CSE250: ELECTRONIC DEVICES AND CIRCUITS

EXPERIMENT 1 :

STUDY OF OP-AMP : COMPARATOR, INVERTING AMPLIFIER, NON-INVERTING AMPLIFIER

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Data Sheet

Task-02:

Input Amplitude from oscilloscope, v_I = 2.04 V
Output Amplitude from equation, $v_O = -(\frac{R_2}{R_1}) \times v_I$ = -5.1 V
Output Amplitude from oscilloscope, v_O = -5.20 V

Task-03:

Input Amplitude from oscilloscope, v_I = 2.04 V
Output Amplitude from equation, $v_O = (1 + \frac{R_2}{R_1}) \times v_I$ = 7.4 V
Output Amplitude from oscilloscope, v_O = 7.92 V

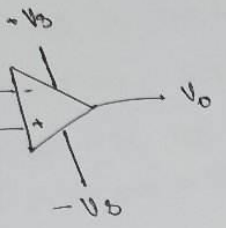
EXPERIMENT 1 – Study of Op-Amp: Comparator, Inverting Amplifier, Non-Inverting Amplifier

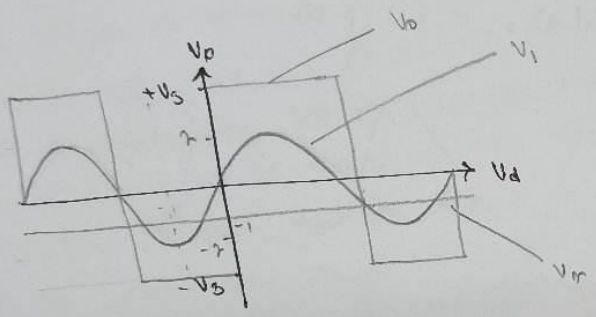
TEST YOUR UNDERSTANDING

(1) $4V_{(p-p)}$ or $\pm 2V$

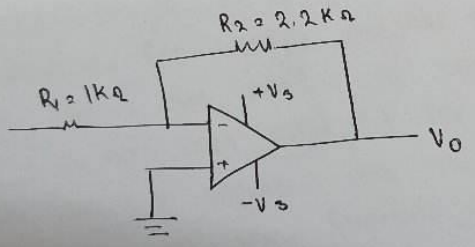
$V_1 = \pm 2V$

$V_2 = V_{REF} = -1V$

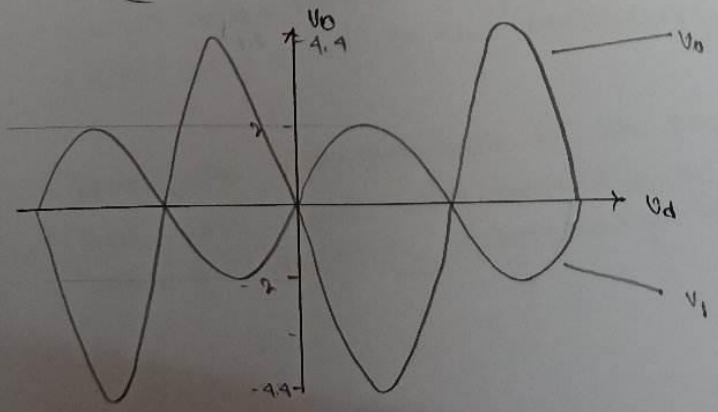




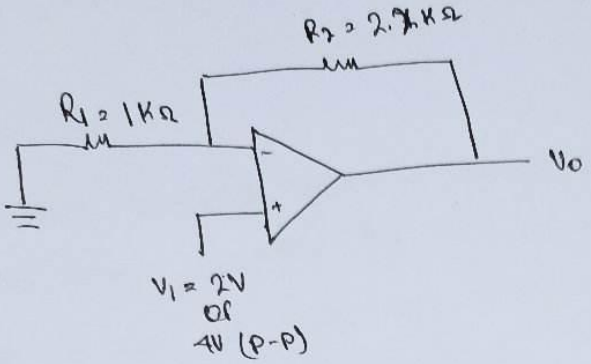
(2) $4V_{(p-p)}$ or $V_1 = \pm 2V$



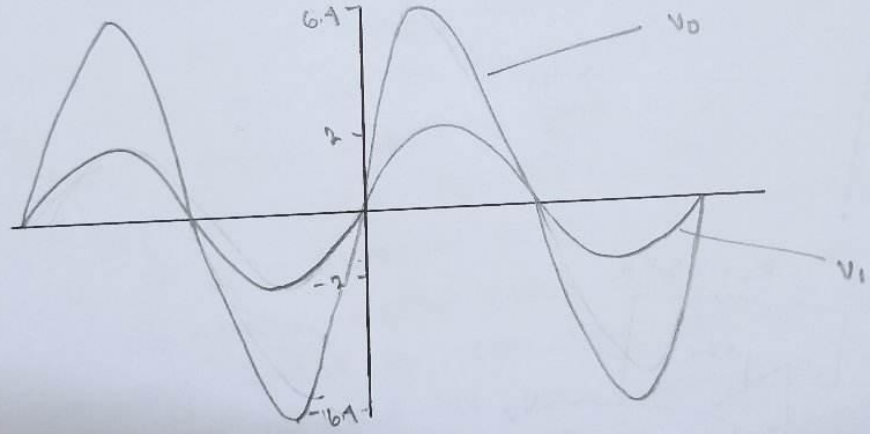
$$V_o = -\left(\frac{R_2}{R_1}\right)V_1 \Rightarrow V_o = -\left(\frac{2.2}{1}\right)(4) = -8.8\,V\ (p\text{-}p)$$



(3)



$$V_o = \left(1 + \frac{R_2}{R_1}\right) V_i \Rightarrow V_o = \left(1 + \frac{2.2}{1}\right)(4) = 12.8\ V\ (P-P)$$

