



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**  
**An Autonomous Institution**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade(III Cycle)  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **23ECB202 – LINEAR INTEGRATED CIRCUITS**

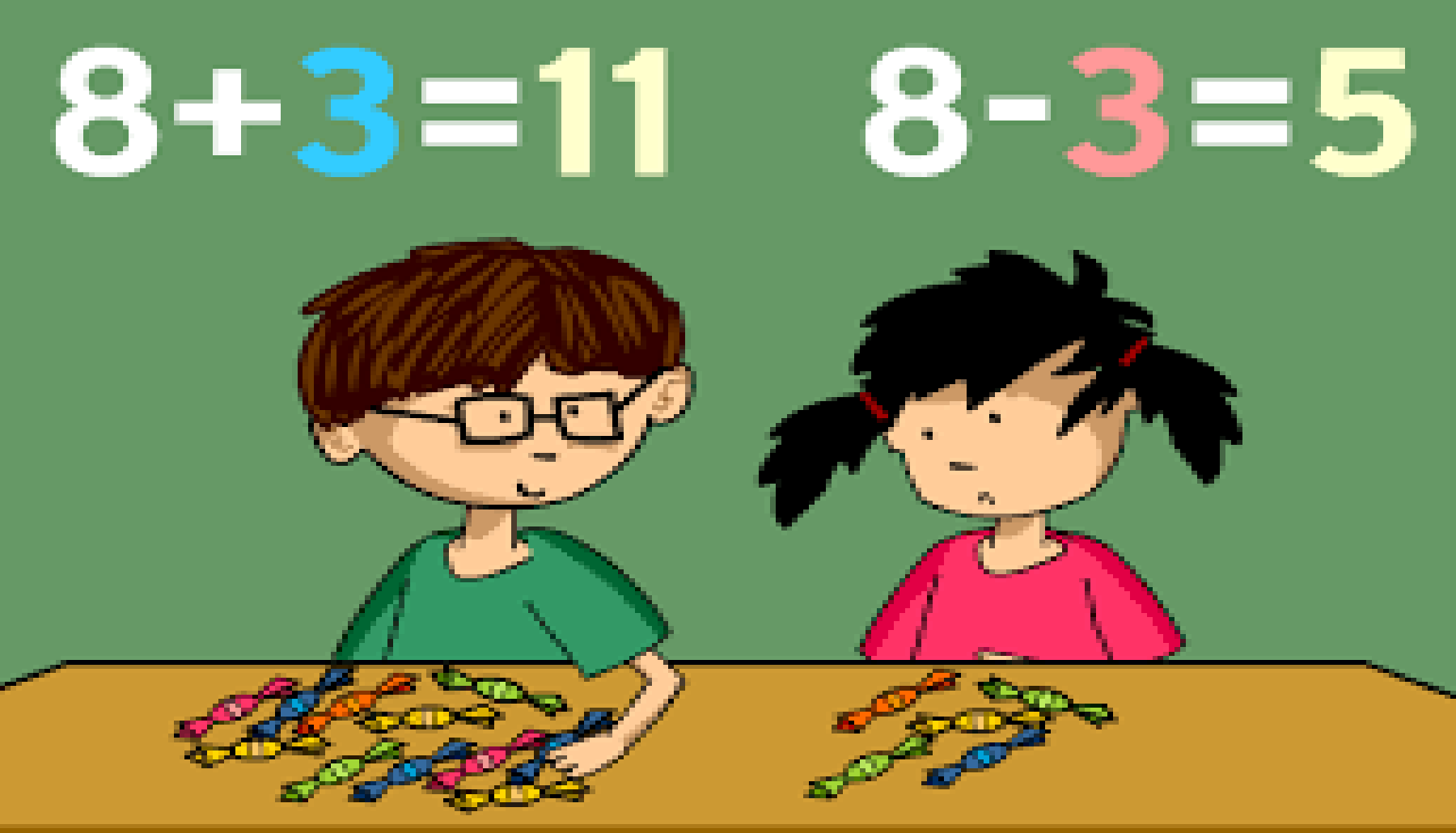
II YEAR/ IV SEMESTER  
1

#### **UNIT 2 – APPLICATIONS OF OPERATIONAL AMPLIFIERS**

**TOPIC 3– Adder and Subtractor**



Guess?????





