EXPERIMENT NO: 01

FAMILIARIZATION/IDENTIFICATION OF ELECTRONIC COMPONENTS

AIM: To familiarize and identify various components used in electronic laboratories.

THEORY:
Basic components like capacitors, resistors, inductors, diodes, light emitting diode (led) and transistors can be divided into 2 categories: (i) Passive components like resistors and capacitors and (ii) Active components like diodes and transistors. Active components require external source for their operation whereas passive components require external source for their operation.

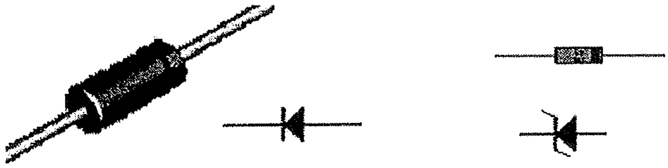
Resistors
A resistor is a passive, two- terminal component used to oppose the flow of current. Resistor offers a specific value of resistance to control current in a circuit to develop a voltage across it. The unit of resistance is ohms (Ω).

Capacitors
A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric (insulator). When a potential difference (voltage) exists across the conductors, an electric field is present in the dielectric. This field stores energy. The effect is greatest when there is a narrow separation between large areas of conductors; hence capacitor conductors are often called plates.

Inductors
An Inductor is a passive, two-terminal, electronic component which resist changes in electric current passing through it.

Transformer
A transformer is a device that transfers electrical energy from one circuit to another at different voltages without changing the frequency. It works on the principle of mutual induction.

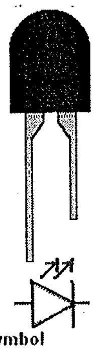
Semiconductor diode
A semiconductor diode is a two terminal device consisting of a PN junction formed either in Germanium or Silicon crystal. When a P-type material is diffused to one side of an N-type material, a PN junction is formed.



(a) (b)

If the PN junction is made between very heavily doped materials then it forms a Zener diode.

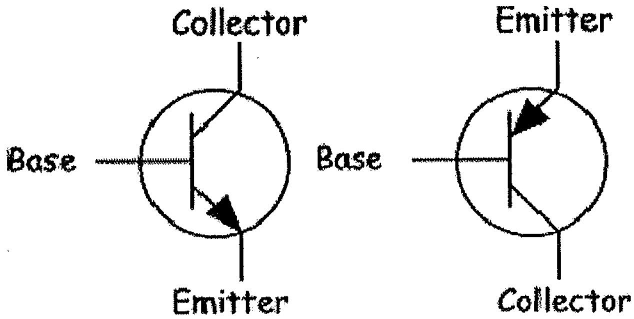
Light Emitting Diode (LED):



LEDs are PN junction devices which emit light radiation when biased in the forward direction. The amount of light emitted depends on the forward current.

Transistors:

Transistors are current controlled solid-state devices that conduct current in proportion to an input current. The symbol for a transistor is shown in figure. The transistor on the left is called an "NPN" transistor and the transistor on the right is called a PNP transistor.



The three regions are emitter, base and collector.

WIRES

A connecting wire is used to attach two circuits or components together. The gauge or size of the wire must be large enough to support the amount of current flow. The most common household wiring is copper and Aluminium. Type THHN wire is commonly used in residential installations. Type THWN is designed for all-weather conditions and is used in outdoor installations.

CABLES

Coaxial Cable: Coaxial cabling has a single copper conductor at its center. A plastic layer provides insulation between the center conductor and a braided metal shield.

Fiber Optic Cable: Fiber optic cabling consists of a centre glass core surrounded by several layers of protective materials. It transmits light rather than electronic signals eliminating the problem of electrical interference. It has the capability to carry information at vastly greater speeds.

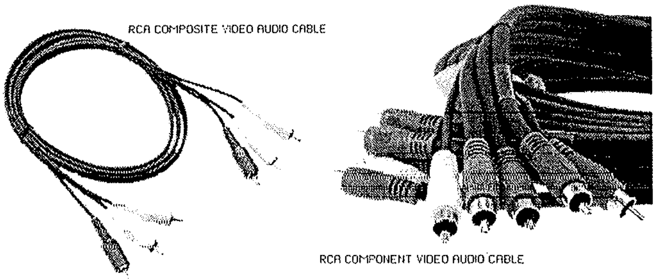
Unshielded Twisted Pair (UTP) Cable: Twisted pair cabling comes in two varieties: shielded and unshielded. Unshielded twisted pair (UTP) has four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch.

Shielded Twisted Pair (STP): Each pair of wires is individually shielded with foil. There is a foil or braid shield inside the jacket covering all wires. There is a shield around each individual pair, as well as around the entire group of wires.

AUDIO AND VIDEO CABLES

RCA Connector Cables

The RCA cables are usually used for connecting your DVD player, stereo speakers, digital camera and other audio/video equipment to your TV. RCA connector cables are a bundle of 2-3 cables including Composite Video (colored yellow) and Stereo Audio cables (red for right channel and white or black for the left audio channel).



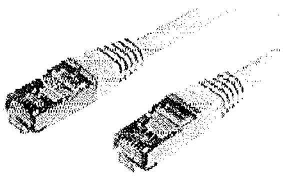
Phone RJ11 Cable

The telephone cable, otherwise known as RJ11, is used for connecting to the Internet through DSL/ADSL modems.

A standard phone cable has 4 wires and the connector has four pins. The connector has a clip at the top to help maintain a tight connection.

Ethernet Cable

Ethernet is the standard for wired networking around the world.



The Ethernet cable, otherwise known as RJ45, is based on twisted pair cable and is made from 8 individual wires. The Ethernet connector, likewise, has 8 pins and looks similar to a phone plug. It has a clip to help maintain a tight connection like a phone connector.

CONNECTORS

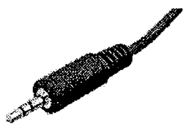
USB (Universal Serial Bus) Connectors:

5-PIN MINI USB CABLE

USB is a standard for a wired connection between two electronic devices. It can be used to connect keyboards, mouse, game controllers, printers, scanners, digital cameras. The USB 1.1 specification supports data transfer rates of up to 12Mb/sec and USB 2.0 has a maximum transfer rate of 480 Mbps.

Audio Connectors:

3.5mm headphone jack

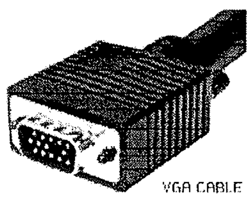


The most common audio cable is the standard headphone jack, otherwise known as a TSR connector. Most speakers and microphones can be connected to the computer with these audio cables.

Video connector:

VGA

One of the most common video connectors for computer monitors and high-definition TVs is the VGA cable. A standard VGA connector has 15-pins.



VGA CABLE

S-Video

S-Video cables, otherwise known as Separate Video or Super Video cables, carry analog video signals and are commonly used for connecting DVD players, camcorders, older video consoles to the television.

FUSES

Fuse is a piece of wire of a material with a very low melting point. When a high current flow through the circuit due to overloading or a short circuit, the wires gets heated and melts. As a result, the circuit is broken and current stops flowing.

Fuses are manufactured in a wide range of current and voltage ratings to protect wiring systems and electrical equipment. Self-resetting fuses automatically restore the circuit after the overload has cleared, and are useful in environments where a human replacing a blown fuse would be difficult or impossible, for example in aerospace or nuclear applications.

SWITCHES

An electrical switch is any device used to interrupt the flow of electrons in a circuit. Switches are essentially binary devices: they are either completely on ("closed") or completely off ("open").

Switches can be either 1) Mechanical switches or 2) Electrical/Electronic switches.

Mechanical switch is a switch in which two metal plates touch each other to make a physical contact for the current to flow and separate from each other to interrupt the flow of current. Mechanical Switches can be categorized on the basis of their operation:

SPST (Single Pole Single Throw)

This is a simple ON/OFF switch. It is also called as On Way Switch.

SPDT (Single Pole Double Throw)

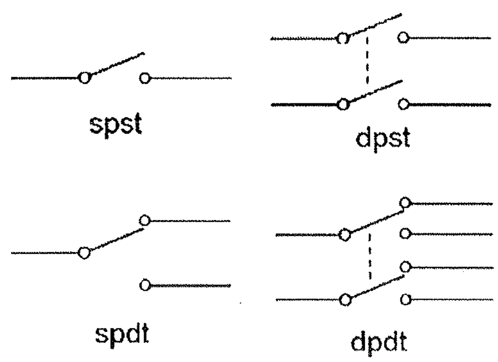
This button has three pins in which, one pin is used as common and called a Two- Way Switch.

DPST (Double Pole, Single Throw)

This switch is basically two SPST switches in one package and can be operated by a single lever.

DPDT (Double Pole Double Throw)

This switch is equivalent to two SPDT switches packaged in one pack. This switch has two common pins and four signal pins.



