North South University

Department of Electrical & Computer Engineering

LAB REPORT - 3

Course Code: EEE111L

Course Title: ANALOG ELECTRONICS-I LAB

Section: 6

Lab Number: 3

Experiment Name:

Clipper and Clamper circuits

Experiment Date: 11-3-2023 & 18-3-2023

Date of Submission: 25-3-2023

Submitted by Group Number: 4

Group members:

Name	ID	Obtained Mark Simulation [5]	Obtained Mark Lab Report [15]
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Course Instructor: MHUD

Submitted To: Md. Anisur Rahman Asif

1. Experiment name:

Clipper and Clamper circuits.

2. Objectives:

Study of Clipper and Clamper circuits.

3. Apparatus:

Serial no.	Component Details	Specification	Quantity
1.	p-n junction diode	1N4007	1 piece
2.	Resistor	100KΩ	1 piece
3.	Capacitor	0.1μF	1 piece
4.	DC power supply		1 unit
5.	Signal generator		1 unit
6.	Trainer Board		1 unit
7.	Oscilloscope		1 unit
8.	Digital Multimeter		1 unit
9.	Chords and wire		as required

4. Theory:

Clipper circuits are the circuits that clip off or removes a portion of an input signal, without causing any distortion to the remaining part of the waveform. These are also known as clippers, clipping circuits, limiters, slicers etc. Clippers are basically wave shaping circuits that control the shape of an output waveform. It consists of linear and non-linear elements but does not contain energy storing elements. The basic operation of a diode clipping circuits is such that, in forward biased condition, the diode allows current to pass through it, clamping the voltage. But in reverse biased condition, no any current flows through the diode, and thus voltage remains unaffected across its terminals. Clamper circuits are the electronic circuits that shift the dc level of the AC signal. Clampers are also known as DC voltage restorers or level shifter. Clampers are basically classified as positive and negative that includes both biased and unbiased conditions individually. These circuits are used to clamp an input signal to a different dc level. It basically adds dc component to the applied input signal in order to push the signal to either the positive or negative side. Clamper circuit is a combination of a resistor along with a diode and capacitor. It sometimes also employs dc battery so as to have an additional shift in the signal level. Clamper circuits are constructed in a similar manner as that of clipper circuits. However, clamper includes an extra charging element that is the capacitor in its circuit.

5. Circuit Diagram:

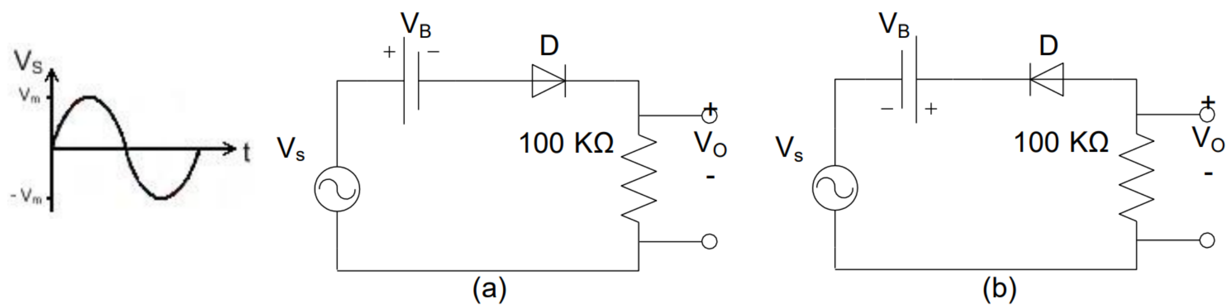


Figure: Circuit Diagram for Clipper Circuit using Bias Diode.

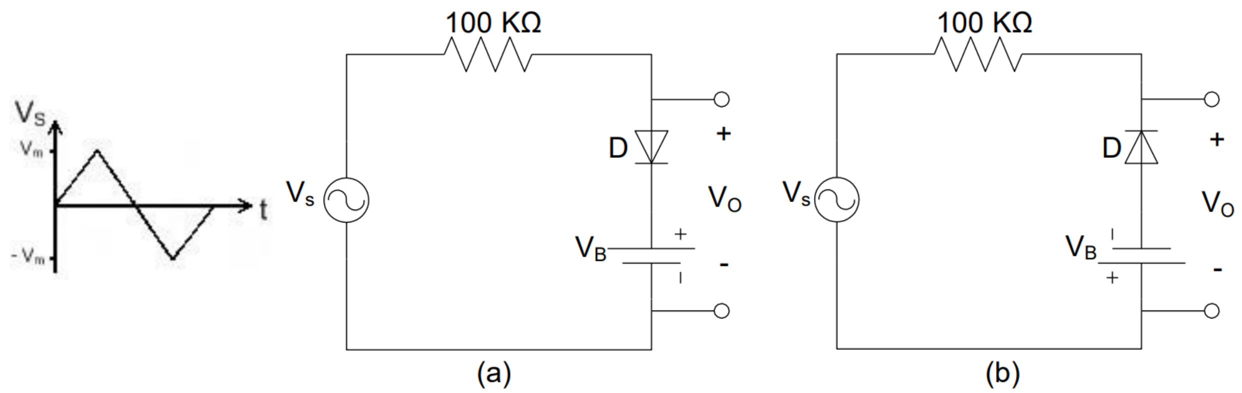


Figure: Circuit Diagram for Biased Parallel Clipper Circuit.

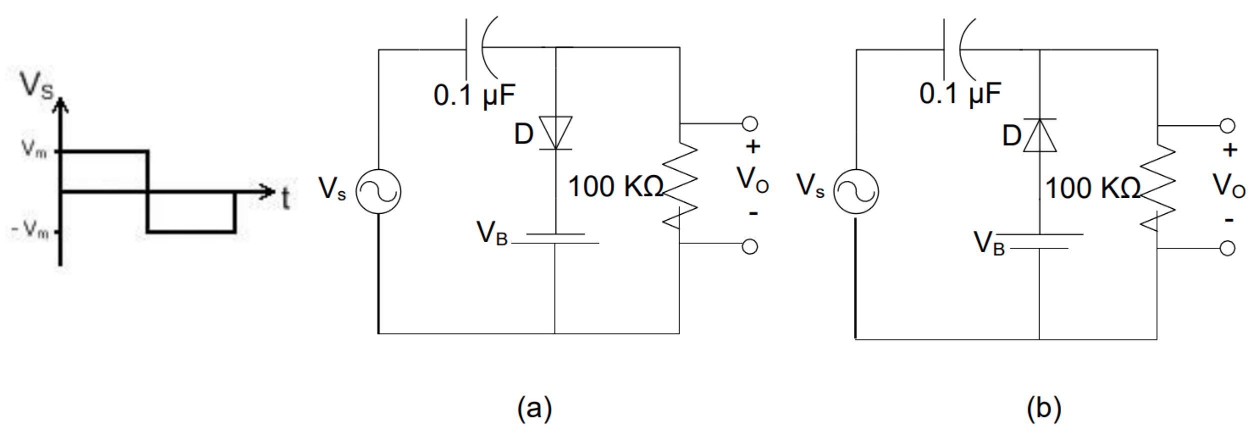


Figure: Circuit Diagram for Clamper Circuit.

6. Experimental Procedure:

- First, we had to measure the resistance of the resistor accurately using a digital multimeter (DMM) and construct the biased series clipper circuit using sinusoidal voltage source with 5 volts peak (V_m) and 1kHz frequency.

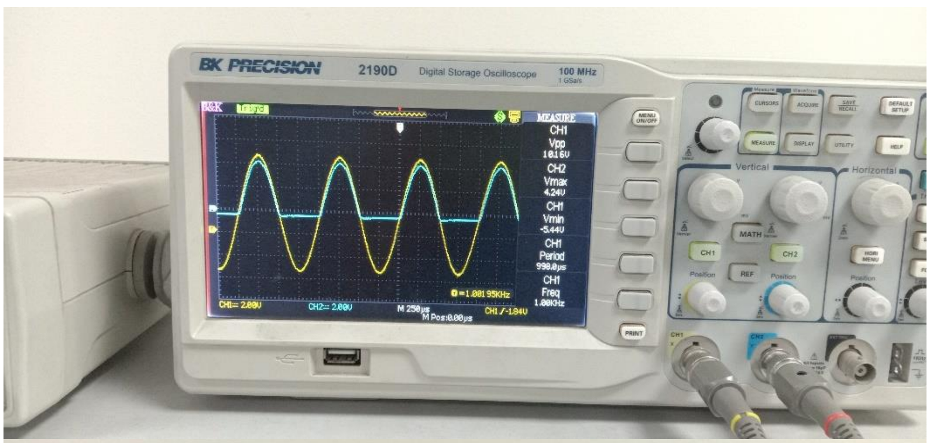
- Then we observed the output wave shapes for various values of V_B, specially V_B = 2.5 volts for each circuit in the Oscilloscope.

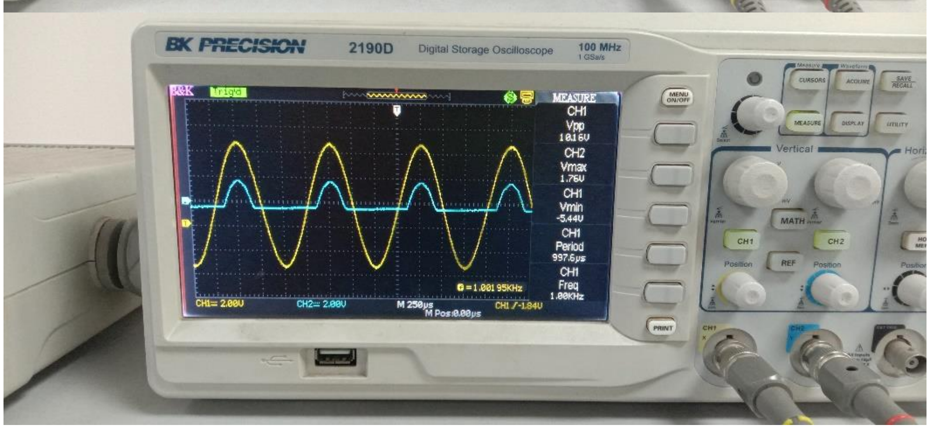
- We repeated the process for biased parallel clipper circuit using triangle voltage source with 5 volts peak (V_m) and 1kHz frequency and observed the outputs.

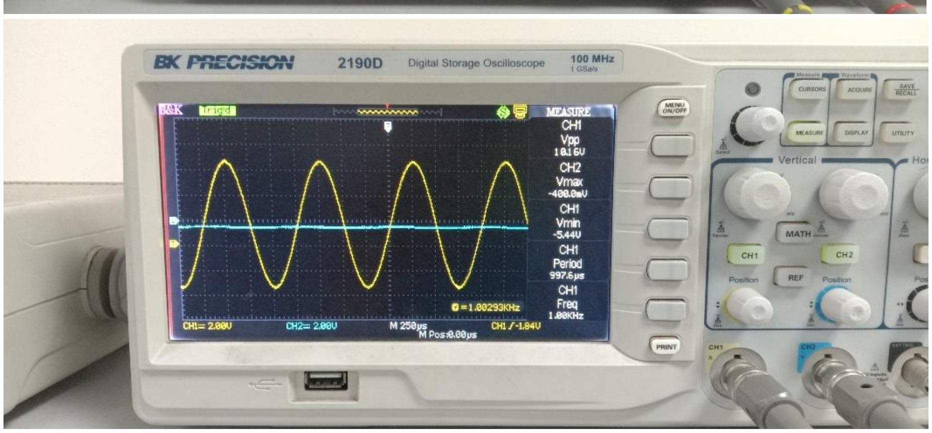
- We also construct the clamper circuit using 0.1 µF capacitor and rectangular and square voltage source with 5 volts peak (V_m) and 1kHz frequency and observed the outputs.

7. Results:

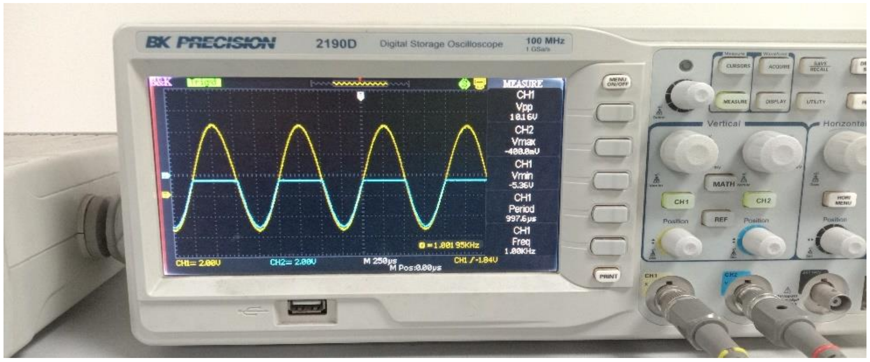
From the result we can say that the bias voltage determines the level at which the diode conducts and clips the input signal. During the positive half cycle, the diode starts conducting only after its anode voltage value exceeds the cathode voltage value and during the negative half cycle, the input appears as output until the input value will be less than the negative reference voltage. A higher bias voltage will result in more of the input signal being clipped, while a lower bias voltage will result in less of the input signal being clipped. Since cathode voltage becomes equal to the reference voltage, the output that appears in the below pictures.