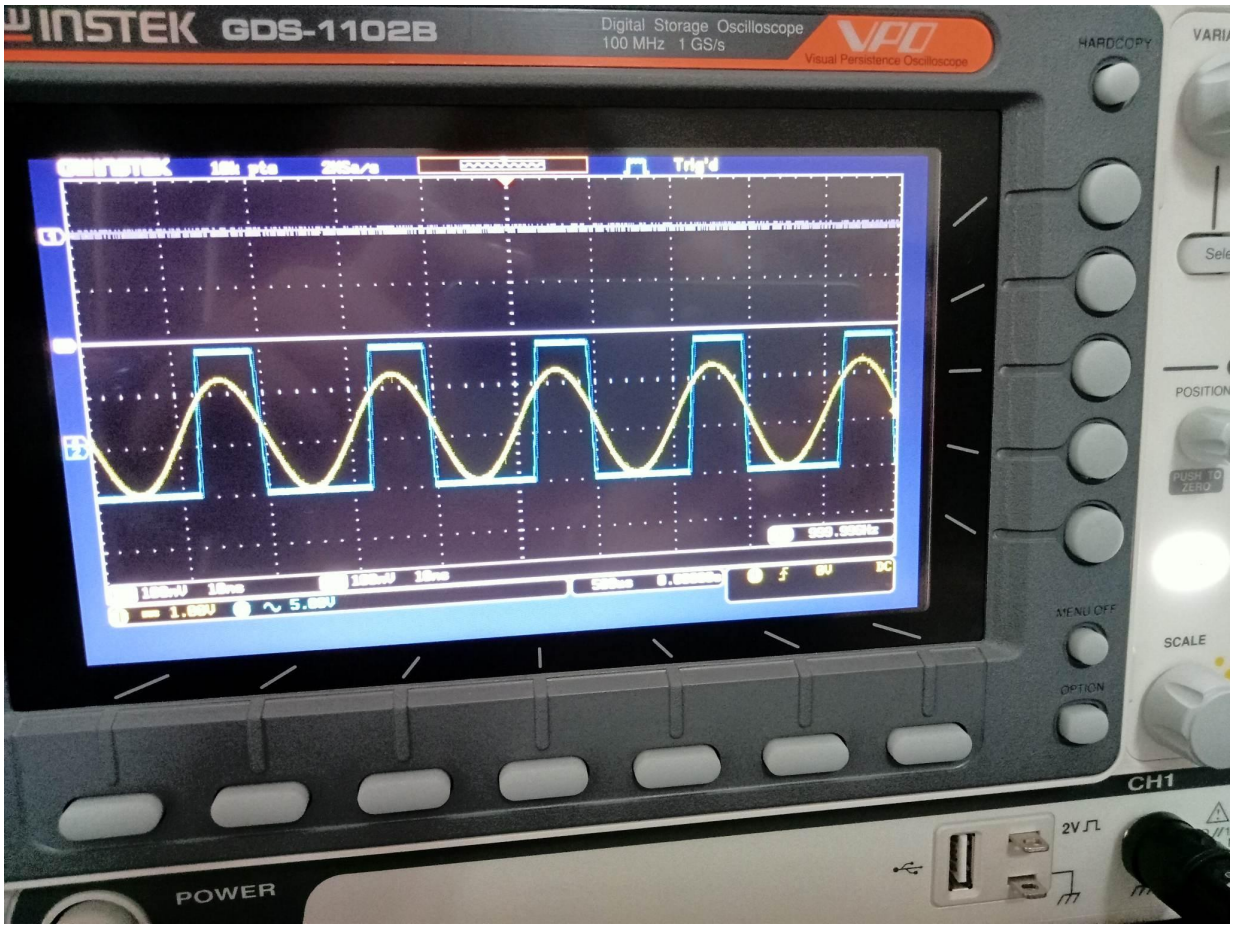


DISCUSSION

IC for op-amp is used to built comparator, inverting amplifier and non-inverting amplifier. The 4th pin, used for -Vs, and the 7th pin, used for +Vs are connected to the trainer board power supply of -8V and +8V respectively, for all the 3 tasks. The 6th pin is always connected to the channel-2 of the Oscilloscope for this experiment, to get the shape of curve and measurements for the output. For comparator, the 2nd pin is considered to be input and the input voltage is taken from the function generator. Also, it is connected with channel-1 of the oscilloscope to observe the curve shape and measurements. The 3rd pin is connected to DC supply, which acts as the reference. For inverting amplifier, same connections are made for the inputs, but instead of connecting 3rd pin to DC supply, it has been grounded. For non-inverting amplifier, the 2nd pin has been grounded and the 3rd pin is ~~set as it~~ connected to the function generator and the channel-1 of the oscilloscope. All the connections are done using jumper wires. For all the 3 tasks, graphs for input and output are shown on the oscilloscope.

During the experiment, some of the problems faced are ~~as~~ there were loose connections due to the some of the ~~broken~~ wires used resulting in inaccurate input/output graphs.

