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LAB #2

ELCN8005-21F-Sec1-Electronics Design Principles

Basic Op Amps

OBJECTIVE

A) Inverting amplifier
B) Non-inverting amplifier
C) Voltage follower
Design a circuit using one of the quad Op-amps in your first semester
ESD kit.
1) Decide the power to be applied to the IC based on your datasheet.
State your reason. (hint: +/- 3 up to +/- 10)
2) Prepare circuits in advance and prepare the tables with predicted/calculated outcomes to compare with the actual values (minimum 10 entries).
3) The amplification should be approximately 2 for both amplifiers.
4) Use a potentiometer (variable resister) to vary the input voltage.

EQUIPMENTS

Op amp – LM348N

Resistor

Multimeter - 1

Function generator - 1

Oscilloscope - 1

Multisim

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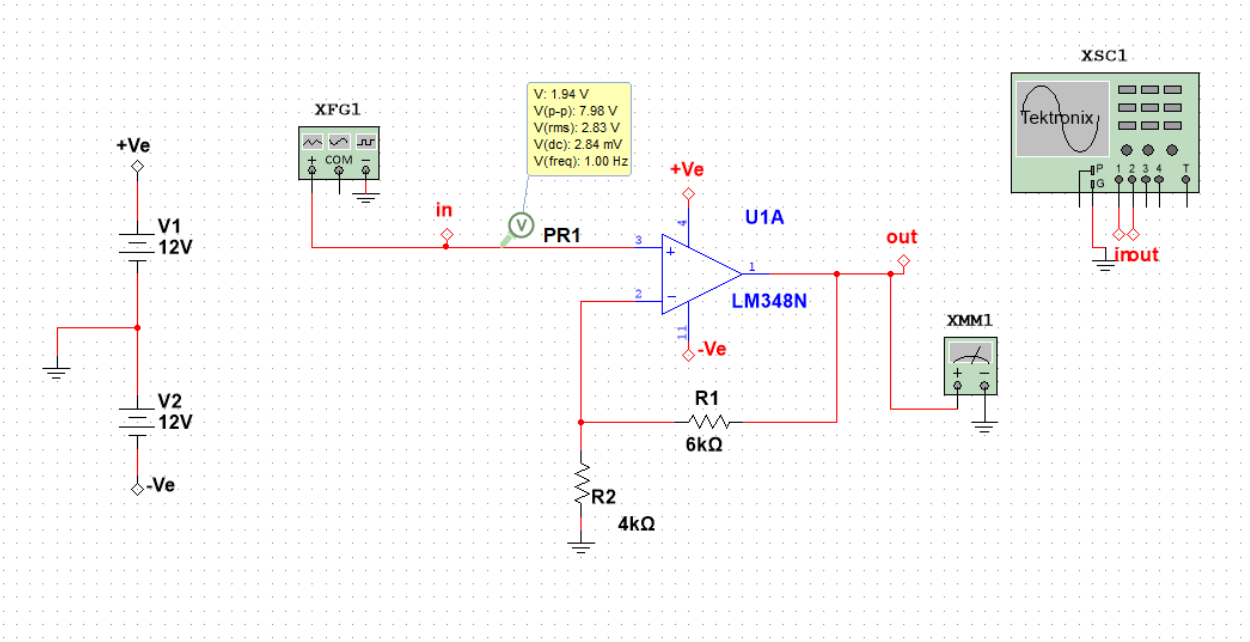
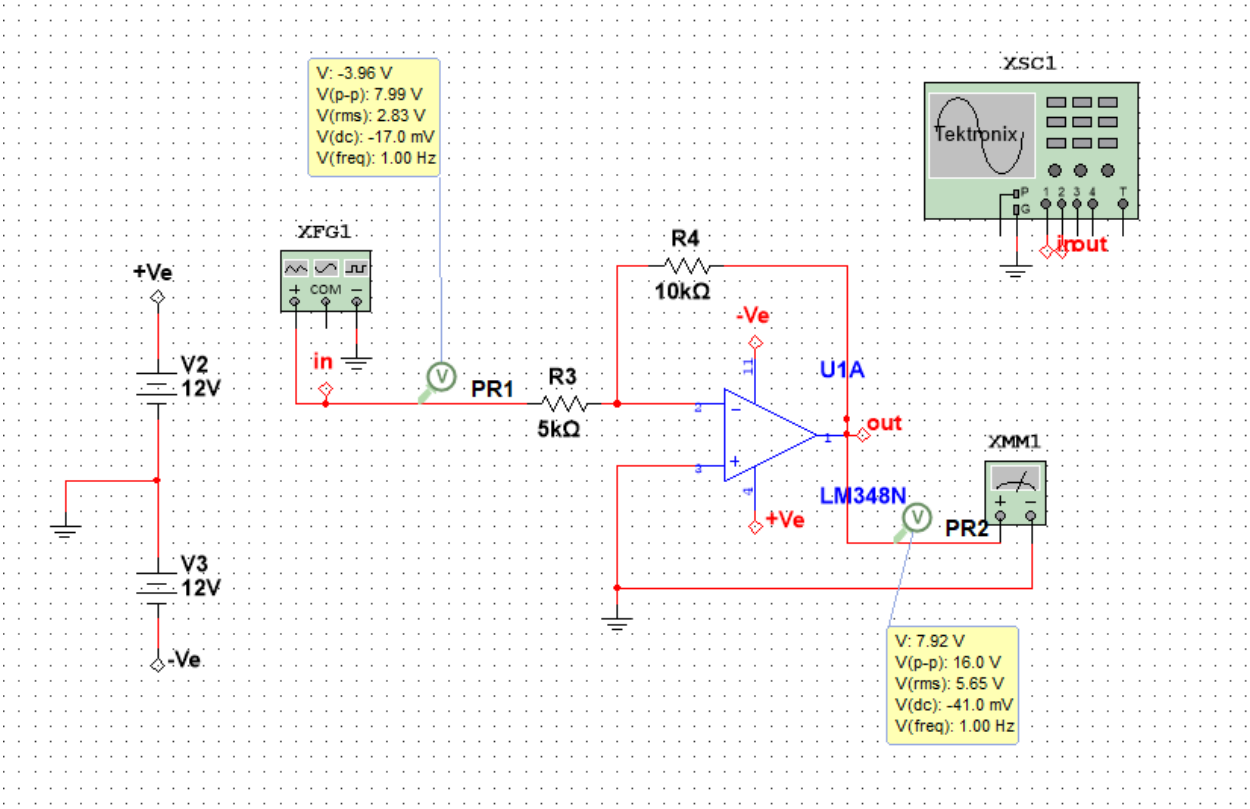
SCHEMATIC IN MULTISIM

