INSTITUTE VISION

- To establish a leading Global Centre of excellence in multidisciplinary education, training and research in the area of Engineering, Technology and Management.

- To produce technologically competent, morally and emotionally strong and ethically sound professionals who excel in their chosen field, practice commitment to their profession and dedicate themselves to the service of mankind.

INSTITUTE MISSION

1. To develop world class laboratories and other Infrastructure conducive in acquiring latest knowledge and expertise.
2. To bridge the knowledge and competency gaps of institute's fresh pass-outs vis-à-vis field requirements.
3. To strengthen Industry-Institute Interaction and partnership for imbibing corporate culture amongst our faculty and students.
4. To promote research culture among faculty and students enhancing their academic and professional confidence needed to face global challenges.
5. To honour commitment towards social and moral values.

DEPARTMENT OF ELCTRONIC AND COMMUNICATION ENGINEERING

VISION:

To emerge as a centre of excellence producing globally competent and morally sound professionals in the field of Electronics & Communication Engineering who will practice commitment to their profession and dedicate themselves to the service of mankind.

MISSION:

To develop state-of-the-art laboratories providing relevant practical inputs to students. To provide strong knowledge base to students in the area of Electronics & Communication Engineering, and to train them as per requirement of industries and research organizations. To facilitate institute industry interaction to the benefit of stake holders and to motivate teachers for continuous improvement of their academic standards.

Program Educational Objectives (PEOs):

PEO1:

Graduate will have the fundamental and advance knowledge in Mathematics, Science, Electronics & Communication Engineering and design methodologies to successfully accomplish their professional career in industry as an Engineer, theoretically practically, in the field of Electronics & Communication Engineering, or become an entrepreneur.

PEO 2:

Graduate will have strong fundamental knowledge in specialized areas of Electronics & Communication Engineering to contribute towards research and developments through paper publications, projects and pursue higher studies in their specialized fields.

PEO 3:

Graduate shall learn all interpersonal skills and inculcate sense of social responsibilities and environmental concerns so as to make them good leaders and citizens.

Program Specific Outcomes (PSOs):

PSO1:

Students will have proficiency in grasping fundamental principles of Electronics & Communication Engineering and effectively applying them across diverse domains, including Semiconductors, Communications, Signal processing, Antennas, Networking, VLSI, Embedded systems, and becoming adept in the latest tools and methodologies employed in both research and industry.

PSO2:

Student will foster critical thinking to evaluate engineering issues pertinent to Electronics & Communication Engineering through the cultivation of profound expertise and skills in the realms of fundamental sciences, engineering mathematics, and core engineering principles, enabling the resolution of intricate engineering dilemmas.

PSO3:

Student will be able to acquire the skill to conduct independent research, seek innovative solutions, and make contributions to the progress of knowledge in specialized areas of electronics and communication engineering. Adhere to ethical principles in engineering practice, research, and innovation, while exemplifying a steadfast dedication to integrity, social responsibility, and sustainable development.

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ACKNOWLEDGEMENT

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ABSTRACT

"**OP-AMP APPLICATION TRAINER KIT "**

Operational amplifier is usually Called Op Amps. An amplifier is a device that accepts a varying input signal and produces a similar output signal with a larger amplitude.They are the basic components used to build analog circuits. The name "operational amplifier" comes from the fact that they were originally used to perform mathematical operations such as integration and differentiation.We also easily perform its application on bread board trainer and check that our project will successes or not. So we show on this project the various application of opamp using bread board trainer.

Applications:

- Inverting amplifier
- Non-inverting amplifier
- Summing amplifier
- Comparator
- Integrator
- Differentiator

Chapter 1 : INTRODUCTION

1.1 What is OP-AMP ?

An **Operational Amplifier**, or op-amp for short, is fundamentally a voltage amplifying device designed to be used with external feedback components such as resistors and capacitors between its output and input terminals. These feedback components determine the resulting function or "operation" of the amplifier and by virtue of the different feedback configurations whether resistive, capacitive or both, the amplifier can perform a variety of different operations, giving rise to its name of "Operational Amplifier"

An Operational Amplifier is basically a three-terminal device which consists of two high impedance inputs. One of the inputs is called the **Inverting Input**, marked with a negative or "minus" sign, (–). The other input is called the **Non-inverting Input**, marked with a positive or "plus" sign (+).

A third terminal represents the operational amplifiers output port which can both sink and source either a voltage or a current. In a linear operational amplifier, the output signal is the amplification factor, known as the amplifiers gain (A) multiplied by the value of the input signal and depending on the nature of these input and output signals, there can be four different classifications of operational amplifier gain.

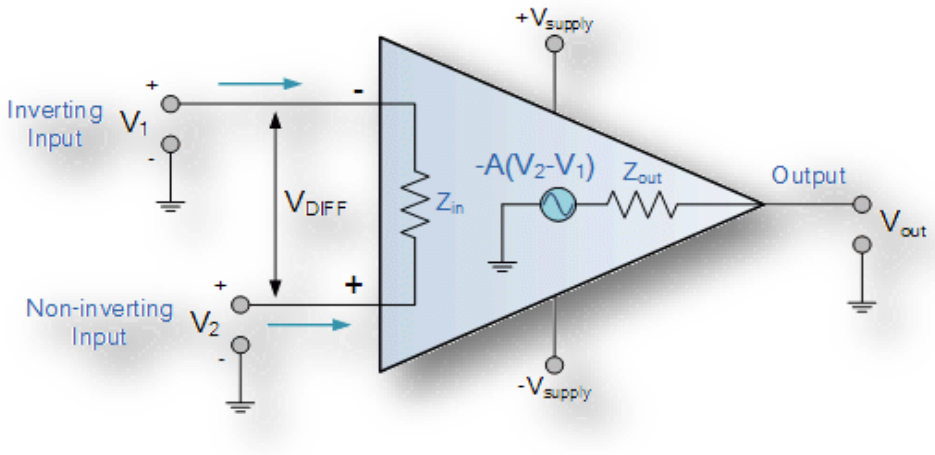

Fig 1. Op-Amp

Chapter 2: Basic Theory

2.1 What is an Ideal OP -Amp?

An operational amplifier (OP Amp) is a direct current coupled voltage amplifier. That is, it increases the input voltage that passes through it. The input resistance of an OP amp should be high whereas the output resistance should be low. An OP amp should also have very high open loop gain. In an ideal OP amp, the input resistance and open loop gain is infinity whereas the output resistance is zero.

An ideal op amp have following characteristic:----------

- Open-loop Gain : ∞
- Input Impedance (Rin) : ∞
- Output Impedance (Rout) : 0
- Input offset Voltage : 0
- Output Voltage : ∞
- Common Mode Rejection Ratio (CMRR) : ∞

2.2 Operational Amplifier General Conditions

- The **Operational Amplifier**, or **Op-amp** as it is most commonly called, can be an ideal amplifier with infinite Gain and Bandwidth when used in the Open-loop mode with typical DC gains of well over 100,000 or 100dB.
- The basic Op-amp construction is of a 3-terminal device, with 2-inputs and 1-output, (excluding power connections).
- An Operational Amplifier operates from either a dual positive (+V) and an corresponding negative (-V) supply, or they can operate from a single DC supply voltage.
- The two main laws associated with the operational amplifier are that it has an infinite input impedance, (Z = ∞) resulting in "**No current flowing into either of its two inputs**" and zero input offset voltage V1 = V2.
- An operational amplifier also has zero output impedance, (Z = 0).
- Op-amps sense the difference between the voltage signals applied to their two input terminals and then multiply it by some pre-determined Gain, (A).

- This Gain, (A) is often referred to as the amplifiers “Open-loop Gain”.
- Closing the open loop by connecting a resistive or reactive component between the output and one input terminal of the op-amp greatly reduces and controls this open-loop gain.
- Op-amps can be connected into two basic configurations, **Inverting** and **Non-inverting**.