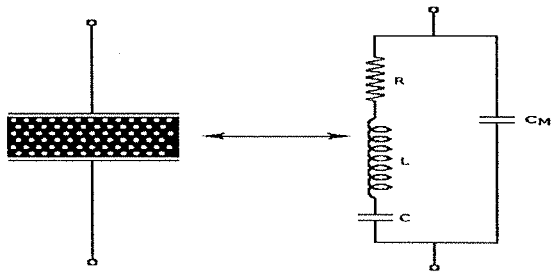
Electrical switches, which are faster in response than mechanical switches and can be switched automatically by an electronic circuit like microcontroller or microprocessor.

CRYSTALS

Crystals are solids that are formed by a regular repeated pattern of molecules connecting together. In crystals, a collection of atoms called the Unit Cell is repeated in exactly the same arrangement over and over throughout the entire material. Because of this repetitive nature, crystals can take on strange and interesting looking forms.

A quartz crystal, for example, exhibits a very important property known as piezo-electric effect. When a mechanical pressure is applied across the faces of the crystal, a voltage proportional to the applied mechanical pressure appears across the crystal. Conversely, when a voltage is applied across the crystal surfaces, the crystal is distorted by an amount proportional to the applied voltage. An alternating voltage applied to a crystal causes it to vibrate at its natural frequency.

ELECTRONIC OSCILLATOR CHIP



(a) Crystal Mounting (b) Electrical Equivalent Circuit Of a Crystal

www.CircuitsToday.com

DISPLAYS

A display device is an output device for presentation of information in visual form. When the input information is supplied as an electrical signal, the display is called an electronic display.

CRT (Cathode Ray Tube):

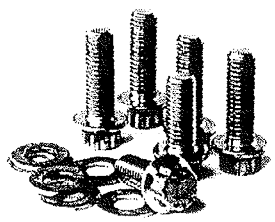
A cathode ray tube (CRT) is a specialized vacuum tube in which images are produced when an electron beam strikes a phosphorescent surface.

LCD (Liquid Crystal Display): A liquid crystal display (LCD) monitor is a computer monitor or display that uses LCD technology to show clear images, and is found mostly in laptop computers and flat panel monitors.

LED (Light-Emitting Diodes):

An **LED display** is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors

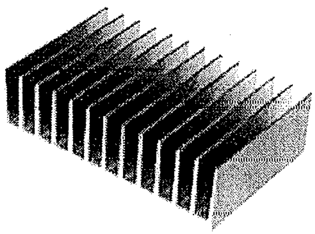
FASTENERS



Fasteners are used to mechanically join or affix other hardware objects together, and come in many forms which include rivets, nuts, bolts, studs, screws, washers, eyebolts, nails, and threaded fasteners.

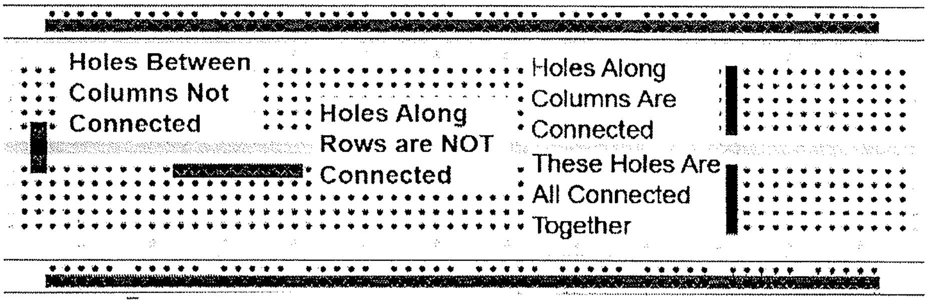
HEAT SINK

Heat sinks cool high-powered devices to prevent overheating. The reliability of electronic components is generally reduced by the square of an increase in temperature. Heat sinks are essential in dissipating generated heat and improving component life.



BREADBOARD

Breadboards are used to test circuits. Wires and components are simply pushed into the holes to form a completed circuit and power can be applied. One of the main advantages of using a breadboard is that the components are not soldered and if they are positioned incorrectly they can be moved easily to a new position on the board.



In a breadboard, the top and bottom rows of holes are connected horizontally and split in the middle, while the remaining holes are connected vertically.

PRINTED CIRCUIT BOARD (PCB)

Printed circuit boards are electronic circuit boards for mounting electronic components on a non-conductive board, and for creating conductive connections between them. The boards are made from glass reinforced plastic with copper tracks in the place of wires. Components are fixed in position by drilling holes through the board, locating the components and then soldering them in place. The copper tracks link the components together forming a circuit.

RESULT:

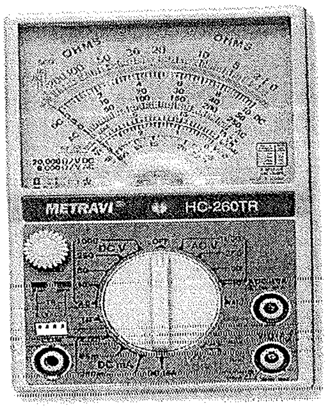
EXPERIMENT NO: 2

FAMILIARIZATION OF/APPLICATION OF TESTING INSTRUMENTS & COMMONLY USED TOOLS

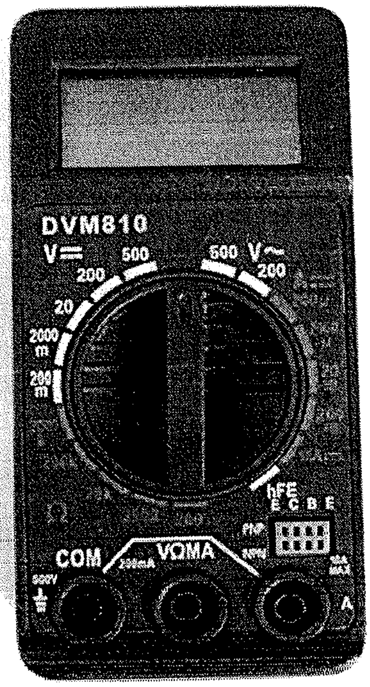
AIM: To familiarize the following testing instruments.

1. MULTIMETERS

A multimeter is a device used to measure voltage, resistance and current in electronics & electrical equipment. There are two types of multimeter Analog & Digital. Analog has a needle style gauge and Digital has a LCD display.



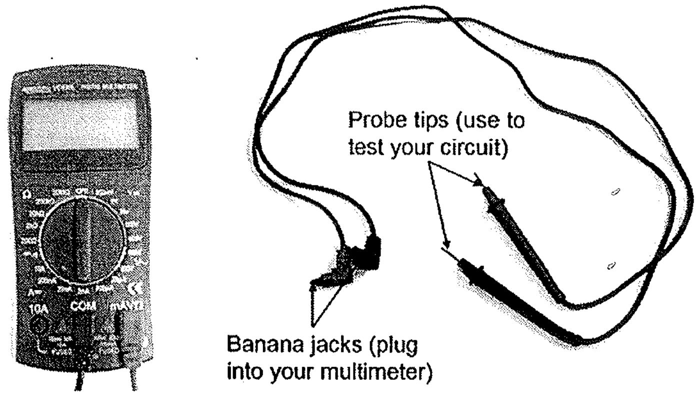
Analog multimeter



Digital multimeter

Probes- The red and black wires

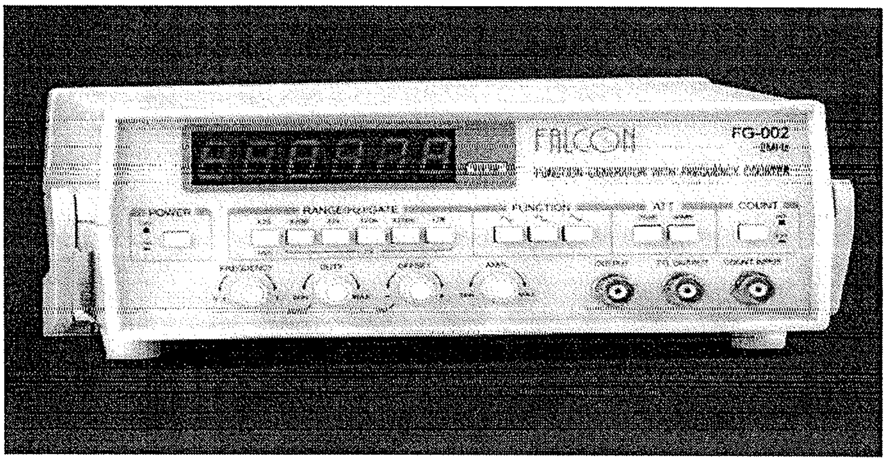
A test **probe** is a physical device used to connect electronic test equipment to a device under test (DUT).One end of the lead is called a banana jack; this end plugs into the multimeter. The other end is called the probe tip; this is the end used to test the circuit. Following standard electronics convention, the red probe is used for positive, and the black probe is used for negative.



Test Probes

2. FUNCTION GENERATOR

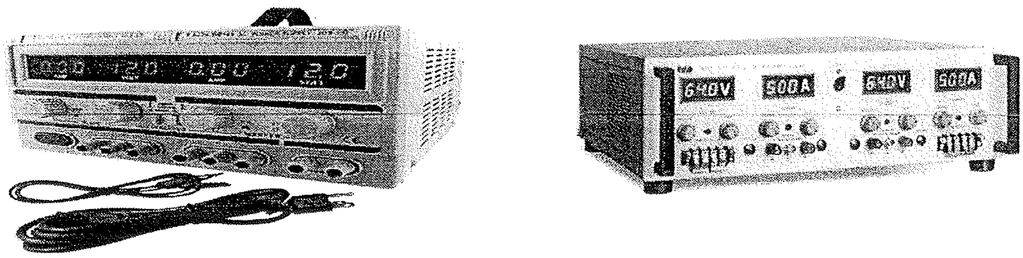
A function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes. It is used to test the response of circuits to common input signals. The electrical leads from the device are attached to the ground and signal input terminals of the device under test.



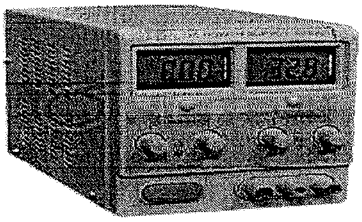
2MHz Function Generator with Frequency Counter

3. REGULATED POWER SUPPLY

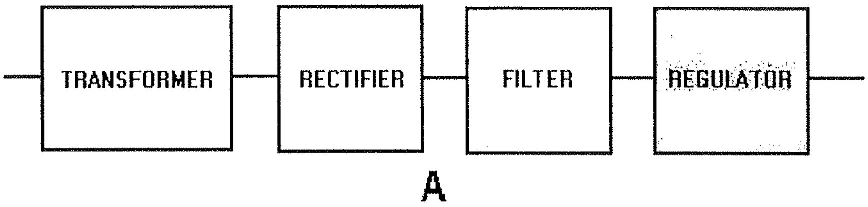
There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function.



Dual Power Supply



Single power supply



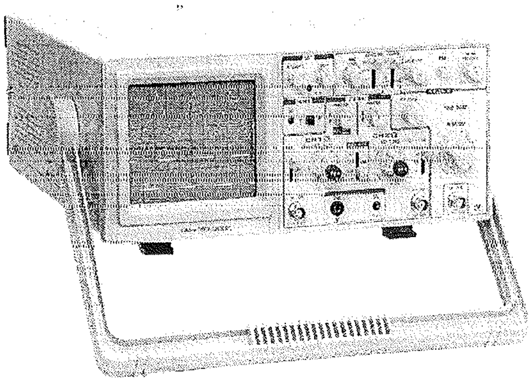
Block Diagram of Regulated power supply

Each of the blocks is described in more detail below:

- Transformer: Steps down high voltage AC mains to low voltage AC.
- Rectifier: Converts AC to DC, but the DC output is varying.
- Filter: Smoothes the DC from varying greatly to a small ripple.
- Regulator: Eliminates ripple by setting DC output to a fixed voltage.
- Dual Supplies: Some electronic circuits require a power supply with positive and negative outputs as well as zero volts (0V). This is called a 'dual supply' because it is like two ordinary supplies connected together as shown in the diagram. Dual supplies have three outputs, for example a ±9V supply has +9V, 0V and -9V outputs.

4. CATHODE RAY OSCILLOSCOPE

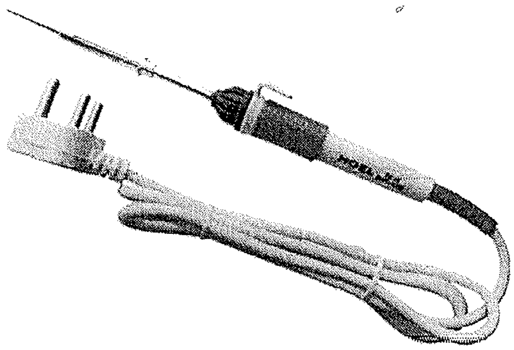
(Cathode Ray Oscilloscope) is the instrument which is used to observe signal waveforms. Signals are displayed in time domain i.e. variation in amplitude of the signal with respect to time is plotted on the CRO screen. X-axis represents time and Y-axis represents amplitude. It is used to measure amplitude, frequency and phase of the waveforms. It is also used to observe shape of the waveform. C.R.O. is useful for troubleshooting purpose. It helps us to find out gain of amplifier, test oscillator circuits.



Cathode Ray Oscilloscope

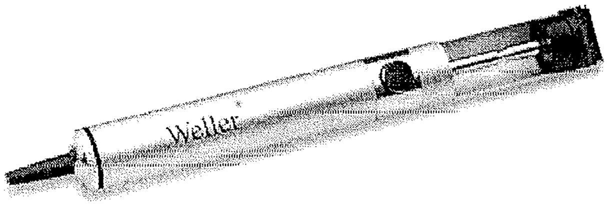
5. SOLDERING IRON

A soldering iron is a tool with a metal tip that gets really hot. Its job is to transfer heat to things like wires, transistor leads, and pads on PCBs. After the appropriate areas are heated properly, solder is applied. Solder is a thin tube, usually rolled in spools, made of various metal alloys. Its job is to hold the individual components together. Usually it contains 60% tin and 40% lead.



6. DESOLDERING PUMP

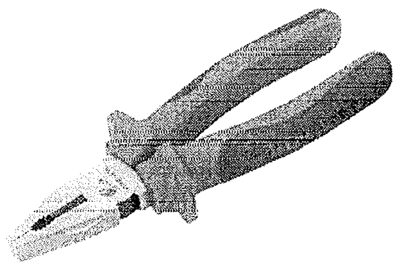
A **desoldering pump**, colloquially known as a solder sucker, is a manually-operated device which is used to remove solder from a printed circuit board.

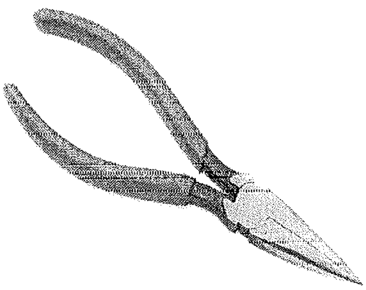


A solder sucker is essentially a tiny hand-held syringe-like pump. It creates and uses vacuum pressure to suck solder off of whatever it's on.

7. PLIERS

A plier is a tool that is used for holding small objects or for bending and cutting wire. Needle-nose pliers (also known as pointy-nose pliers, long-nose pliers, pinch-nose pliers or snipe-nose pliers) are used for both cutting and holding pliers used by electricians, network engineers and other tradesmen to bend, re-position and cut wire. **Combination pliers** are a type of pliers used by electricians and other tradesmen primarily for gripping, twisting, bending and cutting wire and cable.

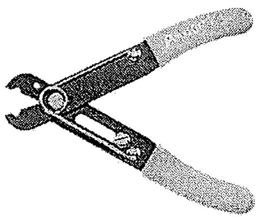




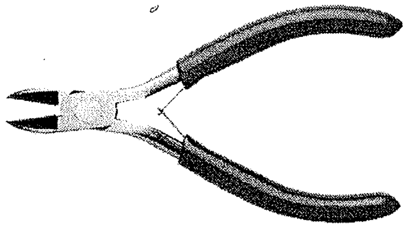
Combination pliers **Nose pliers**

8. WIRE STRIPPER AND CUTTER

Wire cutters or diagonal cutting pliers or diagonal cutters) are pliers intended for the cutting of wire. A wire stripper is a tool designed to remove the protective covering (jacket) off of a cable to expose the inner wires. Because different wires come in different shapes, there are dozens of different wire strippers available.



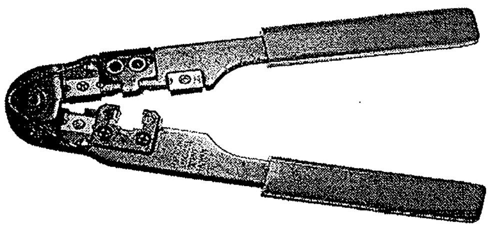
Wire stripper



Wire Cutter

9. CRIMPING TOOL

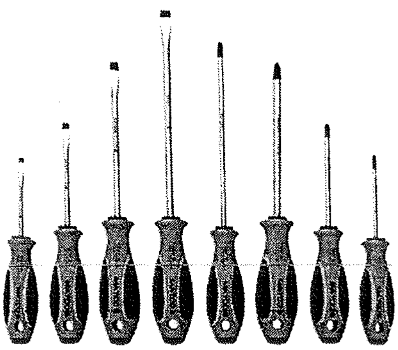
A crimping tool is a device used to conjoin two pieces of metal by deforming one or both of them in a way that causes them to hold each other. The result of the tool's work is called a crimp. A good example of crimping is the process of affixing a connector to the end of a cable.



Crimping tool

10. SCREW DRIVERS

A Screwdriver is a tool, usually hand-operated, for turning screws with slotted heads. For screws with one straight diametric slot cut across the head, standard screwdrivers with flat blade tips and in a variety of sizes are used. Special screws with cross-shaped slots in their heads require a special screwdriver with a blade tip that fits the slots.



