A Laboratory Manual for

Workshop Practice(WPE)

(22006)

Semester- I

Diploma in Electronics Engineering Group

(EJ/IS)

Bharati Vidyapeeth Institute of Technology

Navi Mumbai

Bharati Vidyapeeth Institute of Technology

Navi Mumbai

Certificate

This is to certify that, Mr./ Ms. …………………………………………….

Roll No. ……………… of first Semester of Diploma in ……………………………………………………… engineering of Bharati Vidyapeeth Institute of Technology Navi Mumbai(Inst.code:…….) has satisfactorily completed the term work in the subject Workshop Practice (22006) for the academic year 20…. to 20…. as prescribed in the MSBTE curriculum.

Place: ……………………... **Enrollment No. : …………………**

Date:………………………. **Exam. Seat No. : ………………….**

Sign:

Name:

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

List of experiments and progressive assessment for term work (TW) D-3

Academic Year: | **Name of Faculty:**

Course code: | **Subject Code:**WPX (22006)

Name of candidate: | **Enroll no.** **Roll no.**

Semester: 1-I | **Marks:** Max: 50 Min :20

Sr. No.	Title	Date of performance	Date of submission	Marks	Sign of teacher
1	Use relevant safety symbol from standard safety chart for a given situation.				
2	Perform mock drill session for firefighting using various classes of fire extinguishers and related accessories.				
3	Identify various fitting tools based on given specifications.				
4	Select machine tools and equipment used in fitting Shop.				
5	Prepare the given fitting job as per given drawings. Part-I				
6	Prepare the given fitting job as per given drawings. Part-II				
7	Identify the given hand tools, machine tools and equipment used in sheet metal shop.				
8	Prepare two simple sheet metal jobs as per given drawing. Part-I				
9	Prepare two simple sheet metal jobs as per given drawing. Part-II				
10	Perform sheet metal and fitting operation for the given utility job. Part-I				
11	Perform sheet metal and fitting operation for the given utility job. Part-II				
12	Identify various: (a) Passive electronic components in the given circuit. (b) Active				

	electronics components in the given circuit.				
13	Identify various controls available on the front panel of analog and digital multimeter.				
14	Determine the value of given resistor using digital multimeter to confirm with colour code				
15	Test the semiconductor diodes using digital multimeter.				
16	Test the LEDs display using multimeter.				
17	Identify three terminals of a transistor using digital multimeter.				
18	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.				
19	Identify relay terminals (coil, common, normally open and close)				
20	De-solder the components using de-soldering tools.				
21	Build simple circuits using resistors, diode, switch and LED.				
22	Build simple circuits using relay and other electronics components.				
23	Test the circuit developed in the experiment No.21 using various testing equipment.				
24	Solder more than two components on PCB for continuity.				
Total marks					
Marks out of 50					

Signature of student: Signature of Faculty:

Experiment no. 1

Title: Use relevant safety symbol from standard safety chart for a given situation.

Theory :

Safety is the state of being "safe" (from French *sauf*), the condition of being protected from harm or other non-desirable outcomes. Safety can also refer to the control of recognized hazards in order to achieve an acceptable level of risk.

What is a safety sign?

a) safety and/or health sign

– a sign providing information or instruction about safety or health at work by means of a signboard, a colour, an illuminated sign or acoustic signal, a verbal communication or hand signal.

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b) signboard

– a sign which provides information or instructions by a combination of shape, colour and a symbol or pictogram which is rendered visible by lighting of sufficient intensity. In practice, many signboards may be accompanied by supplementary text, eg ‘Fire exit’, alongside the symbol of a moving person. Signboards can be of the following types:

i) prohibition sign

– a sign prohibiting behaviour likely to increase or cause danger (eg ‘no access for unauthorised persons’)

Intrinsic features:

(a) round shape;

(b) black pictogram on white background, red edging and diagonal line (the red part to take up at least 35% of the area of the sign).

ii) warning sign

– a sign giving warning of a hazard or danger (eg ‘danger: electricity’)

Intrinsic features:

(a) triangular shape;

(b) black pictogram on a yellow background with black edging (the yellow part to take up at least 50% of the area of the sign).

iii) mandatory sign

– a sign prescribing specific behaviour (eg ‘eye protection must be worn’)

Intrinsic features:

(a) round shape;

(b) white pictogram on a blue background (the blue part to take up at least 50% of the area of the sign).

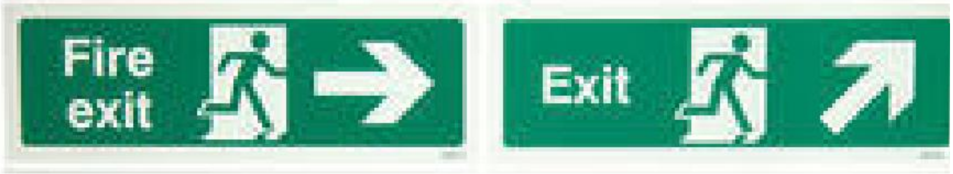
iv) emergency escape or first-aid sign

– a sign giving information on emergency exits, first aid, or rescue facilities (eg emergency exit/escape route.

Intrinsic features:

(a) rectangular or square shape;

(b) white pictogram on a green background (the green part to take up at least 50% of the area of the sign).



c) safety colour

– a colour to which a specific meaning is assigned (eg yellow means ‘be careful’ or ‘take precautions’)

d) illuminated sign

– a sign made of transparent or translucent materials which is illuminated from the inside or the rear to give the appearance of a luminous surface (eg emergency exit signs)

e) hand signal

– a movement or position of the arms or hands giving a recognised signal and guiding people who are carrying out manoeuvres which are a hazard or danger to people.

General safety rules

1. Safety glasses must be worn.
2. Safety footwear must be worn when working in the workshop.
3. Ask workshop supervisor before using equipment.
4. Clean machines after use.
5. Take care when using compressed air.
6. Hearing protection should be worn when using machinery.
7. Working alone after hours is not permitted

Causes of workshop accidents

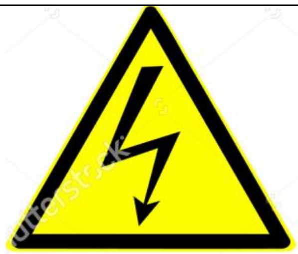
Work shop accidents are unexpected happing that can be harmful to students in the workshop. Workshop accidents are caused when:

1. Equipments are not properly arranged in the workshop
2. Students are careless when handling equipments
3. Students do not follow the manufacturer's guide handing the equipment
4. Students do not follow the worship safety rules and regulations
5. Students play in the workshop
6. Equipments are faulty due to lack of regular servicing
7. Work out parts of equipments is not replaced.

First aid

First aid is the immediate treatment or care given to a person suffering from an injury or illness until more advanced care is provided or the person recovers. First aid equipment includes first aid kits and other equipment used to treat injuries and illnesses.

Student Activity:

Sr. No.	Symbol	Meaning or purpose
1		
2		
3		
4		
5		
6		

7		
8		

Conclusion:

Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 2

Title: Perform mock drill session for firefighting using various classes of fire extinguishers and related accessories.

Theory:

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light, and various reaction products. Slower oxidative processes like rusting or digestion are not included by this definition.

Fire can be extinguished by removing any one of the elements of the fire tetrahedron. Consider a natural gas flame, such as from a stovetop burner. The fire can be extinguished by any of the following:

- turning off the gas supply, which removes the fuel source.
- covering the flame completely, which smothers the flame as the combustion both uses the available oxidizer (the oxygen in the air) and displaces it from the area around the flame with CO2.
- application of water, which removes heat from the fire faster than the fire can produce it (similarly, blowing hard on a flame will displace the heat of the currently burning gas from its fuel source, to the same end), or
- application of a retardant chemical such as Halon to the flame, which retards the chemical reaction itself until the rate of combustion is too slow to maintain the chain reaction.

Classes of Fire - A, B, C, D, and K

Fires are classified by the types of fuel they burn.

Class A

Class A Fires consist of ordinary combustibles such as wood, paper, trash or anything else that leaves an ash. Water works best to extinguish a Class A fire.

Class B

Class B Fires are fueled by flammable or combustible liquids, which include oil, gasoline, and other similar materials. Smothering effects which deplete the oxygen supply work best to extinguish Class B fires.

Class C

Class C Fires. Energized Electrical Fires are known as Class C fires. Always de-energize the circuit then use a non-conductive extinguishing agent. Such as Carbon dioxide.

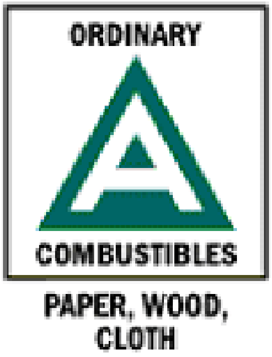
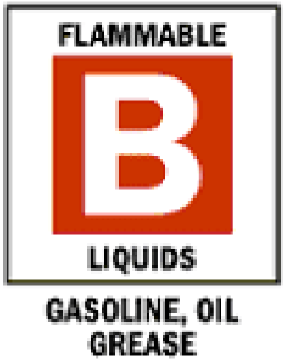
Class D

Class D Fires are combustible metal fires. Magnesium and Titanium are the most common types of metal fires. Once a metal ignites do not use water in an attempt to extinguish it. Only use a Dry Powder extinguishing agent. Dry powder agents work by smothering and heat absorption.

Class K

Class K Fires are fires that involve cooking oils, grease or animal fat and can be extinguished using Purple K, the typical agent found in kitchen or galley extinguishers.

Tools and Equipments:

NAME OF EXTINGUISHER	APPLICATION	IMAGE
	**Class A** fires involve solid combustible materials of organic nature such as wood, paper, rubber, plastics, etc.	
	**Class B** fires involve flammable or combustible liquids and gases such as gasoline, diesel fuel, paint, paint thinners, and propane. (Class B fires generally involve materials that Boil or Bubble.) The background of the symbol will be either Metallic or Red, if in color.	

	**Class C** fires generally deal with electrical Current. As long as it's "plugged in" it would be considered a class C fire. Examples include fires involving fuse boxes, circuit breakers, appliances, and machinery The background of the symbol will be either Metallic or Blue, if in color.	
	**Class D** fire involves combustible metals such as sodium, potassium, magnesium, and titanium. It takes special extinguishing agents (Metal-X, foam) to fight such a fire. The background of the symbol will be either Metallic or Yellow, if in color.	

Issue and return system of tools, equipment and consumables

1. Tools, and Non consumable materials will be issued/returned by entering/leaving in the Daily issue Register. Staff is authorized to draw the material from Storehouse.
2. Tool kits will be issued/returned to students at the end of the practical. A Tool kit issued/returnedregister as per format attached as Appendix to this standard operating procedure will be maintained to register the particulars of issues
3. For every issued/returned signature of individuals irrespective of the appointment shall be taken.

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 3

Title : Identify various fitting tools based on given specifications.

Theory :

Introduction:

The bench work and fitting plays an important role in every engineering works, to complete and finish the job to the desired accuracy. Though today in most industries most of the work is done by automatic machines and finish to a fairly good degree of accuracy. Still they required some operations to be done by hand to finish them to the desired accuracy. The operations commonly used in fitting work may be:

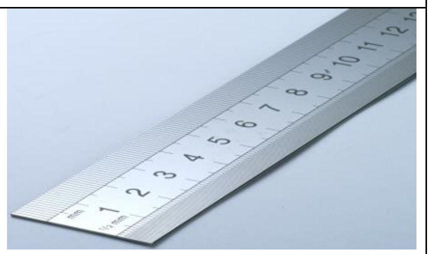
1. Filing
2. Marking
3. Punching
4. Chipping
5. Sawing(cutting)
6. Grinding
7. Drilling
8. Threading(tapping)
9. Scrapping
10. Reaming

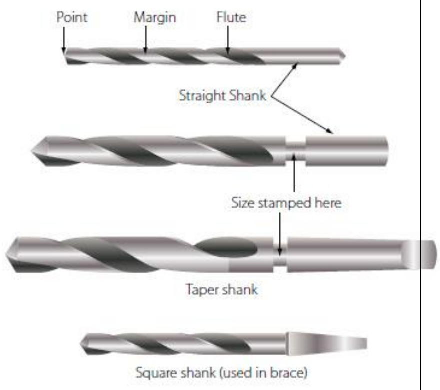
Tools and Equipment:

NAME	DESCRIPTION	IMAGE
Bench Vice	The most commonly used vice is the engineers parallel vice sometime called as fitter vice. It must be firmly fitted to bench with the help of wrench screw or nuts and both the vice essentially consists of cast iron body, a fixed jaw, a movable jaw both made up of cast steel, a handle, a square, threaded screw up and nut all made of mild steel, separate cast steel a plates form jaw places are fixed to jaw by steel by means of jaw plates have teeth for holding firmly but this has some disadvantages for soft metals which may be damaged when held firmly between the face protective grips or claps which can be damaged when held firmly between the face protective grips or claps which can be made of land. Fiber tin plates are therefore usually fitted over the jaw to prevent the damaging of the surface of finishing work. The moment of the vice is caused by the movement of the screw	

	through	
Hacksaw	The hacksaw is the chief tool used by the fitter for cutting plates rods, pipes and bars into desired length. It consists of metal frame which may be solid or adjustable. The blade fits over two pegs which project from the sliding in the ends of frame. The wing nut at the front end to the frame is for tensioning the blade.	
Centre punch	The centre punch looks like a point has angles more than that of prick punches the angles usually being 60 degree. The centre punch is needed to mark prick punch marks larger at the same blow of the hammer is needed to mark the point. In its body portion the punch is steel rod 150mm long and 8 to 13 mm in diameter.	
Hammer	The hammer is used to strike the job or tool. A hammer consists of head, face, peen and shaft or handle. The hammer heads are made from plain of about 0.6% carbon and are shaped by stamping and forging. The two ends must be hardened and tempered and the centre of the head with eye is left soft. The size of hammer is indicated by its weight. The various types of hammers in common used are as follows: 1. Ball peen hammer2. Cross peen hammer3. Straight peen Hammer4. Double Face Hammer5. Soft hammer	
Flat Chisel	The flat chisel is the most common of the entire chisel used in engineering. It is chisel, which is used for general chipping operation. It may be used for removing the surface of jobs. The flat chisel should be down to shape shown in diagram wider cutting edge should be slightly curved as soon as this will prevent the common digging in. when it is being used the length of the flat chisel varies from 100 to 400mm which the width of cutting edge varies from 10 to 35mm.	

File	A file is hardened piece of high grade steel with slanting rows of teeth. It is used to cut smooth or fie metal ports. It cuts all metals except hardened steel and it cuts only on the forward stroke. The files are classified according to size, cut of teeth, grade and shape or cross section of the file. **The size of file** is indicated by its length. It is the distance from points to the heel without tong. The length of file is 200mm to 450mm and 100mm to 200mm for finer work. **Shape of file:** The shapes of files according to their shapes or cross-section are classified as shown below: 1. Flat file 2. Square file 3. Triangular file 4. Round file 5. Half round files 6.Knife edge files 7. Hand file 8. Pillar file 9. Warding file 10. Needle file.	
Tap	Taps are made up of high speed steel and taps are usually made in sets of three:1. Taper taps2. Plug taps3. Bottoming taps. According to their specification they are called as roughed, antependia and finished respectively. The ends of the rougher have above six threads tapered. This is used to start the threads so that the threads are formed gradually as the tap is turned into holes. The intermediate is tapered back from the edge about three or four threads. This used after the tapered tap has been used to cut the threads so as possible. The finishes have full threads for whole of its length. This is used to finish work prepared by other two taps.	
Tap Wrench	The upper part of tap wench of the shank ending in the square for holding the tap by a tap wrench. This is two handled wrench and it may be either fixed or adjustable. Wrench may be used for taps of various sizes.	

V Block	V-Blocks are precision metalworking jigs typically used to hold round metal rods or pipes for performing drilling or milling operations. They consist of a rectangular steel or cast iron block with a 90-degree channel rotated 45-degrees from the sides, forming a V-shaped channel in the top. A small groove is cut in the bottom of the "V". They often come with screw clamps to hold the work. There are also versions with internal magnets for magnetic work-holding. V-blocks are usually sold in pairs.	
Angle plate	An angle plate is a work holding device used as a fixture in metalworking. The angle plate is made from high quality material (generally spheroidal cast iron) that has been stabilized to prevent further movement or distortion. Slotted holes or "T" bolt slots are machined into the surfaces to enable the secure attachment or clamping of work pieces to the plate, and also of the plate to the worktable. Angle plates also may be used to hold the work piece square to the table during marking-out operations. Adjustable angle plates are also available for work pieces that need to be inclined, usually towards a milling cutter. Angle plates also may be used to hold the work piece square to the table during marking out operations.	
Steel rule	These are made up of stainless steel and are available in many sizes ranging from 1/2 ft. to 2 ft. These are marked in inches or millimetres. All the faces are machined true. The edges of steel rule should be protected from rough handling.	

Twist drills	A drill is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking. Special designed drills are also used in medical and other applications such as in space missions. The drill bit is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding of small particles (oil drilling), or crushing and removing pieces of the work piece	
Reamers	A reamer is a type of rotary cutting tool used in metalworking. Precision reamers are designed to enlarge the size of a previously formed hole by a small amount but with a high degree of accuracy to leave smooth sides. There are also non-precision reamers which are used for more basic enlargement of holes or for removing burrs. The process of enlarging the hole is called reaming. There are many different types of reamer and they may be designed for use as a hand tool or in a machine tool, such as a milling machine or drill press.	
Marking block	A surface gauge is very useful when finding the centre of a piece of round section material. It is normally used to 'scribe' parallel lines. Its base is heavy and this means it is stable when in used. Surface gauge - gauge consisting of a scriber mounted on an adjustable stand; used to test the accuracy of plane surfaces	

Surface Plate	A surface plate is a solid, flat plate used as the main horizontal reference plane for precision inspection, marking out (layout), and tooling setup. The surface plate is often used as the baseline for all measurements to the work piece, therefore one primary surface is finished extremely flat with accuracy up to 0.00001 in or 250 nm for a grade AA or AAA plate.	
Die	The tool used for cutting external threads on round bars ortubes is called Die.	
Die Stock	The tools for holding and threading die are called asdie stock. The die stock is provided with threading rings. When threaded die is interested into stocks, the threaded rings are lightened so that it engages in drilled holes of to hold it.	
Try Square	It is used for checking squareness of small works	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 4

Title : Select machine tools and equipment used in fitting Shop.

