Summer 2023

EEE/ETE 111L

Analog Circuits-I Lab (Sec-11)

Faculty: Professor Dr. Monir Morshed (DMM)

Instructor: Rokeya Siddiqua

Lab Report 03: Diode rectifier circuits.

Date of Performance: 26 August 2023 **Date of Submission:** 02 September 2023	<u>**Group no.:**</u> **05** 1. Mahmudul Hasan- 2011551043 2. **Sabrina Haque Tithi- 2031265642** 3. Afrin Akter- 2112246642 4. Joy Kumar Ghosh – 2211424642 5. Sazid Hasan- 2211513642

Experiment No : 03

Experiment Name : Diode Rectifier circuits.

Objective :

Study of different diode rectifier circuits.

Theory :

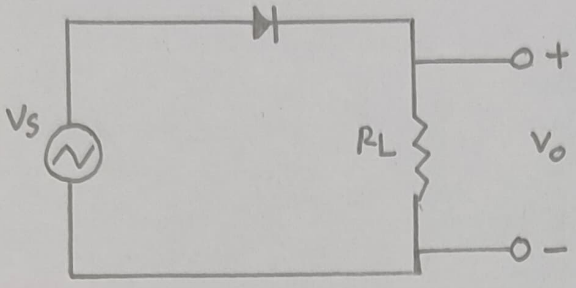
A diode flows current in one direction only In reverse bias it becomes open so no current Passes. The current flows in forward bias only. A rectifier converts an AC signal into a DC signals. when an alternative voltage is applied across a diode it allows only the half cycle. Positive or negative it depends on the orientation of the diode. During forward bias, the negative side won't be in consideration.

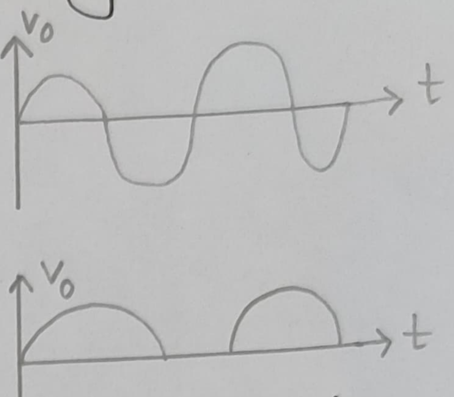
There are two types of diode rectifers -

1) Half wave rectifer.
2) Full wave rectifier.

Half wave rectifier :

It can be build by using one signal diode.

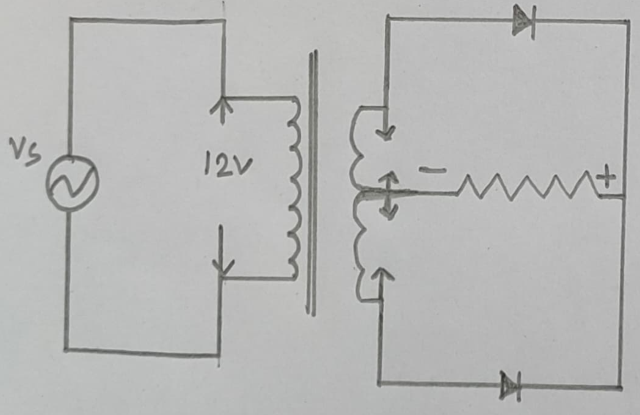


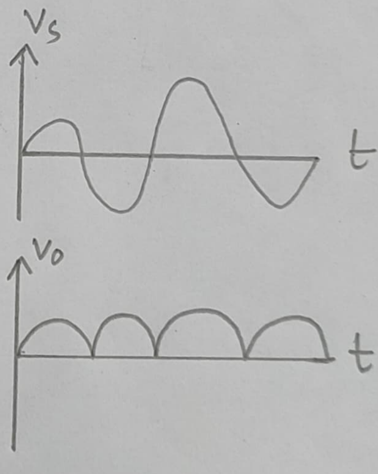


Output recieves half of the input. Average dc voltage is low. Output voltage is not smooth due to ripple.

Full wave Rectifier :

In this both the half cycle is present in the output.

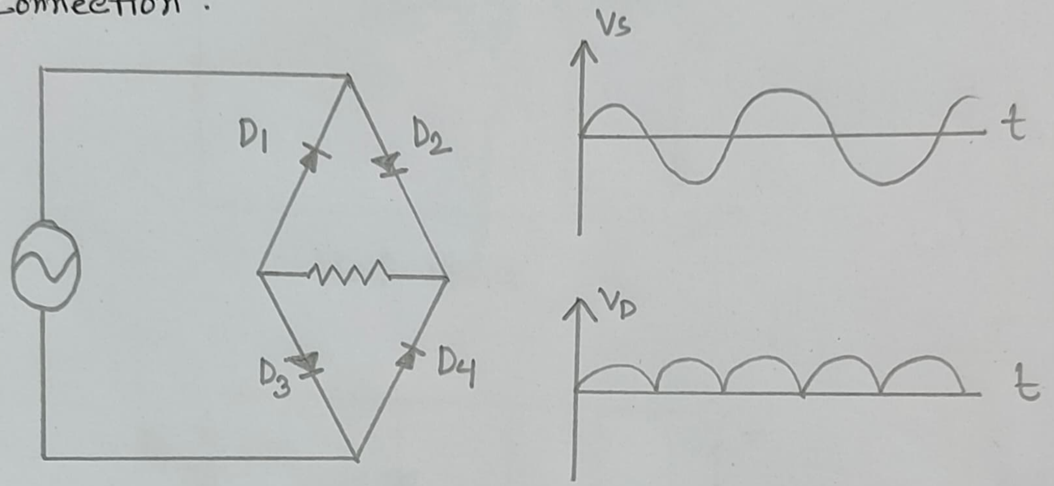




Full wave rectifier using Center tapped transformer.

Full wave rectifier requires more space and it is not cost effective.

To solve the problem Full-wave bridge rectifier. In this four diodes will be connected as bridge Connection.



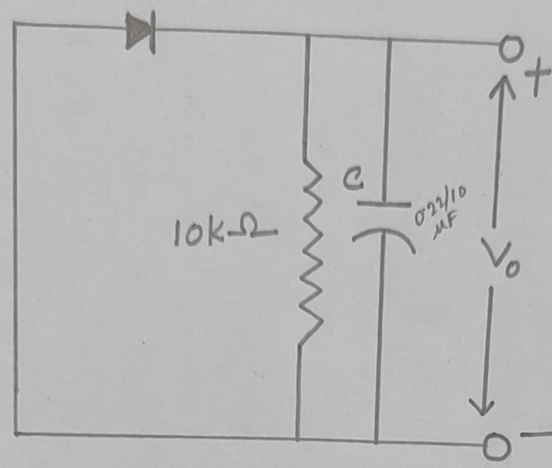
full wave brige rectifier.

List of Equipment :

1. P-n junction diode → IN4007 → 4 pieces.
2. Resistor → 10KΩ → 1 piece
3. capacitor → 0.22 uF, 10 uF → 1 piece each
4. Signal generator → 1 unit.
5. Trainer Board → 1 unit.
6. Oscilloscope → 1 unit
7. Digital Multimeter → 1 unit
8. chords & wire → per requirement.

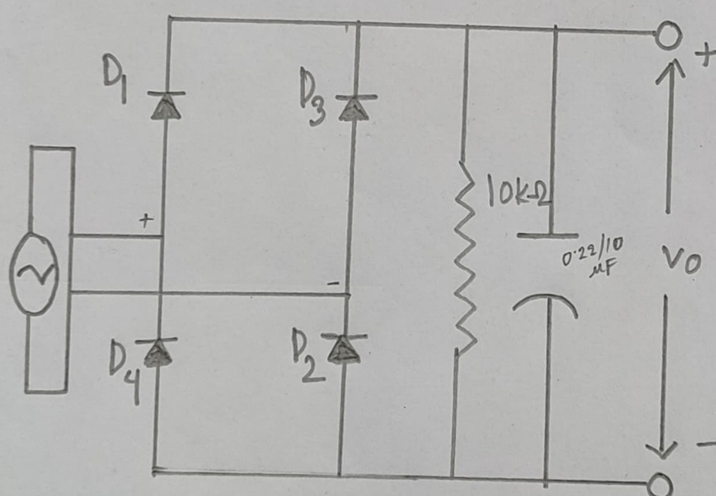
Circuit Diagram :

(1)



Half wave

(2)



full wave

Data table :

	Half wave Rectifier	full wave Rectifier
Vo (P-P) (without capacitor)	5·00 V	
Vo(P-P) (with 0.22 uF)	1·60 V	
Vo (P-P) (with 10 uF)	0·20 V	

Ans: to: the: Q: NO-01

For Fig 2.4 & fig 2.5, draw the input-output wave shape without capacitor, with 0.22µf capacitor and 10µf capacitor.

Ans: Graph is attached with the report.

Ans: to: the: Q: NO-02

Compare the change in the wave-shape and Peak to peak values for no capacitor at the Output to 0.22 μF to 10 μF.

Ans: In comparison to the ripple wave-form created with a 0.22 μF, the output wave from obtained with 10 μF produces a straight horizontal line.

There is a considerable different in Frequency from 10 KHZ to 100HZ. The output curve shifts from a straight line to a curved line. when the capacitance is changed from 10KHZ to 100 HZ, the line becomes a rippling wave. when the waveforms are compared it is clear that the output voltage wavefrom different can be seen. The output wavefrom is produced by 10μF.

The half wave rectifier value is 500V.
The full wave rectifier value is ______.

Then for voltage 0.22mF capaciton, the half-wave rectifier value is 1.60 V. & the full wave rectifier value is ______ mV. for voltage-out with a 10 μF capacitor, the half-wave rectifier value is 0.20 mV. & the full-wave rectifier value is ______ uV.

Ans: to: the: Q: NO-03

Explain the effect on the output signal for changing the frequency of the input signal.

Ans: From the graph we can see, some graphs showing the input and output But they are quietely changing at the time of charging.

In the 1st case, if we add 0.22uF the in the output graph we see the Vmax and Vmin is increasing drastically and if more charge ~~added~~ in the result is the same as they are increasing. The Vpp ~~& Vmax~~ also increasing but if we add more charge to it then after a certain period the Vpp also start decreasing.

Ans: to: the: Q: No — 04

Between half wave and full wave which circuit Produces smoother output? Briefly explain in Context with data collection.

Ans: At first, when we do the experiment we made circuit for half wave retifier. then we found some value and ~~a~~ input-output with out capacitor graph. After doing the Half-wave circuit we can see that the Half wave circuit ~~is not~~ ~~the~~ have not that smoother output.

and, then when we statcted doing full-wave circuit we faced some technical issues. we have all our circuits and connections fixed properly. and cheaked lot of time with our lab instructor also; But due to some ware problem and some technical problem we could not complete the full wave rectifier circuit.

But through theoretical knowledge ~~we can say th~~ rectifier graph and after seeing some full wave and we can say that, ~~the~~ Between half wave and full wave circuit "Full-wave" ~~make~~ produces smoother output.

Discussion:

In our 3rd Experiment (Diode Rectifier circuit) we learnt about diode rectifier circuit. In the theory Part we saw types of recti-fier and their advantages and disadvantages. Some alternative uses also noticed. Such as half-wave rectifier, full-wave rectifier, full-wave bridge rectifier. we ~~saw two~~ did two circuit in multism.

Observed wave form for different frequencies. Also observed the output with capacitor and without capacitor than we collects all the output for report purpose. But in this Experiment we faced some thechnical issues while doing Full-wave rectifier circuits. we fixed all our connections and circuit properly. And we have cheaked it lot of time also with out lab Instructor. But Due to some technical problem we ~~can't~~ chould not complete the full-wave rectifier circuit.

Contribution:-

SN	Name	ID	Contribution
01	Sabrina Haque Tithi	2031265642	Report Writing & Data writing
02	Sazid Hasan	2211513642	1st circuit building & Operating Oscilloscope
03	Afrin Akter	2112246642	Simulation, graph & operating function Generator.
04	Joy Kumar Ghosh	2211424642	2nd circuit building, helped in operating Oscilloscope
05	Mahmudul Hasan	2011551043	Absent due to fever.

Attachment:

1) Simulation
2) Graph
3) Oscilloscope Picture
4) Data sheet.

Roll No. Group-5

Fig 2·4(a): Input-Output without Capacitor

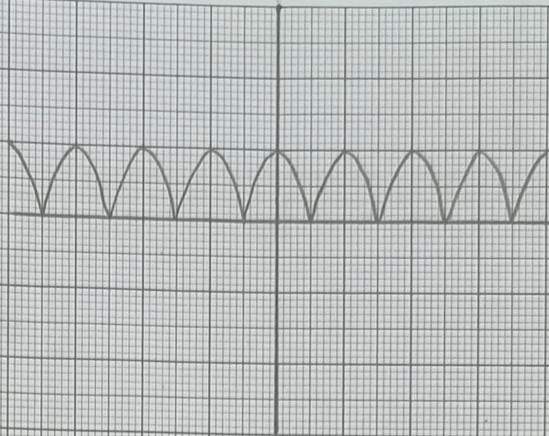


Fig 2·5(a): Output without capacitor

Fig 2·4(b): Input-output with 0·22 μF

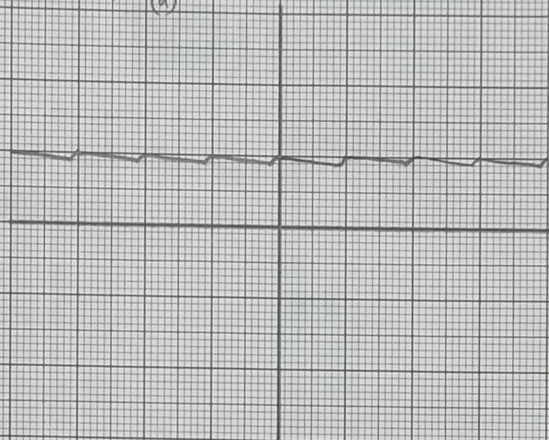


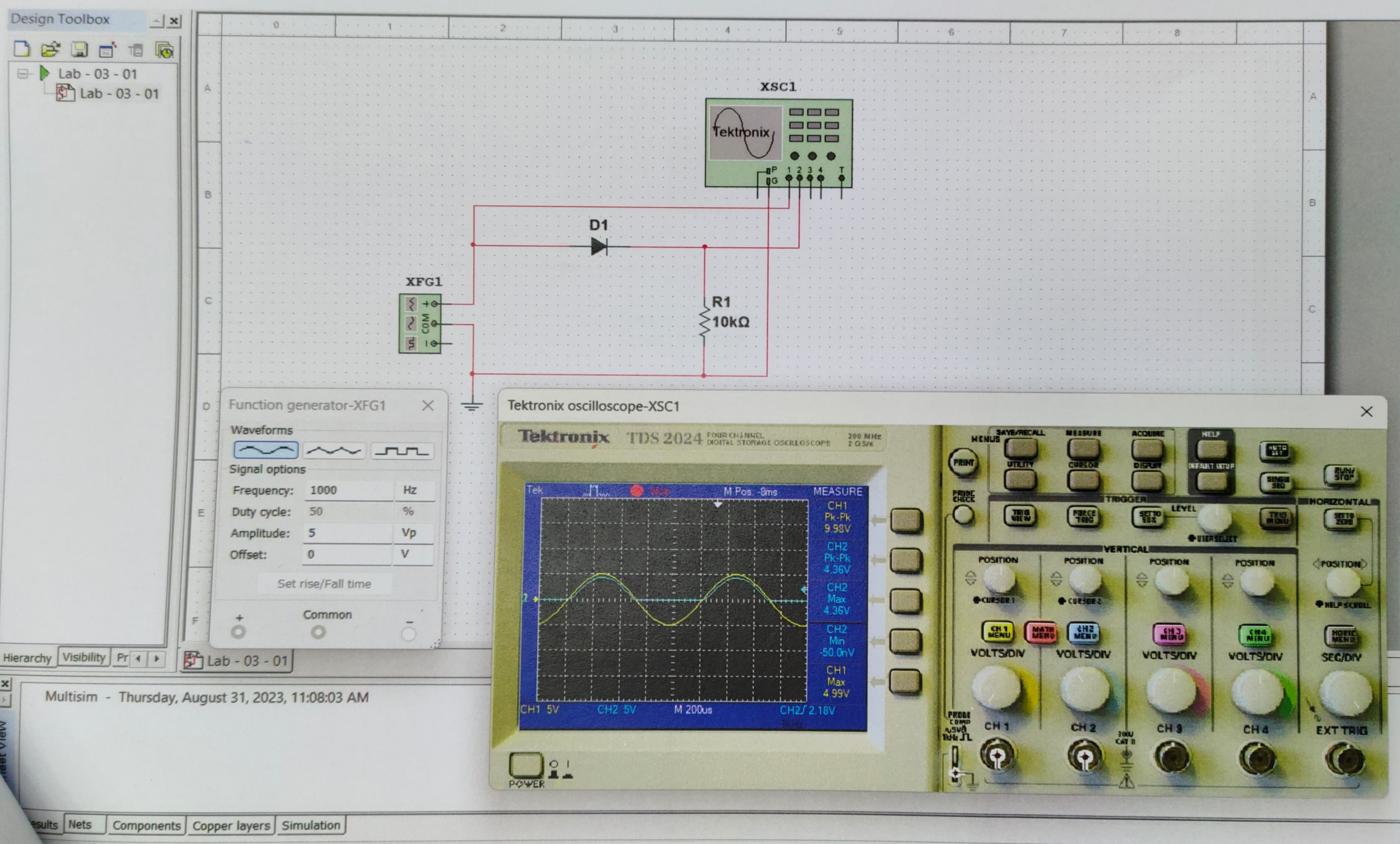
Fig 2·5(b): Output with 0·22 μF

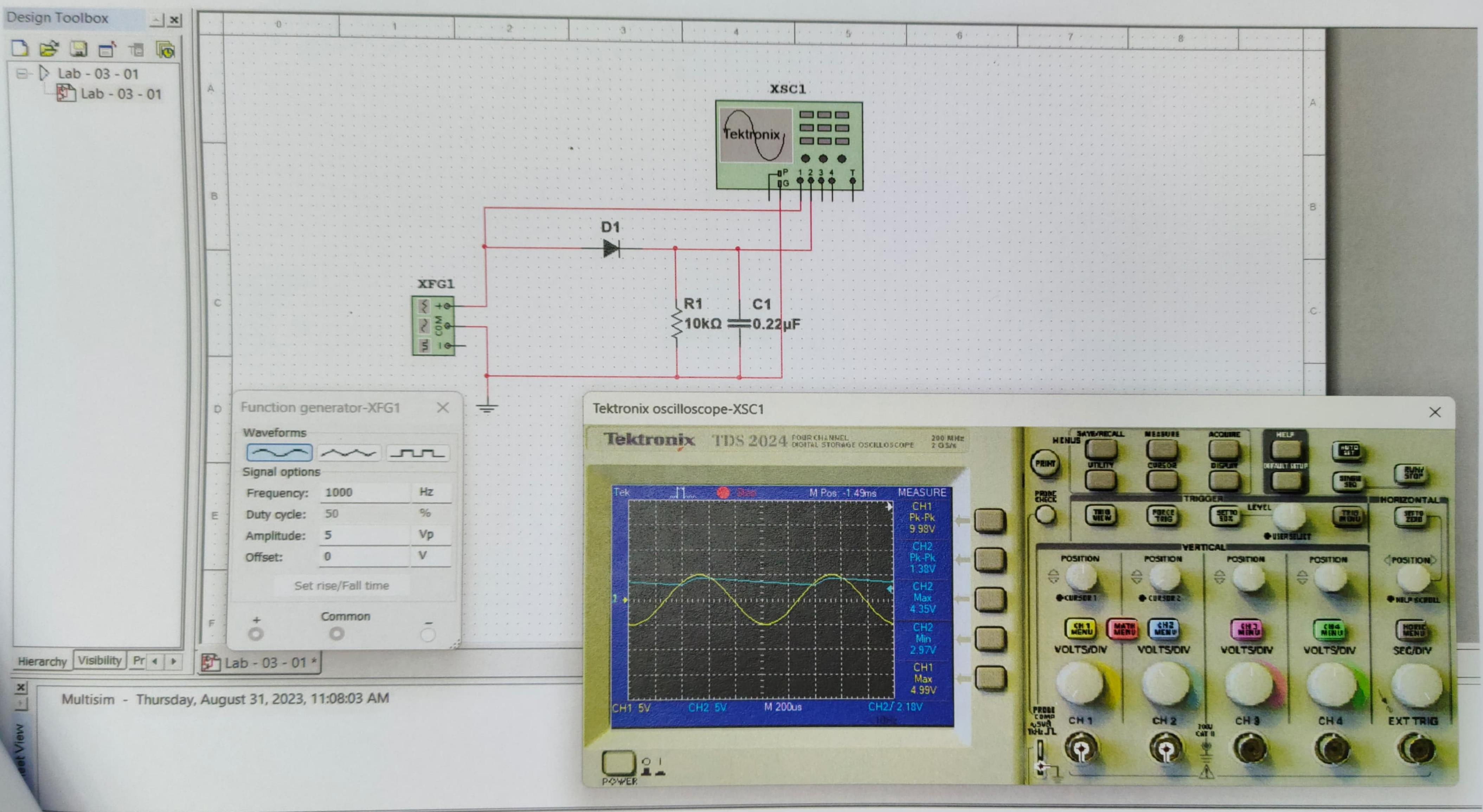
Fig 2·4(c): Input-Output with 10 μF

