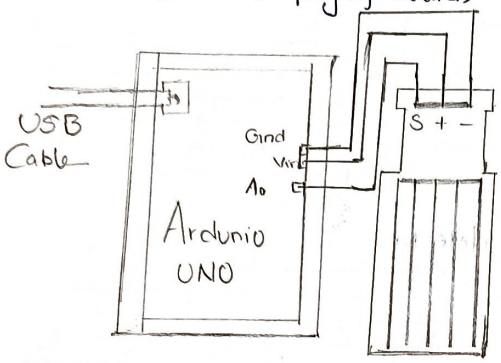
EXPERIMENT NO. 10

AIM: Project based on electronics components and sensors

Title: Water Level Measure Sensor

Apparatus: Arduino Uno board, Water level Sensors, Connecting Wires

Circuit diagram: Displaying board,



Working principle:

Water level Sensor is used to measure the water level according to its length of level.

It is first (Gnd) have to Connect to Uno Arduino Board as Shown above.

Sensor has terminals named S, + and − as shown above

Then S terminal is Connected to A0 point in Arduino board using Connecting Wires

Then "+" terminal is have to Connect with Vin in the Arduino UNO board using Connecting Wire

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Performance Result:

and at last "-" terminal is have to Connect to Gnd on the Arduino.UNO Board with Connecting wires.

Then Swith on the System Connected to the Arduino board using USB Cable.

and open the Arduino terminal write the following code

Code:

```
Const int waterLevelpin = A0 ; // Water
level Sensor analog pin

Void setup(){
    Serial.begin(9600);
}
Void loop(){
    int water level=
        analogRead(waterLevelpin);
    // Convert analog value to percentage
    (assuming full range is 0-1023)
    float waterlevelpercentage =(waterLevel/1023.0)*100.0;
    Serial.Print("water level: ");
    Serial.Print(water level percentage);
    Serial.Print("%");
    delay(1000); // Delay for Stability
}.
```

Result: Ex: 56 % 1%
0 %

Applications:

Applications of Water Level Sensor.

1. prevent water waste.
2. Avoid tank damage
3. Saves money.
4. Automatic
5. Water maximation
6. Reliable
7. Convenient installation
8. Optional ranges
9. Send alerts
10. Compact / simple design.

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