2

LABORATORY REPORT FORMAT

1. NAME OF THE LABORATORY WITH CODE :
2. DATE OF EXPERIMENT :
3. EXPERIMENT NO. :
4. ROLL NO. :
5. GROUP NO. :
6. NAME OF THE EXPERIMENT :
7. EQUIPMENT / INSTRUMENT / COMPONENTS USED WITH SPECIFICATIONS:
8. THEORETICAL ASPECTS OF THE EXPERIMENTS /ANALYSIS OF THE CIRCUIT
9. CIRCUIT DIAGRAMS :
10. TABLES AND OBSERVATIONS :
11. RESULTS AND GRAPHS :
12. CONCLUSIONS / COMMENTS :

Lab Report Writing Strategies

A. Each lab report should reflect (1) the purpose of each lab and experiment, (2) the procedures of each experiment, (3) the theoretical results of each experiment, (4) the measured results of each experiment, (5) any conclusions from each experiment.

B. Be sure to use any relevant equations when comparing theoretical and measured results and to use the measured component values when calculating theoretical results.

C. Make a habit of labelling details directly on the ckt. diagram, *immediately* after making a measurement , this will help us understand what was done, and also serve as a note for writing the lab report later.

D. Tables and figures should *always* have descriptive captions, which are properly placed.

E. Each waveform should be labelled.

F. All figures, tables, and equations should *always* be numbered .

G. Where applicable, use percent error to describe how a circuit functions.

NOTE : SUBMIT LABORATORY REPORT FOR EACH EXPERIMENT IN THE NEXT WEEK AFTER COMPLETING THE EXPERIMENT.

To successfully complete the experiment in one lab turn, come prepared to the laboratory. Read the experiment in advance. Always take safety precautions while performing experiments.

Personal and General laboratory safety

Good common sense is needed for safety in a laboratory. It is expected that each student will work in a responsible manner and exercise good judgment and common sense. If at any time you are not sure how to handle a particular situation, ask your faculty member, Teaching Assistant or Instructor for advice. **DO NOT TOUCH ANY THING WITH WHICH YOU ARE NOT COMPLETELY FAMILIAR!!!** It is always better to ask questions than to risk harm to yourself or damage to the equipment.

1. Read labels carefully.
2. Do not use any equipment unless you are trained and approved as a user by your supervisor.
3. Keep the work area clear of all materials except those needed for your work. Extra books, purses, etc. should be kept away from equipment.
4. Equipment Failure - If a piece of equipment fails while being used, report it immediately to your supervisor Never try to fix the problem yourself because you could harm yourself and others.
5. Clean up your work area & switched off all equipments before leaving.

Experiment No.1

ITLE: To know your laboratory.

ope: Since there are rapid changes in various branches of electronics engineering, it is necessary for all engineers rking at various levels to know the basic principles of some standard equipments and universal rules for boratory. The working knowledge shall help them to perform various practicals with ease.

EW CONCEPTS:

boratory experiments are expected to develop intellectual skills, motor skills and attitude in students.

struments used in electronics laboratory.

fferent types of instruments are used in a laboratory. Every user of these instruments shall know the range and nitations of the instrument.

mmeter: The ammeter is an instrument used for measurement of current in electronic circuits. It available in various versions. e.g. Ammeter (measuring current in amperes), milliammeter, icroammeter. It is always connected in series.

oltmeter: A voltmeter is used to measure the voltage produced by source or any element in a rcuit. It is always connected across the voltage to be measured. Voltmeters can have their range of readings tended by the use of multiplier.

ultimeter: A multimeter is very important instrument which enables the measurement of many rameters like current, voltage, resistance, diode condition, transistor parameters etc. Different odels of multimeter are available in market. Multimeters are available in analog and digital versions. Analog ultimeters are made using high quality jeweled meter movement. Digital multimeters use logic circuits for easuring various parameters. Digital multimeters are more easy and clear to read for most people.

