Basic Electronic Circuits Lab (IEC-103)

Experiment-03

Objective

To realize summing, averaging, and difference amplifier using operational amplifier.

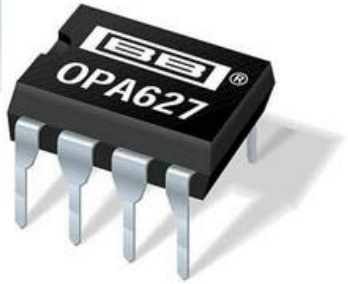
Components

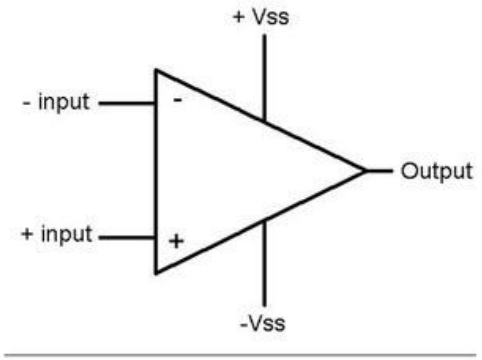
- **Op-amp IC (**741**)**
- **Resistances (**1kΩ**,** 2.2kΩ **and** 4.7 kΩ**)**
- **Breadboard**
- **Connecting wires**

Equipment

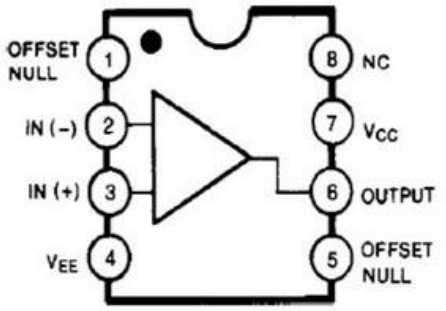
- **Function Generator for generating input signal.**
- **Power supplies ($\pm$ 12 V) to power up op-amp.**
- **CRO for input and output voltage measurements**

