Experiment No 2

ADDER (SUMMING) AMPLIFIER

Aim: To design and setup a summing amplifier circuit with OP AMP 741C for a gain of 2 and verify the output.

Objectives: After completion of this experiment, student will be able to design and setup a summing amplifier using OP AMP.

Equipments/Components:

Sl .No	Name and Specification	Quantity required
1	Dual power supply +/- 15V	1
2	DC power source 1.5V	2
3	Function generator (0- 1MHz)	1
4	Oscilloscope	1
5	Bread board	1
6	IC 741C	1
7	Resistor	3
8	Probes and connecting wires	As required.

Theory:

Op-amp can be used to design a circuit whose output is the sum of several input signals. Such a circuit is called a summing amplifier or an adder. Summing amplifier can be classified as inverting & non-inverting summer depending on the input applied to inverting & non-inverting terminals respectively. Circuit Diagram shows an inverting summing amplifier with 2 inputs. Here the output will be amplified version of the sum of the two input voltages with 180^0 phase reversal.

$$V_o = - (R_f / R_i)(V_1+V_2)$$

Procedure

1. Check the components.
2. Setup the circuit on the breadboard and check the connections.
3. Switch on the power supply.
4. Give $V_1 = V_2 = +1.5V$ DC with polarity as shown in fig.1.
5. Make sure that the CRO selector is in the D.C. coupling position**.**

6. Observe input and output on two channels of the oscilloscope simultaneously.
7. Note down and draw the input and output waveforms on the graph.
8. Verify that the output voltage is -6V DC
9. Repeat the procedure with V_1 =1Vpp / 1 KHz sine wave and V_2 = +1.5Vdc as shown in fig2.

RESULT

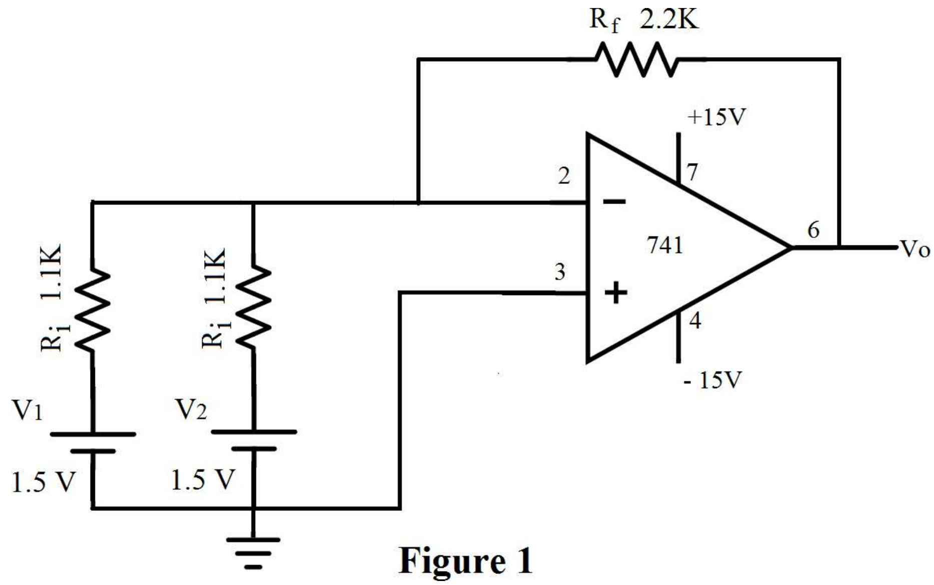


Figure 1

Circuit diagram

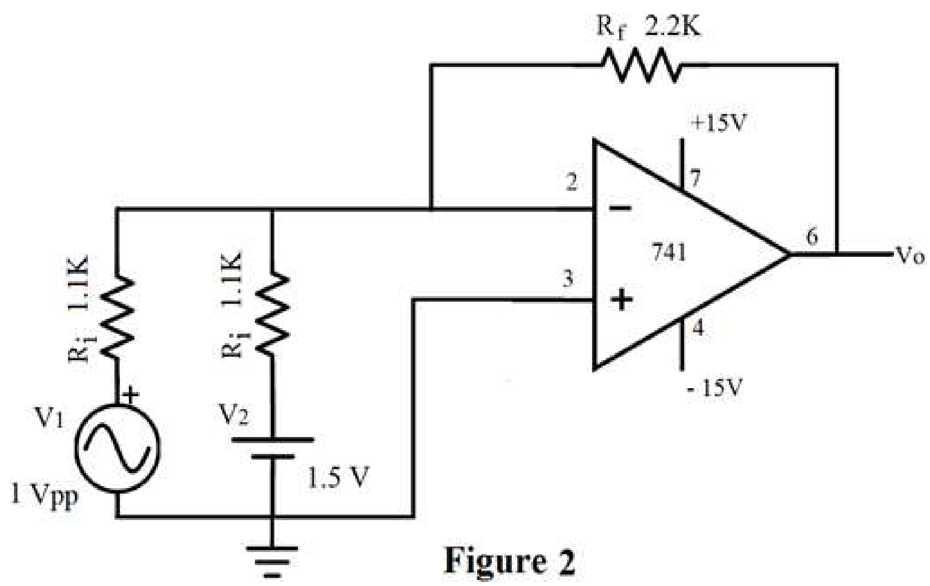


Figure 2

Design:

The output voltage of an inverting summing amplifier is given by $V_o = -(R_f / R_i)(V_1+V_2)$

Let $R_i = 1.1K\Omega$

Then $R_f = 2.2K\Omega$

Then $V_o = -2(V_1+V_2)$

Observations:

Part1:

V_1= 1.5 DC

V_2= 1.5 DC

Then Vo=?

Part 2:

V_1= 1Vpp sine wave

V_2= 1.5 DC

Then Vo=

Graph:

SUBSTRACTOR (DIFFERENCE) AMPLIFIER

Aim: To design and setup a difference amplifier circuit with OPAMP IC 741C for a gain of 2 and verify the output.

Objectives: After completion of this experiment, student will be able to design and setup a difference amplifier using OP AMP.

Equipments/Components:

Sl. No	Name and Specification	Quantity required
1	Dual power supply +/- 15V	1
2	DC power source 1.5V	1
3	Function generator (0-1MHz)	1
4	Oscilloscope	1
5	Bread board	1
6	IC 741C	1
7	Resistor	3
8	Probes and connecting wires	As required.

Theory:

A difference amplifier is a circuit that gives the amplified version of the difference of the two inputs, Vo =A(V1-V2), Where V1 and V2 are the inputs and A is the voltage gain. Here input voltage V1 is connected to non-inverting terminal and V2 to the inverting terminal. This is also called as differential amplifier. Output of a differential amplifier can be determined using super position theorem. When V_1=0, the circuit becomes an inverting amplifier with input V_2 and the resulting output is V_{02}= -Rf /Ri (V_2). When V_2=0, the circuit become a non-inverting amplifier with input V_1 and the resulting output is V_{01}= Rf/Ri(V_1). Therefore the resulting output according to super position theorem is

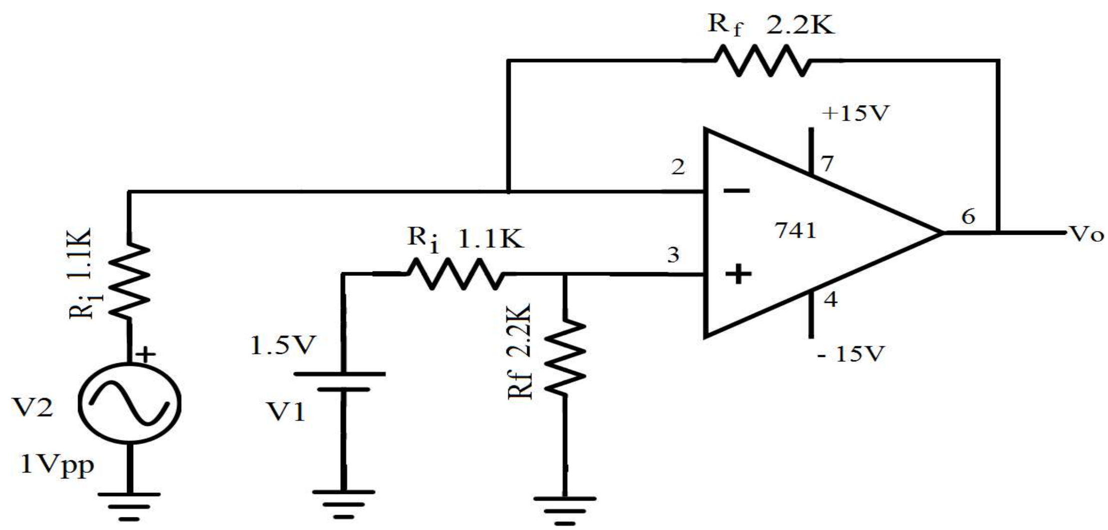
$$Vo = V_{01} + V_{02} = Rf/Ri(V1-V2)$$

Procedure

1. Check the components.
2. Setup the circuit on the breadboard and check the connections.
3. Switch on the power supply.
4. Give V_1 = +1.5V DC with polarity as shown.

5. Give V_2= 1Vpp/ 1 KHz sine wave.
6. Make sure that the oscilloscope coupling selector is in the D.C. position**.**
7. Observe input and output on oscilloscope simultaneously.
8. Note down and draw the input and output waveforms on the graph.

Circuit Diagram



Design:

Given the gain = 2

Vo = V_{01}+ V_{02} = Rf/Ri(V1-V2)

That is Rf / Ri = 2

Let Ri = 1.1KΩ

Then Rf = 2.2KΩ

Observations:

V_1= 1.5 DC

V_2= 1Vpp sine wave

Then Vo = ?

Graph: