

LAB # 01
THE OSCILLOSCOPE



SUBMITTED BY:

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REG NO:

21PWCSE1993

SECTION:

“A”

SUMITTED TO:

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COMPUTER SYSTEM ENGINEERING

ASSESSMENT RUBRICS

LAB REPORT ASSESSMENT				
Criteria	Excellent	Average	Nil	Marks Obtained
1. Objectives of Lab	All objectives of lab are properly covered [Marks 1]	Objectives of lab are partially covered [Marks 0.5]	Objectives of lab are not shown [Marks 0]	
2. Procedure	All experimental steps are shown. [Marks 2]	Some of the experimental steps are shown. [Marks 1]	Experimental steps not shown [Marks 0]	
3. Demonstration of Concepts	The student demonstrated a clear understanding of the assignment concepts [Marks 2]	The student demonstrated a clear understanding of some of the assignment concepts [Marks 1]	The student failed to demonstrate a clear understanding of the assignment concepts [Marks 0]	
4. Experimental Results	All experimental results are completely shown in form of table [Marks 3]	Experimental results are partially shown and some of the observations are missing [Marks 1.5]	No experimental results are shown [Marks 0]	
5. conclusion	Conclusion of the lab is properly written [Marks 2]	Conclusion of the lab is partially written [Marks 1]	Conclusion of lab is not written [Marks 0]	
<p style="text-align: right;">Total Marks Obtained: _____</p> <p style="text-align: center;">Instructor Signature: _____</p>				

Objective:

This exercise is of a particularly practical nature, namely, introducing the use of the oscilloscope. The various input scaling, coupling, and triggering settings are examined along with a few specialty features.

Equipment:

1. DC Power Supply
2. AC Function Generator
3. Digital Multimeter
4. Oscilloscope

Components:

- | | |
|------------------|------------------------|
| 1. 10 k Ω | Actual: 9865 Ω |
| 2. 33 k Ω | Actual: 32549 Ω |

Procedure

1) Find the following elements on your oscilloscope:

- Channel-1 and Channel-2 BNC input connectors.
- Trigger BNC input connector.
- Channel-1 and Channel-2 select buttons.
- Horizontal Sensitivity (or Scale) and Position knobs.
- Vertical Sensitivity (or Scale) and Position knobs.
- Trigger Level knob.

2) Note that the main display is similar to a sheet of graph paper. Each square will have an appropriate scaling factor or weighting, for example, 1 volt per division vertically or 2 milliseconds per division horizontally. Waveform voltages and timings may be determined directly from the display by using these scales.

3) Select the channel-1 and 2 buttons. There should now be two horizontal lines on the display. They may be moved via the Position knob.

4) One of the more important fundamental settings on an oscilloscope is the Input Coupling. This is controlled via one of the bottom row buttons. There are three choices: Ground removes the input thus showing a zero reference.

5) Set the channel-1 Vertical Scale to 5 volts per division. Set the channel-2 Scale to 2 volts per division. Set the Time (Horizontal) Scale to 1 millisecond per division. Finally, set the input coupling to Ground for both input channels and align the two lines to the center line of the display via the Vertical Position knob.

6) Build the circuit shown in the figure using $E=10V$, $R_1=10k\Omega$ and $R_2=33k\Omega$. Connect a probe from the channel-1 input to the power supply (tip to plus, black clip to ground). Connect a second probe from channel-2 to R_2 (again, tip to the high side of the resistor and the black clip to ground).

7) Switch both inputs to DC coupling. The two lines should have deflected upward. Channel1 should be raised two divisions (2 divisions at 5 volts per division yields the 10-volt source). Using this method, determine the voltage across R_2 (remember, input-2 should have been set for 2 volts per division). Calculate the expected voltage across R_2 using measured resistor values and compare the two in Table 1. Note that it is not possible to achieve extremely high precision using this method (e.g., four or more digits). Indeed, a DMM is often more useful for direct measurement of DC potentials. Double check the results using a DMM and the final column of Table 1.

8) Select AC Coupling for the two inputs. The flat DC lines should drop back to zero. This is because AC Coupling blocks DC. This will be useful for measuring the AC component of a combined AC/DC signal, such as might be seen in an audio amplifier. Set the input coupling for both channels back to DC.

9) Replace the DC power supply with the function generator. Set the function generator for a 1-volt peak sine wave at 1 kHz and apply it to the resistor network. The display should now show two small sine waves. Adjust the Vertical Scale settings for the two inputs so that the waves take up the majority of the display. If the display is very blurry with the sine waves appearing to jump about side to side, the Trigger Level may need to be adjusted. Also, adjust the Time Scale so that only one or two cycles of the wave may be seen. Using the Scale settings, determine the two voltages (following the method of step 7) as well as the waveform's period and compare them to the values expected via theory, recording the results in Tables 2 and 3. Also crosscheck the results using a DMM to measure the RMS voltages.

10) To find the voltage across R1, the channel-2 voltage (VR2) may be subtracted from channel-1 (E source).

11) One of the more useful aspects of the oscilloscope is the ability to show the actual wave shape. This may be used, for example, as a means of determining distortion in an amplifier. Change the wave shape on the function generator to a square wave, triangle, or other shape and note how the oscilloscope responds. Note that the oscilloscope will also show a DC component, if any, as the AC signal being offset or "riding on the DC". Adjust the function generator to add a DC offset to the signal and note how the oscilloscope display shifts. Return the function generator back to a sine wave and remove any DC offset.

Data Table:

For R1:

	Scale (V/Div)	# Of Divisions	Voltage Peak-Peak	Voltage RMS
Oscilloscope	5	2	9.7	8/10
Theoretical			10	8/10

For R2:

	Scale (V/Div)	# Of Divisions	Voltage Peak-Peak	Voltage RMS
Oscilloscope	5	2	9.7	6.85
Theoretical			10	7.07

AC

For R1:

	Scale (V/Div)	# Of Divisions	Voltage Peak-Peak	Voltage RMS
Oscilloscope	5	2	7.67	5.42
Theoretical			7.7	5.44

For R2:

	Scale (V/Div)	# Of Divisions	Voltage Peak-Peak	Voltage RMS
Oscilloscope	5	2	6.75	7.67
Theoretical				

For Frequency and Time Period:

	Scale (S/Div)	# Of Divisions	Time Period	Frequency
Oscilloscope	5	2	1ms	1kHz