Non-inverting amplifier:



Inverting amplifier:



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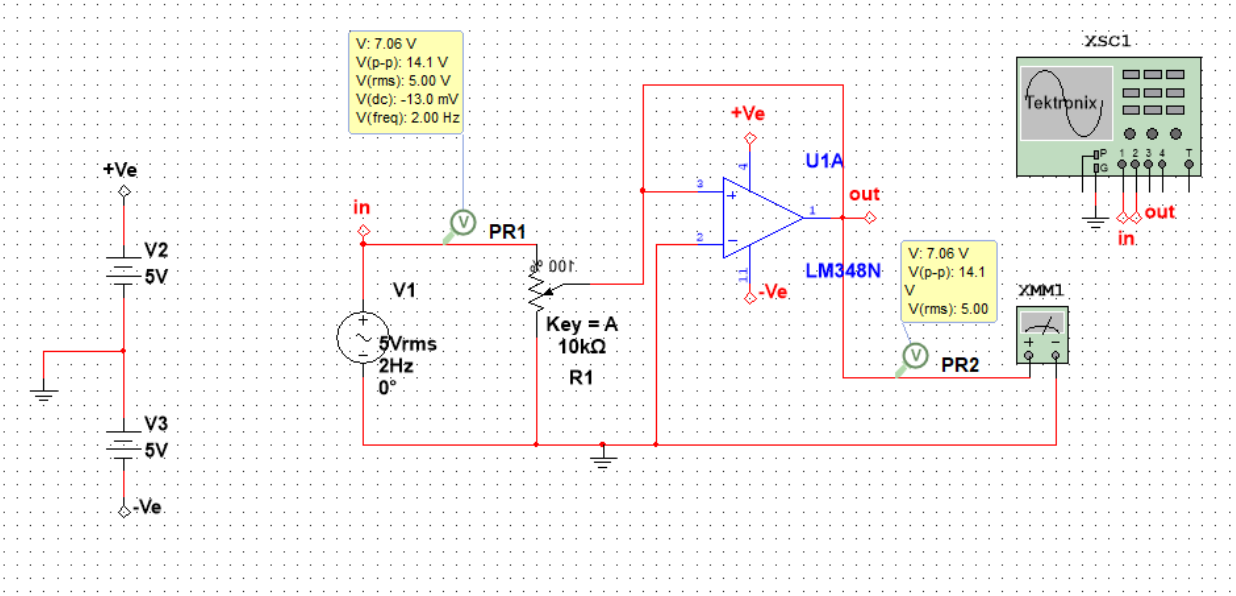
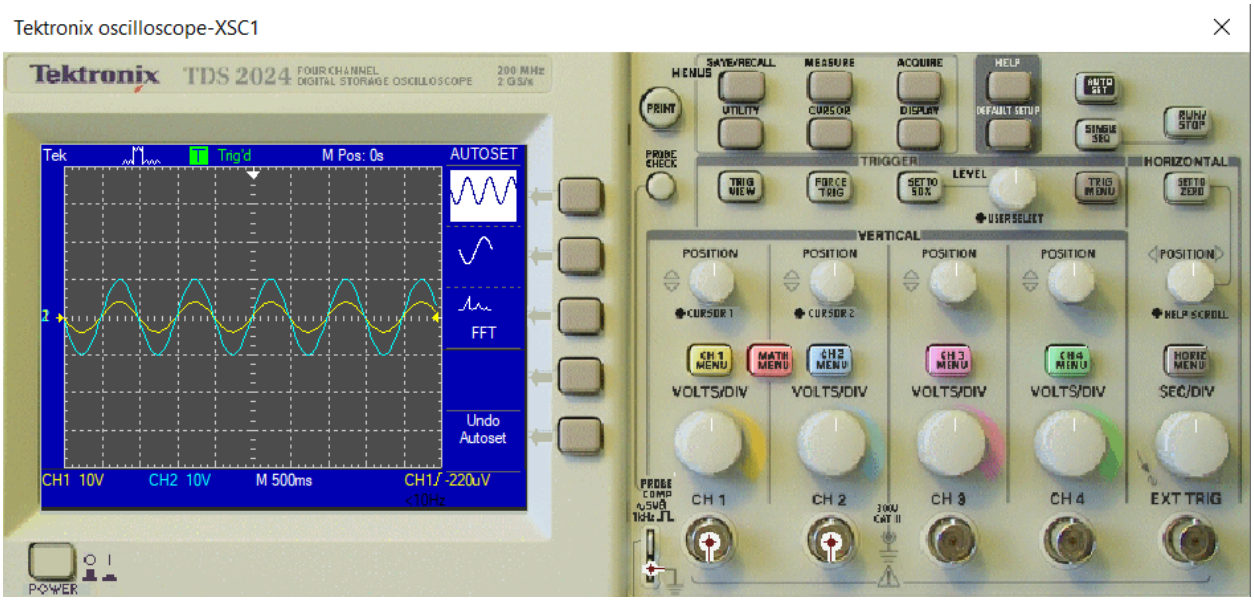
Voltage Follower:



OUTPUT

Non-inverting amplifier:



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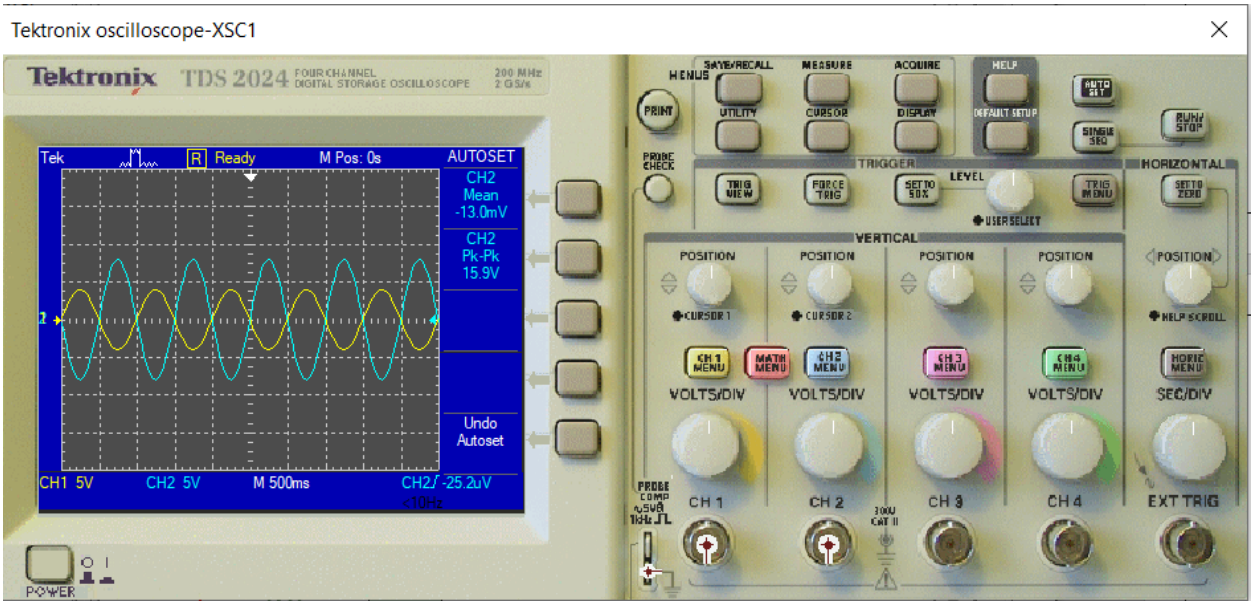
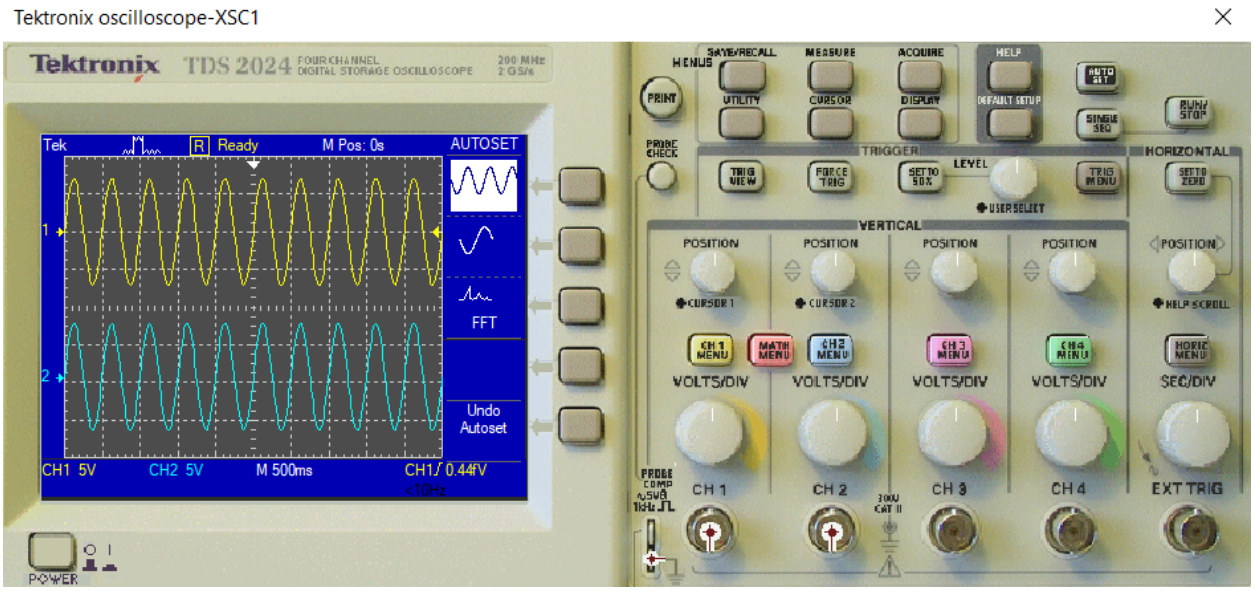
Inverting amplifier:



Voltage Follower:



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INPUT

Non-inverting amplifier:

Case	Rf	R2
1	22k	5k
2	22k	10k
3	22k	22k
4	4.7k	3k
5	4.7k	4.7k

Inverting amplifier:

Case	Rf	R2
1	10k	1k
2	10k	2k
3	20k	3k
4	20k	6k
5	10k	10k

CALCULATIONS

Inverting:

$Av = -Rf/R2$

Case 1:

$Av = -Rf/R2$

$Av = -10k/1k = -10$

Case 2:

$Av = -Rf/R2$

$Av = -10k/2k = -5$

Case 3:

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Av = −Rf/R2

Av = -20k/3k = -6.6

Case 4:

Av = −Rf/R2

Av = -20k/6k = -3.3

Case 5:

Av = −Rf/R2

Av = -10k/10k = -1

Non-Inverting:

Av=1+Rf/R2

Case 1:

Av = 1+Rf/R2

Av = 1+22k/5k = -10

Case 2:

Av = 1+Rf/R2

Av = 1+22k/10k = -5

Case 3:

Av = 1+Rf/R2

Av = 1+22k/22k = -6.6

Case 4:

Av = 1+Rf/R2

Av = 1+4.7k/3k = -3.3

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Case 5:

Av = 1+Rf/R2

Av = 1+10k/10k = -1

Slew rate = 2 π f V

Ex: F = 2khz V = 8v

2 π * 1khz* 8 = 0.05024V/μS

Maximum Frequency the Op Amp Can Handle

fmax = SR / 2πA

SR = 0.5 V/us

A = 8v

fmax = 9952.22 Hz

THEORY VS PARCTICAL

Non-inverting amplifier:

Case	Gain	I/p V	O/p V
1	5.4	2.82	9.131
2	3.2	2.82	8.15
3	2	2.82	5.656
4	2.56	2.82	7.234
5	2	2.82	5.656

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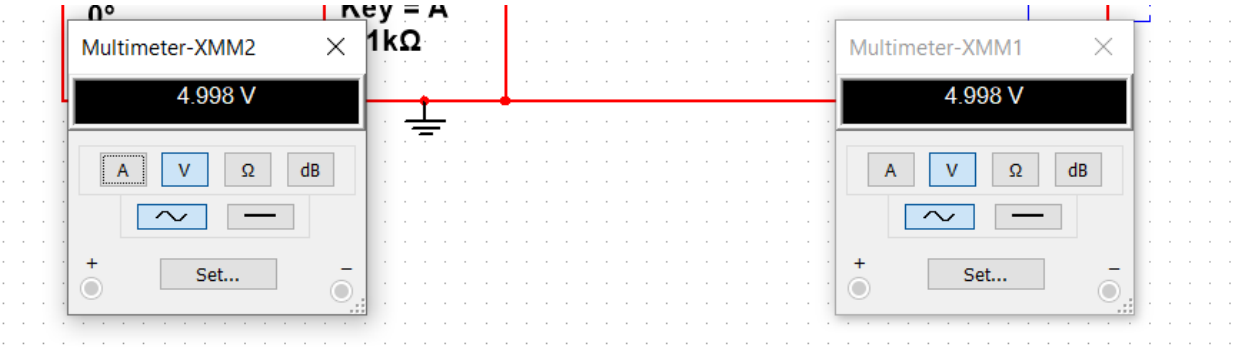
Inverting amplifier:

Case	Gain	I/p V	O/p V
1	-10	2.82	9.514
2	-5	2.82	8.901
3	-6.6	2.82	9.322
4	-3.3	2.82	8.237
5	-1	2.82	2.831

Voltage follower:

Vin = Vout



CONCLUSION

- The theory and practical gain vary by +-2. The value of the output changes according to the value of the resistor is changed.
- This tolerance also occurs because of the passive and active components used in the circuit such as resistor and operational amplifier

DISCUSSION

The inverting amplifier inverts the input sine wave into 180-degree shift.

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The non-inverting amplifier changes its output according to the input by the gain.

Voltage follower the output is equal to input.