Lab Report # 4

Course Code:

EEE231

Submitted By:

Haider Ali

Registration No:

FA21-BEE-053

Submitted To:

Dr. Ali Arshad

Objectives:

Understand a Combinational Clipper and verify its results practically as well through software

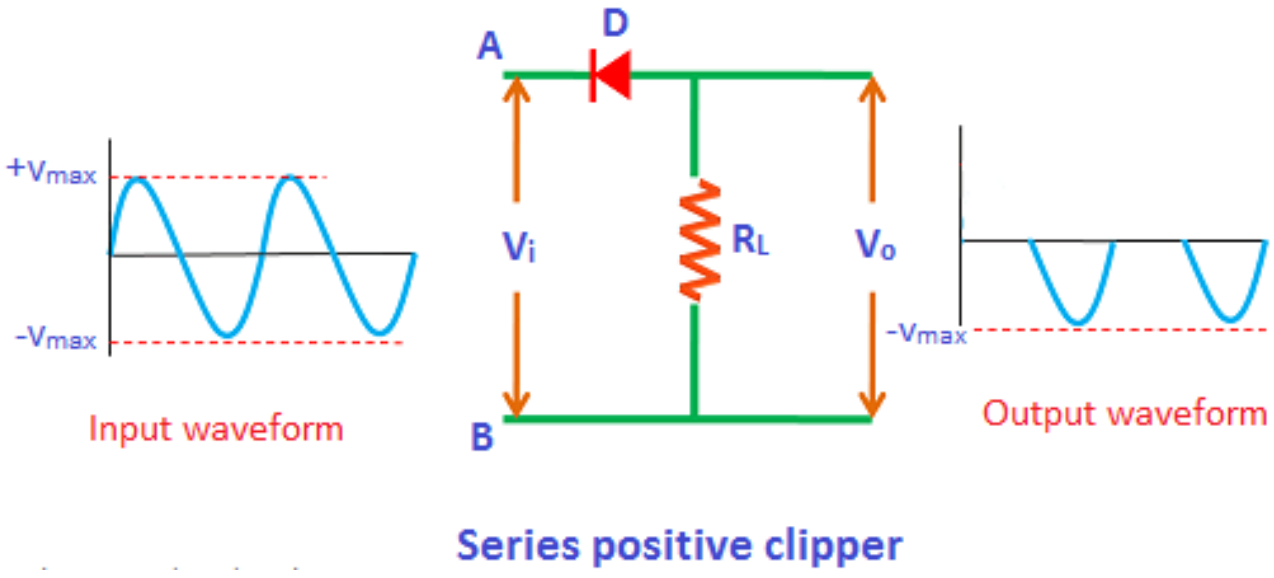
Simulation.

- Describe diode clipper operating characteristics.
- To use a positive clipping circuit.
- To use a negative clipping circuit.

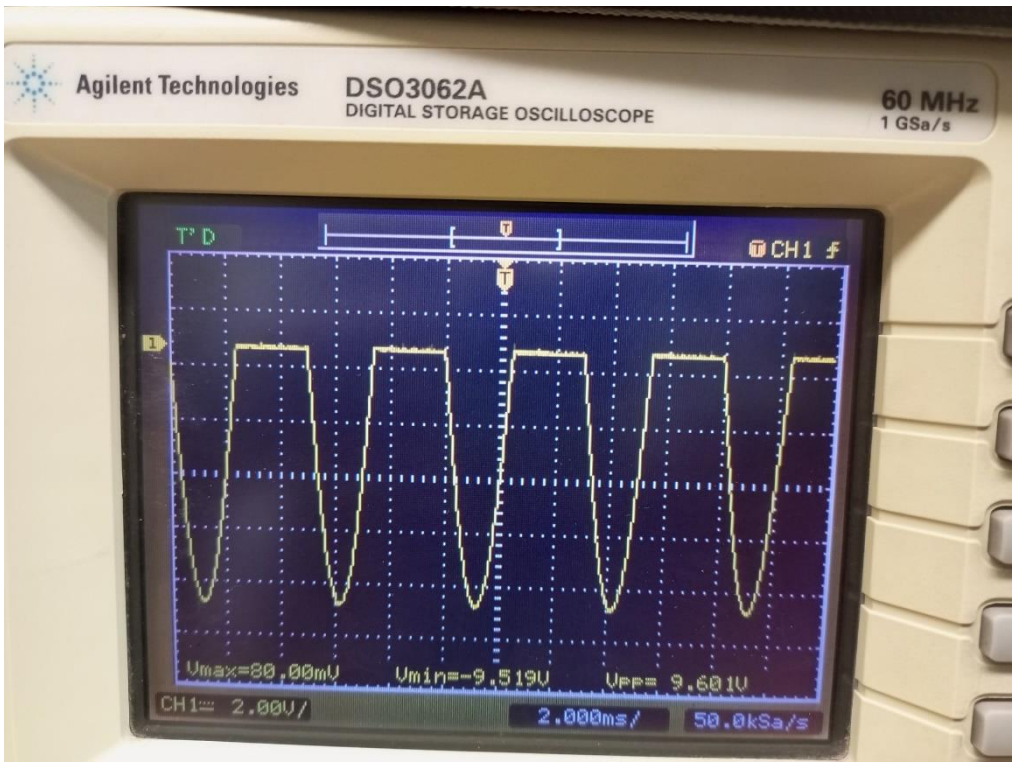
LAB TASKS

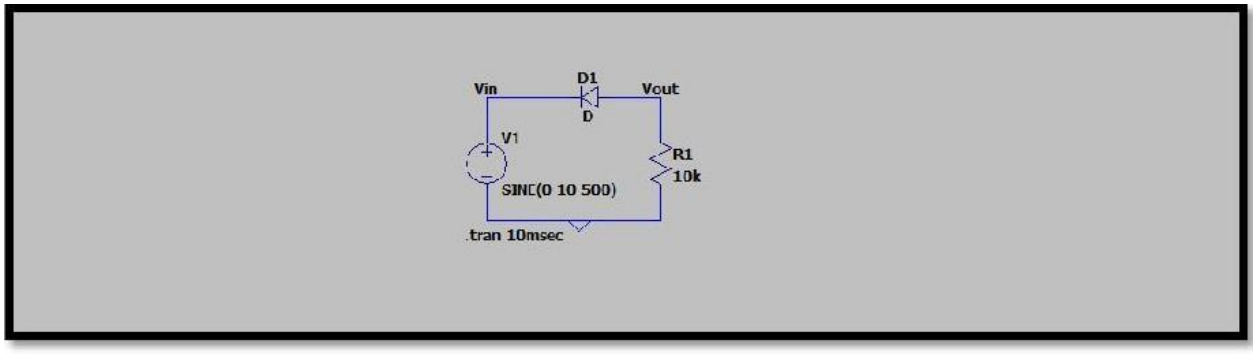
Task 1:

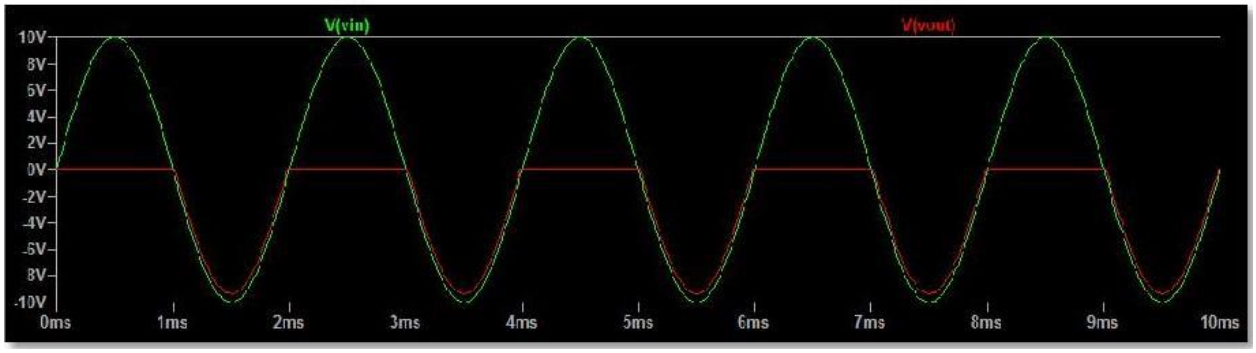
Series Positive Clippers:



Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
CH1
Vmax=80.00mV
Vmin=-9.519V
VPP= 9.601V
CH1 2.00V/
2.000ms/
50.0kSa/s


Vin
D1
D
Vout
V1
SINE(0 10 500)
R1
10k
.tran 10msec


V(vin)
V(vout)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
1ms
2ms
3ms
4ms
5ms
6ms
7ms
8ms
9ms
10ms

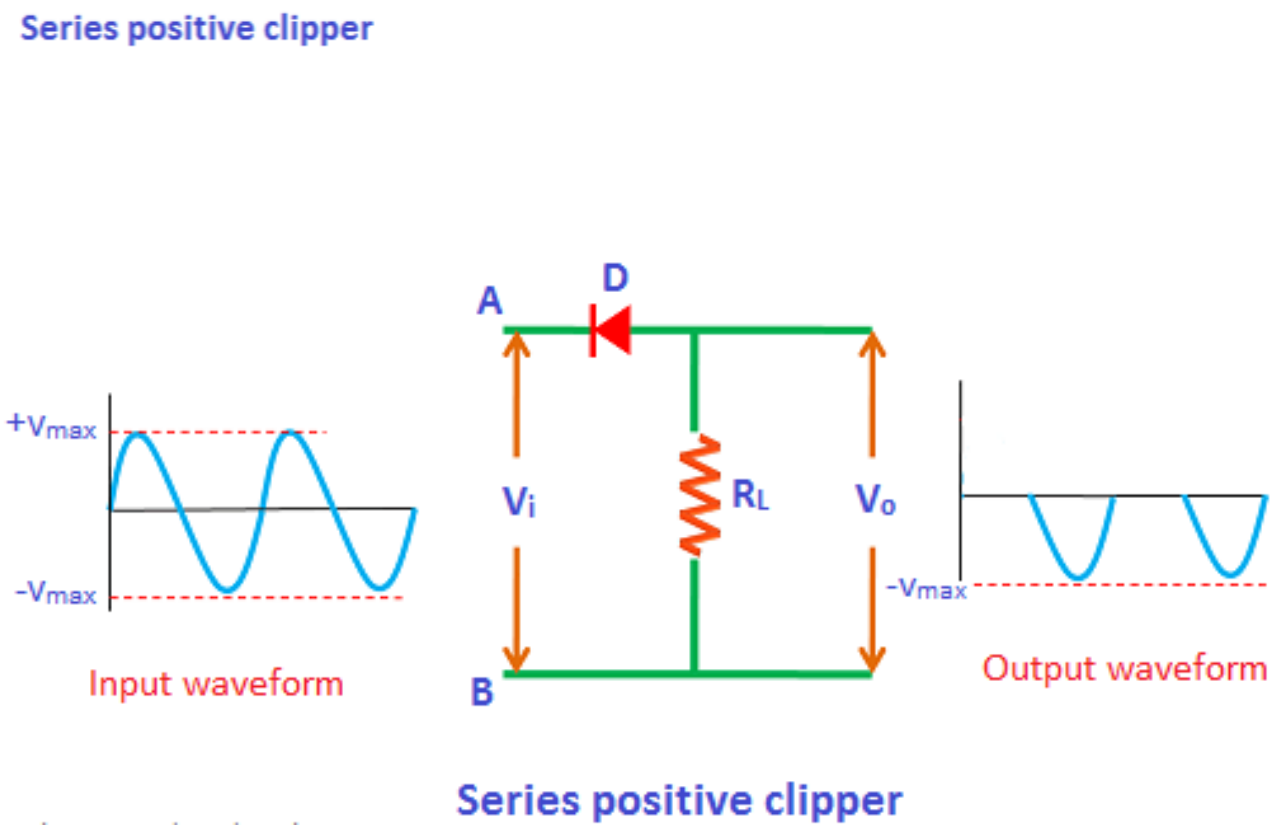
Analysis about series positive clippers:

In this circuit the diode is in series with the output load resistance, then the clipper is said to be a

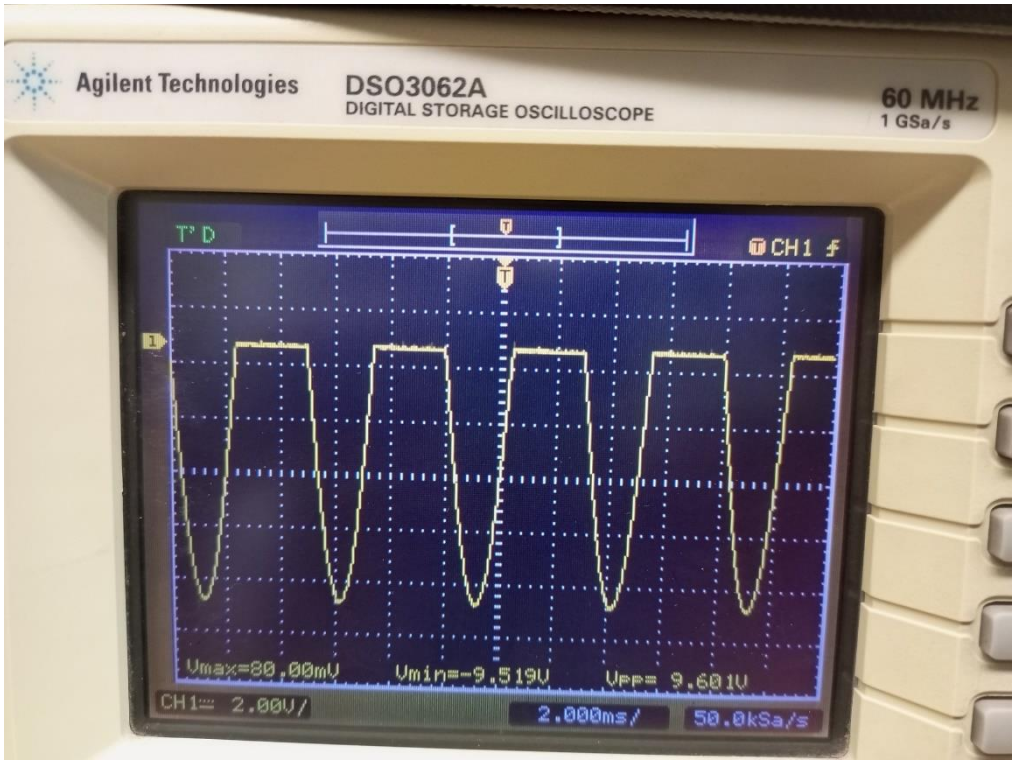
Series positive clipper. During positive half cycle then the diode is said to be reverse biased.

