

## **Electronics-1**



### **Lab # 01**

<b>Name</b>	Muhammad Ahmad
<b>Registration Number</b>	FA21-BEE-053
<b>Instructor's Name</b>	Dr. Ali Arshad

## OBJECTIVES

- Basic understanding of creating arbitrary waveforms using function generator.
- Basic understanding of viewing a time varying voltage waveform on digital oscilloscope and understanding various control knobs of digital oscilloscope.

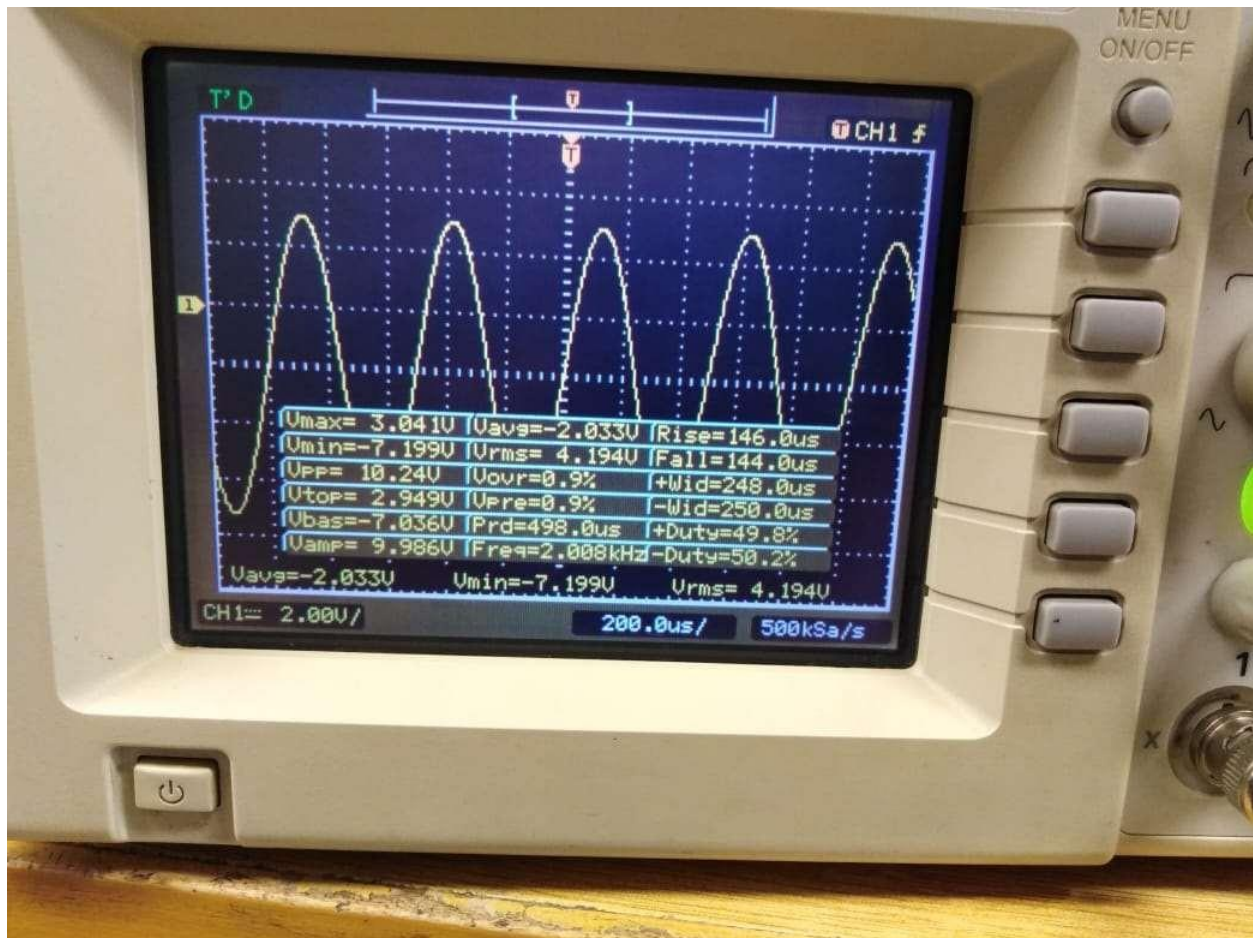
## EQUIPMENT AND MATERIALS

- Digital Function Generator
- Digital Oscilloscope with Probes.

## LAB TASKS

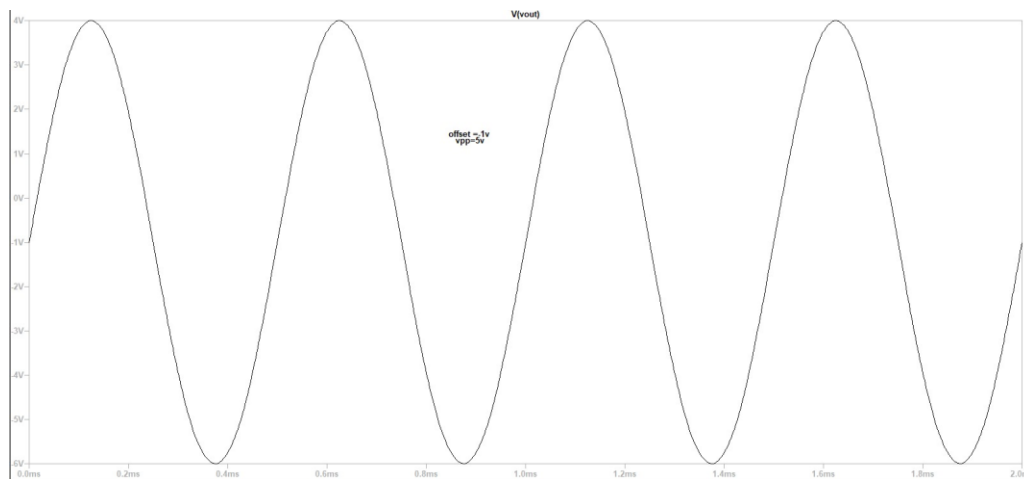
### Section-I Oscilloscope and Function Generator