2.3 Operational Amplifier Gain

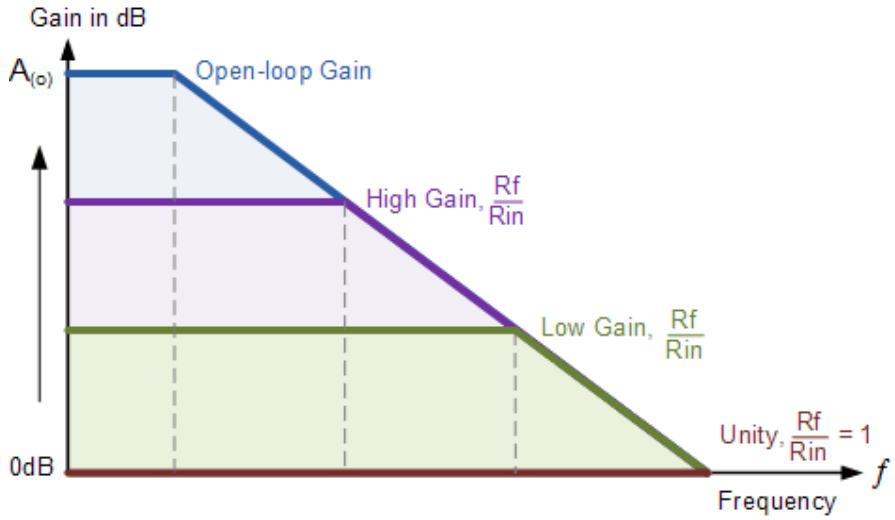

Fig 2. Gain of an Op-amp

- The Open-loop gain called the **Gain Bandwidth Product**, or (GBP) can be very high and is a measure of how good an amplifier is.
- Very high GBP makes an operational amplifier circuit unstable as a micro volt input signal causes the output voltage to swing into saturation.
- By the use of a suitable feedback resistor, (R_f) the overall gain of the amplifier can be accurately controlled

Chapter 3: Hardware Implementation

3.1 Block diagram:

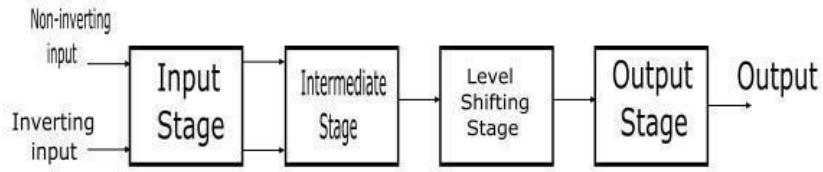

Fig 3. Block diagram of an Op-amp

3.2 Description of Block Diagram :

- **Input Stage** − The input stage is the dual input, balanced output differential amplifier. This stage provides most of the voltage gain and introduces the input resistance of operational amplifier.
- **Intermediate Stage** − This stage is dual input, unbalanced output differential amplifier, which is driven by the output of first stage.
- **Level Shifting Stage** − Since direct coupling is used, therefore the DC voltage at the output of intermediate stage is above the ground potential. Hence, the level shifting transistor circuit is used after intermediate stage to shift the DC level at intermediate stage output downward to zero volts with respect to ground
- **Output Stage** − The output stage is a push-pull complementary amplifier. The output stage increases the output voltage. The output stage also provides low output resistance.

Application of Op-amp :

VOLTAGE FOLLOWER : A voltage follower (also known as a buffer amplifier, unity-gain amplifier, or isolation amplifier) is an op-amp circuit whose output voltage is equal to the input voltage (it "follows" the input voltage). Hence a voltage follower op amp does not amplify the input signal and has a voltage gain of 1

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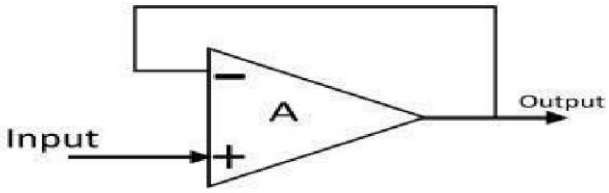


Fig 4. Voltage follower

INVERTING AMPLIFIER : An inverting amplifier takes the input through its inverting terminal through a resistor *R*1, and produces its amplified version as the output. This amplifier not only amplifies the input but also inverts it (changes its sign).

