1.IDENTIFICATION, SPECIFICATIONS, TESTING OF R, L, C COMPONENTS (COLOR CODES), POTENTIOMETERS, SWITCHES (SPDT, DPDT &DIP), COILS, GANG CONDENSERS, RELAYS, BREAD BOARD

AIM: To identify the different component symbols.

APPARATUS: Resistors
Capacitors
Transformers
Semi conductors
Transistors

THEORY:

RESISTORS:

Opposition to flow of current is called resistance. The elements having resistance are called resistors. They are of two types

1. Fixed resistor
2. Variable resistor

CAPACITORS:

Capacitors are used to store large amount of static current. When they are included in circuit it acts open circuit. They are three types

1. Disk capacitor
2. Fixed capacitor
3. Variable capacitor

TRANSFORMERS:

Transformers are used to transfer the current. They are of two types

1. Step up Transformer

2. Step down Transformer

SEMICONDUCTORS:

Semiconductors are partial conductors which conducts electricity partially through them.

They play major role in electronics.

1 P-N Junction diode

2. Zener diode

Semiconductor is a material for which the width of the forbidden gap between the valence band conduction is very small. As gap is very small valence electron acquire required energy to go in to the conduction band. These free electrons constitute of current under the influence of applied electric field. They are a class of material whose electrical conductivity lies between that of a conductor and an insulator. The conductivity of a semiconductor lies in a range of10^5 and 10^{-4}siemens /meter.

INDUCTOR SPECIFICATIONS:

1. Inductance Value
2. Resistance
3. Capacitance
4. Frequency Value
5. Quality Factor
6. Power Losses
7. Current Ratings
8. Electro Magnetic Radiations
9. Temperature Coefficient

SWITCHES:

SPST: Single pole single through

SPDT: Single pole double through

DPST: Double pole single through

DPDT: Double pole double through

DIODES:

Diodes have more priority now a days. They are mostly used in developing electronic systems. They are

1. P-N Junction diode
2. Zener diode

Zener diode works with reverse bias voltage. So it also called voltage regulating diode.

TRANSISTORS:

They are of 4 types

1. BJT: Bi polar junction transistor again 2 types

NPN-BJT

PNP-BJT

Here B-base

C-collector

E-Emitter

2. FET: Field effect transistors again 2 types

P-Channel FET

N-Cannel FET

Here G-Gate terminal

D-Drain terminal

S-Source terminal

3. JFET: Junction field effect transistors

4. MOSFET: Metal oxide semiconductor field effect transistor

These are of two types

a. Depletion MOSFET:

These are again classified into two types

N-Channel DMOSFET

P-Channel DMOSFET

Here ss is substrate

b. Enhancement MOSFET:

These are again classified into two types

N-Channel EMOSFET

P-Channel EMOSFET

Here G-Gate terminal

D-Drain terminal

S-Source terminal

ss-substrate

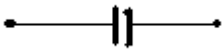
CIRCUIT DIAGRAM:

RESISTORS:

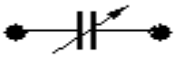
-fixed resistor

-variable resistor

CAPACITORS:

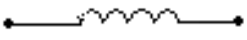


-fixed capacitor

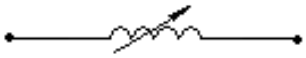


-variable capacitor

INDUCTORS:

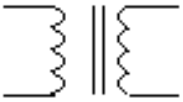


-Fixed inductor



Variable inductor

TRANSFORMERS:



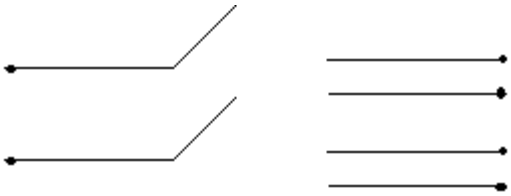
Primary secondary

SWITCHES:

SPST

SPDT

DPST



DPDT

SEMICONDUCTORS:

P-N Junction diode

Zener diode

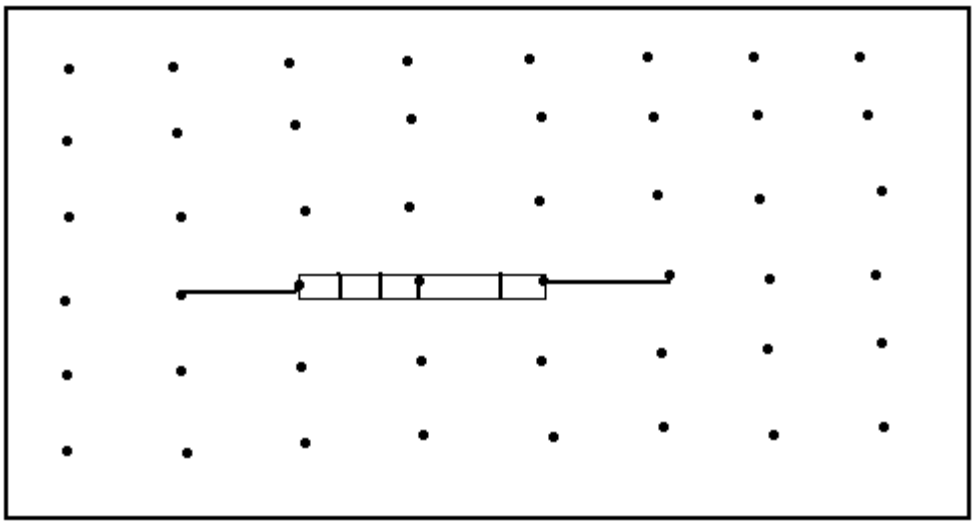
BREAD BOARD:

An experimental version of a circuit generally lay out on a flat board and assembled with temporary connections so that circuit elements may be easily substituted or changed. The name originates from the fact that early electrical circuits were actually wired on wood bread boards.

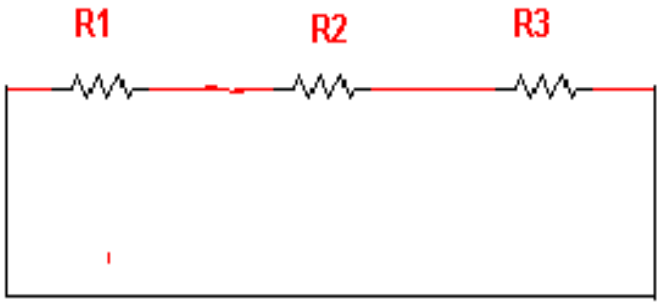
It is used to connect an electronic circuit temporarily for testing and experimentation.

A typical bread board is shown in fig.

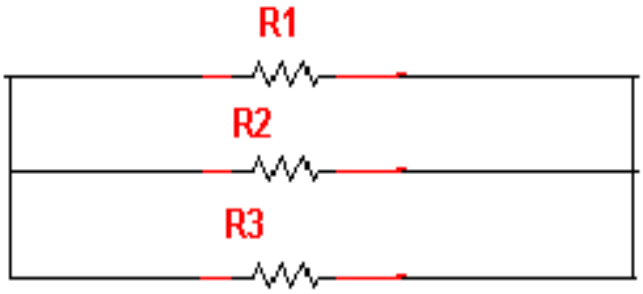
BREAD BOARD



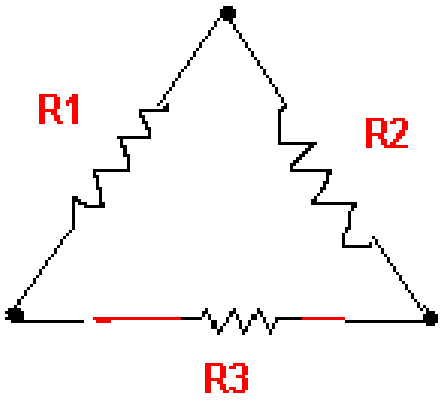
SERIES CONNECTION

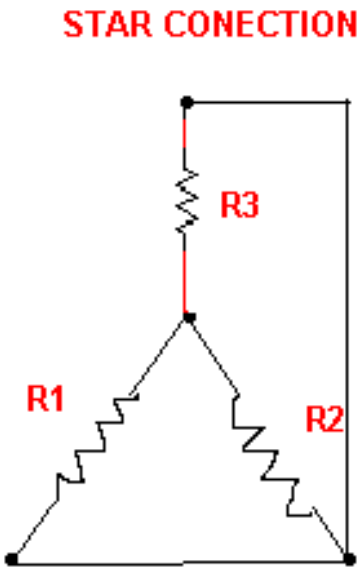


PARALLEL CONNECTION



DELTA CONECTION

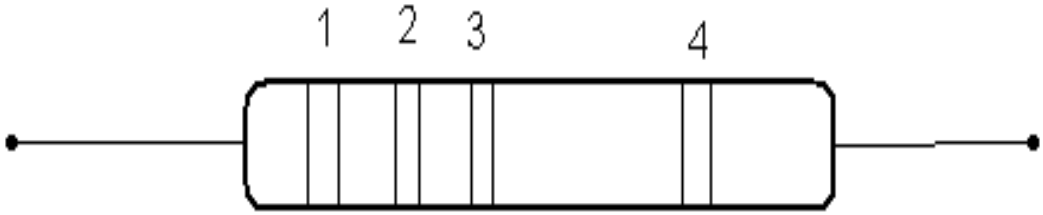




RESISTOR COLOR CODE:

The resistance value and tolerance of carbon resistor is usually indicated by color coding. Color bands are printed on insulating body. They consist of four color bands or 5 color bands & they are read from left to right.

A typical resistor with color bands is shown in figure



The above resistor has 4 color bands.

The first band represents first digit

The second band represent second digit

The third band represents multiplier (this gives the no. of zeros after the 2 digits)

The 4th band represents tolerance in %

The color codes are presented in below table

COLOR	First digit for the 1st band	Second digit for the 2nd band	Multiplier digit for the 3rd band	Resistance tolerance
Black	**0**	**0**	**10^0**	**-**
Brown	**1**	**1**	**10^1**	**±1%**
Red	**2**	**2**	**10^2**	**±2%**
Orange	**3**	**3**	**10^3**	**±3%**
Yellow	**4**	**4**	**10^4**	**-**
Green	**5**	**5**	**10^5**	**-**
Blue	**6**	**6**	**10^6**	**-**
Violet	**7**	**7**	**10^7**	**-**
Gray	**8**	**8**	**10^8**	**-**
White	**9**	**9**	**10^9**	**-**
Gold	**-**	**-**	**10^-1**	**±5%**
Silver	**-**	**-**	**10^-2**	**±10%**
No color	**-**	**-**	**-**	**±20%**

If third band is gold the first two digit are multiplied by 10^-1

If the third band is silver the first two digits are multiplied by 10^-2

If the 4th band is gold the tolerance is ±5**%**

If the 4th band is silver is the tolerance is ±10**%**

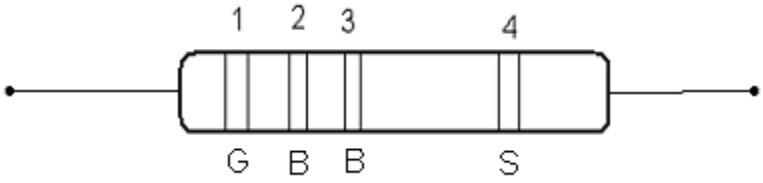
If the 4th band is no color the tolerance is ±20**%**

The numerical value associated with each color

B	B	R	O	Y	G	B	V	G	W
black	brown	red	orange	Yellow	green	blue	violet	gray	White
0	1	2	3	4	5	6	7	8	9

EXAMPLES:

The resistor has a color band sequence green, blue, brown and silver identify the resistance value.