11. TWEEZERS

Tweezers are tools used for picking up objects too small to be easily handled with the human hands.

RESULT:

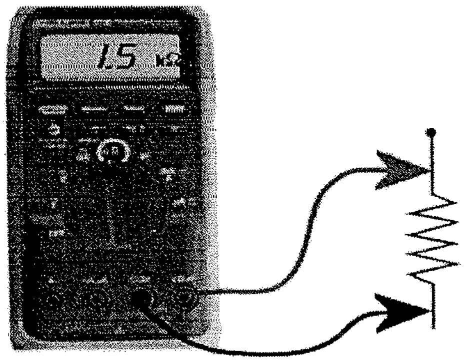
EXPERIMENT NO: 3

TESTING OF ELECTRONIC COMPONENTS

AIM: To test the electronic components such as

1. RESISTOR

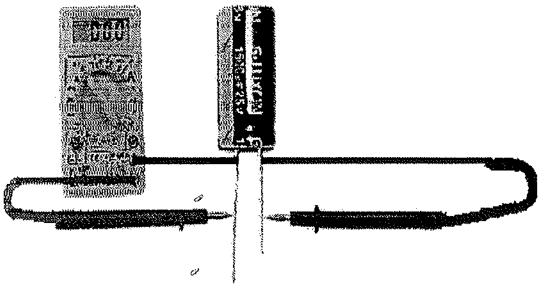
To set up for the check, take the multimeter and place its probes across the leads of the resistor. The orientation doesn't matter, because resistance isn't polarized. The resistance that the multimeter reads should be close to the rated resistance of the resistor. For example, the following resistor above is a 1KΩ resistor with a tolerance rating of 5%. Therefore, the resistance of the resistor can vary between 950Ω and 1050Ω. If the ohmmeter is reading in the value and tolerance range of the resistor, the resistor is good.



2. CAPACITOR

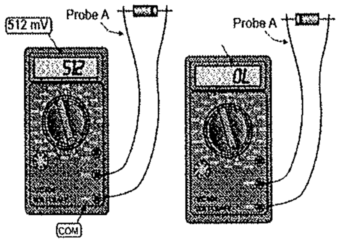
To test a capacitor, set the multimeter to Rx10 or Rx1K scale. Connect the tester negative probe to the capacitor positive terminal and the positive probe to the negative terminal. At the moment you connect the multimeter terminals to the capacitor leads, the multimeter needle will move to zero and then slowly move towards infinity and settle there. This will happen only if the capacitor under test is healthy.

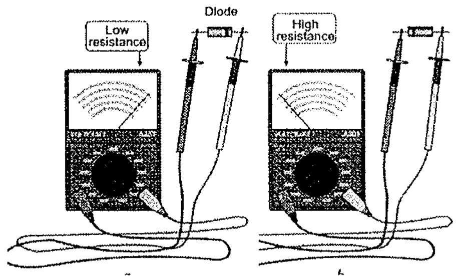
- If the capacitor under test is short, the multimeter needle will go to zero and remain there.
- If the capacitor under test is open, the multimeter needle will not move (will remain at the infinity position which is the initial position for analogue multi meters).
- If the capacitor under test has leakage then the needle will first deflect to zero, and then slowly move towards infinity and will settle at a point before infinity.



3. DIODE

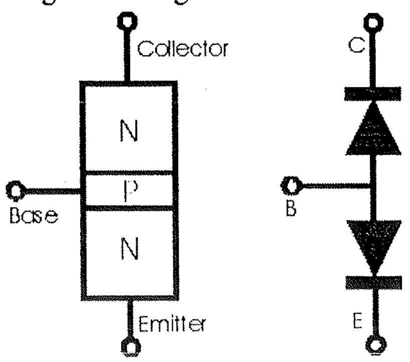
When using an analog instrument to test a diode, the needle will swing almost fully across the scale when the diode is placed in one direction and hardly move when the diode is reversed. The needle does not measure the resistance of the diode but rather the flow of current in one direction and no current-flow in the other direction. If the value is equal to or near equal, either low or high in both directions, the diode is faulty, and should be replaced. Digital instruments have a position on the dial to measure diodes, as shown in figure. When we connect probes to each other, the multimeter should buzz, which signals a short circuit, and display tells 0. When we separate the probes the buzzing stops, and a symbol for open circuit is displayed (this can be either 0L or 1). Now we connect probes to the diode and then we reverse the diode. One measurement will show some resistance and the other shows open circuit.





4. TRANSISTOR

The test relies on the fact that a transistor can be considered to comprise of two back to back diodes, and by performing the diode test between the base and collector and the base and emitter of the transistor using an analog multimeter.



It should be noted that a transistor cannot be functionally replicated using two separate diodes because the operation of the transistor depends upon the base which is the junction of the two diodes, being one physical layer, and also very thin.

Step by step instructions:

The instructions are given primarily for an NPN transistor as these are the most common types in use. The variations are shown for PNP varieties - these are indicated in brackets (.. .. ..):

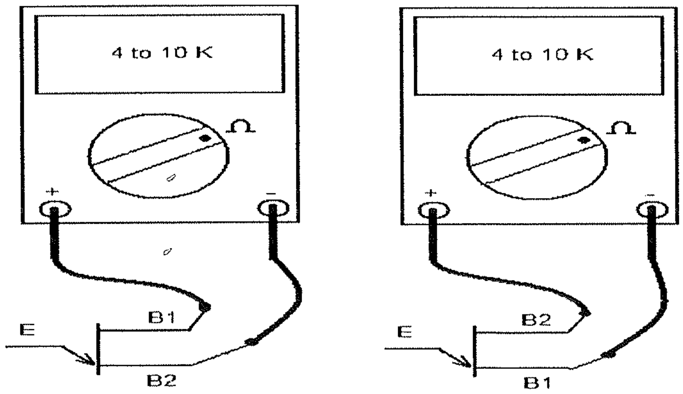
1. Set the meter to its ohms range - any range should do, but the middle ohms range if several are available is probably best.
2. Connect the base terminal of the transistor to the terminal marked positive (usually colored red) on the multimeter
3. Connect the terminal marked negative or common (usually colored black) to the collector and measure the resistance. It should read open circuit (there should be a deflection for a PNP transistor).
4. With the terminal marked positive still connected to the base, repeat the measurement with the positive terminal connected to the emitter. The reading should again read open circuit (the multimeter should deflect for a PNP transistor). Now reverse the connection to the base of the transistor, this time connecting the negative or common (black) terminal of the analogue test meter to the base of the transistor.
5. Connect the terminal marked positive, first to the collector and measure the resistance. Then take it to the emitter. In both cases the meter should deflect (indicate open circuit for a PNP transistor).
6. It is next necessary to connect the meter negative or common to the collector and meter positive to the emitter. Check that the meter reads open circuit. (The meter should read open circuit for both NPN and PNP types.
7. Now reverse the connections so that the meter negative or common is connected to the emitter and meter positive to the collector. Check again that the meter reads open circuit.
8. If the transistor passes all the tests then it is basically functional and all the junctions are intact.

5. UJT- UNI JUNCTION TRANSISTOR

UJT (Uni junction transistor) can be easily tested by using a digital multimeter. The three steps for testing the health of a UJT are as follows.

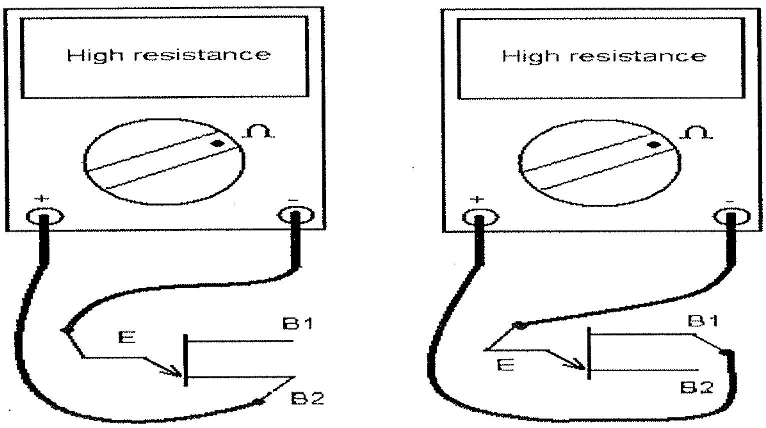
5.1 Measuring the resistance between B1 and B2 terminals.

Set your digital multimeter in resistance mode. Connect the positive lead of multimeter to the B1 terminal and negative lead to the B2 terminal. The multimeter will show a high resistance (around 4 to 10K). Now connect the positive lead to B2 terminal and negative lead to B1 terminal. Again the multimeter will show a high resistance (around 4 to 10K).Also both the readings will be almost same.



