SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB204 – LINEAR AND DIGITAL CIRCUITS

II YEAR/ III SEMESTER

UNIT 1 – **FUNDAMENTALS OF OPAMP**

TOPIC 5 – Instrumentation amplifiers

Guess?????

+


Cute fun horn
7 Voice Converter Sound Mode
Blue/Pink/Orange/Green

Why instrumentation amplifier?

- To amplify small signals in the presence of noise has gone through an evolution over the years
- The simplest approach, the discrete operational amplifier, isn't suitable as an instrumentation amplifier
- An instrumentation amplifier is used to amplify very low-level signals, rejecting noise and interference signals

What is an instrumentation amplifier?

- An instrumentation amplifier is used to amplify very low-level signals, rejecting noise and interference signals
- Inputs to the **instrumentation amplifiers** will have very low signal energy
- High gain and accurate
- High CMRR

Instrumentation Amplifier using Op Amp

- Op-amps 1 & 2 are non-inverting amplifiers
- Op-amp 3 is a difference amplifier
- Instrumentation amplifier's final output Vout is the amplified difference of the input signals applied to the input terminals of op-amp 3
- Let the outputs of op-amp 1 and op-amp 2 be Vo1 and Vo2 respectively

  Then, Vout = (R3/R2)(Vo1-Vo2)
- The potential at node A is the input voltage V1. Hence the potential at node B is also V1, from the virtual short concept. Thus, the potential at node G is also V1

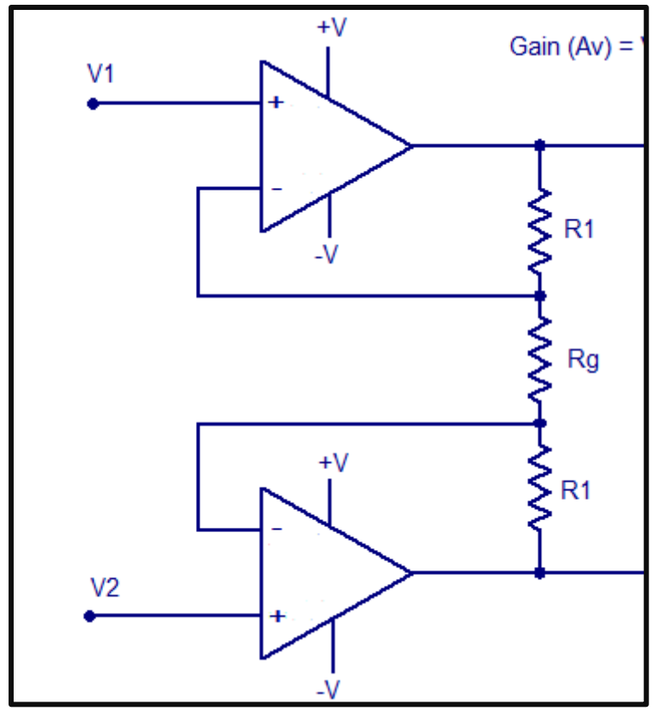
Activity

In class activity

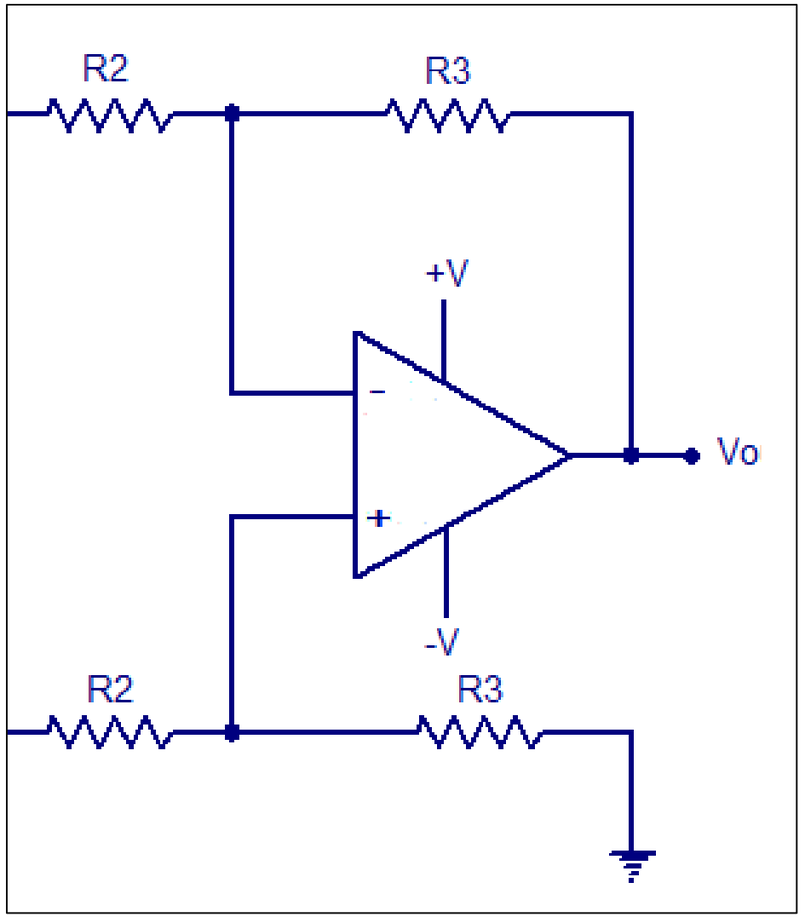
Students should make the correct shape from the given tangram kit.

