Date 24/11/2021

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Op-Amp as inverting and non-inverting Amplifier.

Aim:- To study Op-Amp as inverting and non-inverting amplifier.

Material required:

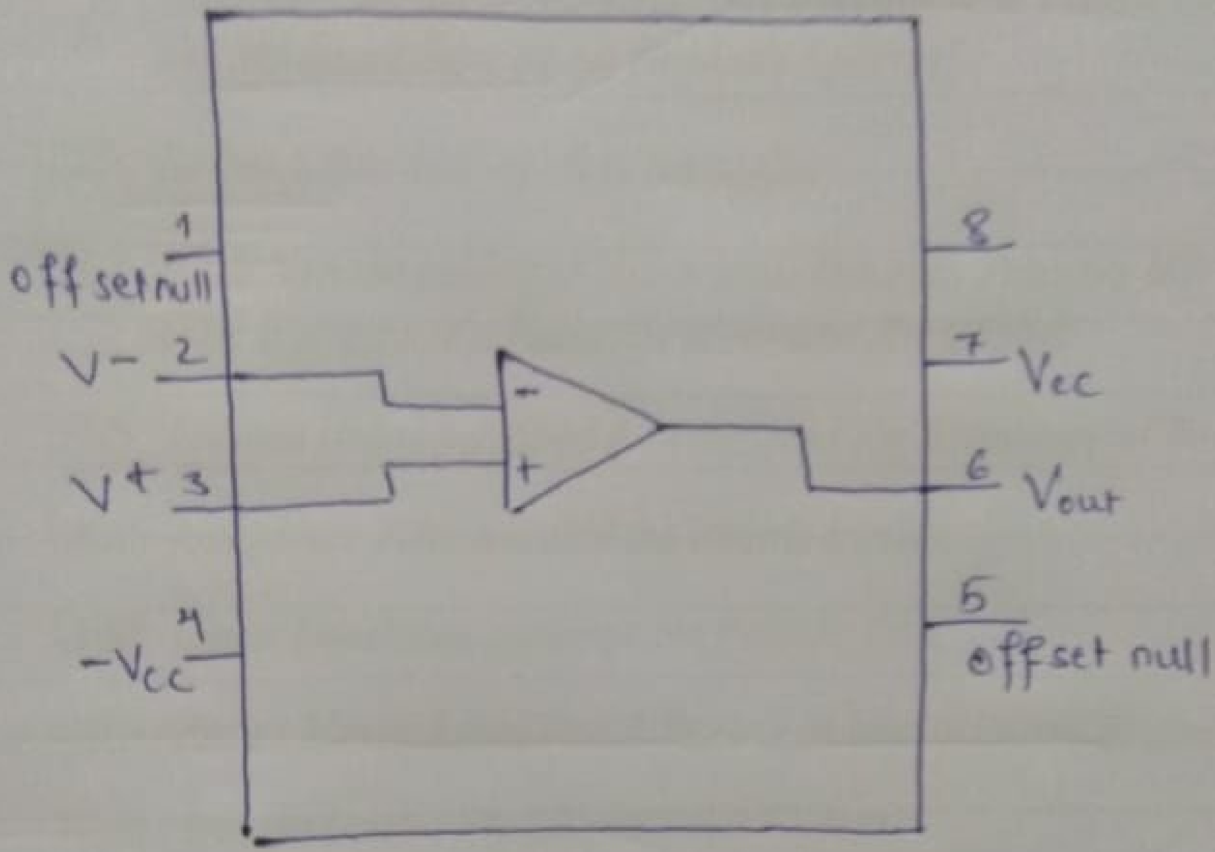
i) Multimeter
ii) Breadboad
iii) CRO
iv) Function generator for input source.
v) Power Supply (±15V)
vi) Op-Amp (IC-741) -1NO
vii) Rectifier $R_{in} = 1k$ $R_f = 3.9k, 5.6k$

Theory:-

An operational amplifier (or) Op-amp is a very high gain defferential amplifier with input impedance and low output impedance. The basic circuit mode using a difference amplifier having two input and one output. The plus (+) input produces an output that is in phase with the signal applied, where an input to the minus (-) input results in an opposity polarity output.

Most exciting op-amp's are produced on a single semi-conductor substrate as an integral circuit (IC 741). The two most widely used constant gain. amplifier are the inverting and non-inverting amplifier.

Teacher's Signature



[Fig - Operational Amplifier (op-Amp)]

Inverting Amplifier.

It inverts and amplifies a voltage (multiplied by a negative constant)

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

$Z_{in} = R_{in}$ (because V_- is a virtual ground)

Non-Inverting Amplifier.

It amplifies a voltage (multiplies by a constant greater than 1)

$$V_{out} = V_{in}\left(1 + \frac{R_2}{R_1}\right)$$

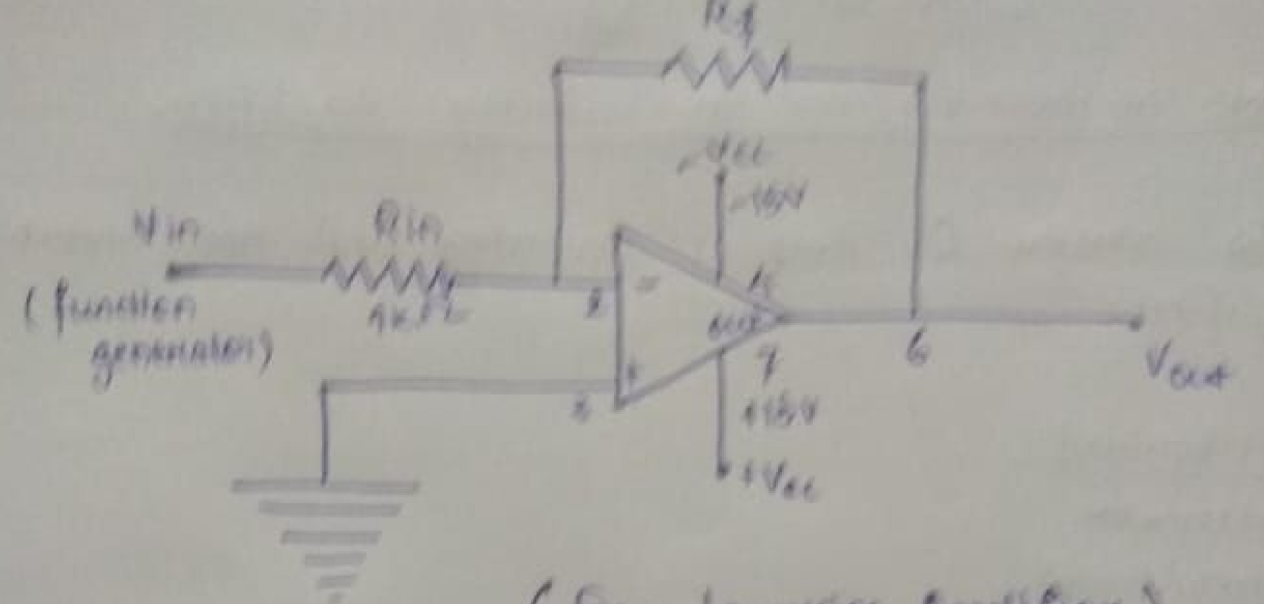
input impedance $Z_{in} \approx \infty$ (infinity).

1. The input impedance is at least the impedance between non-inverting (+) and inverting (-) inputs, which is typically 1 MΩ to 10 TΩ, plus the impedance of the path from the inverting (-) input to ground (i.e. R_1 in parallel with R_2)

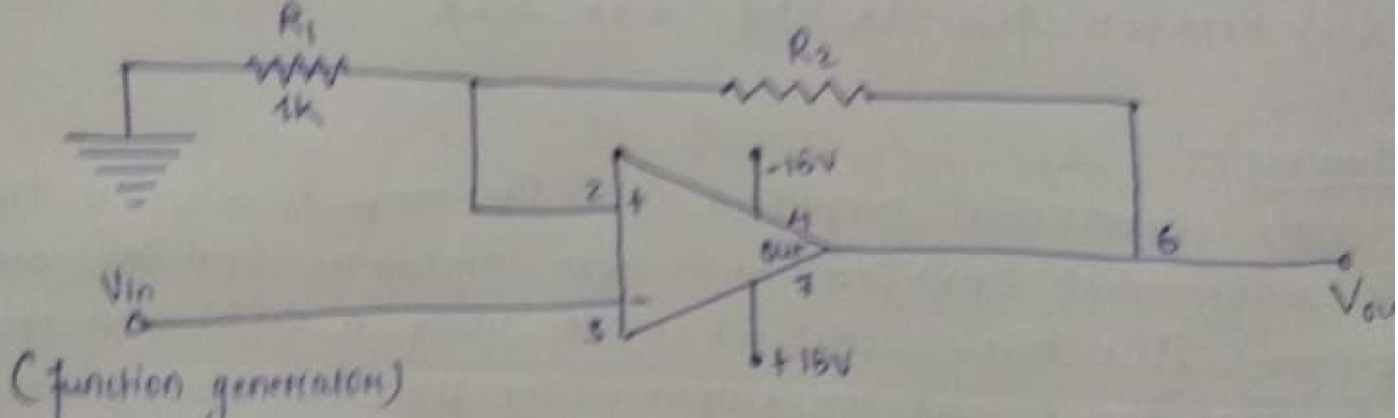
2. Because negative feedback ensures that the non-inverting and inverting inputs match, the input impedance is actually much higher.

PROCEDURE :

1) The Op-Amp was setup as per the circuit diagram (inverting or non-inverting as the case may be).



(Fig - Inverting Amplifier)



(Fig:- Non-Inverting Amplifier)

2. Power supply was provided and the gain of the amplifier was measured by nothing down the output voltage with a multimeter

3. The gain was determined with the value of feedback resister (R_f) keeping the input resistance constant (R_{in})

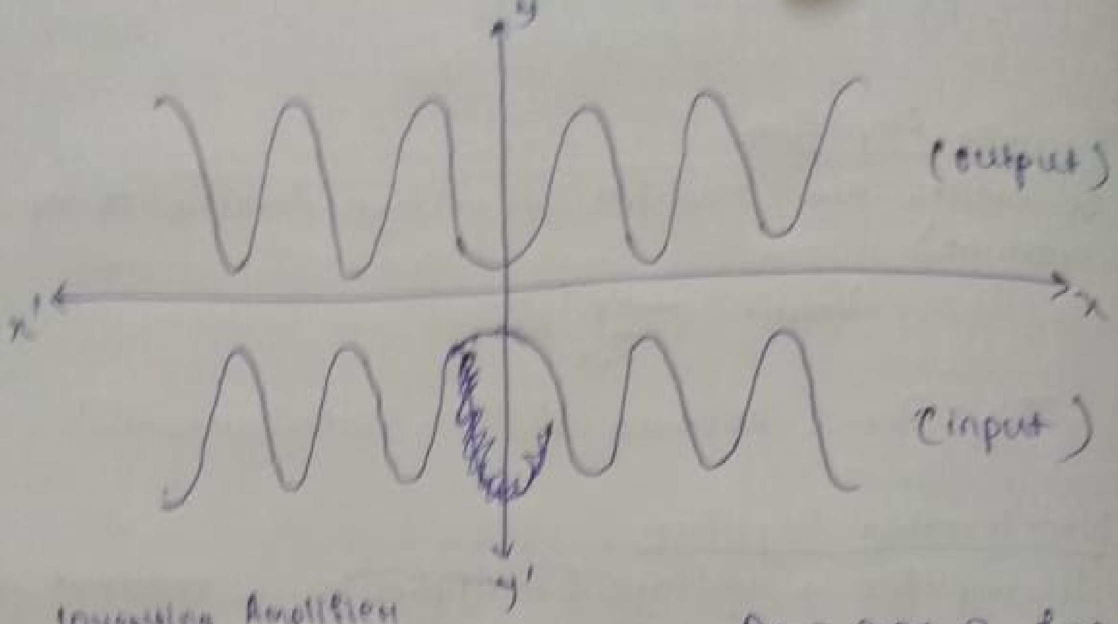
Observation Table :

$R_f = 3.9 k\Omega$, $f = 1kHz$

Type of Amplifier	Input AC voltage	Output Voltage	Calculated Theoretical gain	Measured pratical gain	Measured phase difference
Inverting	1V	4V	-3.9	-4	180°
Non- inverting	1V	5.52V	4.9	5.52	0°

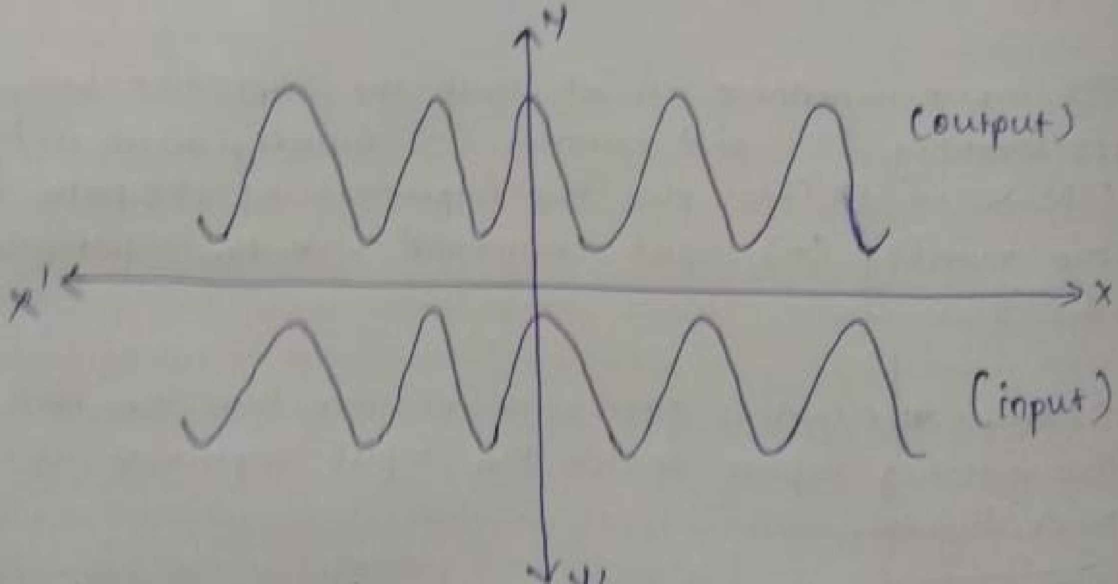
For $R_f = 5.6 k\Omega$, we only have calculated theoretical gain from the gain formula for inverting and non-inverting input. So we have gain for inverting input and non-inverting input are -5.6 and 6.6 respectively.

CONCLUSION: In this experiment, we came to know about the principle and characteristics of an operational amplifier. We also learnt about its application as an inverting and non-inverting amplifier, their characteristics and working. Both the type of amplifier have a wide range of application in field of electronics.



Inverting Amplifier
Input Voltage - 1V
Output Voltage - 4V (observed)

Rf = 3.9k Ω , f = 2kHz



Non-inverting Amplifier
Input Voltage = 1V
Output Voltage = 5.52V
(observed)

Rf = 3.9k Ω , f = 1kHz.