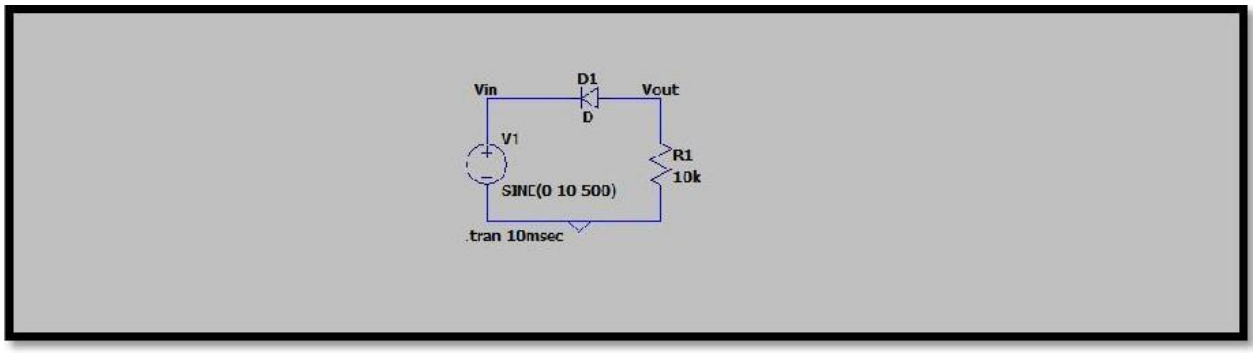
We can say that series positive clipper removes the series of positive half cycles.

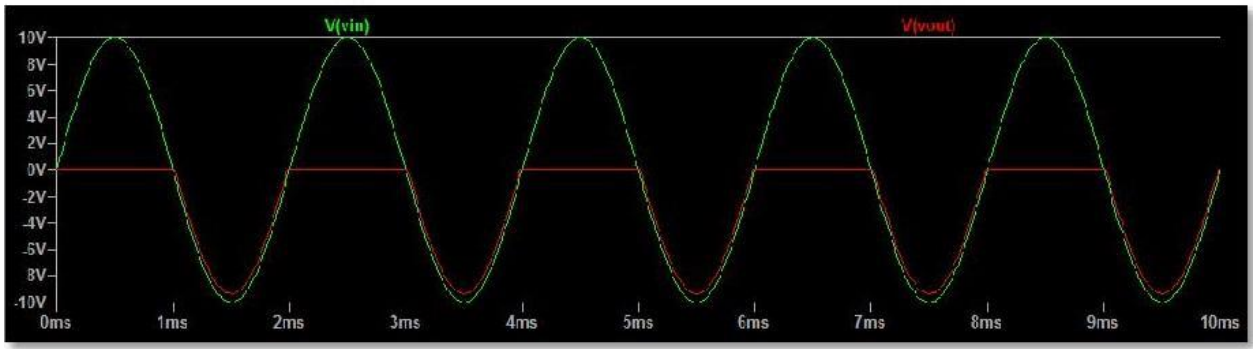
Task 2:



Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
CH1
Vmax=80.00mV
Vmin=-9.519V
Vpp= 9.601V
CH1 2.00V/
2.000ms/
50.0kSa/s


Vin
D1
D
Vout
V1
SINE(0 10 500)
R1
10k
.tran 10msec


V(vin)
V(vout)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
1ms
2ms
3ms
4ms
5ms
6ms
7ms
8ms
9ms
10ms

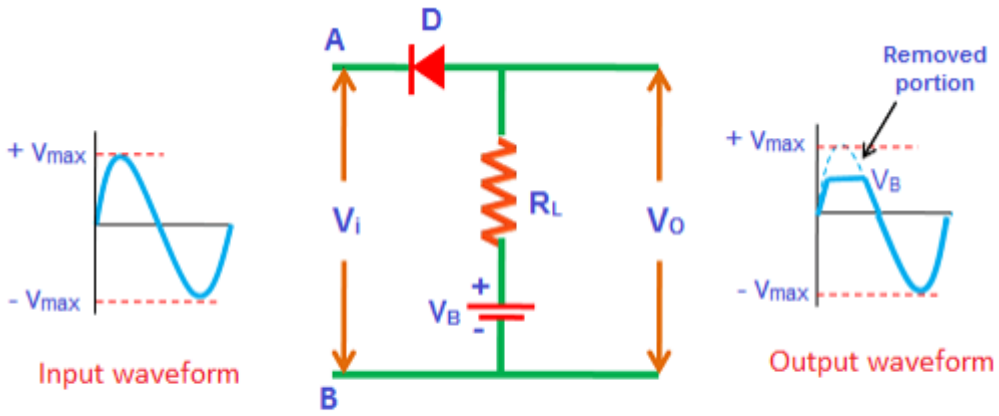
Analysis about series positive clippers:

In this circuit the diode is in series with the output load resistance, then the clipper is said to

be a Series positive clipper. During positive half cycle then the diode is said to be reverse biased.We can say that series positive clipper removes the series of positive half cycles.

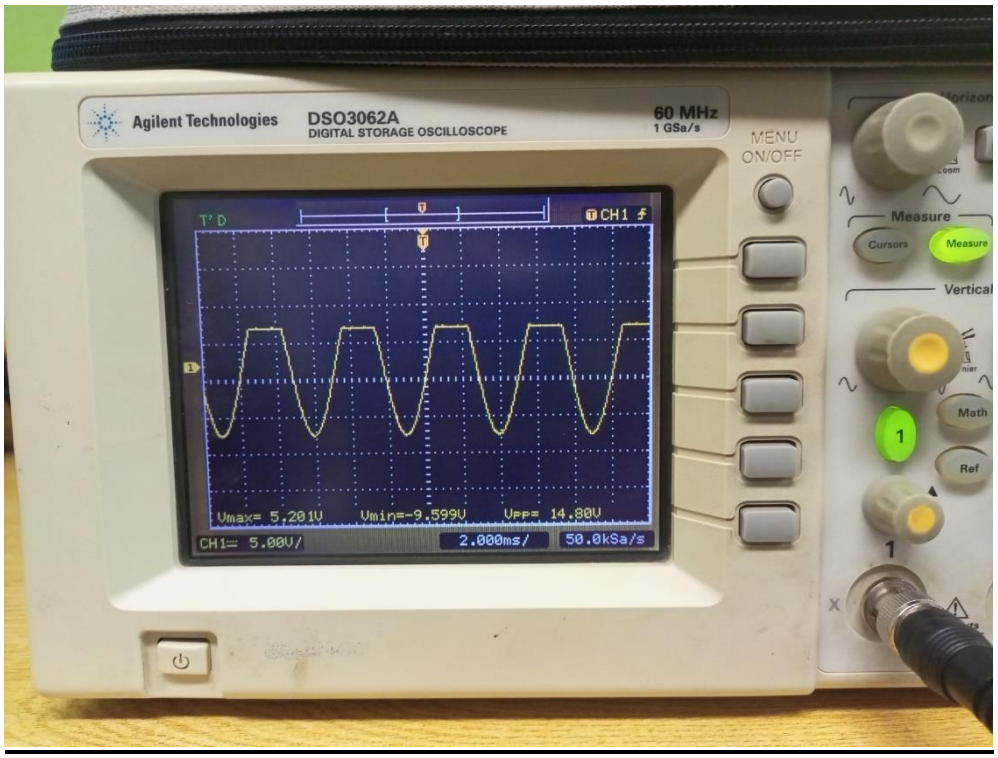
Task 3:

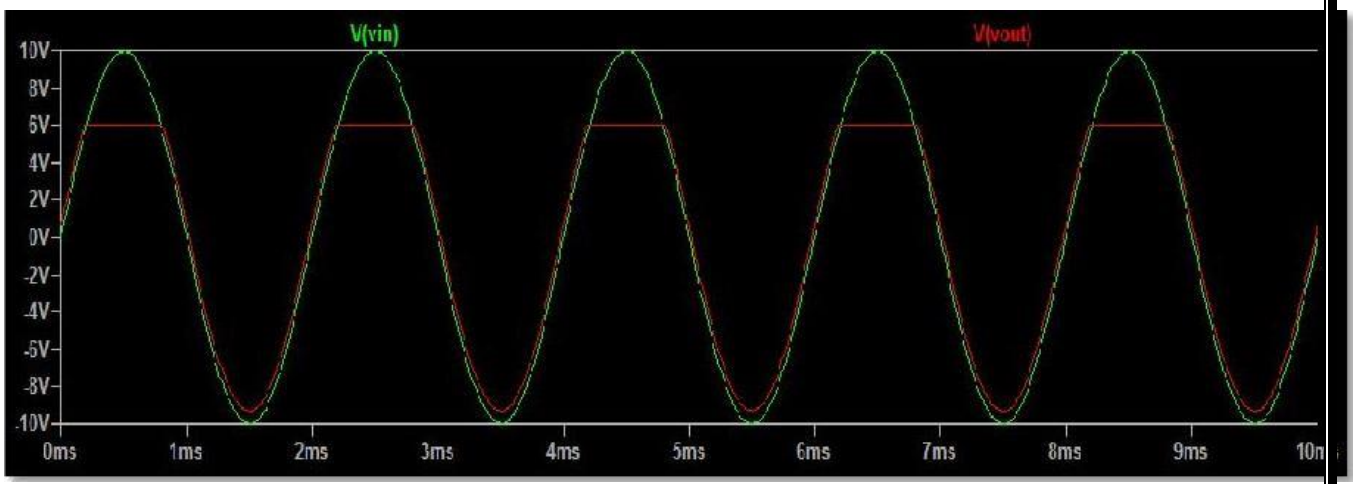
Series positive clipper with positive bias



Series positive clipper with positive bias

Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
CH1
Measure
Cursors
Measure
Vertical
Math
Ref
Vmax= 5.201V
Vmin=-9.599V
VPP= 14.80V
CH1 5.00V/
2.000ms/
50.0kSa/s


V(vin)
V(vout)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
1ms
2ms
3ms
4ms
5ms
6ms
7ms
8ms
9ms

Analysis about series positive clipper with positive bias:

During the positive half cycle then the diode is said to be reverse biased. Therefore, the diode is

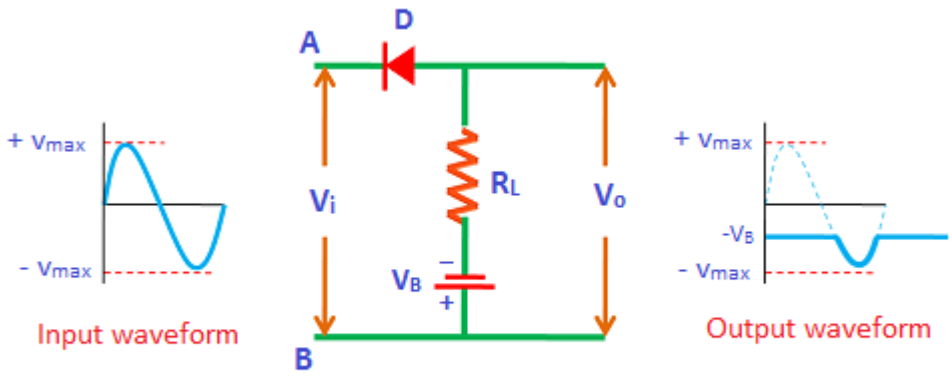
reverse biased by the input supply voltage V_i. During the negative half cycle the diode is forward

Biased by both battery voltage V_B and input supply voltage V_i. We can say that series positive

Clipper with positive bias removes a small portion of positive half cycles.