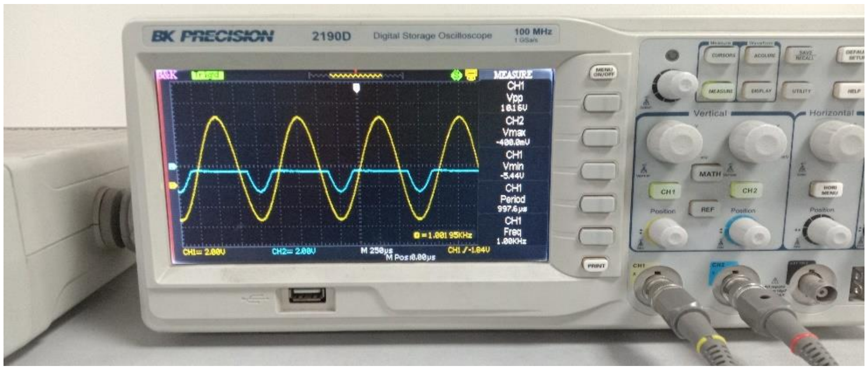


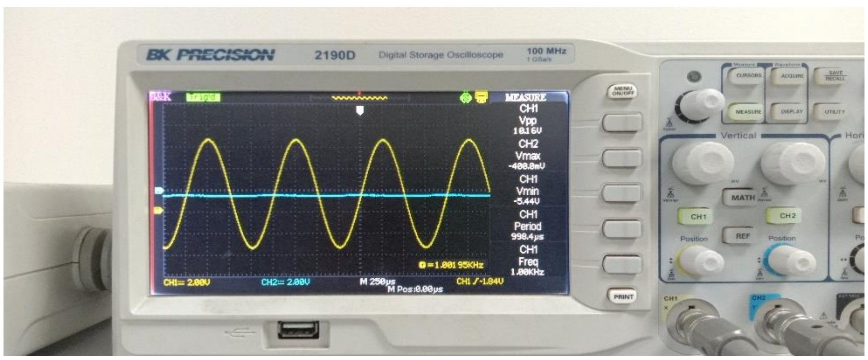




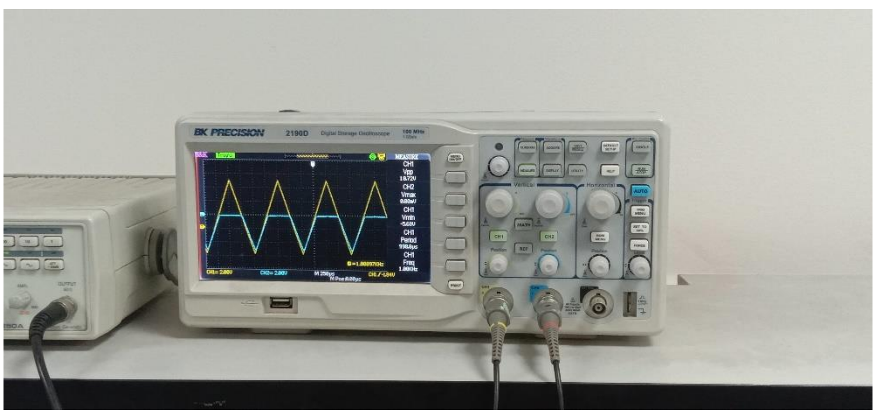
During the positive half cycle, the diode becomes reverse-biased, and no output is generated across the resistor, and during the negative half cycle, the diode conducts and the entire input appears as output across the resistor.

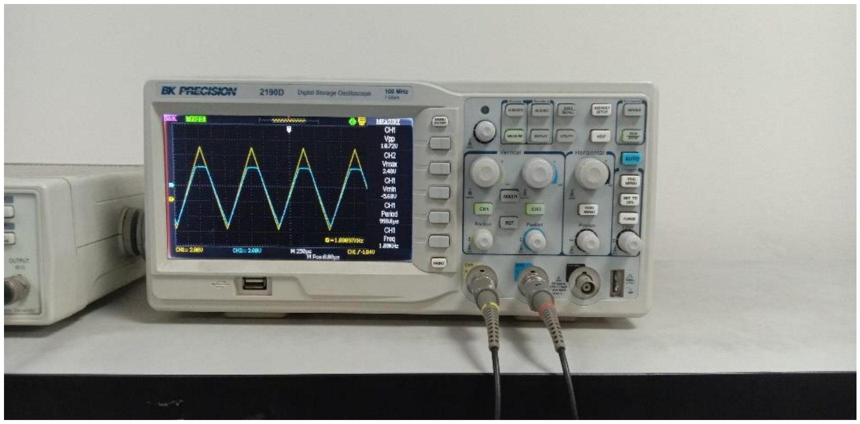


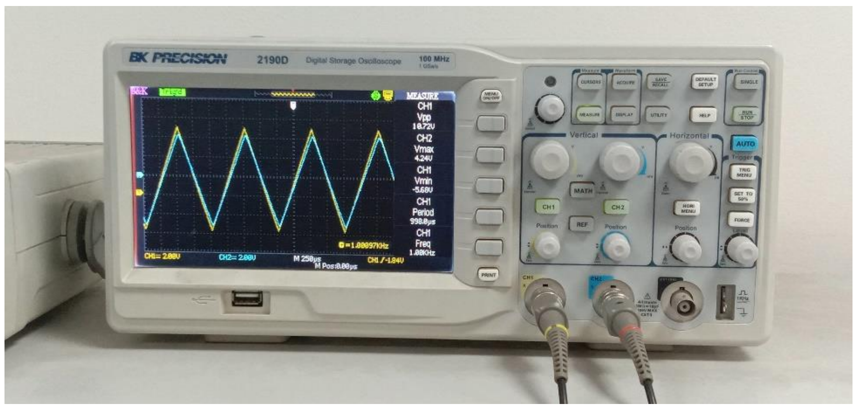




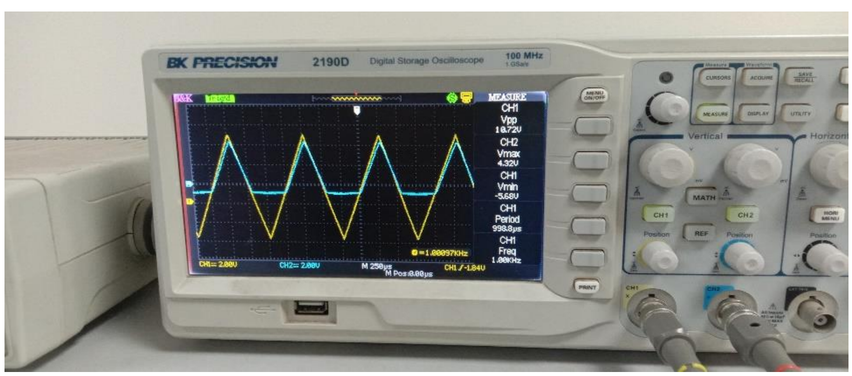
During the positive half cycle, the input is generated as output, and during the negative half cycle, positive reference voltage will be the output voltage that appears in the below pictures.

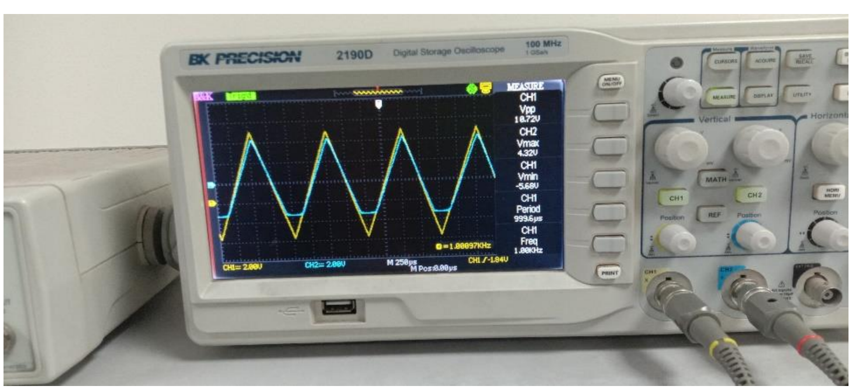


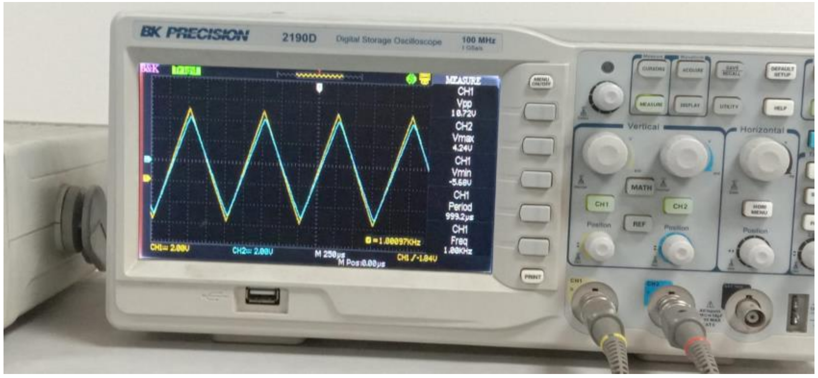




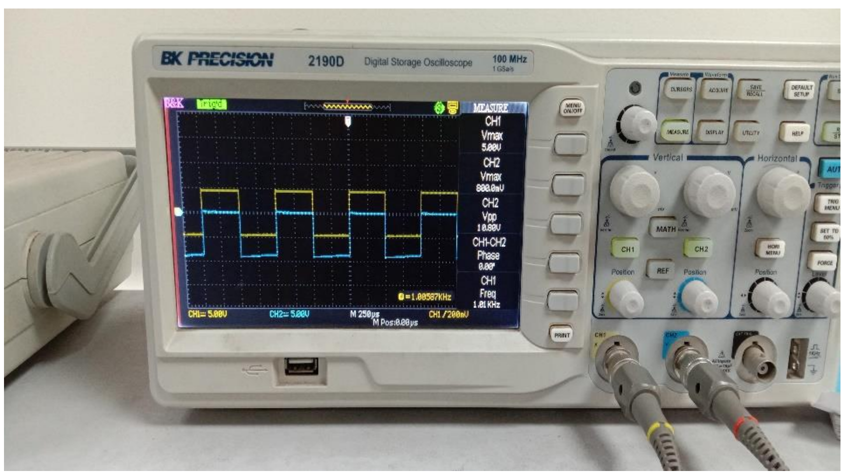
Instead of the positive reference voltage, a negative reference voltage is connected in series with the diode to form a shunt negative clipper with a negative reference voltage. During the positive half cycle, the entire input appears as output, and during the negative half cycle, reference voltage that appears in the below pictures.

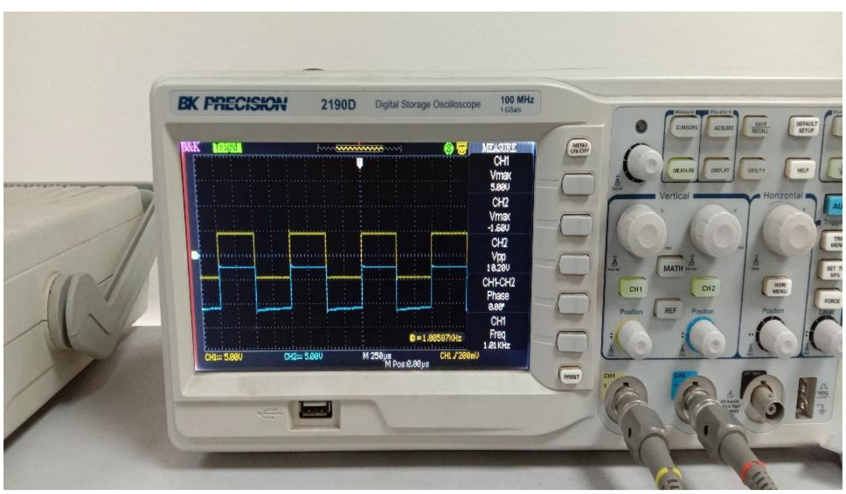


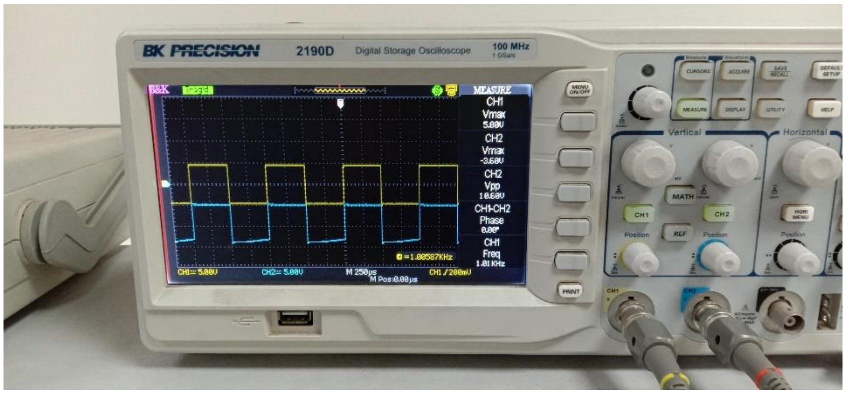




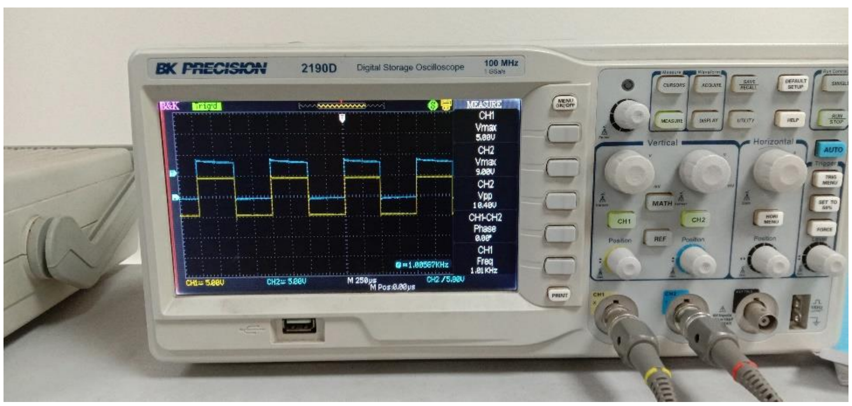
The capacitor value will determine the charging and discharging time constant of the circuit, which will affect the amount of time it takes for the DC level to shift to the desired level. The amount of DC shift will depend on the choice of bias voltage and the specific configuration of the circuit. If a positive clamper circuit is used, the output waveform will have a positive DC offset, while if a negative clamper circuit is used, the output waveform will have a negative DC offset. By inverting the reference voltage directions, the negative reference voltage is connected in series with the diode. During the positive half cycle, the diode starts conduction before zero, as the cathode has a negative reference voltage, which is less than that of zero and the anode voltage, and thus, the waveform is clamped towards the negative direction by the reference voltage value.