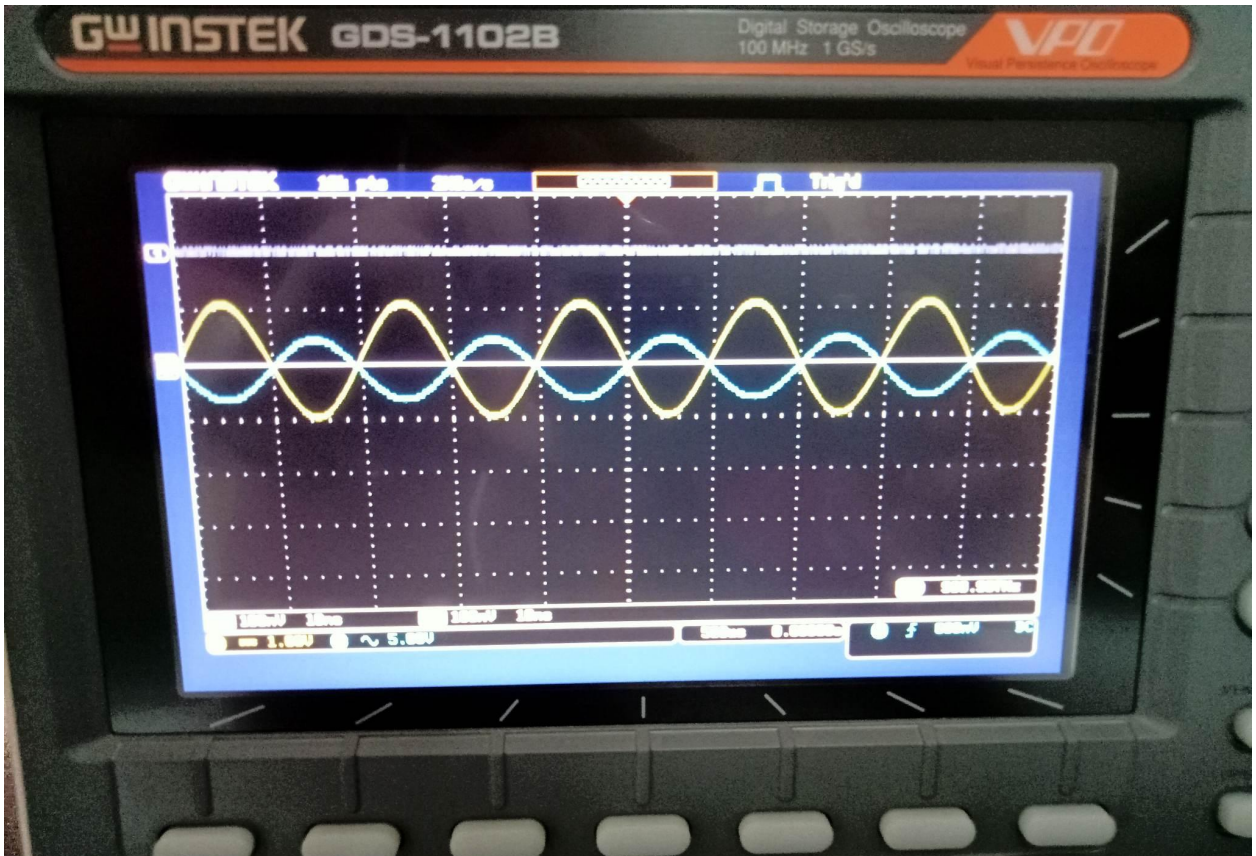
TASK 01 :