1ST Band	2nd band	3rd band	4th band
1st digit	2nd digit	multiplier	tolerance
5	6	10^1	±10%

The resistance value=56x10^1±10%

=560Ω±10%

Therefore the resistance should be with in the range of 555Ω to 565Ω

SECIFICATIONS OF R, L, C COMPONENTS

RESISTOR:

1. Resistance value:

This is the value of the resistance expressed in ohms.

Ex: 10Ω, 1MΩ

2. Tolerance:

This is the variation in the value of the resistance i.e. expected from exact indicated value usually tolerance is represented in %

Ex: 1%, 2%, 20%...

2. Power rating:

The power rating is very important in the sense that it determines the maximum current that a resistor can withstand without being destroyed.

The power rating of resistor is specified as so many watts at a specific temperature such as one or two watts at 70 degree.

CAPACITOR:

1. Value of capacitance
2. Tolerance
3. Voltage rating
4. Temperature coefficient
5. Leakage resistance
6. Frequency range
7. Dielectric constant
8. dielectric strength
9. power factor
10. Stability

INDUCTOR;

Inductor value:

The inductance is defined as the ability of an inductor which opposes the change in current. It is denoted by the letter "L" and its unit is Henry (H).Ex:1H, 2H,…

Mutual inductance:

It is the ability of a varying current in one inductor L1 induced voltage in another inductor L2 nearby.

It is represented by Lm and is measured in Henry.

$M=K\sqrt{(L1XL2)}$ H

Coefficient of coupling:

It is defined as the ratio of flux linkages between L1 and L2. To total flux produced by L1. It is represented by K and its typical value is 1.

$K=LM/\sqrt{(L1XL2)}$

Permeability:

It is denoted by micro's" and it is return as $\mu=B/H$.

Where B=flux density

H=Flux intensity

PROCEDURE:

Different components can be identified by using their different symbols.

RESULT:

Components should be identified by using their symbols.

2. SOLDERING PRACTICE- SIMPLE CIRCUITS USING ACTIVE AND PASSIVE COMPONENTS

Soldering is a process for joining metal parts with the aid of molten metal, where the melting temperature is situated below that of material joined and where by the surface of part are coated without turn in becoming molten.

A soldering connection ensures metal continuity on the other hand, when two metals are joined, behave like a single solid metal by joining disconnected. (Or) physically attaching to each other, the connection could be

Types of soldering:

1. Iron soldering
2. Mass soldering
3. Dip soldering
4. Wave soldering

Solder alloys:

Tin lead, Tin antimony, Tin lead antimony, Tin silver, Tin Zinc.

Soldering is an alloying process between two metals with which it divides some of the metal, with which it comes into contact. A flux is used to remove this oxide from the area to be soldered.

Soldering of solder alloy:

Even though the alloy Sb 60/pb 60 is cheaper and still finds a good market, it is advisable to prefer Sn 63/pb 37 for high quality inter connection because

It has a5c higher melting point which means soldering range is 5c higher.

The tensile strength as well as sheal strength of Sn60/pb 37

Is higher in comparison to Sn60/pb 40.

Only tin trans the inter molecular bond with copper of CU_3Sn andCU_6SN.

The specific gravity of Sn63/ Pb 37 is also lesser than that of Sn60/ pb 40.

Higher composition of tin increases the electrical as well as thermal conductivity. I t also gives brightness to the joint flux.

FLUX: To aid the soldering process, a substance called flux is used. Flux has below three purposes.

Remove the film of tarnish from the metal surface to be soldered.

To prevent the base metals from being re exposed to oxygen in the air to be avoids oxidation during heating, which means rotation of welding by preventing from oxidation.

Assist in the transfer of heat to metal being soldered.

The soldering process involves

1. Melting of the solder which makes the higher flux and brings the impurities suspended in it to the surface.

2. Partial dissolution of some metals in the connection by solder.

3. Cooling and fusing solder with the metal quest often for locating a problem in the functioning of the circuit.

It is necessary to remove a component from the printed circuit board and carryout the requisite tests on it.