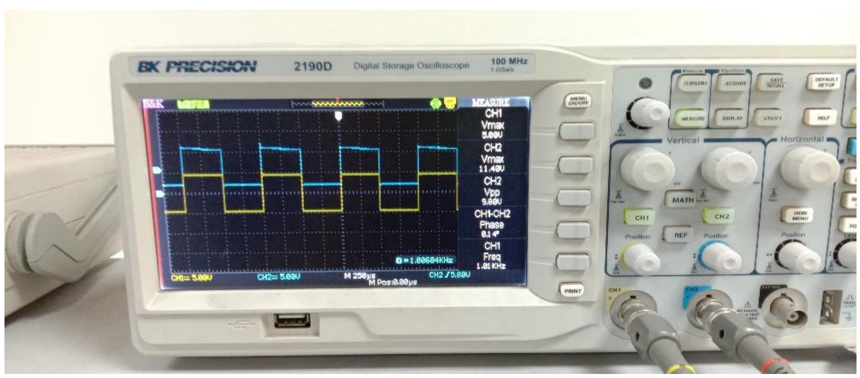


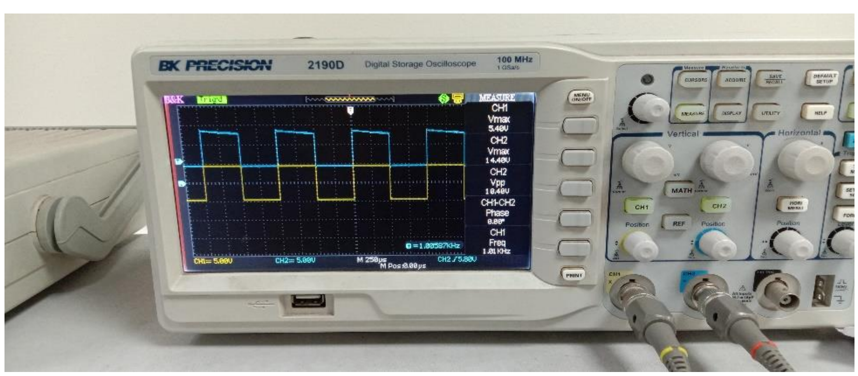




A positive reference voltage is added in series with the diode of the positive clamper. During the positive half cycle of the input, the diode conducts as initially, the supply voltage is less than the anode positive reference voltage. Once the cathode voltage is greater than the anode voltage then the diode stops conduction. During the negative half cycle, the diode conducts and charges the capacitor. The output is generated that appears in the below pictures.







Lastly, we can assume that the diode is a silicon diode because once we are supplying over 0.7 V, current starts flowing through the circuit.

8. Questions and Answers (Q/A):

1. **Sketch all the waveforms observed on the oscilloscope.**
   Answer: The simulation part contains all of the wave forms observed in the experiment.

2. **What role dose the value of capacitor used in the clamping circuit play in order to obtain proper clamping?**
   Answer: In a clamper circuit, the value of the capacitor plays a crucial role in determining the behavior of the circuit and achieving the desired output. The capacitor is used to shift the DC level of a signal to a desired voltage level. The value of the capacitor is important because it determines the amount of time it takes for the capacitor to charge or discharge, which in turn determines the time it takes for the circuit to clamp the signal. A larger capacitor value will result in a longer time constant, which will result in a slower response time for the clamping circuit. Conversely, a smaller capacitor value will result in a shorter time constant and a faster response time for the clamping circuit. Different capacitor values can be used to shift the DC level of the input signal to different voltage levels. Therefore, experimentation and testing with different capacitor values is essential to achieve the desired behavior and output of the clamper circuit.

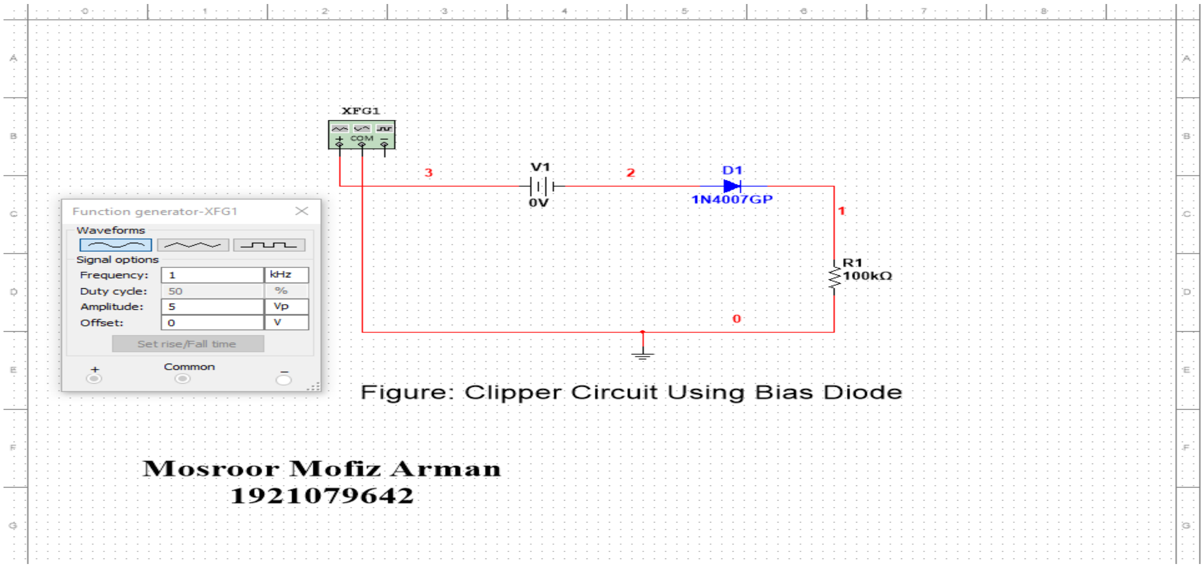
9. Discussion:

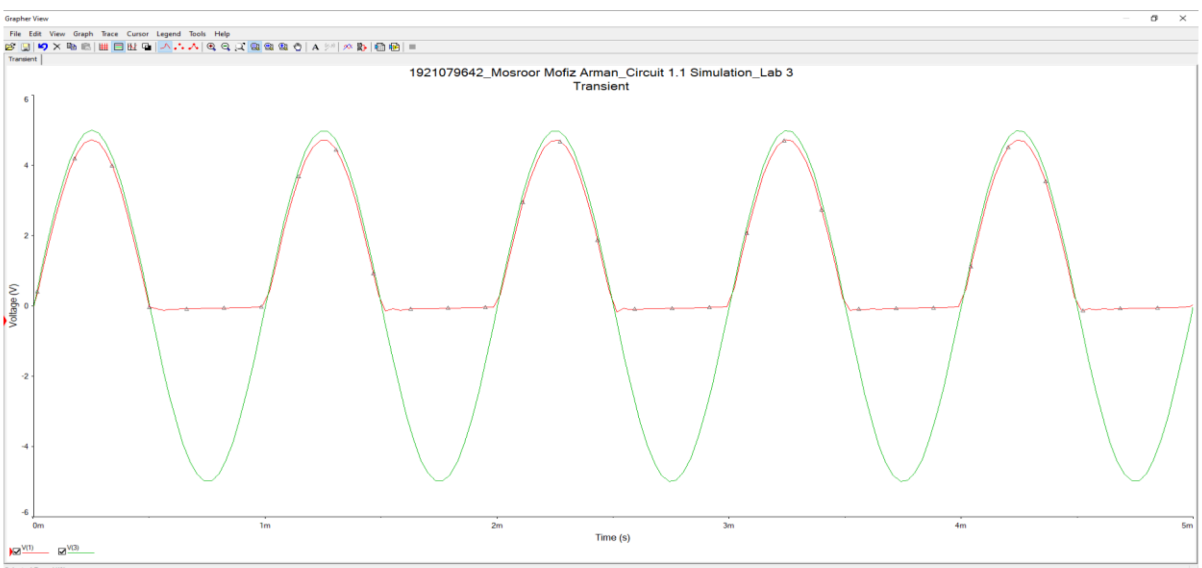
The discussion part of the experiment has been attached with the lab report.

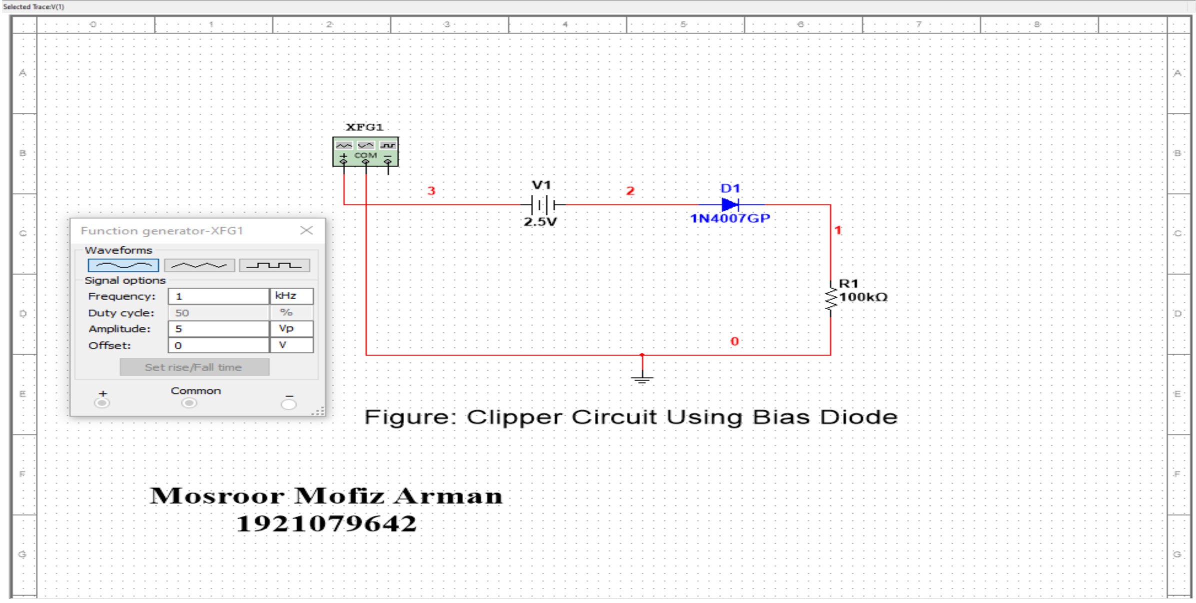
10. Experimental Data Table:

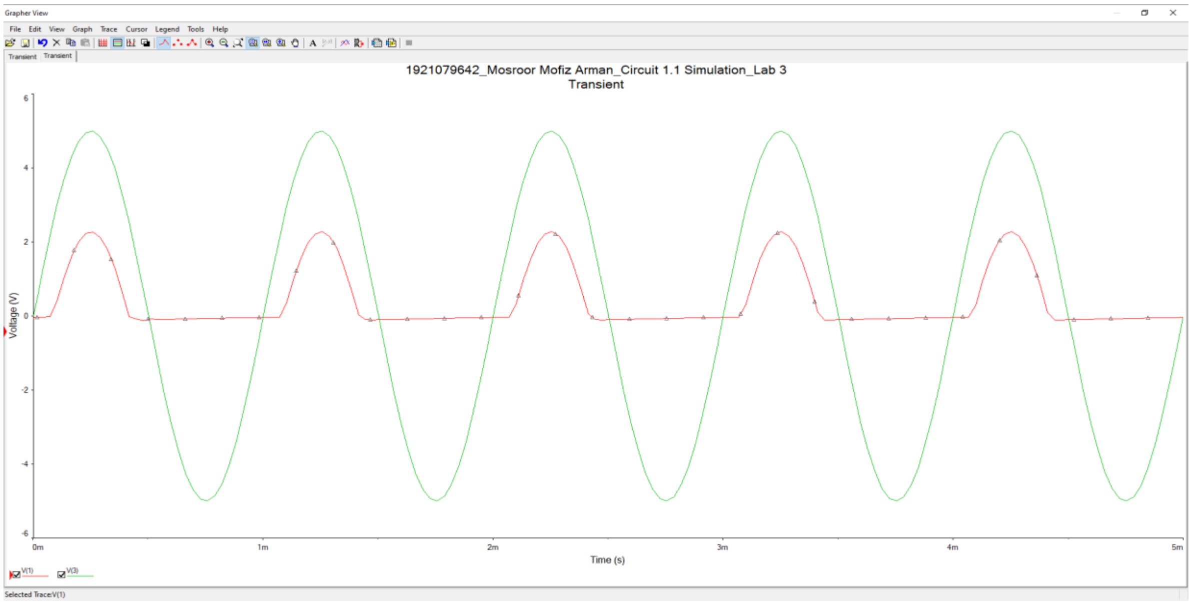
There is no experimental data table in this experiment.

