EAST WEST UNIVERSITY
Department of Computer Science and Engineering

# CSE 251-Lab

Course Name: Electronic Circuits
Course Code: CSE 251
Section No: 01

**Experiment No:** 04

**Name of the Experiment:** Adder and Amplifier Circuits Using 741 Op Amp.

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## Objectives:

**1.** To familiarize with the 741 Op Amp Integrated Circuit (IC).

**2.** To design and construct an adder using 741 Op Amp.

**3.** To design and construct an amplifier using 741 Op Amp.

## Theory and Circuit diagram:

An operational amplifier is designed so that it performs some mathematical operations when external components, such as resistors and capacitors, are connected to its terminals. There are lots of circuit design with the operational amplifier. We will perform three circuit design with operational amplifier.

### Inverting Amplifier:

An inverting op amp is an operational amplifier circuit with an output voltage that changes in the opposite direction as the input voltage. In other words, it is out of phase by 180º.

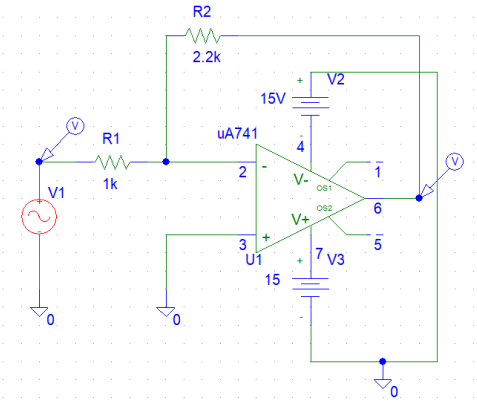


**Figure 01: An Inverting Amplifier Circuit.**

Theoretically using KCL we have,

$$\text{Vout} = -\left(\frac{\text{R2}}{\text{R1}}\right) \times \text{Vinp}$$

$$= -\left(\frac{2.2\,k}{1\,k}\right) \times 5$$

$$= \mathbf{-11\,V}$$

**Non-Inverting Amplifier:**

A non-inverting op amp is an operational amplifier circuit with an output voltage that is in phase with the input voltage. Its complement is the inverting op amp, which produces an output signal that is 180o out of phase.

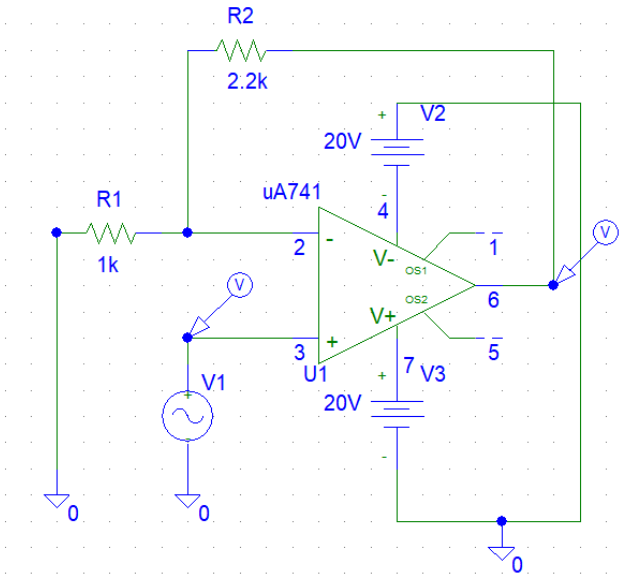


**Figure 02: A Non-Inverting Amplifier Circuit.**

Theoretically using KCL we have,

$$\text{Vout} = \left(1 + \frac{\text{R2}}{\text{R1}}\right) \times \text{Vinp}$$

$$= (1 + \frac{2.2\ k}{1\ k}) \times \text{Vinp}$$

$$= 3.22 \times 5$$

$$= \mathbf{16.1\ V}$$

**Summing Amplifier:**

The Summing Amplifier is another type of operational amplifier circuit configuration that is used to combine the voltages present on two or more inputs into a single output voltage.

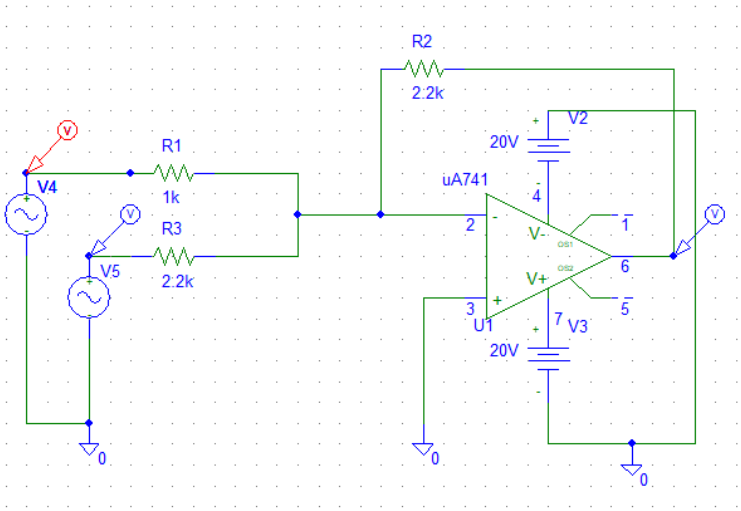


**Figure 03: A Summing Amplifier Circuit.**

Theoretically we have the following equation for this circuit,

$$\mathbf{Vout} = -\left(\frac{\mathrm{R2}}{\mathrm{R1}} \times V4 + \frac{\mathrm{R2}}{\mathrm{R3}} \times V5\right)$$