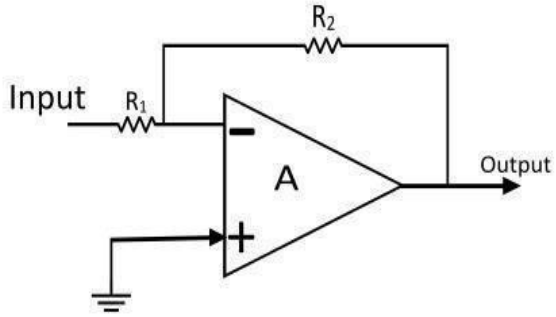


Fig 5. Inverting Amplifier

NON - INVERTING AMPLIFIER : A non-inverting amplifier takes the input through its non-inverting terminal, and produces its amplified version as the output. As the name suggests, this amplifier just amplifies the input, without inverting or changing the sign of output

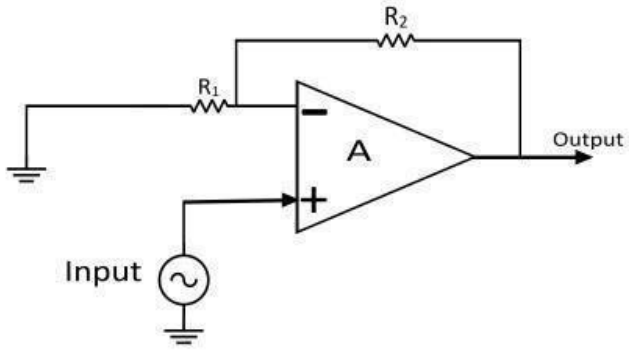


Fig 6. Non Inverting Amplifier

DIFFERNTIATOR : An op-amp based differentiator produces an output, which is equal to the differential of input voltage that is applied to its inverting terminal.

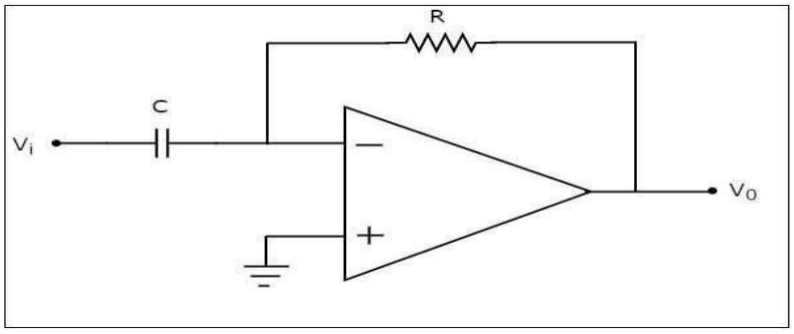


Fig 7. Differentiator

INTEGRATOR : An op-amp based integrator produces an output, which is an integral of the input voltage applied to its inverting terminal.

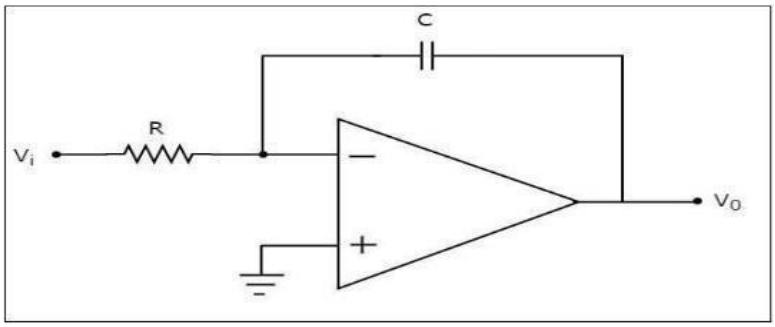


Fig 8. Integrator

3.4 CIRCUIT COMPONENTS :

For OP-AMP application Trainer Kit

- Op amp IC IC 741
- Resistor 10k ohm (6)
- Variable resistor 10k ohm (2)
- Capacitor 1 uF (3)
- Switch
- Connector