The process of repair usually involves

Disassembly of a particular component.

Testing of component

Replacing of the component found defective.

4. In this process of removal and replacement of electronic devices, the process of soldering is employed. Specific gravity of Sn63/ pb 37 is also lesser than that of Sn60/p 40 that makes the equipment lighter.

3. STUDY AND OPERATION OF MULTIMETERS, FUNCTION GENERATOR, REGULATED POWER SUPPLIES

AIM: To study and operation of multimeters, function generator, and regulated power supply.

APPARATUS: Multimeter
Function generator
Regulated power supply.

THEORY:

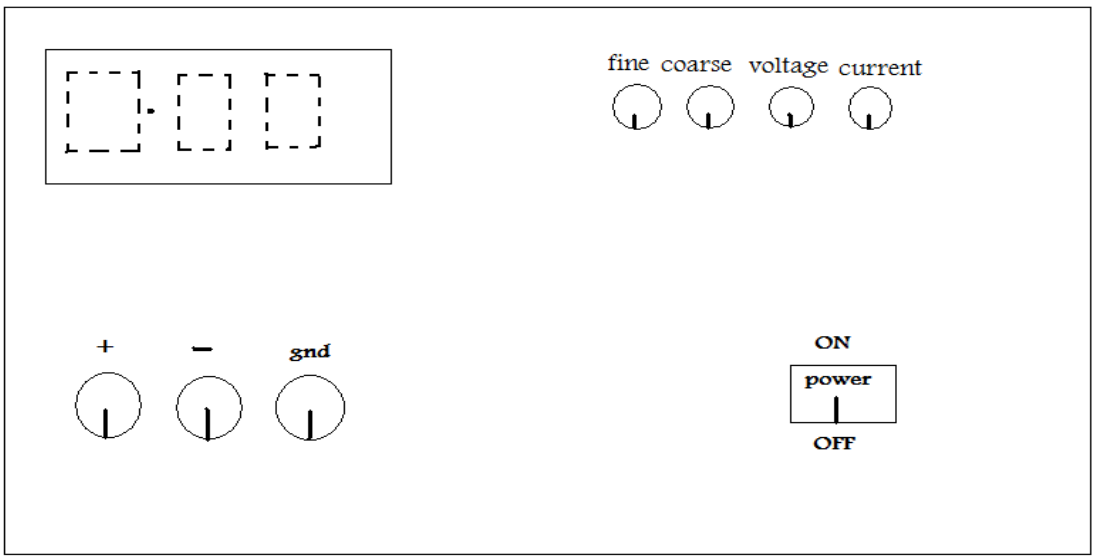
REGULATED POWER SUPPLY

Power supplies provided by a regulated DC voltage facilities fine and coarse adjustments and monitoring facilities for voltage and current. They will work in constant voltage and current mode depending on current limit and output load.