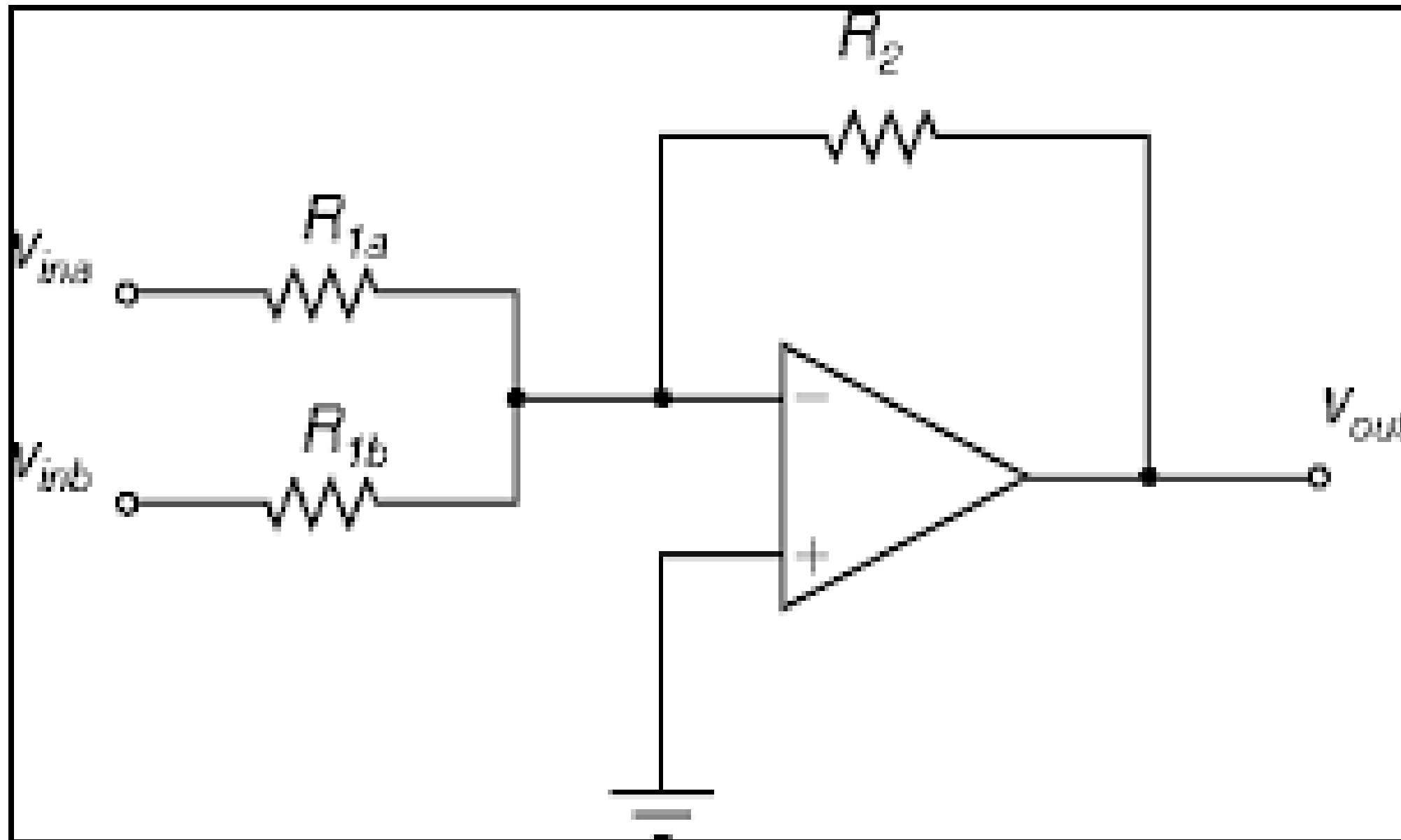
## Why?



- In digital circuits, an adder–subtractor is a circuit that is capable of adding or subtracting numbers
- A circuit that does adding or subtracting depends on a control signal
- It is also possible to construct a circuit that performs both addition and subtraction at the same time
- The Subtract or also called a differential amplifier, uses both the inverting and non-inverting inputs to produce an output signal which is the difference between the two input voltages  $V_1$  and  $V_2$



# Adder using Op Amp





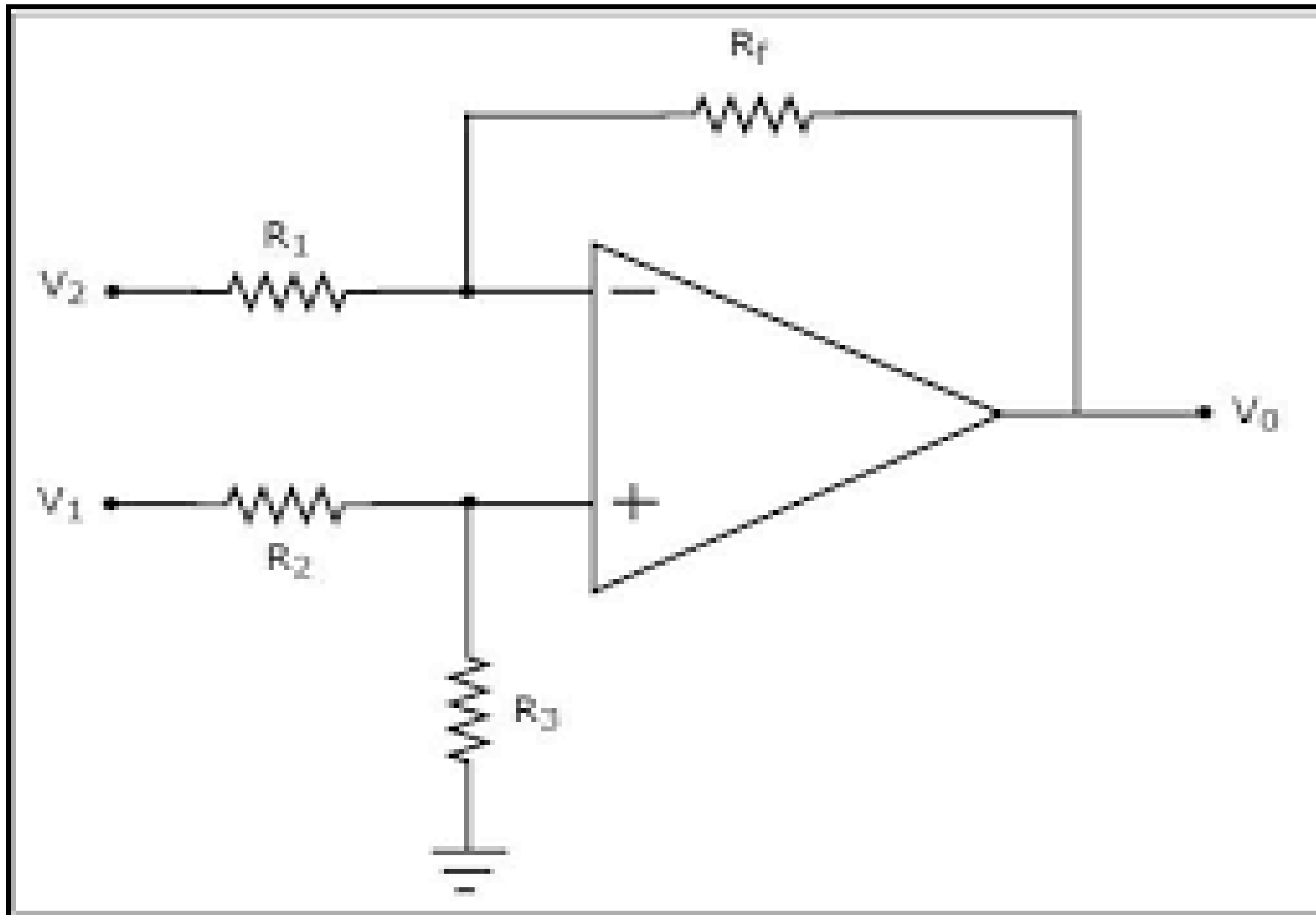
# Adder using Op Amp



- Op-amp is used to design a circuit whose output is the sum of several input signals
- If the input resistors are equal in value then the summed output voltage is as given and gained +1
- If the input resistors are unequal in value then the output voltage is weighted sum and becomes
- $V_{out} = - (V_1(R_2/R_{1a}) + V_2(R_2/R_{2a}) + \text{etc})$



# Subtractor using Op Amp





# Subtractor using Op Amp



- ❑ Subtractor is used to produce an output signal which is difference between the two input voltages  $V_1$ ,  $V_2$  allowing one signal to be subtracted from another
- ❑ If the input resistors are equal in value then the output voltage is gained as  $+1$
- ❑ If the input resistance are unequal then the circuit become a differential amplifier
- ❑ Output will be,  $V_0 = V_1 - V_2$