11. Simulation:

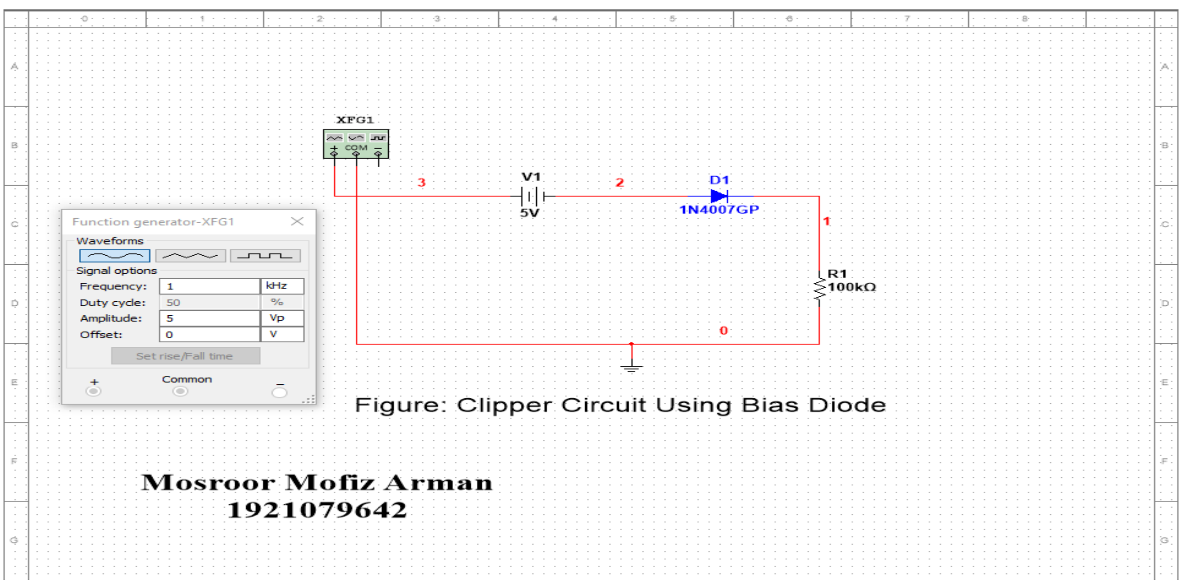




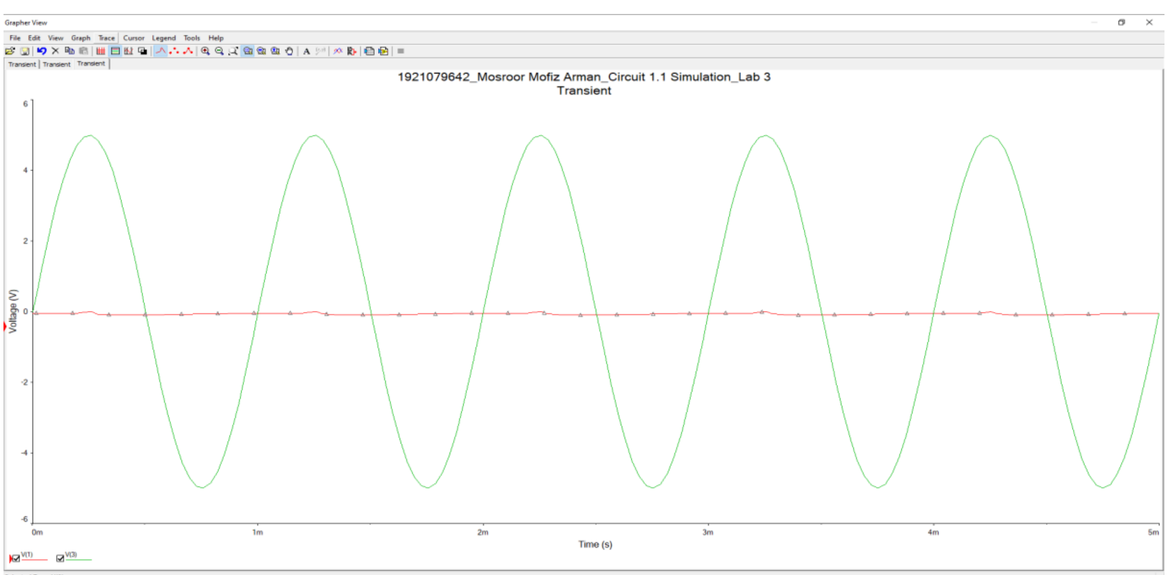




1921079642_Mosroor Mofiz Arman_Circuit 1.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)



XFG1
V1
5V
D1
1N4007GP
R1
100kΩ
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clipper Circuit Using Bias Diode
Mosroor Mofiz Arman
1921079642



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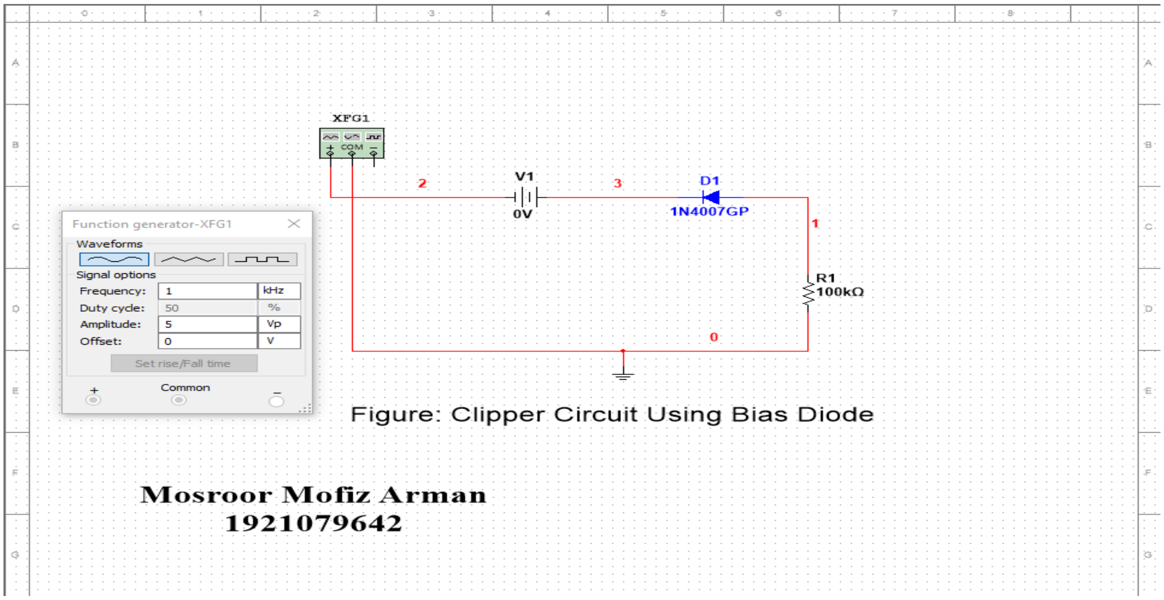
Transient
Voltage (V)
Time (s)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COM
V1
0V
D1
1N4007GP
R1
100kΩ
2
3
1
0
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clipper Circuit Using Bias Diode
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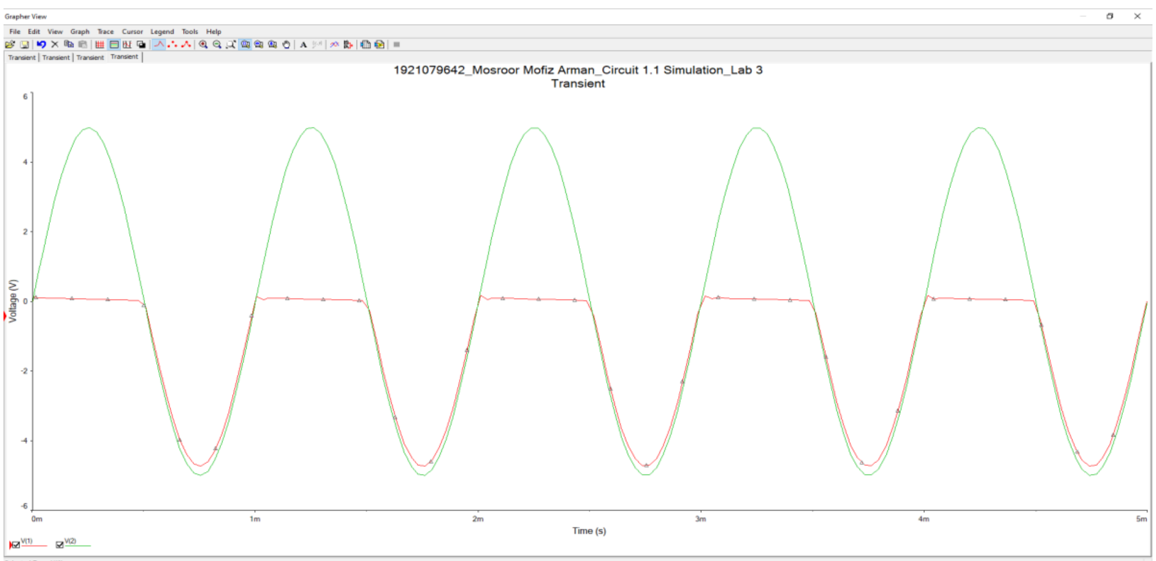
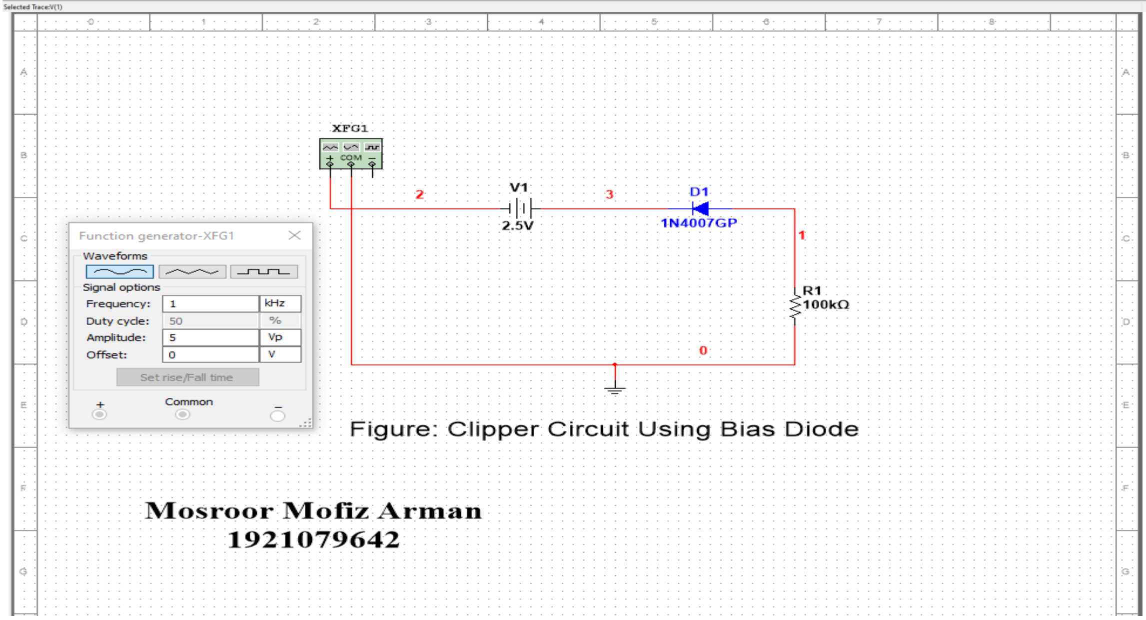

Grapher View
1921079642_Mosroor Mofiz Arman_Circuit 1.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
0m
1m
2m
3m
4m
5m
V(1)
V(2)
Selected Trace:V(1)


XFG1
COM
V1
2.5V
D1
1N4007GP
R1
100kΩ
2
3
1
0
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
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Set rise/Fall time
Common
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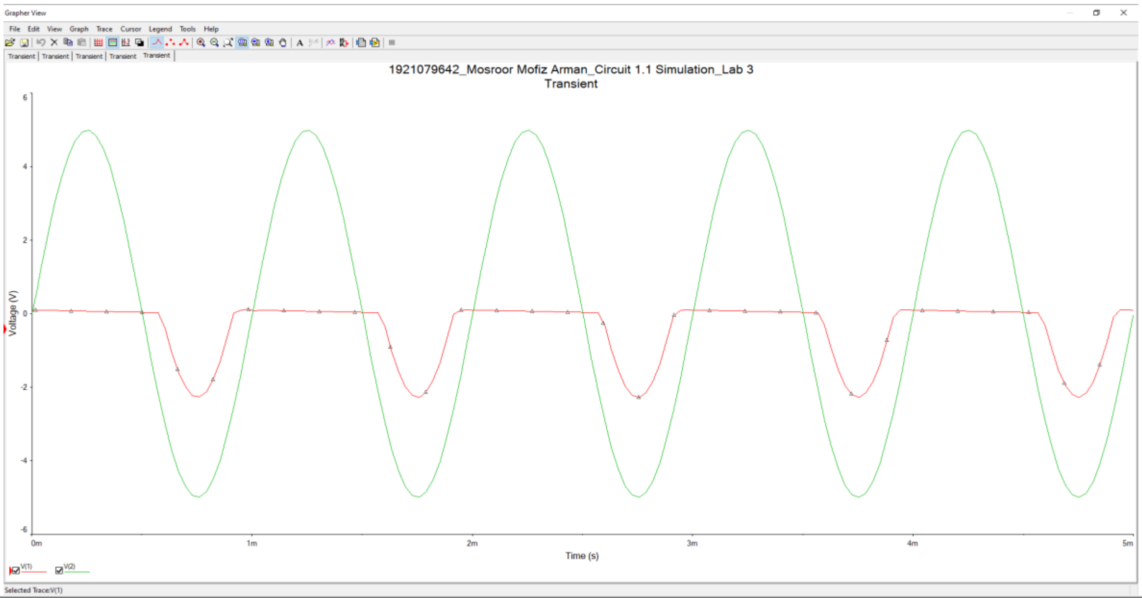