R.O: The cathode ray oscilloscope is the most useful instrument, which will display the waveform of signal on reen. The quantity is measured with time scale and voltage scale, which are adjustable by means of, range ting. They are available in various versions as a single trace or dual trace. Single trace C.R.O. displays one veform at a time whereas dual trace displays two waveforms simultaneously.

nction Generator: The function generator or signal generator produces sine wave, square wave, triangular ve output with frequencies from few hertz to few megahertz with peak to peak voltage ranging from few illivolts to few volts. This instrument is used to produce basic test signals, which are used to check performance electronic circuits.

C power supply: Most of the electronic devices need dc voltage or dc current for excitation. wer supply is the instrument, which supplies the dc voltage and/or current. Different types of wer supplies are used in laboratory depending on the need. They may give constant dc output tage or current or can be variable.

DS: Component Development System : Experiments can be done on CDS without fabricating PCB's and ldering components on to it. Variable supplies and sine / square function generator provided on board facilitate y experimentation and testing on passive and active components' circuits IC's digital logic circuits, Op-amp's .

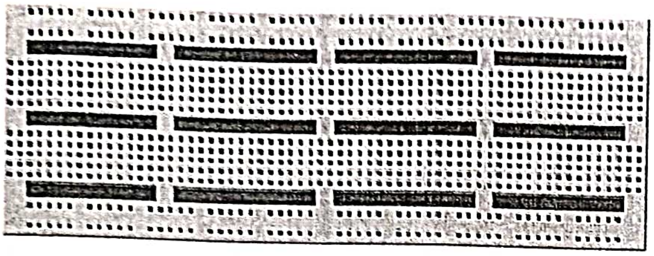
BSERVATION : (A) Name of the Instrument (B) Make of Instrument (C) Technical Data

Breadboard Sockets

In order to temporarily construct a circuit without damaging the components used to build it, we must have some sort of a platform that will both hold the components in place and provide the needed electrical connections. Although more sophisticated techniques and devices have been developed to make the assembly and testing of electronic circuits easier, the concept of the breadboard remains, and the process of assembling components on a temporary platform is still known as "breadboarding."

The figure shows a small, modern breadboarding socket. The socket itself is molded nylon;. Along the center a groove is molded in, except for small sections in the middle and at either end, to maintain strength and

stability. Above the groove you see a series of columns of five holes each, with a matching set of columns below the groove.The holes on each side of the central groove are all spaced 0.1" apart; the groove separates the two sets of holes by 0.3". This makes this type of breadboard socket ideal for mounting integrated circuits (ICs) of the dual-in-line type.
The important factor here is that the five holes in each individual column are electrically connected to each other, but remain insulated from all other sets of holes. This is accomplished as shown to the right. This is an underside view of the breadboard socket with the insulating layer of paper removed. The nylon block contains a series of rectangular slots with thin walls between the slots. A prefabricated set of contacts, similar to the detail shown here, is inserted into each slot to provide the required electrical connections as well as to hold each component lead securely. This breadboard socket is useful and works well for experiments of many kinds. However, it is limited is size and capability. A larger version is shown below:



The middle area works just like a longer version of the smaller breadboard socket you saw first on this page: each column of five holes is electrically connected, but is also insulated from all other parts of the breadboard.Beyond the main columns of holes, however, you'll note four sets or groups of holes along the top and bottom. Each of these consists of five separate sets of five holes each, for a total of 25 holes. These groups of 25 holes are all connected together. This makes them ideal for distributing power to multiple ICs or other circuits.There are a number of variations on this breadboard socket arrangement, but they all serve the same functions of allowing individual components and ICs to be mounted on a stable platform, and then facilitating the interconnection of these components to form an electronic circuit that can be observed and tested while in operation.
These breadboarding sockets are sturdy and rugged, and can take quite a bit of handling. However, there are a few rules you need to observe, in order to extend the useful life of the electrical contacts and to avoid damage to components. These rules are: (1) Always make sure power is disconnected when constructing or modifying your experimental circuit. It is possible to damage components or incur an electrical shock if you leave power connected when making changes. (2) Whenever possible, use ¼ watt resistors in your circuits. ½ watt resistors may be used when necessary; resistors of higher power ratings should never be inserted directly into a breadboard socket.

