ECEN 325 – Electronics

Fall 2020

Lab 3: Report

Submitted by:

Student Name	UIN:	Section #
Michael Mengistu	12500724	**508**

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I. Objective

The objective of this lab is to have a better understanding of how op amps works by designing and building op amp circuits.

II. Procedure

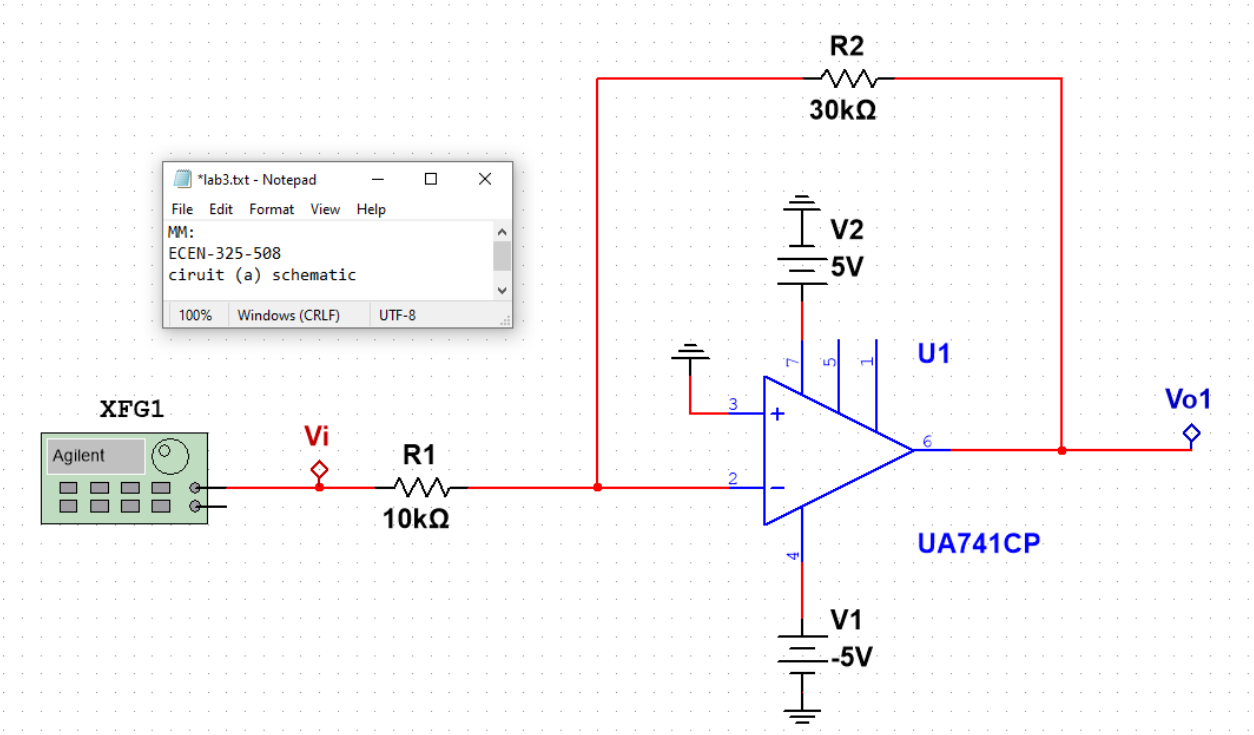
For the procedure I first had to calculate the values of unknown resistors for 3 op amp circuits. Then I created a schematic of the three circuits and built a breadboard design for each of them. After that, I measurement the bode plots, time domains, and the total harmonic distortion of the circuits and then built a 4th op amp circuit and measured the values of the resistors to find the input current of the circuit.

III. Difficulties

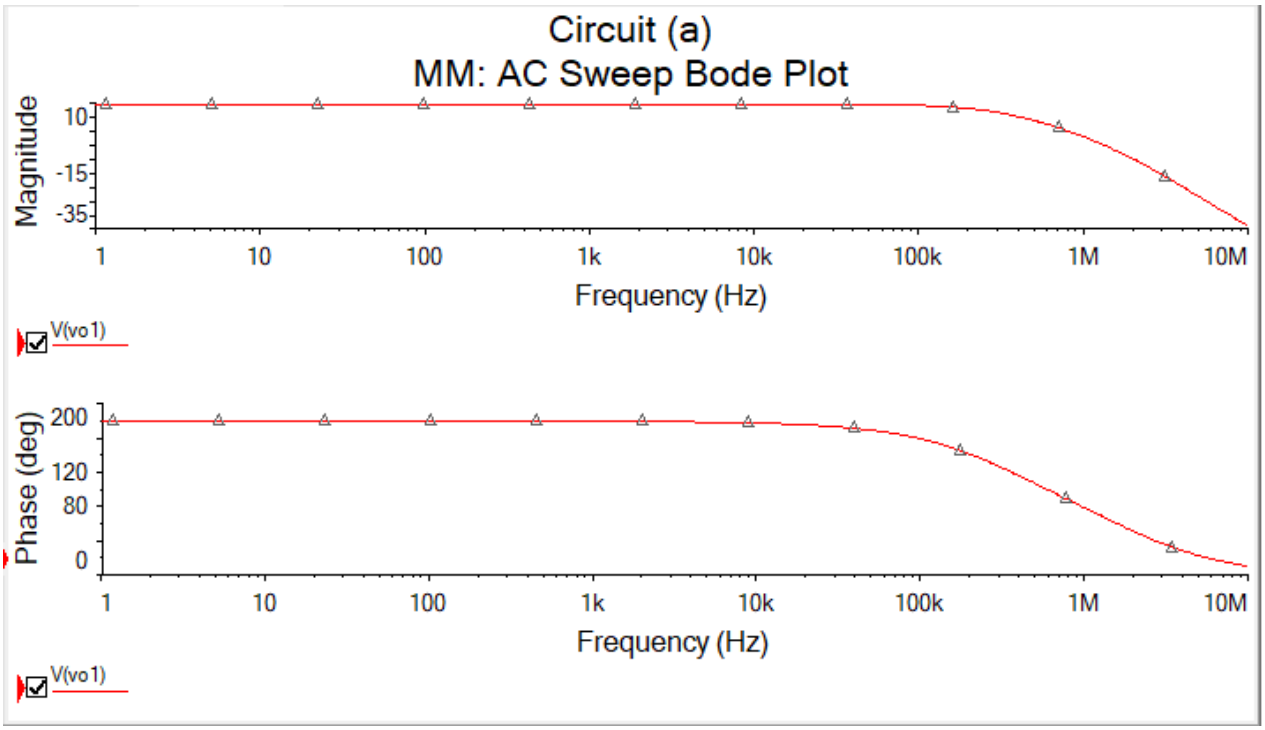
There were no difficulties during the lab.

