

## ELG2331: Experiment 2 Oscilloscope and Function Generator

### Objectives:

- 1) To introduce the operation of an oscilloscope as a measuring instrument.
- 2) To introduce the function of a function generator as a signal source.

### Introduction:

The oscilloscope is a cathode ray tube with electronics circuits that makes it able to function as a very fast clock and a voltmeter. A sweep generator that causes the electron beam to move across the tube face at a known rate performs the clock function. Amplifiers to deflection plates that produce a known vertical deflection for a given input voltage provide the voltage function. Many of the recently manufactured oscilloscopes have dual channels so that the scope will contain duplicates of the electronics except for the trigger circuit and CRT.

### Equipment:

- 1) 1 voltage source.
- 2) 1 multimeter.
- 3) 1 oscilloscope.
- 4) 1 function generator.
- 5) 1 resistance box.
- 6) 1  $\mu$  capacitor.
- 7) Different resistors.

### Operation of the Oscilloscope and the function generator

Making a measurement with the Oscilloscope consists of two major phases: (1) getting it to display anything, (2) getting it to display what we want to display. If any of several of the controls are not properly set, no display at all will appear, so the procedure is to get all of these controls into a working state.

**Step ONE:** Set the oscilloscope controls as follows:

*Power: ON*

*Intensity: Mid scale*

*V Mode: CH 1*

*Vertical Position (both knobs): Mid scale*

*Volts/Div (both knobs): 2V*

*Variable Volts/Div (both knobs): Fully clockwise*

*AC-GND-DC (both switches): DC*

*Polarity: Normal (CH 2 Position IN)*

*Horizontal Position: Mid scale*

*Time/Div: 1ms*

*Sweep Mode: Auto*

*Trigger Source: CH 1*

*Trigger Level: zero*

*Trigger Coupling: AC.*

If everything is in order, you should see a blue-green horizontal line through the middle of the screen.

**Step TWO: Set up the function generator to produce a 1 kHz sine wave:**

*Power: ON*

*Duty and DC Offset: In*

*Amplitude: Mid scale*

*Attenuator, Invert: Both out*

*Range: 1K*

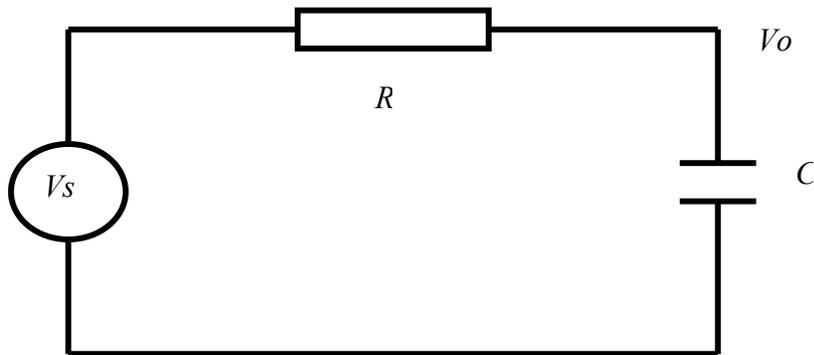
*Function: Sine*

*Frequency: 1.0*

**Step THREE:** Examine the effect of each control. Change the timebase to observe what effect is produced. Examine different waveforms produced by the function generator.

**The Experiment:**

- 1) Design an experiment to measure voltages and calculate currents. Use only 1 resistor and 1 capacitor (RC circuit: with appropriate values). Work with frequencies in the interval 1 kHz to 10 kHz. Avoid using electrolytic capacitors in this experiment. You may use the following circuit.
- 2) Measure the magnitude and phase of  $V_o$  if  $V_s$  is sinusoidal wave with no DC offset 5 V magnitude (10 v peak-to-peak). Vary the frequency between 1 kHz and 10 kHz.
- 3) What is the relationship between the voltage and current through the capacitor?



**Report:**

- 1) What are the advantages and disadvantages of using the oscilloscope as a voltmeter?
- 2) Based upon the sketches of the waveforms and the measured amplitudes for the waves in the circuit, does the theory hold for the AC waveforms? Support the answer further with numerical data.