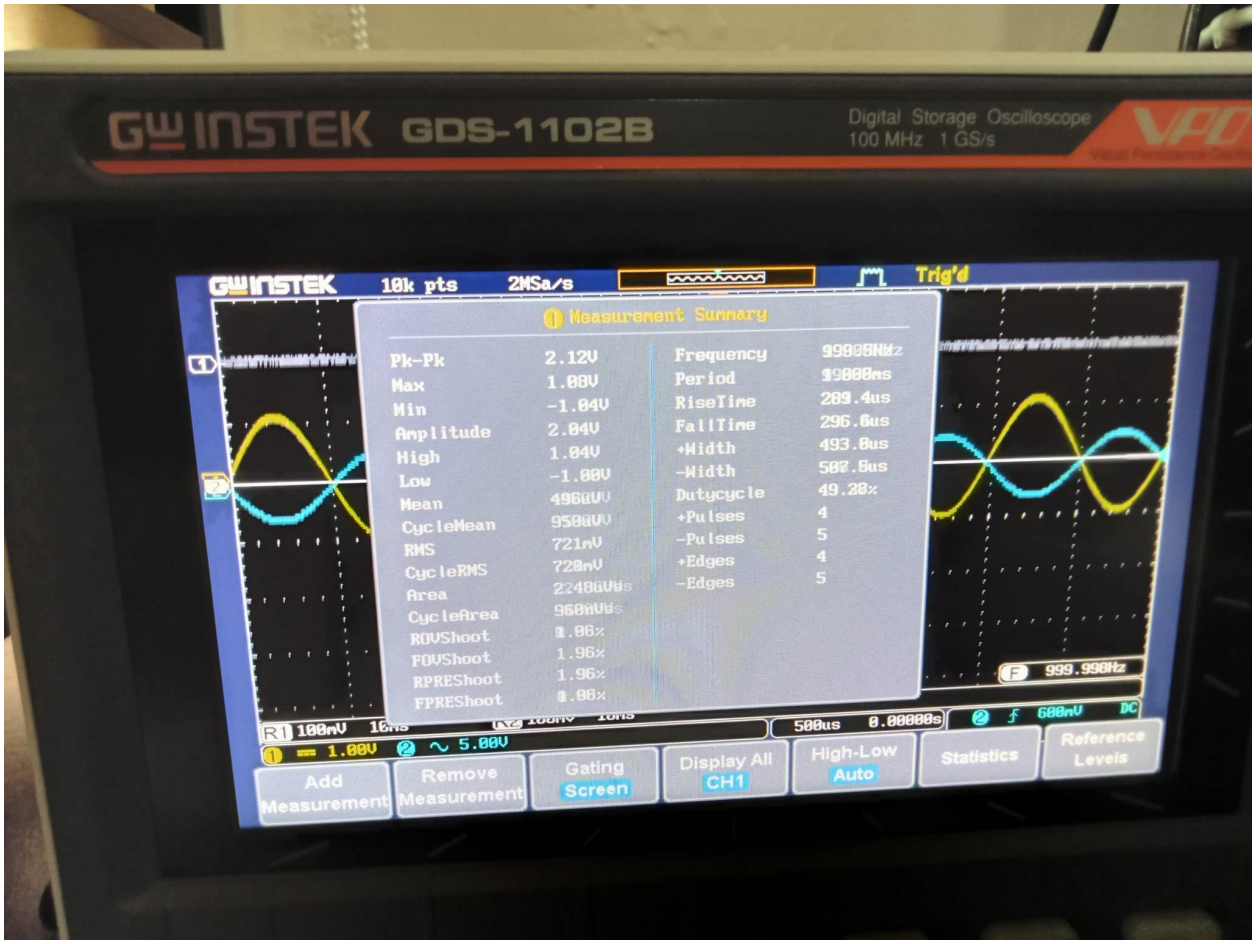

INSTEK GDS-1102B
Digital Storage Oscilloscope
100 MHz 1 GS/s
VPO
Visual Persistence Oscilloscope
HARDCOPY
Trig'd
POSITION
MENU OFF
SCALE
OPTION
CH1
2V
POWER


GW INSTEK
10k pts
2MSa/s
Trig'd
Measurement Summary
Pk-Pk 2.20V
Max 1.12V
Min -1.08V
Amplitude 2.12V
High 1.08V
Low -1.04V
Mean 20.6mV
CycleMean 21.0mV
RMS 768mV
CycleRMS 768mV
Area 103uVs
CycleArea 21.0uVs
ROVShoot 1.89%
FOVShoot 1.89%
RPREShoot 1.89%
FPREShoot 1.89%
Frequency 1.000kHz
Period 1.000ms
RiseTime 282.7us
FallTime 282.2us
+Width 506.8us
-Width 494.8us
Dutycycle 50.68%
+Pulses 4
-Pulses 5
+Edges 5
-Edges 4
F 999.998Hz
100mV
500us 0.00000s
0V DC
1.00V
5.00V
Add Measurement
Remove Measurement
Gating Screen
Display All CH1
High-Low Auto
Statistics
Reference Levels


GW INSTEK
10k pts
2MSa/s
Trig'd
Measurement Summary
Pk-Pk 14.2V
Max 9.20V
Min -5.00V
Amplitude 13.4V
High 8.80V
Low -4.60V
Mean 108mV
CycleMean 107mV
RMS 6.37V
CycleRMS 6.37V
Area 541uVs
CycleArea 107uVs
ROVShoot 2.99%
FOVShoot 2.99%
RPREShoot 2.99%
FPREShoot 2.99%
Frequency 999.0Hz
Period 1.001ms
RiseTime 30.22us
FallTime 29.80us
+Width 355.5us
-Width 645.5us
Dutycycle 35.51%
+Pulses 5
-Pulses 4
+Edges 5
-Edges 5
1.00003kHz
100mV
1.00V
5.00V
500us
0.00000s
Add Measurement
Remove Measurement
Gating Screen
Display All CH2
High-Low Auto
Statistics
Reference Levels

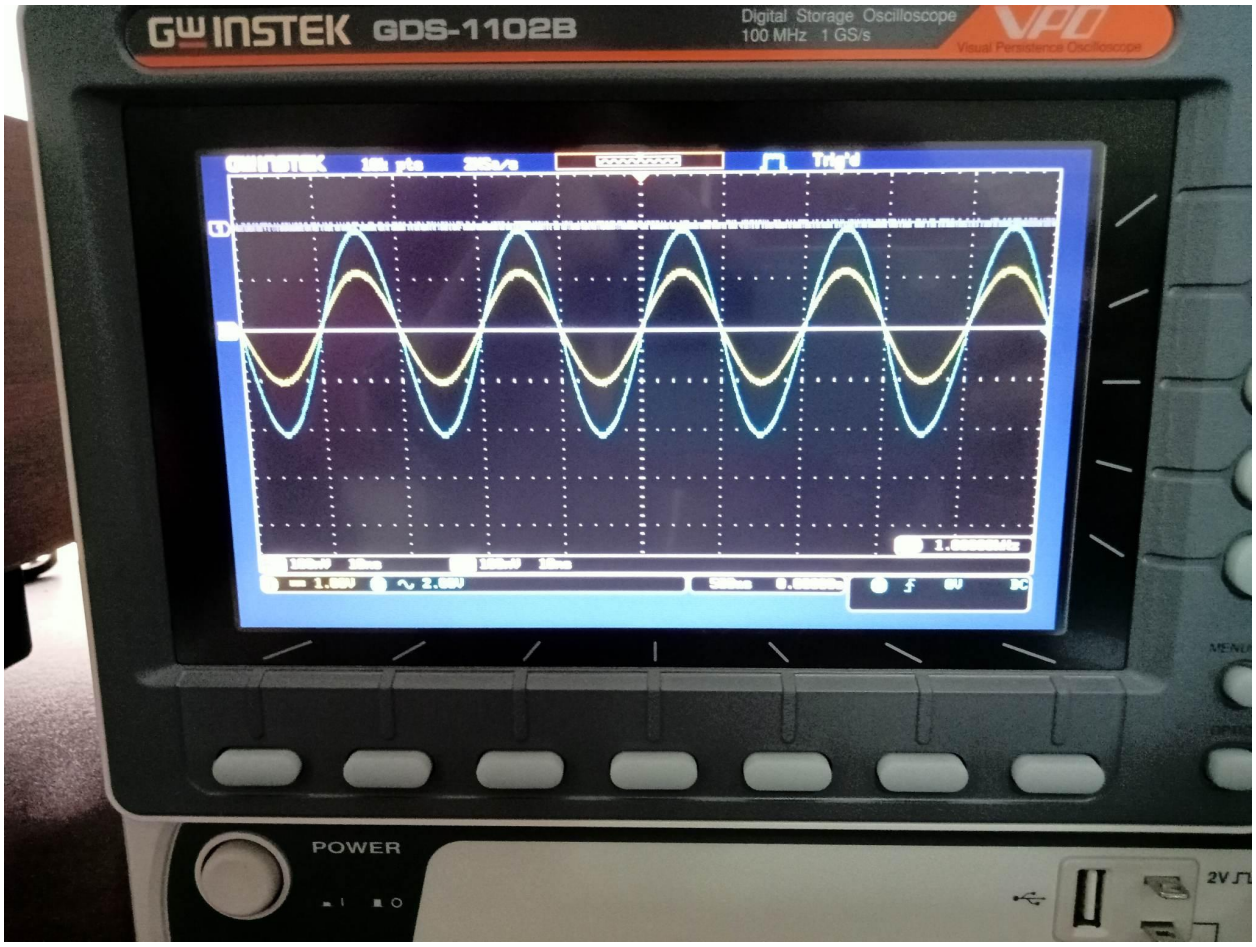
TASK 02 :

