LAB SESSION 01
FAMILIARIZATION OF EQUIPMENTS

Name of Student: ……

Roll No.: ……Section: ……

Date of Experiment: …….

Report submitted on: ……

Marks obtained: ……

Remarks: ……

Instructor's Signature: ……...

DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING AND TECHNOLOGY

OBJECTIVE:

- To study about Digital Multimeter.
- To study about Function Generator.
- To study about Dual Track Power Supplies.
- To study about Digital Oscilloscope and observe basic waveforms on CRO

EQUIPMENT REQUIRED:

- Digital Multimeter
- Function Generator
- Bread Board
- Cathode Ray Oscilloscope

THEORY:

In an Electronic Devices Lab, many instruments are required for measurement and taking results. Some more basic equipment is discussed here with brief introduction.

Digital Multimeter:

Digital Multimeter is a combination of Ammeter, Voltmeter, Ohmmeter and Continuity meter. Sometimes, there is also a terminal to check the transistor whether it is PNP or NPN. It is used for measurement of resistance, AC & DC voltage and current, continuity of a wire etc. It has separate AC and DC voltage and current ranges, resistance ranges, continuity, diode circuit. Some points should be kept in mind during measurements.

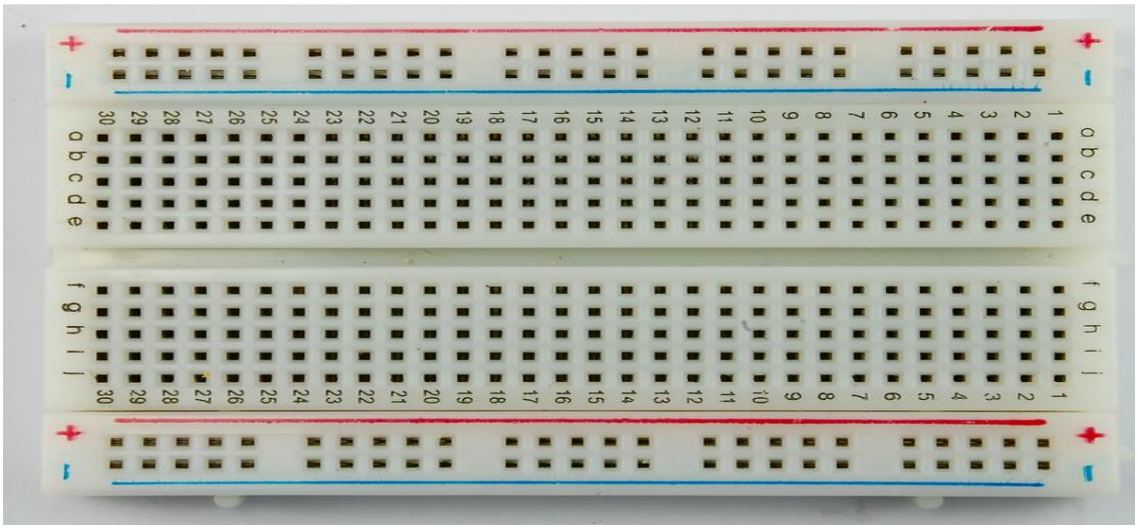
- Voltage should always be measured in *parallel*.
- Current should always be measured in *series*.
- Switch off circuit supply before measuring resistance of a resistor connected in circuit, and take out the resistor from circuit.

Function Generator (SG-1003):

Function Generator also called sine generator is used for making a **sine wave, square wave and triangular wave.** It is used in association with CRO. Signal from Function Generator is fed to the CRO, which analyzes the properties of the signal.

BREAD BOARD:

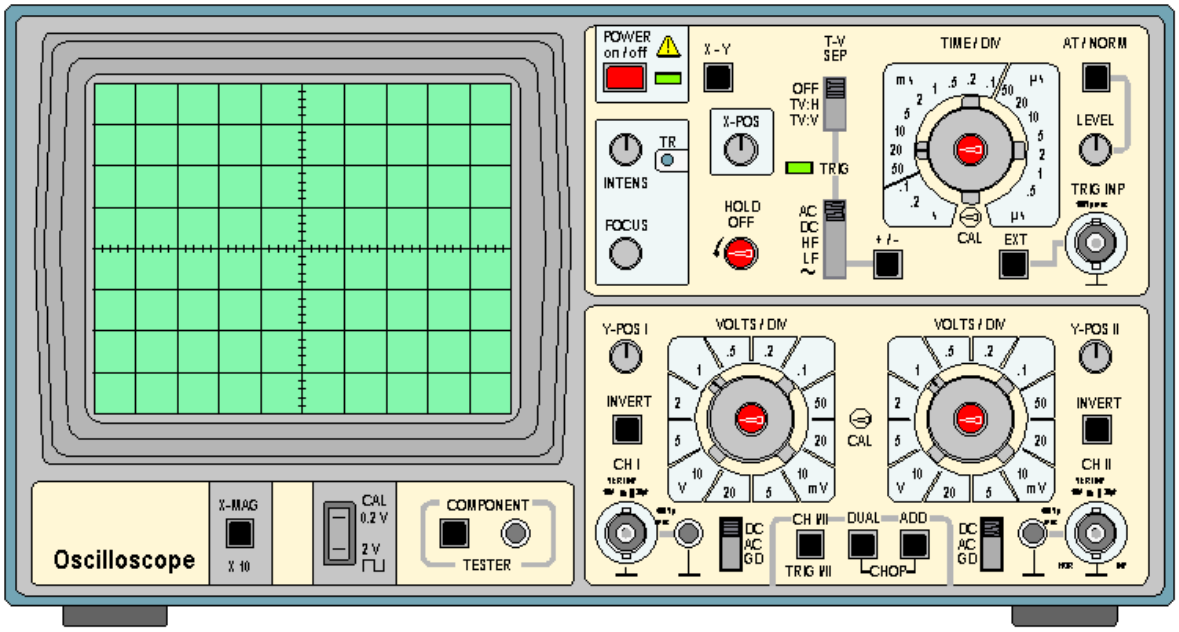
Bread Board is an array of horizontal and vertical wires inside the body of the bread board, and upper side of it is perforated to insert wires in it. Bread board is used for checking circuit before printing it on PCB. It can also be used for making temporary circuit.