$$= -\left(\frac{2.2\mathrm{k}}{1\mathrm{k}} \times 3 + \frac{2.2\mathrm{k}}{2.2\mathrm{k}} \times 5\right)$$

$$= \mathbf{-11.6\ V}$$

**Simulation:**

Inverting Amplifier:

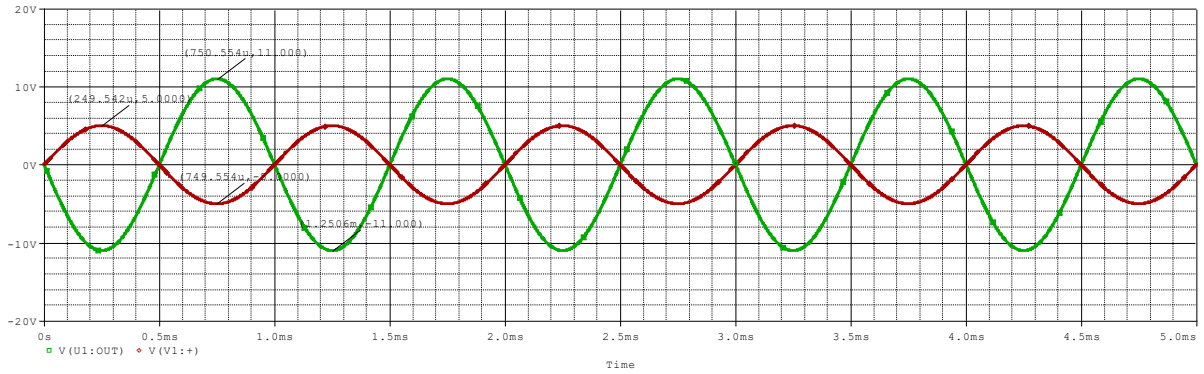


**Figure 04: Graph simulation for inverting amplifier.**

We have peak value for *(green line)* Vout = 11 V and theoretically, we have the same value.

Non-Inverting Amplifier:

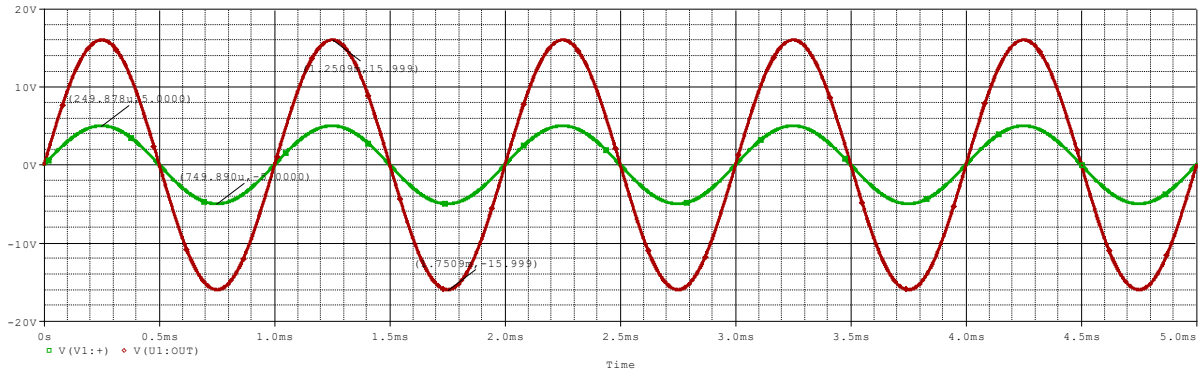


**Figure 05: Graph simulation for non-inverting amplifier.**

We have peak value for *(red line)* Vout = 15.999 V and theoretically, we have Vout = 16.1 V.