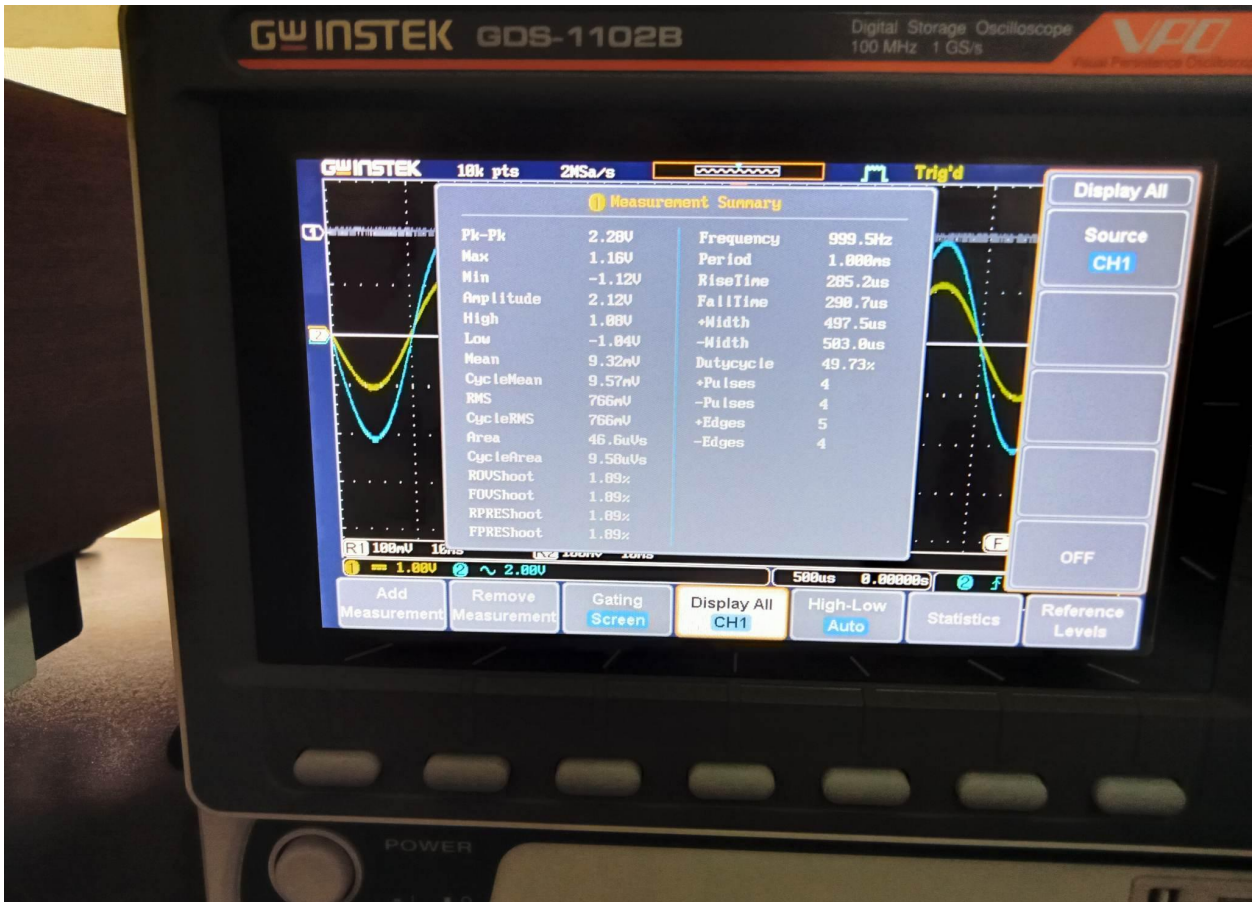

GW INSTEK GDS-1102B
Digital Storage Oscilloscope
100 MHz 1 GS/s
VPO
Trig'd


GW INSTEK GDS-1102B
Digital Storage Oscilloscope
100 MHz 1 GS/s
GW INSTEK 10k pts 2MSa/s Trig'd
Measurement Summary
Pk-Pk 2.12V
Max 1.08V
Min -1.04V
Amplitude 2.04V
High 1.04V
Low -1.00V
Mean 4960uV
CycleMean 9500uV
RMS 721mV
CycleRMS 720mV
Area 22486uVs
CycleArea 9600uVs
ROVShoot 1.86x
FOVShoot 1.96x
RPREShoot 1.96x
FPREShoot 0.00x
Frequency 99900Hz
Period 10000ns
RiseTime 289.4us
FallTime 296.6us
+Width 493.0us
-Width 507.5us
Dutycycle 49.20x
+Pulses 4
-Pulses 5
+Edges 4
-Edges 5
F 999.990Hz
100mV
500us 0.00000s
600mV DC
1.00V 5.00V
Add Measurement
Remove Measurement
Gating Screen
Display All CH1
High-Low Auto
Statistics
Reference Levels


GW INSTEK 10k pts 2MSa/s Trig'd
Measurement Summary
Pk-Pk 5.80V
Max 2.80V
Min -3.00V
Amplitude 5.20V
High 2.60V
Low -2.60V
Mean -13.1mV
CycleMean -11.2mV
RMS 1.92V
CycleRMS 1.92V
Area -65.5uVs
CycleArea -11.3uVs
ROVShoot 3.85x
FOVShoot 0.00x
RPREShoot 0.00x
FPREShoot 3.85x
Frequency 1.000kHz
Period 99905us
RiseTime 292.2us
FallTime 291.0us
+Width 499.0us
-Width 501.0us
Dutycycle 49.90x
+Pulses 4
-Pulses 4
+Edges 5
-Edges 4
F 999.995Hz
100mV
500us 0.00000s
600mV DC
1.00V 5.00V
Add Measurement
Remove Measurement
Gating Screen
Display All CH2
High-Low Auto
Statistics