1. Op amp IC (741) : An op amp ic is dual inline ic ,which means number of pins have equal on both side of ic.

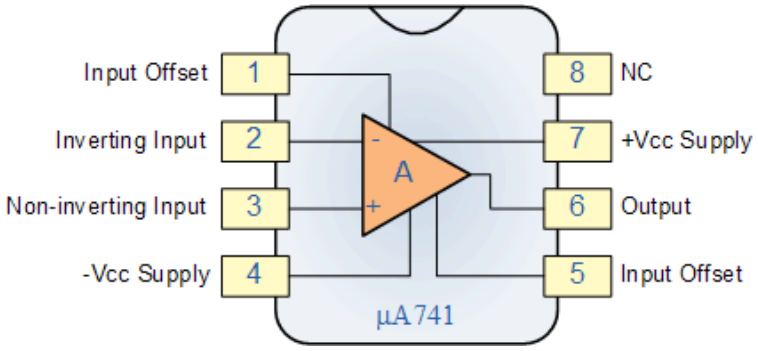


Fig 9 . OP-AMP IC-741

- **RESISTOR :** A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

Fig 10.Resistor

- **CAPACITOR:** Capacitor mainly exist to store an electric charge or capacitor is composed of energy. The two conducting parallel plates separated by a dielectric medium, which by design is a poor conductor of electricity

Fig 11. Capacitor

CHAPTER 4: CONCLUSION

4.1 Advantages :-

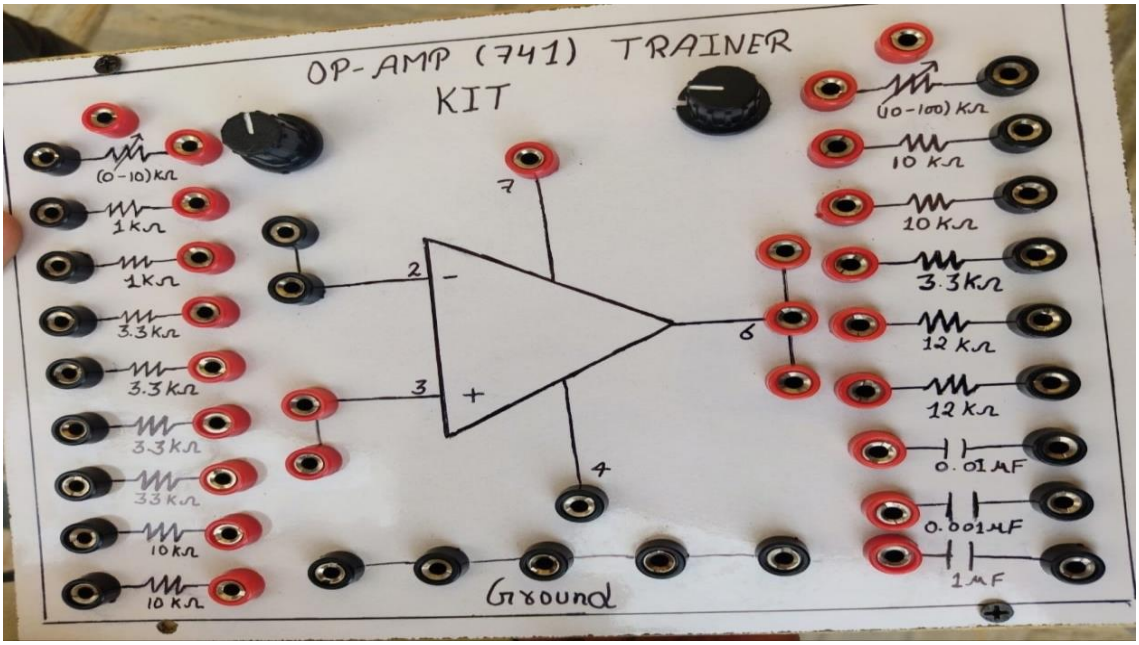
Op-amps are made of transistors. The advantages of using op-amps as gain blocks instead of simpler transistor circuits is usually simpler design made with fewer mounted parts (even though the total device count is higher, considering the complexity inside the op-amps) and more ideal and predictable performance, often at lower supply current. There are exceptions, where individual transistors are more suited to the desired functions, when higher frequencies, larger currents, voltages or higher power are involved. Also, if cost is more important than ideal performance, transistor designs can often beat op- amp ones, even though there are some very low cost op-amps available.