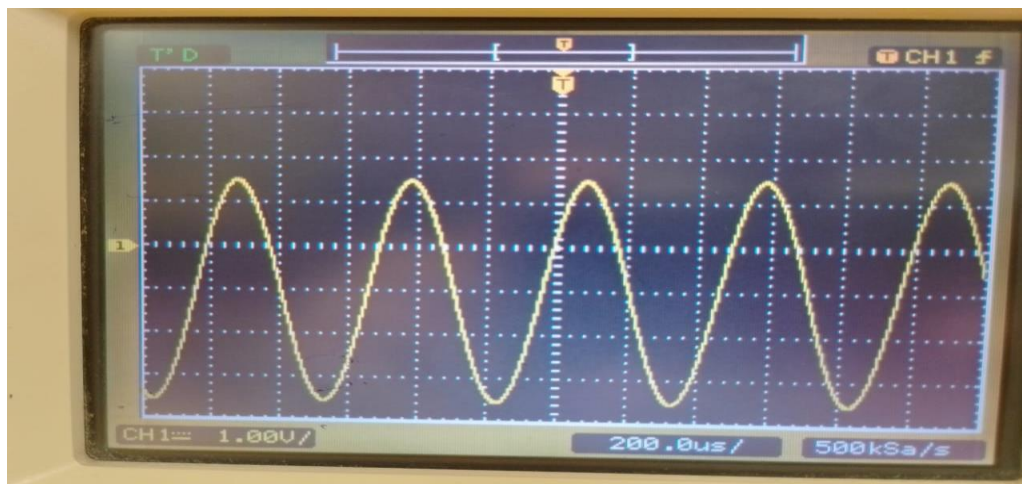
In lab task 1:



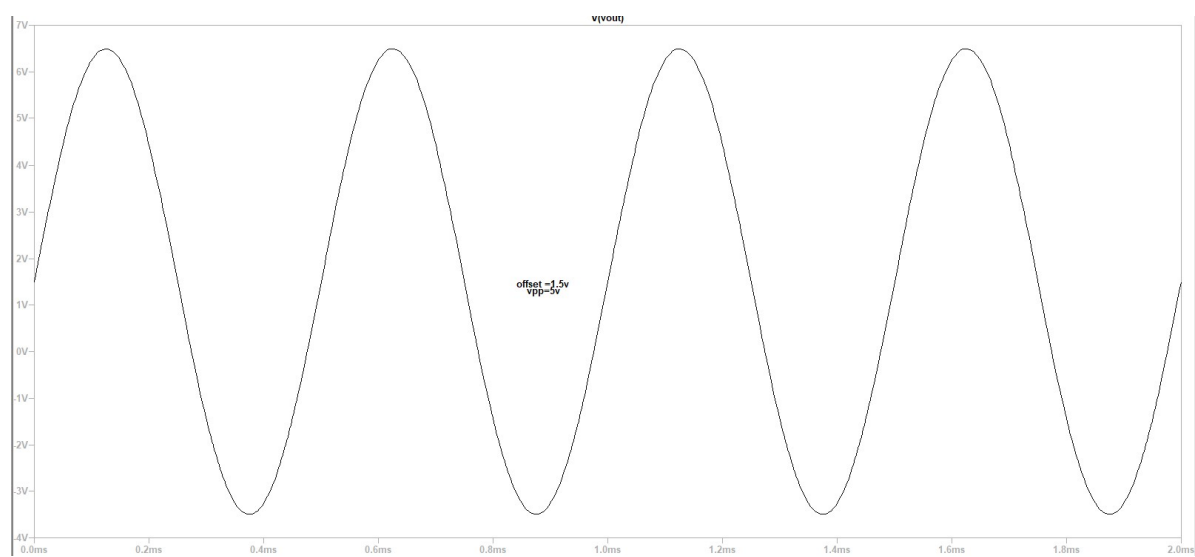
Before	Task #1	After
500 mV	CH1	1.0V
500 $\mu$ s	Time base status	200 $\mu$ s
-1V	1.5V	2V
$V_{max} = 1.52V$	$V_{max} = 4$	$V_{max} = 4.5V$
$V_{min} = -3.559V$	$V_{min} = -1$	$V_{min} = -560.0mV$
$V_{pp} = 5.08V$	$V_{rms} = 2.2$	$V_{pp} = 5.08V$
$V_{amp} = 4.9$	$freq = 2\text{ Hz}$	$\Delta \text{Time period} = 500$
$V_{rms} = 2.03V$	Time period = 498 $\mu$ s	Frequency = 2.008 KHz
Time period = 500 $\mu$ s	$V_{pp} = 5.01V$	
Freq = 2kHz		
AC		
$V_{max} = 2.52V$		
$V_{min} = -2.51V$		
$V_{pp} = 5.08V$		
$V_{rms} = 1.81V$		
Time period = 500 $\mu$ s		
Freq = 2kHz		

When offset is 1v

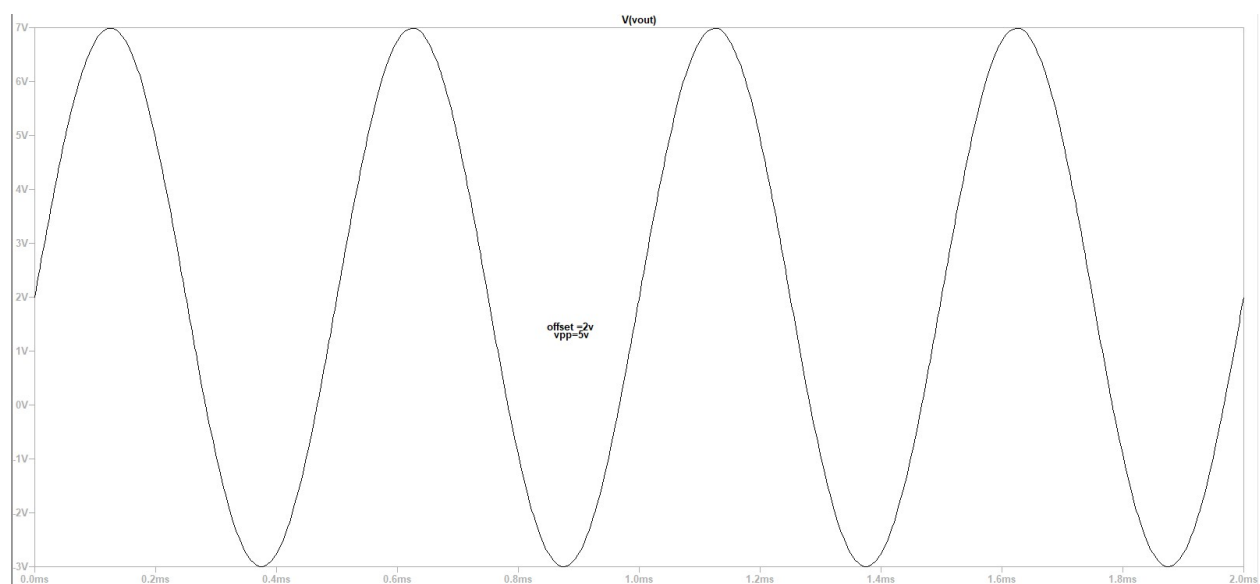




When offset is 1.5v

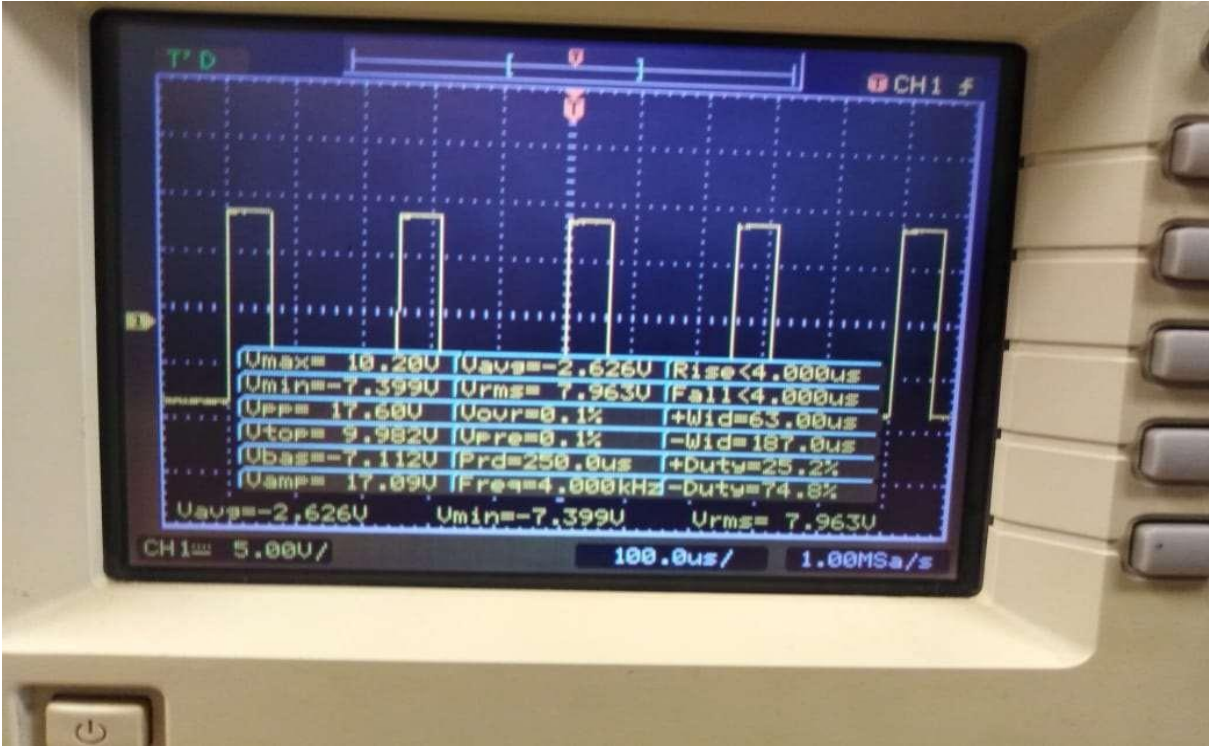


When offset is 2v

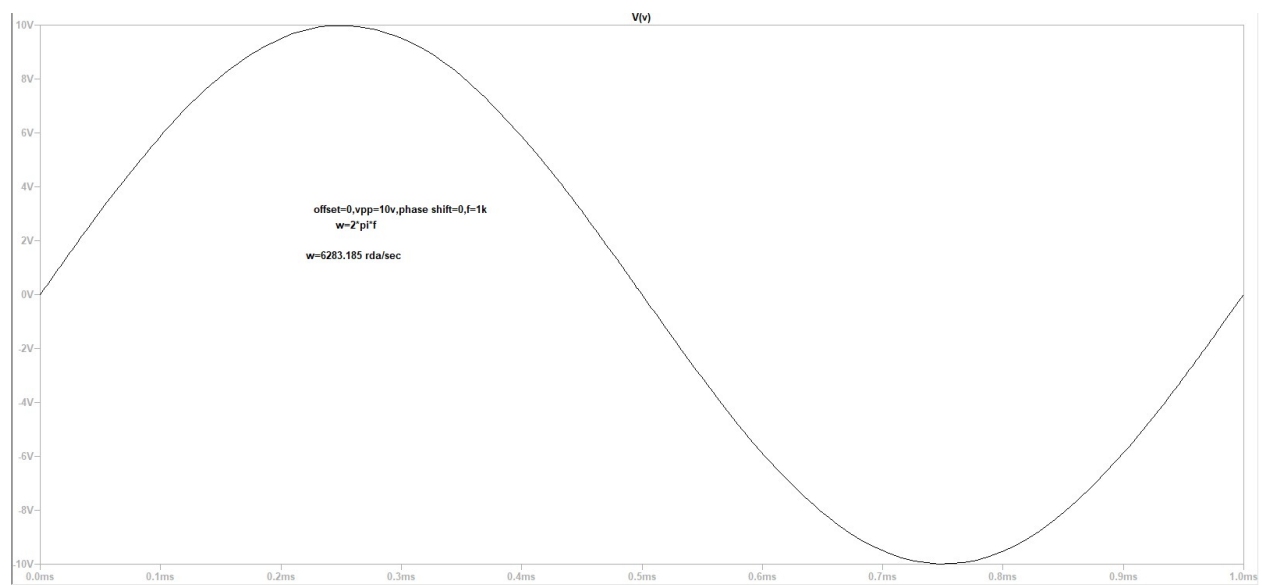


Offsets(V <sub>DC</sub> )	V <sub>pp</sub>	V <sub>max</sub>	V <sub>min</sub>	V <sub>rms</sub>
0	5	2.561	2.479	1.803
-1	5.041	1.561	3.519	2.044
1.5	5.081	4.081	0.999	2.365
2	5.041	4.561	0.52	2.717

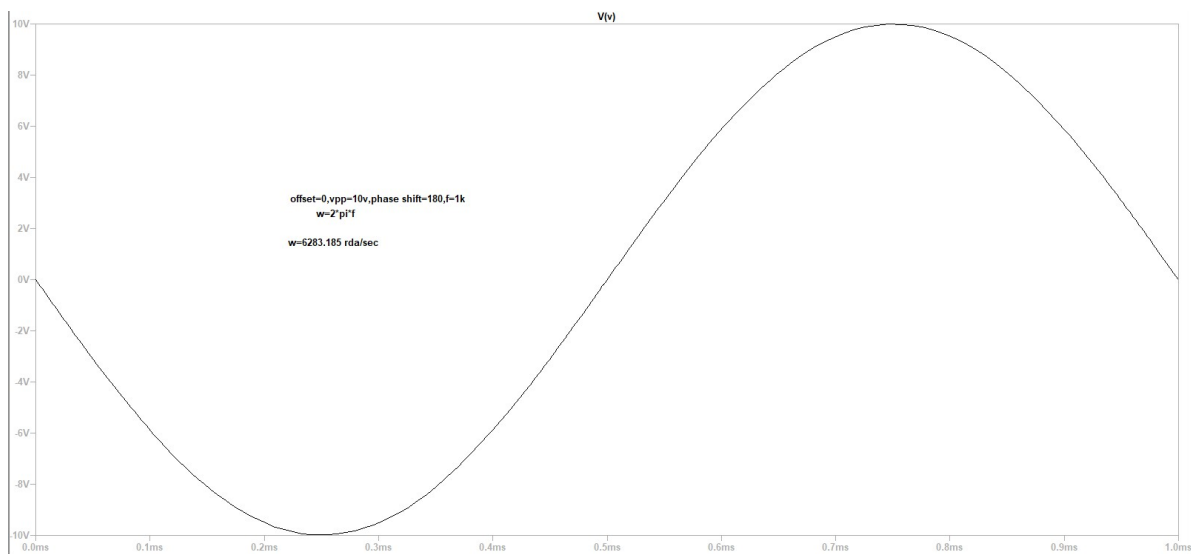
In lab task 2:  
 When duty cycle is at 74.8%.