# Activity



## *In class activity*

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





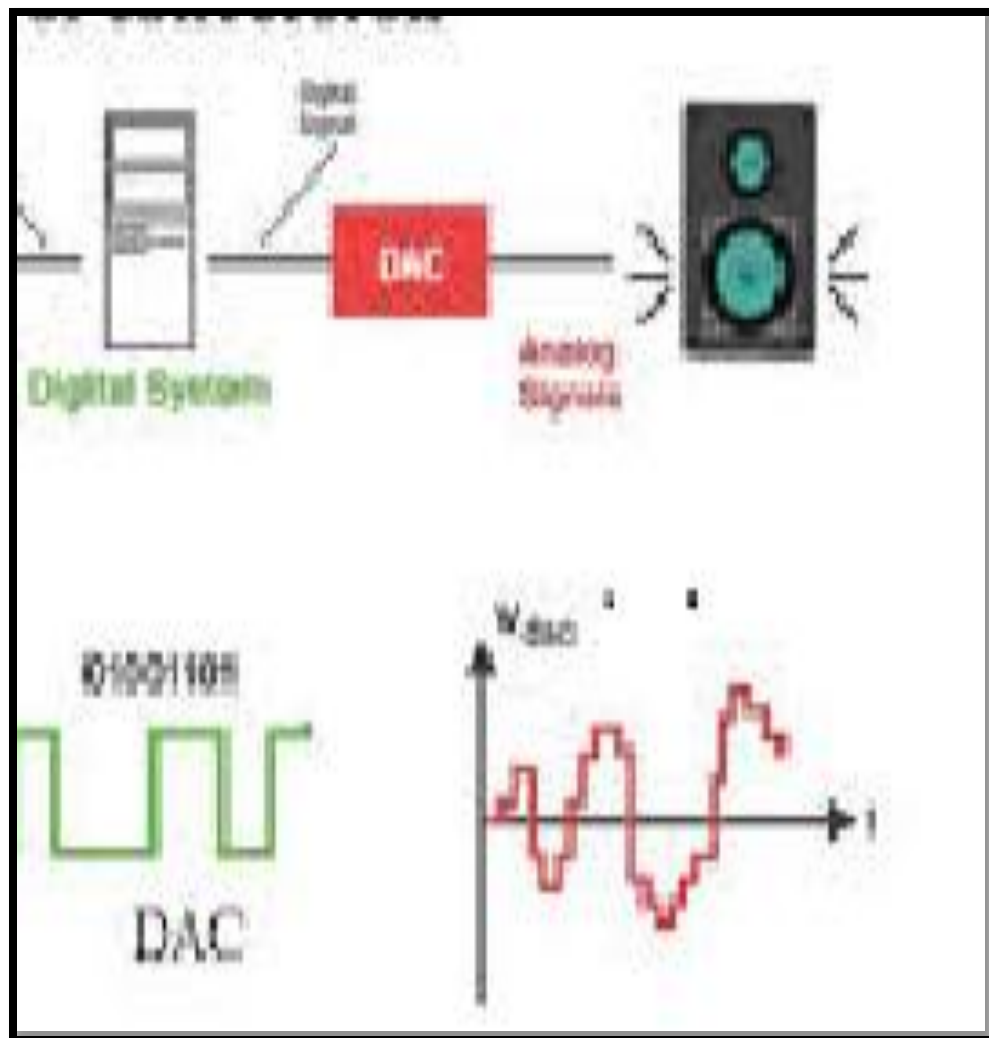
# Audio Mixer



- ❑ A **mixer** is an electronic device which is often **used for** changing the quality and the levels of **audio** signals
- ❑ It is also known as a **mixing** console, an **audio mixer**, or a soundboard
- ❑ Using a **mixer** is the most convenient way to route or combine various **audio** signals and even change the timbre and dynamics of the sound



# Digital to Analog conversion



- ❑ In the real world, most data are available in the form of analog in nature.
- ❑ While manipulating the data, these two converting interfaces are essential to digital electronic equipment
- ❑ DAC will process the digital sound signal back into the analog signal that is used by audio output equipment such as a speaker