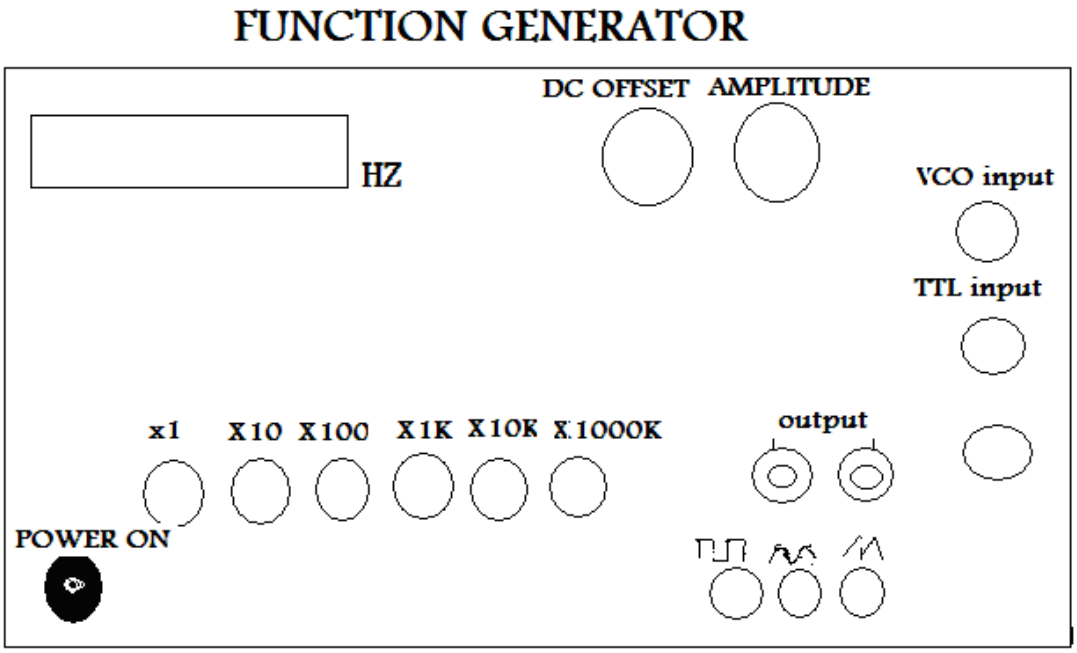
The current limit has good stability, load and line regulations. Outputs are protected against overload and short circuit damages. They are available in single and dual channel models with different voltage and current capacities. Overload protection circuit of constant self restoring type is provided to prevent the unit as well as the circuit under use.

The power supplies are specially designed and developed for well regulated DC output. These are useful for high regulation laboratory power supplies, particularly suitable for experimental setup and circuit development in R&D.

REGULATED POWER SUPPLY



FUNCTION GENERATOR



Designation	Specifications
Wave form	: Sine, squares, triangles, TTL square waves
Amplitude	: 0-20V for all the functions.
Sine distortion	: Less than 1% from 0.1 HZ to 100 HZ harmonics
	Modulation showed down fundamental for 100K HZ to 1MHZ.
Offset	: Continuously variable 10V
Frequency range	: 0.1 HZ to 1Mhz in ranges.
Output impedance	: 600 ohms, 5%.
Square wave duty cycle	: 49% to 51%.
Differential linearity	: 0.5%

Range selectors: Decode frequency by multiplying the range selected with the frequency indicated by dial gives the output frequency, which applies for all functions.

Function selectors: Selected desired output wave form which appears at 600Ω output.

VCO input: An external input will vary the output frequency. The change in frequency is directly proportional to input voltage**.**

TTL output: A TTL square wave is available at this jack. The frequency is determined by the range selected and the setting of frequency dial. This output is independent of amplitude and D.C OFFSET controls**.**

Amplitude control: Control he amplitude of the output signal, which appears at 600ohms.

OFFSET control: Control the DC offset of the output. It is continuously variable for ±5V, ±100V.

