Experiment #8 Op-amp as Summing and Difference Amplifier.

Objective

To study and implement summing and differential amplifiers.

Equipment

Function generator with probes
DMM
Dc supply
Oscilloscope
Trainer IT-2006
Resistor

Theory

An ideal operational amplifier is an amplifier having infinite voltage gain and infinite bandwidth. It has infinite input impedance and zero output impedance. But practically op amp has a very high Av and input impedance .it has low output impedance .it's bandwidth is Wide.it has two inputs ,inverting and non-inverting. It operates on 2V DC. Supply Voltages one positive and other negative.

8.1 Summing Amplifier

The summing Amplifier is an application of inverting op-amp .it has two or more inputs and its output Voltages are proportional to the negative of algebraic sum of its voltage as given in (8.1).

$$V_{out} = -(V_{in1} + V_{in2} + V_{in3} \dots V_{inn}) \qquad (8.1)$$

But when Rf is larger than input resistors, amplifiers have gain of Rf/R where R is a value of each equal -value input resistors. The expression is given in (8.2).

$$V_{out} = -\frac{R_f}{R_A}(V_{in1} + V_{in2} + V_{in3} \dots V_{inn}) \qquad (8.2)$$

Circuit Diagram

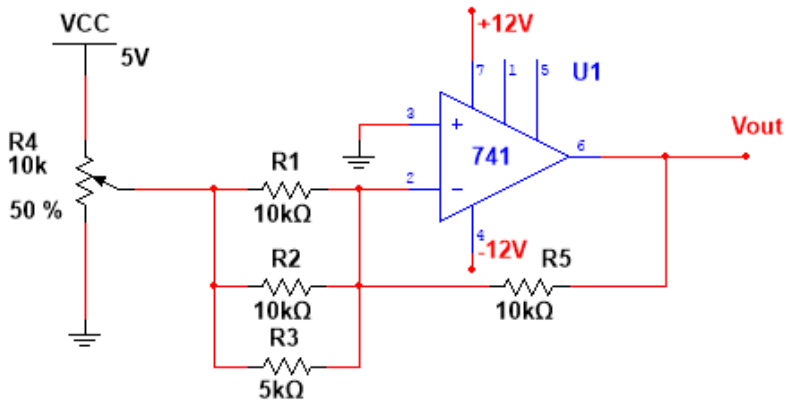

Figure 8.1: Circuit Diagram of Summing Amplifier

Procedure

1. Connect circuit diagram according to given circuit shown in Figure 8.1.
2. Connect V_1, V_2 and V_3 with potentiometer.
3. Set potentiometer 0.5 V and check Vout using DMM.
4. Calculate output voltages by using (8.3).

$$\text{Vout} = -(V_1 + V_2 + V_3) \qquad (8.3)$$

5. Compare calculate value with DMM values.
6. Set potentiometer 1V and repeat step 4 and 5.
7. Set potentiometer 2V and repeat step 4 and 5.
8. Set potentiometer 3V and repeat step 4 and 5.

Observations

Potentiometer Value	0.5 V	1 V	2 V	3 V
Vo (DMM Value)				
Vo (theoretical Value)				

8.2 Difference Amplifier

A differential Amplifier is a type of electronic circuit that amplifies between two input voltages but suppress any voltage common to two inputs.

$$V_{out} = A_v(V_{in}{}^{+} - V_{in}{}^{-}) \qquad (8.4)$$

So basically, differential amplifier is a subtractor. It is very useful op amp circuit and by adding more resistors in parallel with input resistance Ra and Rf the resistance circuit can be made to Add or subtract the voltage applied to their respective inputs. One of the most common ways of doing this is to connect a resistive bridge to input of amplifier.