5.2 Reverse biasing the emitter junction.

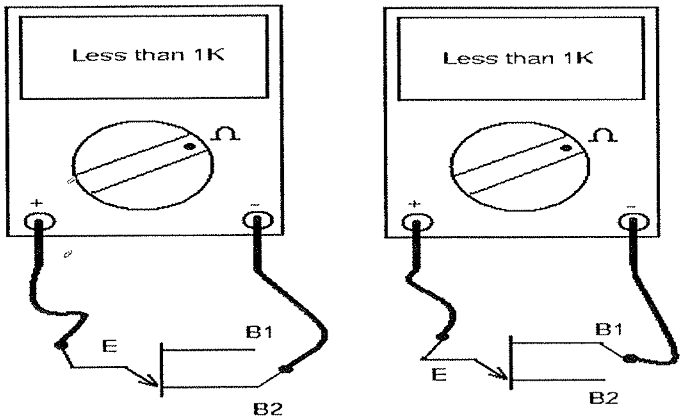
Set the digital multimeter in resistance mode. Connect negative lead of the multimeter to the emitter and positive lead to the B1.The multimeter will show a high resistance (around 100's of K's).Now connect the negative lead once again to the emitter and positive lead to B2.Again the meter will show a high resistance. In both cases the reading will be almost same. This test is almost like reverse biasing a diode.



Reverse biasing the emitter junction

5.3 Forward biasing the emitter junction.

Set the digital multimeter in resistance mode. Connect the positive lead to the emitter and negative lead to B1.The multimeter will show a low resistance (around few 100 ohms).Now connect the positive lead once again to the emitter and negative lead to the B2 terminal. Again the multimeter will show a low resistance reading (around few 100 ohms).



Forward biasing the emitter junction

6. FET- FIELD EFFECT TRANSISTOR

- Set the multimeter to the diode range setting.
- Connect the multimeter's negative probe to the FET's source pin.
- Touch the meter's positive probe to the gate pin while keeping the negative probe in contact with the source. This removes any static charges stored in the FET.
- Remove the positive probe from the gate and connect it to the drain pin. There should be a low reading indicating conductivity. The device is now "turned on" due to the FET's capacitance being charged by the meter.
- Touch a finger to both the source and drain pins while continuing to hold the negative probe to the source and the positive probe to the drain. It is fine if your finger also touches the drain pin. Your finger discharges the gate by connecting it with the source; the FET stops conducting. When the FET is in the non-conducting state, the multimeter reads a high resistance. The FET is functioning normally.

RESULT:

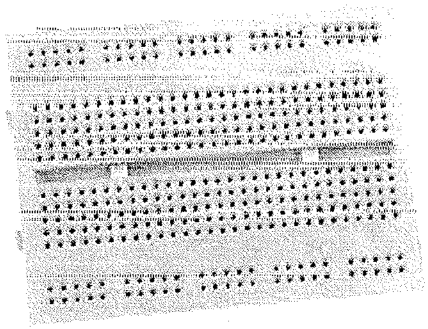
EXPERIMENT NO: 4

INTERCONNECTION METHODS AND SOLDERING PRACTICE

AIM: To assemble and interconnect the electronic components on printed circuit board by soldering practice.

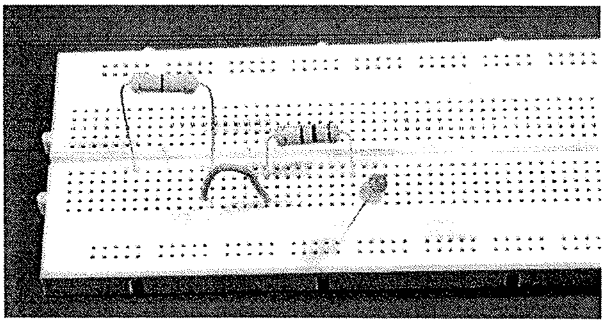
BREADBOARD

Breadboards are used to test circuits. Wires and components are simply pushed into the holes to form a completed circuit and power can be applied. One of the main advantages of using a breadboard is that the components are not soldered and if they are positioned incorrectly they can be moved easily to a new position on the board.



1. Interconnection method

Bread board component placement

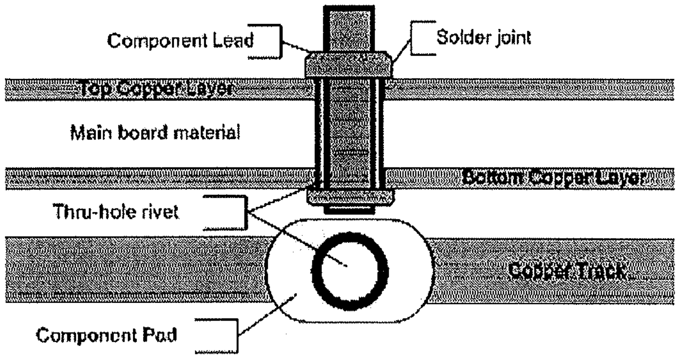


Bread boarding Safety Precautions

1. The component leads are to be nipped off appropriately so that they do not fit clumsily.
2. Leadless components like potentiometers will need small rigid single core soldered terminal extensions to facilitate easy insertion to the breadboard.
3. While bread boarding a circuit, the component distributions may not be that critical, but their positioning will definitely require serious attention.

2. PCB Component placement

Bend the lead as necessary and insert the component through the proper holes on the board.



2.1 Soldering

1. Make sure soldering iron tip is clean and tinned with solder.
2. Heat the pad and component legs with tip of the iron simultaneously, be careful not to burn the printed circuit board or any plastic or insulation.
3. Whilst the iron is still in contact with the area, apply a small amount of solder to the join; hold the iron on until the solder flows properly.
4. Check to make sure the solder joint is nice and shiny and that it does not bridge any connections.
5. Clean off the soldering iron and tin the tip, try to keep the tip well tinned with a nice shiny layer of solder at all times.
7. After soldering there can be excess flux on the board and around the soldering joints, cleaning this off with a toothbrush and rubbing alcohol can help to protect the joints from corrosion.
8. Having completed soldering the circuit the extended legs on the components need to be trimmed using wire clippers. The circuit is now ready for testing.

2.1.1. Soldering Safety Precautions

1. Only work in an environment that is well lit and ventilated.
2. Always unplug the soldering iron when it is unattended.
3. Be careful to keep clothes, hair, power cables and skin etc away from the soldering iron tip and the metal shaft.
4. Be careful when returning the iron to its stand, make sure it is secure and does not fall off.
5. Always handle the iron by the plastic handle.
6. Point the circuit away from yourself and others whilst trimming down component legs, and be careful of any sharp bits of metal whilst handling the circuit or components.

RESULT:

EXPERIMENT NO: 5

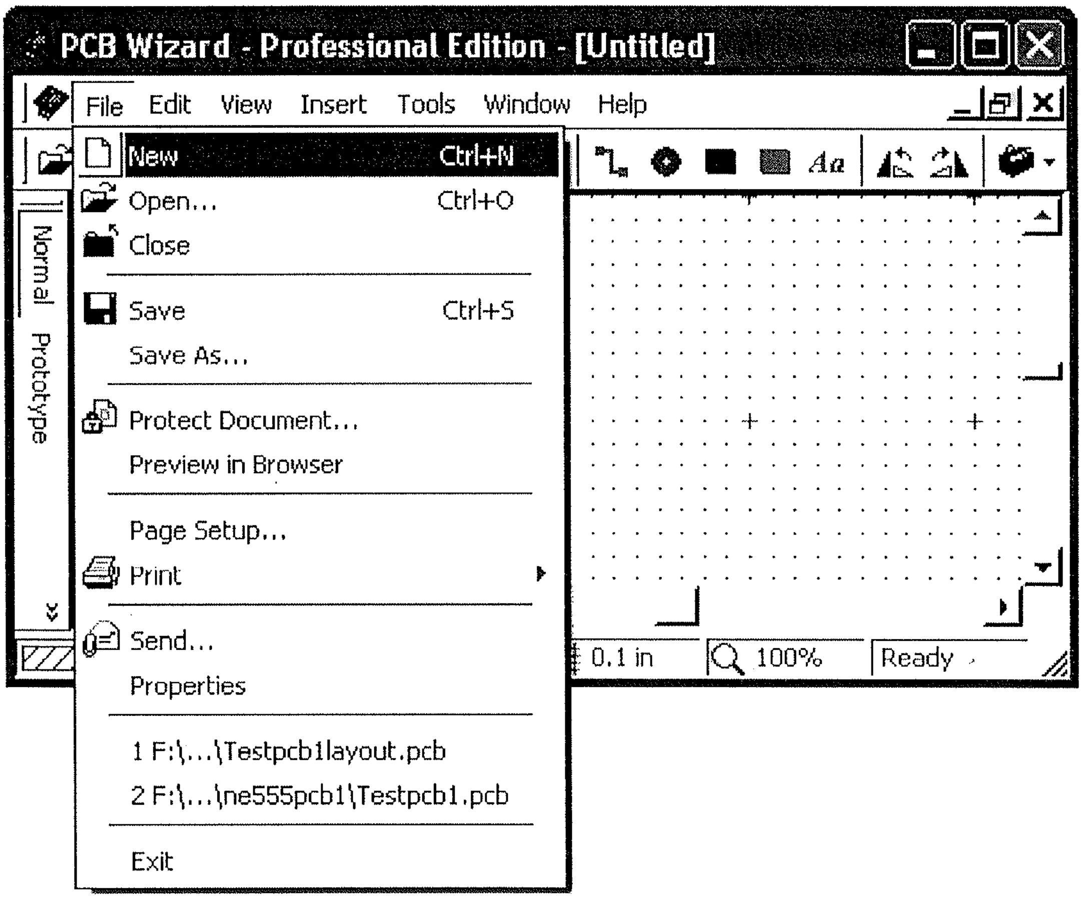
DRAWING OF ELECTRONIC CIRCUIT DIAGRAMS

AIM: To draw electronic circuit diagrams using EDA tools and to interpret the data sheets of IC's.