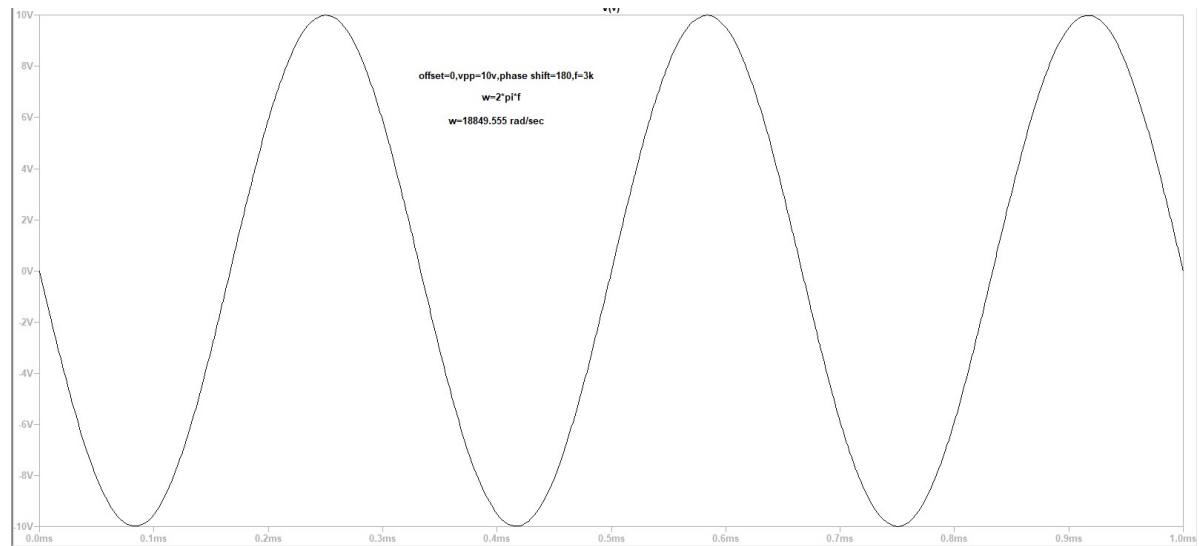
In lab task 3:



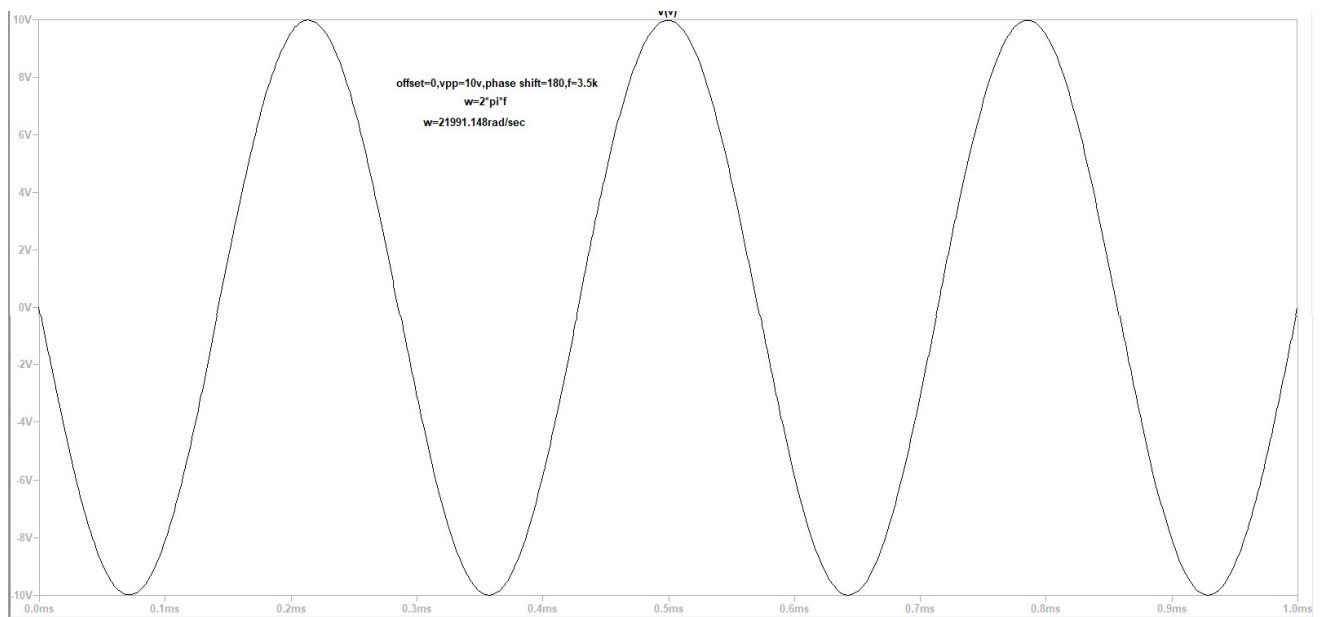
When phase shift of 180 is applied:



For  $f=3k$

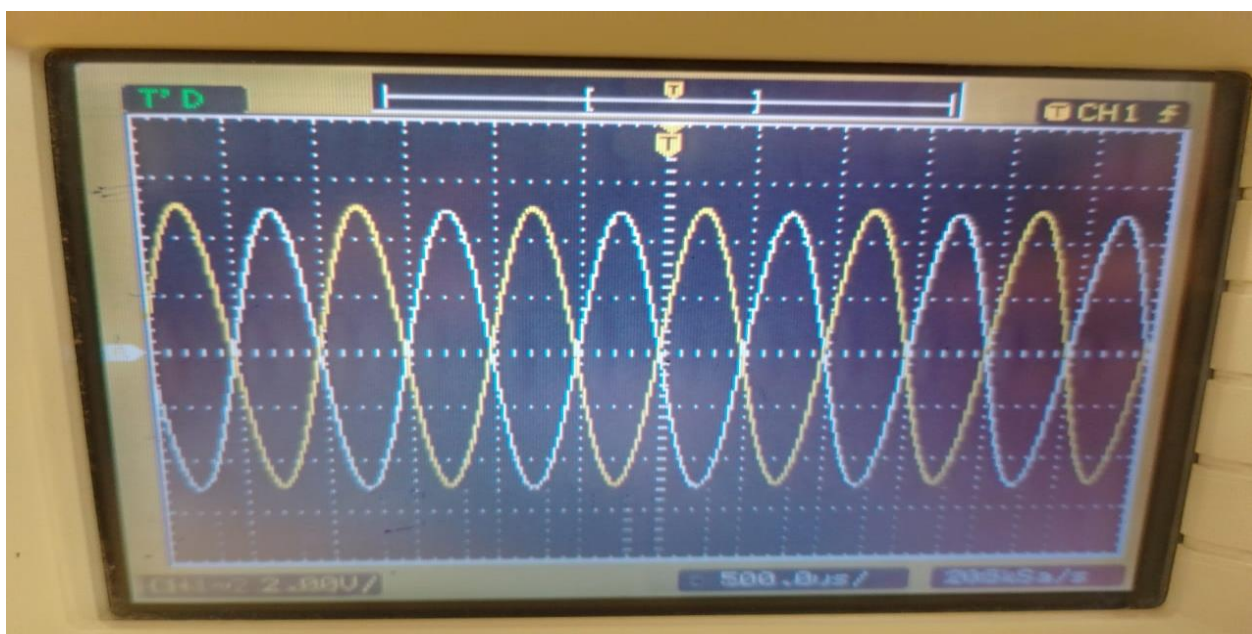
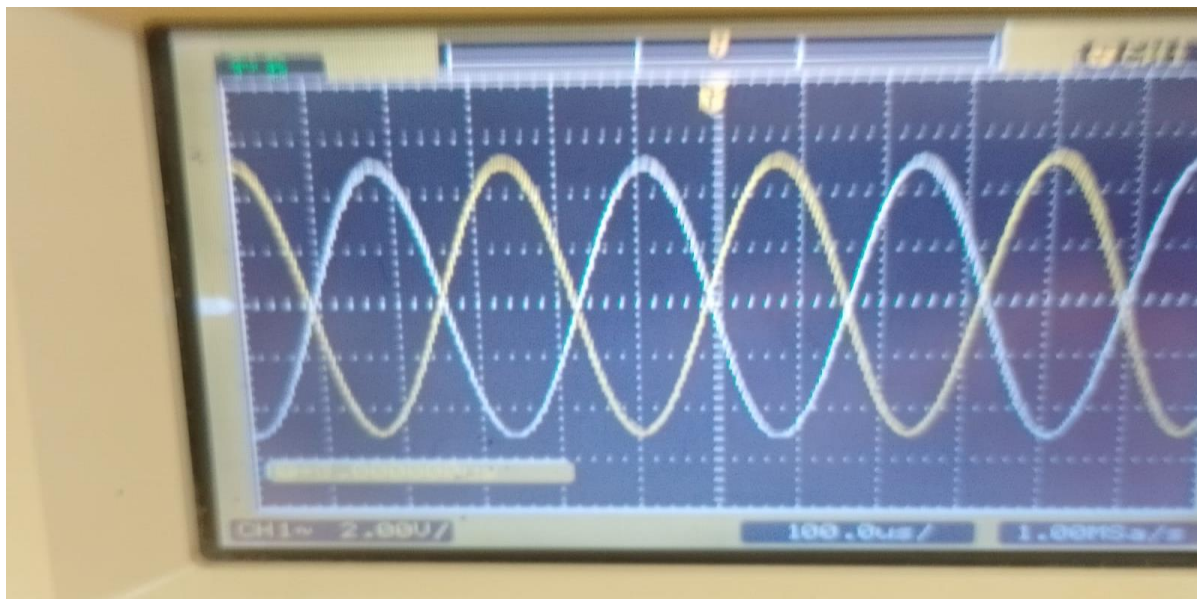


For  $f=3.5k$





With Offset is 0v:





## Section-2 Introduction to LTSPICE

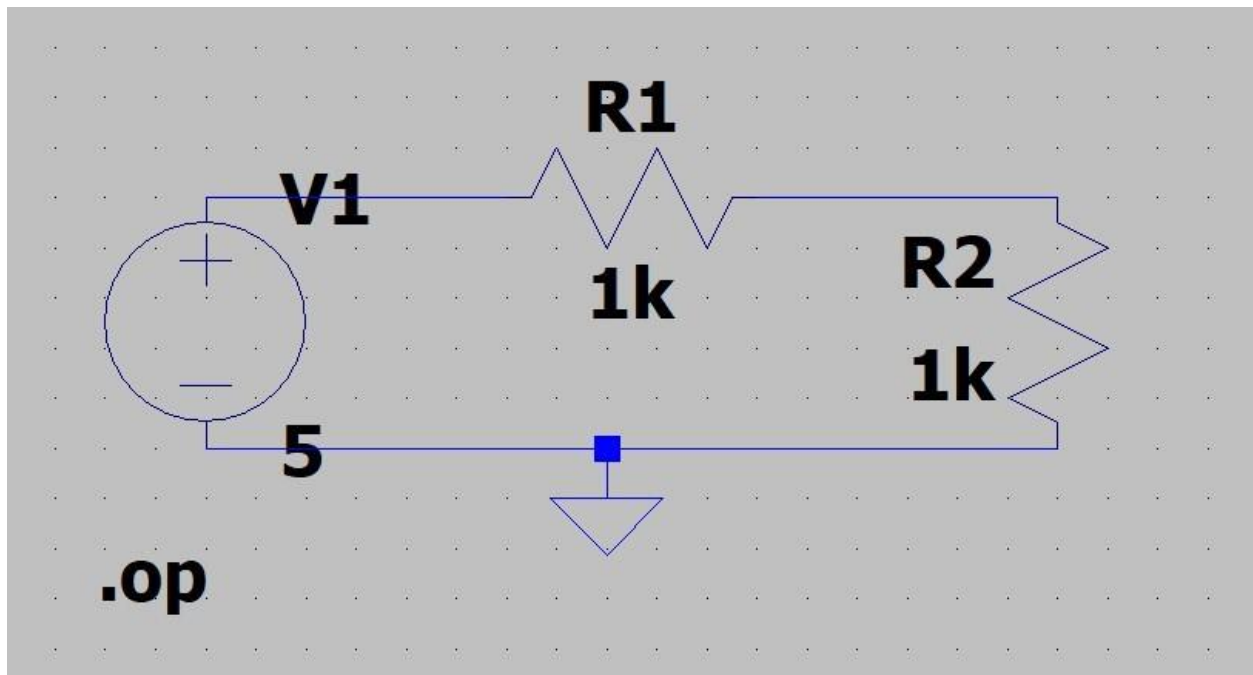
Task 4:

Solution:

--- Operating Point ---

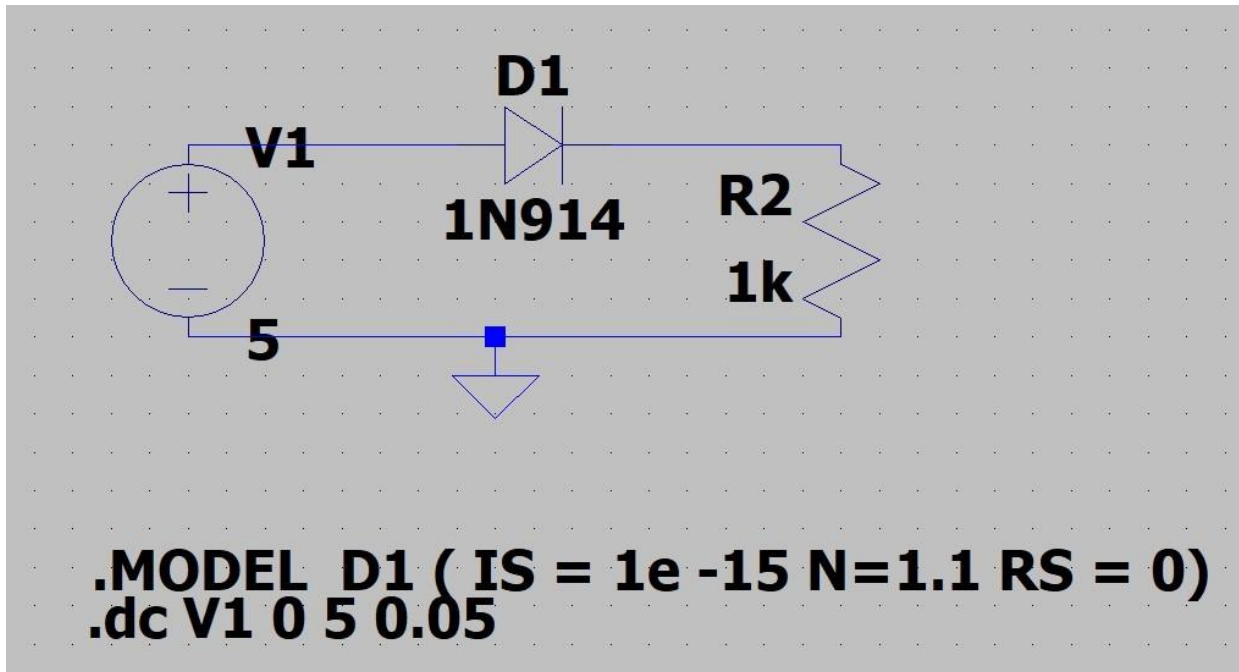
V(n001):	5	voltage
V(n002):	2.5	voltage
I(R2):	-0.0025	device_current
I(R1):	-0.0025	device_current
I(V1):	-0.0025	device_current