4.2 Limitations of op-amp:-

The primary limitation of op-amp is that they are not especially fast: The typical performance degrades rapidly for frequencies greater than about 1 MHz, although some models are designed specially to handle higher frequencies.

4.3 Application of Project:-

This operational amplifier kit can be used in electronics labs to understand the basic operations performed by OP-AMP. It is easy to handle and easily under stable by the students who are willing to understand the basic applications of OP- AMP.



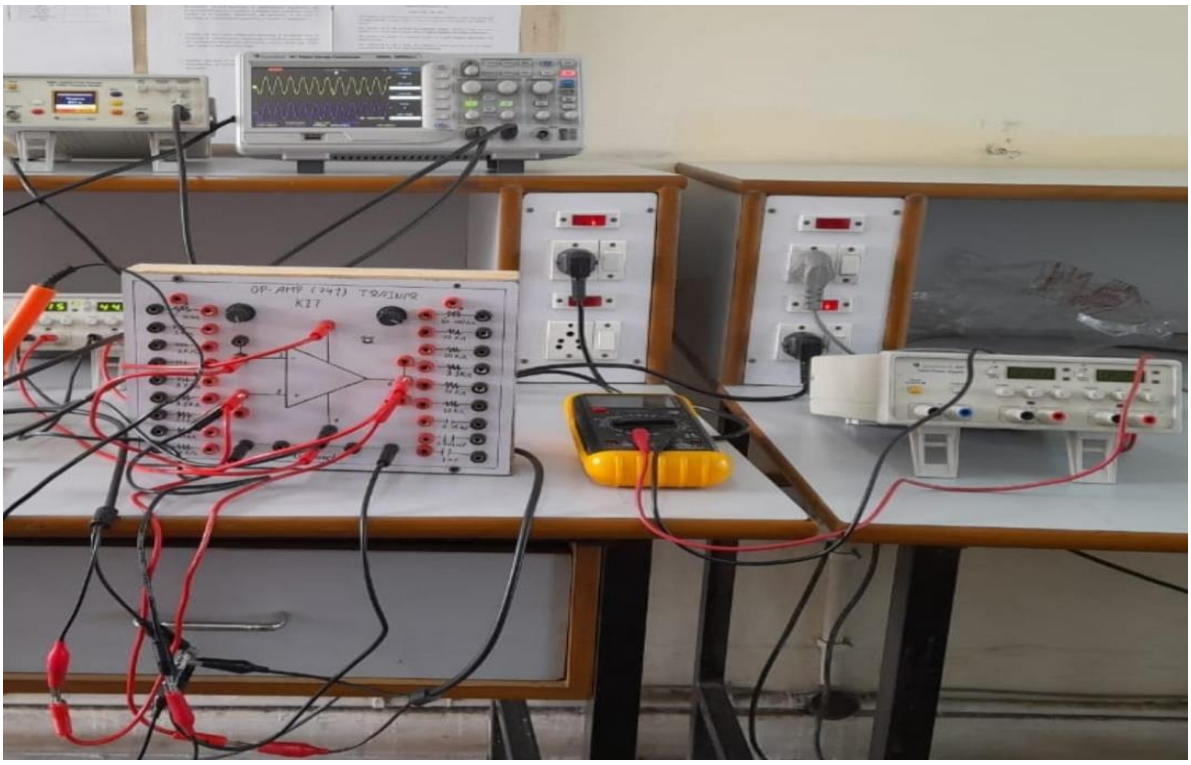


Figure 12. Working Of an Op-Amp Trainer Kit

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