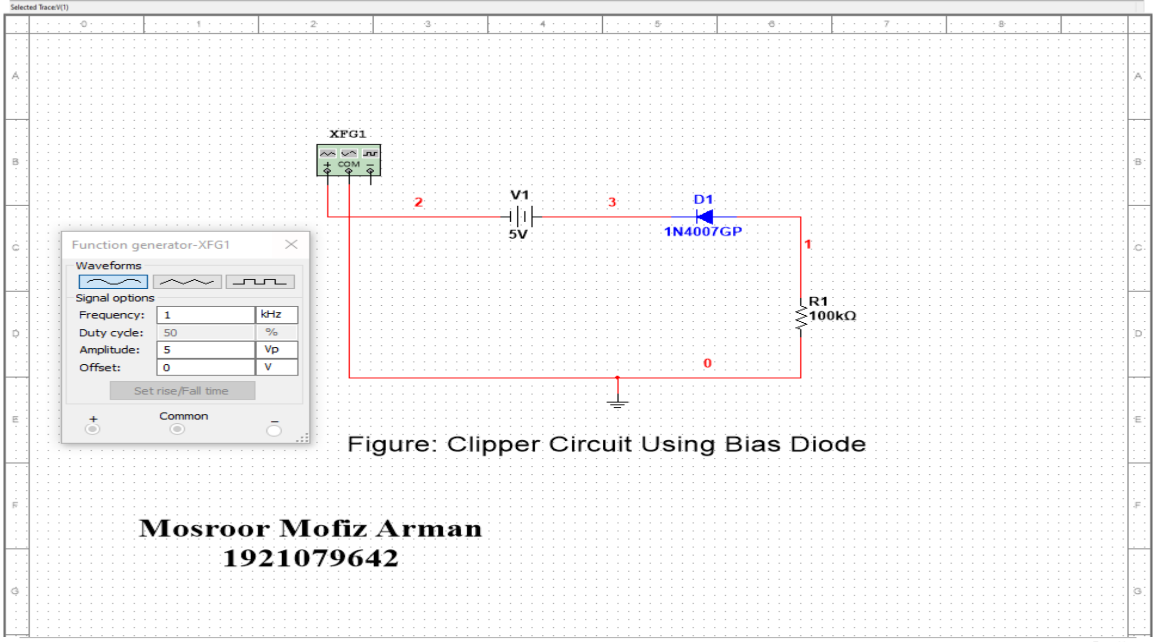
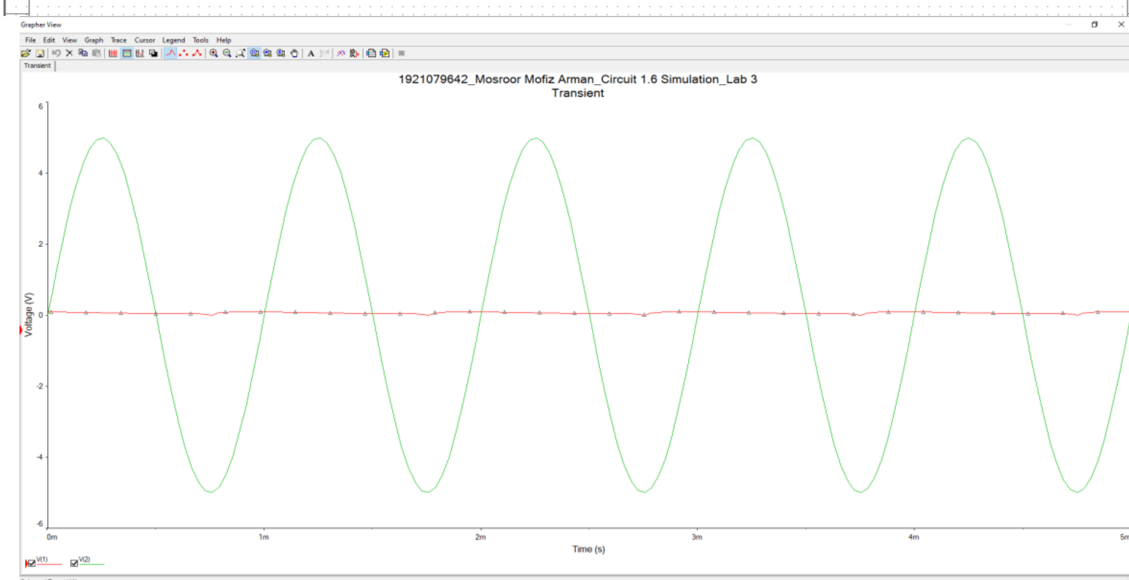
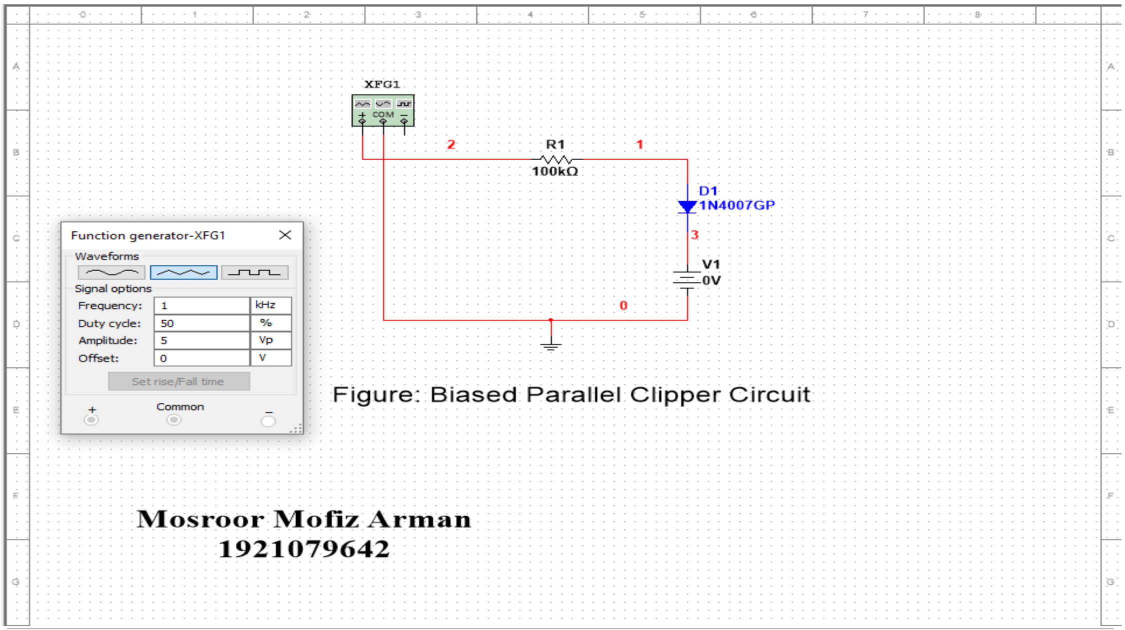
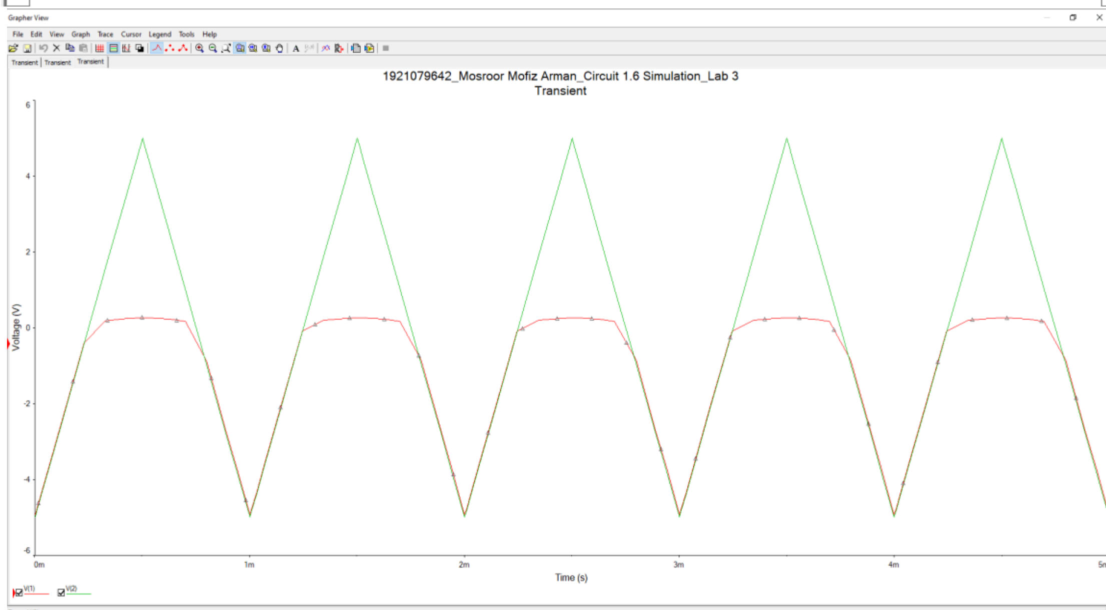
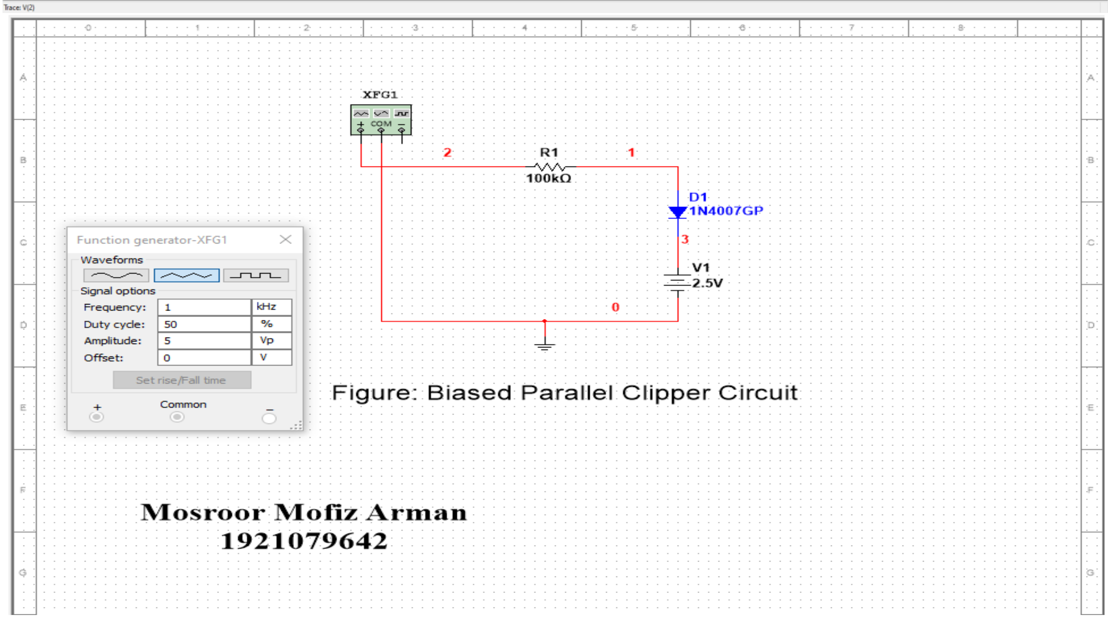


Figure: Clipper Circuit Using Bias Diode




XFG1
R1
100kΩ
D1
1N4007GP
V1
0V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Biased Parallel Clipper Circuit
Mosroor Mofiz Arman
1921079642


1921079642_Mosroor Mofiz Arman_Circuit 1.6 Simulation_Lab 3
Transient
Voltage (V)
Time (s)


XFG1
R1
100kΩ
D1
1N4007GP
V1
2.5V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Biased Parallel Clipper Circuit
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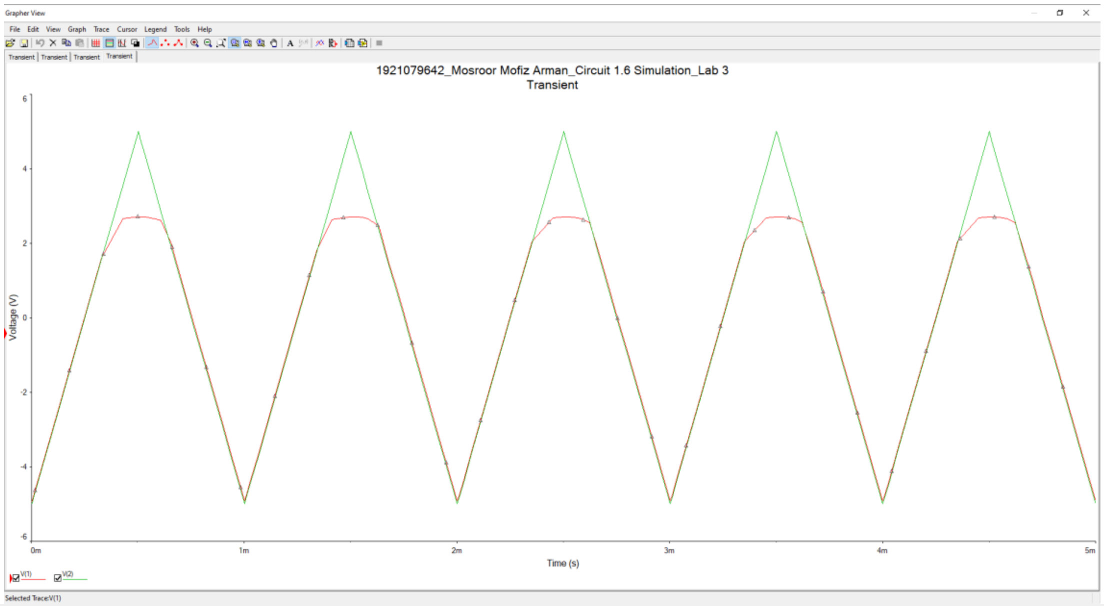


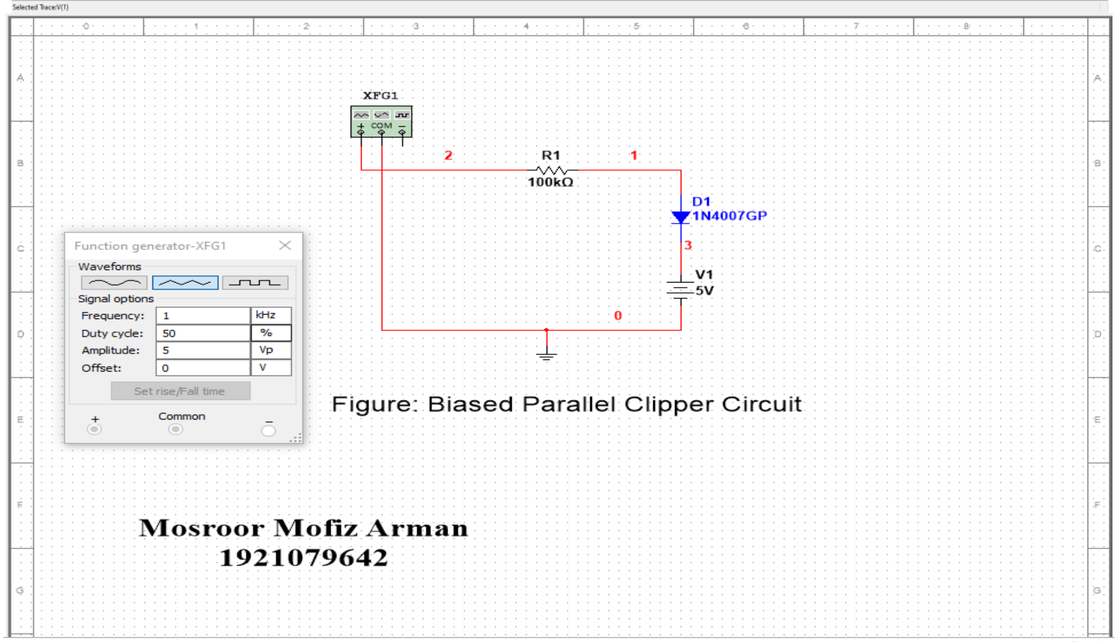
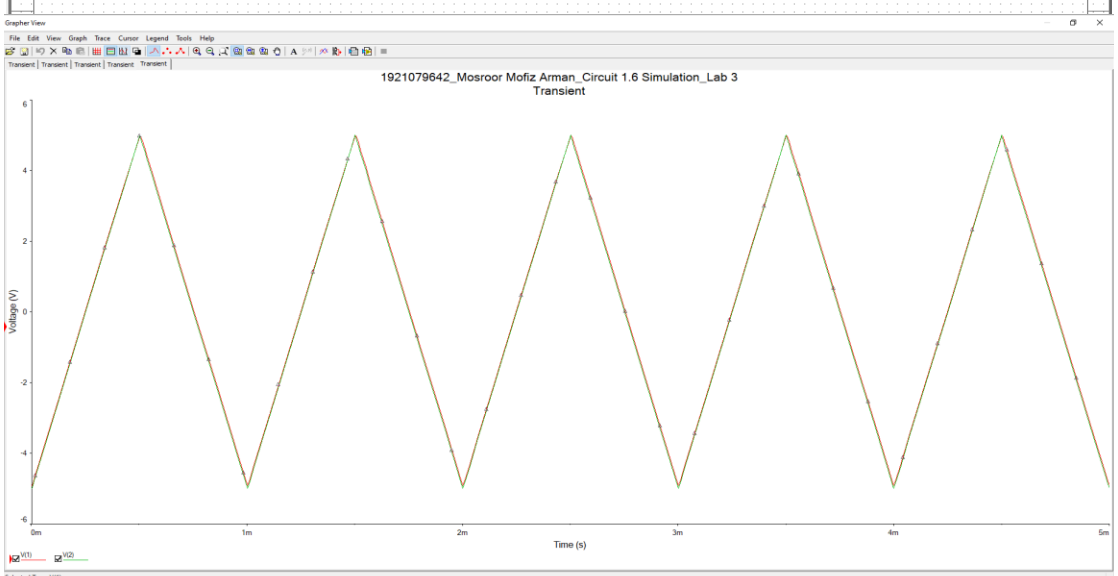
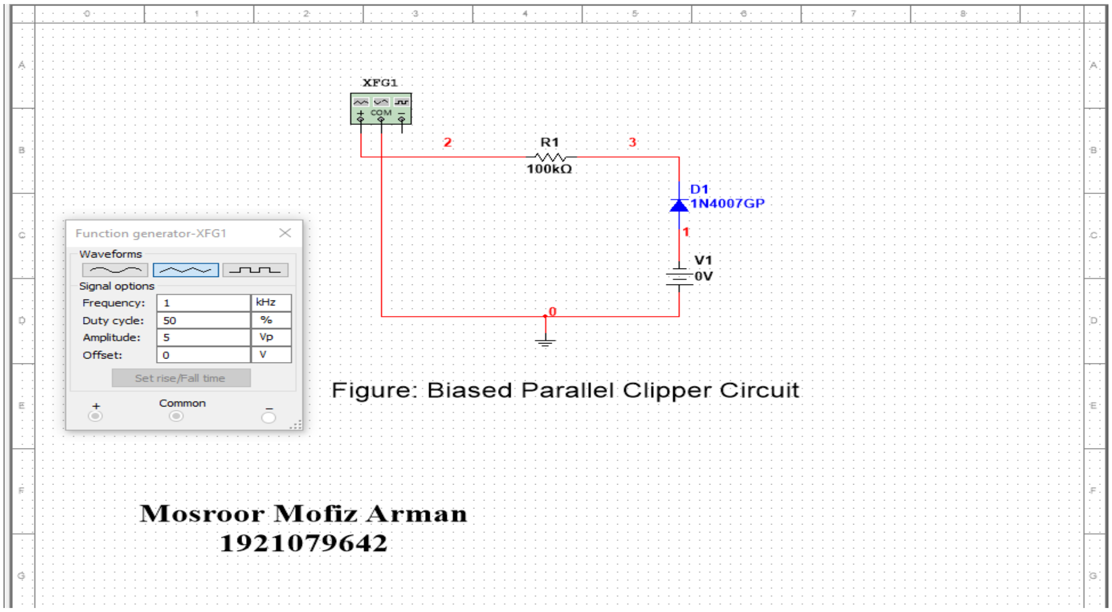


Figure: Biased Parallel Clipper Circuit




XFG1
COM
R1
100kΩ
D1
1N4007GP
V1
0V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Biased Parallel Clipper Circuit
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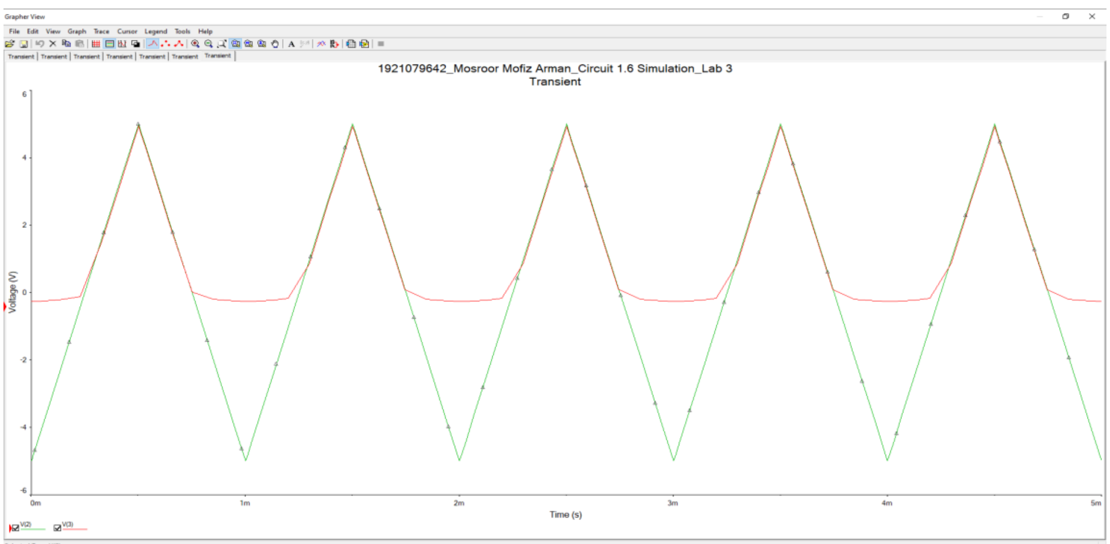
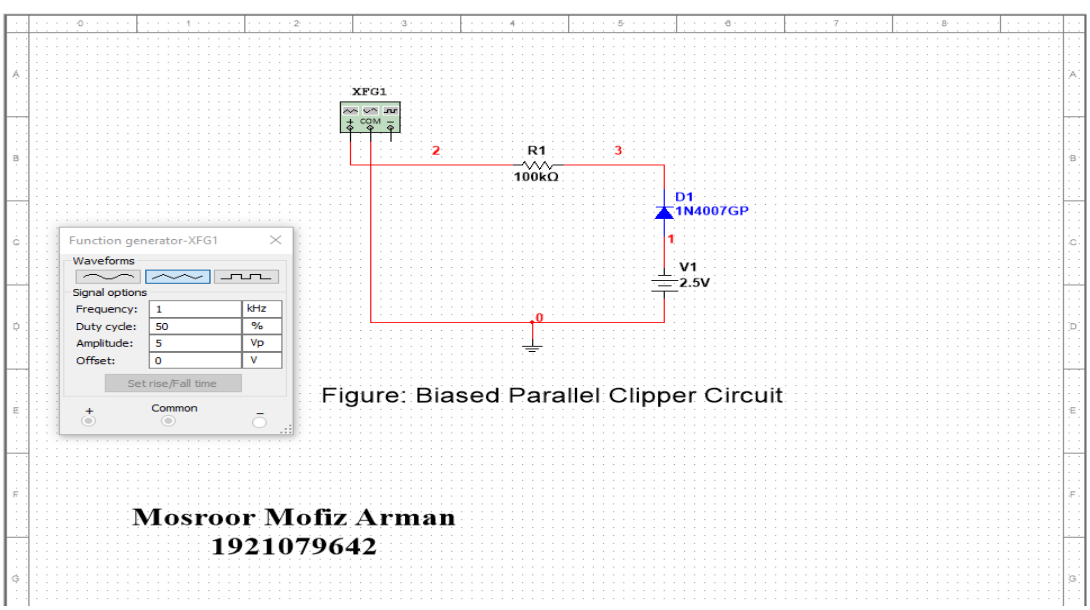

Grapher View
1921079642_Mosroor Mofiz Arman_Circuit 1.6 Simulation_Lab 3
Transient
Voltage (V)
Time (s)


XFG1
COM
R1
100kΩ
D1
1N4007GP
V1
2.5V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Biased Parallel Clipper Circuit
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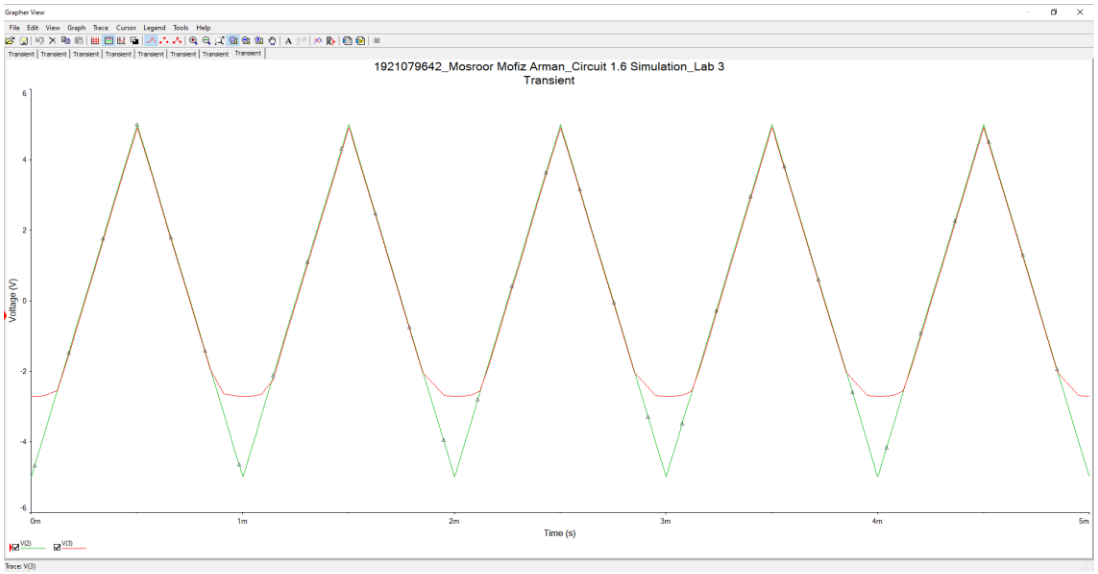
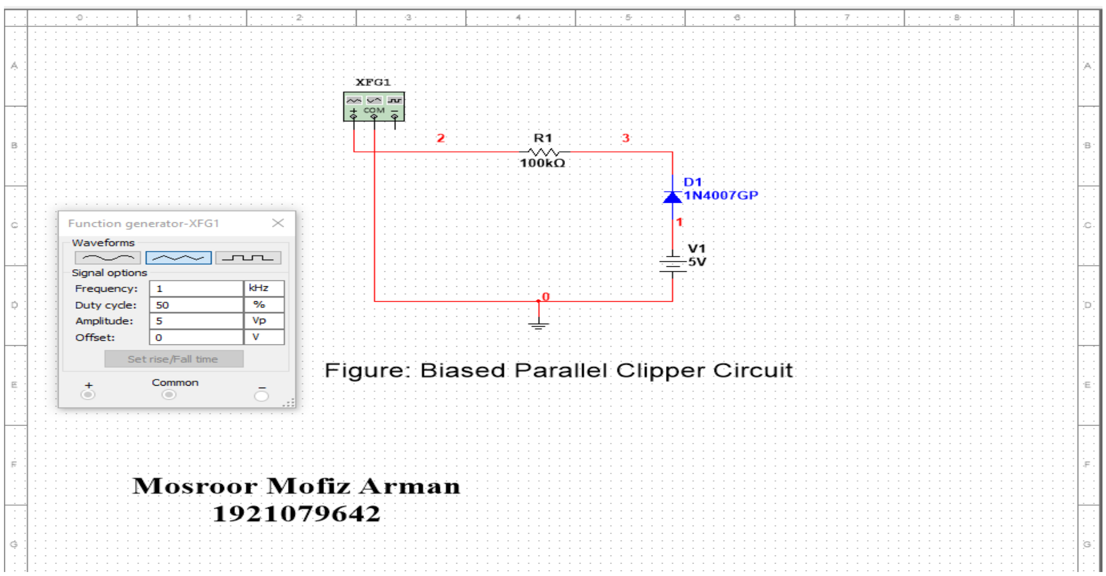

Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
1921079642_Mosroor Mofiz Arman_Circuit 1.6 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
0m
1m
2m
3m
4m
5m
V(2)
V(3)
Trace: V(3)