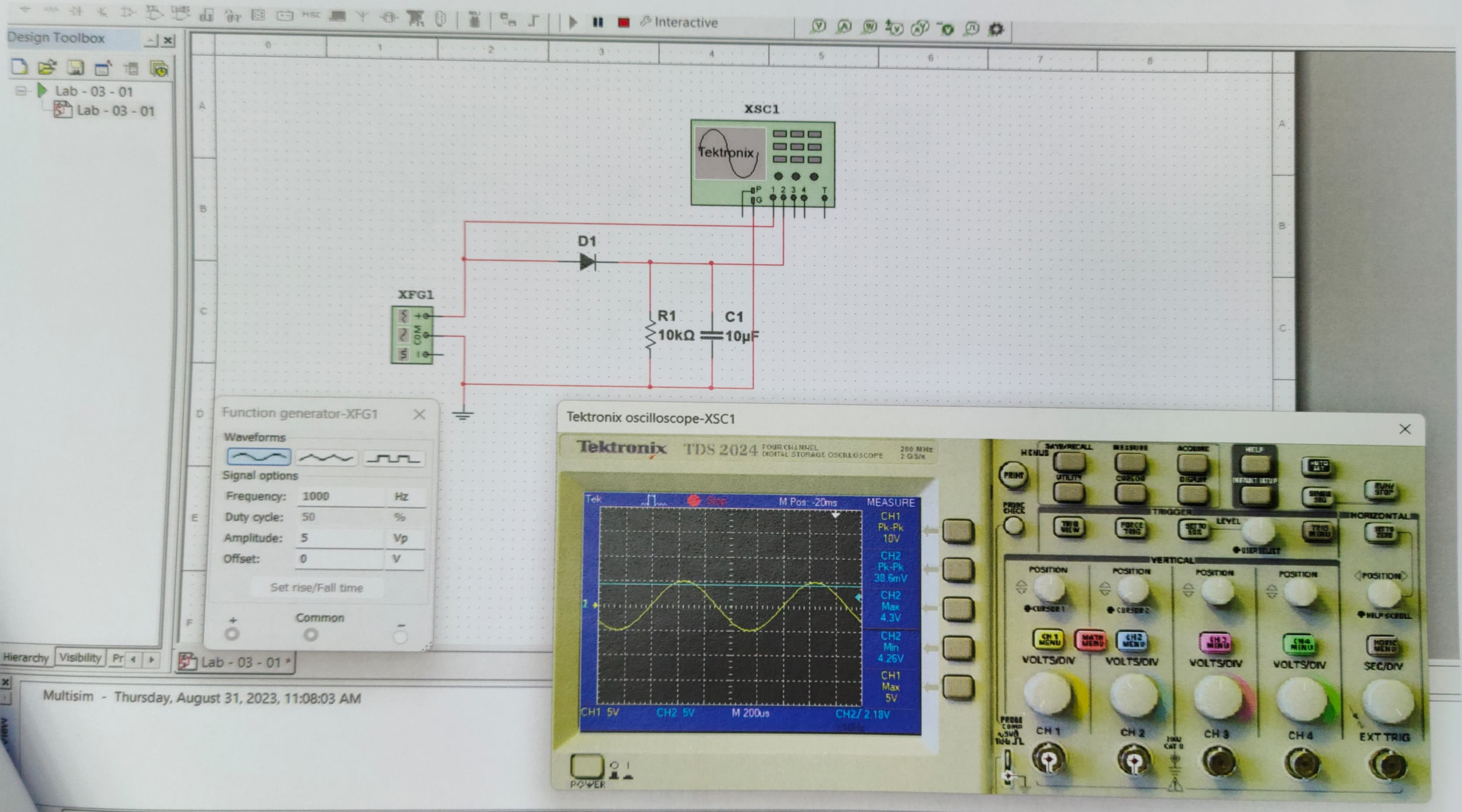
Fig 2·5(c): Output with 10 μF

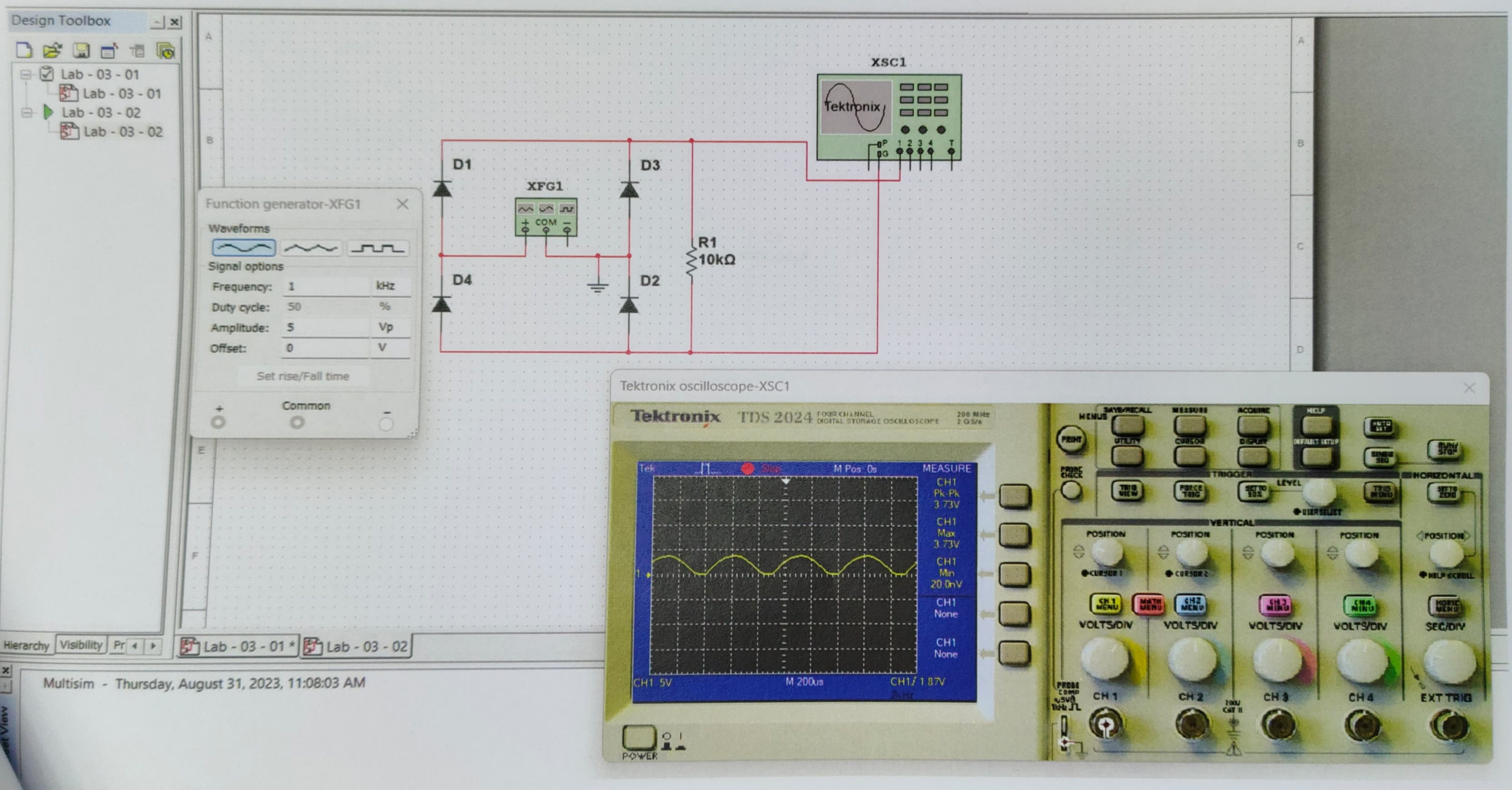
MICRO

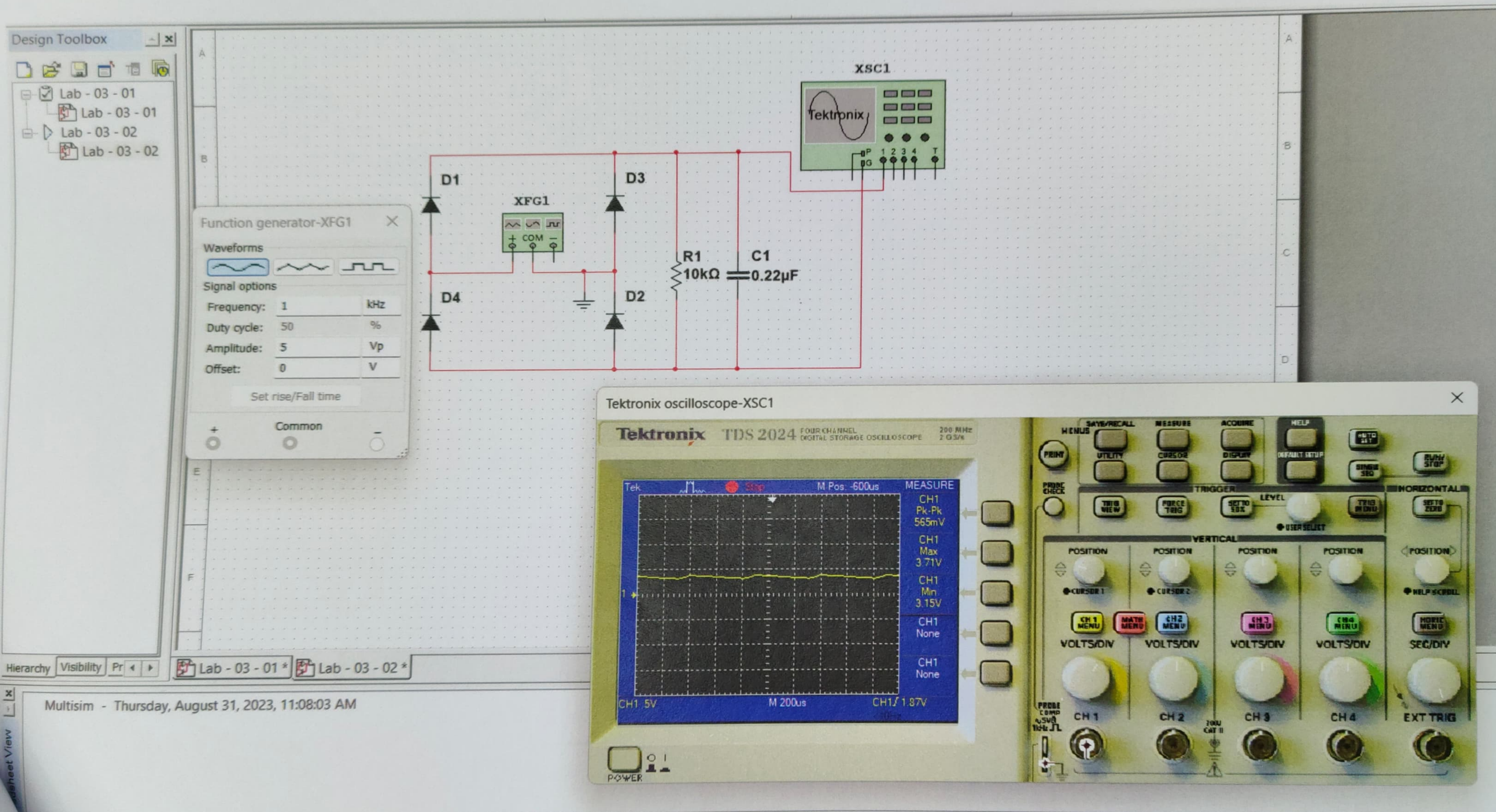
N.P. 20 cm x 25 cm

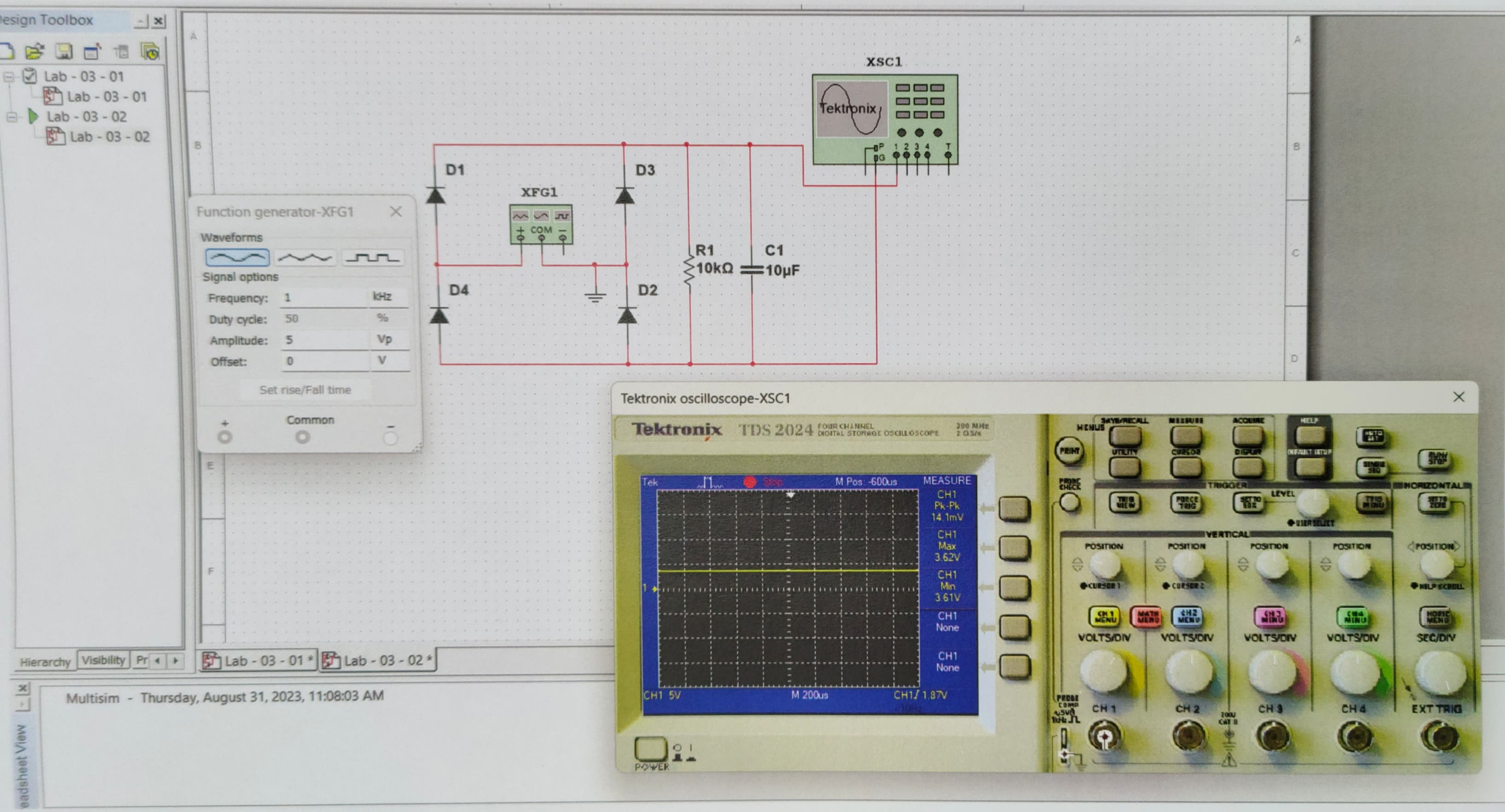

Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
XSC1
Tektronix
D1
XFG1
COM
R1
10kΩ
Function generator-XFG1
Waveforms
Signal options
Frequency: 1000 Hz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Tektronix oscilloscope-XSC1
Tektronix TDS 2024
Tek
M Pos: -8ms
MEASURE
CH1 Pk-Pk 9.98V
CH2 Pk-Pk 4.36V
CH2 Max 4.36V
CH2 Min -50.0nV
CH1 Max 4.99V
CH1 5V
CH2 5V
M 200us
CH2 ƒ 2.18V
POWER
VOLTS/DIV
SEC/DIV
CH 1
CH 2
CH 3
CH 4
EXT TRIG
Hierarchy
Visibility
Lab - 03 - 01
Multisim - Thursday, August 31, 2023, 11:08:03 AM
Nets
Components
Copper layers
Simulation

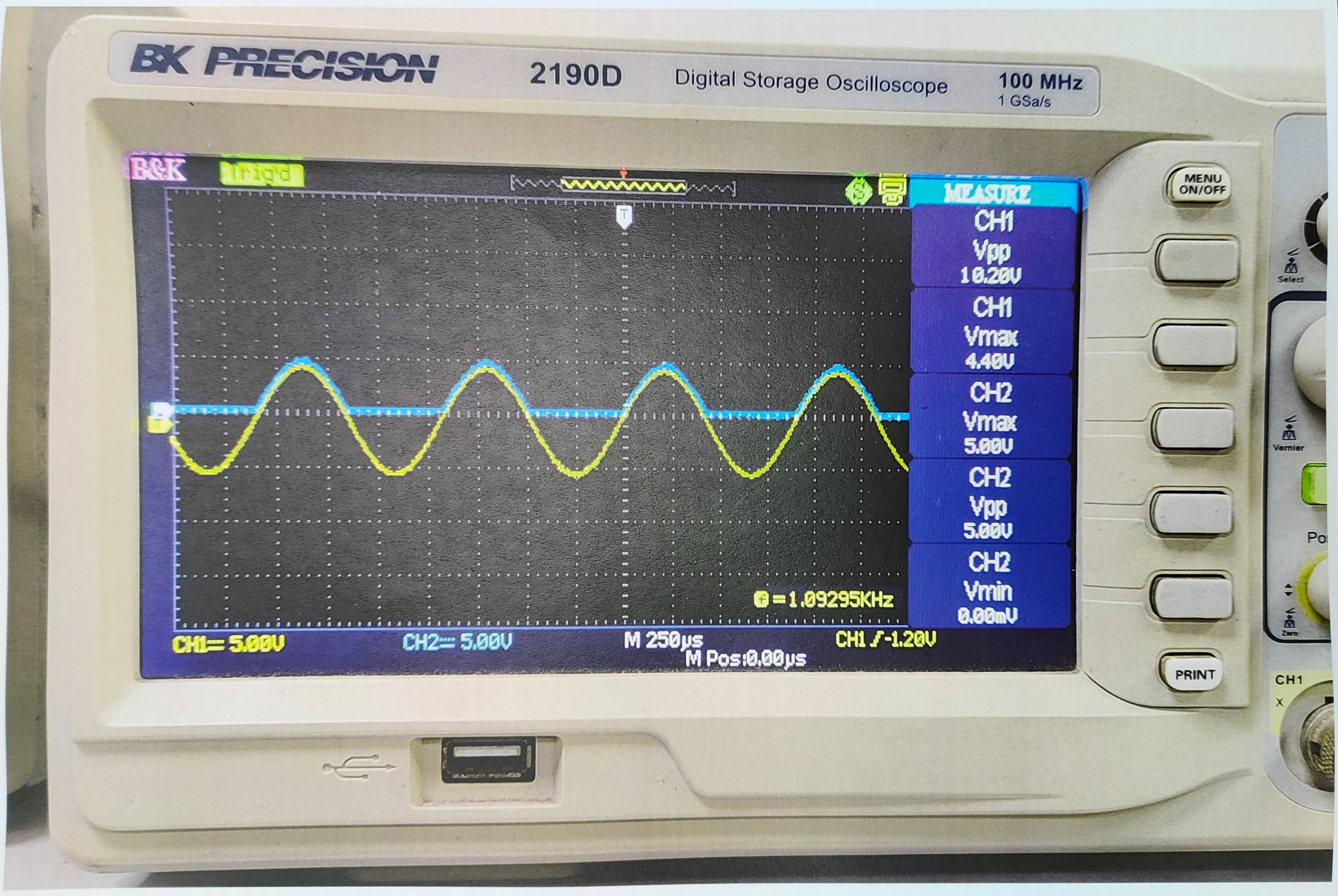

Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
XSC1
Tektronix
D1
XFG1
COM
R1
10kΩ
C1
0.22µF
Function generator-XFG1
Waveforms
Signal options
Frequency: 1000 Hz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Tektronix oscilloscope-XSC1
Tektronix TDS 2024 FOUR CHANNEL DIGITAL STORAGE OSCILLOSCOPE
200 MHz 2 GS/s
Tek
M Pos: -1.49ms
MEASURE
CH1 Pk-Pk 9.98V
CH2 Pk-Pk 1.38V
CH2 Max 4.35V
CH2 Min 2.97V
CH1 Max 4.99V
CH1 5V
CH2 5V
M 200us
CH2 / 2.18V
POWER
Hierarchy
Visibility
Lab - 03 - 01 *
Multisim - Thursday, August 31, 2023, 11:08:03 AM


Interactive
Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
XSC1
Tektronix
D1
XFG1
R1
10kΩ
C1
10μF
Function generator-XFG1
Waveforms
Signal options
Frequency: 1000 Hz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Tektronix oscilloscope-XSC1
Tektronix TDS 2024
M Pos: -20ms
MEASURE
CH1 Pk-Pk 10V
CH2 Pk-Pk 38.6mV
CH2 Max 4.3V
CH2 Min 4.26V
CH1 Max 5V
CH1 5V
CH2 5V
M 200us
CH2 / 2.18V
Hierarchy
Visibility
Lab - 03 - 01 *
Multisim - Thursday, August 31, 2023, 11:08:03 AM

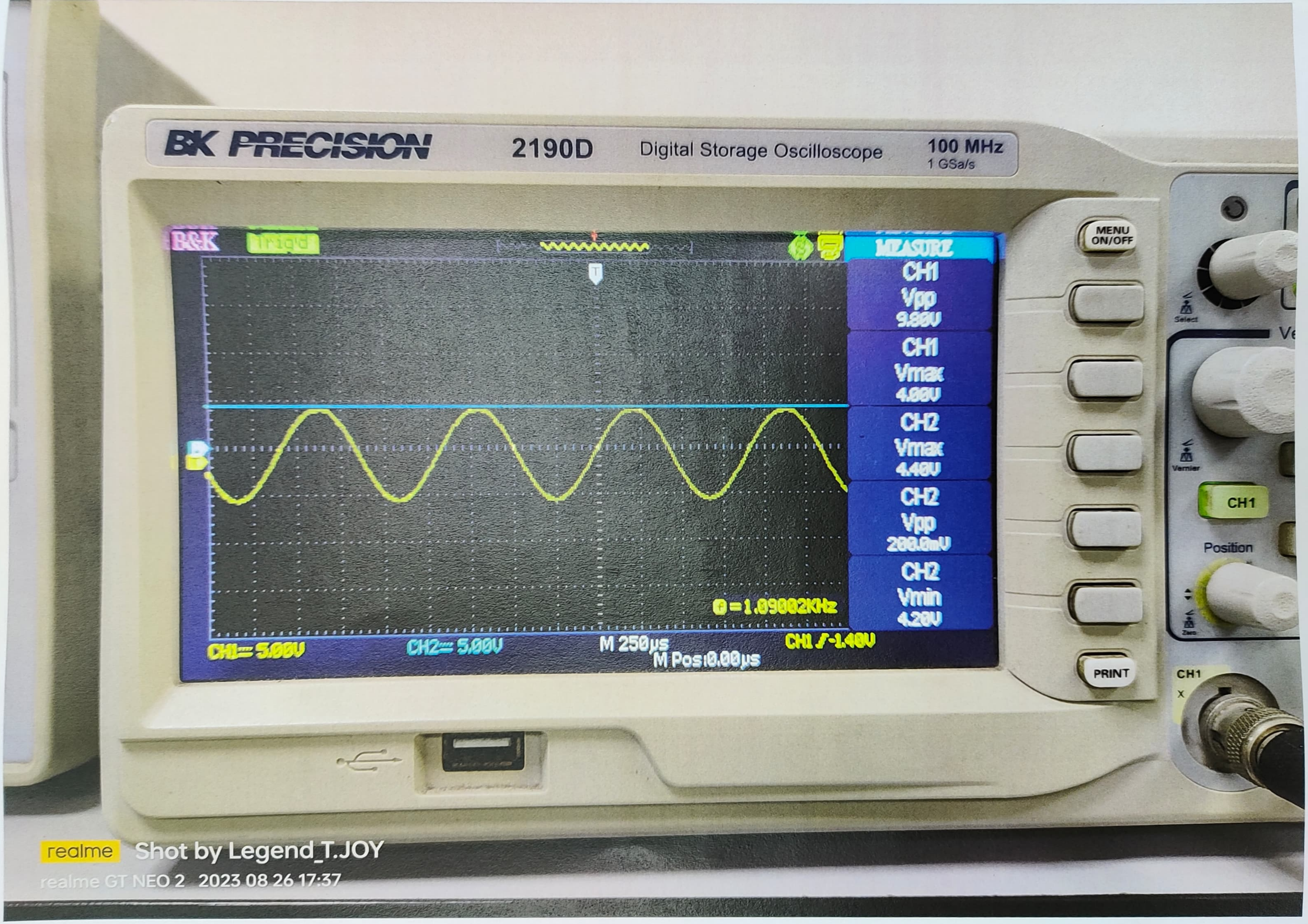

Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
Lab - 03 - 02
Lab - 03 - 02
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
D1
D3
D4
D2
XFG1
COM
R1
10kΩ
XSC1
Tektronix
Tektronix oscilloscope-XSC1
Tektronix TDS 2024 FOUR CHANNEL DIGITAL STORAGE OSCILLOSCOPE
Tek
M Pos: 0s
MEASURE
CH1 Pk-Pk 3.73V
CH1 Max 3.73V
CH1 Min 20.0nV
CH1 None
CH1 None
CH1 5V
M 200us
CH1 / 1.87V
POWER
VOLTS/DIV
SEC/DIV
CH 1
CH 2
CH 3
CH 4
EXT TRIG
Hierarchy
Visibility
Lab - 03 - 01 *
Lab - 03 - 02
Multisim - Thursday, August 31, 2023, 11:08:03 AM


Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
Lab - 03 - 02
Lab - 03 - 02
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
D1
D2
D3
D4
XFG1
COM
R1
10kΩ
C1
0.22µF
XSC1
Tektronix
Tektronix oscilloscope-XSC1
Tektronix TDS 2024
MEASURE
CH1 Pk-Pk 565mV
CH1 Max 3.71V
CH1 Min 3.15V
CH1 None
CH1 None
M Pos: -600us
CH1 5V
M 200us
CH1 ∫ 1.87V
Hierarchy
Visibility
Lab - 03 - 01 *
Lab - 03 - 02 *
Multisim - Thursday, August 31, 2023, 11:08:03 AM

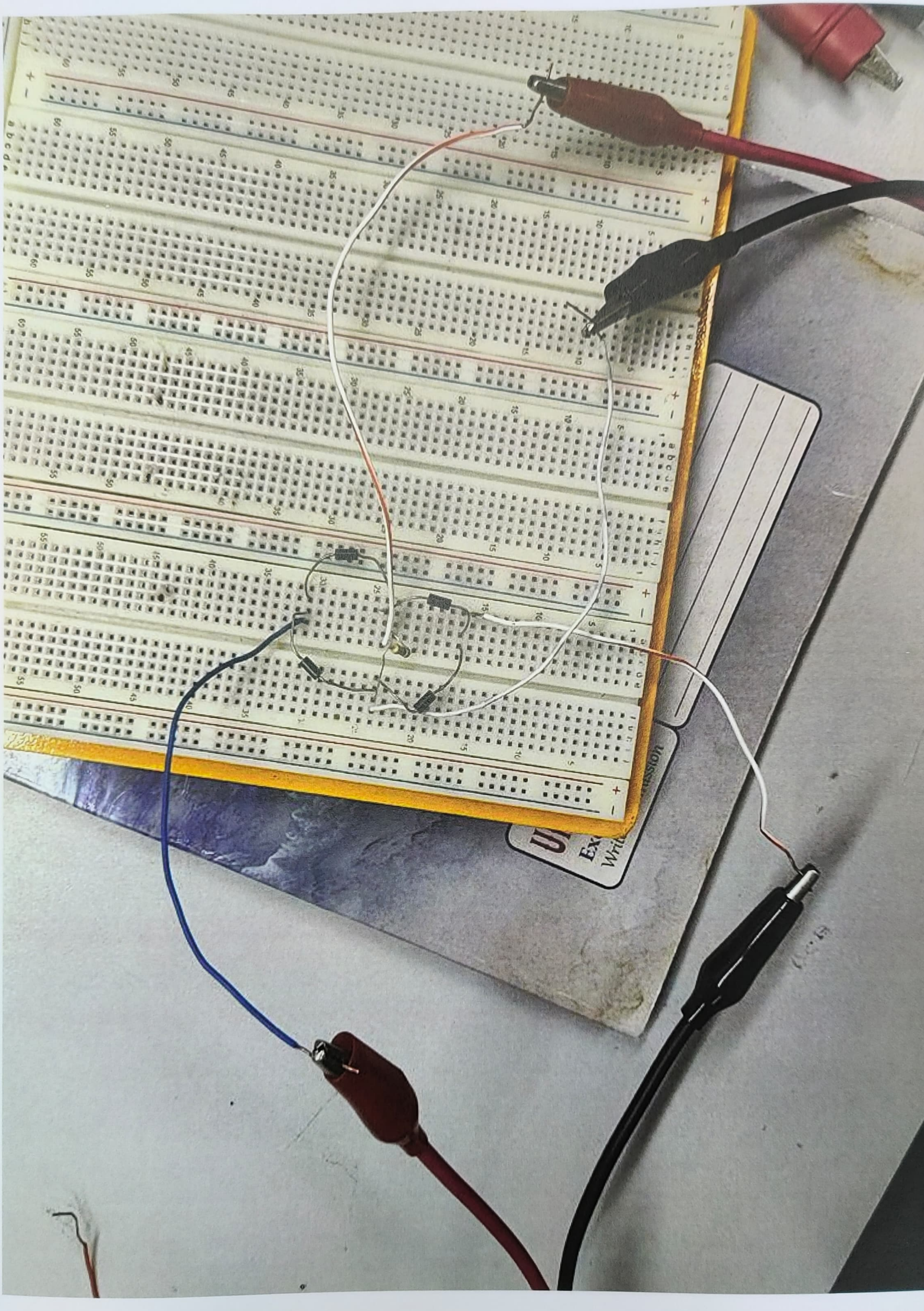

Design Toolbox
Lab - 03 - 01
Lab - 03 - 01
Lab - 03 - 02
Lab - 03 - 02
XSC1
Tektronix
D1
D3
XFG1
COM
D4
D2
R1
10kΩ
C1
10µF
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Tektronix oscilloscope-XSC1
Tektronix TDS 2024 FOUR CHANNEL DIGITAL STORAGE OSCILLOSCOPE
Tek
Stop
M Pos: -600us
MEASURE
CH1 Pk-Pk 14.1mV
CH1 Max 3.62V
CH1 Min 3.61V
CH1 None
CH1 None
CH1 5V
M 200us
CH1 1.87V
VOLTS/DIV
SEC/DIV
CH 1
CH 2
CH 3
CH 4
EXT TRIG
POWER
Hierarchy
Visibility
Lab - 03 - 01 *
Lab - 03 - 02 *
Multisim - Thursday, August 31, 2023, 11:08:03 AM