Theory :

Operation of Fitting shops machineries

NAME	DESCRIPTION	IMAGE
Drilling machine	In drilling the job held is vice and other clamping device on the table of the machine. Cylindrical work pieces are mounted by means of gripping plate and V-block. The gripping plate is long enough to fasten by 2 screws at both end with V-bloc and work piece are placed between them. The socket contains drill is fitted in machine spindle and the spindle is lowered by hand level to lightly touched the centre of job already marked out for drilling. Be sure that the point of drill is exactly over the centre of punch mark. The machine is now started and now the rotating drill is gradually pressed into metal to produce a hole. As more of the drill enters the mental see whether the drill is running symmetrically. The pressure on the drill should be relieved frequently otherwise cutting edge of the drill from leaving spilled. Brass and caste iron paraffin and turpentine are used.	

Power saw	A power hacksaw is a type of hacksaw that is powered either by its own electric motor (also known as electric hacksaw) or connected to a stationary engine. Most power hacksaw are stationary machines but some portable models do exist. Stationary models usually have a mechanism to lift up the saw blade on the return stroke and some have a coolant pump to prevent the saw blade from overheating. While stationary electric hacksaw are reasonably uncommon they are still produced but saws powered by a stationary engines have gone out of fashion. The reason for using one is that they provide a cleaner cut than an angle grinder or other types of saw.	
Grinder	A bench grinder or pedestal grinder is a machine used to drive an abrasive wheel (or wheels). Depending on the grade of the grinding wheel it may be used for sharpening cutting tools such as lathe tools or drill bits. Alternatively it may be used to roughly shape metal prior to welding or fitting. A wire brush wheel or buffing wheel can be interchanged with the grinding wheels in order to clean or polish work-pieces.	

Basic process

1. Chipping:-Chip formation is part of the process of cutting materials by mechanical means, using tools such as saws, lathes and milling cutters. An understanding of the theory and engineering of this formation is an important part of the development of such machines and their cutting tools.

2. Filling:-Methods of filing The following are the two commonly used methods of filing:

1. Cross-filing. This method is used for efficient removal of maximum amount of metal in the shortest possible time. It may be noted that the file must remain horizontal throughout the stroke (long, slow and steady) with pressure only applied on the forward motion.

2. Draw filing. This method is used to remove file marks and for finishing operations. Here, the file is gripped as close to the work as possible between two hands. In this filing method, a fine cut file with a flat face should be used.

3.Scraping:- A hand scraper is a single-edged tool used to scrape metal from a surface. This may be required where a surface needs to be trued, corrected for fit to a mating part, needs to retain oil, or to give a decorative finish. Surface plates were traditionally made by scraping. Three raw cast surface plates, a flat scraper and a quantity of bearing blue (or Red Lead) were all that was required in the way of tools.

4.Grinding:-Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. A wide variety of machines are used for grinding: Hand-cranked knife-sharpening stones (grindstones), Handheld power tools such as angle grinders and die grinders, Various kinds of expensive industrial machine tools called grinding machines, Bench grinders often found in residential garages and basements.

5.Marking:-Marking out or layout means the process of transferring a design or pattern to a workpiece, as the first step in the manufacturing process. It is performed in many industries or hobbies although in the repetition industries the machine's initial setup is designed to remove the need to mark out every individual piece.

6. Sawing:-A saw is a tool consisting of a tough blade, wire, or chain with a hard toothed edge. It is used to cut through material, very often wood. The cut is made by placing the toothed edge against the material and moving it forcefully forth and less forcefully back or continuously forward. This force may be applied by hand, or powered by steam, water, electricity or other power source. An abrasive saw has a powered circular blade designed to cut through metal.

Sawing is a process wherein a narrow slit is cut into the workpiece by a tool consisting of a series of narrowly spaced teeth, called a saw blade. Sawing is used to separate work parts into two or more pieces, or to cut off an unwanted section of a part.

7. Drilling:-Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute.

8. Tapping:-Taps and dies are tools used to create screw threads, which is called threading. Many are cutting tools; others are forming tools. A tap is used to cut or form the female portion of the mating pair (e.g., a nut). A die is used to cut or form the male portion of the mating pair (e.g., a bolt). The process of cutting or forming threads using a tap is called tapping, whereas the process using a die is called threading.

Both tools can be used to clean up a thread, which is called chasing. However, using an ordinary tap or die to clean threads will generally result in the removal of some material, which will result in looser and weaker threads. Because of this, threads are typically cleaned using special taps and dies made for this purpose, which are known as "chasers".

9. Dieing:-A die is a specialized tool used in manufacturing industries to cut or shape material mostly using a press. Like molds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology.

10. Reaming:-The process of enlarging the hole is called reaming. There are many different types of reamer and they may be designed for use as a hand tool or in a machine tool, such as a milling machine or drill press.

Safe and Correct Practices

The following are some of the safe and correct work practices in bench work and fitting shop:

- Position the work piece area such that the cut to be made is close to the vice.
- Use soft jaws when holding finished work surfaces in a bench vice.
- Position the work in a vice so that it does not overhang into an aisle of the other area where a person might accidentally brush against it.
- Select the hacksaw blade pitch and set, most suitable for the material and the nature of cutting operation.
- Apply force only on the forward (cutting) stroke, relieve the force on the return stroke.
- Cut a small groove with a file in sharp corners, where a saw cut is to be started.
- The groove permits accurate positioning of the saw teeth from digging in and bending the metal.
- For cutting thin metal strips, clamp them between two pieces of the wood. Cutting through both the wood and the metal prevents the saw teeth from digging in and bending the metal.

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 5

Title : Prepare the given fitting job as per given drawings Part I.

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 6

Title : Prepare the given fitting job as per given drawings Part II.

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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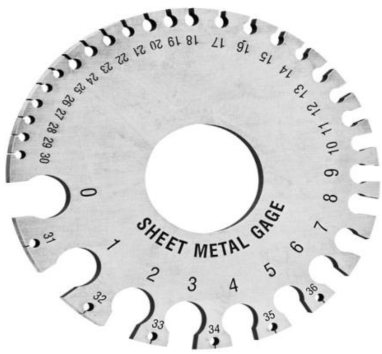
Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 7

Title : Identify the given hand tools, machine tools and equipment used in sheet metal shop.

Theory : Sheet metal work is generally regarded as the working of metal from 16 gauges down to 30 gauges with hand tool and simple machines into various forms by cutting, forming into shapes and joining. It as useful trade in engineering works also for day to day requirements. in sheet metal work , the knowledge of geometry metal work, measurements and properties of metal is essential . Examples :- pipes , hoods , funnels hoppers etc.

Basic tools used in sheet metal works

Thickness Gauge	It is used to measure the clearance between the parts during	
Sheet Metal Gauge	It's used to measure the thickness of sheet.	
Dividers	They are used for drawing circles or arcs on sheet metals and also to marak points and divide lines in to equal parts	

Puncher	Its used for marking out work and locating centers .	
Snips and shears	A snip is used like a pair of supports to cut thin , soft meta	
Pliers	They are used for holding, cutting and bung work	
Rivet set	Its used for shape the end of the rivet into a round, smooth	
Straight edge	It's used for scribing long straight line .	

Pliers	Pliers are a hand tool used to hold objects firmly. They are also useful for bending and compressing a wide range of materials	
Scriber	It's a long wire of steel with it's one end sharply pointed and hardened to scratch lines on sheet metal in laying out patterns .its also called metal workers pencil	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 8

Title: Prepare two simple sheet metal jobs as per given drawings. Part-I

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 9

Title: Prepare two simple sheet metal jobs as per given drawings. Part-II

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 10

Title: Perform sheet metal and fitting operation for the given utility job. Part-I

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 11

Title: Perform sheet metal and fitting operation for the given utility job. Part-II

NAME OF JOB	
MATERIAL USED	
TOOLS USED	
JOB DRAWING	

PROCEDURE	

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment no. 12

Title: Identify various:

(a) Passive electronic components in the given circuit.
(b) Active electronics components in the given circuit.

Theory:

ACTIVE COMPONENTS

Any component that is capable of providing a power gain is called an active component. They inject power to the circuit, and can control the current (or energy) flow within the circuit. In other words those devices or components which required external source to their operation are called Active Components.

For Example: battery, vacuum tubes, transistor and SCR (silicon controlled rectifier / thyristor).Diode, BJT, FETetc

Explanation and Example: As we know that Diode is an Active Components. So it is required an External Source to its operation.
Because, If we connect a Diode in a Circuit and then connect this circuit to the Supply voltage., then Diode will not conduct the current Until the supply voltage reach to 0.3(In case of Germanium) or 0.7V(In case of Silicon).

PASSIVE COMPONENTS

Those devices or components which do not required external source to their operation is called Passive Components. These components cannot provide any power gain or control the current (energy) flow in the circuit and need the help of active devices to operate. In other words these devices or components can store or maintain Energy, drawn from an active element, in the form of Voltage or Current are known as Passive Components

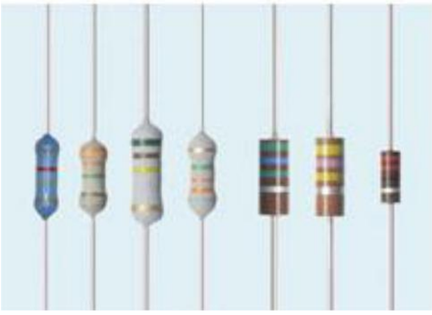
For Example: Resistor, Capacitor, Inductor etc.

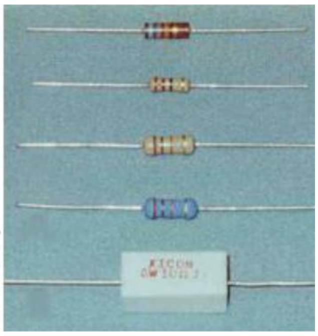
Explanation and Example: Passive Components do not require external source to their operation. Like a Diode, Resistor does not require 0.3 0r 0.7 V. I.e., when we connect a resistor to the supply voltage, it starts work automatically without using a specific voltage

In very Simple words;
Active Components: **Energy Donor**
Passive Components: **Energy Acceptor**
Also Passive Components are in linear and Active Components are in non linear category.

RESISTORS

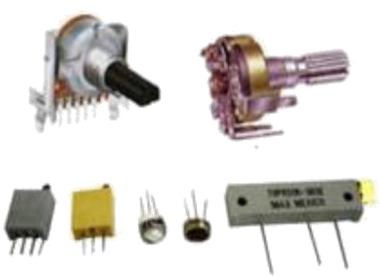
A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law. A device used in electrical circuits to maintain a constant relation between current flow and voltage. Resistors are used to step up or lower the voltage at different points in a circuit and to transform a current signal into a voltage signal or vice versa, among other uses. The electrical behaviour of a resistor obeys Ohm's law for a constant resistance; however, some resistors are sensitive to heat, light, or other variables.





POTENTIOMETERS

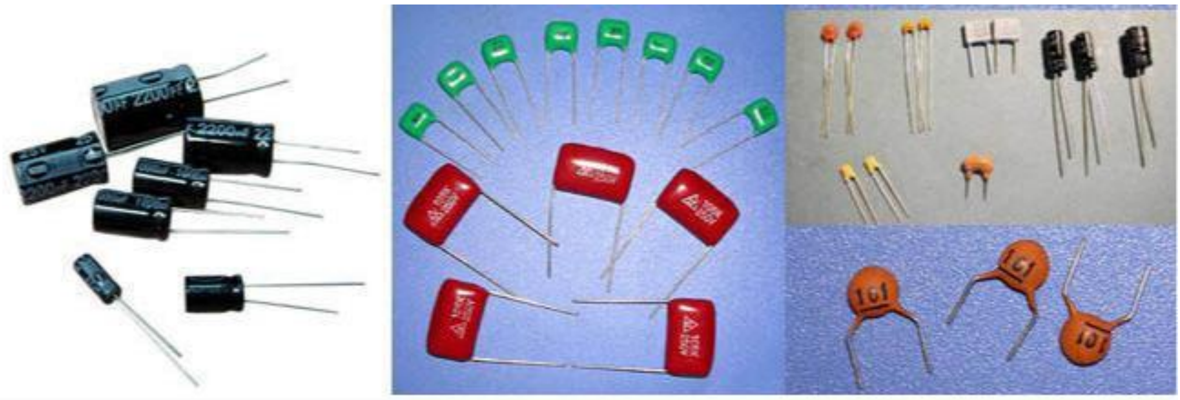
Potentiometers are variable resistors. They normally have their value marked with the maximum value in Ohms. Smaller trimpots may use a 3-digit code where the first 2 digits are significant, and the 3rd is the multiplier (basically the number of 0′s after the first 2 digits). For example, code 104 = 10 followed by four 0′s = 100000 Ohms = 100K Ohms. They may also have a letter code on them indicating the taper (which is how resistance changes in relation to how far the potentiometer is turned). They are typically marked with an “VR” on a circuit board.



CAPACITORS

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. By contrast, batteries store energy via chemical reactions. The forms of practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator); for example, one common construction consists of metal foils separated by a thin layer of insulating film. Capacitors are widely used as parts of electrical circuits in many common electrical devices.

Capacitors are also very commonly used. A lot have their values printed on them, some are marked with 3-digit codes, and a few are color coded. The same resources listed above for resistors can also help you identify capacitor values. They are typically marked with an “C” on a circuit board.



INDUCTORS

An inductor, also called a coil or reactor, is a passive two-terminal electrical component which resists changes in electric current passing through it. It consists of a conductor such as a wire, usually wound into a coil. When a current flows through it, energy is stored in a magnetic field in the coil. When the current flowing through an inductor changes, the time-varying magnetic field induces a voltage in the conductor, according to

Faraday’s law of electromagnetic induction, which by Lenz's law opposes the change in current that created it.

Inductors, also called coils, can be a bit harder to figure out their values. If they are color coded, the resources listed for resistors can help, otherwise a good meter that can measure inductance will be needed. They are typically marked with an “L” on a circuit board.



TRANSFORMERS

A transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (emf) or voltage in the secondary winding.

Transformers are normally pretty easy to identify by sight, and many have their specs printed on them. They are typically marked with an “T” on a circuit board.



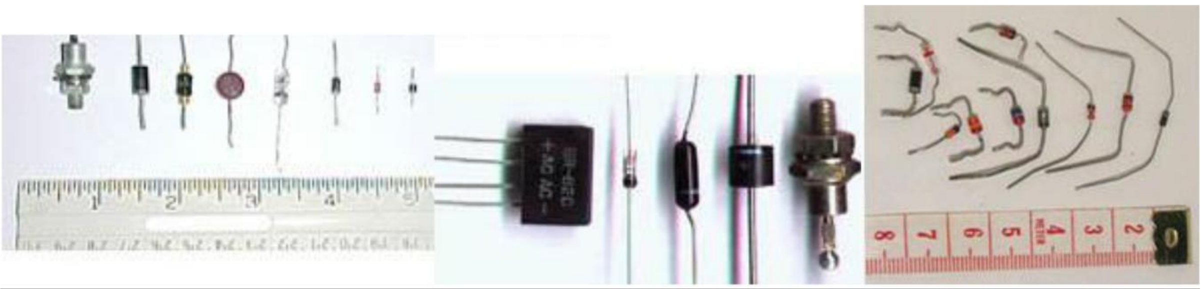
FUSES

In electronics and electrical engineering, a fuse is a type of low resistance resistor that acts as a sacrificial device to provide overcurrent protection, of either the load or source circuit. Its essential component is a metal wire or strip that melts when too much current flows, which interrupts the circuit in which it is connected. Short circuit, overloading, mismatched loads or device failure are the prime reasons for excessive current. A fuse interrupts excessive current (blows) so that further damage by overheating or fire is prevented.

SEMICONDUCTORS DIODES

In electronics, a diode is a two-terminal electronic component with asymmetric conductance, it has low (ideally zero) resistance to current flow in one direction, and high (ideally infinite) resistance in the other.

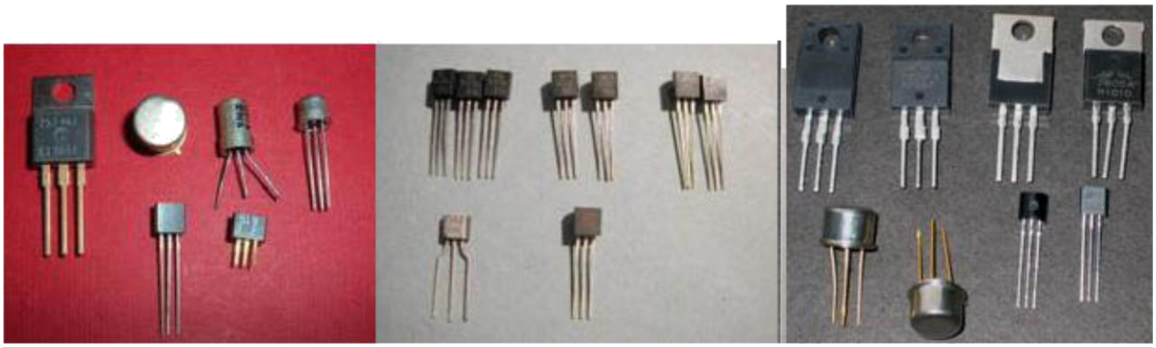
Semiconductors, such as Diodes (typically marked with an "D" on a circuit board).



TRANSISTORS

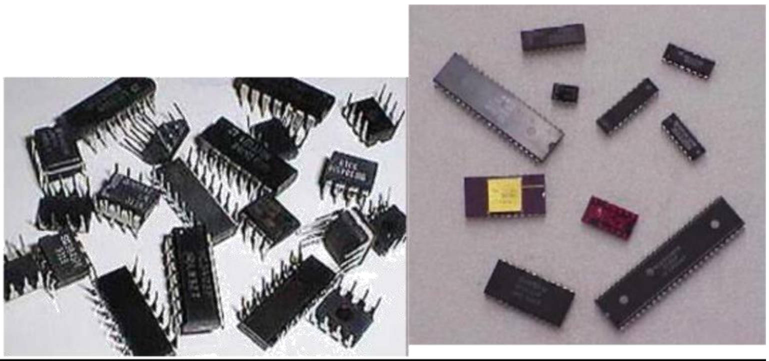
A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

Transistors (typically marked with an “Q” on a circuit board).



INTEGRATED CIRCUITS

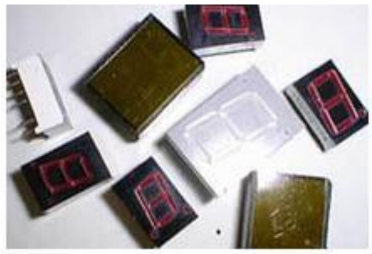
An integrated circuit or monolithic integrated circuit (also referred to as an IC, a chip, or a microchip) is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon. This can be made much smaller than a discrete circuit made from independent components. Integrated circuits are used in virtually all electronic equipment today and have revolutionized the world of electronics. Computers, mobile phones, and other digital home appliances are now inextricable parts of the structure of modern societies, made possible by the low cost of producing integrated circuits. Integrated Circuits (typically marked with an “U” or “IC” on a circuit board)



LED AND LED DISPLAY

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.





SWITCHES

In electrical engineering, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits. Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open", meaning the contacts are separated and the switch is non conducting.