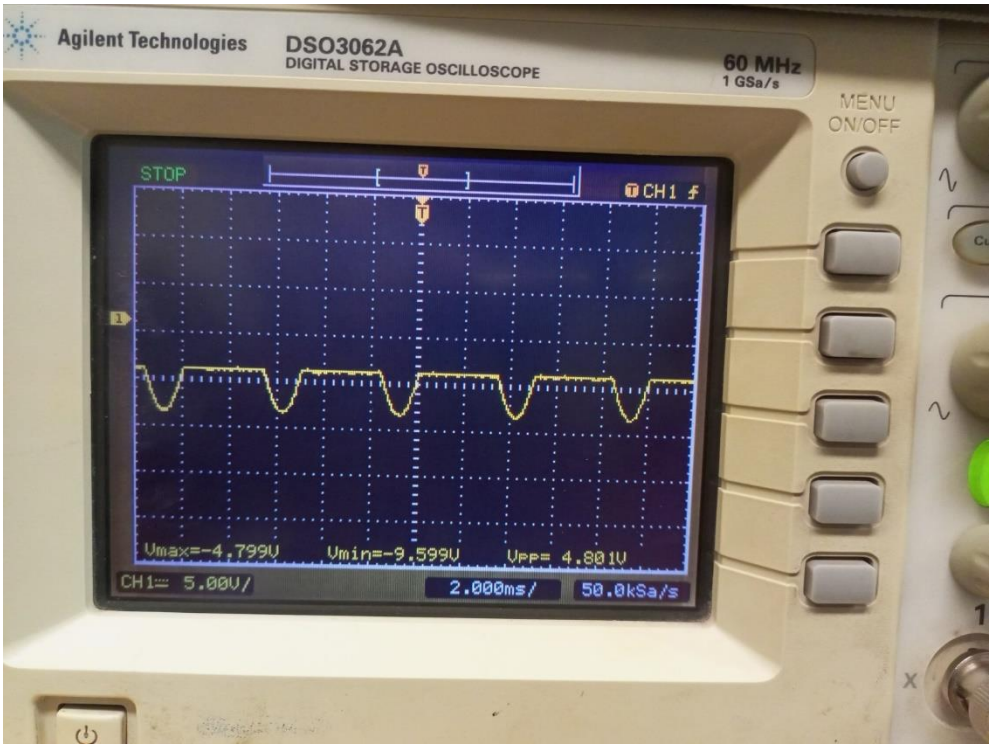
Tasks 4:

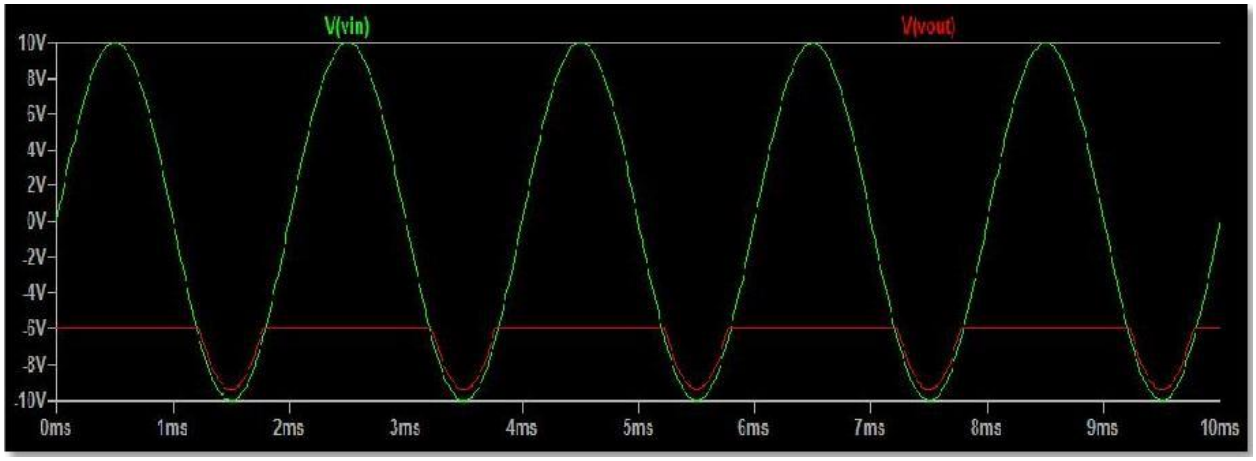
Series positive clipper with negative bias



Series positive clipper with negative bias

Output:

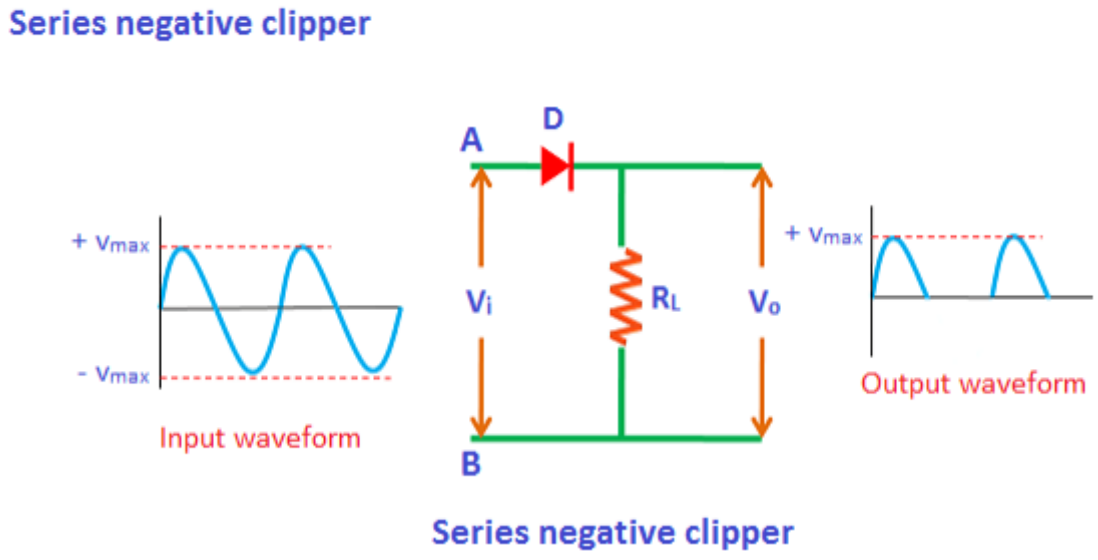

Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
STOP
CH1
Vmax=-4.799V
Vmin=-9.599V
Vpp= 4.801V
CH1 5.00V/
2.000ms/
50.0kSa/s



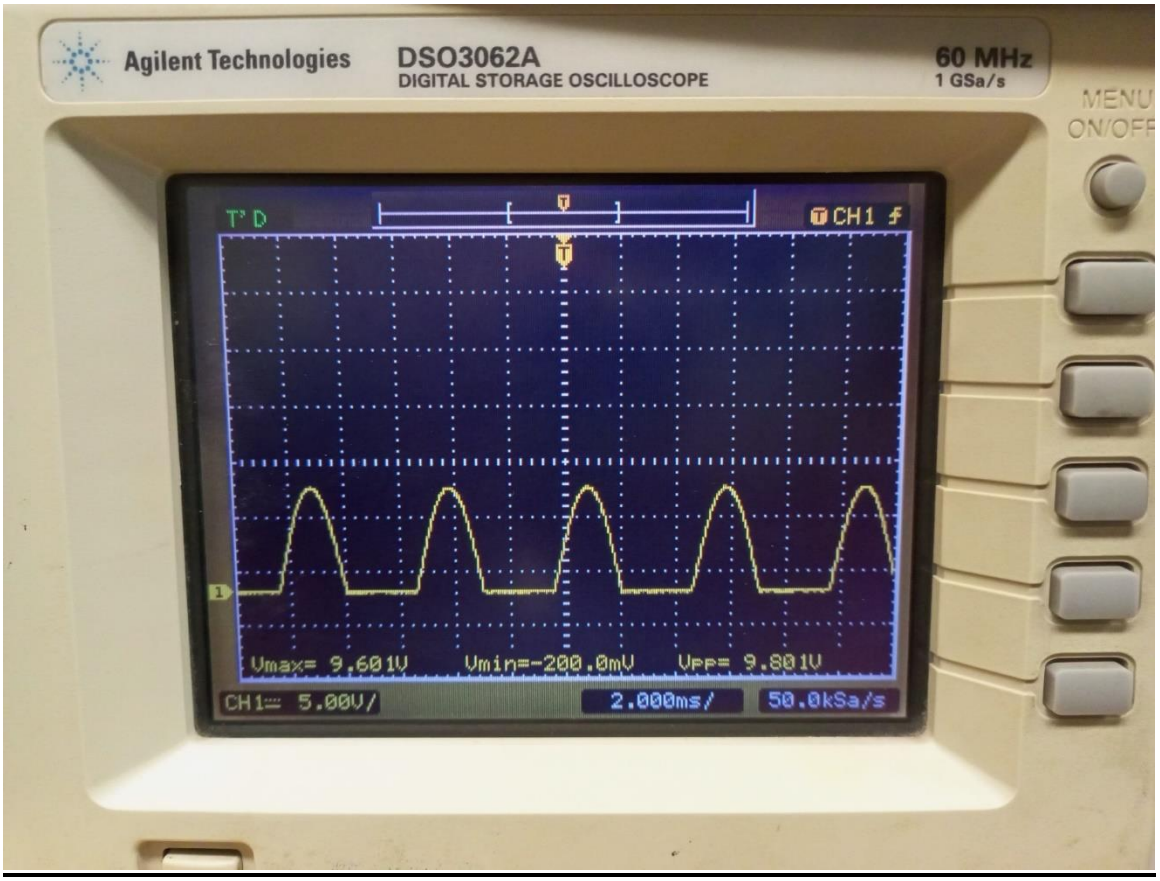
Analysis about series positive clipper with negative bias:

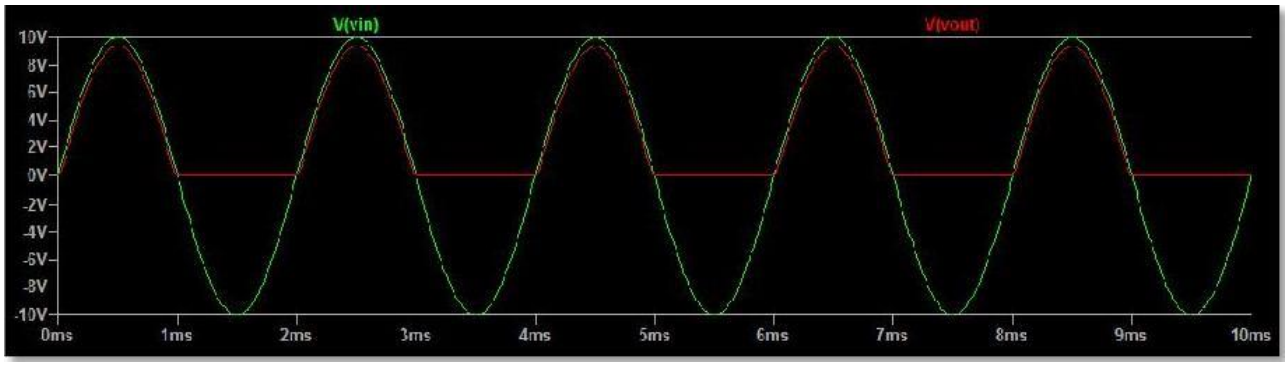
During the positive half cycle the diode is reverse biased by both input supply voltage V_i and Battery voltage V_B. During the negative half cycle, the diode is forward biased by the input Supply voltage V_i and reverse biased by the battery voltage V_B.

Task 5:



Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
CH1
Vmax= 9.601V
Vmin=-200.0mV
Vpp= 9.801V
CH1 5.00V/
2.000ms/
50.0kSa/s


V(vin)
V(vout)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
1ms
2ms
3ms
4ms
5ms
6ms
7ms
8ms
9ms
10ms

Analysis about series negative clippers:

In series negative clipper, the negative half cycles of the input AC signal is

Removed at the output.

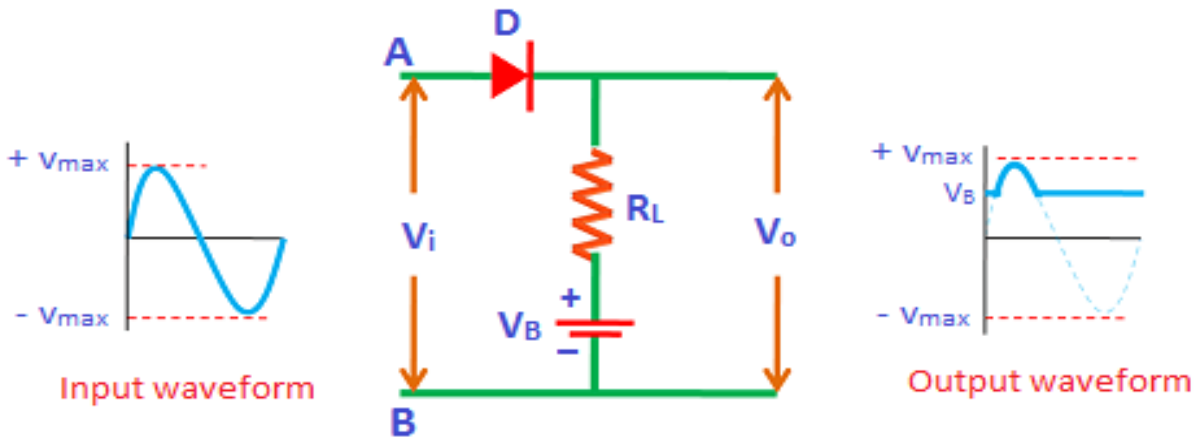
During the positive half cycle the diode is said to be forward biased. During

The negative half cycle the diode is said to be reverse biased. We can say that the series

Negative clipper removes the series of negative half cycles.