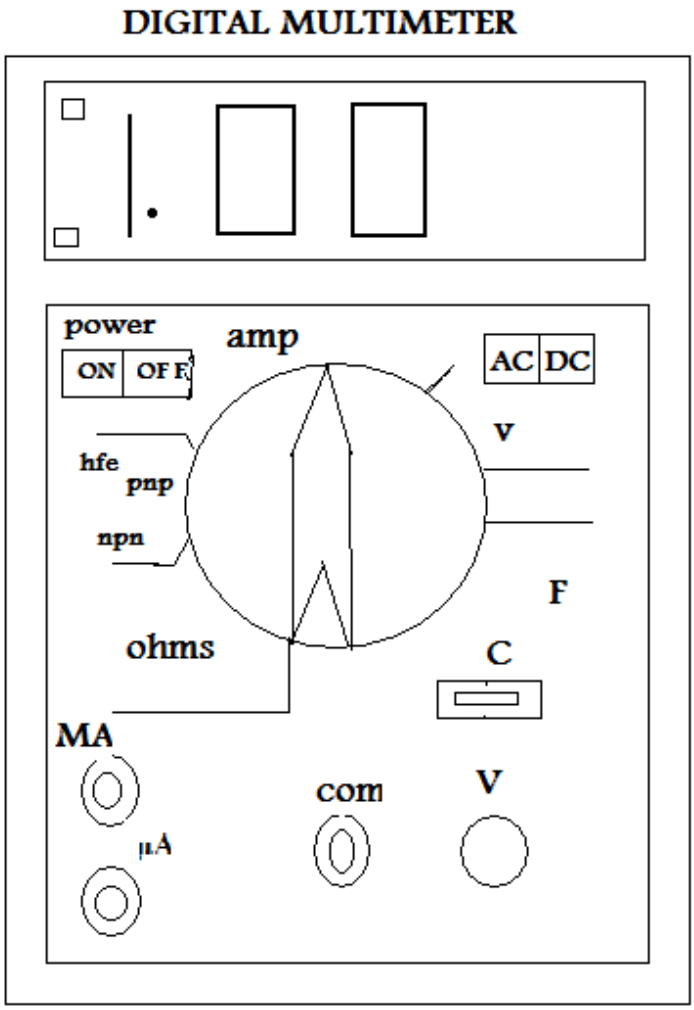
Fine frequency dial: Multiplying the setting of this dial to the frequency range selected gives the output frequency of the wave forms at the 600ohms

MULTIMETER:

DIGITAL MULTIMETER

A multimeter is a versatile instrument and is also called Volt-Ohm-Milliammeter (VOM). It is used to measure the d.c and a.c voltages and resistance values.

A digital millimeter essentially consists of an analog to digital converters. It converters analog values in the input to an equivalent binary forms. These values are processed by digital circuits to be shown on the visual display with decimal values. The liquid crystal display system is generally employed. Actually all the functions in DMM depend ion the voltage measurements by the converter and comparator circuits



Result: The operation of multimeters, function generator, and Regulated Power Supply are studied

4. STUDY & OPERATION OF CRO

AIM: To observe front panel control knobs and to find amplitude, time period and frequency for given waveforms and also find phase by using the lissajous figures.

APPARATUS: Cathode Ray Oscilloscope, function generator, connecting wires.

THEORY: C.R.O is a versatile instrument used for display of wave forms and is a fast x-y plotter.

The heart of C.R.O is and the rest is the circuitry to operate C.R.O

The main parts are

1. Electron gun: - it is used to produce sharply focused beam of electron accelerated to very high velocity.

2. Deflection system: - it deflects the electron both in horizontal and vertical plan.

3. Florescent screen: - the screen which produces, spot of visible light. When beam of electrons are incident on it the other side of tube is coated with phosphorus material.

FRONT PANNEL:

ON-POWER: toggle switch for switching on power.

INTENSITY: controls trace intensity from zero to maximum.

FOCUS: It controls sharpness of trace a slight adjustment of focus is done after changing intensity of trace.

AC-DC: GROUND:

It selects coupling of AC-DC ground signal to vertical amplifier.

X-MAG: It expands length of time base from 1-5 times continuously and to maximum time base to 40 ns/cm.

SQUARE:

This provides square wave 2v (p-P) amplitude and enables to check y calibration of scope.

SAWTOOTH WAVE FORM:

This provides saw tooth wave form output coincident to sweep speed with an output of saw tooth wave (p-p)

VERTICAL SECTION: y position:

This enables movement of display along y-axis.

Y-INPUT: It connects input signal to vertical amplifier through AC-DC ground coupling switch

CALIBRATION: 15mv – 150mv dc signal depending on position selection is applied to vertical amplifier.

DC BALANCE: It is control on panel electrostatic ally in accordance with waveforms to be displayed.

VOLTS/CM: Switch adjusts sensitivity.

HORIZANTAL SECTION:

X-POSITION: This control enables movement of display along x-axis.

TRIGGERING LEVEL: It selects mode of triggering.TIMEBASE: This controls or selects sweep speeds.

VERNUIS: This control the fine adjustments associated with time base sweep.