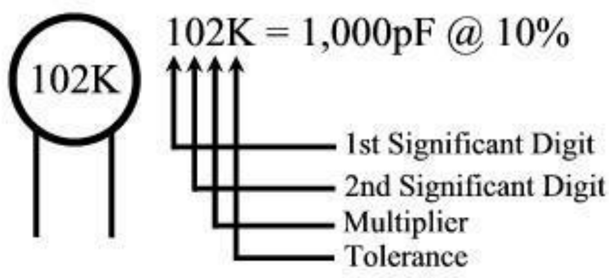


Lab Exercise

1. **Identify Active and passive components**

Name	Symbol	Active or passive Component
Resistor		
Diode		
Transformer		
Inductor		
Electrolytic Capacitor		
LDR		
LED		
Schottky Diode		
MOSFET		

2. Determining capacitor values

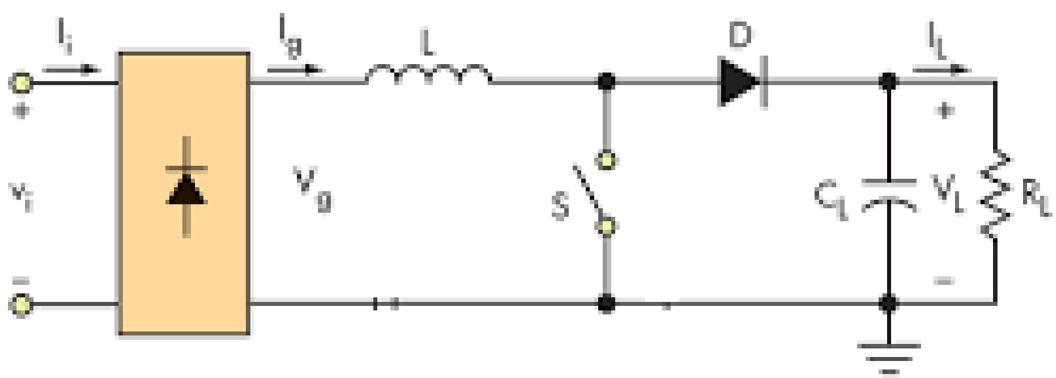


Code	Tolerance
C	±0.25pF
J	±5%
K	±10%
M	±20%
D	±0.5pF
Z	80% / -20%

Determine the value of the ceramic capacitors

No.	Code Number	Actual Value
1	104	
2	223	
3	68	
4		0.47 F
5		33nF μ

3.Identify Active and Passive components in the circuit.



1) **Active Components : - ____**
2) **Passive Components : - ____**

Students' activity:

Collect the catalog from market for instruments required for electronic workshop and write down the specification, cost and name of the manufacture.

Conclusion:

Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment No: 13

Title: Identify various controls available on the front panel of analog and digital multimeter.

Prior Concept:

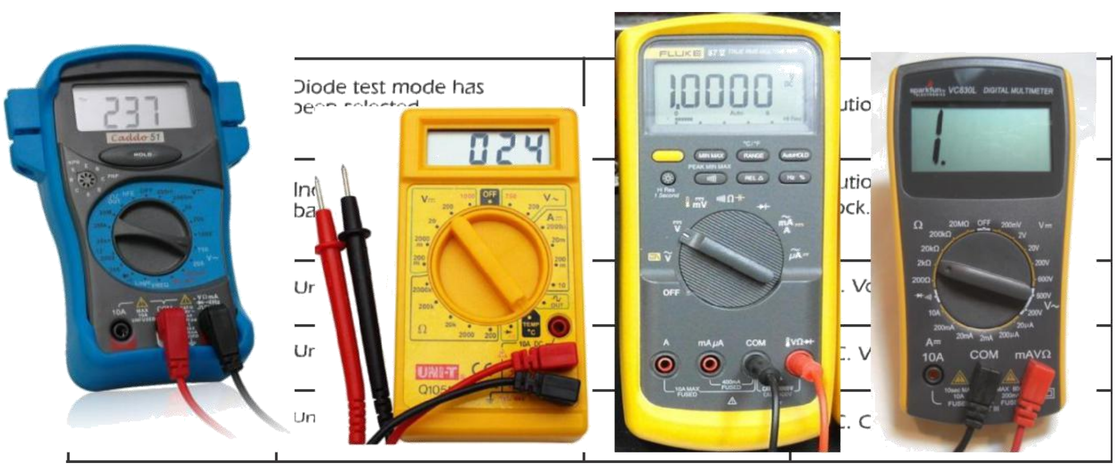
Digital Multimeter : - The digital multimeter is a multi-function instrument that can measure ac and dc voltage or current, and resistance. It appears in various incarnations as a laboratory instrument and as a general purpose test instrument out in the field. The instrument used in the laboratory is based on pre-processing circuitry for each measuring function that converts the input to a dc voltage between ±12 volts.

Analog Multimeter :- The underlying instrument in the analog multimeter is a dc microammeter and therefore its fundamental measurement is dc current. DC currents larger than that necessary to achieve full-scale deflection of the basic meter are measured by shunting the meter with a resistor whose resistance is a known fraction of the internal resistance of the meter.

New Concept:

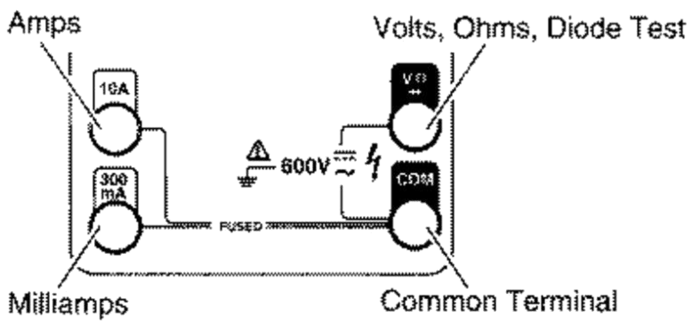
Digital multimeters may also include circuits for:

- Continuity tester; sounds when a circuit conducts
- Diodes (measuring forward drop of diode junctions), and transistors (measuring current gain and other parameters)
- Battery checking for simple 1.5 volt and 9 volt batteries. This is a current loaded voltage scale which simulates in-use voltage measurement.



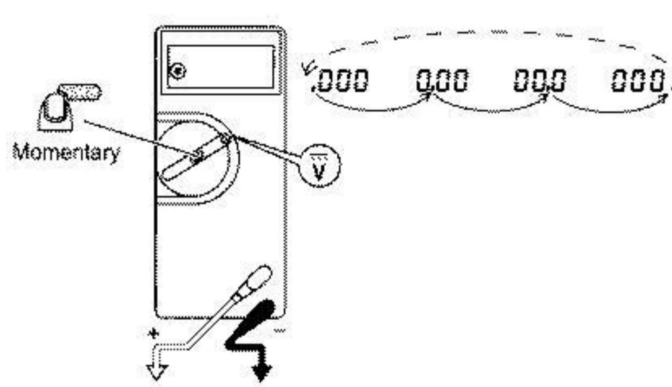
INPUT JACKS

The black lead is always plugged into the common terminal. The red lead is plugged into the 10 A jack when measuring currents greater than 300 mA, the 300 mA jack when measuring currents less than 300 mA, and the remaining jack (V-ohms-diode) for all other measurements.



RANGE FIXING

The meter defaults to autorange when first turned on. You can choose a manual range in V AC, V DC, A AC, and A DC by pressing the button in the middle of the rotary dial. To return to autorange, press the button for one second.



PROCEDURE FOR MEASUREMENT

1) VOLTAGE MEASUREMENT

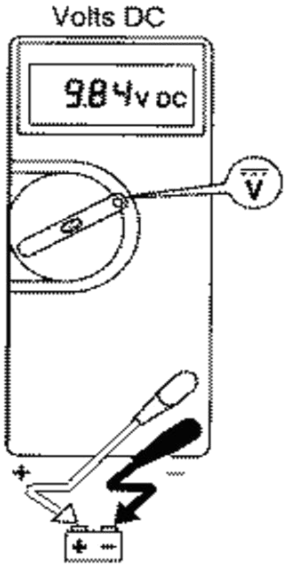
D.C. / A.C. Voltage Measurment

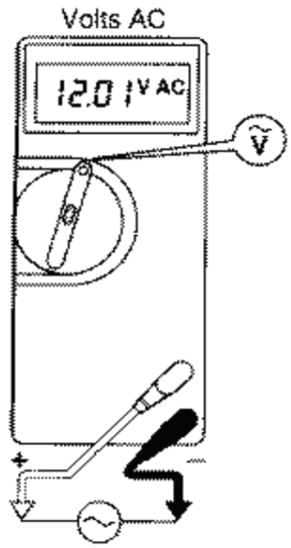
1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket.

2. Set the selector switch to the desired mV D.C./D.C.V/A.C.V range.

3. Connect the test leads to the circuit to be measured.

4. Turn on the power to the circuit to be measured, the voltage value should appear on the digital display along with the voltage polarity(if reversed only).





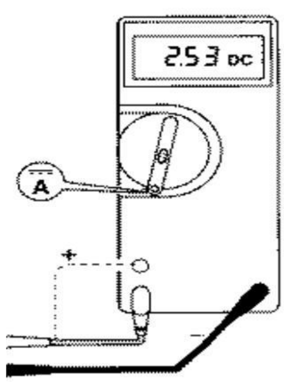
2) CURRENT MEASUREMENT

1. Connect the positive(red) test lead to the ‘V/mA’ jack socket and the negative(black) lead to the ‘COM’ jack socket(for measurements up to 200mA). For measurements between 200mA and 10A connect the red test lead to the ‘10mA’ socket.

2. Set the selector switch to the desired uA/mA/A range.

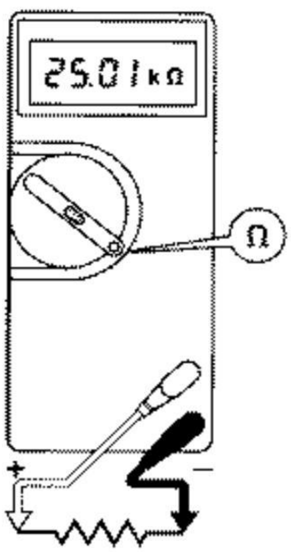
3. Open the circuit to be measured and connect the test leads in **SERIES** with the load in which current is to be measured.

4. To avoid blowing an input fuse, use the 10A jack until you are sure that the current is less than 300 mA. Turn off power to the circuit. Break the circuit. (For circuits of more than 10 amps, use a current clamp.) Put the meter in series with the circuit and turn power on.



RESISTANCE MEASUREMENT

1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket.
2. Set the selector switch to the desired 'OHM Ω'.
3. If the resistance to be measured ia part of a circuit, turn off the power and discharge all capacitors before measurement.
4. Connect the test leads to the circuit to be measured.
5. The resistance value should now appear on the digital display.
6. If the resistance to be measured is part of a circuit, turn off the power and discharge all capacitors before measurement.



CONTINUITY TEST

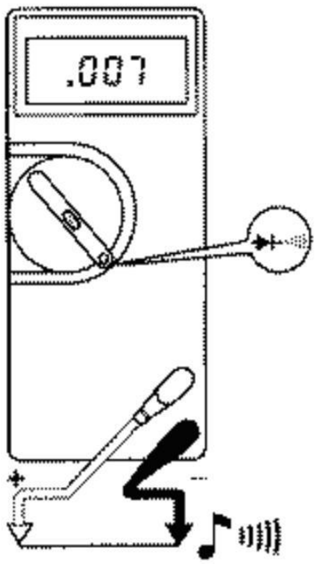
This mode is used to check if two points are electrically connected. It is often used to verify connectors. If continuity exists (resistance less than 210 ohms), the beeper sounds continuously.

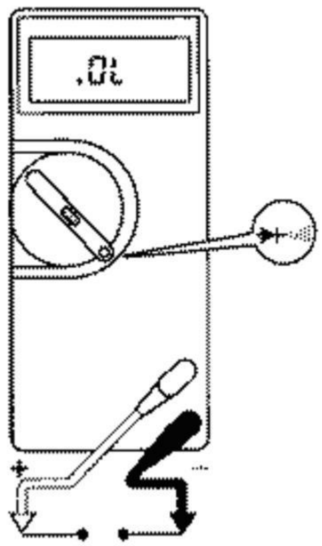
1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket.

2. Set the selector switch to the position.

3. Connect the test leads to two points of the circuit to be tested. If the resistence is Ohms the buzzer will sound.

4. If the resistance to be measured is part of a circuit, turn off the power and discharge all capacitors before measurement.





<u>General Operation</u>

Connection of Probes:

All multimeters come with two probes. They are to be connected to the terminals on the meter itself. The Black probe is to be connected to the COM terminal. Red probe is to be connected to terminal marked with :

- ‘V-Ω’ for voltage measurement,
- ‘mA’ or ‘20A’ for current measurement (there are two terminals, one for 2A range and the other for 20A range)
- ‘V-Ω’ for resistance measurement.

Setting of function:

The multimeter uses different circuits internally to measure different things. Therefore, you must select the correct function before using it.

Setting of Range:

- You can change the sensitivity of the meter by selecting different range for measurement. Set the range to the first range that is higher than the maximum value you expect to measure. This will give a more accurate reading. If you do not know what to expect, use the highest range first. After a reading is obtained, set the range to the appropriate one to get a better reading.

- When the value measured exceeds the existing range, the display will flash. When this happens, set the multimeter to a higher range until some values are displayed.

<u>Analog Multimeter</u>

Parallax errors

One cause of errors on an analogue multimeter, or any analog meter for that matter is parallax errors. This is an important concept when using an analogue multimeter. When viewing the meter, the eye should be at right angles to the plane of the meter back markings. In this way there is no error from viewing the needle at an angle.

Some high end professional meters such as the AVO have a mirror in the scale. In this way it is possible to assess whether the eye is directly in front of the scale - when the eye is viewing correctly, it will not be possible to see the reflection as it is masked out by the needle itself. The offset view below indicates this.

Using the correct range

Another concept in knowing how to use an analogue multimeter is that of knowing which range to use. In terms of the view of the meter, the best accuracy is gained when the meter is towards the full scale deflection, FSD. In this way a given percentage change in the reading gives the maximum and hence most visible change in meter deflection, and accordingly the most accurate reading. However care has to be taken not to overload the meter by placing it on a range much too low for the reading to be taken. If this occurs the meter can swiftly move to the end-stop, and damage may occur if it is overloaded too much. It is always best to start well below the range expected to give full scale deflection and switch the range when everything has settled.

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment No: 14

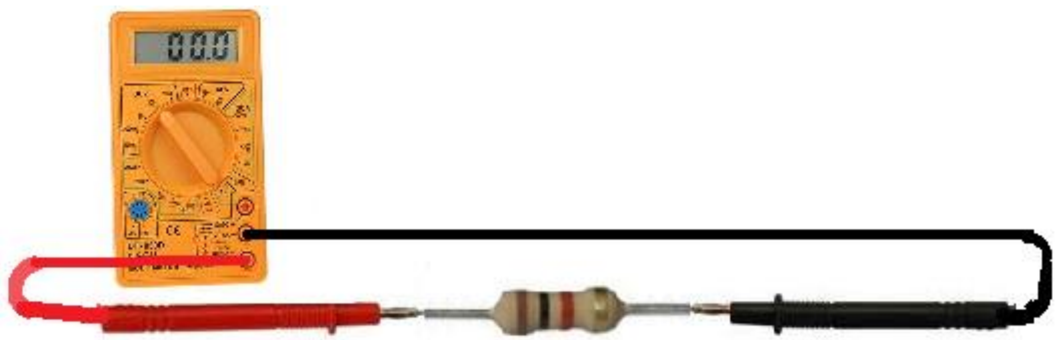
Title: Determine the value of given resistor using digital multimeter to confirm with colour code.

Theory:

A multimeter that can check resistance can also be helpful, providing the resistor is already removed from the board (measuring it while still soldered in can give inaccurate results, due to connections with the rest of the circuit). They are typically marked with an “R” on a circuit board.

When testing a resistor, the multimeter is passing a known amount of electrical current through the resistor and then measuring the amount of current that actually makes it through. Since the multimeter is passing current through the resistor, you want to ensure that the device containing the resistor you are testing is unplugged and turned off. If a normal amount of current were flowing through the resistor and you tried to test the resistor, not only will your reading be inaccurate, but you could damage the resistor and other components. You could also damage your multimeter or receive a nasty electrical shock.

The display should show OL Ω. Why? In Resistance mode, even before test leads are connected to a component, a digital multimeter (DMM) automatically begins taking a resistance measurement. The MΩ symbol may appear in the display because resistance of open (unattached) test leads is very high. When the leads are connected to a component, a DMM automatically uses the Autorange mode to adjust to the best range. Pressing the Range button allows a technician to manually set the range.



Resistance measurement with DMM

Procedure

1. Connect probes: black probe to COM terminal and red probe to terminal marked with 'Ω'
2. Set function to resistance measurement
3. Set to the appropriate range
4. Connect the two probes' crocodile clips to the resistor (or to the resistor circuit via jumper wires) to make measurement
5. Note the reading, adjust range if necessary
6. Take the more accurate reading.

Resistance measurement with AMM

Procedure

Another aspect of using an analogue multimeter for measuring resistance is that the meter needs to be "zero'ed" before making a measurement. This is done by connecting the two probes together so that there is a short circuit, and then using the "zero" control to give full scale deflection on the meter, i.e. zero ohms. Each time the range is changed, the meter needs to be zero'ed as the position may change from one range to the next. The meter needs to be zero'ed because the full scale deflection will change according to aspects such as the state of the battery.

There are a few simple steps required to make a resistance measurement with an analogue multimeter:

1. Select the item to be measured: This may be anything where the resistance needs to be measured and estimate what the resistance may be.
2. Insert the probes into the required sockets Often a multimeter will have several sockets for the test probes. Insert these or check they are already in the correct sockets. Typically these

might be labelled COM for common and the other where the ohms sign is visible. This is normally combined with the voltage measurement socket.

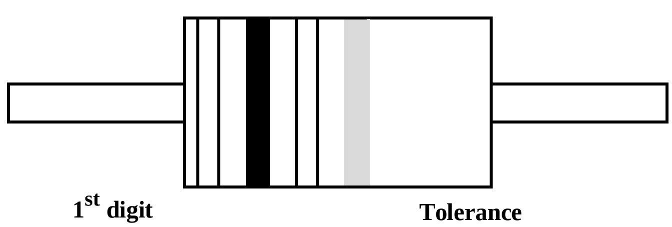
3. Select the required range The analogue multimeter needs on and the required range selected. The range selected should be such that the best reading can be obtained. Normally the multimeter function switch will be labelled with the maximum resistance reading. Choose the one where the estimated value of resistance will be under but close to the maximum of the range. In this way the most accurate resistance measurement can be made.
4. Zero the meter: The meter needs to be zero'ed. This is done by firmly placing the two probes together to give a short circuit and then adjusting the zero control to give a zero ohms (full scale deflection) reading. This process needs to be repeated if the range is changed.
5. Make the measurement With the multimeter ready to make the measurement the probes can be applied to the item that needs to be measured. The range can be adjusted if necessary.
6. Turn off the multimeter Once the resistance measurement has been made, it is wise to turn the function switch to a high voltage range. In this way if the multimeter is used to again for another type of reading then no damage will be caused if it is inadvertently used without selecting the correct range and function.