Cathode Ray Oscilloscope (CRO) (KENWOOD CS-4125):

C.R.O. (Cathode Ray Oscilloscope) is the instrument which is used to observe signal waveforms. Signals are displayed in time domain i.e. variation in amplitude of the signal with respect to time is plotted on the CRO screen. X-axis represents time and Y-axis represents amplitude. It is used to measure amplitude, frequency and phase of the waveforms. It is also used to observe shape of the waveform. C.R.O. is useful for troubleshooting purpose. It helps us to find out gain of amplifier, test oscillator circuits. We can measure amplitude and frequency of the waveforms at the different test points in our circuit. Thus, it helps us for fault finding procedure. In dual channel C.R.O. X-Y mode is available which is used to create patterns Latest digital storage oscilloscope display voltage and frequency directly on the LCD and does not require any calculations. It can also store waveform for further analysis. More detailed study on C.R.O. will be covered in EMI laboratory (SEM-V). In this practical, we will measure amplitude and frequency of the different waveforms like sine wave, square wave, triangular wave and ramp wave.

In many applications, properties of voltage signal are very important to understand the operation of the circuit. In these situations, cathode ray oscilloscope is used which shows waveform of voltage with respect to time. A probe is used to connect the oscilloscope to the circuit. Oscilloscope indicates the potential difference between the two terminals of the probe. The terminal ending with a hook is usually connected to the node in the circuit whose voltage is our need. The other terminal is connected to the ground. The probes are attached to input channels **channel 1, channel 2** of the oscilloscope. Mostly oscilloscopes have two input channels and each channel can display a waveform on the screen with independent from other channel's signal. Both channels can be used to compare the waveform of two different voltages.



Its screen has two dimensional graph plotting ability. Vertical is for Voltage, and Horizontal is for Time.

- **HS:** Horizontal Sensitivity shows Time/div. It shows the time period of a waveform to complete one cycle (one upper and one lower peak).
- **VS:** Vertical Sensitivity shows V/div.
  It shows the peak to peak value of voltages of signal.
- **INTENSITY:** To adjust brightness
- **FOCUS:** To adjust sharpness

NORMAL USE OF CRO:

AUTO..... ON
VERT MODE..... ON
CH2 INV..... OFF
XY..... OFF
×10MAG..... OFF
Variable..... Max. Clockwise

We can find the following factors using CRO.

- Amplitude
- Time period
- Frequency
- Phase difference

TYPES OF SIGNALS:

Following types of signal can be generated using function generator.

- Sine
- Square
- Triangular

In electronics, we mostly work with sinusoidal (sine) signals.

EXPLANATION:

Basically, two characteristics of signals can be changed using function generator.

- Amplitude
- Frequency

For sine wave:

$$V_P = V_{(P\text{-}P)} / 2$$

and $V_{rms} = V_P / \sqrt{2}$

Where: V_P = Peak value of sine function

$V_{(P\text{-}P)}$ = Peak to peak value

V_{rms} = rms value of voltage

rms voltage can also be replaced by DC voltage.

DUTY CYCLE:

If we increase or decrease the either side (+ive or –ive side) of a sinusoidal signal then this process is called duty cycle.

It is the percentage of one period in which a signal is active.

$$D = \frac{T}{P} \times 100\%$$

Where "D" is duty cycle.

Procedure:

- Connect function generator output at the input of CRO at channel 1 or at channel 2.
- Select proper channel i.e. if signal is connected to channel 1 select CH1 and if signal is connected to channel 2 select CH2.

- Adjust Time/Div knob to get sufficient time period displacement of the wave on the CRO screen. With fine tuning of time/div make the waveform steady on screen.
- Use triggering controls if waveform is not stable.
- Keep volt/div knob such that waveform is visible on the screen without clipping.
- Measure P-P reading along y-axis. This reading multiplied with volt/div gives peak to peak amplitude of the AC input wave.
- Measure horizontal division of one complete cycle. This division multiplied by Time/Div gives time period of the input wave.
- Calculate frequency using formula f = 1/T.
- Note down your readings in the observation table

OBSERVATIONS:

TASK-1:

Calculation of Frequency of Basic Waveforms							
Function	**Vertical Division**	**Vertical Sensitivity**	**Amplitude**	**Horizontal Division**	**Horizontal Sensitivity**	**Time Period**	$f = \frac{1}{T}$
	(a)	**V/div (b)**	**V_{P-P} (axb)**	**(c)**	**Time/div (d)**	**sec (cxd)**	**Hz**
Sine							
Square							
Triangular							

TASK-2:

Draw waveforms using Function Generator & CRO, and plot it on graph paper.

Sine Wave:

$V_{in} = 3\,V\ (p-p), \quad f = 0.5\,kHz$

SQUARE WAVE:

$V_{in} = 4\,V\ (p-p), \quad f = 2.5\,kHz$

TRIANGULAR WAVE:

$V_{in} = 5\,V\ (p-p), \quad f = 2.75\,kHz$

CONCLUSION& COMMENTS: