**An oscilloscope is an electronic measuring device which provides a two-dimensional time-domain visual representation of electrical signals. In this experiment, you learn how to use a digital oscilloscope.**

# MANDATORY EXPERIMENTS

## Experiment 1

**Download the catalog of the lab oscilloscope. Review the catalog and describe the functionality of the major control groups on the oscilloscope including display group, vertical group, horizontal group, and trigger group.**

## Experiment 2

**Turn on the oscilloscope and set its channels to GND input mode. Use vertical position knobs to move and adjust the ground levels.**

## Experiment 3

**Set the first channel to DC input mode while no signal is fed to its probe. Watch how the horizontal axis is swept. Change the time/div knob and see its impact on the sweep speed.**

## Experiment 4

**Connect a probe to the oscilloscope and set the volt/div knob to its minimum. Touch the probe tip by your finger. What do see on the oscilloscope screen? Change in input mode to AC, DC, and GND and check the results.**

## Experiment 5

**Connect a proper probe to the first channel of the oscilloscope and watch the calibrated signal of the built-in frequency generator. Read the frequency and amplitude of the calibrated signal. How can this signal be used for calibration check? What happens when the probe is set to 10X?**



*Experiment 5 continued on next page...*

## Experiment 6

**Set the controls of the function generator to produce a sine wave of $1$ kHz frequency and $2$ V amplitude. Use the oscilloscope to see the signal. Read the frequency and amplitude of the sine wave. Is there any difference between the read and set frequencies? Why?**

## Experiment 7

**Add a DC offset to the sine wave in the previous part and check the corresponding signal on the oscilloscope screen in different input modes of DC, AC, and GND.**

## Experiment 8

**Feed the two channels of the oscilloscope by a same $1$ KHz sine wave and investigate the functionality of the math operations such as Add and Inv.**

## Experiment 9

**Repeat the previous part with two $1$ KHz sine waves produced from two different function generators. Explain your observations.**

## Experiment 10

**Use the oscilloscope to watch and measure the potential difference between nodes A and B in the circuit of Fig. 1, where the sinusoidal source has a frequency of $1$ kHz and a peak to peak amplitude of $5$ V. Can you measure the desired voltage simply using a single probe? If no, describe the problem and propose a solution.**



*Experiment 10 continued on next page...*

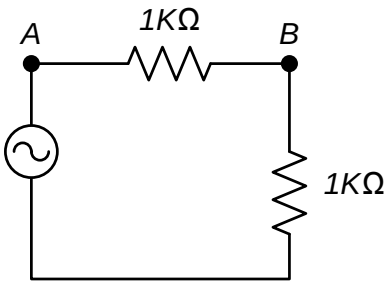


Figure 1: A simple resistive circuit.

## Experiment 11

**Set the controls of the function generator to produce a sine wave of $70$ Hz frequency and $1$ V amplitude. Connect the sine wave to the first channel of the oscilloscope and see it for various triggering sources. Discuss the observations.**

## Experiment 12

**Change the trigger level and trigger slope in the previous part and analyze your observations.**

## Experiment 13

**Feed two sine waves with differences frequencies to two channels of the scope and see the corresponding Lissajous curve on the XY mode. Characterize the Lissajous curve. Is there any relationship between the Lissajous curve and the frequencies of the sine waves?**

## Experiment 14

**Build the circuit of Fig. 2 on the breadboard and see the labeled voltages in the XY mode on the oscilloscope screen. Sweep the frequency and amplitudes of the input sine wave and observe the results. Can you interpret the results?**



*Experiment 14 continued on next page...*

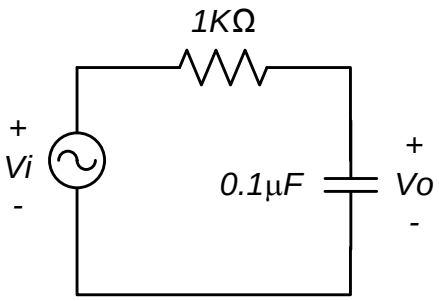


Figure 2: An RC circuit.

# BONUS EXPERIMENTS

## Experiment 15

**Consider the block diagram of a typical analog oscilloscope shown in Fig. 3 and explain how an analog oscilloscope works. How does an analog oscilloscope differ from its digital counterpart?**

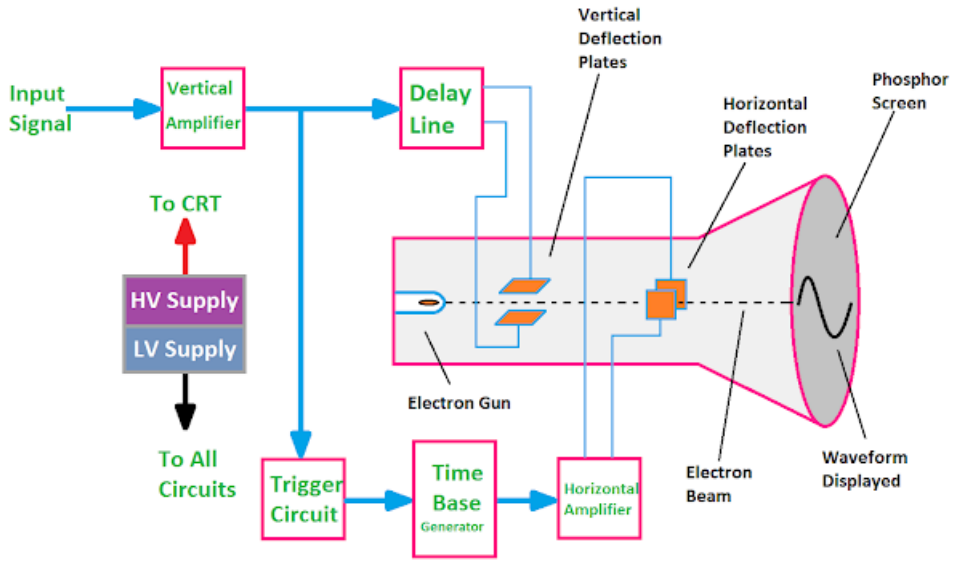


Figure 3: Block diagram of an analog oscilloscope.

*Experiment 16 continued on next page...*

## Experiment 16

**What might lead to a distorted representation of the oscilloscope calibration signal on the screen? What do you offer to resolve the problem?**

## Experiment 17

**Return your work report by filling the LaTeXtemplate of the manual. Include useful and high-quality images to make the report more readable and understandable.**