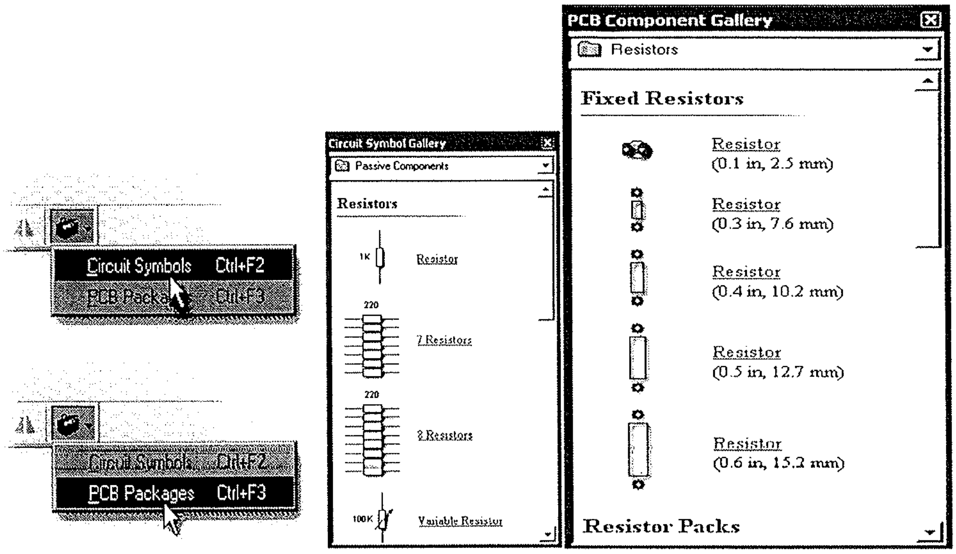
Drawing circuit diagram using PCB Wizard

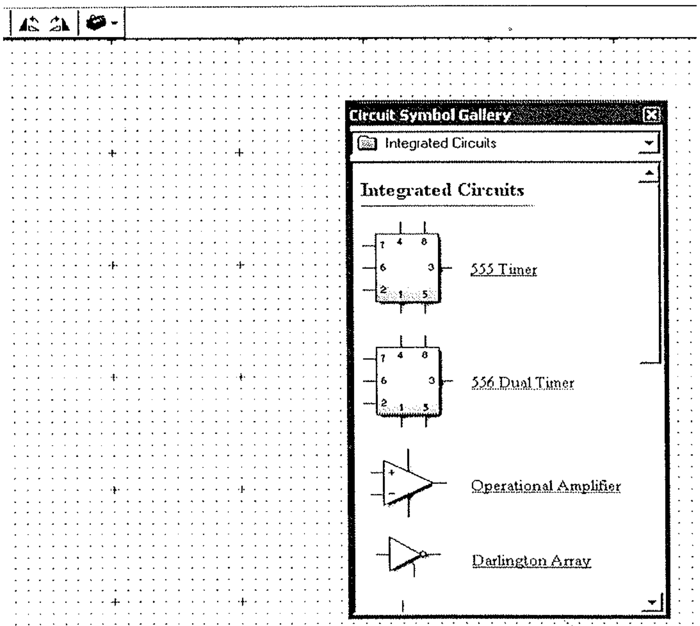
Step1: Double click on the **PCB Wizard** icon and open the application.

Step2: Open a New document by click on the **New** button or choose **New** from the File Menu.

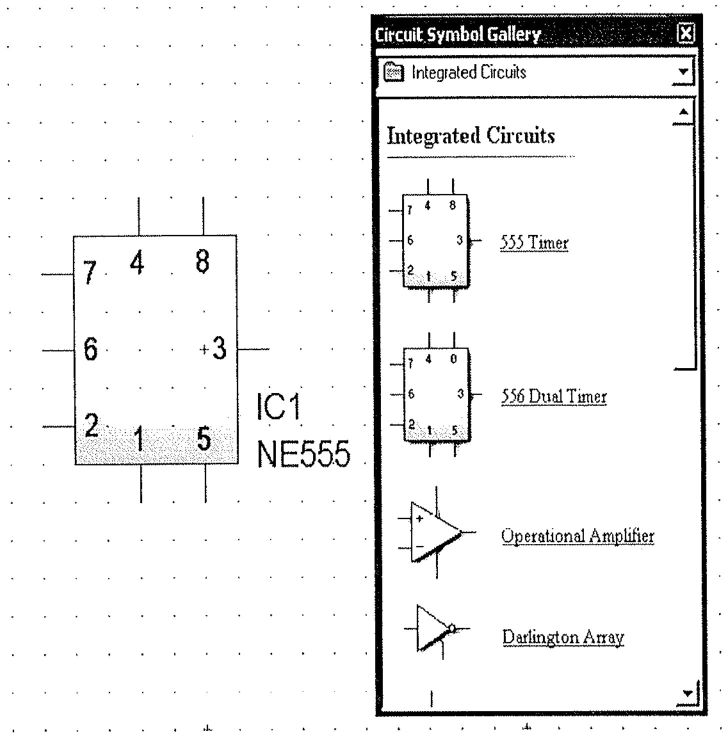


Step3: Add the components to the circuit from a visual library called Gallery. Gallery is subdivided into Circuit Symbols and PCB Packages. Components with in the Gallery are grouped according to their function. At the top of the window the dropdown list allows to select the components. To select the 555timer choose the Integrated Circuit groups.

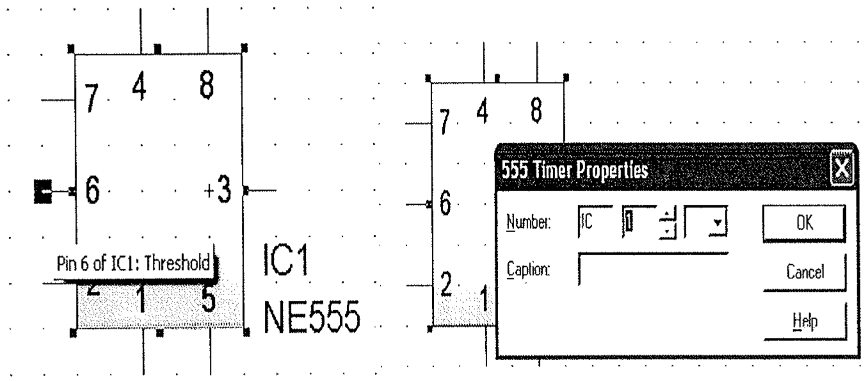




Then move the cursor over the 555 Timer symbol. Press and hold down the left mouse button. With the left mouse button still held down, move the mouse to drag the symbol onto the circuit. Finally, release the mouse button when the circuit symbol is in the required position.

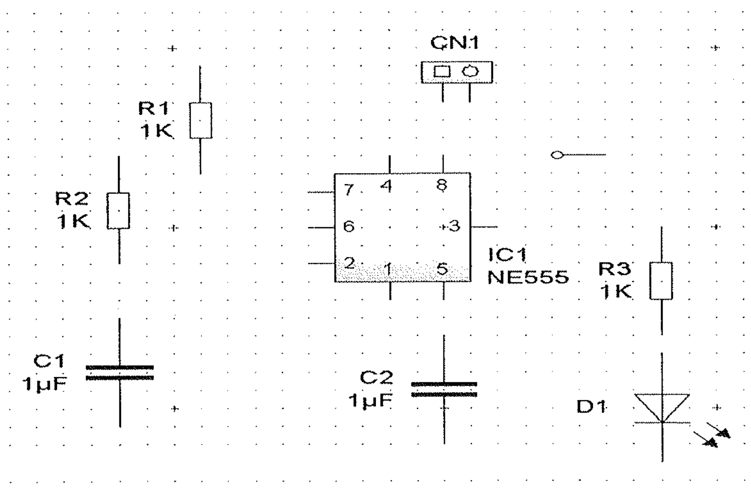


As the components are used they are automatically numbered. Labels next to the components show the current component value and number. Moving the mouse over the component pin will show the name of the pin along with the pin number.