Testing Resistor With Analog Multimeter

Student Activity

Determine the value for the given data

Resistor Colour Codes



2nd digit **Multiplier (no. of zeros, following 2nd digit)**

Colour-code bands on a resistor.

Colour	**Band 1**	**Band 2**	**Band 3**	**Band 4** (Tolerance)
Black	0	0	×1	–
Brown	1	1	×10	1%
Red	2	2	×100	2%
Orange	3	3	×1000	–
Yellow	4	4	×10000	–
Green	5	5	×100000	0.5%
Blue	6	6	×1000000	0.25%
Violet	7	7	×10000000	0.1%
Grey	8	8	–	–
White	9	9	–	–
Gold	–	–	×0.1	5%

Silver	–	–	×0.01	10%

No.	**Colour code**	**Actual Value**	**Measured Value (DMM)**
1	Red, Yellow, black		
2	Red, violet, orange		
3	Blue, gray, green		
4		4.7K	
5		33K	

Conclusion:

Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment No: 15

Title: Test the semiconductor diodes using digital multimeter.

Theory:

Since we know that a diode is essentially nothing more than a one-way valve for electricity, it makes sense we should be able to verify its one-way nature using a DC (battery-powered) ohmmeter.Connected one way across the diode, the meter should show a very low resistance. Connected the other way across the diode, it should show a very high resistance

How to test diodes

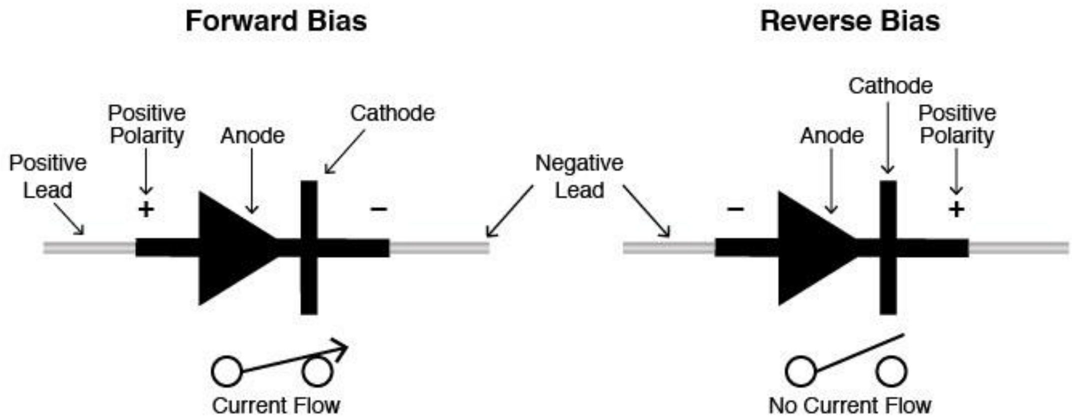
Digital multimeters can test diodes using one of two methods:

1. Diode Test mode: almost always the best approach.
2. Resistance mode: typically used only if a multimeter is not equipped with a Diode Test mode.

Note: In some cases it may be necessary to remove one end of the diode from the circuit in order to test the diode.

Things to know about the Resistance mode when testing diodes:

- Does not always indicate whether a diode is good or bad.
- Should not be taken when a diode is connected in a circuit since it can produce a false reading.
- CAN be used to verify a diode is bad in a specific application after a Diode Test indicates a diode is bad.



- A diode is best tested by measuring the voltage drop across the diode when it is forward-biased. A forward-biased diode acts as a closed switch, permitting current to flow.

A multimeter's Diode Test mode produces a small voltage between test leads. The multimeter then displays the voltage drop when the test leads are connected across a diode when forward-biased. The Diode Test procedure is conducted as follows:

1. Make certain a) all power to the circuit is OFF and b) no voltage exists at the diode. Voltage may be present in the circuit due to charged capacitors. If so, the capacitors need to be discharged. Set the multimeter to measure ac or dc voltage as required.
2. Turn the dial (rotary switch) to Diode Test mode ( ). It may share a space on the dial with another function.
3. Connect the test leads to the diode. Record the measurement displayed.
4. Reverse the test leads. Record the measurement displayed.

Diode test analysis

- A good forward-based diode displays a voltage drop ranging from 0.5 to 0.8 volts for the most commonly used silicon diodes. Some germanium diodes have a voltage drop ranging from 0.2 to 0.3 V.
- The multimeter displays OL when a good diode is reverse-biased. The OL reading indicates the diode is functioning as an open switch.
- A bad (opened) diode does not allow current to flow in either direction. A multimeter will display OL in both directions when the diode is opened.
- A shorted diode has the same voltage drop reading (approximately 0.4 V) in both directions.

A multimeter set to the Resistance mode (Ω) can be used as an additional diode test or, as mentioned previously, if a multimeter does not include the Diode Test mode.

A diode is forward-biased when the positive (red) test lead is on the anode and the negative (black) test lead is on the cathode.

- The forward-biased resistance of a good diode should range from 1000 Ω to 10 MΩ.

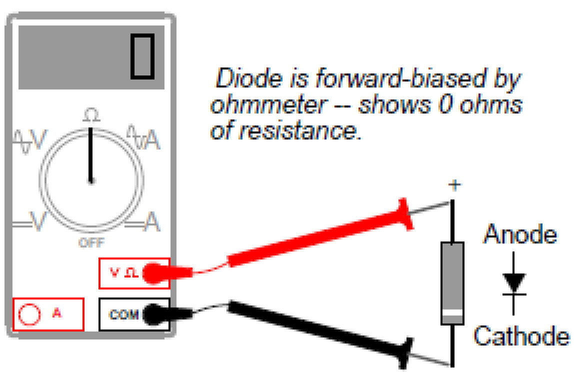
- The resistance measurement is high when the diode is forward-biased because current from the multimeter flows through the diode, causing the high-resistance measurement required for testing.

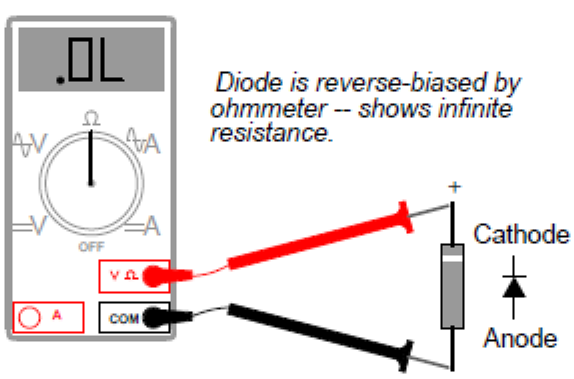
A diode is reverse-biased when the positive (red) test lead is on the cathode and the negative (black) test lead is on the anode.

- The reverse-biased resistance of a good diode displays OL on a multimeter. The diode is bad if readings are the same in both directions.

The resistance mode procedure is conducted as follows:

1. Make certain a) all power to the circuit is OFF and b) no voltage exists at the diode. Voltage may be present in the circuit due to charged capacitors. If so, the capacitors need to be discharged. Set the multimeter to measure ac or dc voltage as required.
2. Turn the dial to Resistance mode (Ω). It may share a space on the dial with another function.
3. Connect the test leads to the diode after it has been removed from the circuit. Record the measurement displayed.
4. Reverse the test leads. Record the measurement displayed.
5. For best results when using the Resistance mode to test diodes, compare the readings taken with a known good diode.





a. Set the Lab DMM to *Diode Testing* mode.

b. Measure the forward and reverse bias voltages of the given diodes and record them

i. Forward bias voltage:

   Place the RED probe on the Anode. Touch the BLACK probe to the Cathode and record the reading

ii. Reverse bias voltage:

   Place the RED probe on the Cathode. Touch the BLACK probe to the Anode and record the reading

No.	**Diode Number**	**Forward Bias Voltage**	**Reverse Bias Voltage**
1	1N4001		
2	1N914		

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

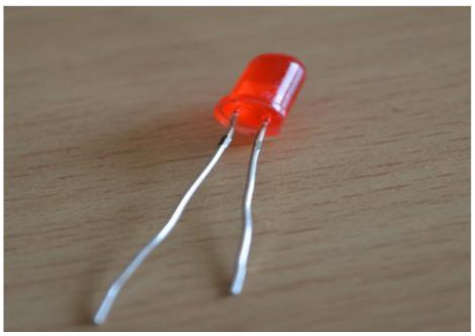
Experiment No: 16

Title: Test the LEDs display using multimeter.

Theory:

Light emitting diode (LED)is a small component used in almost every electronic device. Led has 2 terminals or legs. The bigger leg is the anode or positive terminal and shorter leg is cathode or negative terminal.

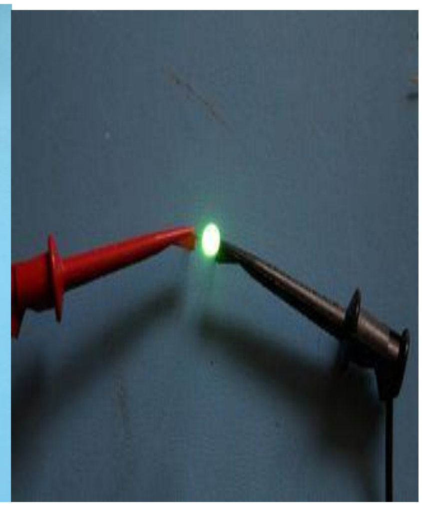
The value displayed on your multimeter is called the forward voltage drop. This indicates the quantity of voltage used up by the LED, or *dropped*, when current is traveling in the appropriate direction, *forward*.



Testing

Determine the Anode and Cathode sides of the LED, if it is a new LED the long leg should be the anode(+)and the short side is the cathode (-). You can also look inside of the LED and see the

larger electrode which is your cathode and the smaller electrode is the anode (+).
Take you resistor and wrap it around the positive(+) lead of your meter, wrap it tight so it does not come off.
Take your test clips, if you are using them, and clip the positive(+) to the predetermined anode(+) of the LED and the negative(-) to the cathode(-)
Turn your meter on and set it to diode scale, should be marked by a diode symbol. If you used the clips you should see your diode emitting otherwise touch the positive(+) lead of the meter(which should have the resistor) to the anode (+) and the negative (-) lead to the cathode(-) and you should have light!
If your diode does not light up make sure that you have you polarity correct and you meter is set to the proper function.

Conclusion:

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<tr><td>C (4)</td><td>P (4)</td><td>A (2)</td><td>T (10)</td><td rowspan="2"></td></tr>
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</table>

Experiment No: 17

Title: Identify three terminals of a transistor using digital multimeter**.**

Theory :

A transistor is basically 2 diodes that share one end. The shared end is called the base and the other 2 ends are called the emitter and collector.

- The collector accepts an input current from the circuit, but it can't send the current through the transistor until allowed to by the base.
- The emitter sends a current out into the circuit, but only if the base allows the collector to pass the current through the transistor to the emitter.
- The base acts like a gate. When a small current is applied to the base, the gate opens and a large current can flow from the collector to the emitter.

Identifying BJT Terminals:

We know that the Bipolar junction transistor has three terminals namely

1. Emitter (E)
2. Base (B)
3. Collector(C)

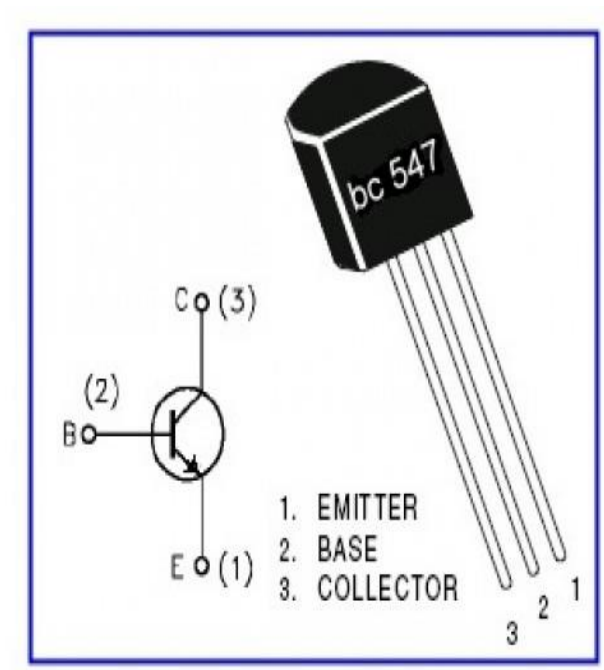
Keep the transistor such that the flat surface facing towards you as shown in the below figure:

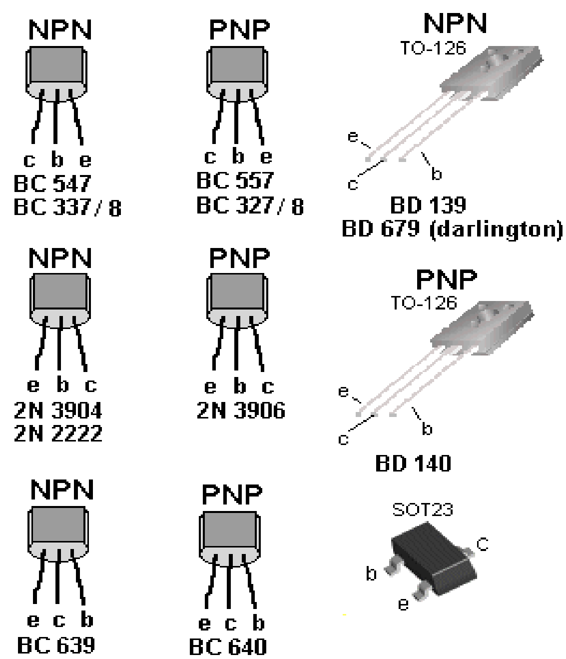
Now starting from left, mark like 1,2 and 3. They are respectively

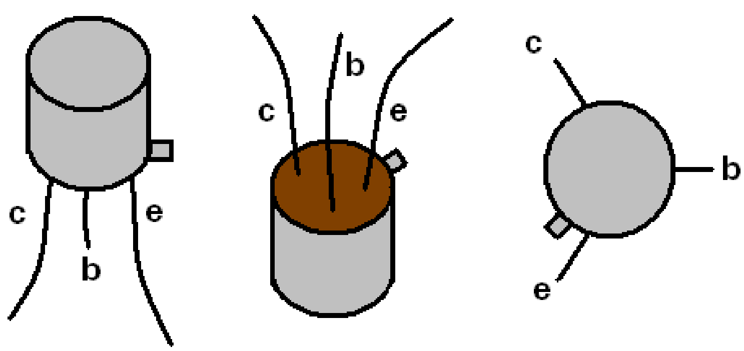
1. Emitter (E)
2. Base (B)
3. Collector(C)

Identifying BJT Types:

Both NPN and PNP trans istor looks similar in physical appearance. We can not differentiate by







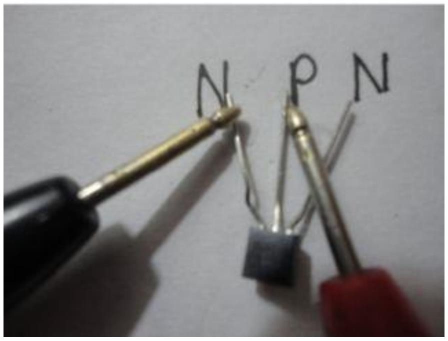
three views of the BC109C transistor

seeing them. We need a multimeter to identify the type of BJT.
Remember the following points:

1. The transistor internally has two diodes (NPN ≡ N - P - N ≡ NP Junction + PN Junction and PNP ≡ P - N - P ≡ PN Junction + NP Junction). ie,Emitter to base is one PN junction (diode) and Base to collector another PN junction (diode).
2. In the diode mode, the multimeter will show the voltage when we keep the positive probe of the multimeter to the anode of the diode and negative probe to the cathode.
3. If the multimeter positive probe is connected to the cathode of the diode and the negative probe to the anode, then it will not give any voltage (showing zero).

Steps to identify the NPN type transistor:

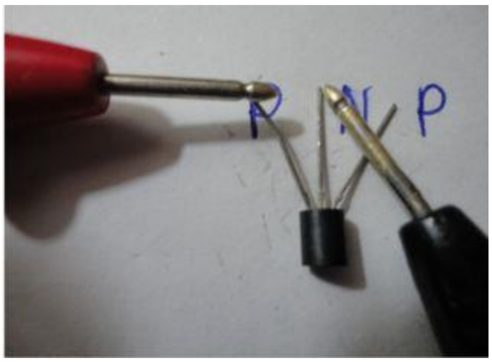
1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the center pin (Base) of the transistor.
3. Touch the negative probe to the pin-1 (Emitter). You will see some voltage in the multimeter.
4. Similarly touch the negative probe to the pin-3 (collector) with respect to the pin-2. You will see some voltage in the multimeter.
5. It will ensure that it is a NPN transistor. The logic behind this is, in NPN transistor Emitter (E) - N type material - Equivalent to cathode of the diode Base (B) - P type material - Equivalent to anode of the diode Collector(C) - N type material - Equivalent to cathode of the diode
6. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any value.



Steps to identify the PNP type transistor:

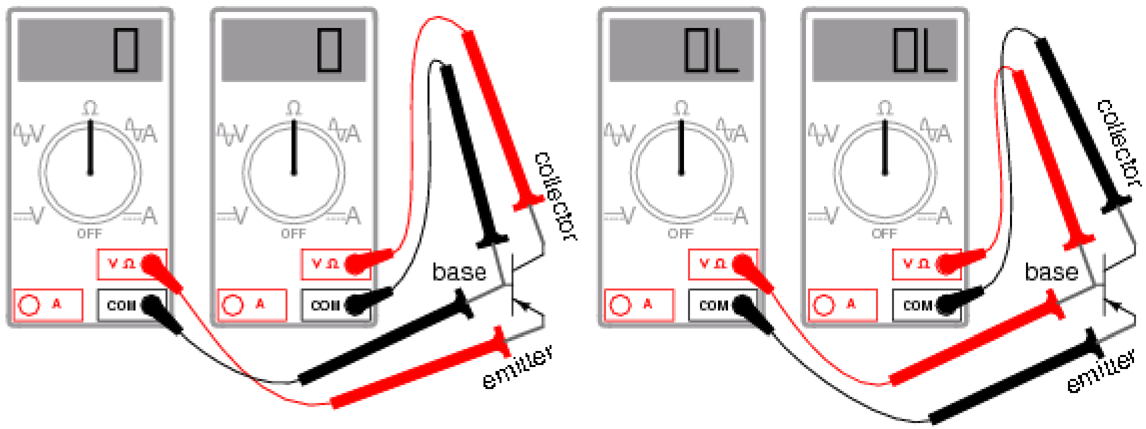
1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the pin-1 (Emitter) of the transistor.
3. Touch the negative probe to the center pin (Base). You will see some voltage in the multimeter.
4. Similarly touch the negative probe to the center pin (Base) with respect to the pin-3 (collector). You will see some voltage in the multimeter.

5. It will ensure that it is a PNP transistor. The logic behind this is, in PNP transistor Emitter (E) - P type material - Equivalent to anode of the diode Base (B) - N type material - Equivalent to cathode of the diode Collector(C) - P type material - Equivalent to anode of the diode
6. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any
7. value.



Notes :

Bipolar transistors are constructed of a three-layer semiconductor “sandwich”• either PNP or NPN. As such, transistors register as two diodes connected back-to-back when tested with a multimeter’s “resistance”• or “diode check”• function as illustrated in Figure below. Low resistance readings on the base with the black negative (-) leads correspond to an N-type material in the b
ase of a PNP transistor. On the symbol, the N-type material is “pointed” to by the arrow of the base-emitter junction, which is the base for this example. The P-type emitter corresponds to the other end of the arrow of the base-emitter junction, the emitter. The collector is very similar to the emitter, and is also a P-type material of the PN junction.



PNP transistor meter check: (a) forward B-E, B-C, resistance is low; (b) reverse B-E, B-C, resistance is ∞.

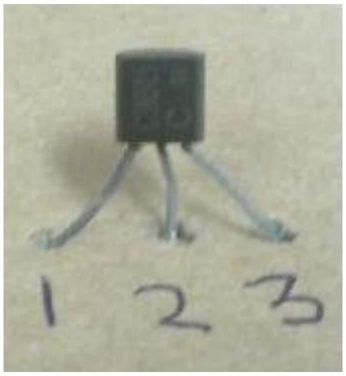
Student Activity:

Measuring and create tables of measurement

- **Set analog multimeter**

- Set analog multimeter and adjust position of rotary knob on Ohm meter, a measurement scale at x10
- Imagine or describe the position of terminals transistor with sequence numbers 1, 2, and 3
- Create a table with 6 units of measurement measuring point, ie 1-2, 1-3, 2-3, 2-1, 3-1, and 3-2
- Specify black probe or negative test probe for the first number, and red probe or positive test probe for the second number, ie the measuring point 1-2, the black probe at point 1, and the red probe at point 2
- Record the results of each measurements, indicated by Ohm meter's needle movement. (Needle Moves or Needle remains silent)

Measuring Point	Result
1-2	

- 

1-3	
2-3	
2-1	
3-1	
3-2	

- **Set digital multimeter**

Transistor	*VCE*	*VEC*	*VBE*	*VEB*	*VCB*	*VBC*
NPN						
PNP						

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

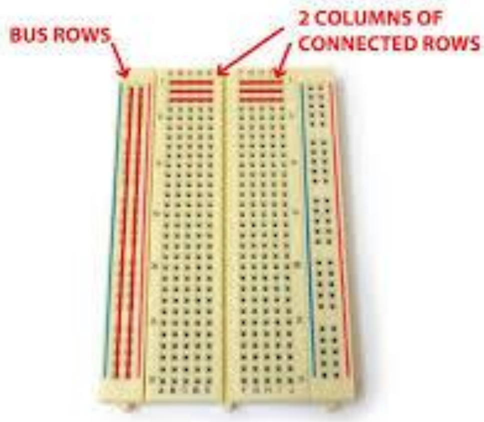
Experiment No: 18

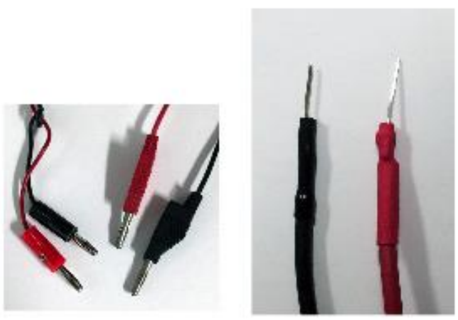
Title: Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.

Theory :

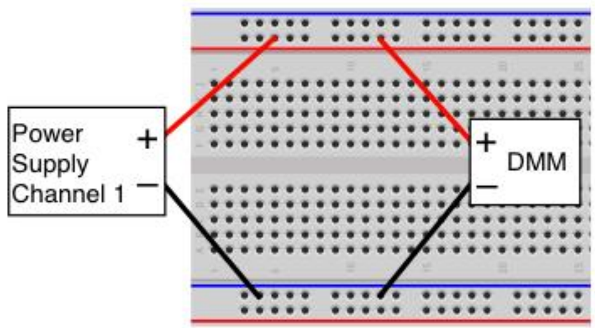
Using the Breadboard :

A solder-less breadboard is a convenient way to prototype electrical circuits without permanently attaching components (i.e. electrical elements) to a circuit board. Each numbered row on a breadboard contains two nodes; A-E are all wired together in each row, and F-J are all wired together in each row. Along each long edge are two long wires called bus bars; each side has a + wire and a – wire that run the length of the breadboard. Insert component leads or jumpers into the holes to make connections: inserting two (or more) wires into the same node (not the same hole) will connect these together.





Test leads have banana plugs on one end and pins on the other.



Connecting power supply and DMM to breadboard

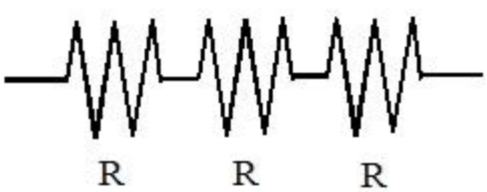


Figure 1 *Resistors in series*

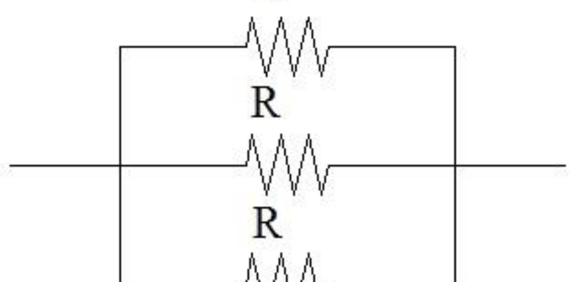
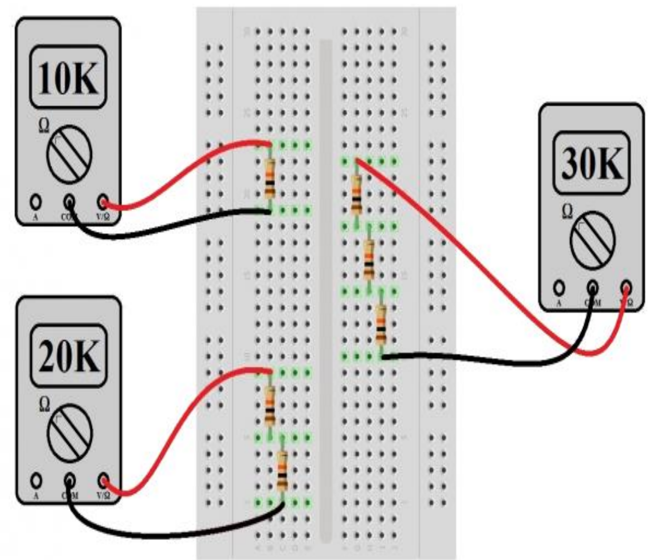


Figure 2 *Resistors in parallel*

Student Activity :

1) Series Connection

- Connect the three resistors in series.
- Record in your journal the resistance values indicated from the color code bands.
- Plug the banana leads of two breadboard leads into the ohms and COM receptacles on the multimeter.
- Measure the resistance of each resistor by connecting the wires of the circuit board leads to each side of the resistor.
- Measure and record the values of R_1, R_2, R_3, and R_{eq} (across all three resistors). Find the percent error between the measured value of R_{eq} and the sum of the measured resistances.

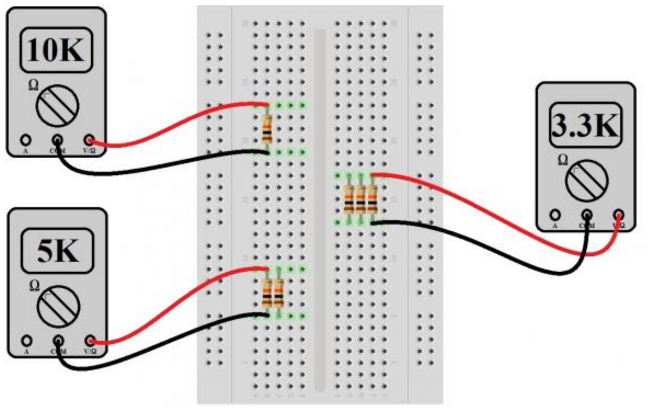


Resistor	Measured Resistance	Expected Resistance	Percent error

2) Parallel Connection

- Connect resistors in parallel.
- Record in your journal the resistance values indicated from the color code bands.

- Measure the resistance of the parallel combination resistors.
- The parallel resistance is measured by placing the circuit board leads where leads are that go off the picture.
- Find the percent error between the measured value of $R_{measured}$ and the calculated $R_{calculated}$ obtained.



Resistor	Measured Resistance	Expected Resistance	Percent error

Conclusion:

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Marks	Dated signature of teacher

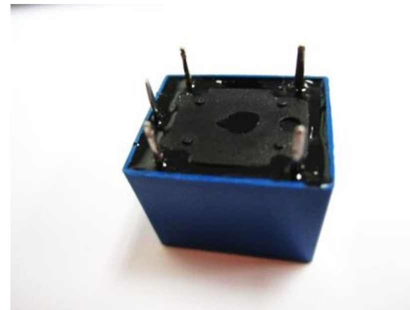
C (4)	P (4)	A (2)	T (10)	

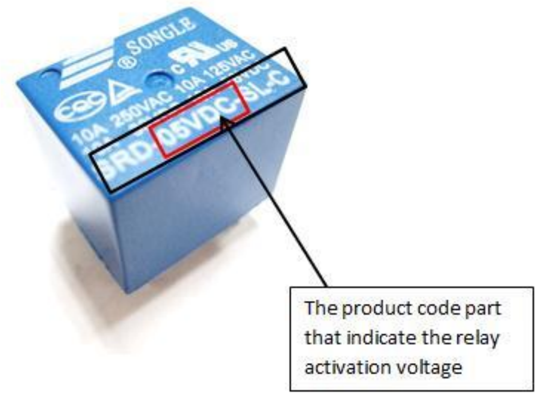
Experiment No:19

Title: Identify relay terminals (coil, common, normally open and close)

Theory : A relay is an electrically activated switch. **Relay** is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit. Thus a small sensor circuit can drive, say, a fan or an electric bulb.

A **relay switch** can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO.





***05VDC indicates that the activation voltage is DC 5V.*

***Then, hinging on this basis, 03VDC would indicate that the activation voltage is DC 3V, 12VDC means an activation voltage of DC 12V and so on.*

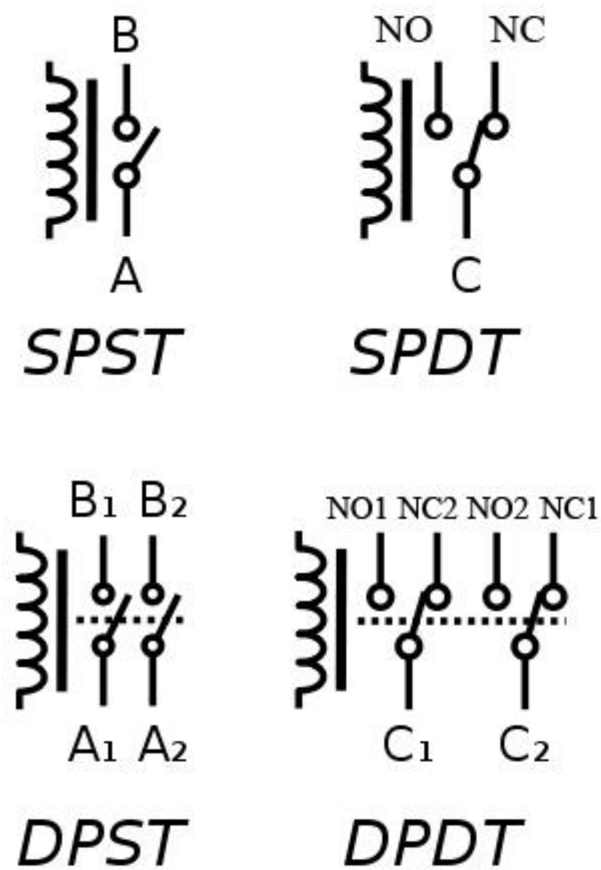
Types:

i) Single Pole Single Throw (SPST) – Such relay has 4 terminal pins which consists of a pair of coil pins and a pair of pins which can be made connected or disconnected by activating or deactivating the relay. Such relay can categorized into normally open or normally closed type.

ii) Single Pole Double Throw (SPST) – Such relay has 5 terminal pins which consists of a pair of coil pins, a common pin, a normally open (NO) pin and a normally closed (NC) pin. When the relay is not activated, the common pin is in contact with the NC pin and when it is activated, the common pin will break away from contact with the NC pin and subsequently makes contact with the NO pin. Also, when the relay is deactivated (from activated state), the common pin will conversely break away from contact with the NO pin and return back in contact with the NC pin.

iii) Double Pole Single Throw (DPST) – Such relay has 6 terminal pins which consist of a pair of coil pins and two pairs of pins, where pins in each pair can be made connected or disconnected by activating or deactivating the relay. Such relay is actually a combination of two SPST relay structures with only one coil pin pair.

iv) Double Pole Double Throw (DPDT) – Such relay has 8 terminal pins which consist of a pair of coil pins, two 3 pins group for each group consists of a common pin, normally open (NO) pin and normally (NC) pin. Such relay is actually a combination of two SPDT relay structures with only one coil pin pair.



Identify NC, NO & C :-
Most of the relays have the abbreviations (NO, NC, C) printed near the leads. If its not, follow these simple steps to identify them:-

1) C (common) can be easily recognised as it is placed in the middle of any one of the side of a relay.

2) Coil terminal lies besides the Common terminal.

3) Once you have figured out which one is common then NC and NO can be identified using continuity tester from multimeter. Connect one probe of multimeter to common(C) and other to any one of the two leads on the opposite side. The one which gives continuity is Normally Closed(NC) and so the other is obviously Normally Open(NO).

NOTE:- Make sure that the relay is not connected to 12V supply i.e. inactive

5 pins relay:-

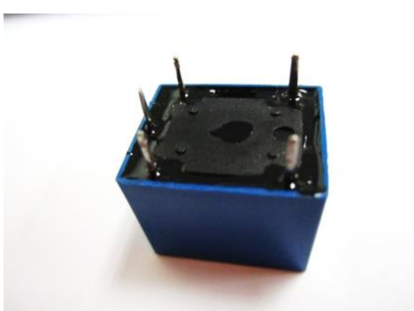
1. Let's start with determining the relay coil pins using a multimeter. Set the multimeter to resistance measuring mode with a scale of 1000 ohm since the coil resistance normally ranges between 50 ohm and 1000 ohm.

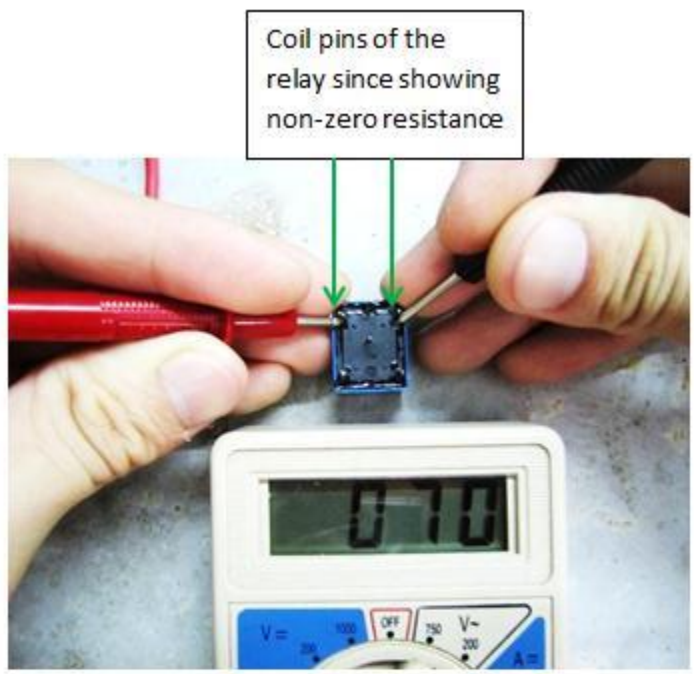
2. Turn back the relay to see pins located at its bottom part. Try to touch the probes of multimeter on a pair of pins of the relay until the touched pair shows a resistance value (but not zero).

***Only the relay coil pin pairs will show non-zero resistance value.*

***Other pin pairs will show either zero resistance or infinite resistance.*

***There is only 1 pair of coil pins found in this case*



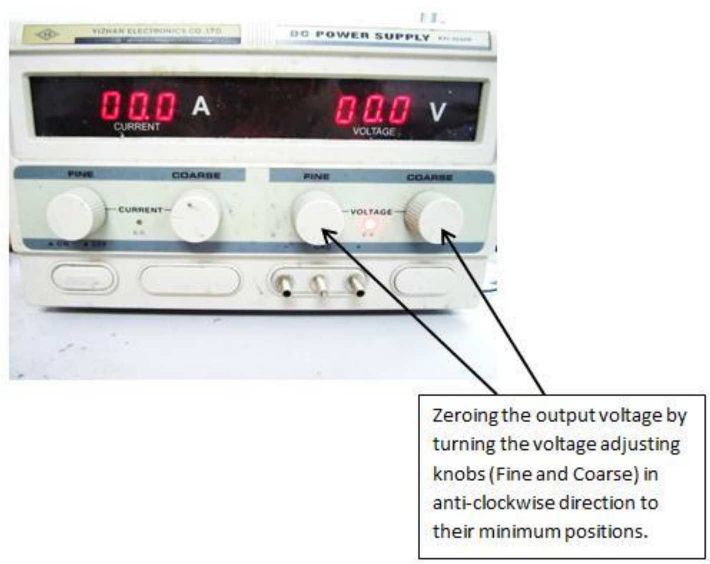


3. Since the coil pin pair is found. There is only 3 remaining pins to determine which are the NC pin, NO pin and common pin. Set your multimeter to continuity test mode. Try to touch the probes of multimeter on remaining pins to determine which are the pins actually connected with each other.These pins actually consist of normally closed (NC) pin/pins and common pin/pins. Based on this finding, the remaining pins must be normally open (NO) pins. To differentiate NC pin and common pin from the connected pins, there is a need to apply voltage across the relay coil so as to activate it.

***In this case, there is only 1 pair of pins found connected. Hence, the 3rd pin must be the normally open (NO) pin.*

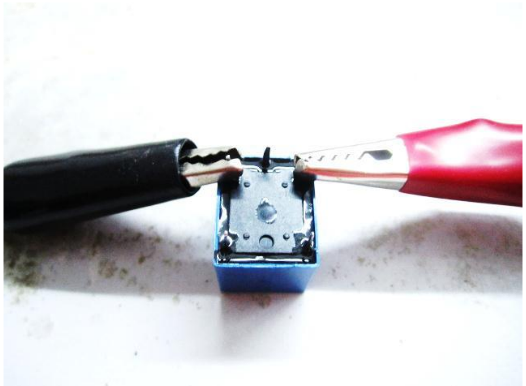
***Since there is only 1 NO pin, there will be only 1 NC pin in the connected pair. The other 1 remaining pin in the connected pair must be a common pin.*

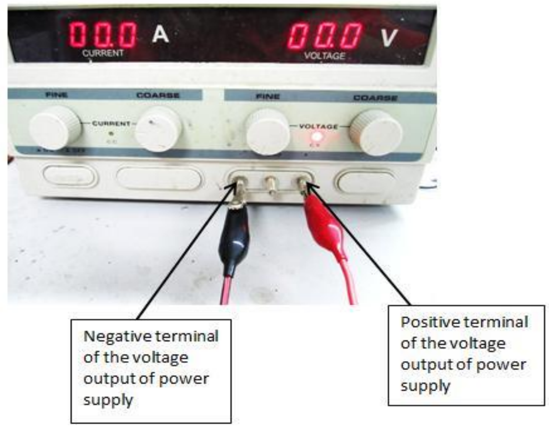
4. Turn on the DC power supply. Without connecting its output terminal to coil pins of the relay, please turn the voltage adjusting knobs until the voltage reading reaches the zero value.

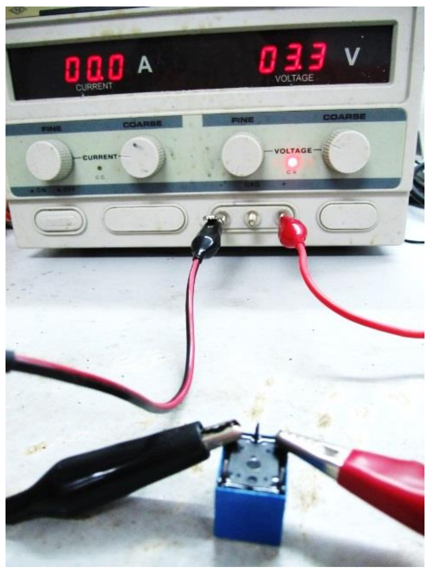


5.Then, connect the output terminal of DC power supply across the coil pins of the relay using crocodile clips.

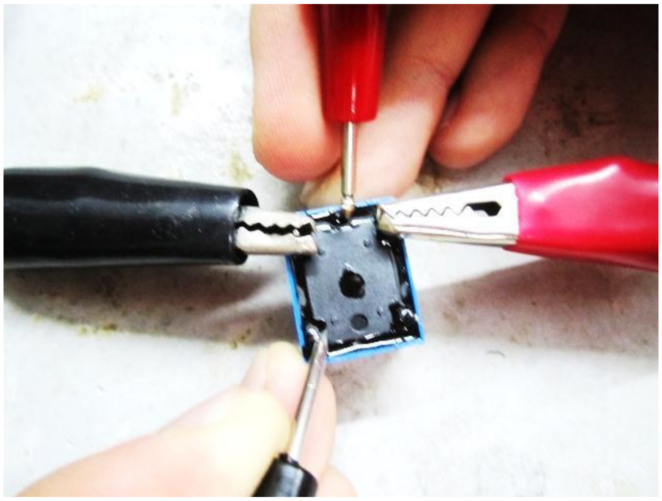
6. Next, increase the output voltage by slowly turning the voltage adjusting coarse knob only in clockwise direction until a “click” sound emitted by the relay is heard (this means that the relay is activated). In this case, although the activation voltage stated is DC 5V, the activation voltage recorded is about 3.3V which is lower.



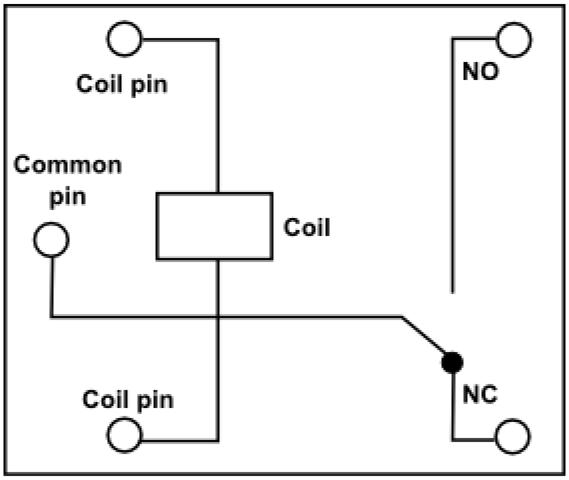




7.Then, with the multimeter set to continuity test mode, check which pin is now connected to the normally open (NO) pin in this moment. That pin would be the common pin. Since the common pin is determined, thus another one remaining pin in the connected pins detected in step 3 must be the normally closed (NC) pin.



8. Now, all the pins of relay have been determined as in Figure below.



View from bottom

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	

Experiment No:20

Title: Electronic Soldering Shop

Prior Concept:

A typical printed circuit board, or PCB, contains a large number of electronic components. These components are held on the board by solder flux that creates a strong bond between the pins of a component and their corresponding pads on the board. However, the main purpose of this solder is to provide electrical connectivity. Soldering and desoldering is performed to install a component on a PCB or to remove it from the board.

New Concept:

1.0 What Is Soldering?

Soldering looks similar to welding—but it's quite different! In welding, you're trying to make a super-strong joint between two pieces of metal. Often a welded joint has to stand up to incredible stresses and strains—for example, if you weld parts of a car body or an airplane fuselage together. So the objective is to make a good mechanical connection. When you solder, the idea is usually to make a good electrical connection.

1.1 Why Do We Need Solder?

Electronic circuits are made of discrete components: tiny devices such as resistors, capacitors, transistors, and LEDs that do specific jobs. When you put them together in different ways, you can build all kinds of amazing electronic gadgets, from radios and televisions to calculators and computers. The components all have little metal legs—terminals that you use to connect them into the circuits. You could just wire these legs together with electrical cables, but the wires might drop off or wriggle free and the connections wouldn't be reliable, so anything you built this way wouldn't work very well. And that's where solder comes in: it makes a much more effective electrical connection.

1.2 How does it work in practice?

A soldering iron is a hand tool used in soldering. It supplies heat to melt the solder so that it can flow into the joint between two work pieces.

A soldering iron is composed of a heated metal tip and an insulated handle. Heating is often achieved electrically, by passing an electric current (supplied through an electrical cord or battery cables) through a resistive heating element.

1.3 Types of soldering iron

a)Simple Iron:

For electrical and electronics work, a low-power iron, a power rating between 15 and 35 watts, is used.

b)Cordless iron:

Small irons heated by a battery, or by combustion of a gas such as butane in a small self-contained tank, can be used when electricity is unavailable or cordless operation is required.

c)Temperature-controlled soldering iron:

Simple irons reach a temperature determined by thermal equilibrium, dependent upon power input and cooling by the environment and the materials it comes into contact with. The iron temperature will drop when in contact with a large mass of metal such as a chassis; a small iron will lose too much temperature to solder a large connection. More advanced irons for use in electronics have a mechanism with a temperature sensor and method of temperature control to keep the tip temperature steady; more power is available if a connection is large. Temperature-controlled irons may be free-standing, or may comprise a head with heating element and tip, controlled by a base called a soldering station, with control circuitry and temperature adjustment and sometimes display.

d)Soldering station:

A soldering station, invariably temperature-controlled, consists of an electrical power supply, control circuitry with provision for user adjustment of temperature and display, and a soldering iron or soldering head with a tip temperature sensor. The station will normally have a stand for the hot iron when not in use, and a wet sponge for cleaning.

Soldering Flux:

Reliable solder connections can only be accomplished with truly cleaned surfaces. Solvents can be used to clean the surfaces prior to soldering but are insufficient due to the extremely rapid rate at which oxides form on the surface of heated metals. To overcome this oxide film, it becomes necessary in electronic soldering to use materials called fluxes.

SOLDERING POT:

Soldering pots are portable and primarily used for melting solder, dip soldering small circuit boards, tinning the ends of wire leads, re-tinning soldering iron tips.Solder pot is very useful for smaller jobs where reliable control of soldering temperature is essential.

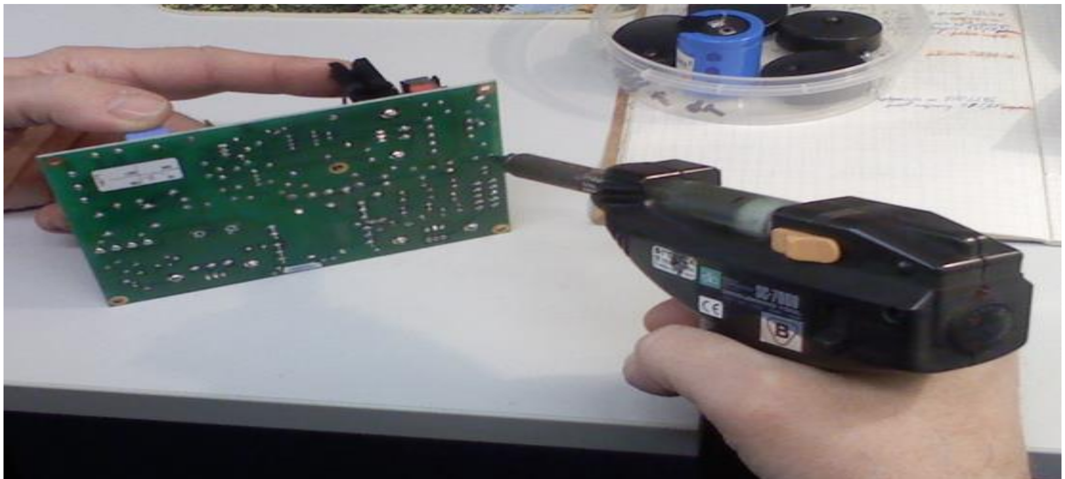
Desoldering:

In electronics, desoldering is the removal of solder and components from a circuit board for troubleshooting, repair, replacement, and salvage.

Desoldering tools and materials include the following:

- Solder wick
- Heat guns, also called hot air guns
- Desoldering pump
- Removal alloys
- Removal fluxes
- Heated soldering tweezers
- Various picks and tweezers for tasks such as pulling at, holding, removing, and scraping components.
- Vacuum and pressure pumps with specialized heater tips and nozzles

- Rework stations, used to repair printed circuit board assemblies that fail factory test.



Desoldering with a desoldering gun

Desoldering pump:

A **desoldering pump** also known as **solder sucker** is a small mechanical device which sucks the liquid/molten solder from the joint where the components are mounted. In order to desolder a component from the PCB, we first heat up the solder joint with the soldering iron till the solder liquefies/melts. At the same moment we actuate the soldering pump by pressing the trigger lever and bring the tip over the molten metal and pull the trigger back by pressing a button shown in the below image. At this instant the lever is pulled back and the tip of the pump sucks the molten solder. This process is repeated until all the residue solder is sucked by the pump and the hole on the PCB is clear to solder a fresh component.

Above image shows a desoldering pump - head, trigger and button of the soldering pump are marked. To actuate the pump the lever is pressed until there is a click sound which indicates that the lever will remain locked in the same position.

The desoldering pump’s bottom head contains a hole through which the molten solder is sucked when the pump is triggered. The head is designed such that the extracted solder does not solidify and block it, consequently the sucked metal can be removed and discarded easily.

Desoldering wick/braid:

A fine mesh of flux-coated, copper strands that absorbs solder when heated. Easier and more effective than a solder-sucker, the braid can be used to remove solder that bridges surface mount connections.

Technique: How To Solder

Soldering is the act of heating two metals (a pad and a lead) and a solder alloy to form a solder joint. As the jointcools, a strong electrical and mechanical connection is formed.

•Select the correct tip and tip temperature

•Turn on the system; wait for the tip to heat up (10-30 seconds).

•Clean the tip on a damp, clean sponge.

Sponge should be:

•Damp, not dry: use de-ionized water

•Clean, not dirty

•Sulfur-free (do not use household sponges)

•Contact the terminal and the pad simultaneously and feed wire core solder into the joint to activate in only one spot. This feeding may cause a hole in the iron plating of the tip.

•Hold the tip steady until the joint is filled evenly with solder.

•Do not rub the tip against the lead.

•Do not apply too much pressure to the joint.
•Good contact with a wet surface is sufficient to pass heat efficiently into the solder joint.
•After soldering, clean the tip on the sponge, tin the tip with RMA solder, and turn the system off.

Students' activity:

Do simple job involving soldering and desoldering of electronic components.

Conclusion:

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Marks				Dated signature of teacher
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Experiment No:21

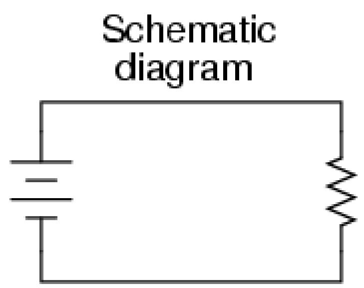
Title: Build simple circuits using resistors, diode, switch and LED.

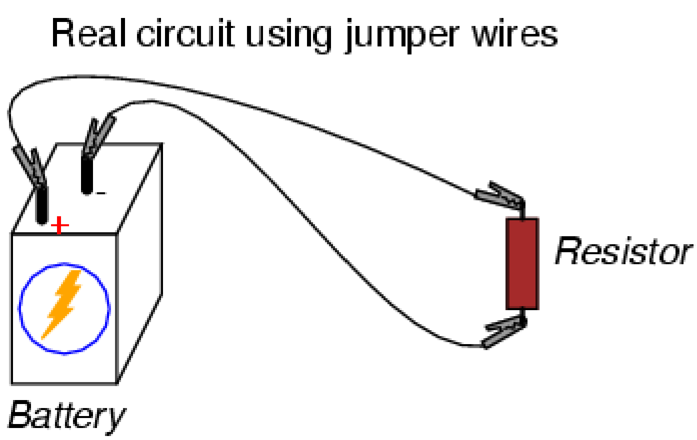
Theory :

1) Build simple circuits using resistors

Here are the steps for building this circuit:

1. Connect the battery snap connector. ...
2. Connect the resistor. ...
3. Connect the LED. ...
4. Use the short jumper wire to connect the terminal strips into which you inserted the LED and the resistor. ...
5. Connect the battery to the snap connector.