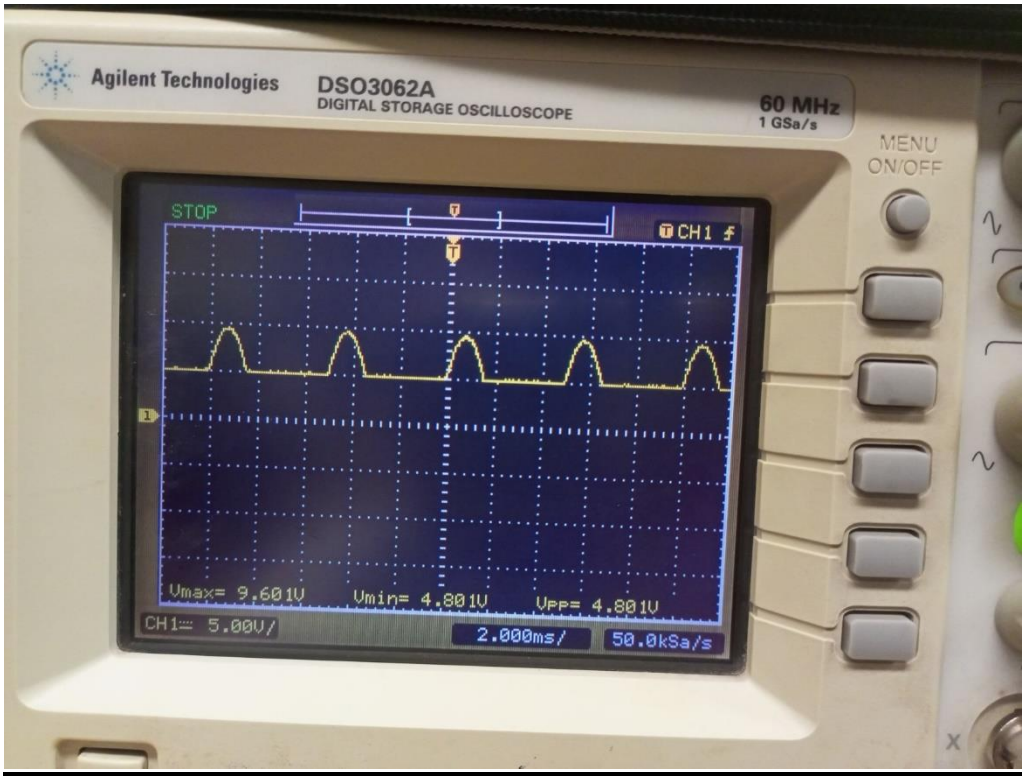
Task 6:

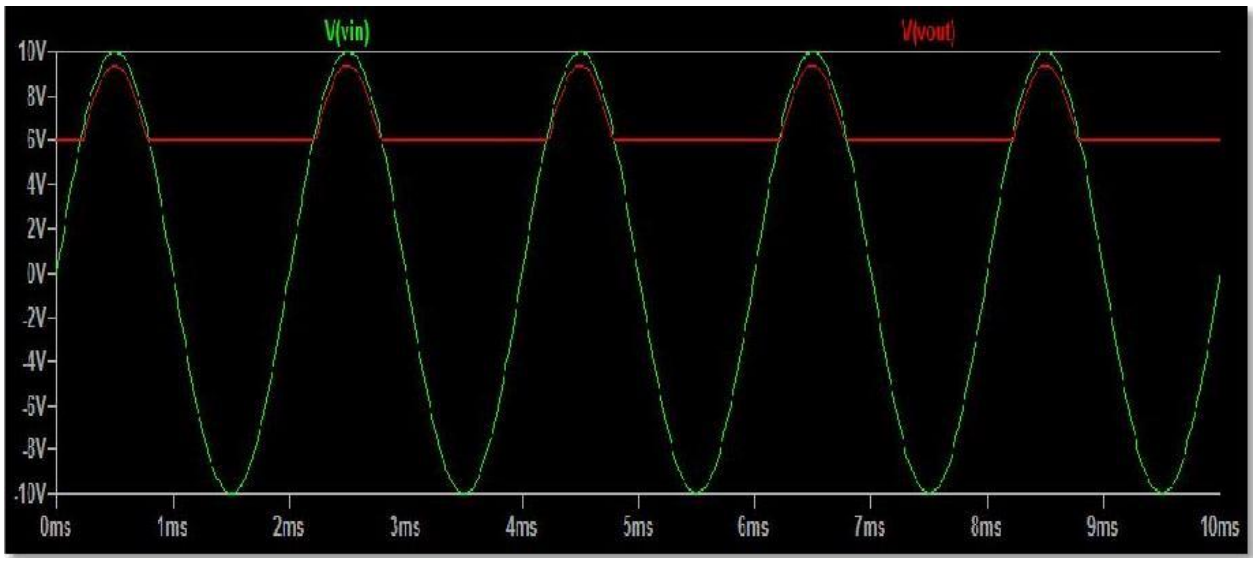
Series negative clipper with positive bias



Series negative clipper with positive bias

Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
STOP
CH1
Vmax= 9.601V
Vmin= 4.801V
VPP= 4.801V
CH1 5.00V/
2.000ms/
50.0kSa/s


V(vin)
V(vout)
10V
8V
6V
4V
2V
0V
-2V
-4V
-6V
-8V
-10V
0ms
1ms
2ms
3ms
4ms
5ms
6ms
7ms
8ms
9ms
10ms

Analysis about series negative clipper with positive bias:

During positive half cycle when the battery voltage is greater than the input supply voltage. Hence, the diode is reverse

biased and does not allow electric current. Therefore, no signal appears at the output. When the

input supply voltage V_i becomes greater than the battery voltage V_B, the diode is forward biased

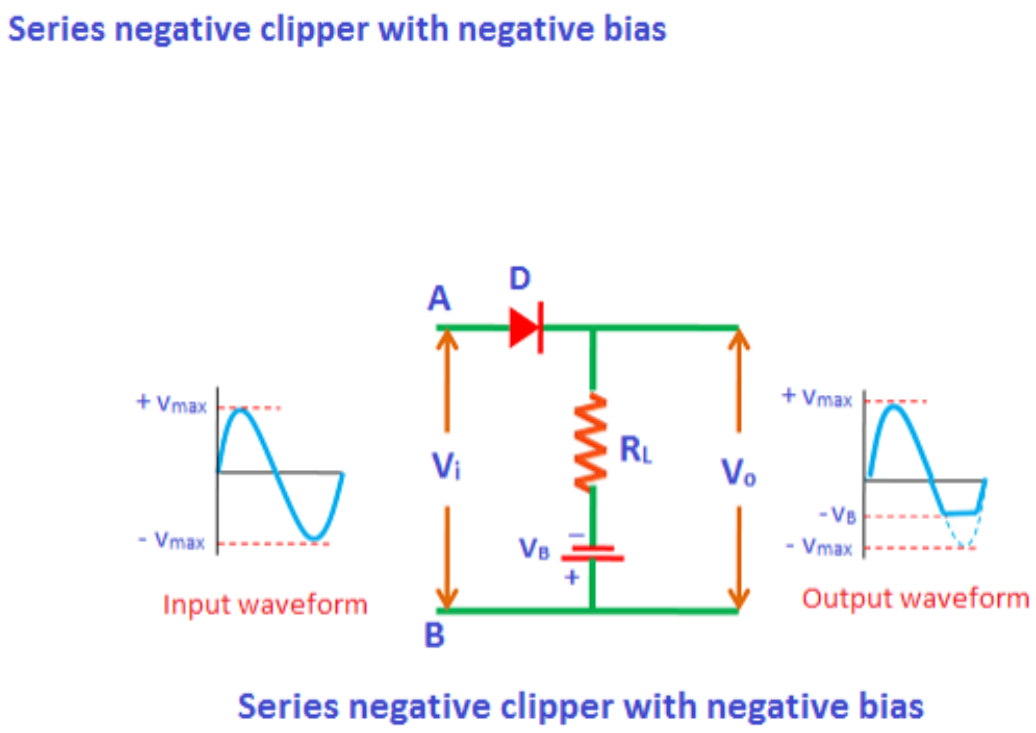
and allows electric current. As a result, the signal appears at the output.

During negative half cycle it doesn't matter whether the input supply voltage is greater or less

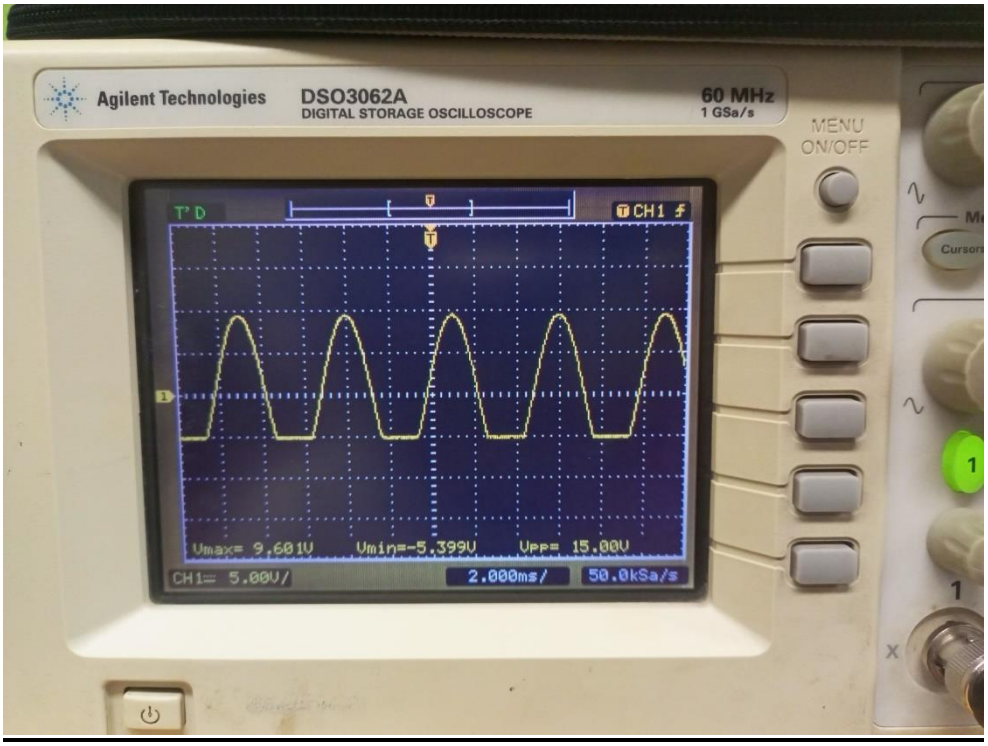
than the battery voltage V_B, the diode always remains reverse biased. Therefore, during the

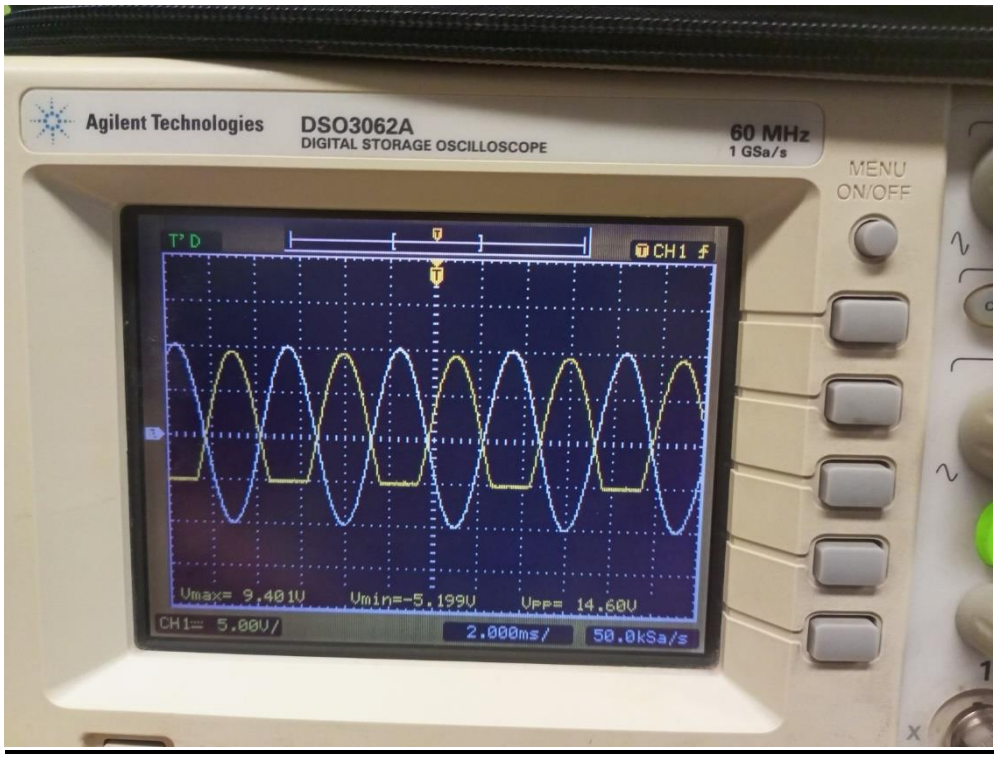
negative half cycle, no signal appears at the output.

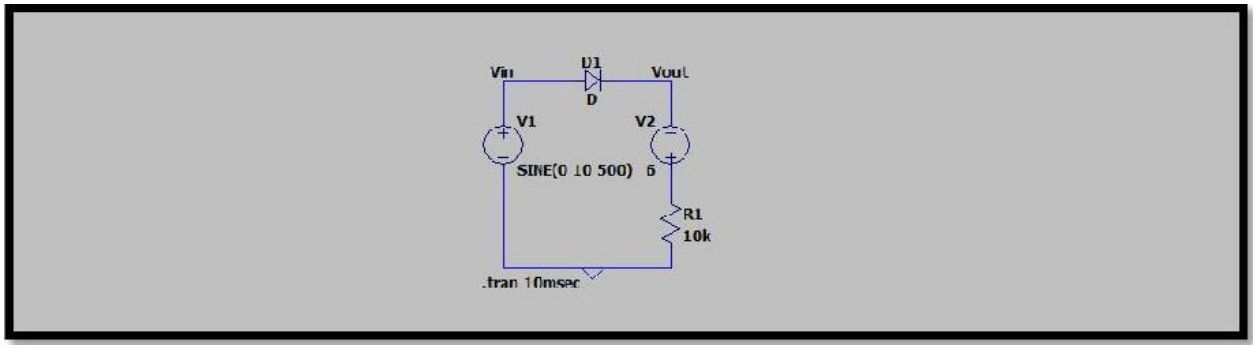
Task 7:

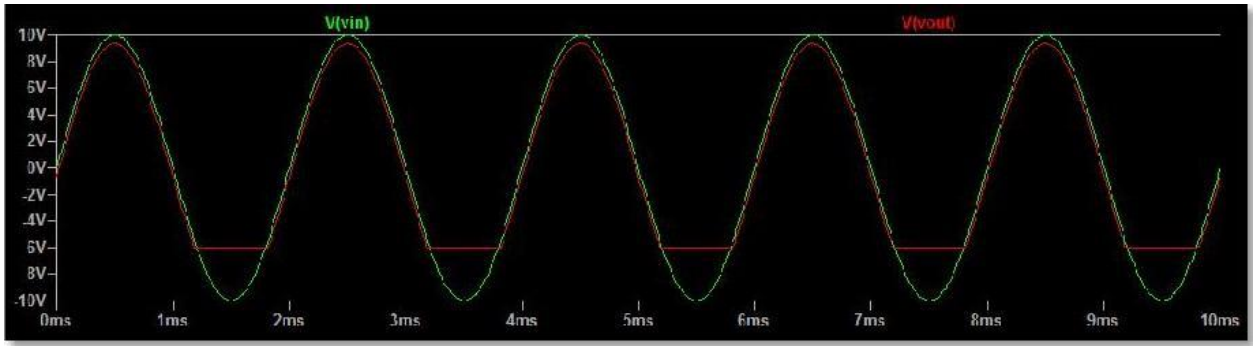


Output:


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
CH1
Vmax= 9.601V
Vmin=-5.399V
Vpp= 15.00V
CH1 5.00V/
2.000ms/
50.0kSa/s


Agilent Technologies
DSO3062A
DIGITAL STORAGE OSCILLOSCOPE
60 MHz
1 GSa/s
MENU
ON/OFF
CH1
Vmax= 9.401V
Vmin=-5.199V
Vpp= 14.60V
CH1 5.00V/
2.000ms/
50.0kSa/s



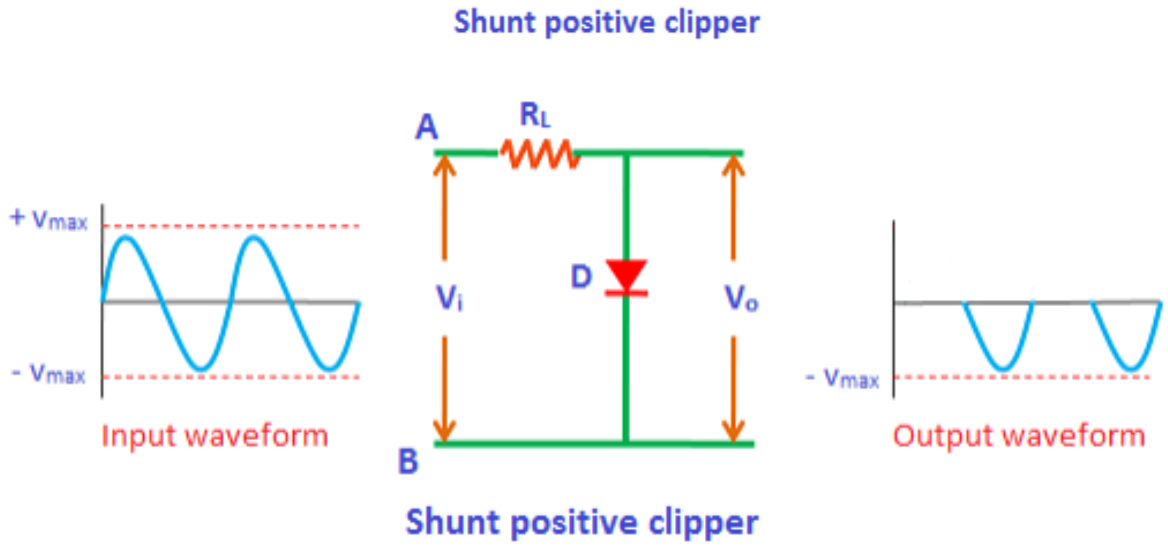


Analysis about series negative clippers with negative bias:

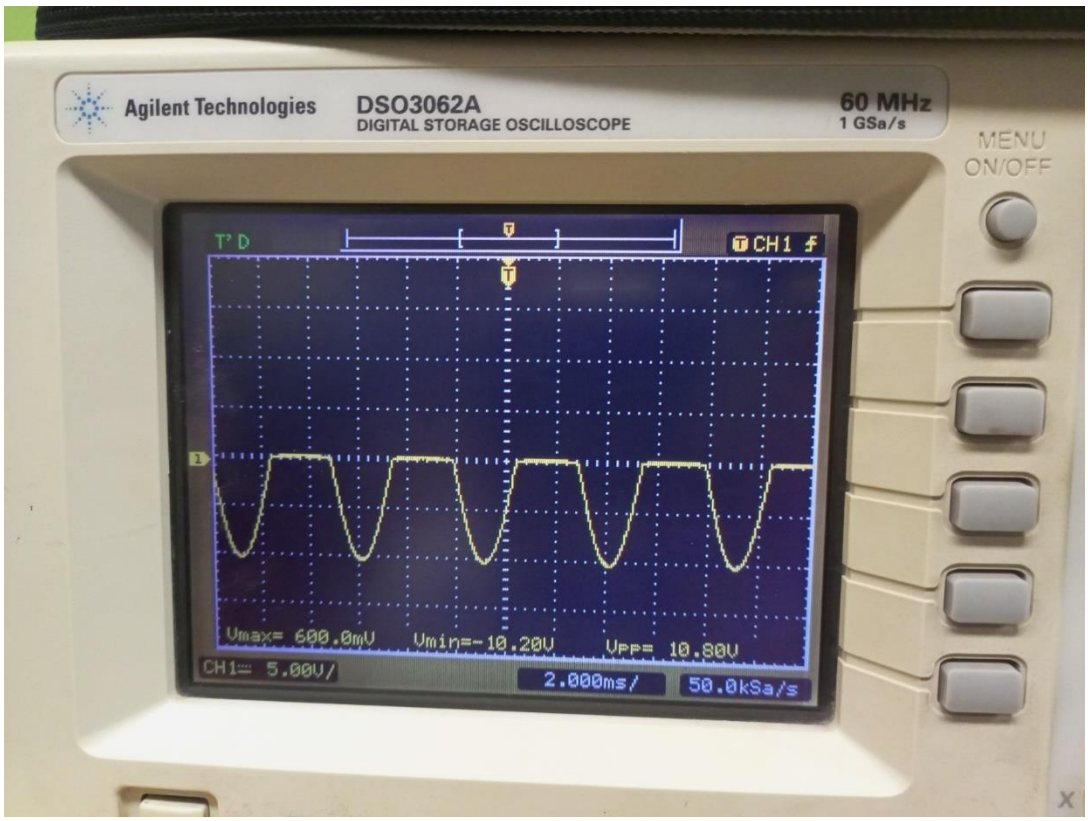
During the positive half cycle, the diode is forward biased it doesn't matter whether the input supply voltage is greater or less than battery voltage V_B, the diode always remains forward biased. Therefore, the signal appears at the output.

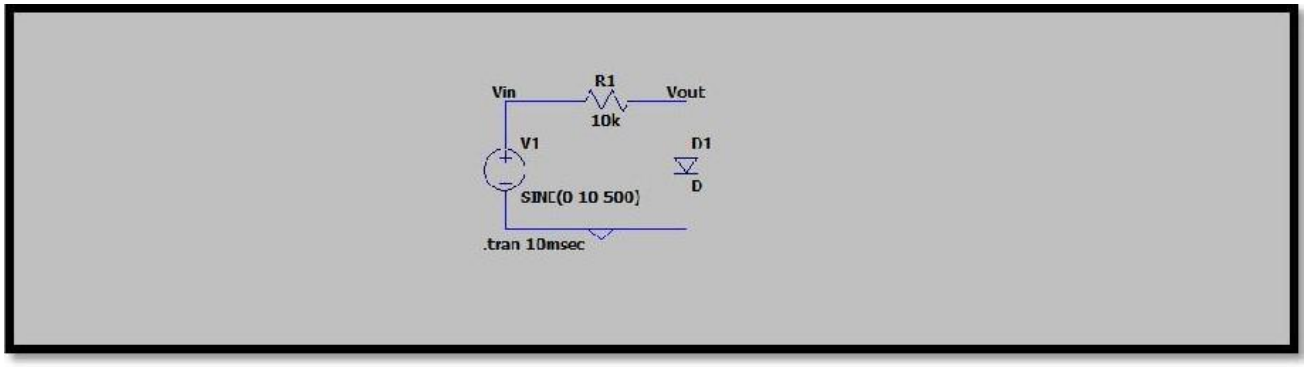
During the negative half cycle, the diode is reverse biased. When the input supply voltage V_i becomes greater than the battery voltage V_B, the diode will become reverse biased. As a result, no signal appears at the output.

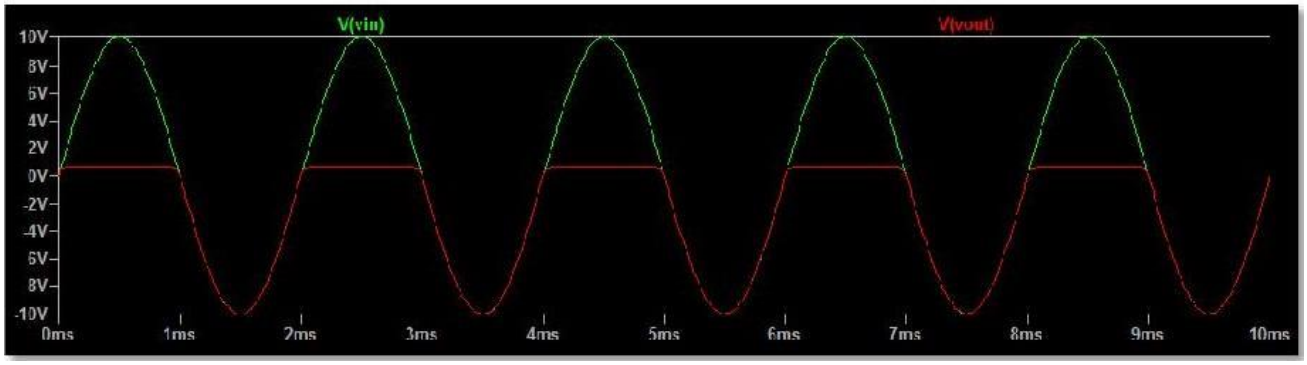
Task 8:



Output:







Analysis about shunt/parallel clipper:

In shunt clipper, the diode is connected in parallel with the output load resistance. The operating

principles of the shunt clipper are nearly opposite to the series clipper. During the positive half

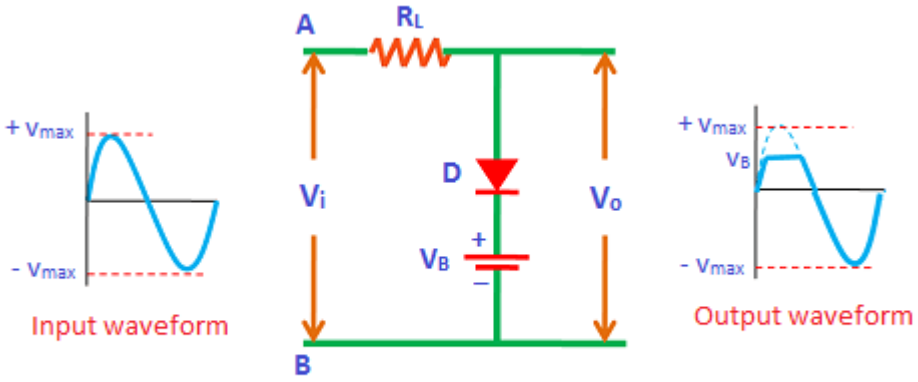
cycle the diode is forward biased and hence no output is generated. On the other hand, during the

negative half cycle the diode is reverse biased and hence the entire negative half cycle appears at

the output.

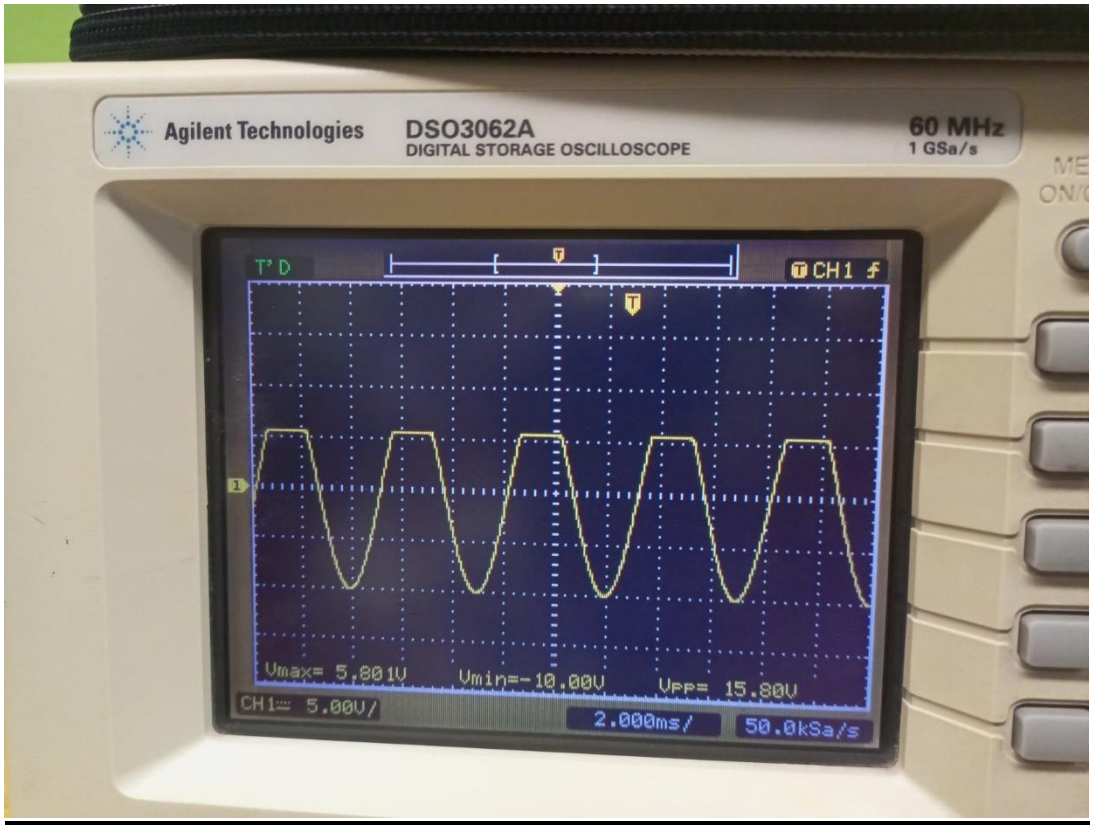
Task 9:

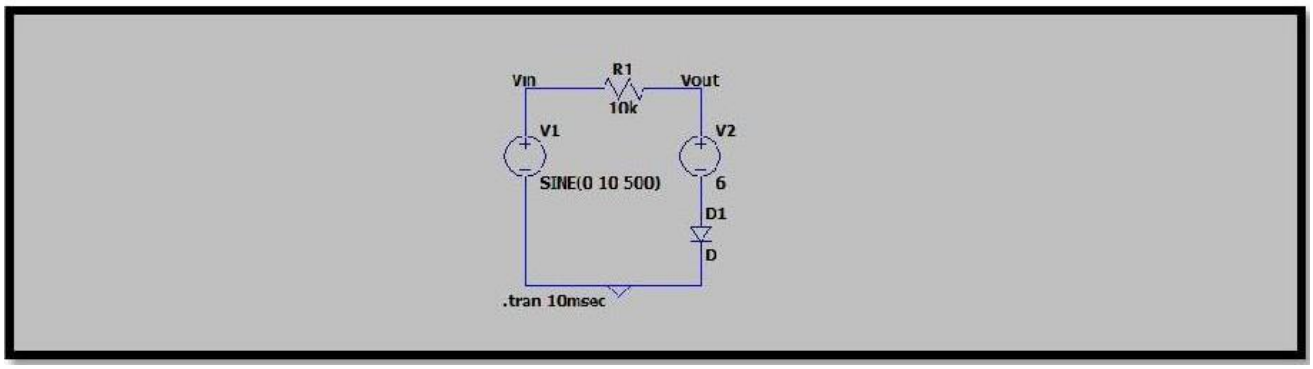
Shunt positive clipper with positive bias

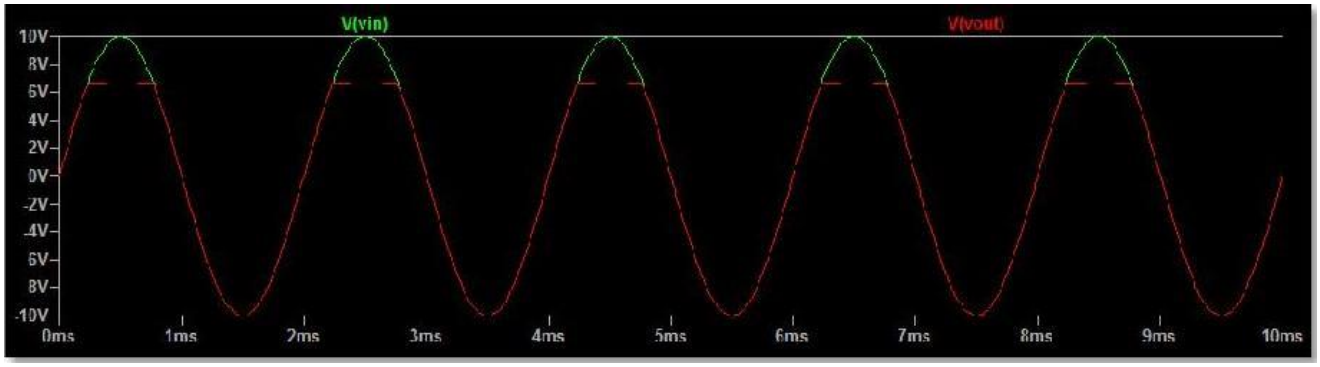


Shunt positive clipper with positive bias

Output:





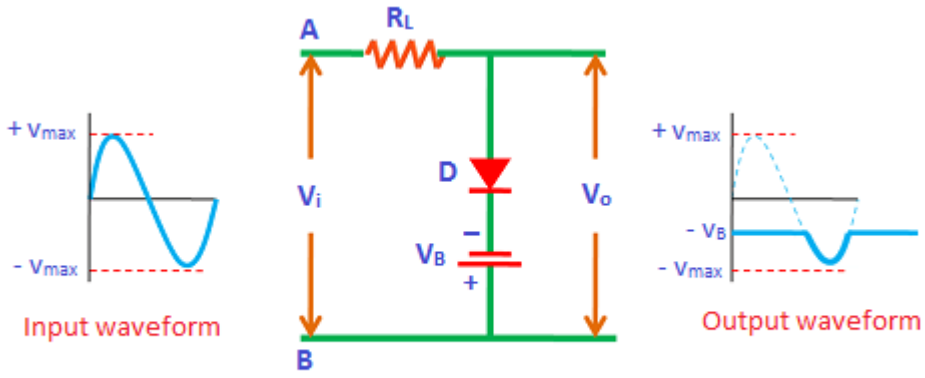


Analysis about shunt/parallel positive clippers with positive bias:

During the positive half cycle, the diode is forward biased by the input supply voltage V_i and reverse biased by the battery voltage V_B. Initially, the input supply voltage V_i is less than the battery voltage V_B. Hence, the battery voltage V_B makes the diode to be reverse biased and the signal appears at the output. When the input supply voltage V_i becomes greater than the battery voltage V_B, the diode D is forward biased by the input supply voltage. Apparently, no signal appears at the output. During the negative half cycle, the diode is reverse biased by both input supply voltage and battery voltage. Whether the input supply voltage is greater or lesser than the battery voltage, the diode always remains reverse biased. As a result, a complete negative half cycle appears at the output.

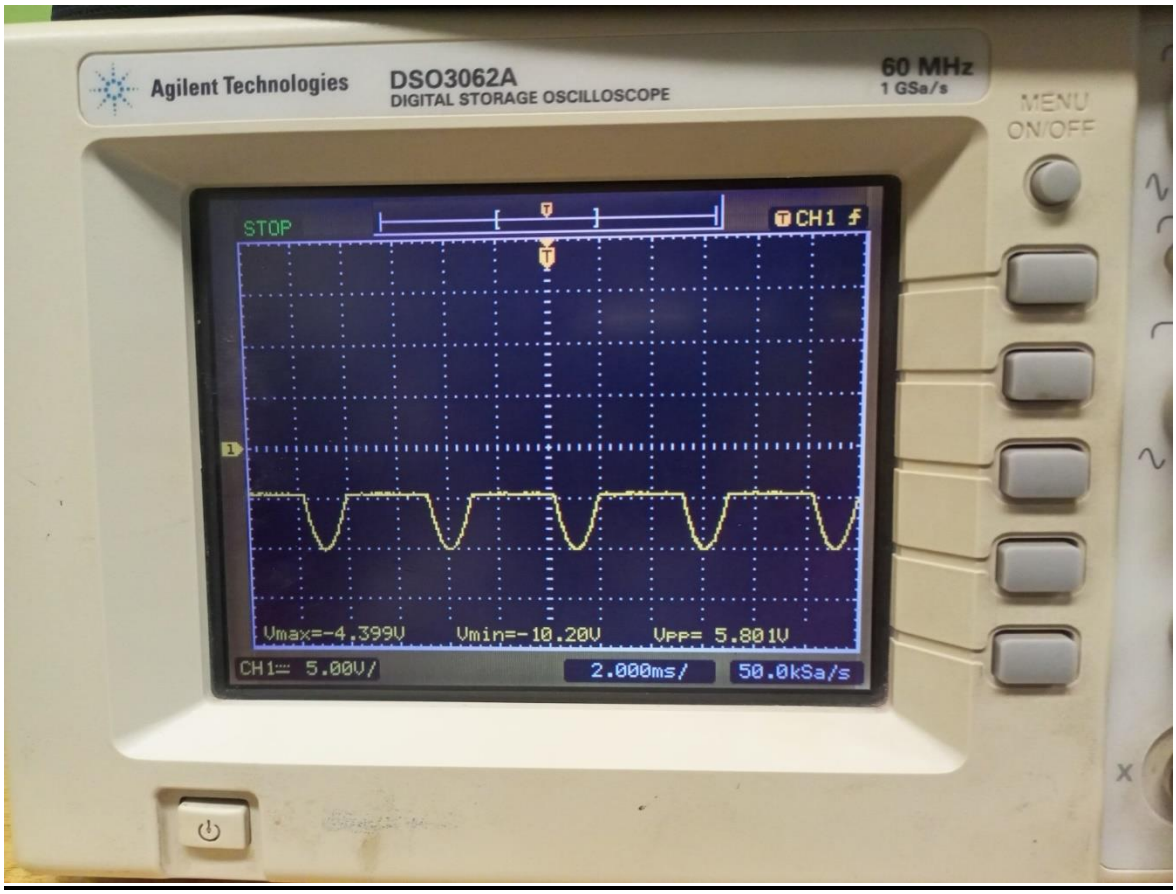
Task 10:

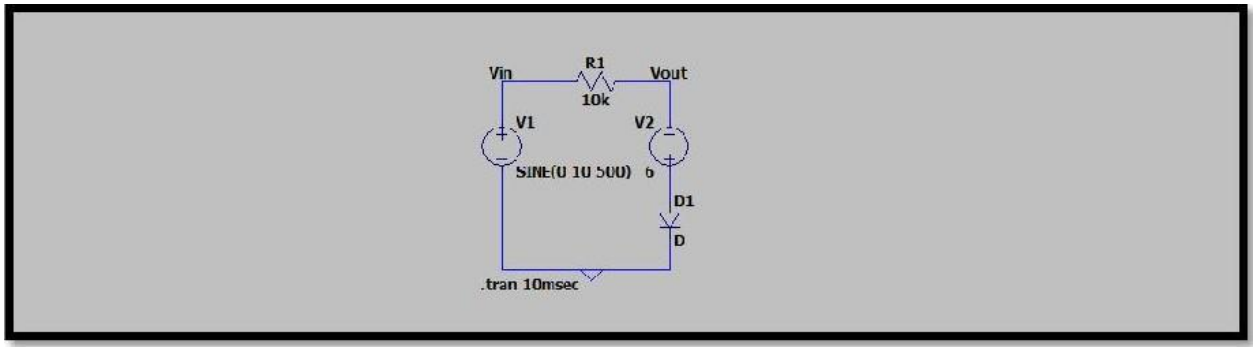
Shunt positive clipper with negative bias

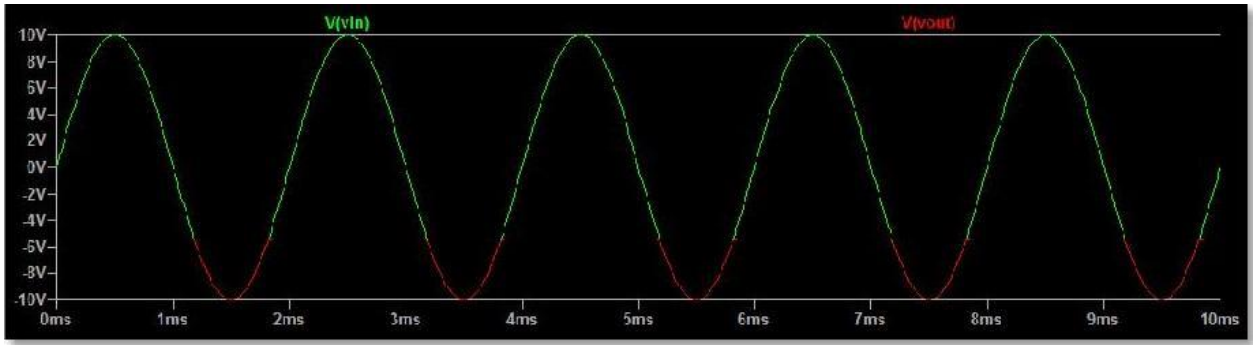


Shunt positive clipper with negative bias

Output:







Analysis about shunt/parallel positive clippers with negative bias:

During the positive half cycle, the diode is forward biased by both input supply voltage V_i and

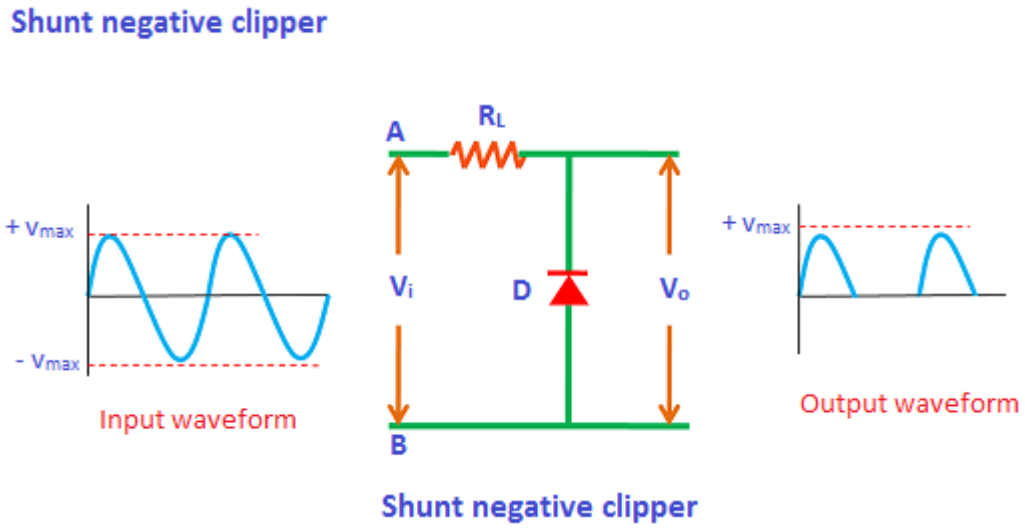
battery voltage V_B and no signal appears at the output during the positive half cycle. When the

input supply voltage V_i becomes greater than the battery voltage V_B, the diode is reverse biased