IV. Results

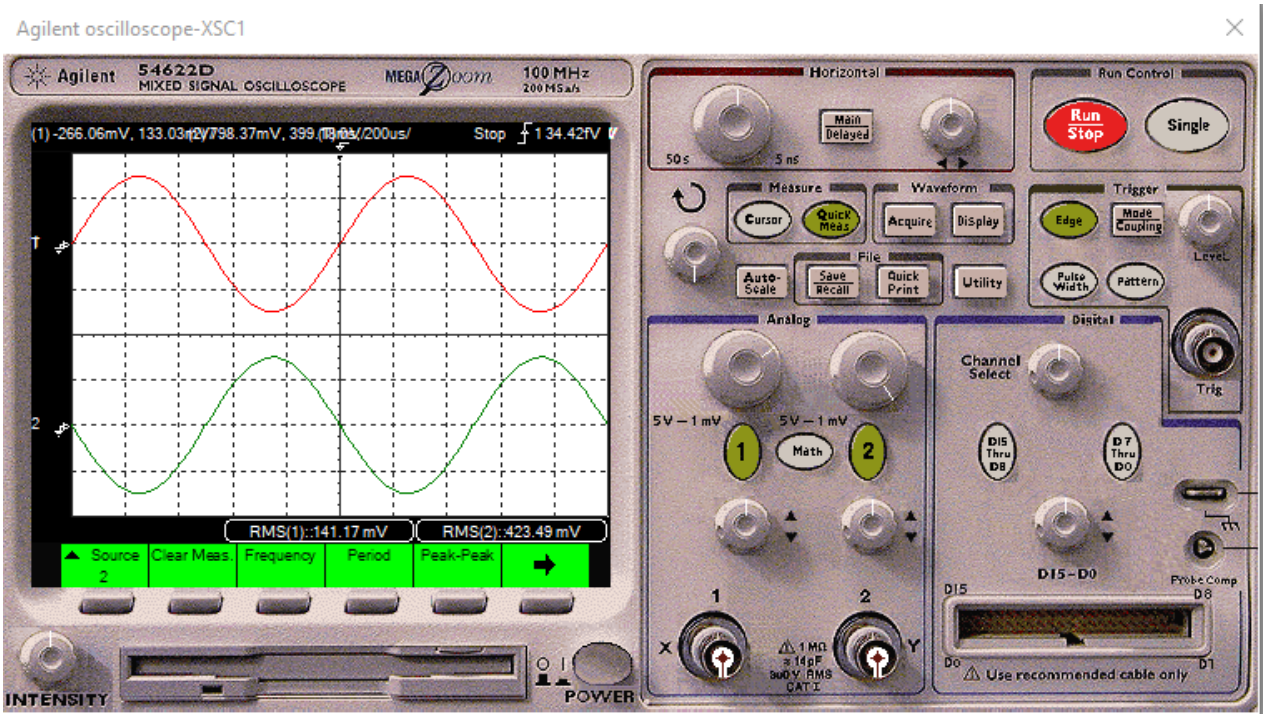
Circuit (a) schematic



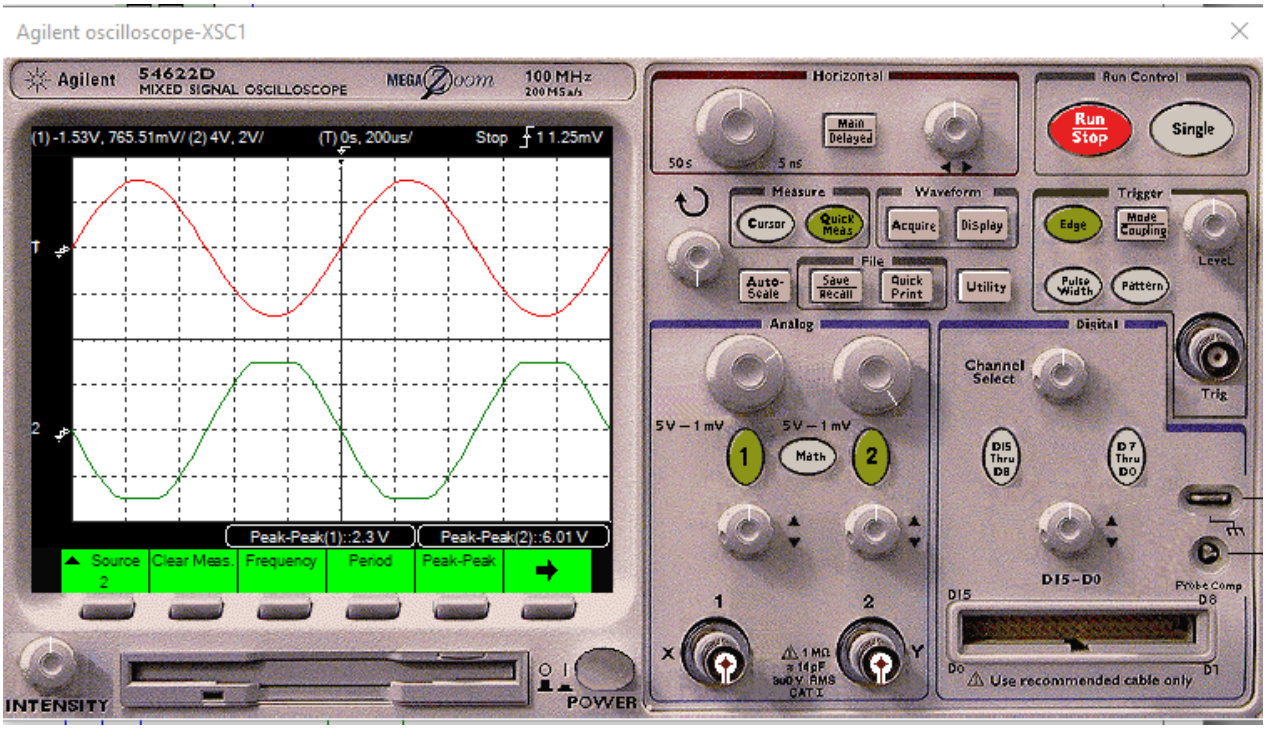
Circuit (a) Bode Plot



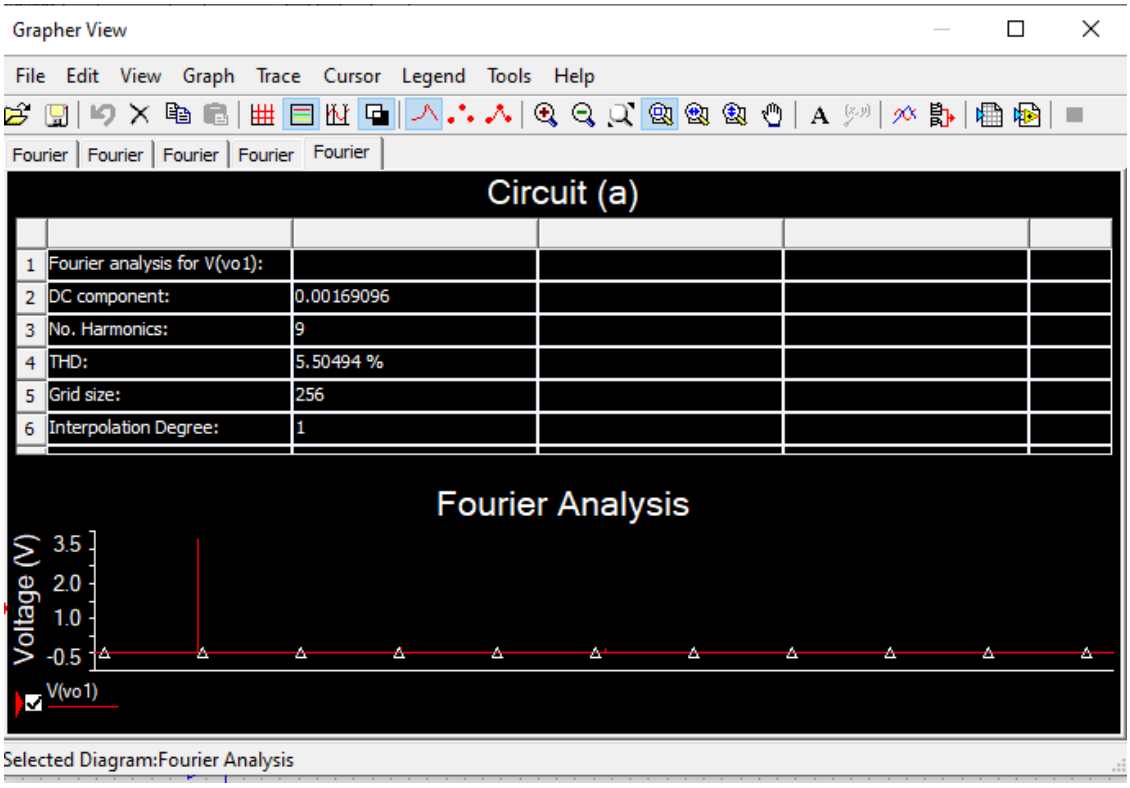
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (a)



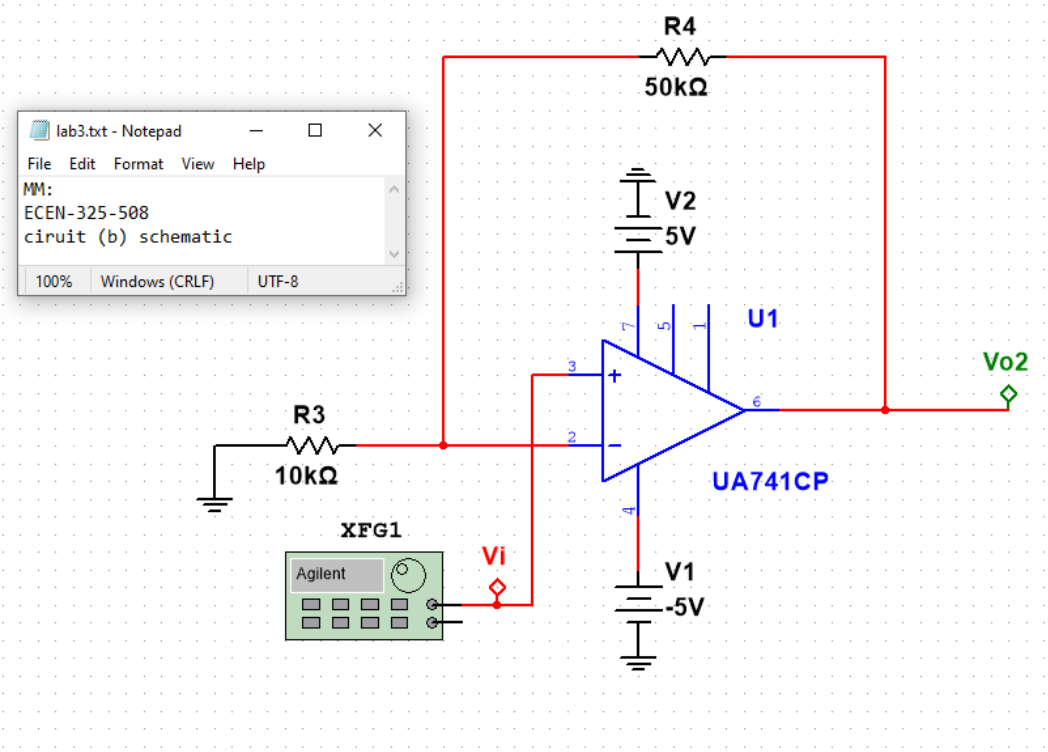
$V_{i,max}$ at 1kH Time-domain waveforms for Circuit (a)