# Applications

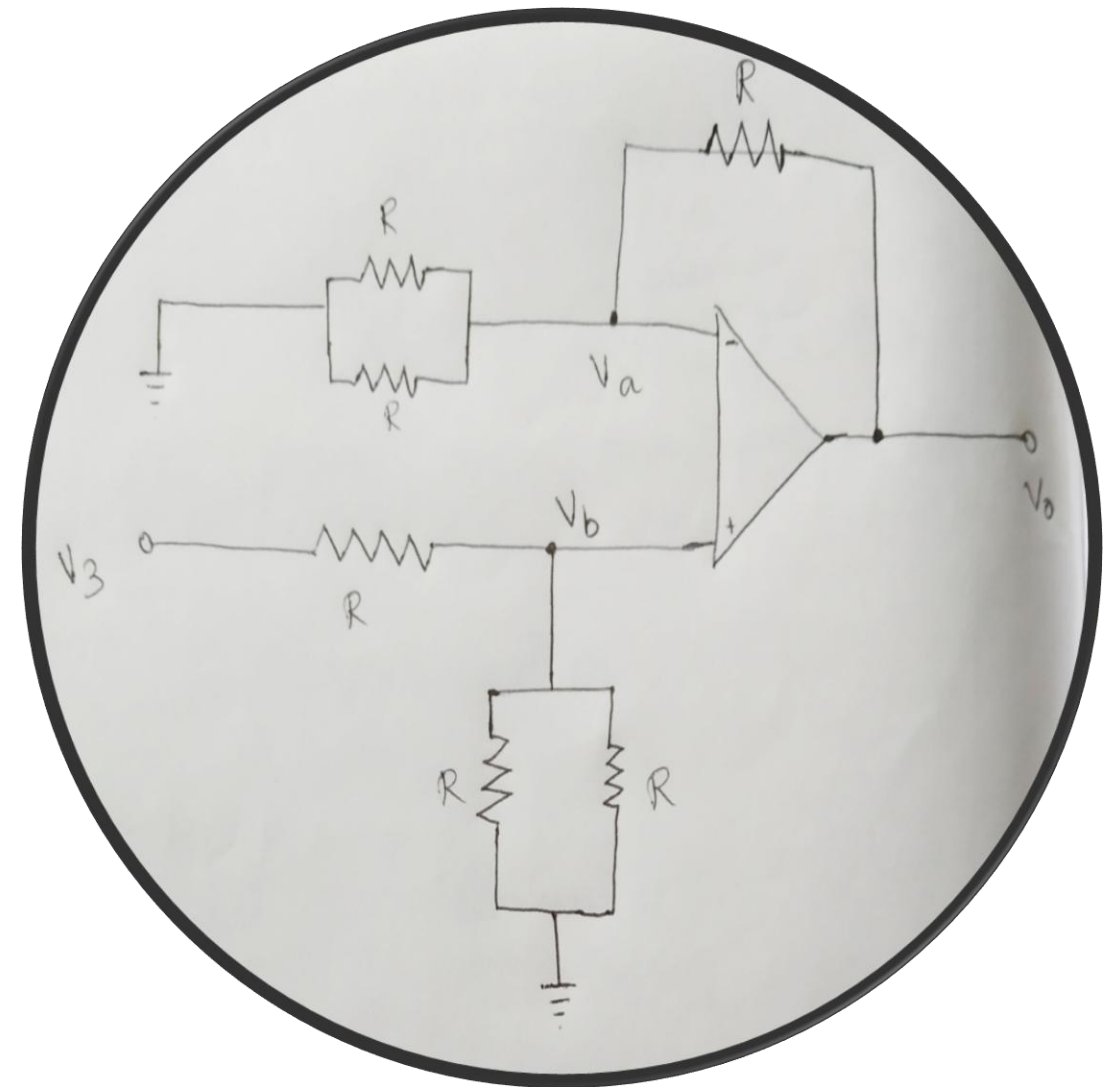




# Adder and Subtractor Amplifier



- It is possible to perform addition and subtraction simultaneously with a single op-amp using the circuit
- The output voltage  $V_o$  can be obtained by using superposition theorem
- To find output voltage  $V_{o1}$  due to  $V_1$  alone, make all other input voltages  $V_2, V_3$  and  $V_4 = 0$





# Assessment



1. Determine the expression of output voltage for inverting summing amplifier consisting of four internal resistors? (Assume the value of internal resistors to be equal)

a)  $V_o = -(R_f/R) \times (V_a + V_b + V_c + V_d)$

b)  $V_o = (R_f/R) \times (V_a + V_b + V_c + V_d)$

c)  $V_o = (R/R_f) \times (V_a + V_b + V_c + V_d)$

d) None of the mentioned

2. The summing amplifier is an application of:

a) Noninverting op-amp

b) Inverting op-amp

c) Integrator

d) Differentiator



**THANK YOU**