(3) Never force component leads into contact holes on the breadboard socket. Doing so can damage the contact and make it useless. You may find it helpful to use diagonal cutters to cut off the very end of a component lead. This will leave a wedge-shaped end on a component lead, to make for easier insertion. (4) Do not insert stranded wire or soldered wire into the breadboard socket. If you must have stranded wire (as with an inductor or transformer lead), solder (or use a wire nut to connect) the stranded wire to a short length of solid hookup wire, and insert only the solid wire into the breadboard. If you follow these basic rules, your breadboarding system will last indefinitely, and your experimental components will last a long time.

Digital Multimeters : Digital multimeters can solve most electrical problems - at the hands of a qualified electrical test profession. In fact, With a good wiring diagram and a good meter, a trained electrical professional can find the cause of almost any problem.There are two basic types of multimeters, digital and analog. Analog multimeters have a needle and DMs have an LCD or a LED display. WIth today's demand for accuracy in testing electrical systems, it makes more sense to have a digital multimeter but an analog multimeter still has its uses.

This article focuses on DMs. A DM will have many functions built into it. As with any tool or piece of equipment, it is necessary to make certain you read and follow digital multimeter instructions and cautions. This will protect you and your electrical equipment.They will test for voltage, current and resistance. These are the three functions needed when trying to diagnose a problem. When you purchase a digital multimeter, one of the most important things to look at is the meter's impedance, which is the meter's operating resistance. Most digital multimeters have very high impedance. Since the meter is part of the circuit being tested, its resistance will affect the current flow through that circuit.

Typical Amperage Test : Digital multimeters can have very high impedance or resistance and they will cause a slight increase in the circuit's current. This becomes a concern when you test electronic systems because the increased current draw can damage the components being tested or, at the very least, alter the readings or change a sensor signal. It's best to get a meter that has an impedance of at least 10 megaohms. That way the current draw is so low it becomes invisible.

Almost all meters have an "auto-range" features that will automatically select the proper range. Some meters will let you override this feature and let you manually select the range you want. Some DMMs do not have this option and must be set manually. Check the documentation that came with your digital multimeter and make sure you know and understand its different ranges.Most meters that have an auto-range will have the setting either before or after the reading. Ohms are measured in multiples of ten and given the designation 'K' or 'M' with 'K' standing for 1,000 ohms and 'M' standing for 100,000,000 ohms. Amps would be displayed as mA, milliamps or 1/1000 of an amp or A for full amps. Volts will also be displayed as mV or volts. When you take a reading with a DMM that has auto-range, be sure you note at what range the meter is on. You could mistake 10 mA as 10 amps.

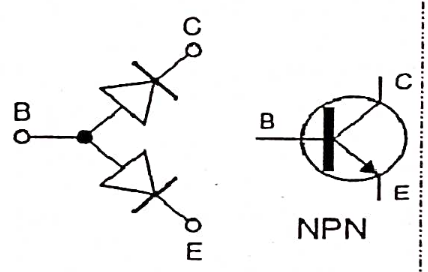
Typical Voltage Test : Most DMs that have auto-range will show the reading with a decimal point. A reading of 12 amps will be 12 amps if you ignore the decimal point.Digital Multimeters do have a limit on how much current they can test. Usually this limit is printed at the point where the red lead plugs into the meter. If it says, "10 Amps Max" then there is a 10-amp fuse inside the meter that will blow if the current is above 10 amps. If you take out the 10-amp fuse and put in a 20-amp fuse, you will burn out the meter beyond repair. I would suggest buying a DMM that will handle at least 20 amps for automotive testing.

Typical Resistance Test :

Another useful function of the DM is the ohmmeter. An ohmmeter measures the electrical resistance of a circuit. If you have no resistance in a circuit, the ohmmeter will read 0. If you have an open in a circuit, it will read infinite. An ohmmeter uses its own battery to conduct a resistance test. Therefore there must be no power in the circuit being tested or the ohmmeter will become damaged. When a component is tested, the red lead is placed on the positive side and the black lead on the negative side. Current from the battery will flow through the component and the meter will determine the resistance by how much the voltage drops. If the component has an open the meter will flash "1.000" or "OL" to show an open or infinite resistance. A reading of 0 ohms indicates that there is no resistance in the component and it is shorted. If a component is supposed to have 1,000 ohms of resistance and a test shows it has 100 ohms of resistance, which indicates a short. If it reads infinite, then it is open.

