Experiment No: 3

Applications of CRO

Aim:

1. To measure Amplitude, Time period and Frequency of a generated signal (Sinusoidal, Triangular and Rectangular).
2. To observe the Phase difference between input and output signals of an RC- Network.

Components:

Name	Range	Quantity
Bread board		1
Function Generator	(0-20)MHz	1
CRO	(0-1)MHz	1
CRO Probes		2
Capacitor	0.1µF /10µF /100µF	1
Resistor or Decade Resistance Box	--	1
Connecting Wires		Required no

Theory:

CRO stands for Cathode Ray Oscilloscope .CRO is a basic instrument employed for the study of several types of waveforms. It can measure various quantities such as peak voltage, frequency, phase difference, pulse-width, delay time, rise time, and fall time. It comprises of a cathode-ray tube (CRT), and input circuitry for focusing and amplification.

An oscilloscope is an electronic measuring device which provides a two dimensional visual representation of a signal. Because the Oscilloscope allows the user to see the signals, their characteristics can be easily measured and observed. The Oscilloscope displays a graph of voltage (on the vertical axis) versus time (on the horizontal axis). Most electrical circuits can be easily connected to the Oscilloscope.

Oscilloscope, previously called an Oscillograph, and informally known as a scope, CRO (Cathode Ray Oscilloscope) is used in many applications

Application:

- General-purpose instruments are used for maintenance of electronic equipment and laboratory work.
- Special-purpose Oscilloscopes may be used for such purposes as analyzing an automotive ignition system, or to display the waveform of the heartbeats as an Electrocardiogram.
- Some computer sound software allows the sound being listened to be displayed on the screen as by an Oscilloscope.

Fig 1: Front Panel Diagram of CRO.

The basic Oscilloscope, as shown in the figure, is typically divided into four sections as follows, the display, vertical controls, horizontal controls and trigger controls. The display is usually a CRT or LCD panel which is laid out with both horizontal and vertical reference lines referred to as the graticule. In addition to the screen, most display sections are equipped with three basic controls, a focus knob, an intensity knob and a trace button.

The vertical section controls the amplitude of the displayed signal. Volts-per-division (Volts/Div) selector knob, an AC/DC/Ground selector switches and the vertical (primary) input for the instrument. Additionally, this section is typically equipped with the vertical beam position.

The horizontal section controls the time base or “sweep” of the instrument. The primary control is the Seconds-per-division (sec/div) selector switch. Also includes a horizontal input for plotting dual and X-Y mode signals. And there is a position knob available in this section. The trigger section controls the start event of the sweep. The trigger can be set to automatically restart after each sweep or it can be configured to respond to an internal or external signal. An external trigger input (EXT input) and level adjustment are available in this section.

Circuit Diagram:

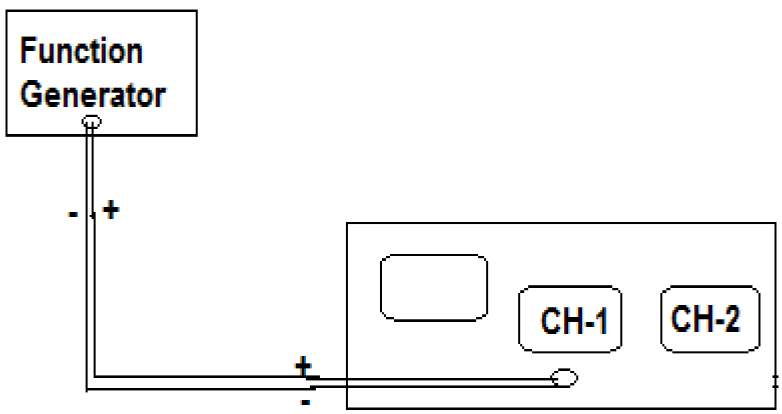


Fig 2: Measurement Amplitude , Timeperiod and frequency

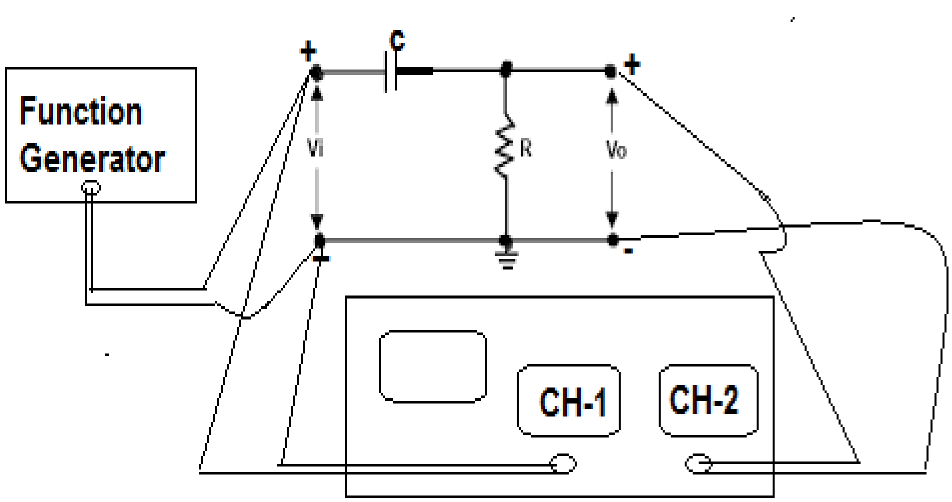
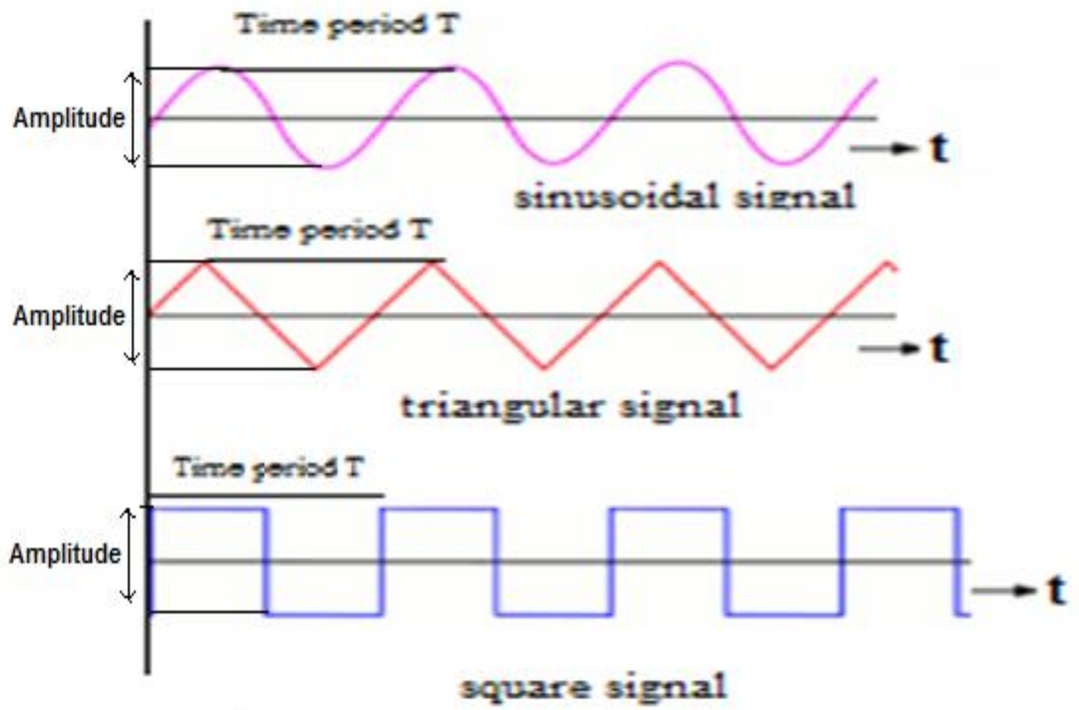
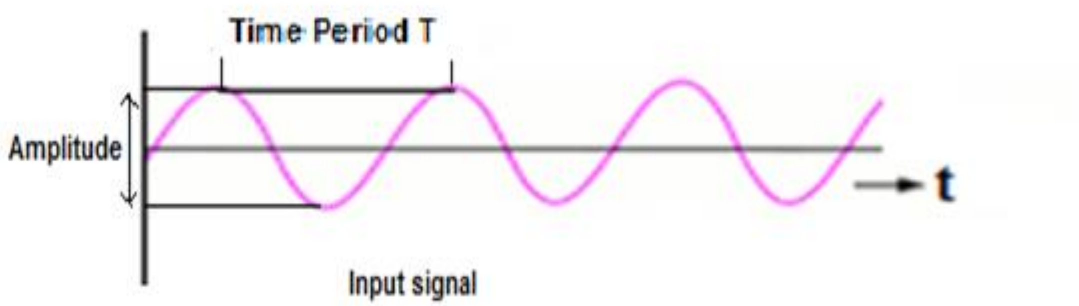
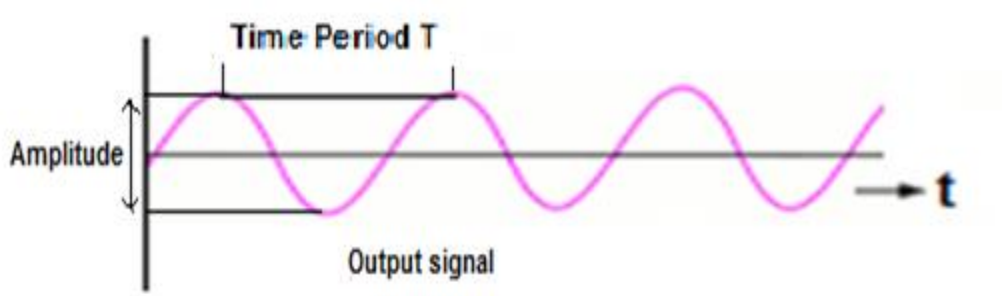


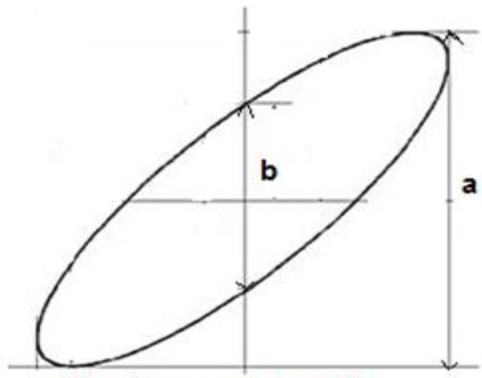
Fig 3: Measurement of Phase difference

Model graphs:









Lissajous pattern-Ellipse

Procedure:

Measurement of Amplitude, Time period and Frequency:

1. Generate a sinusoidal signal of any amplitude and of frequency 1 KHz from signal generator or function generator.
2. Connect a probe from signal generator to any one channel (either CH-1 or CH-2) of the CRO to observe the signal in CRO.
3. Measure the peak to peak amplitude and its time period using CRO and tabulate the readings.
4. Repeat the same steps for Triangular and Square waveforms.

Measurement of phase difference between two signals: (from Lissajous figures)

1. Connections are made as per the circuit Diagram.
2. Generate a sinusoidal signal of 4V peak-peak amplitude and 1KHz frequency from the Signal generator and connect it at the input of an RC circuit.
3. Observe the same input signal on the X-channel of the CRO.
4. Now the Y-channel of CRO is connected at the output of RC circuit across Load resistance.
5. Now press XY mode selector switch (of the CRO) and adjust the two ground levels of X and Y channels to set the beam position to the origin.
6. Now release the two ground buttons.
7. Observe the Lissajous figure and measure the distances ‘a’ and ‘b’ , measure the phase difference between two signals as $\theta = \sin^{-1}(\frac{b}{a})$

8. Tabulate the readings by changing resistance.

Observations:

Measurement of Amplitude, Time period and Frequency:

Sl.no	Waveform		Amplitude(peak-peak) (Volts/mvolts)	Time period (Sec/msec/µsec)	Frequncey (Hz/kHz/MHz)
1	sinusoidal	1KHz			
		50 KHz			
2	triangular	2 KHz			
		20 KHz			
3	square	5 kHz			
		100 KHz			

Measurement of phase difference between two signals: (from Lissajous figures):

f=-------------, C=-----------.

Sl.No	Load Resistance(R_L)	$\theta = \tan^{-1}(\frac{1}{2\pi fRC})$	Parameter 'a'	Parameter 'b'	$\theta = \sin^{-1}(\frac{b}{a})$
1					
2					
3					

Precautions:

1. All connections must be tight.
2. Measure the readings in the CRO without any parallax error.

Results and Discussions:

1. Amplitude, Time period and Frequency of a generated signal (Sinusoidal, Triangular and Rectangular) are measured
2. The Phase difference between input and output signals of an RC- Network is measured and the Lissajous figures are observed.