

Experiment-7

Inverting and non Inverting Amplifiers

* Aim- To study the basic properties of op-amp (Inverting and non-Inverting amp)

* Apparatus- Op-amp, resistor, connecting wires, oscilloscope

* Theory Op-amp is a linear electronic device having 3 terminals. It can perform multiple functions when attached to different feedback combinations. It is generally used as voltage amplifier.

1) Inverting Op-Amp :-

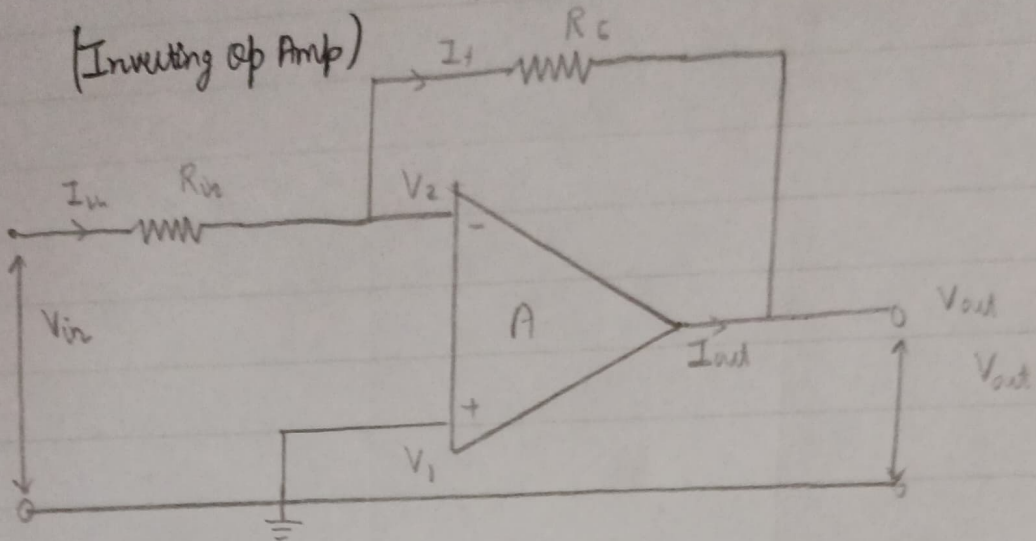
Open loop gain (A_o) of Op-amp is very high making it unstable, so to make it stable with a controllable gain, feedback is applied through some external resistor (R_f) from its output to inverting output terminal. The non-inverting terminal of Opamp is grounded.

$$I = \left(\frac{V_{in} - V_{out}}{R_{in} + R_f} \right)$$

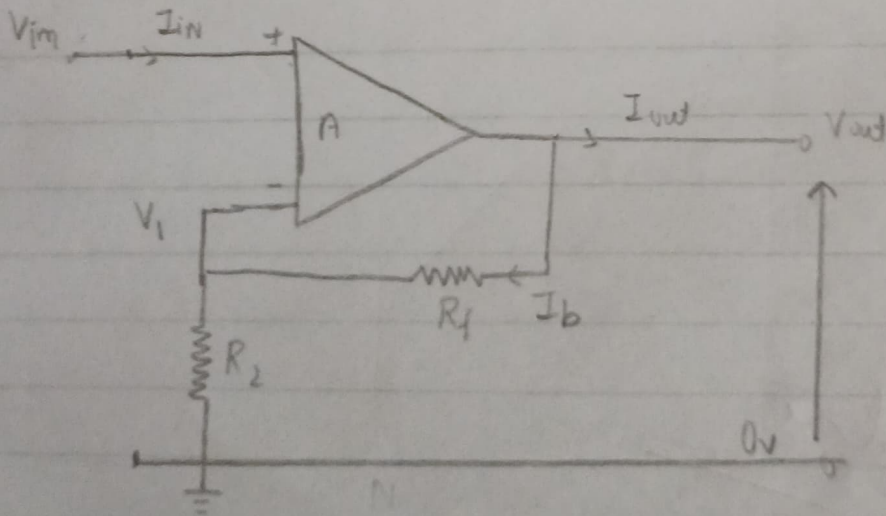
$$I = \frac{V_{in}}{R_{in}} - \frac{V_{out}}{R_f} = \frac{V_{in}}{R_{in}} - \frac{V_{out}}{R_f}$$

$$I = \left(\frac{V_{in} - 0}{R_{in}} \right) = \left(\frac{0 - V_{out}}{R_f} \right)$$

→ Diagram



(Non-Inverting op-Amp)



$$V_{out} = \frac{-R_F}{R_{in}} \times V_{in}$$

$$A_{v1} = \frac{V_{out}}{V_{in}} = \frac{-R_F}{R_{in}}$$

(2) Non-inverting op-amp

In this config, input signal is directly fed to non-inverting terminal where feedback is negative; gain is positive and output voltage in phase with inputs as compared to inverting op-amp where gain is negative, output voltage is out of phase with input. This layout of inverting terminal make R_1 and R_2 a potential divider, hence, determines gain of circuit.

$$V_{in} = \frac{R_2}{R_2 + R_1} \times V_{out}$$

$$A_{v1} = \frac{V_{out}}{V_{in}} = \frac{R_2 + R_1}{R_2} = 1 + \frac{R_1}{R_2}$$

$$V_{out} = \left[1 + \frac{R_1}{R_2} \right] \times V_{in}$$

* Precautions-

- 1) Ensure all connections are secure and correct before powering on circuit.
- 2) Verify power supply voltage matches op amp specifications
- 3) Ensure proper grounding

* Observation Table

(1) Inverting Op Amp ($R_i = 10 \Omega$, $R_f = 2 \Omega$)

S.No	Input Voltage (V)	Output Voltage (V)	Current (mA)
1	-15	3	-0.176
2	-10	2	-0.118
3	-5	1	-0.0588
4	0	0	0
5	5	-1	0.0588
6	10	-2	0.118
7	15	-3	0.176

2) Non Inverting Op-Amp ($R_i = 10 \Omega$, $R_f = 2 \Omega$)

S.No	Input Voltage (V)	Output Voltage (V)	Current (mA)
1	-15	-18	-0.324
2	-10	-12	-0.216
3	-5	-6	-0.108
4	0	0	0
5	5	6	0.107
6	10	12	0.216
7	15	18	0.324

Experiment :

Date _____

Page No. _____

Conclusion

The experiment on the basic prop of op-amp provided a clear understanding of their functionality. By analyzing their gain, input and output behaviour we observed how signal inversion and amplification depends on circuit design. The inverting amp showed phase reversal with gain by external resistor, while non-inverting maintained phase and offered high inp impedance.

* GRAPHS

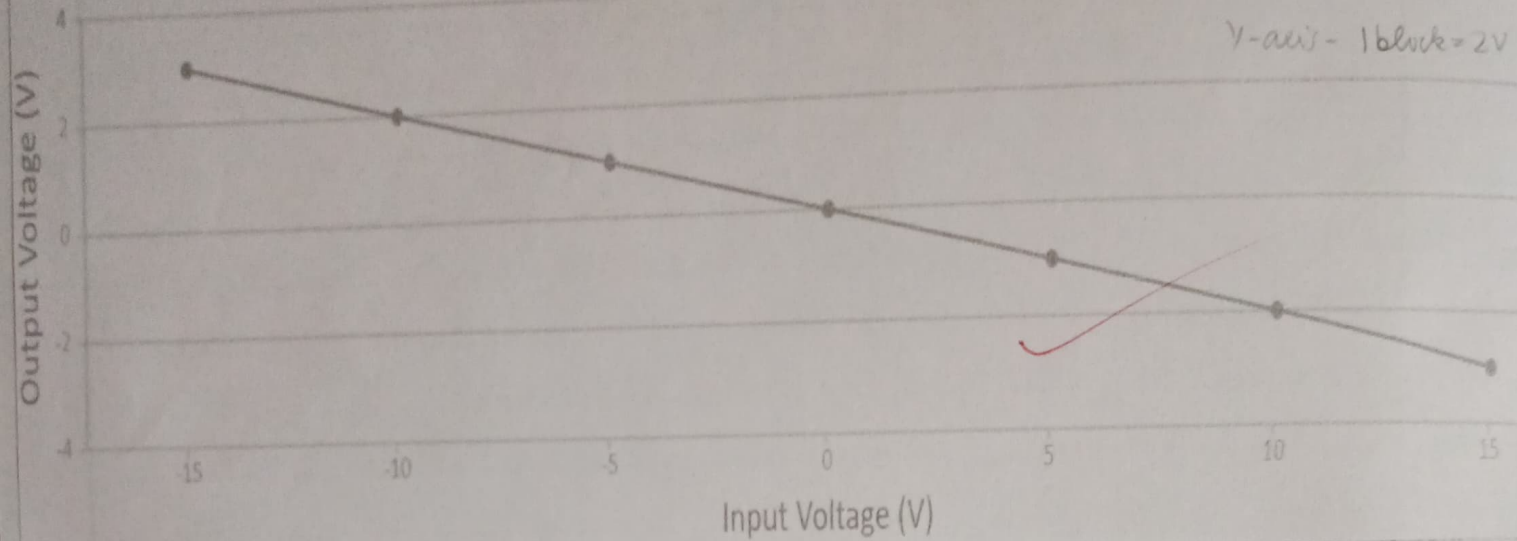
1) Inverting Op Amp

Vo-Vi Plot

Scale

x-axis - 1 block = 5V

y-axis - 1 block = 2V



2) Non Inverting Op Amp

Vo-Vi Plot

Scale

x-axis - 1 block = 5V

y-axis - 1 block = 10V