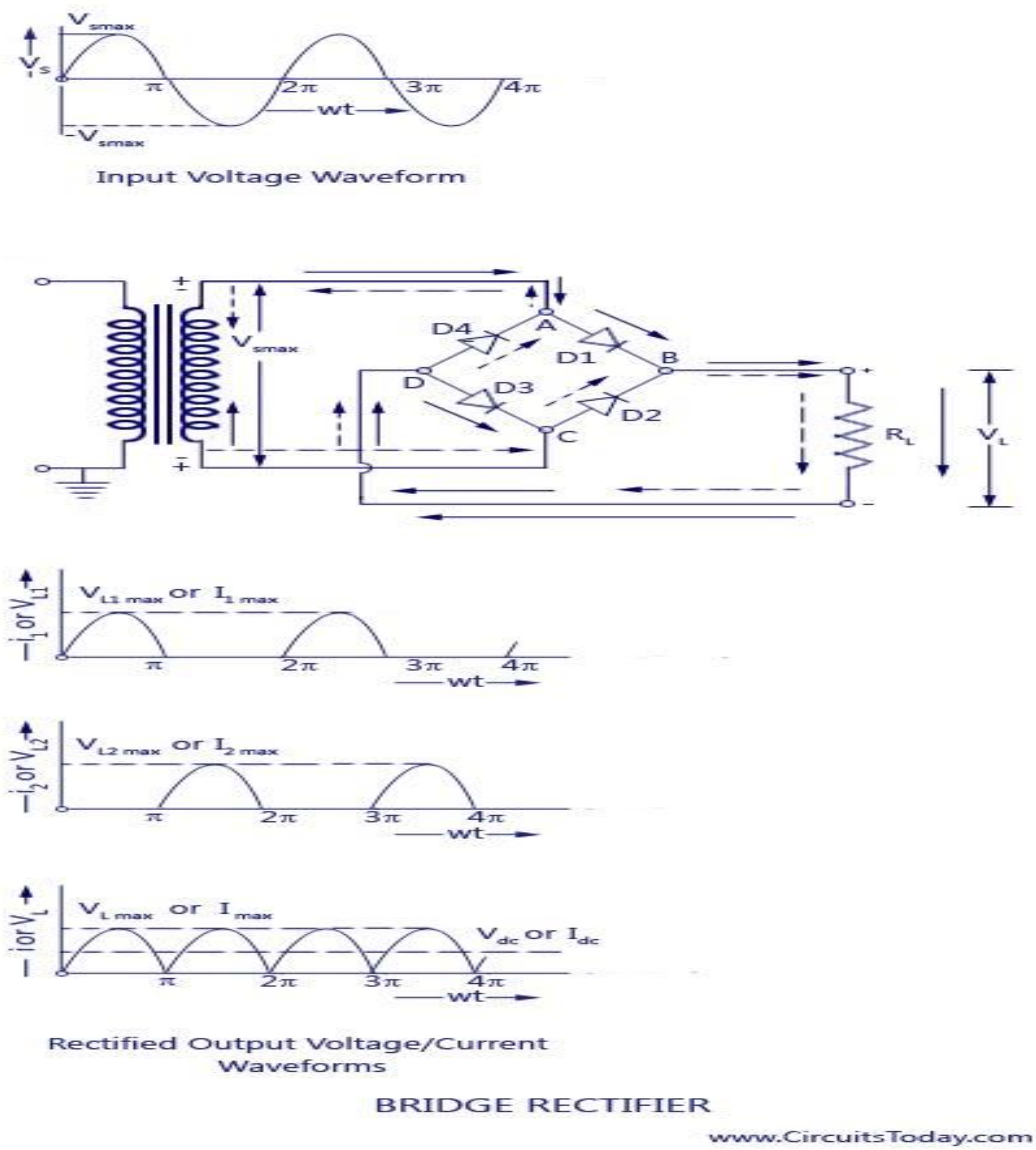




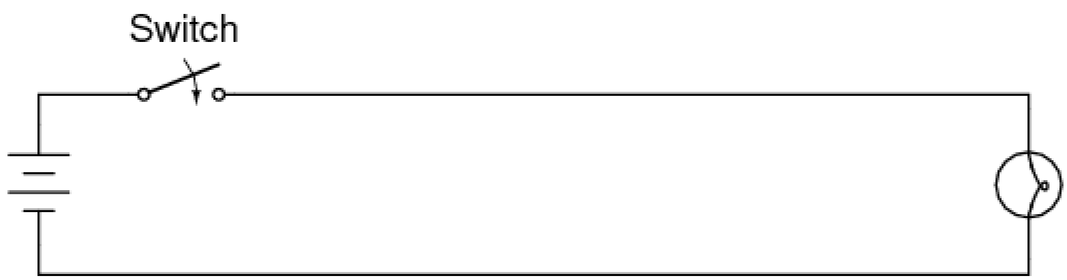
2) Build simple circuits using diode

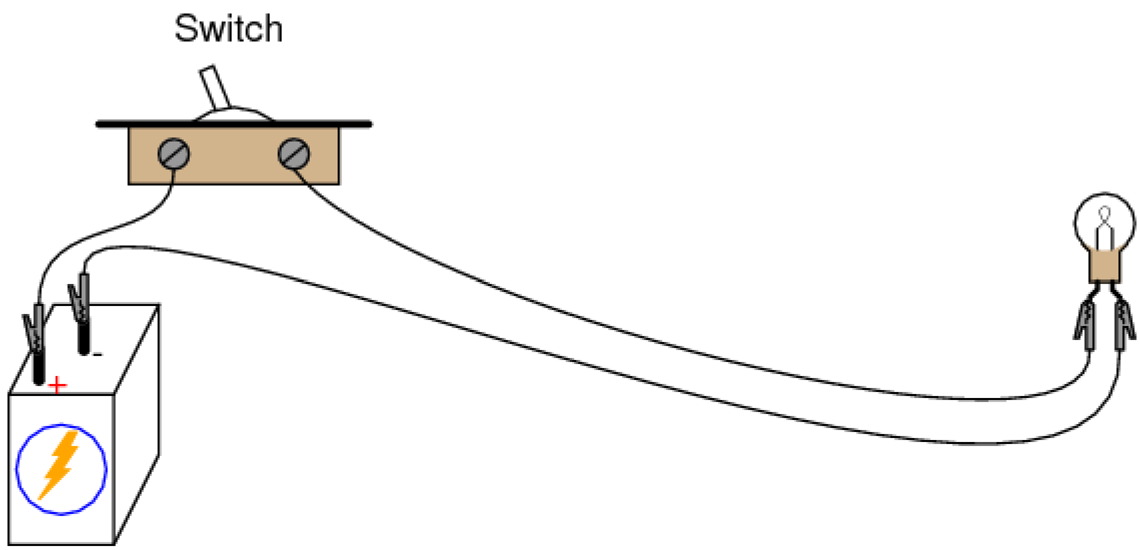
The most common function of a diode is to allow an electric current to pass in one direction (called the diode's forward direction), while blocking current in the opposite direction (the reverse direction).

1. Take 4 diodes for example the 1N4007 rectiifer diodes.
2. In the circuit diagram, 4 diodes are arranged in the form of a bridge. The transformer secondary is connected to two diametrically opposite points of the bridge at points A & C. The load resistance R_L is connected to bridge through points B and D.



3) Build simple circuits using switch



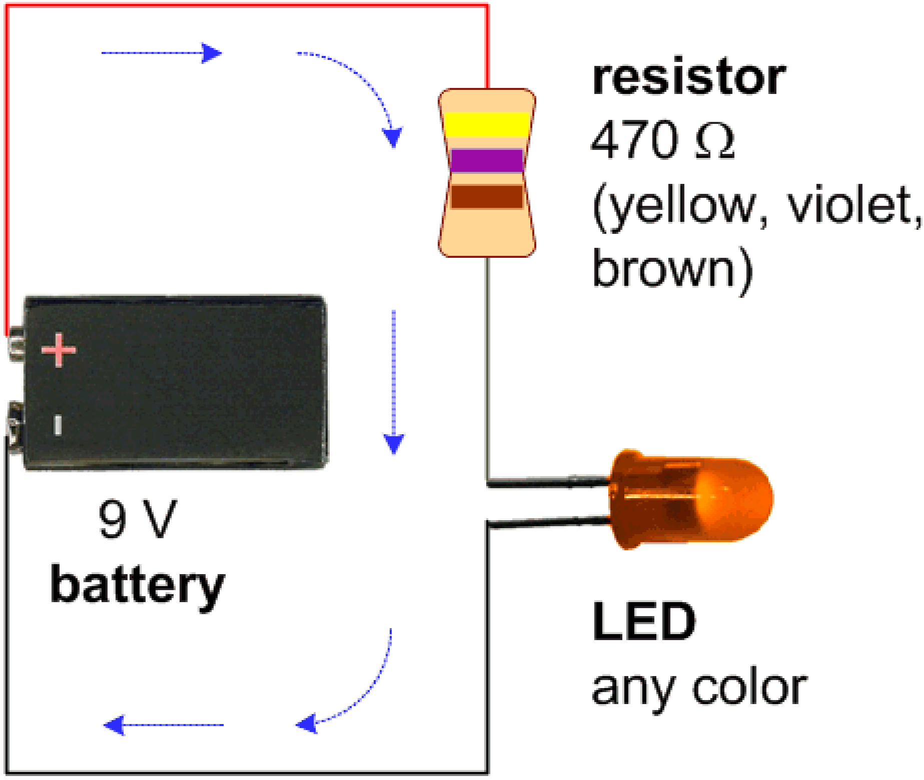


Build a one-battery, one-switch, one-lamp circuit as shown in the schematic diagram and in the illustration. This circuit is most impressive when the wires are *long*, as it shows how the switch is able to control circuit current no matter how physically large the circuit may be.

Measure voltage across the battery, across the switch (measure from one screw terminal to another with the voltmeter), and across the lamp with the switch in both positions. When the switch is turned off, it is said to be *open*, and the lamp will go out just the same as if a wire were pulled loose from a terminal. As before, any break in the circuit *at any location* causes the lamp to immediately de-energize (darken).

4) Build simple circuits using LED

We start by showing you the LED circuit in series with a resistor. You must make some calculations to figure out the resistor value, depending on voltage power supply, LED voltage drop and desired current.



- **Series LED circuit**
- (Source Voltage – LED Voltage Drop) / Amps = OHMs
  Amps = mA/1000
- Example:
  Source Voltage = 9 volts
  Voltage Drop = 3.1 volts typical for a blue or white LED
  Desired Current = 13 milliamps
- So the resistor we need is: (9 – 3.1) / (13 / 1000) = 452 ohms so we will use a 470 Ω resistor.

Conclusion:

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C (4)	P (4)	A (2)	T (10)	

Experiment No: 22

Title: Build simple circuits using relay and other electronics components

Theory :

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.
The relay's switch connections are usually labeled COM(POLE), NC and NO:COM/POLE= Common, NC and NO always connect to this, it is the moving part of the switch.
NC = Normally Closed, COM/POLE is connected to this when the relay coil is not magnetized.
NO = Normally Open, COM/POLE is connected to this when the relay coil is MAGNETIZED and vice versa.
A relay shown in the picture is an electromagnetic or mechanical relay.

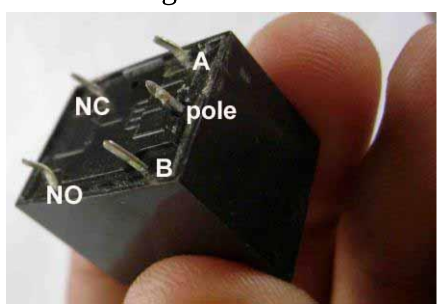


Fig. Relay

There are 5 Pins in a relay. Two pins A and B are two ends of a coil that are kept inside the relay. The coil is wound on a small rod that gets magnetized whenever current passes through it.
COM/POLE is always connected to NC(Normally connected) pin. As current is passed through the coil A, B, the pole gets connected to NO(Normally Open) pin of the relay.
The following circuit also works as a dark sensor. When you block light falling on LDR, the relay gets activated and Pole of relay gets connected to NO pin that eventually gives power to LED- D1.

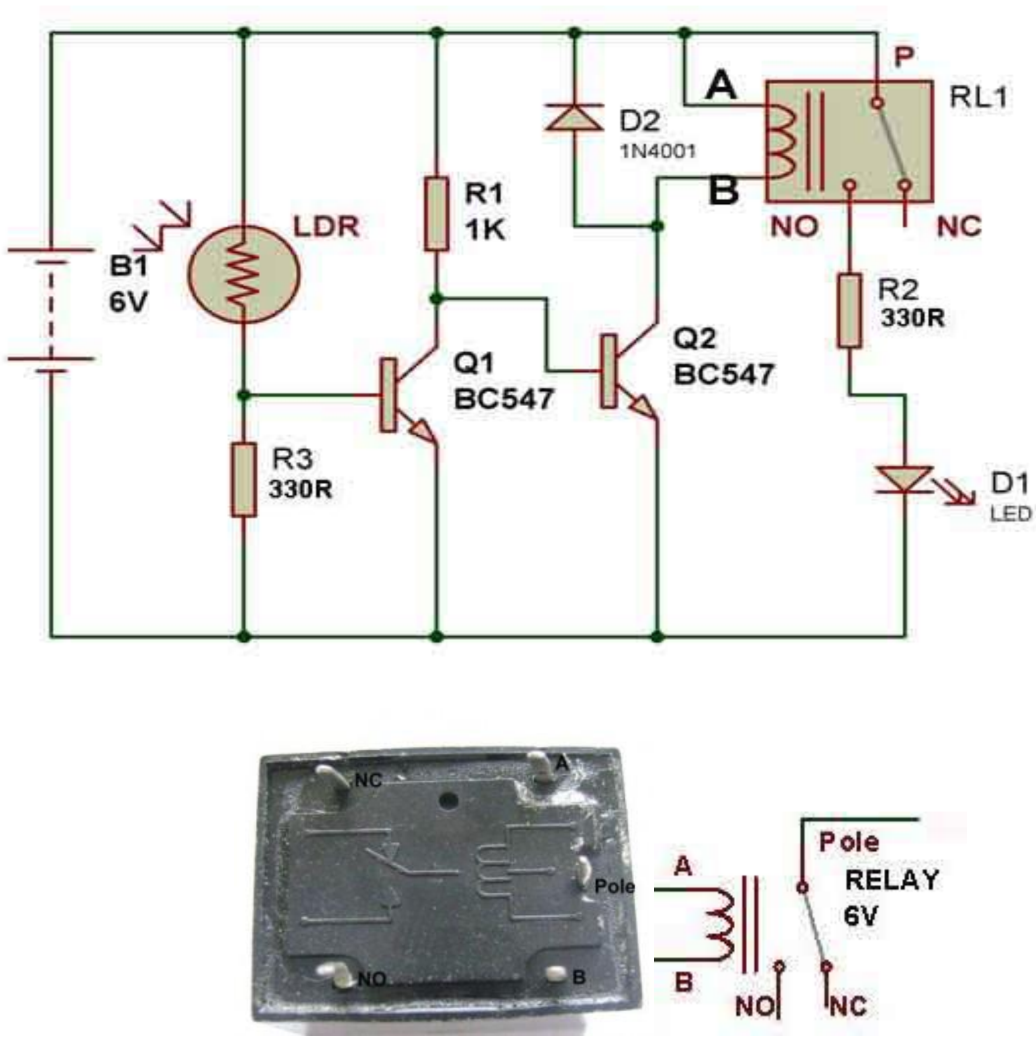


Fig. Dark sensor using two transistors and a relay.

Light sensor using relay and transistors

In this case, the configuration of relay has been changed. Here, NO (Normally open) terminal has been left open. In normal case, the D1-LED remains ON. When light falling on LDR is interrupted, pole of relay gets connected to NO terminal. Hence, NC (Normally connected) terminal does not get power and that switches the D1- LED off.

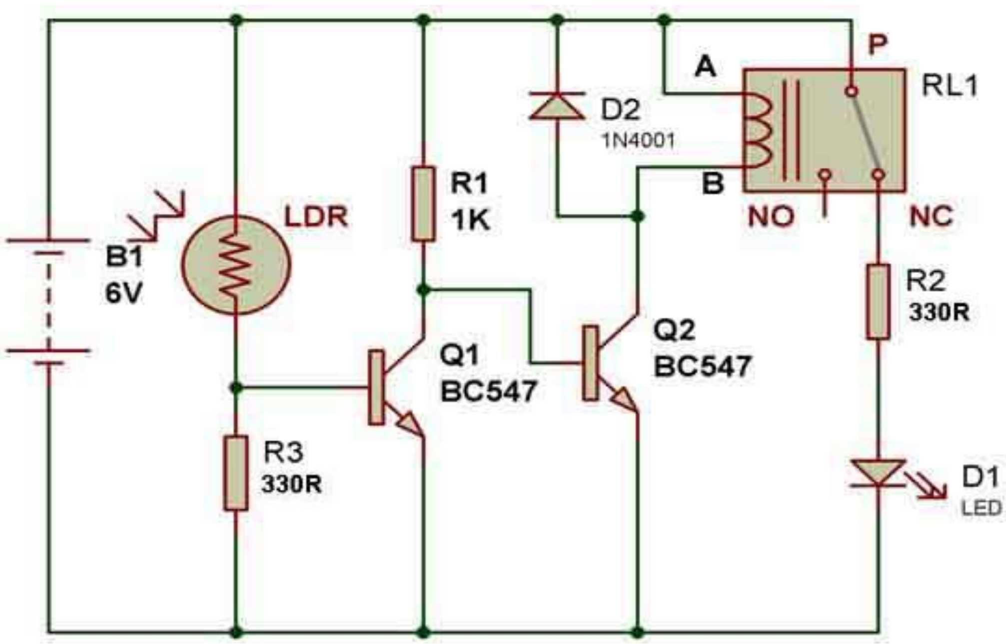
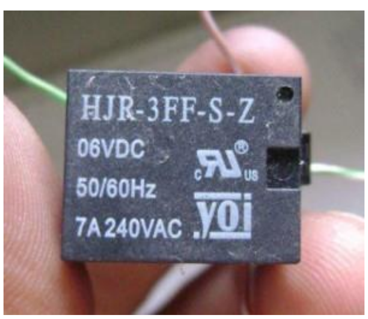


Fig. Light sensor using two transistors and a relay.

Connect to COM(pole) and NO if you want the switched circuit to be on when the relay coil is on.
Connect to COM(pole) and NC if you want the switched circuit to be on when the relay coil is off.

GENERAL SPECIFICATION OF A RELAY



06VDC- means that the voltage across the relay coil has to be 6V-DC.

50/60Hz- The relay can work under 50/60Hz AC.

7A, 240VAC- The maximum AC current and AC voltage specification that can be passed through NC, NO and pole pins/terminals of relay.

Conclusion:

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<tr><td>C (4)</td><td>P (4)</td><td>A (2)</td><td>T (10)</td><td rowspan="2"></td></tr>
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Experiment No:23

Title: Test the circuit developed in the experiment No.22 using various testing equipment.

The First Step Is To Test The Coil of Relay

If the resistance is 320Ω and the tolerance value is ±10% , then we should get resistance values somewhere between 288Ω to 352Ω.

Bring your multimeter and put it in the ohmmeter setting. After this connect the multimeter's probe leads to both the terminals of the ohmmeter. Don't worry about which probe should be connected to which terminal. We are trying to find resistance, so we don't have to bother about polarity.

Now, read the resistance. If the resistance falls with the range mentioned in the datasheet . Then the coil is good. However, if you get readings that are either very high or very low, then there is a problem with the coil. The only thing that you can do now is to replace the relay.

The Second Step Is To Test The Terminals of Relay

Now, that we have tested the coil, its time to test the various terminals of the relay. Again, the best way is to measure the resistance between them. We shall be testing the following :

- Normally Closed Terminal (NO)
- Normally Open Terminal (NC)
- Common Terminal (COM)

Testing The Normally Closed (NC) Terminal of The Relay

When there is no voltage through NC, then the resistance of NC-COM should be nearly 0Ω . If this reading is around 0Ω, then the NC terminal is working fine.

I am providing below, the step by step guide to test the NC terminal.

- Put the multimeter in the ohmmeter setting
- Place one of the multimeter probes on the NC terminal and the other on the COM terminal
- Read the resistance
- If the resistance value is around 0Ω , the NC terminal is working fine.

Testing The Normally Open (NO) Terminal of The Relay

The step by step guide to test the NO terminal is given below.

- Put the multimeter in the ohmmeter setting
- Place one of the multimeter probes on the NO terminal and the other on the COM terminal
- Read the resistance
- If the resistance value is around several MΩ , the NO terminal is working fine.

If you get very high resistance , to the tune of several MΩ, then the NO terminal is also working fine. That's because when the NO and COM are not connected, the impedance is very high.

Conclusion:

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Experiment No:24

Title: Solder more than two components on PCB for continuity

Theory :

What is soldering and when should you use it?

- 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 used to form a permanent connection between electronic components.
- The metal to be soldered is heated with a soldering iron and then solder is melted into the connection.
    - Only the solder melts, not the parts that are being soldered.
    - Solder is a metallic "glue" that holds the parts together and forms a connection that allows electrical current to flow.
- You can use a solderless breadboard to make test circuits, but if you want your circuit to last for more than a few days, you will want to solder the components together.

Materials and Equipment

- A soldering iron
    - A soldering iron is used to heat the connections to be soldered.
    - For electronic circuits, you should use a 25- to 40-watt (W) soldering iron.
    - Higher wattage soldering irons are not necessarily hotter; they are just able to heat larger components. A 40-W soldering iron makes joints faster than a 25-W soldering iron does.
    - A soldering iron can be purchased at hardware stores and at most large department stores.
- Rosin core solder
    - Solder has a lower melting point than the metals that are being connected do. The solder melts when it is heated by the soldering iron, but the metals being joined will not melt.
    - The rosin core acts as a flux. It prevents oxidation of the metals that are being connected, and enhances the ability of the solder to "wet" the surfaces that are being joined.
    - Solder that is used to join copper pipes has an acid core, which is appropriate for pipes, but will corrode electronic connections. Use solder that has a rosin core.
    - For most electronics work, a solder with a diameter of 0.75 millimeters (mm) to 1.0 mm is best. Thicker solder might make soldering small joints difficult and

also increases the chances of creating solder bridges between copper pads that are not meant to be connected.

  - An alloy of 60/40 (60% tin, 40% lead) is used for most electronics work, but lead-free solders are available as well.