Summing Amplifier:

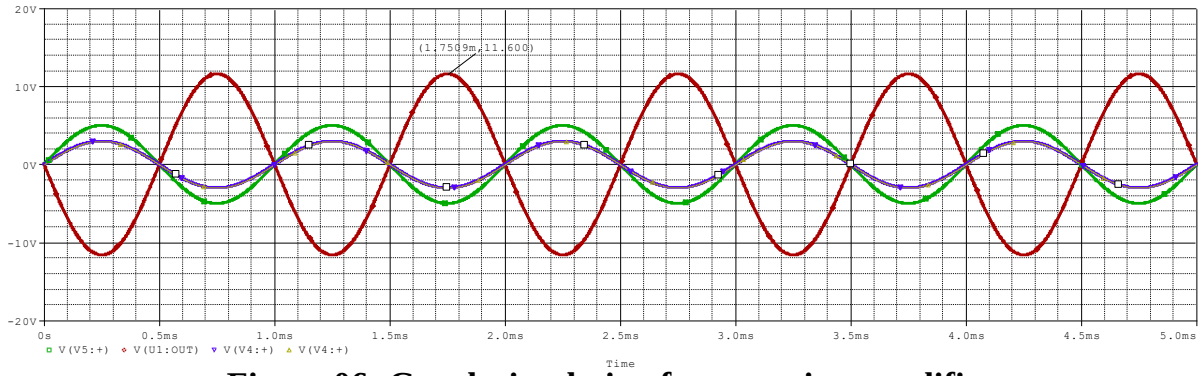


**Figure 06: Graph simulation for summing amplifier.**

We have peak value for *(red line)* Vout = 11.6 V and theoretically, we have Vout = 11.6 V.

**Equipments and Components Needed:**

1. Digital trainer board
2. DC power supply
3. Signal generator
4. Oscilloscope
5. Digital multimeter
6. 741 Op Amp (1 pc)
7. Resistor (as required from pre-lab design)
8. Breadboard
9. Connecting wires

**Physical Experiment:**

We collect all the equipment from lab and we build the circuit as our theory.

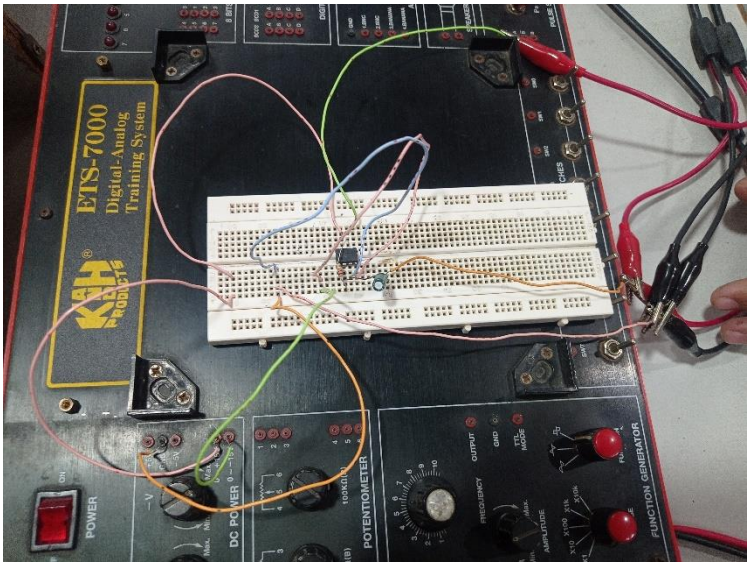


**Figure 07: Circuit build for inverting amplifier.**

After giving power to this circuit (figure-07) we have the following graph. To generate graph, we used digital oscilloscope. Here yellow line is for input voltage and the blue line is for output voltage.

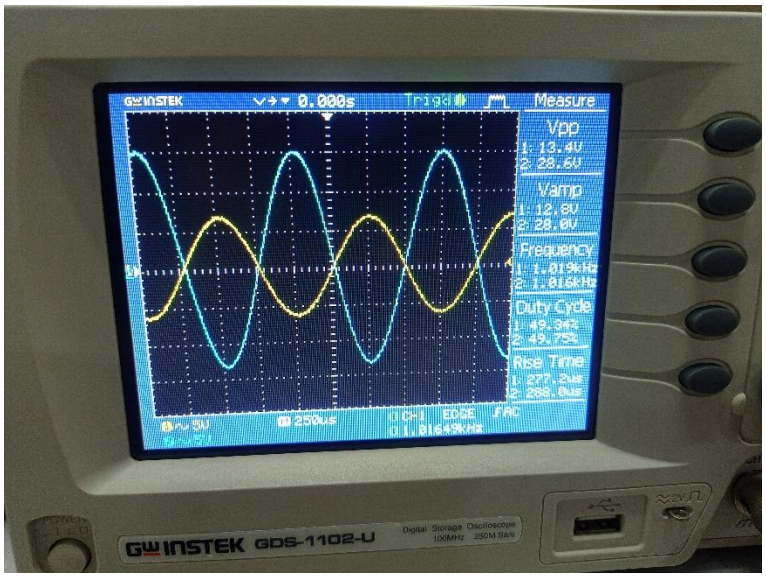


**Figure 08: Graph in oscilloscope.**

**Discussion:**

This experiment is carried out both in a physical laboratory and in a virtual environment using PSpice. Because the magnitudes were not interrupted in PSpice, the trials were considerably easier to carry out. As a result, the predicted and experimental values were similar. However, there is a discrepancy while the experiment was carried out physically.