Input Stage

- The circuit is divided into two stages.
- The input stage has two non-inverting buffer amplifiers
- The input-stage amplifiers also provide high impedance, which minimizes loading of the sensors.
- The gain-setting resistor (R_G) allows the designer to select any gain within the operating region of the device.

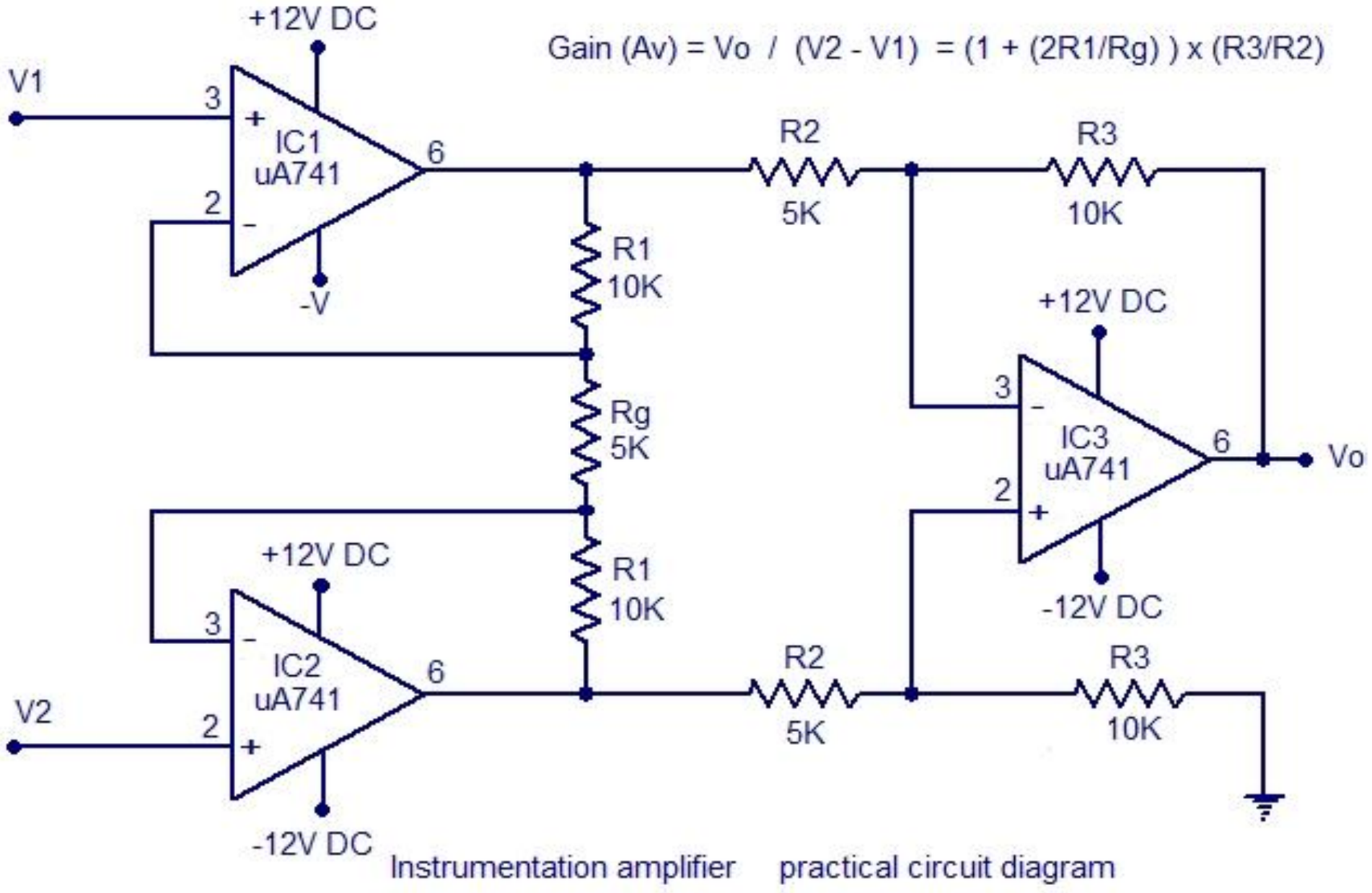


Output Stage



- The output stage is a traditional difference amplifier.
- The ratio of internal resistors, R2/R1, sets the gain of the internal difference amplifier
- Typically G = 1 V/V for most instrumentation amplifiers
- The balanced signal paths from the input to the output yield excellent CMRR.

Instrumentation Amplifier



Instrumentation amplifier practical circuit diagram

Applications

EEG

BP

ECG

Light Intensity Meter

Analog Weighing scale

Advantages

- Accurate Testing and Measurement
- Stable and Easy to Use
- Reliability of the Setup and Results
- Highly Scalable

Disadvantages

Long Range Transmission Issues

- Superimposing of the original wave when the sound or noise gets transmitted over a long range.
- The system will depend on special cables that can cancel this noise or superimposition

Assessment

1. An instrumentation system does not include

a) Transducer
b) Instrumentation amplifier
c) Automatic process controller
d) Tester
Answer: d

2. Why output of transducer is not directly connected to indicator or display?

a) Low level output is produced
b) High level output is produced
c) No output is produced
d) Input is fed directly
Answer: a

3. What are the features of instrumentation amplifier?

a) Low noise
b) High gain accuracy
c) Low thermal and time drift
d) All of the mentioned
Answer: d

THANK YOU