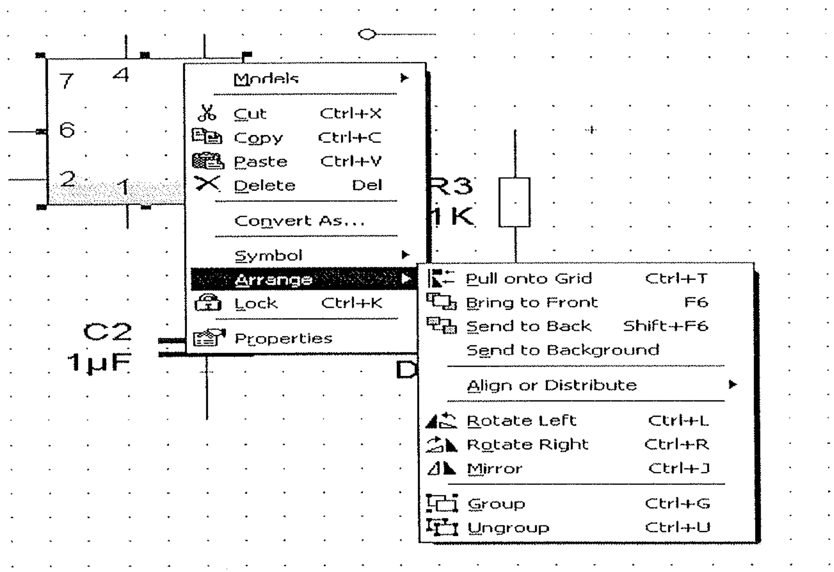


The pin number must match the number of the pin on the associated PCB package. Double click on the component allow changing its individual properties.

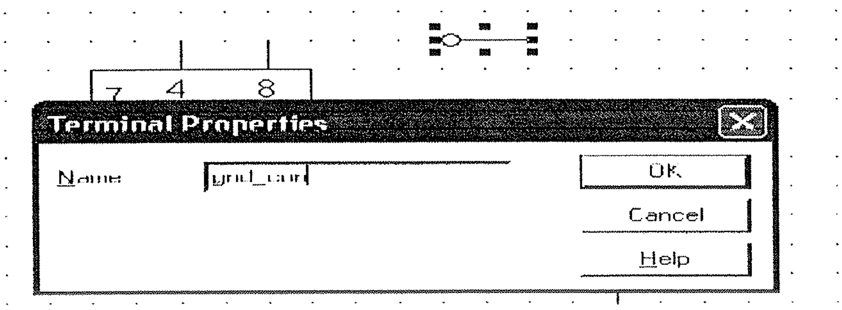
Step 4: Add the remaining components to draw the 555 timer circuit.



Step 5: Components can be aligned by Right click on the components.

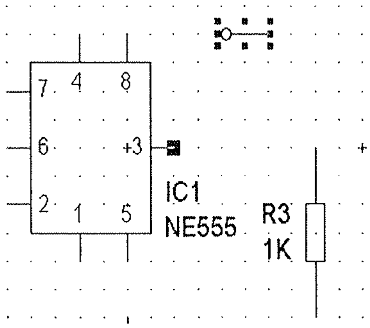


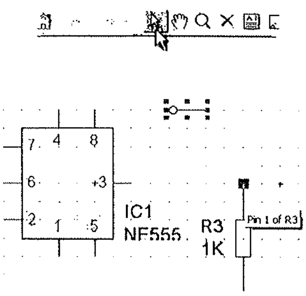
Terminals are special components that allow different parts of circuit to be connect together. To add net name to terminal double click on the terminal component.



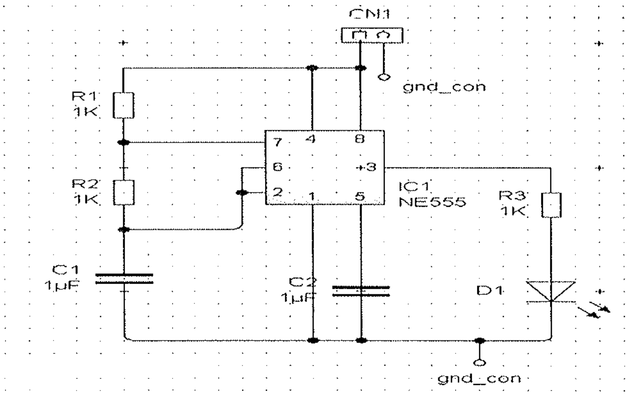
Step6: Once the components have been placed, start to wire the components together. To do this, first click on the **Select** button from the top toolbar. Next, move the mouse over

the pin 1 of R3. As hold the mouse over the pin a hint appears describing that particular component pin. Press and hold down the left mouse button. With the mouse button still held down, move the mouse to place a wire. To complete the wire, release the mouse button over the pin3 of IC 555.





You can now wire up the rest of the circuit using the diagram on the right as a guide.



Step7: Then save the design by click on the save option inside a folder

RESULT:

EXPERIMENT NO: 6

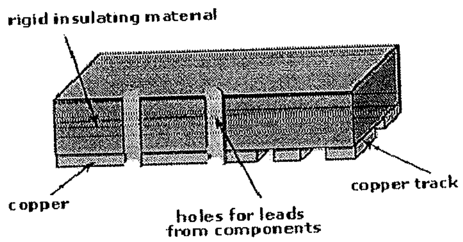
PRINTED CIRCUIT BOARDS

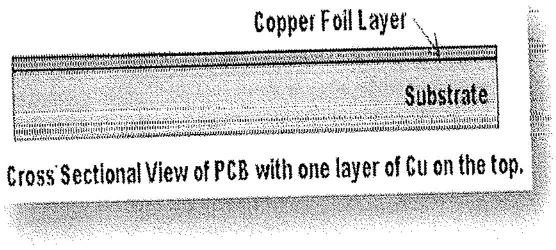
THEORY:

Printed circuit board

Printed circuit boards are electronic circuits boards created for mounting electronic components on a nonconductive board, and for creating conductive connections between them. The creation of circuit patterns is accomplished using both additive and subtractive methods. The conductive circuit is generally copper, although aluminum, nickel, chrome, and other metals are sometimes used.

Single-sided PCB: The simplest and the cheapest type of board, with a single layer of copper on a rigid base material.





PCB cross sectional view

PROCEDURE

1. PCB Preparation

1.1 Cutting and Cleaning

Cut board to size. Raw PCB material will be oxidized layer and dirty. So remove the oxidized layer with steel wool. Wash with soap and dry with paper towel and do not touch the copper side again.

1.2 Generate Art Work: Preparation

Prepare Schematics and board layout with components for reference during construction. Print solder layer on butter paper do not touch frosty side. The laser toner will act like glue to bond butter paper to copper board. Apply heat it will transfer image to PCB

1.3 Transfer Art Work (Ironing)

Preheat iron (temperature between polyester and rayon) and iron on blank white side heat for 5 minutes.

1.4 Cooling and separation

Hold paper tight and rinse under cold water do not allow water to deform paper and prematurely separate it from board. Turn over paper and cold back side and peel paper away from board.

1.5 Etching.

Fully submerge the above prepared PCB into etchant solution, agitate regularly. Ferric chloride will etch away Copper not protected by the laser toner (resist material).Etching will start at edges and move toward center. Remove from bath when all copper is etched away, then wash with soap and remove the resist material with steel wool and wash again .The new PCB is ready and coat with varnish to protect from further oxidation.

1.6 Drilling:

Now drill the holes for leaded components.

RESULT:

EXPERIMENT NO: 7.

ASSEMBLING AND DISMANTLING OF DESKTOP COMPUTER

AIM:

To assemble and disassemble the desktop computer system

Steps for Assembling

- Fix the SMPS on the cabinet of PC using the screws provided.
- Fix the motherboard on the cabinet of PC using the screws provided.
- Connect the power cables from SMPS to motherboard.
- Insert the preprocessor into the slot provided
- Fix the processor fan on the processor and use clips on it to keep it firm.
- Connect the power cable to the processor fan
- Insert the RAM card into the slots provided on the motherboard.
- Set the jumpers setting on the hard disc drive.
- Fix the hard disc drive in the space provided in the PC cabinet
- Fix the FDD in the space provided in the PC cabinet using screws provided.
- Fix the CD-ROM in the space provided in the PC cabinet
- Connect the FDD,HDD, CD-ROM drive to motherboard using flat ribbon.
- Connect power supply to the HDD, FDD, CD-ROM drive using the cables from the SMPS.
- Connect wires of speakers and lights of cabinet to the motherboard.
- Connect the network interface and other cards to motherboard by inserting in right slots and fix them in cabinet using the screws provided.
- Place the cabinet in right position.
- Fix the doors of the cabinet.
- Connect the data cable of monitor to the CPU.
- Connect the keyboard cable to the CPU.
- Connect the mouse cable to the CPU.
- Connect other devices to CPU.
- Connect the LAN cable to NIC in CPU.
- Connect the power supply to CPU.
- Connect the power supply to Monitor.
- Switch on the computer after giving the power supply.

Powering up for the first time:

1. Ensure that no wires are touching the CPU heat sink fan.
2. Plug your monitor, mouse and keyboard.
3. Plug in power card and switch the power supply if everything is connected as it should be.

Steps for Dissembling

- Switch off the power supply
- Disconnect the power supply cable from monitor.
- Disconnect the power supply cable from CPU.
- Disconnect the LAN cable.
- Disconnect the other devices in CPU such as printers.
- Disconnect the mouse cable from CPU.
- Disconnect the keyboard cable from CPU.
- Disconnect data cable of monitor from CPU.
- Remove the doors of cabinet.
- Place the cabinet such that motherboard faces the ceiling.
- Disconnect the NIC and other cards from mother board by removing from slots and unscrewing from cabinet.
- Disconnect the wires of speakers from mother board.
- Remove power supply cables from HDD, FDD, CD-ROM drive etc.
- Disconnect the HDD, FDD, CD-ROM drive from mother board by removing flat ribbon cable.
- Remove CR-ROM from cabinet.
- Remove the FDD from cabinet by unscrewing it.
- Remove the HDD from cabinet by unscrewing it.
- Removing RAM cards from slots on mother board.
- Disconnect the power cables from processor fan.
- Remove the processor fan by unlocking clips on it.
- Disconnect the power cables from SMPS on power cabinet.
- Remove mother board from cabinet by unscrewing it.
- Remove the SMPS from cabinet of PC by unscrewing it.

RESULT:

EXPERIMENT NO: 8

SQUARE WAVE GENERATOR IN IC BASE USING 555 TIMER

AIM

To design and set up a square wave generator using IC 555 Timer and assemble it on PCB.

APPARATUS REQUIRED

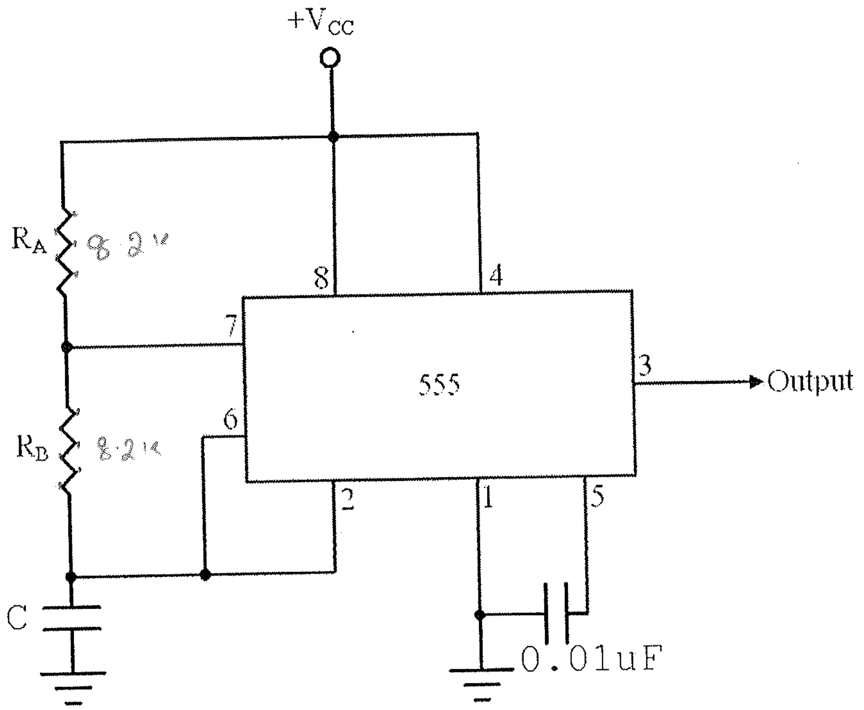
Sl.No.	Name	Specification	Quantity
1.	IC	NE 555	1
2.	Resistors	8.2KΩ	2
3.	Regulated power supply	(0-30)V	1
4.	Capacitors	0.1μF,0.01 μF	1,1
5.	CRO	30 MHz	1

THEORY

The **555 timer** is an integrated circuit (chip) implementing a variety of timer and multivibrator applications. The timer basically operates in one of the two modes—monostable (one-shot) multivibrator or as an astable (free-running) multivibrator. the 555 is used in astable mode to generate square wave. An astable multivibrator has no stable states. The circuit transits from one quasistable state to another and back automatically. Hence the circuit is also called free running non-sinusoidal oscillator.

Pin 5 is bypassed to ground through a 0.01 μF capacitor. The power supply (+Vcc) is connected to common of pin 4 and pin 8 and pin 1 is grounded. If the output is high initially, capacitor C starts charging towards through R_A and R_B. As soon as the voltage across the capacitor becomes equal to2/3Vcc, the upper comparator triggers the flip-flop, and the output becomes low. The capacitor now starts discharging through R_B and transistor Q_1. When the voltage across the capacitor becomes*1/3Vcc*, the output of the lower comparator triggers the flip-flop and the output becomes high. The cycle then repeats.

CIRCUIT DIAGRAM



DESIGN

The total period of the output waveform is

$T = t_c + t_d = 0.69\,(R_A + 2\,R_B)\,C$

Thus the frequency of oscillation is

$f_0 = 1/T = 1.45/[0.69\,(R_A + 2\,R_B)\,C]$

If we want to design an astable multivibrator of 50% duty cycle and 1 KHz frequency, the duty cycle is

$(R_A + R_B) / (R_A + 2\,R_B) = .5$

Solving we have, $R_A = R_B$

Substituting $C = 0.1\ \mu F$ and $f_0 = 1$ KHz, we get

$R_B = 1.45/[4 \times 1000 \times 0.1\ \mu F] = 3.6\ K\,\Omega$

Hence $R_A = 3.3\ K\,\Omega$

PROCEDURE

1. Assemble the circuit as shown in Figure with the calculated values of R_A, R_B and C on PCB
2. The CRO is connected between pin 3 and pin 1 to see the output waveform.
3. Measure the charging time tc and discharging time td for a suitable value of time/div selected on CRO.
4. Plot the wave forms on a graph paper

OUTPUT WAVEFORM

RESULT

EXPERIMENT NO: 9

SINE WAVE GENERATOR USING IC 741 OP-AMP

AIM

To design and set up a sine wave generator using IC 741 OP-AMP and assemble it on PCB

APPARATUS REQUIRED

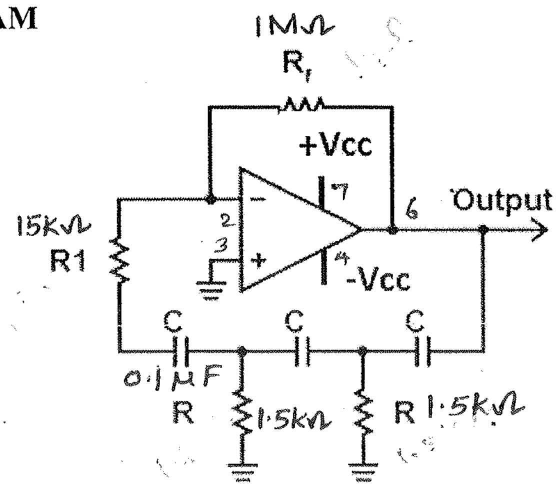
Sl.No.	Name	Specification	Quantity
1.	Function Generator	3 MHz	1
2.	CRO	30 MHz	1
3.	Dual Regulated Power Supply	0 – 30 V	1
4.	Op-Amp	IC 741	1
5.	Bread Board		1
6.	Resistors	1.5KΩ, 15 KΩ, 1 MΩ	2,1,1
7.	Capacitors	0.1μF	3

THEORY

Op-amp is used in inverting configuration as amplifier, with feedback loop consisting of a R-C phase shift network. The phase shift network consists of three RC voltage dividers. The capacitor reactance and phase shift introduced by each divider varies with frequency between 0 to 90 degrees. At the described operating frequency, each R-C network introduces a phase shift of 60^0, giving a total of 180^0 phase shift. Another 180^0 phase shift is introduced at the input of inverting amplifier making total phase shift around the loop 360^0. From calculation it is found that $f_0 = 1/ 2\pi\sqrt{6}\,RC$, $R_f / R_1 = 29$

This circuit will produce the sinusoidal waveform of frequency f_0, if the gain is 29 & total phase shift around the loop is 360^0. In most of the cases amplifier gain is kept more than 29. So that Gain β does not become less than unity and the oscillations does not die out.

CIRCUIT DIAGRAM



DESIGN

For an RC phase shift oscillator the frequency is given by

$$f_{oscillation} = \frac{1}{2\pi RC\sqrt{6}}$$

Let f = 500 Hz & Choose C = 0.1 μF.

Then R=1.3 KΩ≈ 1.5 KΩ

$R_1 \geq 10R$

Therefore R_1 = 10 * 1.5 KΩ = 15 KΩ

$R_f \geq 29R_1$

Therefore, $R_f \geq 29R_1$ = 29*15 KΩ = 435 KΩ.

Use 1 MΩ Resistor

.

PROCEDURE

1. Verify the conditions of Op-amp.
2. Connect the circuit as shown in the circuit diagram.
3. The IC is given proper biasing.
4. Observe the output in the CRO.

OUTPUT WAVEFORMS

RESULT