Circuit Diagram:

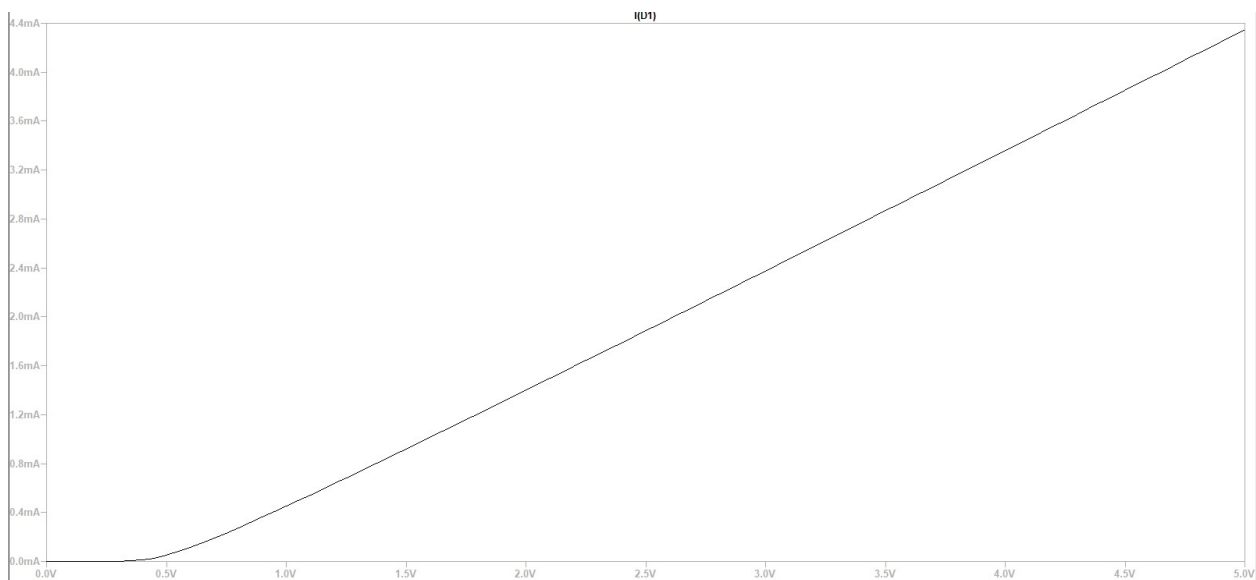


### Task 5:

Circuit Diagram:

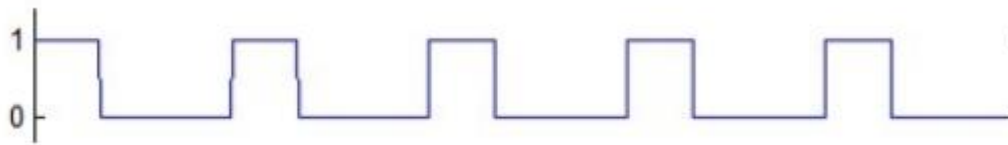


V-I graph of diode:



### SECTION 3 (Design Problem):

Set the oscilloscope and function generator to display on the oscilloscope screen the exact voltage waveform as shown below i.e. the on time is only 50% of the off time and only five complete cycles are visible on the screen. The voltage should vary from 0 to 1V. (Choose frequency of your own choice).



Voltage = 1 V<sub>pp</sub>

Frequency = 2KHZ

Offset = 500mVDC

Duty Cycle = 33%

We let the frequency of 2KHZ of our own choice and set the offset of 500mVDC. And the duty cycle is 33% because the ON-Time is 50% of the OFF-Time. If we press Auto-scale, we would have our desired output of the square wave.

## **Post Lab Discussion:**

What are the important features of ammeters, voltmeters, and ohmmeters? Ammeters:

The important function of ammeters is to measure the current passing through a circuit.

### **Voltmeter:**

The important function of voltmeter is to measure voltage across two points of conductor or a circuit.

### **Ohmmeter:**

The function of ohmmeter is to measure the resistance across two points of an object or a branch.

- What are the functions of the following buttons:

#### **X-Y:**

X-Y mode is a specialized two-channel mode of oscilloscopes when the signal of channel 1 is used for the deviation along the horizontal axis (X) and the signal of channel 2 – along the vertical axis (Y). X-Y

Mode allows displaying the dependence of one physical process (Y signal) on the other one (X signal).

#### **X10:**

An X10 probe has the effect of reducing capacitance by a factor of ten. The trade-off is that is also attenuates the signal by a factor of ten. That is, 1/10 the signal applied to the tip of the probe actually reaches the input of the oscilloscope.

#### **LEVEL**

It is used to manipulate the trigger function of an oscilloscope.

- If we change the vertical position of the signal, will it change the amplitude?

No it will not change the amplitude as the oscilloscope is an output and it does not affect the input in any shape or form. It only projects the output.

- If we change the horizontal position of the signal, will it change the amplitude?

No it will not change the amplitude as the oscilloscope is an output and it does not affect the input in any Shape or form. It only projects the output

## Critical analysis/Conclusions:

We have learnt the basics of using an oscilloscope and function generator. We have Learnt how to adjust our signal so that we can view it easily in order to complete our Experiment. We have also how to send and analyze signal accordingly.