Procedure

1. Connect circuit diagram according to given circuit shown in Figure 8.1.
2. Measure the input values V_B and V_A by DMM.
3. Determine the difference value by using (8.5).

$$Vo = V_A - V_B \qquad (8.5)$$

4. Measure and record the output voltage Vo.

5. Calculate Vo from the equation (8.6).

$$Vo = \frac{R_2}{R_1}(V_A - V_B) \qquad (8.6)$$

6. Record the difference between theoretical and practical values

Circuit Diagram

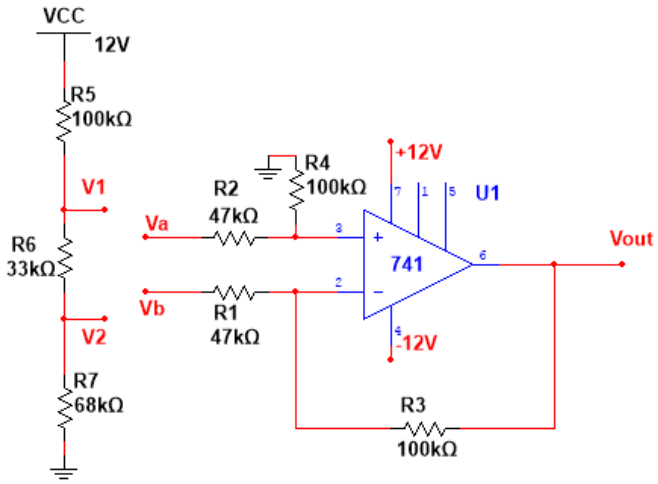

Figure 8.2: Circuit Diagram of Difference Amplifier

Observations

Parameter	Vo
Theoretical Value	
Practical	

Lab Tasks

1. From Figure 8.3, calculate Vo by theoretical and practical method when potentiometer is at 1.5V,2.5V?

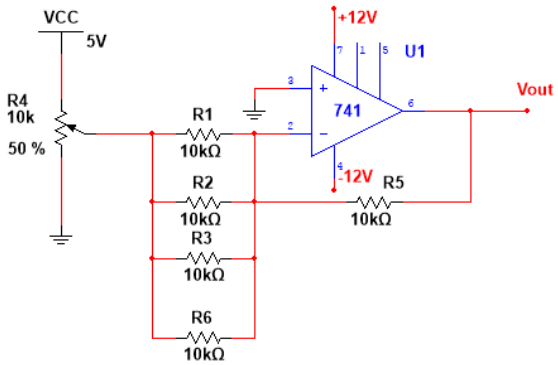

Figure 8.3: Summing Amplifier

2. From Figure 8.4, calculate Vo when $V_1 = 5V$ and $V_2 = 2V$?

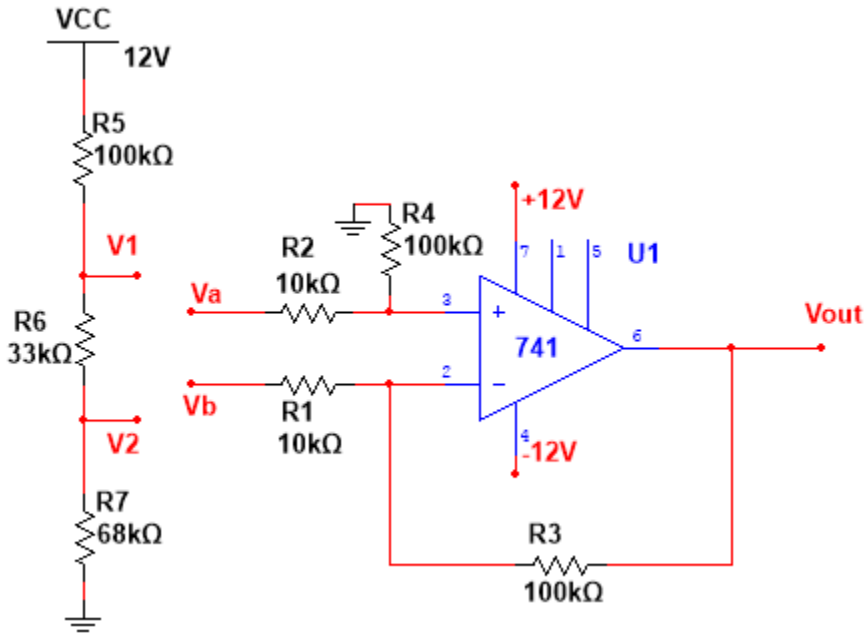

Figure 8.4: Difference Amplifier

Conclusion