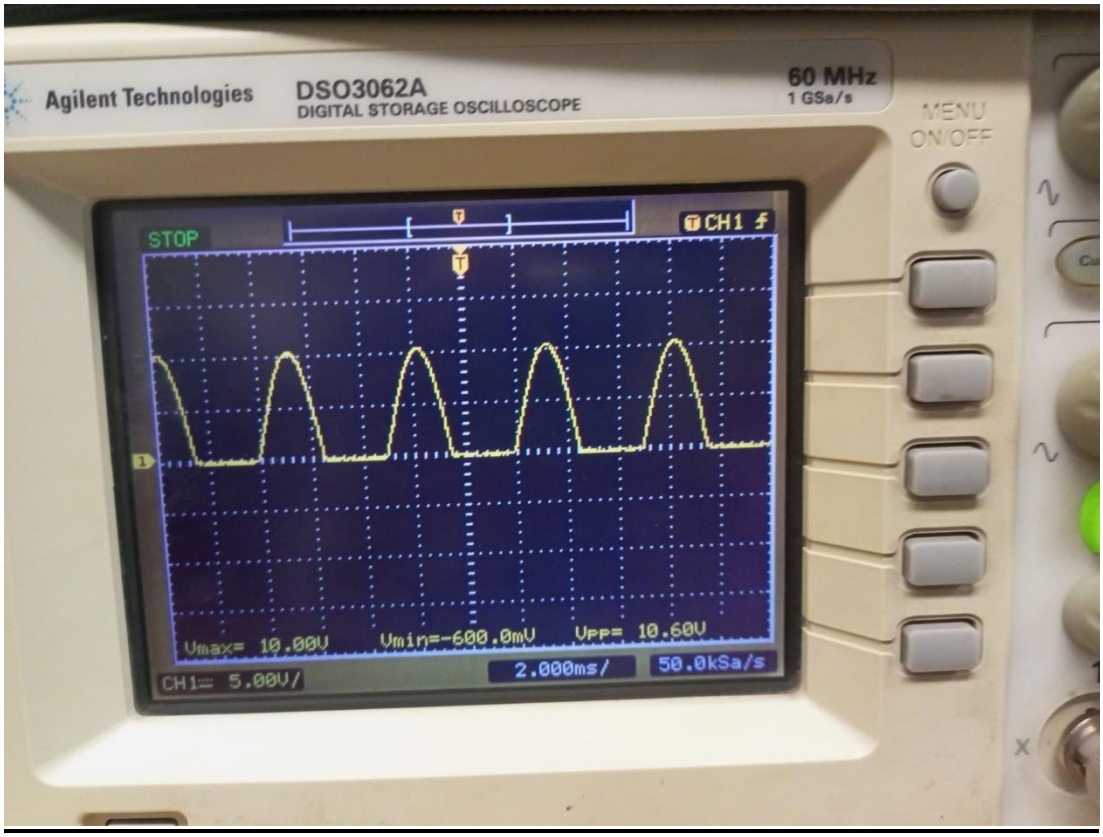
by the input supply voltage V_i. During the negative half cycle, the diode is reverse biased. As a

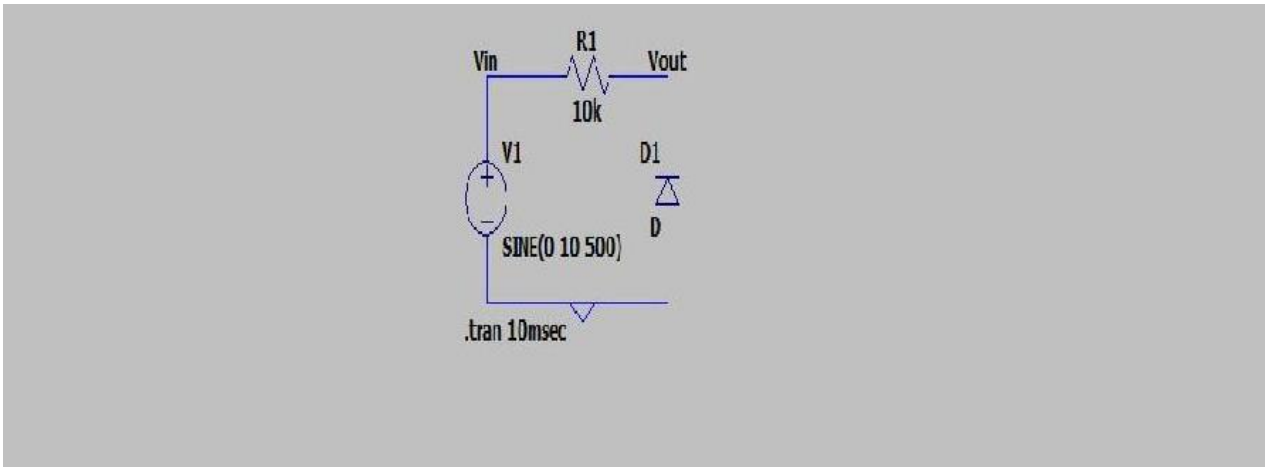
result, the signal appears at the output.

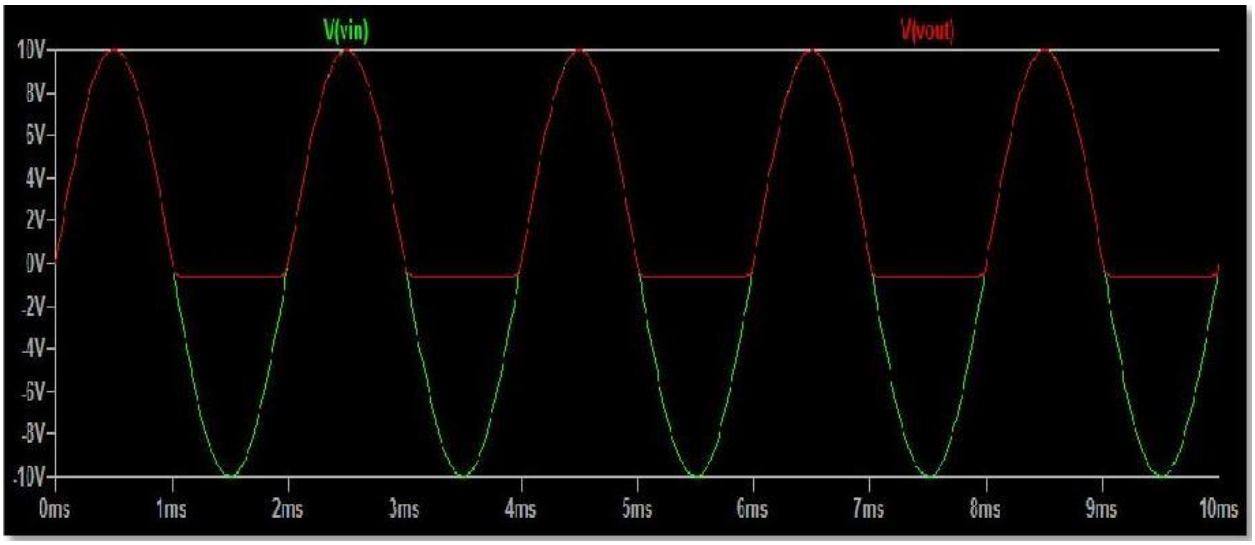
Task 11:



Output:







Analysis about shunt negative clippers:

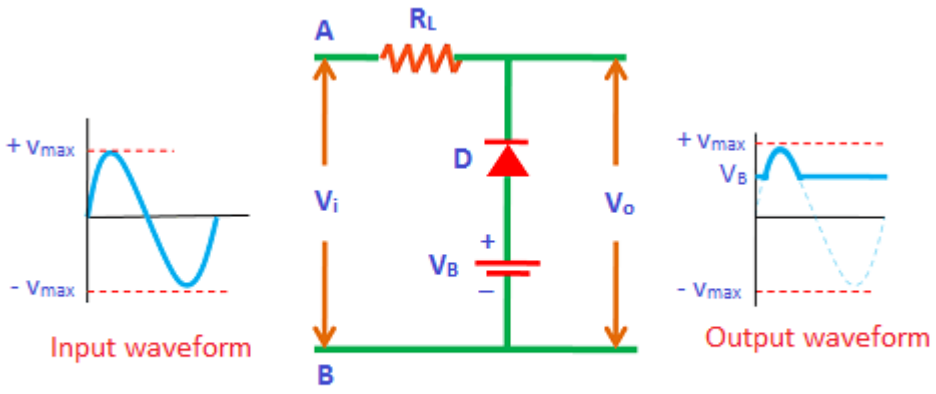
During the positive half cycle the diode is reverse biased and for a while the entire positive half

cycle appears at the output and during the negative half cycle the diode is forward biased and

hence no output signal is generated.

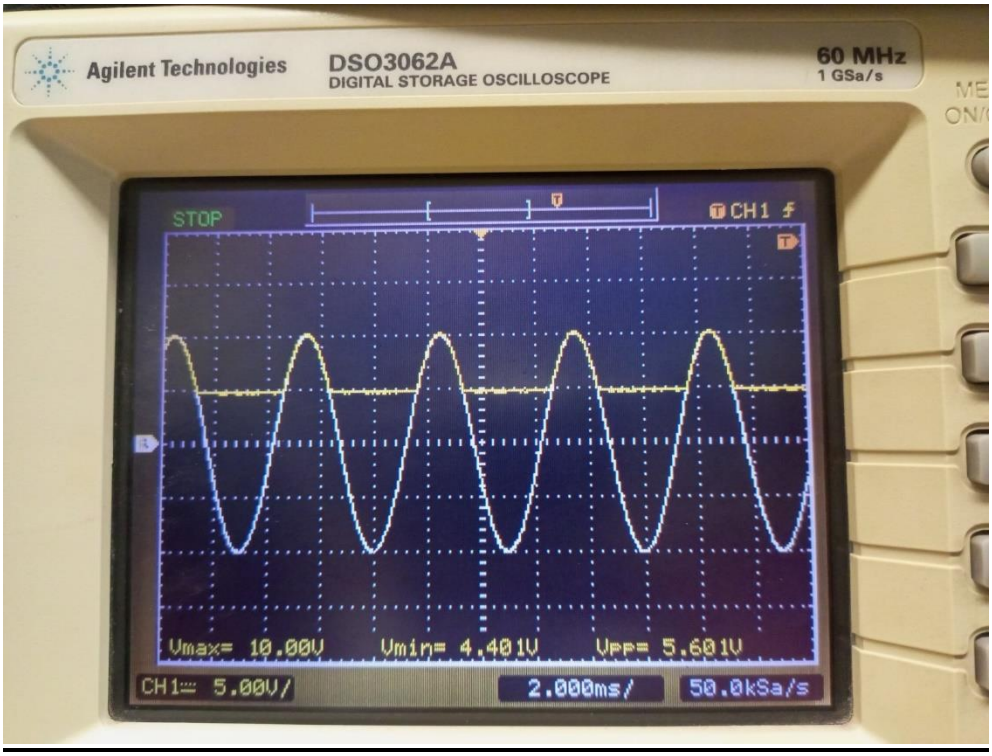
Task 12:

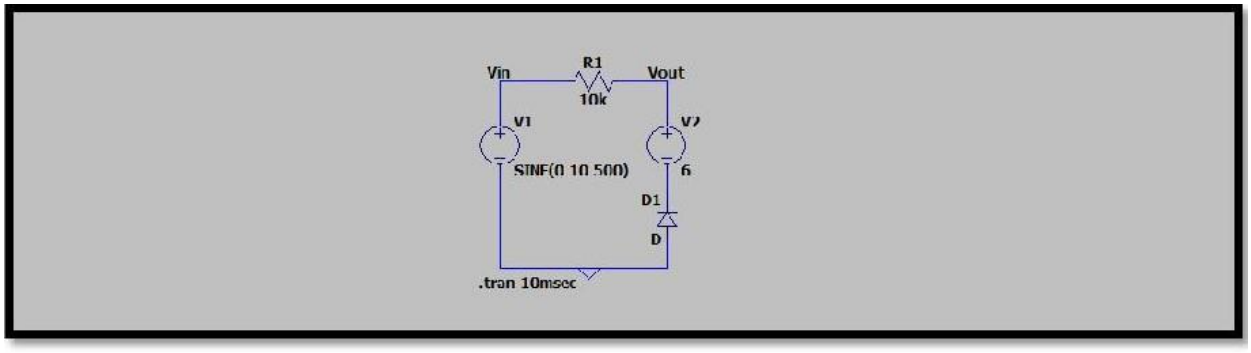
Shunt negative clipper with positive bias

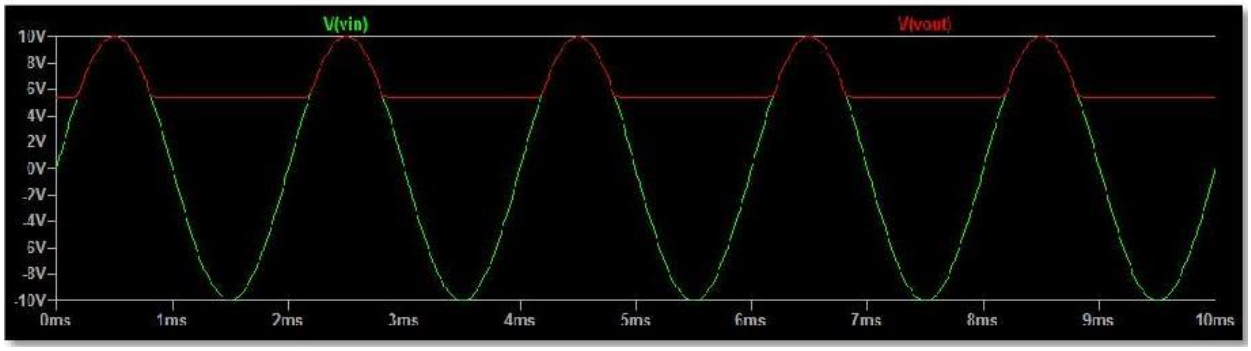


Shunt negative clipper with positive bias

Output:



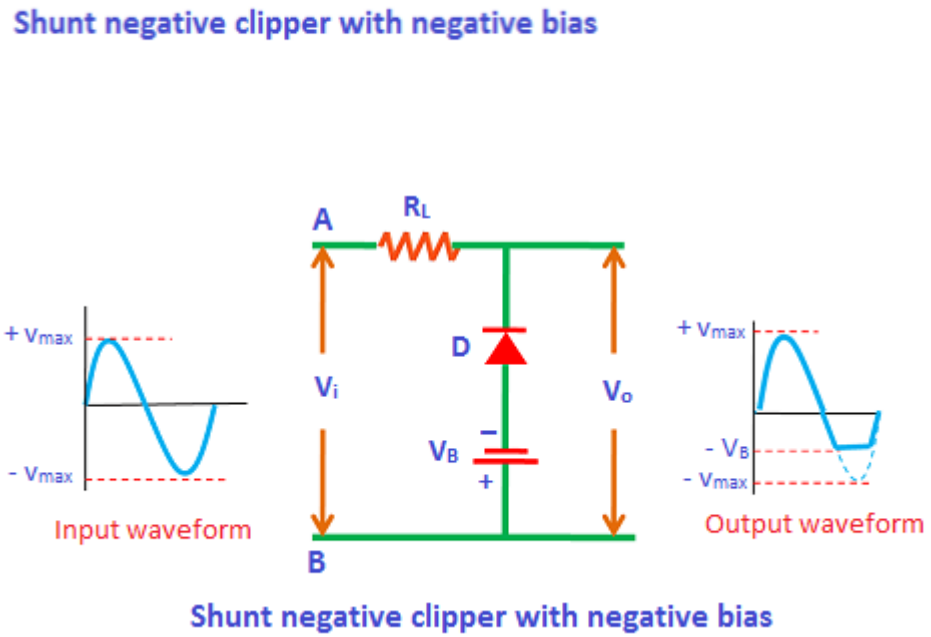




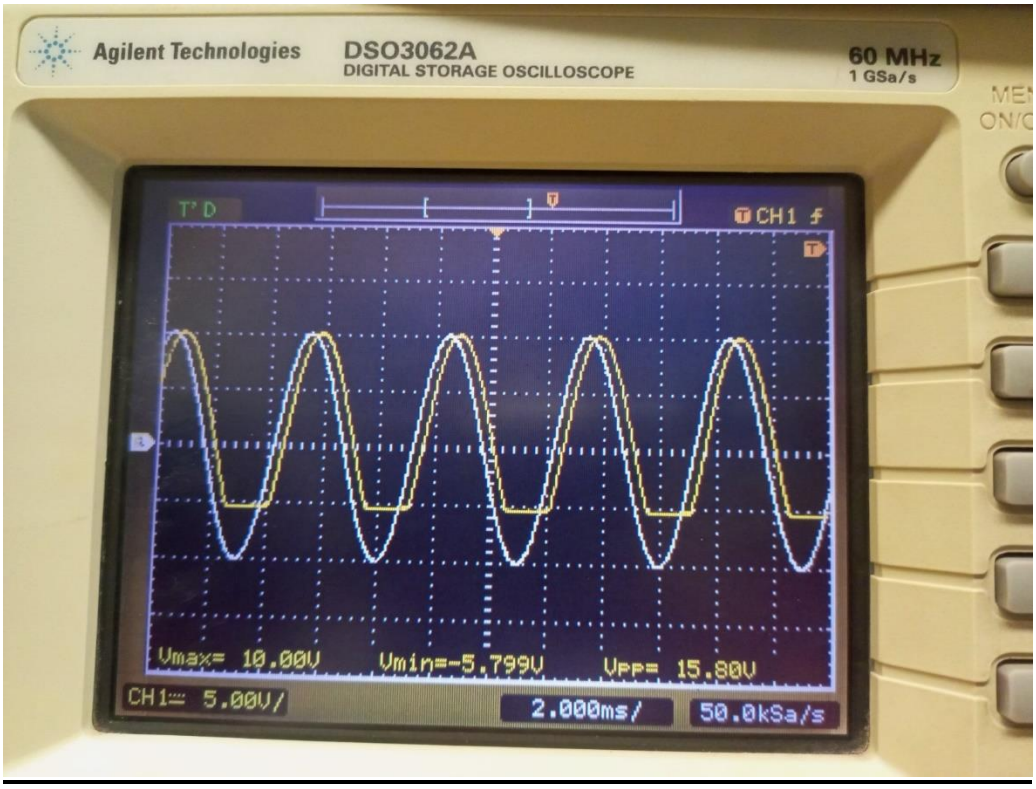
Analysis about shunt/parallel clippers with positive bias:

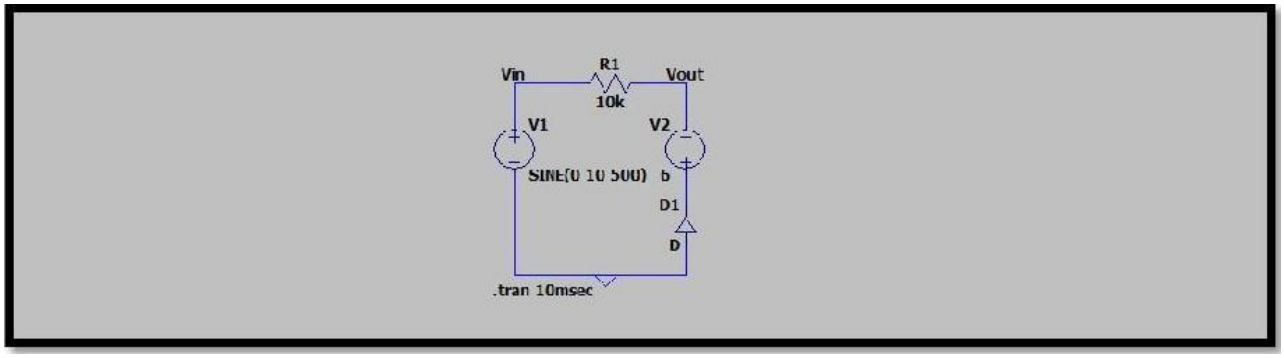
During the positive half cycle, the diode is reverse biased by the input supply voltage V_i and forward biased by the battery voltage V_B. When the input supply voltage becomes greater than the battery voltage then the diode is reverse biased by the input supply voltage and the signal appears at the output. Initially when the input supply voltage is less than the battery voltage. So the diode is forward biased by the battery voltage. During the negative half cycle, the diode is forward biased by both input supply voltage V_i and battery voltage V_B. So the complete negative Half cycle is removed at the output.

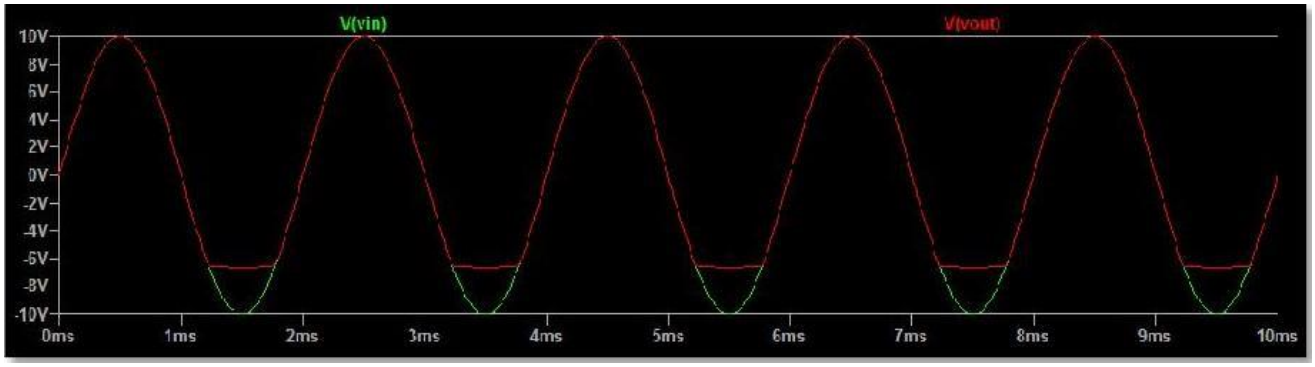
Task 13:



Output:







Analysis about shunt/parallel clippers with negative bias:

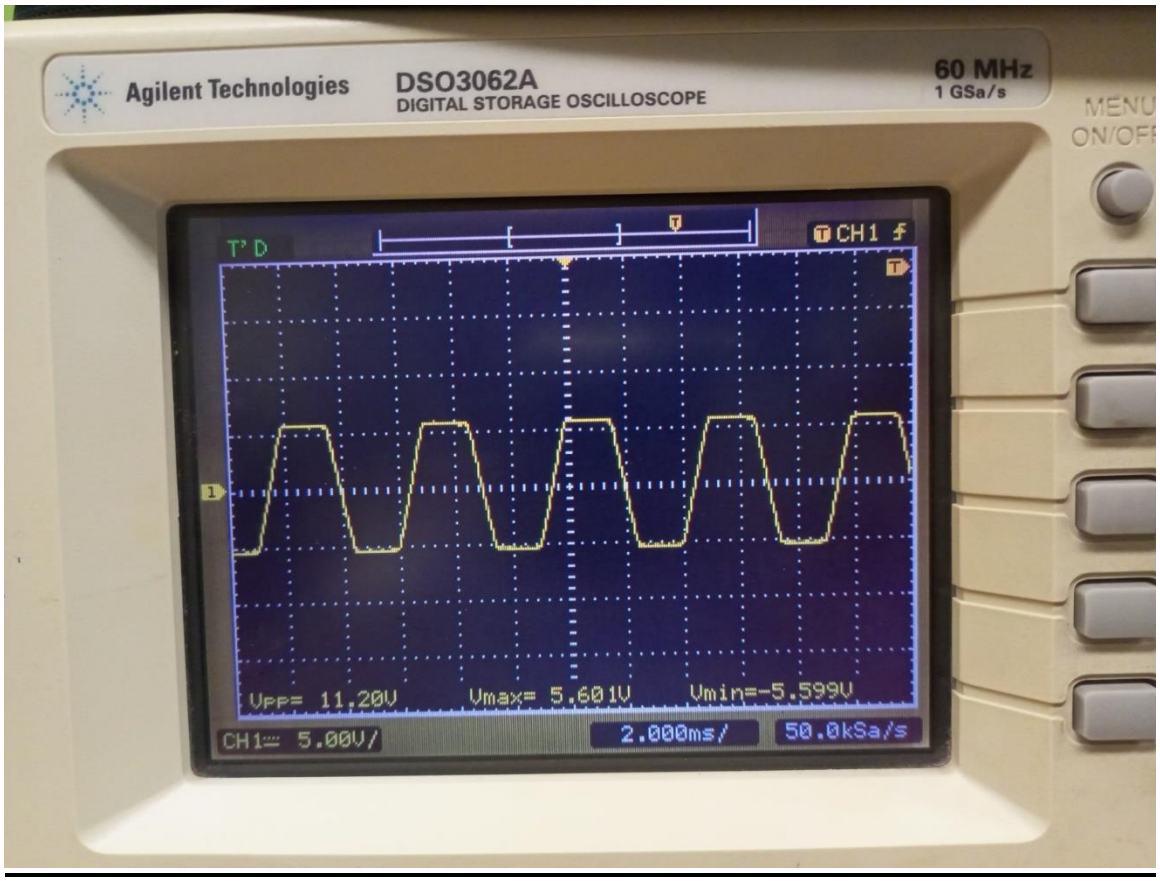
During the positive half cycle, the diode is reverse biased by both input supply voltage V_i and battery voltage V_B at last the complete positive half cycle appears at the output. Initially when the input supply voltage is less than the battery voltage. So the diode is reverse biased by the battery voltage. As a result, the signal appears at the output. During the negative half cycle, the diode is forward biased when the input supply voltage becomes greater than the battery voltage, the diode is forward biased by the input supply voltage. As a result, the signal does not appear at the output.

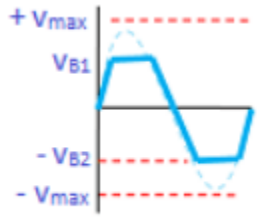
Design Problem:

• Is a circuit possible that can clip both +ve and –ve half cycles of a wave? Can a combination

of both positive and negative clipper circuits be designed to achieve such a circuit?

Output:





Output waveform

►Yes it can possible to clip both positive and negative half cycles of a wave.

Critical Analysis/Conclusions:

- **In this lab the clipper circuit design output waveforms have been studied and the**

  Required parameters are compared.

- **This lab is about the understanding of clippers that what are clippers circuits how**

  And why they are formed and how to use diodes to make clipper circuits. Moreover,

  To analyze the working of diodes in clipper circuits and to find waveforms and all

  The required values of clipper circuits are obtained with the help of oscilloscope.

- **We have understood the concept of pure AC and pure DC and how to convert**

  Clipper Circuits to pure AC and pure DC only by changing / varying voltage

  Through power Supply/trainer.

- **Moreover we learn that the Diode clipping circuits are used to eliminate amplitude**

  Noise or voltage spikes, voltage regulation or to produce new waveforms from an

  Existing signal such as squaring off the peaks of a sinusoidal waveform to obtain a

  Rectangular waveform as seen above.