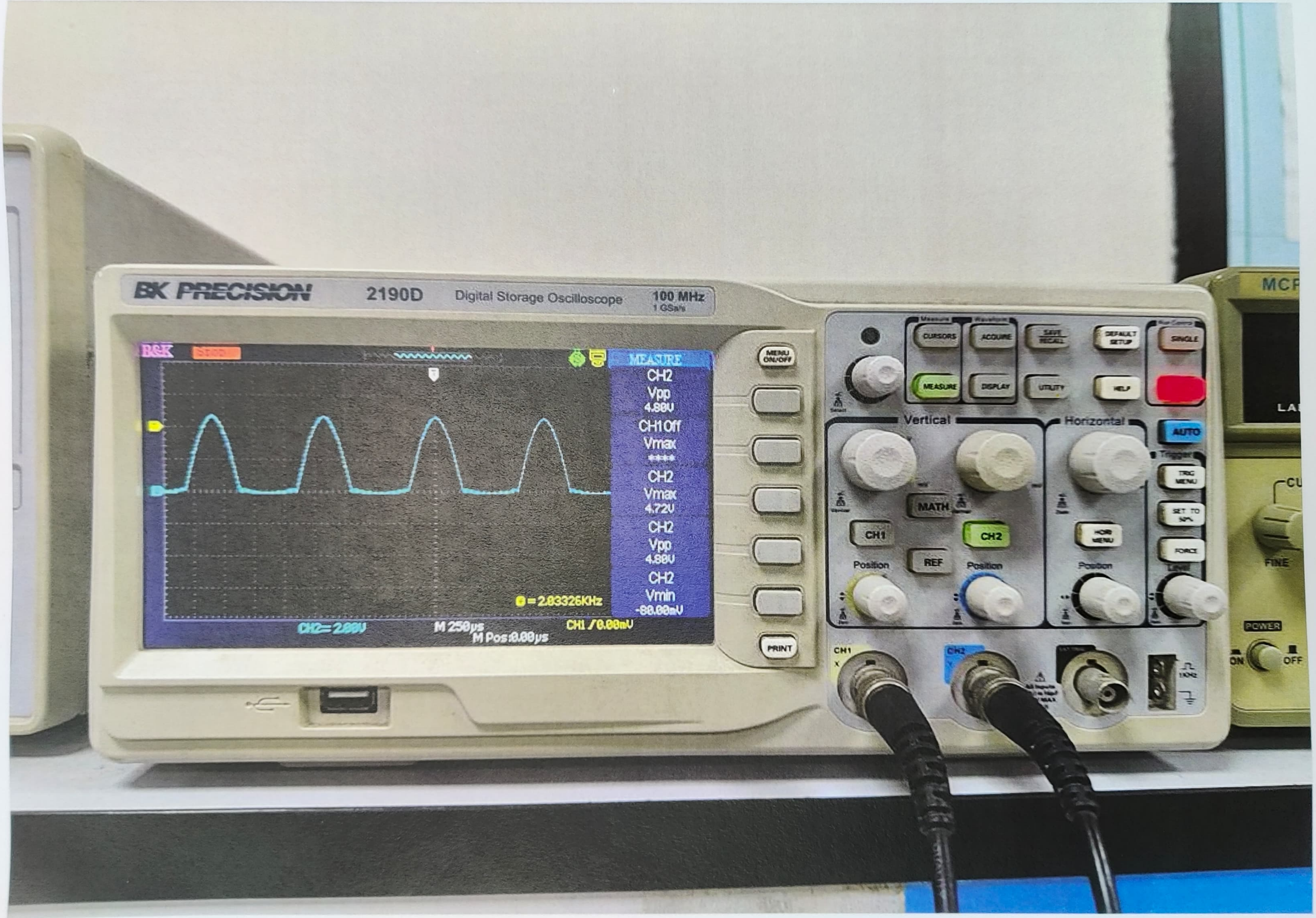

B&K PRECISION
2190D
Digital Storage Oscilloscope
100 MHz
1 GSa/s
B&K
Trig'd
MEASURE
CH1
Vpp
10.20V
CH1
Vmax
4.40V
CH2
Vmax
5.00V
CH2
Vpp
5.00V
CH2
Vmin
0.00mV
=1.09295KHz
CH1= 5.00V
CH2= 5.00V
M 250μs
M Pos:0.00μs
CH1 -1.20V
MENU ON/OFF
PRINT
Select
Vernier
CH1


B&K PRECISION
2190D
Digital Storage Oscilloscope
100 MHz
1 GSa/s
B&K
Stop
MEASURE
CH1
Vpp
10.20V
CH1
Vmax
4.40V
CH2
Vmax
5.00V
CH2
Vpp
1.60V
CH2
Vmin
3.40V
<10Hz
CH1= 5.00V
CH2= 5.00V
M 250μs
M Pos:0.00μs
CH2 9.80V
MENU ON/OFF
PRINT



B&K PRECISION
2190D
Digital Storage Oscilloscope
100 MHz
1 GSa/s
B&K
Trig'd
MEASURE
CH1
Vpp
9.80V
CH1
Vmax
4.00V
CH2
Vmax
4.40V
CH2
Vpp
200.0mV
CH2
Vmin
4.20V
f=1.09002KHz
CH1 5.00V
CH2 5.00V
M 250µs
M Pos:0.00µs
CH1 -1.40V
MENU ON/OFF
PRINT
CH1
Position
realme
Shot by Legend_T.JOY
realme GT NEO 2 2023 08 26 17:37




B&K PRECISION
2190D
Digital Storage Oscilloscope
100 MHz
1 GSa/s
MEASURE
CH2
Vpp
4.80V
CH1 Off
Vmax
****
CH2
Vmax
4.72V
CH2
Vpp
4.80V
CH2
Vmin
-80.00mV
= 2.03326KHz
CH2= 2.00V
M 250μs
M Pos:0.00μs
CH1 / 0.00mV
MENU ON/OFF
PRINT
CURSORS
ACQUIRE
MEASURE
DISPLAY
UTILITY
DEFAULT SETUP
HELP
SINGLE
AUTO
Vertical
Horizontal
MATH
CH1
CH2
REF
Position
Position
Position
TRIG MENU
SET TO 50%
FORCE
CH1
CH2
POWER
ON
OFF
FINE

Equipment and Components:

Serial no.	Component Details	Specification	Quantity
1.	p-n junction diode	1N4007	4 piece
2.	Resistor	10KΩ	1 piece
3.	Capacitor	0.22μF, 10μF	1 piece each
4.	Signal generator		1 unit
5.	Trainer Board		1 unit
6.	Oscilloscope		1 unit
7.	Digital Multimeter		1 unit
8.	Chords and wire		as required

Experimental Setup:

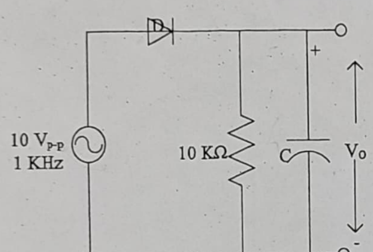


Figure 2.4: Half wave

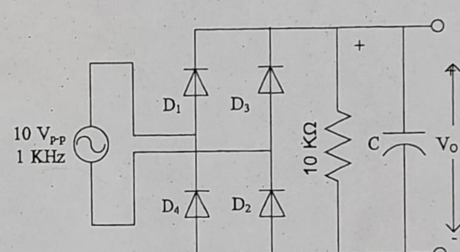


Figure 2.5: Full Wave

Procedure:

1. First, connect the circuit in breadboard as shown in figure 2.4 without any capacitor.
2. Apply 1 KHz 10V (p-p) sinusoidal input signal from signal generator.
3. Connect channel 1 of oscilloscope to the input side, and channel 2 of oscilloscope to output side. Observe the wave shapes and p-p values inputs and outputs and draw them in the graph paper with proper p-p values.
4. Connect the 0.22μF capacitor and repeat step 3. [decrease the Volts/DIV for proper wave-shape]
5. Now keeping capacitor fixed at 0.22 μF, Observe the change in output wave shape by 1st varying the frequency lower than 1 Khz and then higher than 1 khz.
6. Connect the 10μF capacitor and repeat step 3 and step 5. [decrease the Volts/DIV for proper wave-shape]
7. Repeat steps 1-6 for Figure 2.5.

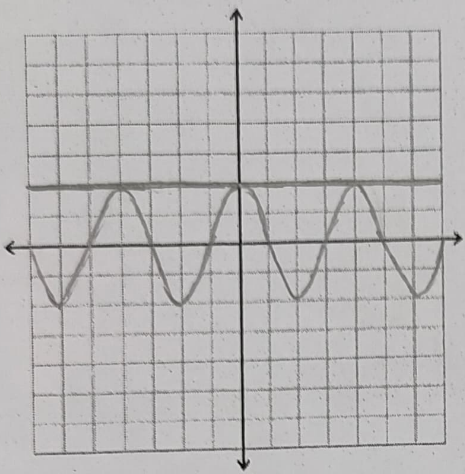
Data Collection:

Signature of instructor:

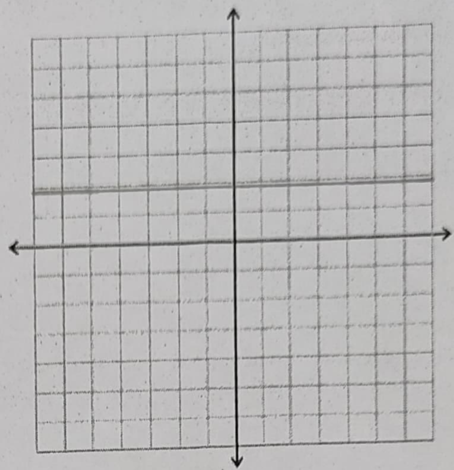
Experiment: 2,
Performed by Group# 5

Theoretical value: R = 10 kΩ

Measured value: R = ___ kΩ 9.89 kΩ



c) *Input-output with 10uF (fig 2.4)*



f) *Input-output with 10uF (fig 2.5)*

Report:

1. For Fig 2.4 and Fig 2.5, draw the input-output wave-shape without capacitor, with 0.22μF capacitor and 10μF capacitor.
2. Compare the change in the wave-shape and peak to peak values for no capacitor at the output to 0.22 μF to 10 μF.
3. Explain the effect on the output signal for changing the frequency of the input signal
4. Between half wave and full wave which circuit produces smoother output? Briefly explain in context with your data collection.