Testing a diode with a DIGITAL multimeter : Digital multimeters have a special setting for testing a diode, usually labelled with the diode symbol. Connect the **red** (+) lead to the anode and the **black** (-) to the cathode. The diode should conduct and the meter will display a value (usually the voltage across the diode in mV, 1000mV = 1V). Reverse the connections. The diode should NOT conduct this way so the meter will display "off the scale" (usually blank except for a 1 on the left).

Testing a transistor with a multimeter :Set a digital multimeter to diode test and an analogue multimeter to a low resistance range such as × 10, as described above for testing a diode. **Test each pair of leads both ways** (six tests in total): The **base-emitter (BE)** junction should behave like a diode and conduct one way only. The **base-collector (BC)** junction should behave like a diode and conduct one way only. The **collector-emitter (CE)** should not conduct either way. The diagram shows how the junctions behave in an NPN transistor. The diodes are reversed in a PNP transistor but the same test procedure can be used.

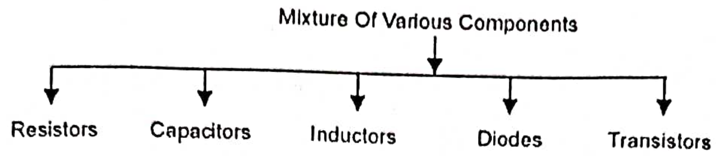


Testing an NPN transistor

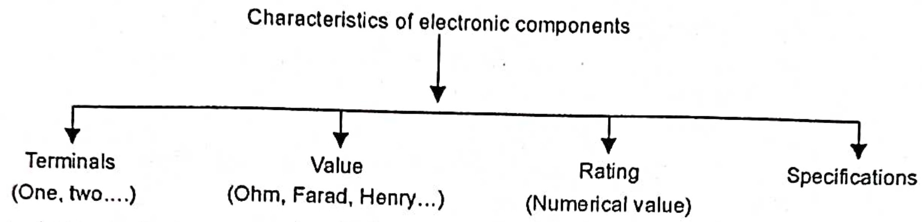
Experiment No.2(ECS51)

TITLE:
To identify and understand names and related terms of various electronic components used in electronic circuits.

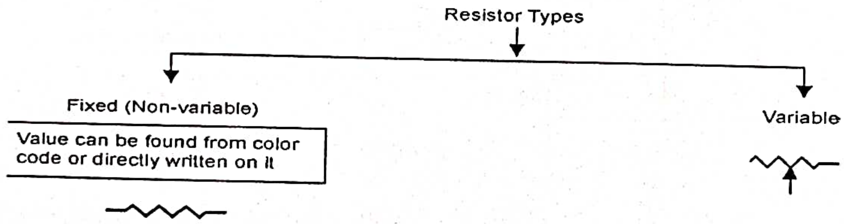
Electronic components : To observe various electronic components physically and identify each component by name from the mixture of various components.



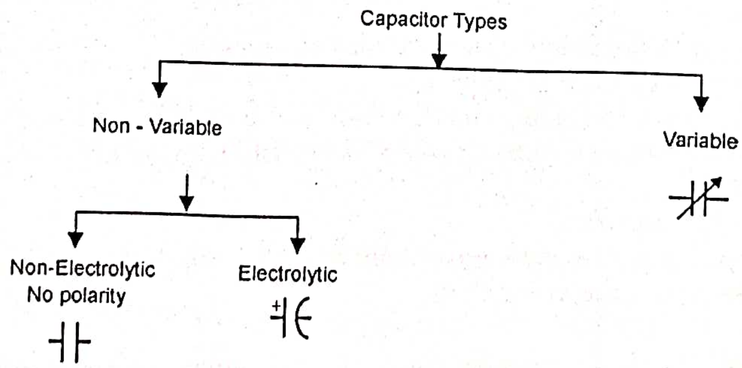
Characteristics of electronic components
Identify different terminals of components, find their values and observe numbering associated with it.
Concept structure:



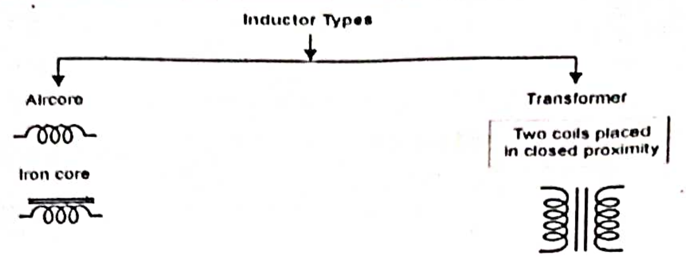
Resistor : It is the most common component with two terminals used in the circuit to limit the amount of current through it. Its unit is Ohm (Ω). **Concept structure:**



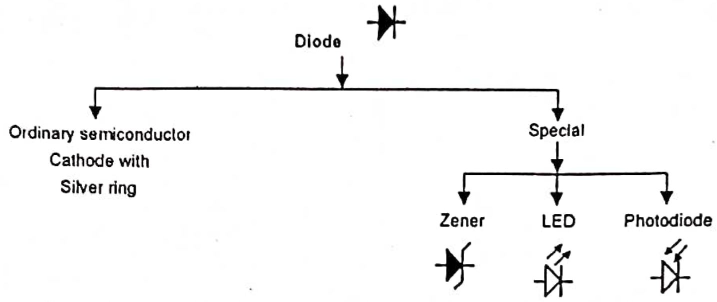
Capacitor : It is passive component with two terminals used for holding or storing electric charge. Its unit is farad. (F)
Concept structure:



Inductor : It is passive component used to provide opposition to the change in the flow of current in a circuit. The unit of inductor is Henry (H).

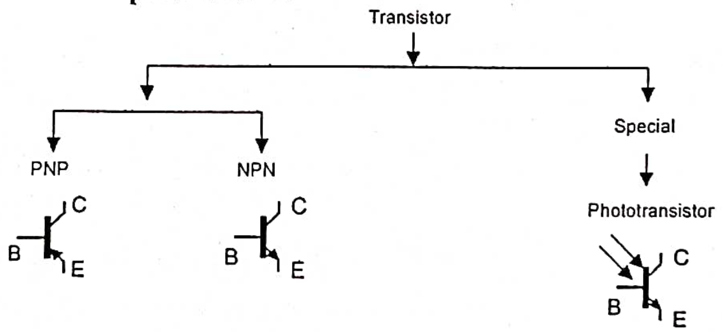


Diode : It is a two terminal active component, which allows current to flow only in one direction.



Transistor : It is a three terminal active component used for amplification of weak ac signals or for switching dc voltages.

Concept structure:



LEARNING OBJECTIVES:

1. To identify all the components by physically observing each component.
2. Ability to observe the mixture of various components.
3. Ability to draw symbols of components along with their values or written Information on it.

APPARATUS: Mixture of various electronic components like resistors, capacitors, Inductors, diodes, transistors.

6.0 STEPWISE PROCEDURE:

1. Observe the given mixture of components.
2. Draw pictorial view of components. Also draw the symbol of each Component.
3. Note values and rating in the given observation table.

Sr. No.	Components	Pictorial View	Symbol	Rating/Values

Resistors

Example: 

Function: Resistors restrict the flow of electric current, for example a resistor is placed in series with a light-emitting diode (LED) to limit the current passing through the LED.

Resistor values - the resistor colour code

Resistance is measured in ohms, the symbol for ohm is an omega Ω.
1 Ω is quite small so resistor values are often given in kΩ and MΩ.
1 kΩ = 1000 Ω 1 MΩ = 1000000 Ω.

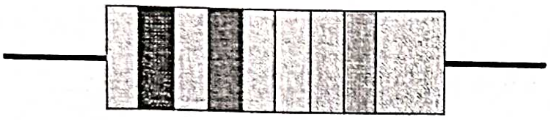
Resistor values are normally shown using coloured bands.
Each colour represents a number as shown in the table.

Most resistors have 4 bands:

- The first band gives the first digit.
- The second band gives the second digit.
- The third band indicates the number of zeros.
- The fourth band is used to shows the tolerance (precision) of the resistor, this may be ignored for almost all circuits but further details are given below.

