

Applications of Operational Amplifier

Aim:

To study the operation and to measure the gain of Operational Amplifier in the following circuits

- i. Inverting Amplifier.
- ii. Non-inverting Amplifier.
- iii. Difference Amplifier.

Components:

Name(Op-amp)	Quantity
IC 741	1
Resistors- $10K\Omega, 100K\Omega,$	2

Equipment:

Name	Range	Quantity
Bread board		1
Regulated power supply	(0-30)V	1
Function generator	(0-20)MHz	1
CRO	(0-1)MHZ	1
Connecting Wires		1

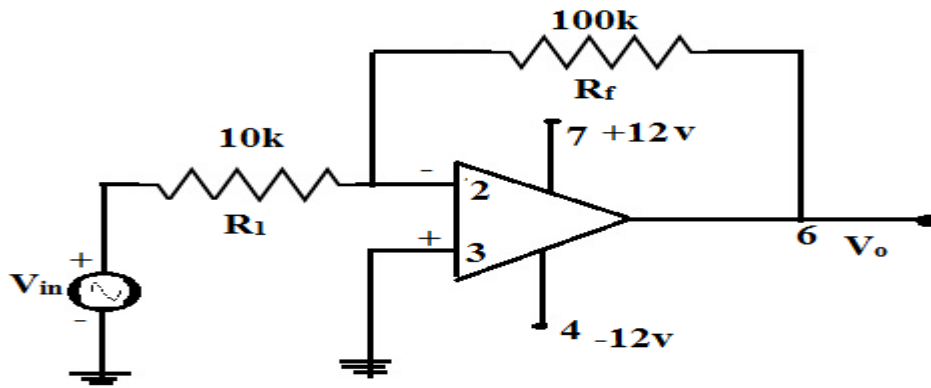
Theory:

An inverting-amplifier circuit is built by grounding the positive input of the operational amplifier and connecting resistors R_1 and R_f , between the inverting input and output terminals as shown in the figure. This is known as Inverting amplifier since the ac or dc input is applied to the inverting terminal (-). For this amplifier voltage gain can be calculated. This circuit amplifies V_{in} applied to inverting terminal.

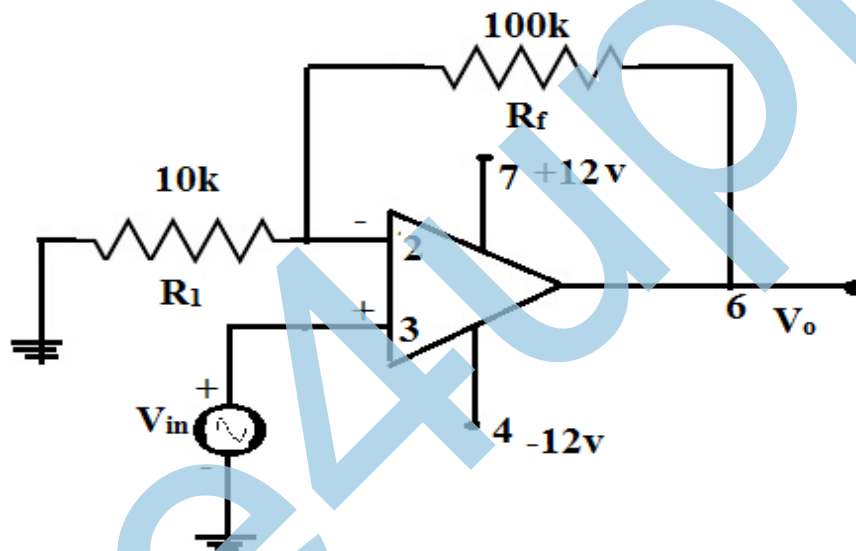
A Non-inverting-amplifier circuit is built by grounding the negative input of the operational amplifier through resistor R_1 and connecting resistor R_f between the inverting input and output terminals as shown in the figure. This is known as Non-Inverting amplifier since the ac or dc input is applied to the Non- inverting terminal (+). For this amplifier voltage gain can be calculated. It amplifies the signal applied to non-inverting terminal.

Difference amplifier is a special circuit which amplifies the difference between inverting and non-inverting inputs.

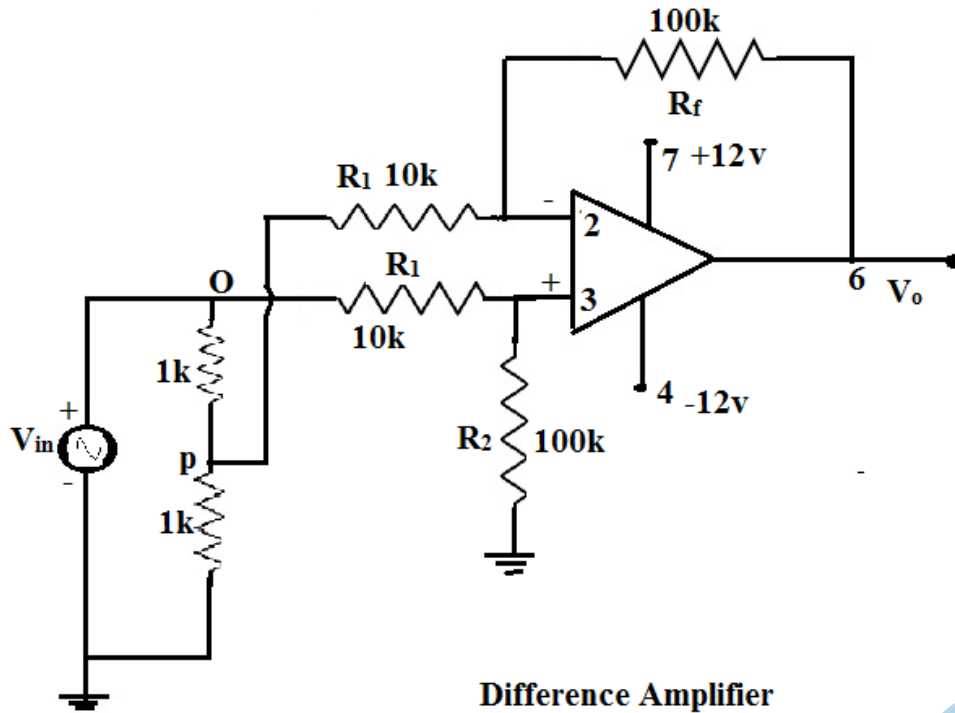
Circuit Diagram:



Inverting Amplifier



Non-Inverting Amplifier



Procedure:

1. Connect the circuit diagram of a given Amplifier (Inverting/Non-Inverting).
2. Generate a sinusoidal signal of $V_s = 100\text{mV}$ (peak to peak) signal of any frequency (1 KHz) using function generator.
3. Apply this signal as V_{in} to the amplifier and measure output voltage (peak-peak). Calculate gain $A = V_o/V_{in}$.
4. For Difference amplifier measure V_2 (between p and GND) and V_o then calculate gain $A = V_o / (V_1 - V_2)$.
5. Repeat the same for two other input voltages.
6. Compare practical and Theoretical gain values.

Observations:

Inverting Amplifier: Gain (Theoretical value) = $- R_f / R_1$

Sl.no	Input voltage(peak-peak) V_s (mV)	output voltage(peak-peak) V_o (mV)	Voltage Gain $A_v = V_o/V_s$
1	100mV		
2	50mV		
3	40mV		

Non-Inverting Amplifier:

Gain (Theoretical value) = $1+(R_f/R_1)$

Sl.no	Input voltage(peak-peak) V_s (mV)	output voltage(peak-peak) V_o (mV)	Voltage Gain $A_v = V_o/V_s$
1	100mV		
2	50mV		
3	25mV		

Difference Amplifier:

Gain (Theoretical value) = R_2/R_1

Sl.no	Input voltage(peak-peak) V_s (mV)	V_1 (between O and GND) $V_s = V_1$	V_2 (between P and GND) $V_2 = V_1/2$	output voltage(peak-peak) V_o (mV)	Voltage Gain $A_v = V_o/(V_1-V_2)$
1	100mV				
2	50mV				
3	25mV				

Result:

The operation of Op-amp in different applications as Inverting Amplifier , Non-Inverting amplifier and Difference Amplifier is studied and gain is calculated for each circuit practically.

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