XFG1
COM
2
3
R1
100kΩ
D1
1N4007GP
1
V1
5V
0
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Biased Parallel Clipper Circuit
Mosroor Mofiz Arman
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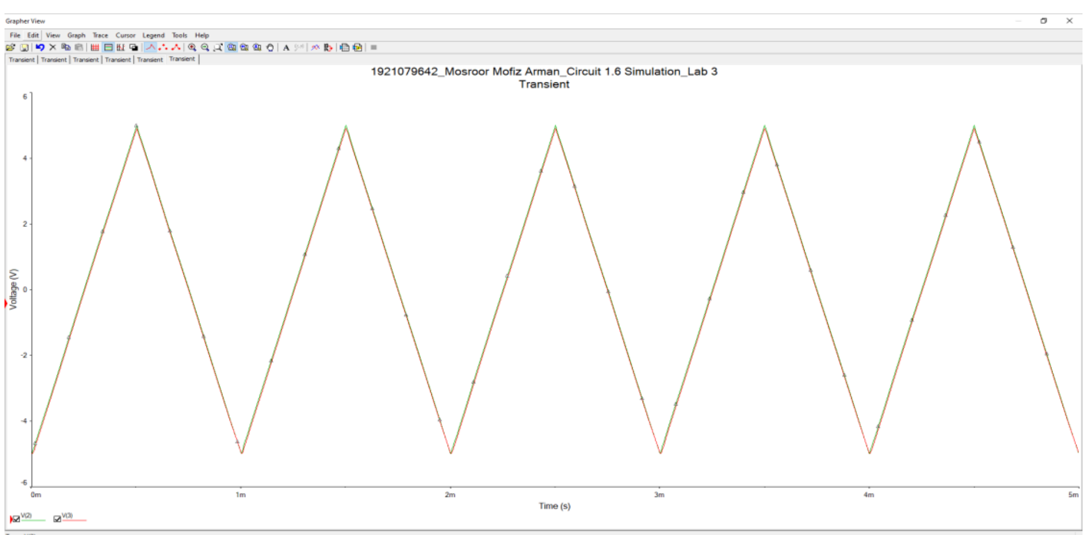
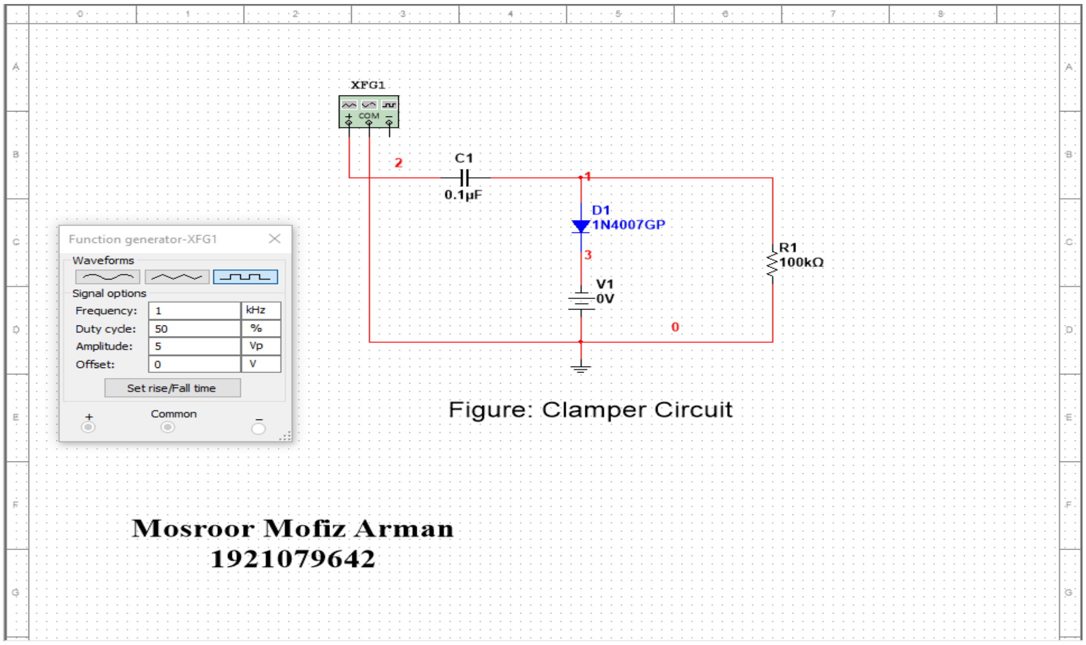
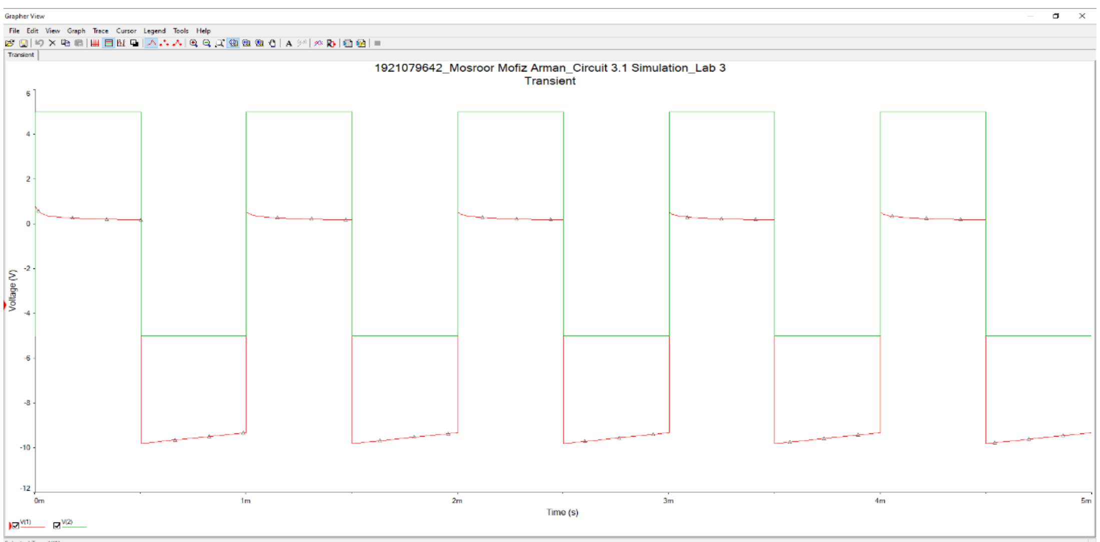
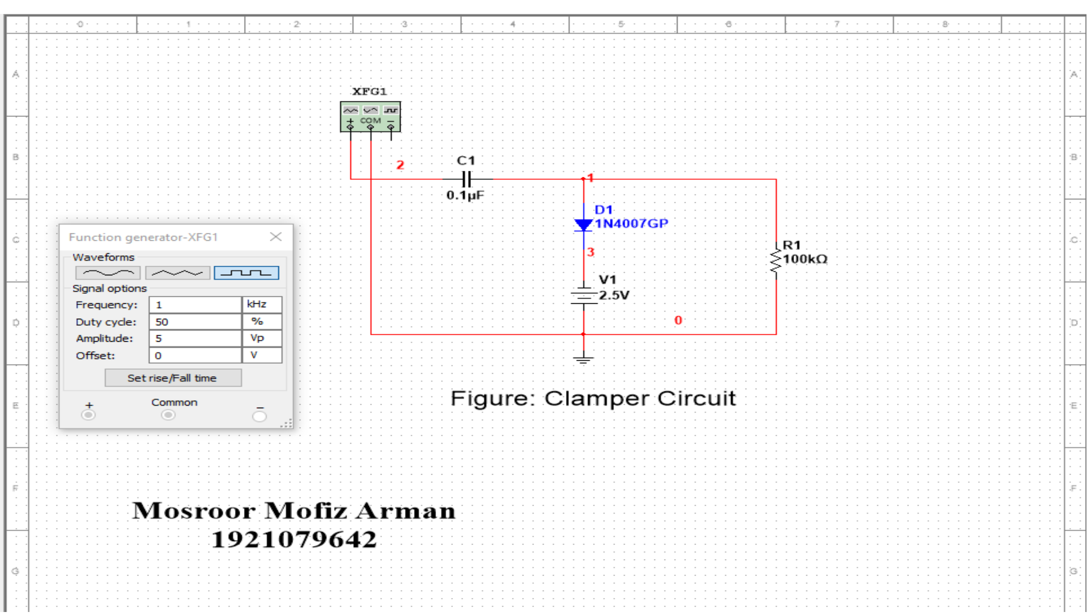

Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
1921079642_Mosroor Mofiz Arman_Circuit 1.6 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
0m
1m
2m
3m
4m
5m
V(2)
V(3)
Trace: V(3)



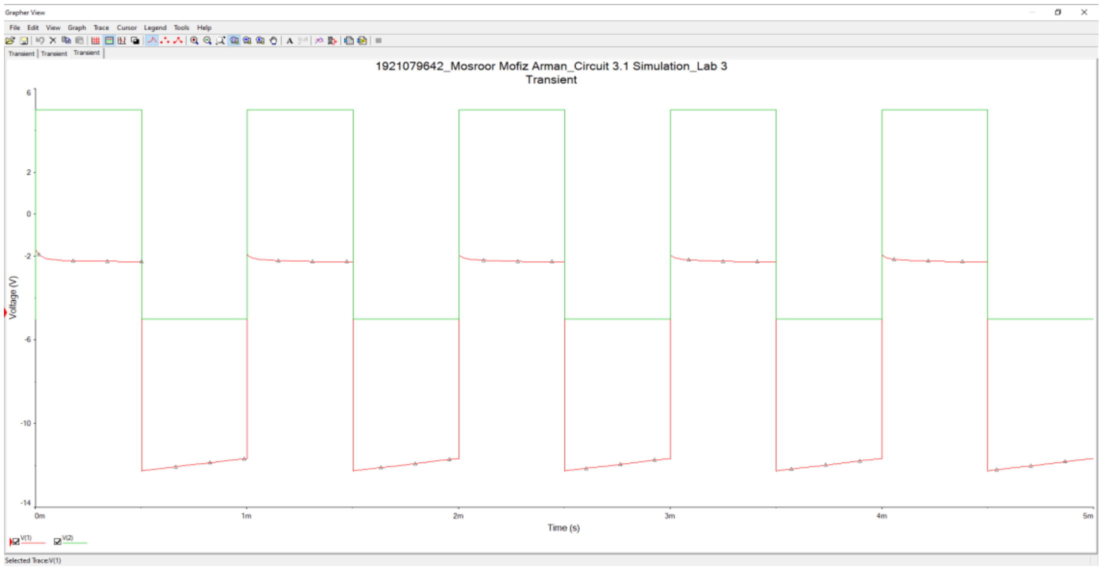
XFG1
COM
C1
0.1µF
D1
1N4007GP
R1
100kΩ
V1
0V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642

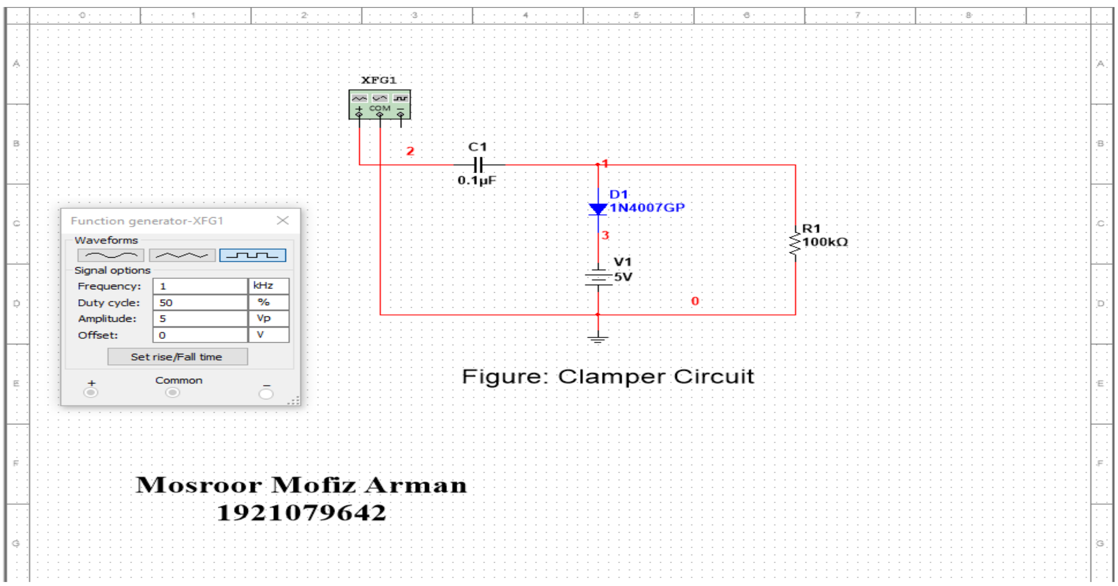


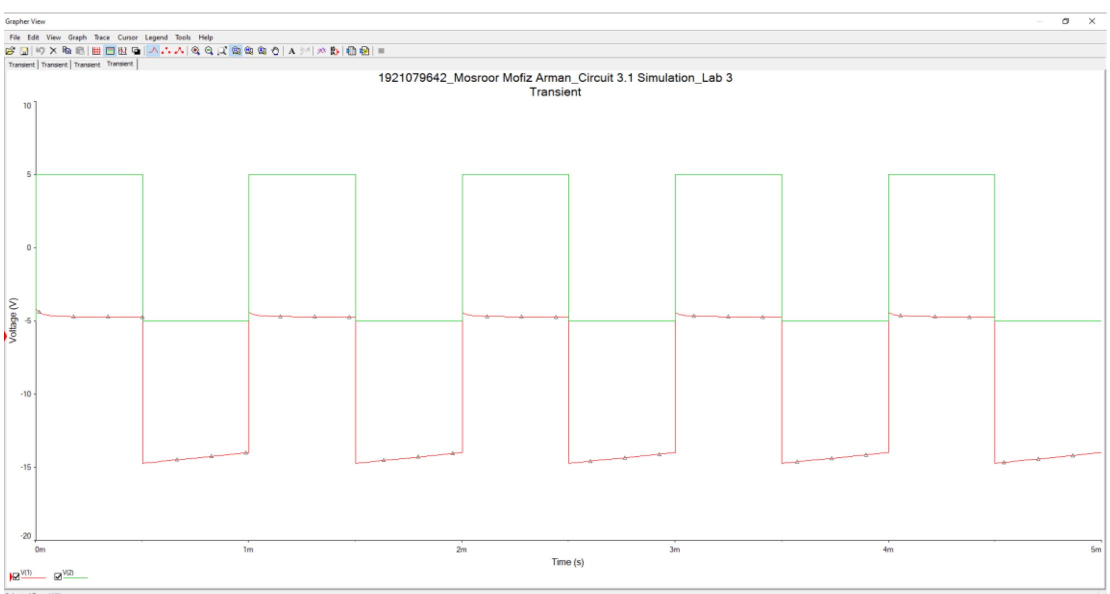
Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
Transient
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
Selected Trace:V(1)