The Resistor Colour Code

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



This resistor has red (2), violet (7), yellow (4 zeros) and gold bands.
So its value is 270000 Ω = 270 kΩ.
On circuit diagrams the Ω is usually omitted and the value is written 270K.

Small value resistors (less than 10 ohm)
The standard colour code cannot show values of less than 10Ω. To show these small values two special colours are used for the third band: gold which means $\times$ 0.1 and silver which means $\times$ 0.01. The first and second bands represent the digits as normal.

For example:
red, violet, gold bands represent $27 \times 0.1 = 2.7\ \Omega$
green, blue, silver bands represent $56 \times 0.01 = 0.56\ \Omega$

Tolerance of resistors (fourth band of colour code)
The tolerance of a resistor is shown by the fourth band of the colour code. Tolerance is the precision of the resistor and it is given as a percentage. For example a 390Ω resistor with a tolerance of $\pm$10% will have a value within 10% of 390Ω, between 390 - 39 = 351Ω and 390 + 39 = 429Ω (39 is 10% of 390).

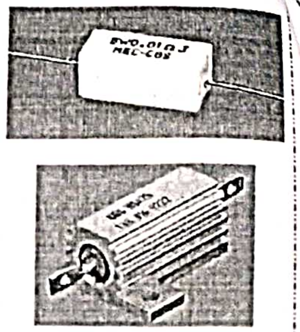
A special colour code is used for the fourth band tolerance:
silver $\pm$10%,   gold $\pm$5%,   red $\pm$2%,   brown $\pm$1%.
If no fourth band is shown the tolerance is $\pm$20%.

Tolerance may be ignored for almost all circuits because precise resistor values are rarely required.

Power Ratings of Resistors :

Electrical energy is converted to heat when current flows through a resistor. Usually the effect is negligible, but if the resistance is low (or the voltage across the resistor high) a large current may pass making the resistor become noticeably warm. The resistor must be able to withstand the heating effect and resistors have power ratings to show this

Power ratings of resistors are rarely quoted in parts lists because for most circuits the standard power ratings of 0.25W or 0.5W are suitable. For the rare cases where a higher power is required it should be clearly specified in the parts list, these will be circuits using low value resistors (less than about 300Ω) or high voltages (more than 15V). The power, P, developed in a resistor is given by:



High power resistors
(5W top, 25W bottom)

$P = I^2 \times R$ where: P = power developed in the resistor in watts (W)
or I = current through the resistor in amps (A)
$P = V^2 / R$ R = resistance of the resistor in ohms (Ω)
V = voltage across the resistor in volts (V)

Examples: A 470Ω resistor with 10V across it, needs a power rating $P = V^2/R = 10^2/470 = 0.21$W. In this case a standard 0.25W resistor would be suitable. A 27Ω resistor with 10V across it, needs a power rating $P = V^2/R = 10^2/27 = 3.7$W. A high power resistor with a rating of 5W would be suitable.

Capacitors **Function :** Capacitors store electric charge. They are used with resistors in timing circuits because it takes time for a capacitor to fill with charge. They are used to smooth varying DC supplies by acting as a reservoir of charge. They are also used in filter circuits because capacitors easily pass AC (changing) signals but they block DC (constant) signals.

LDR :A photoresistor or light dependent resistor or cadmium sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor.A photoresistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Capacitance : This is a measure of a capacitor's ability to store charge. A large capacitance means that more charge can be stored. Capacitance is measured in farads, symbol F. However 1F is very large, so prefixes are used to show the smaller values.

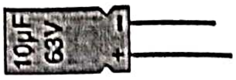
Three prefixes (multipliers) are used, μ (micro), n (nano) and p (pico):

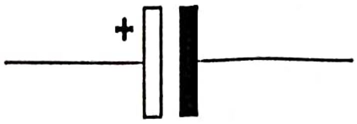
- μ means 10^{-6} (millionth), so 1000000μF = 1F
- n means 10^{-9} (thousand-millionth), so 1000nF = 1μF
- p means 10^{-12} (million-millionth), so 1000pF = 1nF

Capacitor values can be very difficult to find because there are many types of capacitor with different labelling systems!