SIGN SELECTOR: It selects different options of INT/EXT, NORM/TO.

STAB: Present on panel

EXITCAD: It allows time base range to be extended.

HORIZANTAL INPUT: It connects external signal to horizontal amplifier.

Ext SYN: it connects external signal to trigger circuit for synchronization.

OBSERVATIONS:-

Amplitude = no. of vertical divisions * Volts/div.

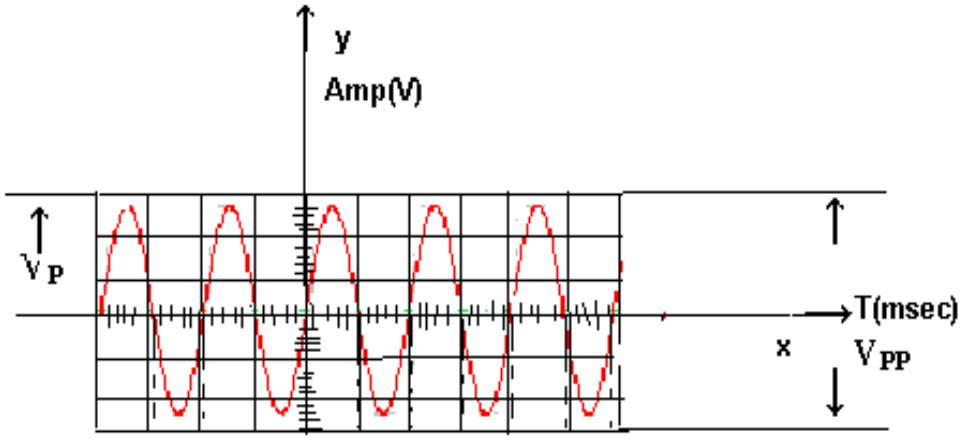
Time period = no. of horizontal divisions * Time/div.

Frequency=1/T

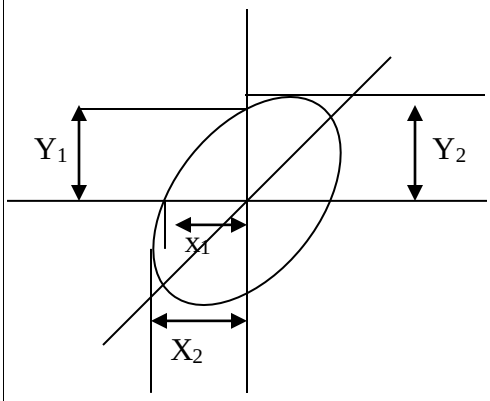
Amplitude taken on vertical section (y).

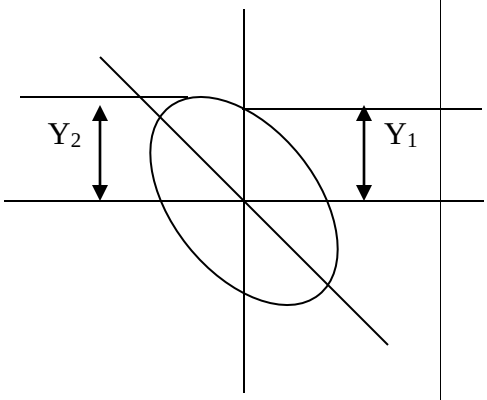
Time period taken on horizontal section(x)

MODEL WAVE FORMS



MESURMENT OF PHASE:





$\phi = \sin^{-1} \frac{Y_1}{Y_2} = \sin^{-1} \frac{X_1}{X_2}$

$\phi = 180 - \sin^{-1} \frac{Y_1}{Y_2}$

APPLICATIONS OF CRO:

1. Measurement of current
2. Measurement of voltage
3. Measurement of power
4. Measurement of frequency
5. Measurement of phase angle
6. To see transistor curves
7. To trace and measuring signals of RF, IF and AF in radio and TV.
8. To trace visual display of sine waves.

RESULT: To calculated the given waveform, frequency, amplitude and phase.