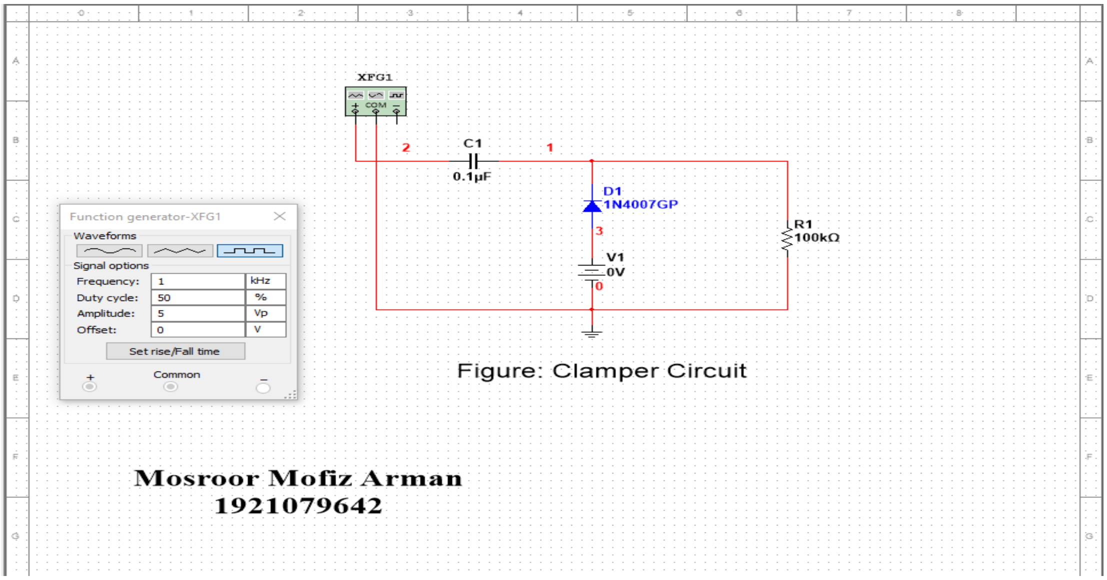


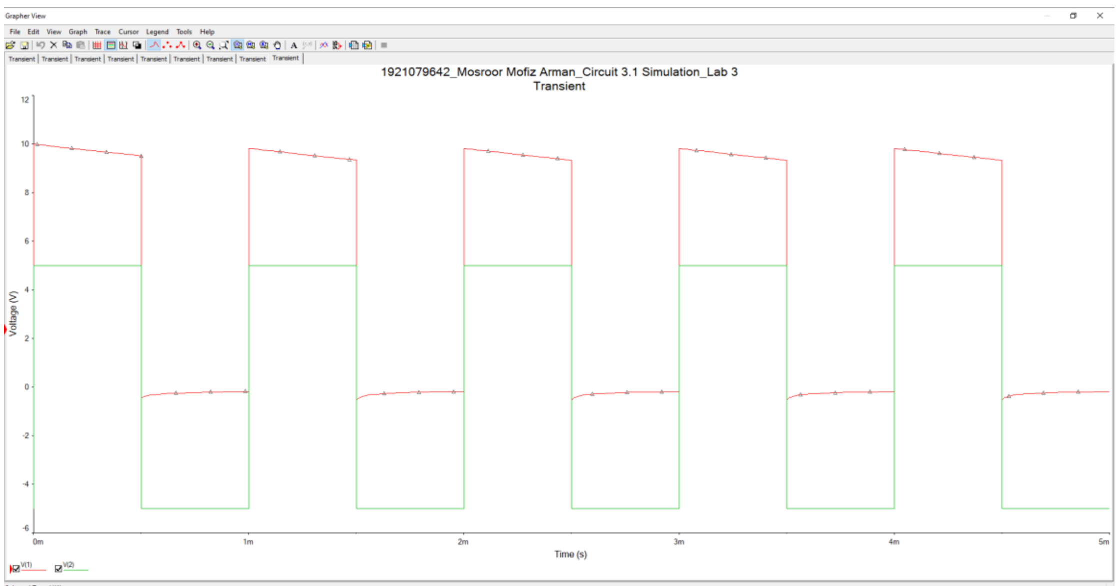
XFG1
COM
C1
0.1µF
D1
1N4007GP
R1
100kΩ
V1
2.5V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642

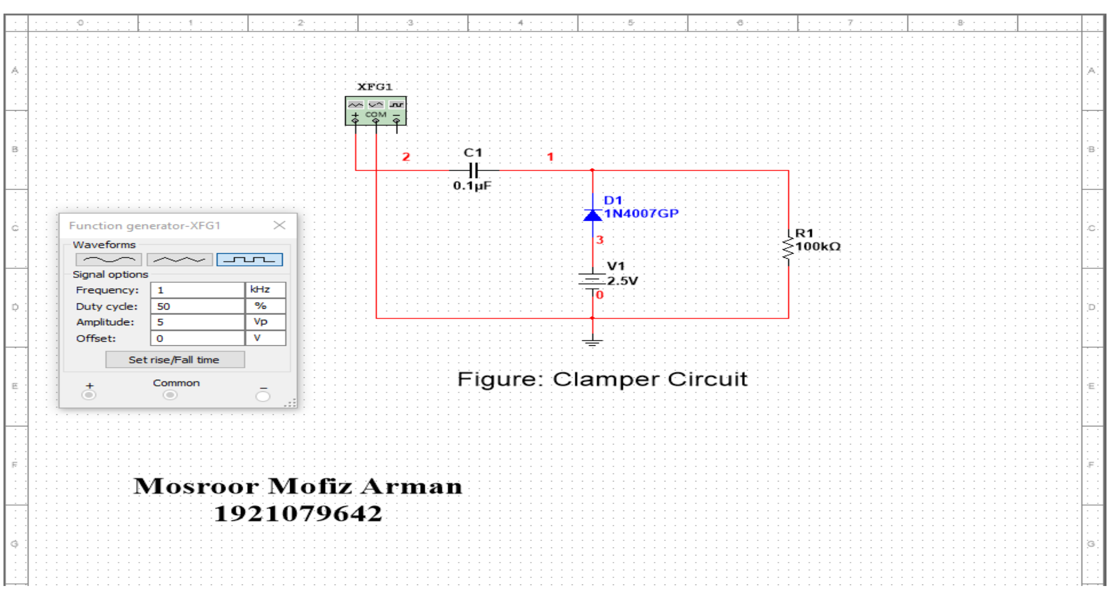

Grapher View
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
V(1)
V(2)
Selected Trace:V(1)

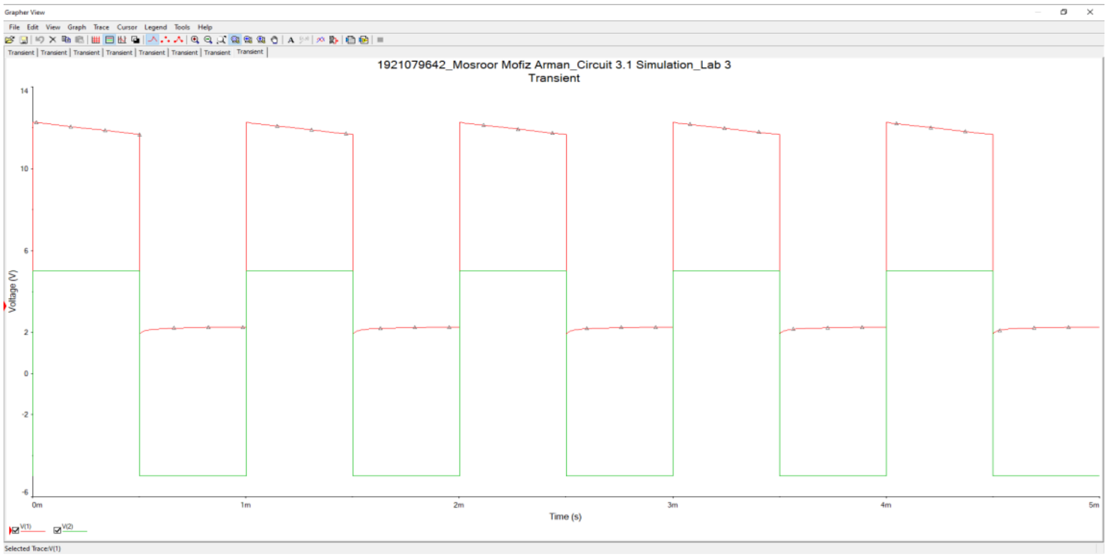

XFG1
C1
0.1µF
D1
1N4007GP
R1
100kΩ
V1
5V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642

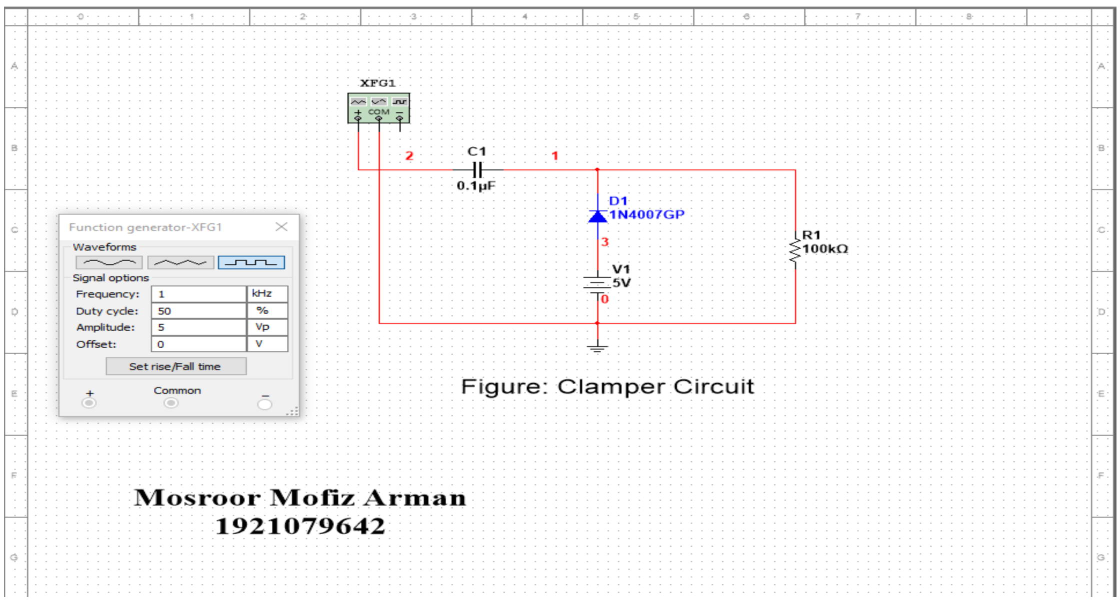

Grapher View
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
V(1)
V(2)
Selected Trace:V(1)

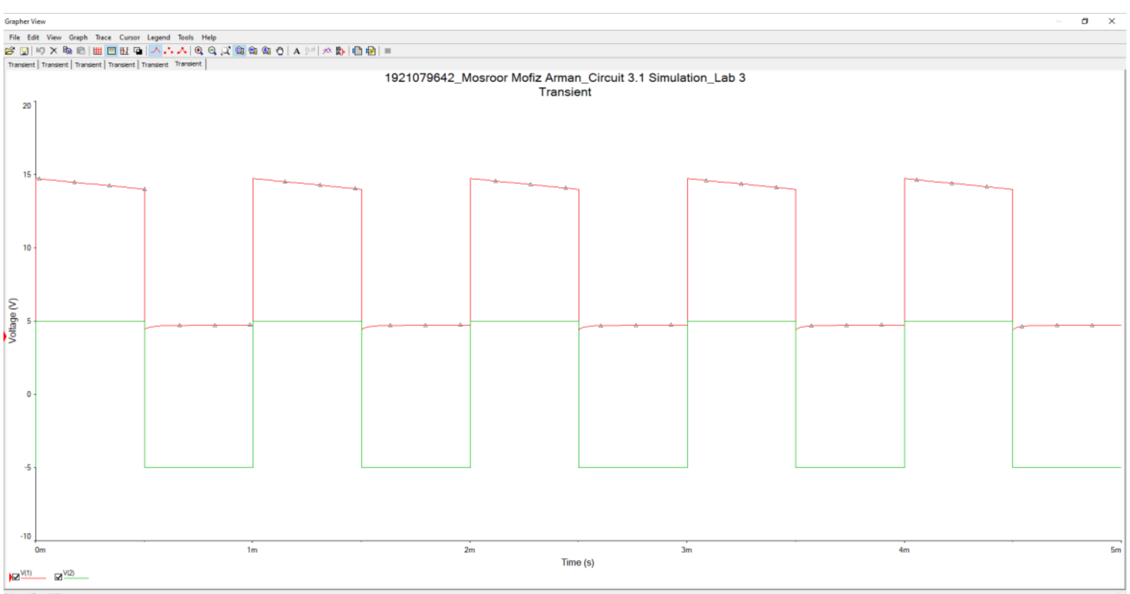

XFG1
COM
C1
0.1µF
2
1
D1
1N4007GP
3
R1
100kΩ
V1
0V
0
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642


Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
0m
1m
2m
3m
4m
5m
V(1)
V(2)
Selected Trace:V(1)


XFG1
COM
C1
0.1µF
2
1
D1
1N4007GP
3
R1
100kΩ
V1
2.5V
0
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642


Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
Selected Trace:V(1)


XFG1
COM
C1
0.1µF
D1
1N4007GP
R1
100kΩ
V1
5V
Function generator-XFG1
Waveforms
Signal options
Frequency: 1 kHz
Duty cycle: 50 %
Amplitude: 5 Vp
Offset: 0 V
Set rise/Fall time
Common
Figure: Clamper Circuit
Mosroor Mofiz Arman
1921079642


Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
1921079642_Mosroor Mofiz Arman_Circuit 3.1 Simulation_Lab 3
Transient
Voltage (V)
Time (s)
Selected Trace:V(1)