There are many types of capacitor but they can be split into two groups, **polarised** and **unpolarised**. Each group has its own circuit symbol.

Polarised capacitors (large values, 1µF +)

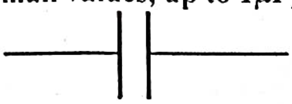
Examples: 

Circuit symbol: 

Electrolytic Capacitors

Electrolytic capacitors are polarised and **they must be connected the correct way round**, at least one of their leads will be marked + or -. They are not damaged by heat when soldering. It is easy to find the value of electrolytic capacitors because they are clearly printed with their capacitance and voltage rating. The voltage rating can be quite low (6V for example) and it should always be checked when selecting an electrolytic capacitor. If the project parts list does not specify a voltage, choose a capacitor with a rating which is greater than the project's power supply voltage. 25V is a sensible minimum for most battery circuits.

Unpolarised capacitors (small values, up to 1µF)

Examples: Circuit symbol: 

Small value capacitors are unpolarised and may be connected either way round. They are not damaged by heat when soldering, except for one unusual type (polystyrene). They have high voltage ratings of at least 50V, usually 250V or so. It can be difficult to find the values of these small capacitors because there are many types of them and several different labelling systems! Many small value capacitors have their value printed but without a multiplier, so you need to use experience to work out what the multiplier should be! For example **0.1** means 0.1µF = 100nF.

Sometimes the multiplier is used in place of the decimal point: For example: **4n7** means 4.7nF.

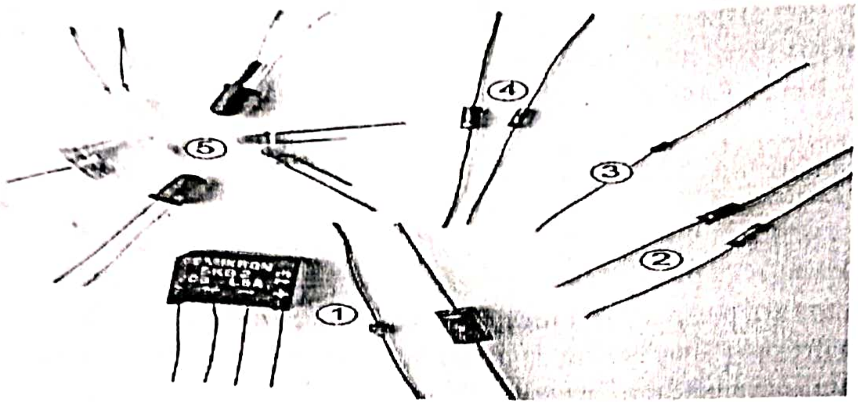
Capacitor Number Code

A number code is often used on small capacitors where printing is difficult:

1)The 1st number is the 1st digit, 2) The 2nd number is the 2nd digit, 3) The 3rd number is the number of zeros to give the capacitance in pF. 4) Ignore any letters - they just indicate tolerance and voltage rating. For example: **102** means 1000pF = 1nF *(not 102pF!)* For example: **472J** means 4700pF = 4.7nF (J means 5% tolerance).

Diodes :

Diodes are a two lead semiconductor. They are polarized and typically have axial leads. The two leads are referred to as the anode and cathode. Signal diodes are around the size of ¼ watt resistors and sometimes use a glass body. The cathode is marked by a band or stripe on the body of the diode. The cathode of an LED is usually marked by a flat spot on the plastic housing or by the shorter of the two leads. High power diodes are much more robust and might appear at first glance to be a short bolt or stud with leads attached to it. Component numbers are usually stamped on the body of the device.



Transistor:

There are many types of transistors. Generally, they are three lead devices. Component model numbers will be stamped directly onto the case. Small power dissipation (< 500 mW) units will usually be seen in plastic TO-92 cases, round metal TO-5 cans or variations on the theme. Mid power devices typically use TO-220, TO-202 or the like "power tab" cases. For higher powers the oval TO-3 cases are employed. A similarly shaped but slightly smaller variant is the TO-66. Power devices will need to use a heat sink to keep them cool. TO-92 cases use a flattened front face so that the three pins may be distinguished from each other without confusion. The round TO-5 can uses a small tab to indicate pin 1.