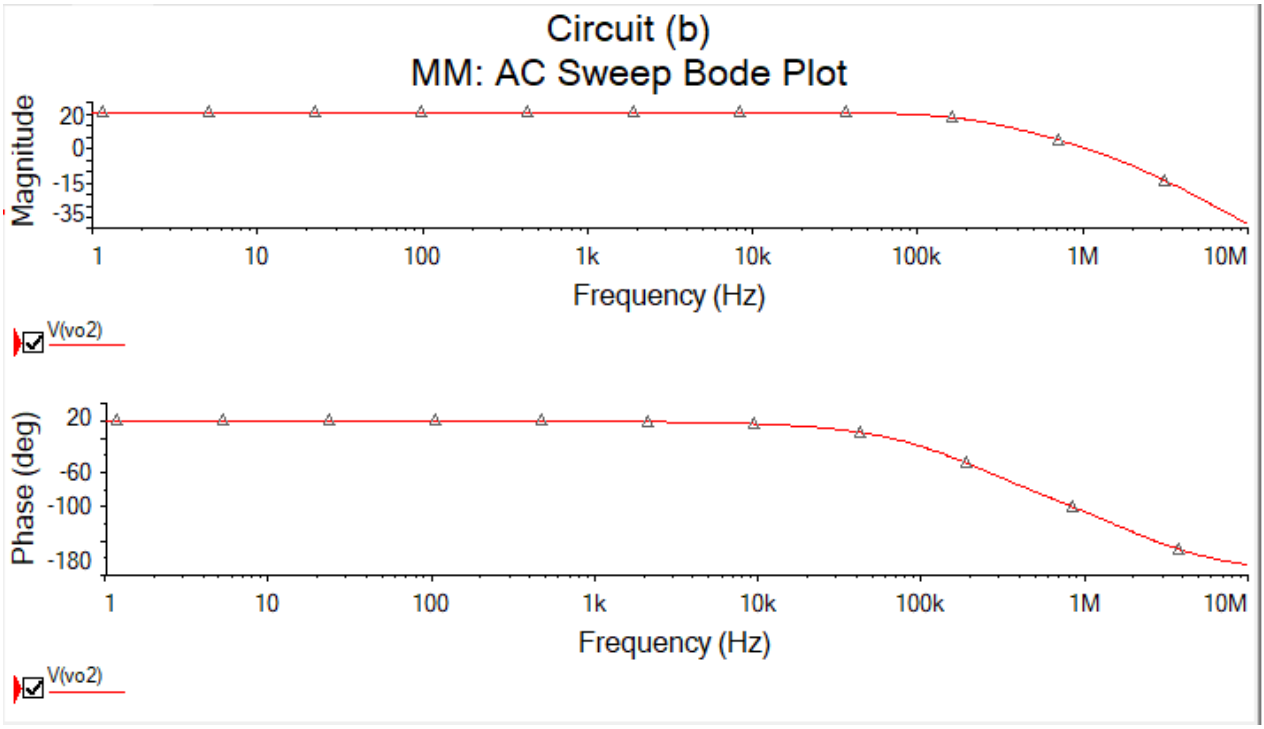
Total harmonic distortion for Circuit (a)