Reference Levels

TASK 03:


GW INSTEK GDS-1102B
Digital Storage Oscilloscope
100 MHz 1 GS/s
Trig'd
POWER


GW INSTEK GDS-1102B
Digital Storage Oscilloscope
100 MHz 1 GS/s
10k pts 2MSa/s
Trig'd
Measurement Summary
Pk-Pk 2.28V
Max 1.16V
Min -1.12V
Amplitude 2.12V
High 1.08V
Low -1.04V
Mean 9.32mV
CycleMean 9.57mV
RMS 766mV
CycleRMS 766mV
Area 46.6uVs
CycleArea 9.58uVs
ROVShoot 1.89%
FOVShoot 1.89%
RPREShoot 1.89%
FPREShoot 1.89%
Frequency 999.5Hz
Period 1.000ms
RiseTime 285.2us
FallTime 298.7us
+Width 497.5us
-Width 503.0us
Dutycycle 49.73%
+Pulses 4
-Pulses 4
+Edges 5
-Edges 4
Display All
Source CH1
OFF
Add Measurement
Remove Measurement
Gating Screen
Display All CH1
High-Low Auto
Statistics
Reference Levels
POWER


GW INSTEK GDS-1102B
GW INSTEK
10k pts
2MSa/s
Trig'd
Measurement Summary
Pk-Pk 8.16V
Max 4.00V
Min -4.16V
Amplitude 7.92V
High 3.84V
Low -4.08V
Mean -79.7mV
CycleMean -80.4mV
RMS 2.84V
CycleRMS 2.84V
Area -398uVs
CycleArea -80.4uVs
ROVShoot 2.02x
FOVShoot 1.01x
RPREShoot 1.81x
FPREShoot 2.02x
Frequency 1.000kHz
Period 1.000ms
RiseTime 293.8us
FallTime 298.1us
+Width 504.8us
-Width 495.1us
Dutycycle 50.49x
+Pulses 4
-Pulses 4
+Edges 5
-Edges 4
Display All
Source CH2
OFF
1.00V
2.00V
500us
0.00000s
Add Measurement
Remove Measurement
Gating Screen
Display All CH2
High-Low Auto
Statistics
Reference Levels
POWER