- Stand on which to hold the hot soldering iron
  - There are a variety of stands available. It is important to always keep the hot iron in its stand when not in use.
- Sponge
  - The damp sponge is used to clean the tip of the iron.

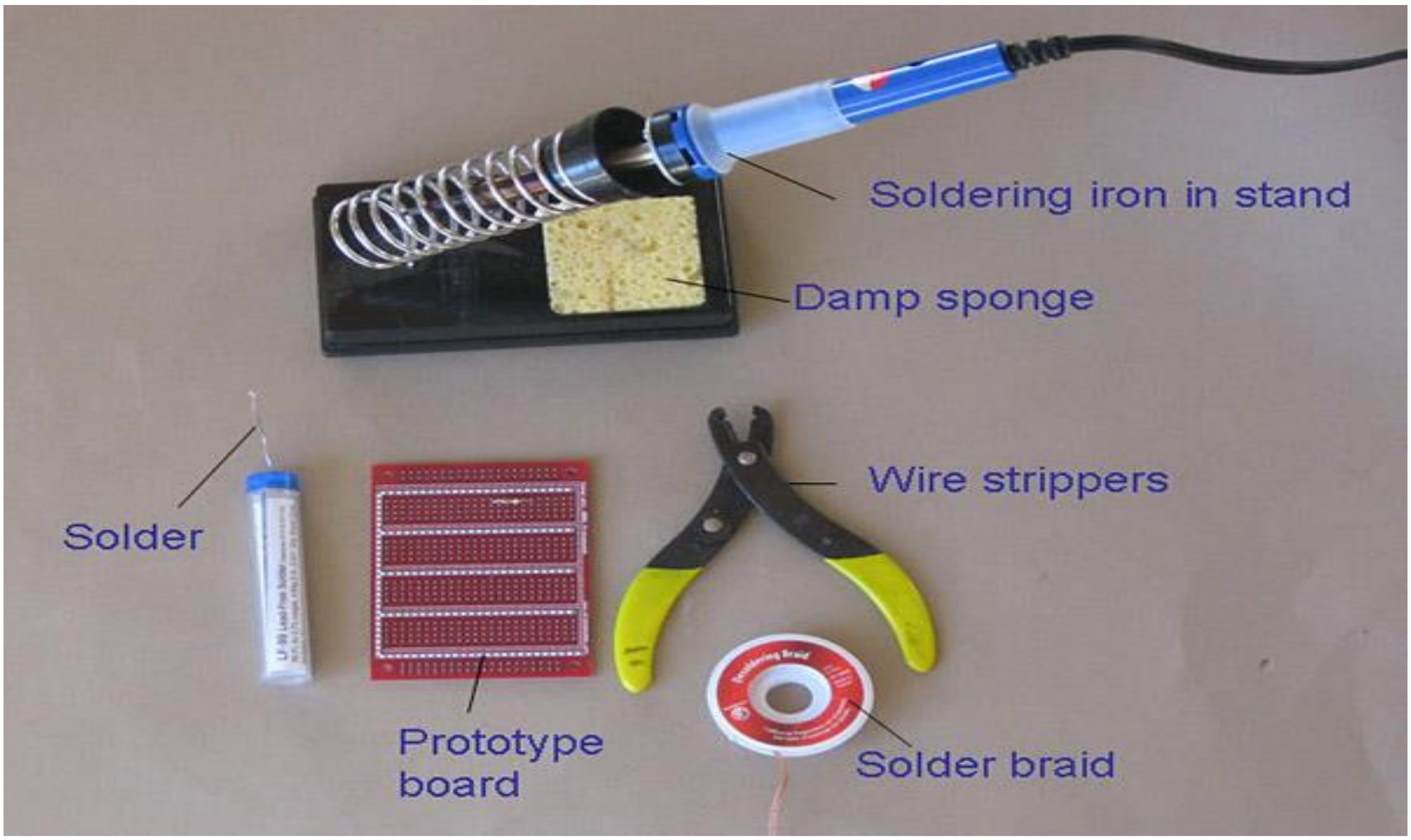


Figure 1. Soldering equipment and materials. The solder in this picture is coiled inside a plastic tube; it is pulled through the top as needed. The spring on the stand holds the hot soldering iron. The damp sponge is used to clean the tip of the iron. Solder braid is used to remove solder; solder is "soaked up" into the braid when it is heated by the soldering iron. The wire strippers can be adjusted to strip the plastic covering off of various thicknesses of wire. The prototype board is used to connect electronic components in a circuit.

- Solder braid
    - This is used to remove solder.
    - To use the braid, place it over the solder to be removed and heat it from above with the iron. The solder will flow into the braid.
    - Solder braid is used to extract an electronic component that is soldered onto a board.
    - It is also used to reduce the amount of solder on a connection.
- Prototype board
    - A prototype board is used to assemble the circuit. The board shown is from www.protostack.com, but Jameco Electronics also supplies prototype boards.
    - Prototype boards have copper tracks or pads for connecting components.
- Steel wool or fine sandpaper
    - This is used to clean connections prior to soldering.
    - Solder will not flow over a dirty connection.
- Crocodile clips
    - These can be used as heat sinks, if needed.

Safety Precautions

1. Caution: A soldering iron can heat to around 400°C, which can burn you or start a fire, so use it carefully.
2. Unplug the iron when it is not in use.
3. Keep the power cord away from spots where it can be tripped over.
4. Take great care to avoid touching the tip of the soldering iron on a power line. If a power cord is touched by a hot iron, there is a serious risk of burns and electric shock.
5. Always return the soldering iron to its stand when it is not in use.
6. Never put the soldering iron down on your work bench, even for a moment!
7. Work in a well-ventilated area.
8. The smoke that will form as you melt solder is mostly from the flux and can be quite irritating. Avoid breathing it by keeping your head to the side of, not above, your work.
9. Solder contains lead, which is a poisonous metal. Wash your hands after using solder.

Tips

Reliable operation of a circuit with soldered connections depends on good soldering practices. Here are some tips for successful soldering.

1. Plan before you start to solder. Identify all the parts that you will be using.
2. It is helpful to attach each part to a piece of paper and write what it is and its value (for example, resistor #1: 100 ohms).
3. Some components, such as LED's, must be placed the correct way around in order to function.
4. The following is a suggested order for the installation of various components:
    - Integrated circuit (IC) holders (note the orientation). The IC will be added later.
    - Resistors
    - Capacitors, less than 1 micro farad
    - Large capacitors, 1 micro farad or greater, note the orientation.
    - Diodes, note the orientation.
    - LED's, note the orientation.
    - Transistors, note the orientation.
    - Solid wire connections between components on the board
        - Solid wire is fairly rigid, so it will stay in place once attached.
    - Stranded wire to parts that are connected by wire to the circuit
        - Stranded wire is more flexible than solid wire.
    - Integrated circuits
        - Connect them the correct way around.
        - Many IC's are static sensitive.
        - Leave IC's in their antistatic packaging until you need them, then ground your hands by touching a metal water pipe or window frame before touching the IC's.
        - Carefully insert IC's in their holders. Make sure all the pins are lined up with the socket, then push down firmly with your thumb.

Preparing the Soldering Iron: Tinning the Tip

1. Place the soldering iron in its stand and plug it in.
2. Wait for the soldering iron to heat up.
3. Moisten the sponge.
4. Wipe the tip of the iron on the damp sponge. This will clean the tip.
5. Melt a little solder on the tip of the iron.
    - This is called tinning and it will help the heat flow from the iron's tip to the joint.
    - The solder should flow onto the tip, producing a bright shiny surface.

- If the solder will not flow onto the tip, clean it by wiping it on the wet sponge.
- When tinned, wipe excess solder off on the wet sponge.
- You do not need to tin the tip before every joint, but you should re-tin it if it has gone dull when the soldering iron has not been used for a few minutes.
- Check the manufacturer's instructions related to tinning the tip.

6. The tip of the soldering iron should be a shiny silver color. If it is black and pitted, replace it with a new one.

Soldering

1. Solder needs a clean surface on which to adhere.
    - Buff the copper foil of a PC board with steel wool before soldering.
    - Remove any oil, paint, wax, etc. with a solvent, steel wool, or fine sandpaper.
2. To solder, heat the connection with the tip of the soldering iron for a few seconds, then apply the solder.
    - Heat the connection, not the solder.
    - Hold the soldering iron like a pen, near the base of the handle.
    - Both parts that are being soldered have to be hot to form a good connection.

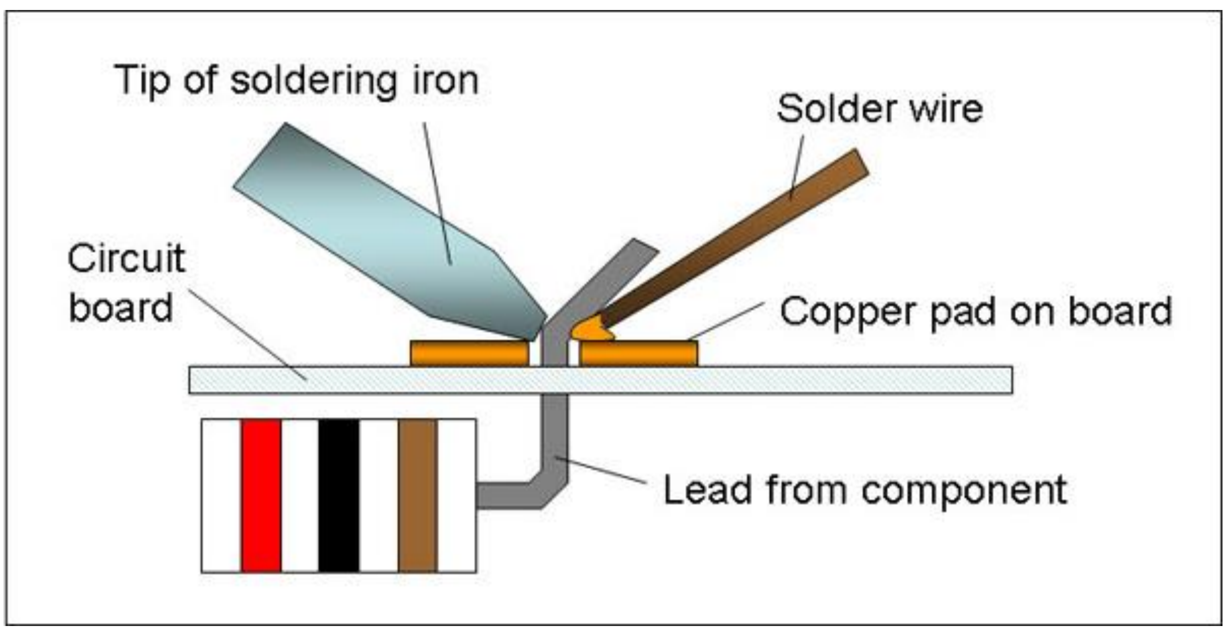
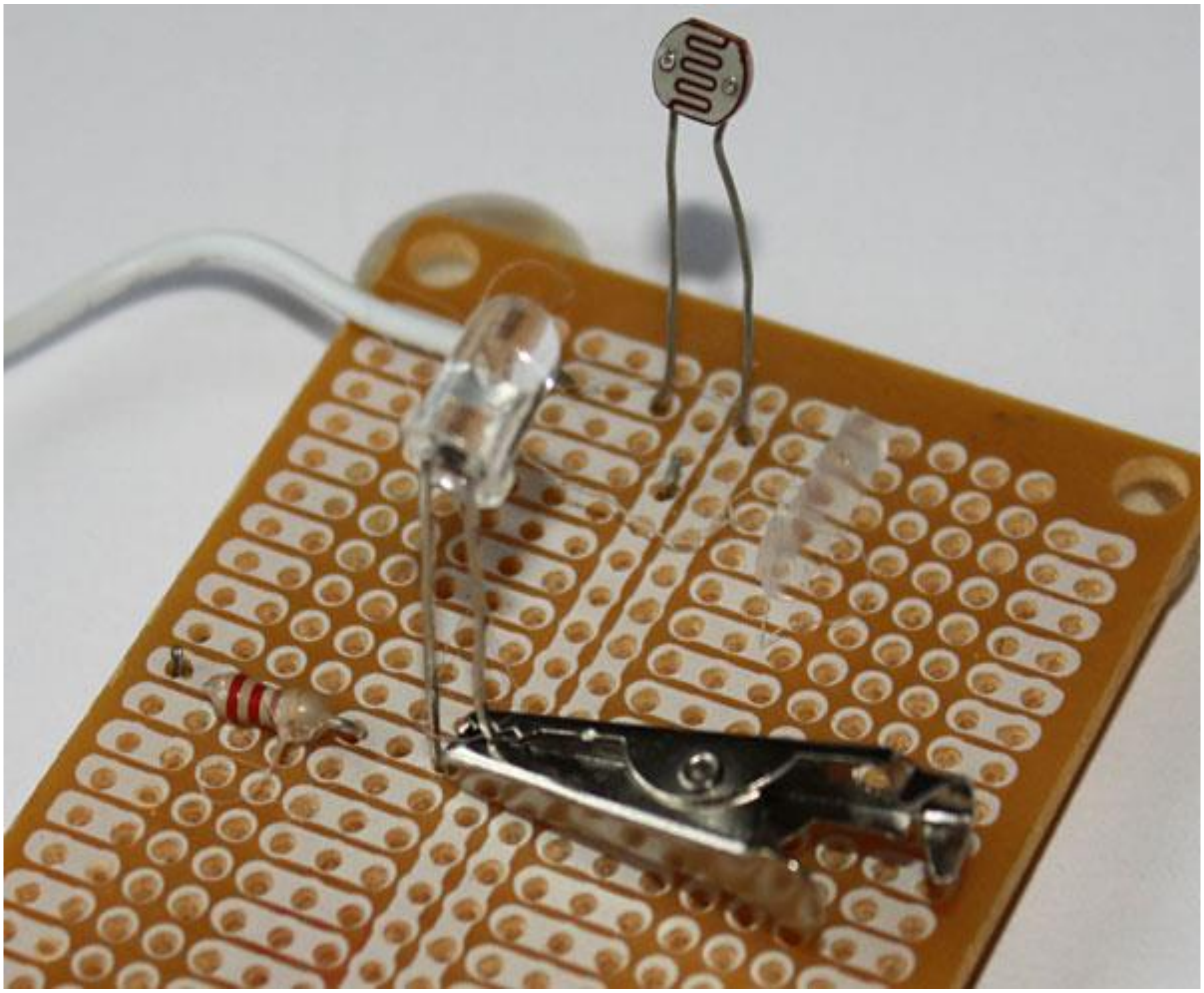


Figure 2. The tip of the soldering iron heats both the copper pad and the lead from the electronic component. Solder melts when placed in contact with the hot metals to be joined.

3. Keep the soldering tip on the connection as the solder is applied.
    - Solder will flow into and around well-heated connections.
    - Use just enough solder to form a strong connection.
4. Remove the tip from the connection as soon as the solder has flowed where you want it to be. Remove the solder, then the iron.
5. Don't move the connection while the solder is cooling.
6. Don't overheat the connection, as this might damage the electrical component you are



soldering.
    - Transistors and some other components can be damaged by heat when soldering. A crocodile clip can be used as a heat sink to protect these components.

Figure 3. By absorbing heat, the crocodile clip will reduce the heat that flows to the component, helping to prevent damage.

7. Soldering a connection should take just a few seconds.
   - If it is taking longer, see the troubleshooting section below.
8. Inspect the joint closely. It should look shiny.
   - If you are soldering a wire (called the lead) onto a PC board (on the track), it should have a volcano shape. See Figure 3.
   - If the connection looks bad, reheat it and try again.

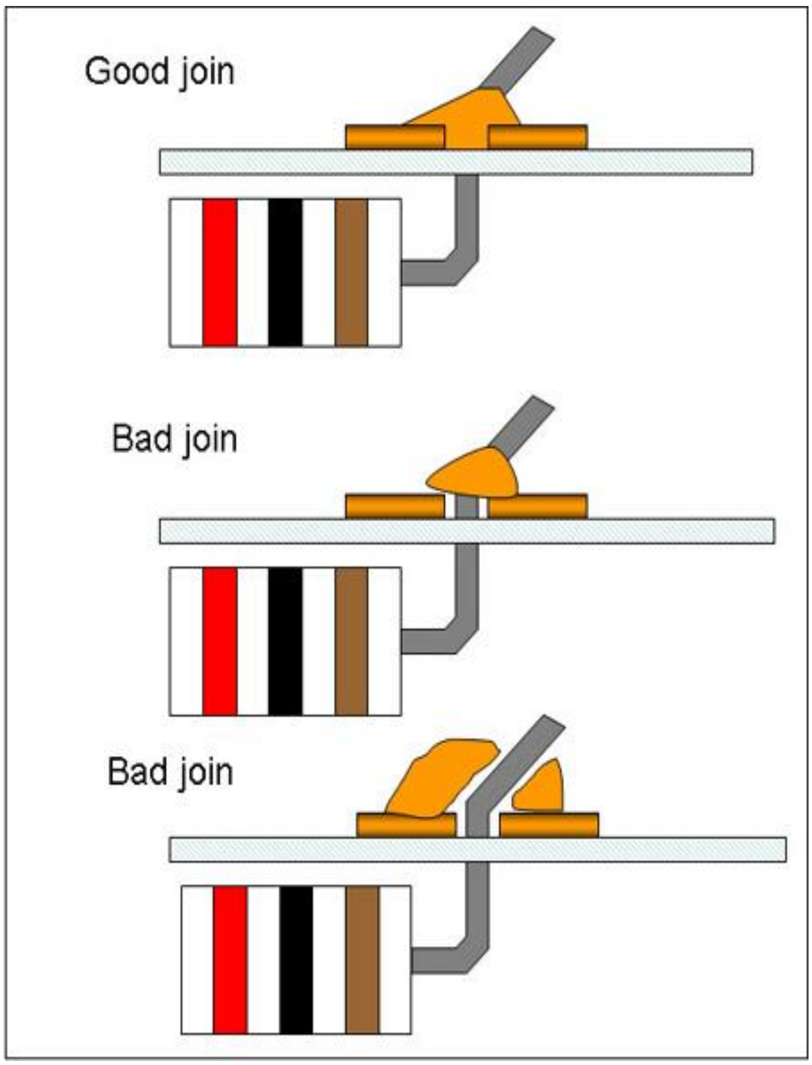


Figure 4. The solder in a good join will be shaped like a cone, with solid contact between the solder and all surfaces to be joined. Bad joins (also called dry joins) should be melted and remade.

9. Wipe the tip of the iron on a damp sponge to clean it. The tip should now be shiny.
10. Unplug the soldering iron when it is not in use.

Conclusion:

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Marks				Dated signature of teacher
C (4)	P (4)	A (2)	T (10)	