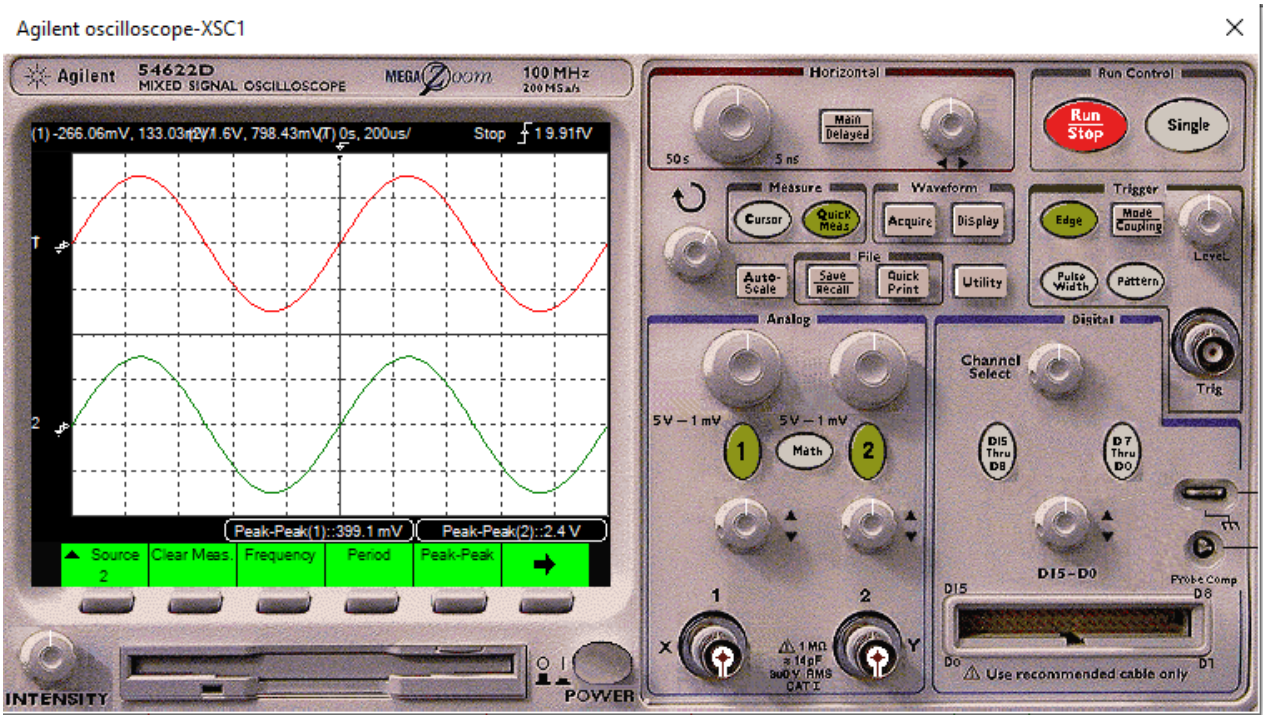
Circuit (b) schematic



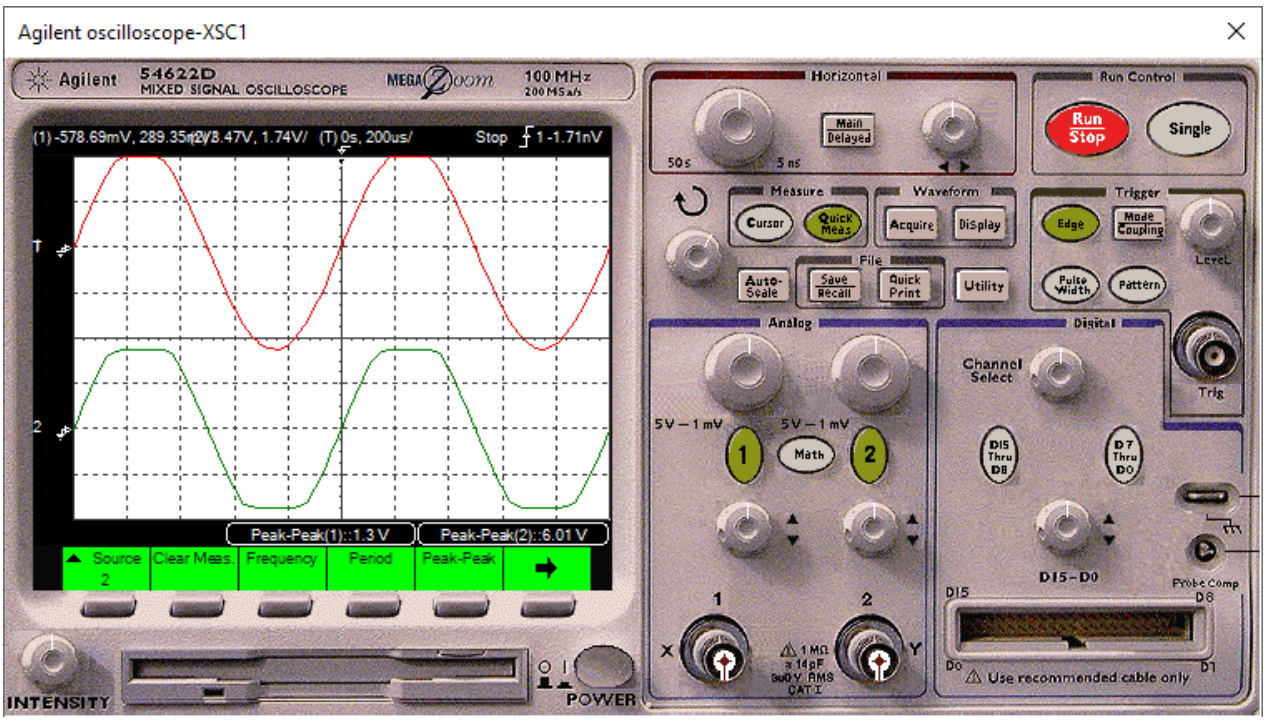
Circuit (b) Bode Plot



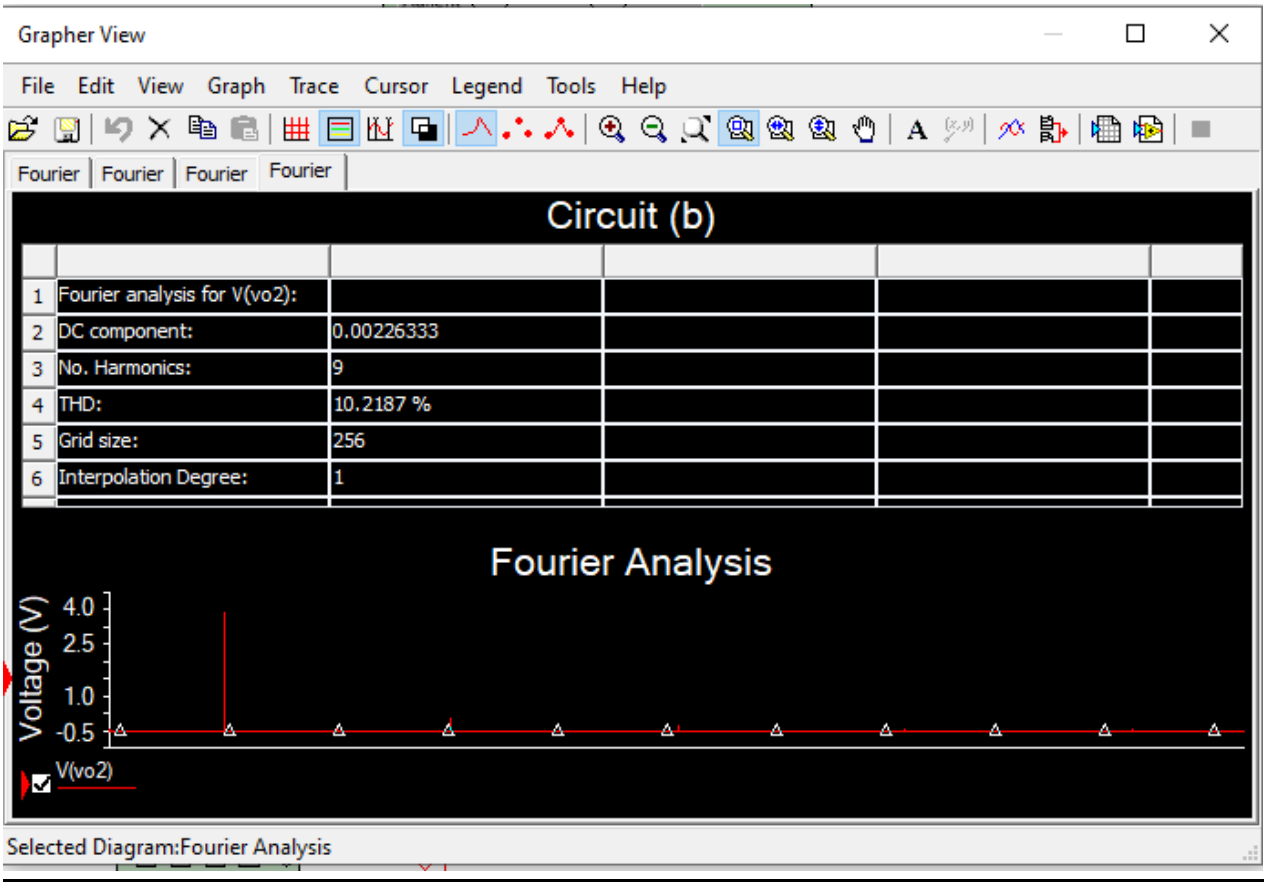
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (b)



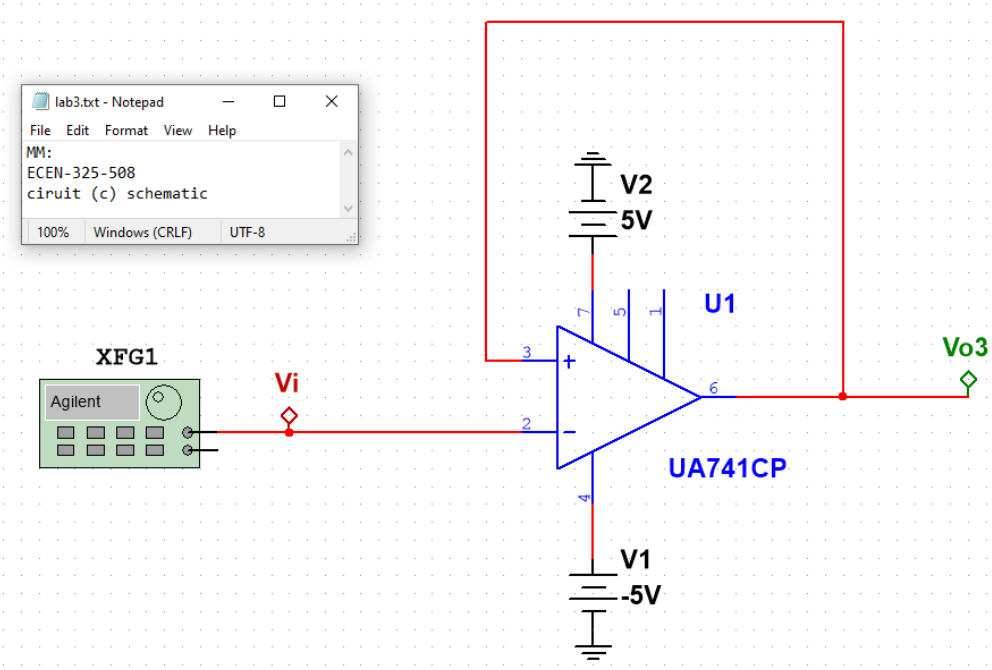
$V_{i,max}$ at 1kH Time-domain waveforms for Circuit (b)



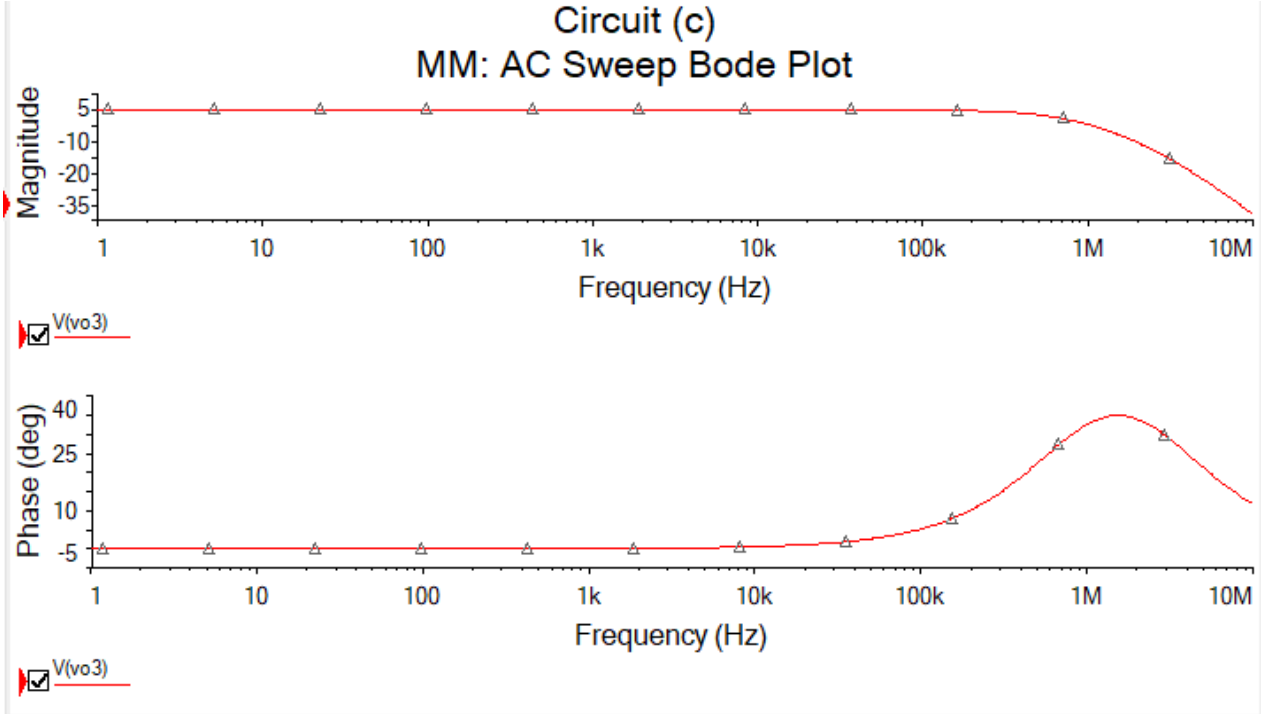
Total harmonic distortion for Circuit (b)



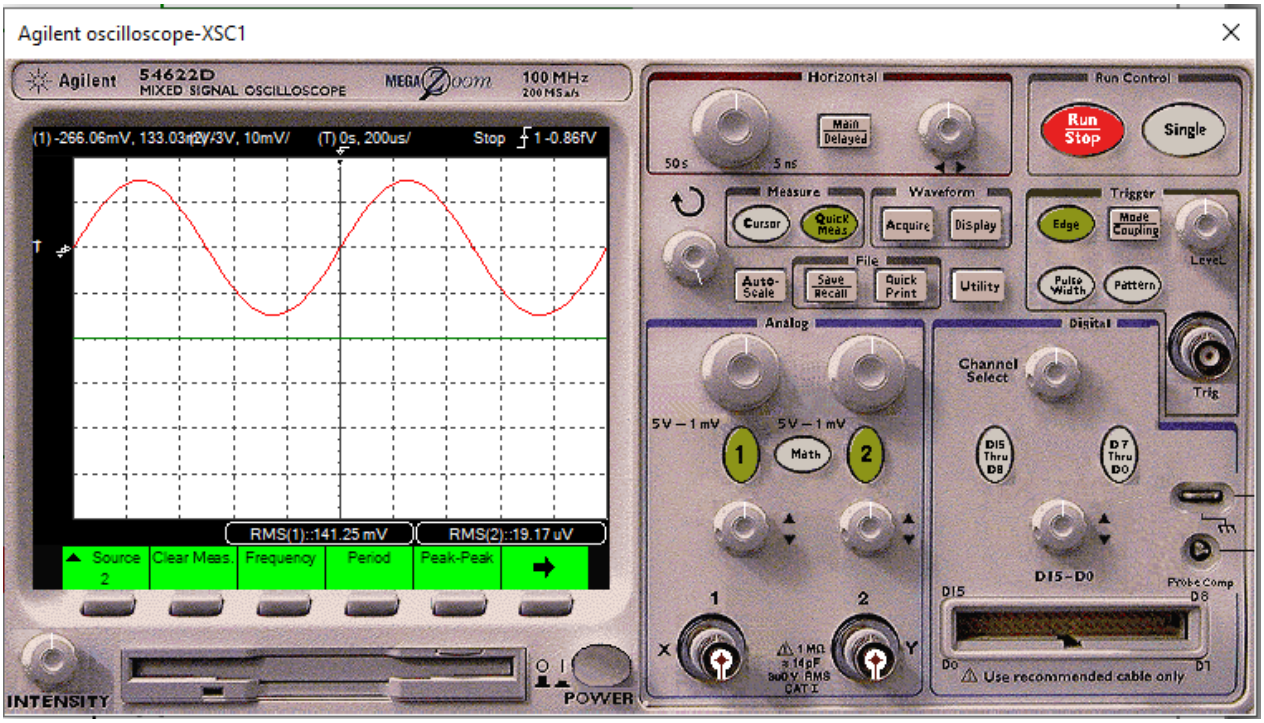
Circuit (c) schematic



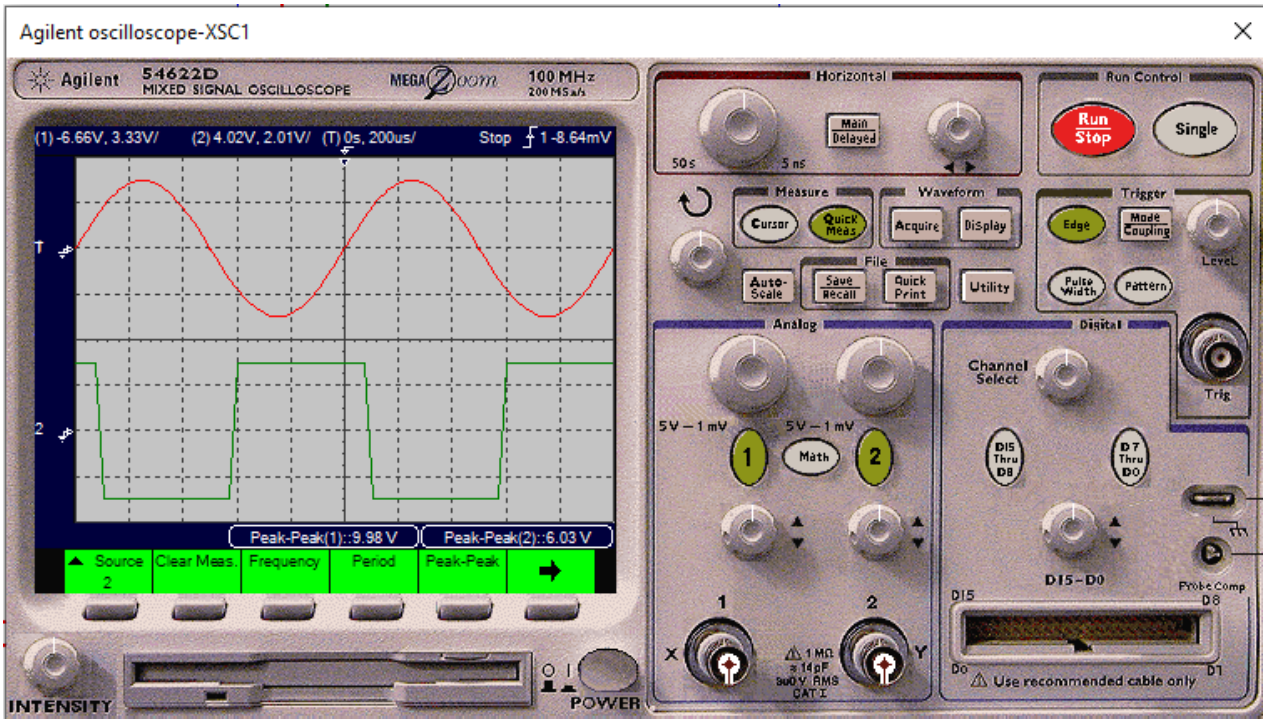
Circuit (c) Bode Plot



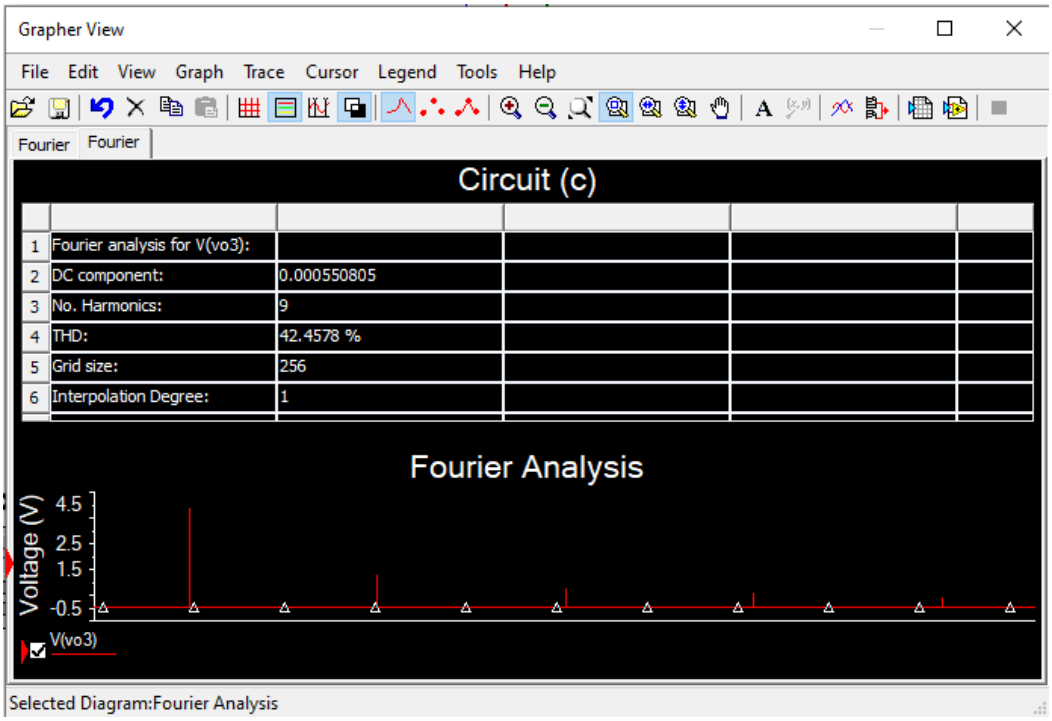
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (c)



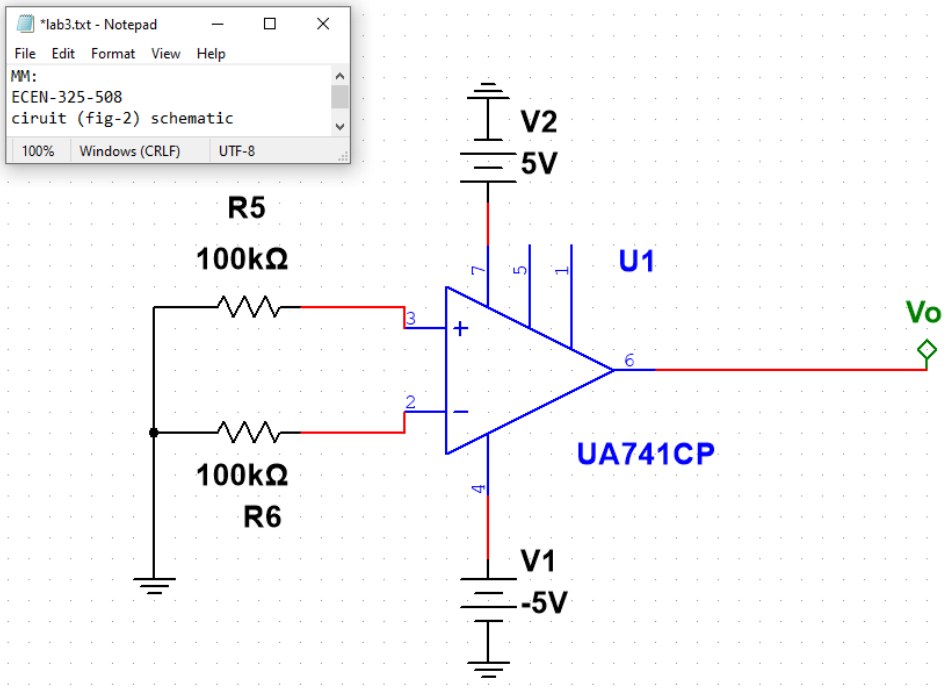
$V_{i,max}$ at 1kH Time-domain waveforms for Circuit (c)



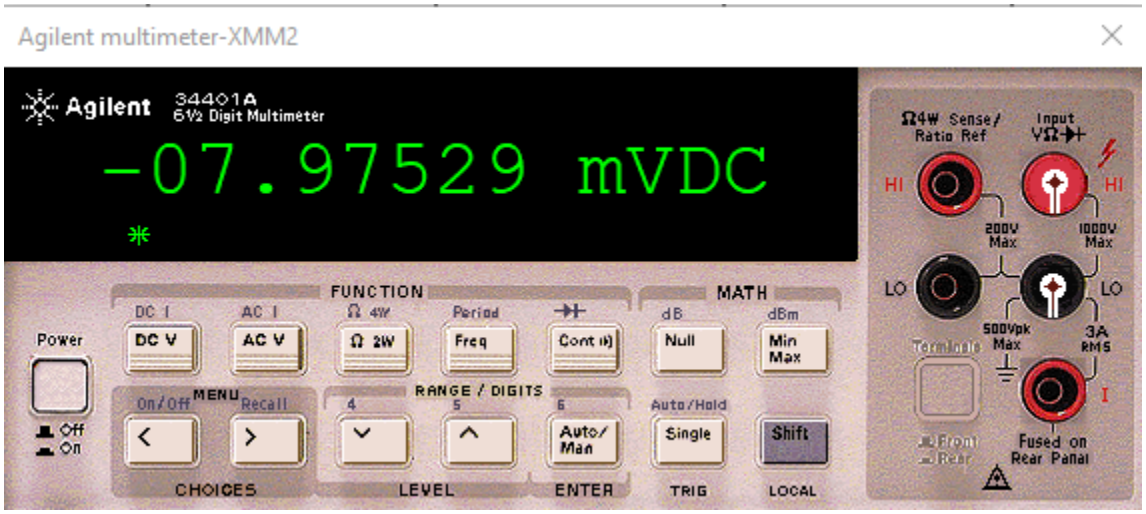
Total harmonic distortion for Circuit (c)



Circuit (fig.2) schematic



Circuit (fig.2) voltage at R5



Circuit (fig.2) voltage at R6

Measured results for bode plots:

Circuit:	gain at 1 kHz:
(a)	9.54 dB
(b)	15.6 dB
(c)	196 µdB

Measured results for Vi(t) = 2sin(2π1000) Time-domain waveforms:

- Found the gain by dividing Vout/Vi and looking at waveforms to see if it is negative or positive gain.

Circuit:	V_i RMS (V)	V_{out} RMS (V)	Gain
(a)	0.14117	0.42349	-2.99986
(b)	0.3991	2.4	6.01353
(c)	0.14125	0.00001917	-0.00014

Measured results for max Voltage amplitude at 1kH:

- Found the amplitude by dividing my measured Peak to Peak voltage by 2

Circuit:	$V_{i,max}$ peak-peak (V)	$V_{i,max}$ amplitude (V)
(a)	2.3	1.15
(b)	1.3	0.65
(c)	10	5

Calculated and measured results:

Circuit:	THD
(a)	5.51%
(b)	10.23%
(c)	42.46%

Measured results of total harmonic distortion:

Circuit:	THD
(a)	5.51%
(b)	10.23%
(c)	42.46%

Measured results of fig.2:

- Found input offset using ohms law

Circuit:	Voltage of R5 (V)	Voltage of R5 (V)	input offset current (uA)
(fig.2)	-0.797529	-0.797529	7.975

V. Conclusion

The Offset voltage the difference between the output's voltage and input's voltage and it is calculated by dividing the output by the input. In conclusion, when comparing my results from my measurements the calculated and measured gain was correct for only certain levels of input voltages. This is mainly due to the saturation rate of the op amp's