741 Op Amp IC

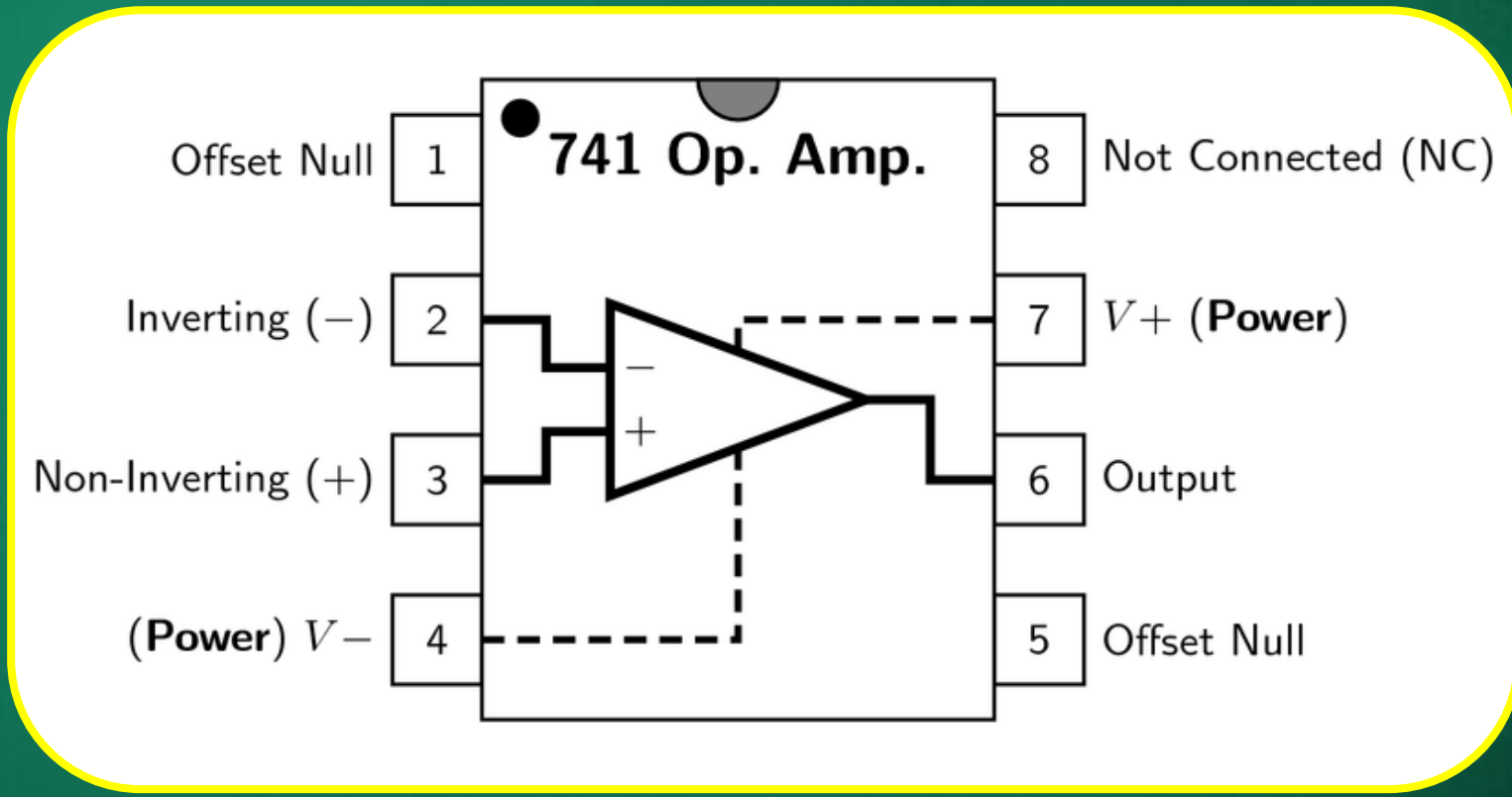




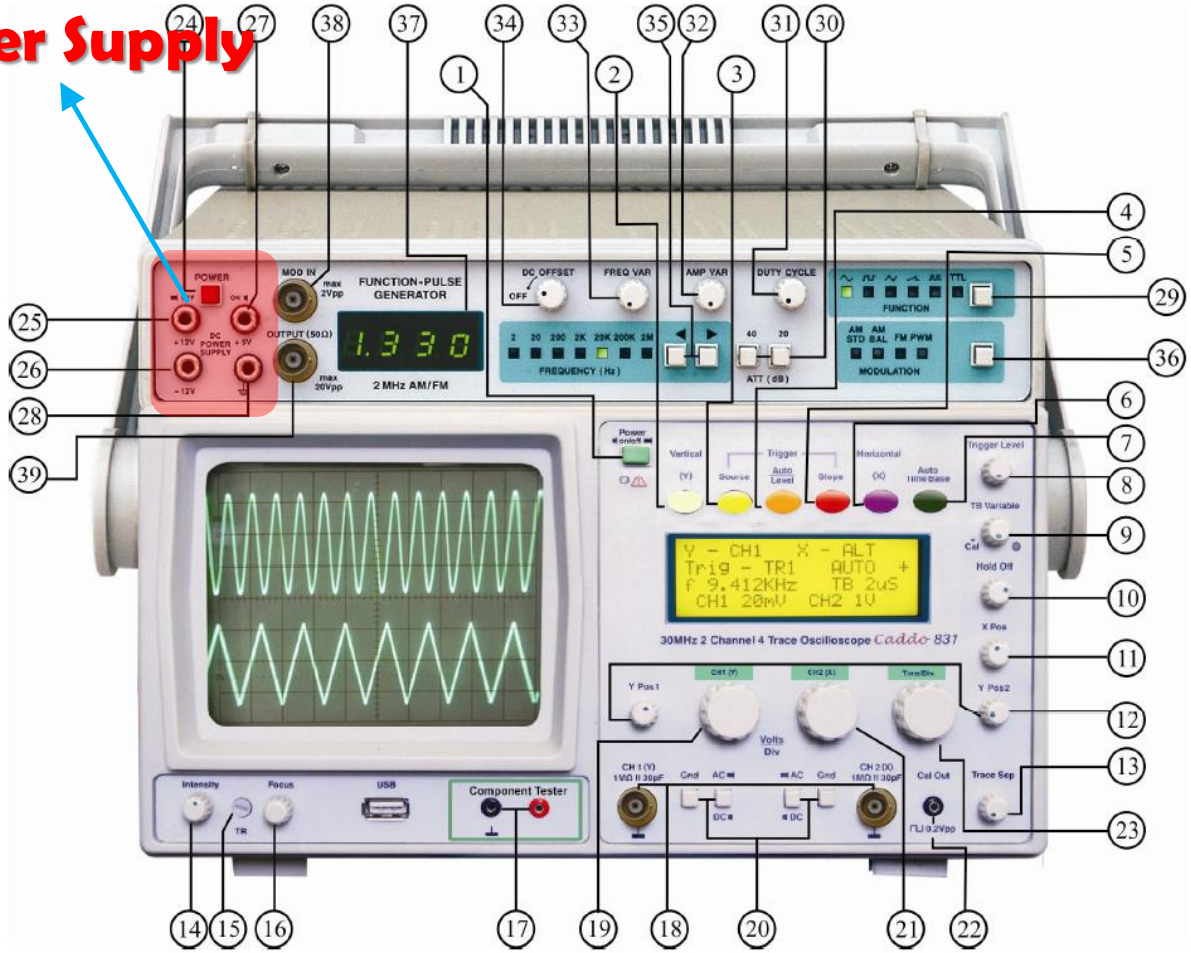
OP-AMP



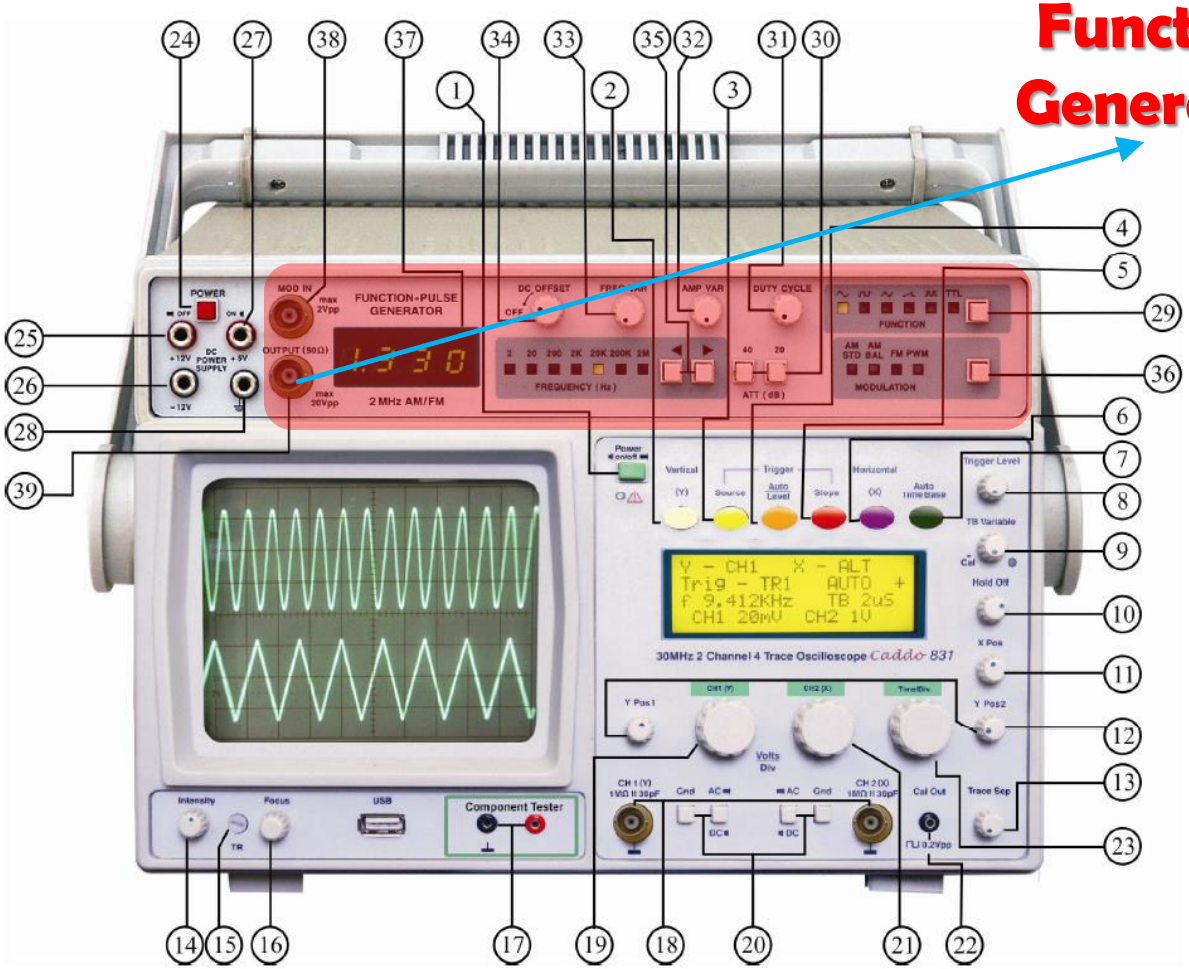
741 Op Amp IC (Pin Diagram)



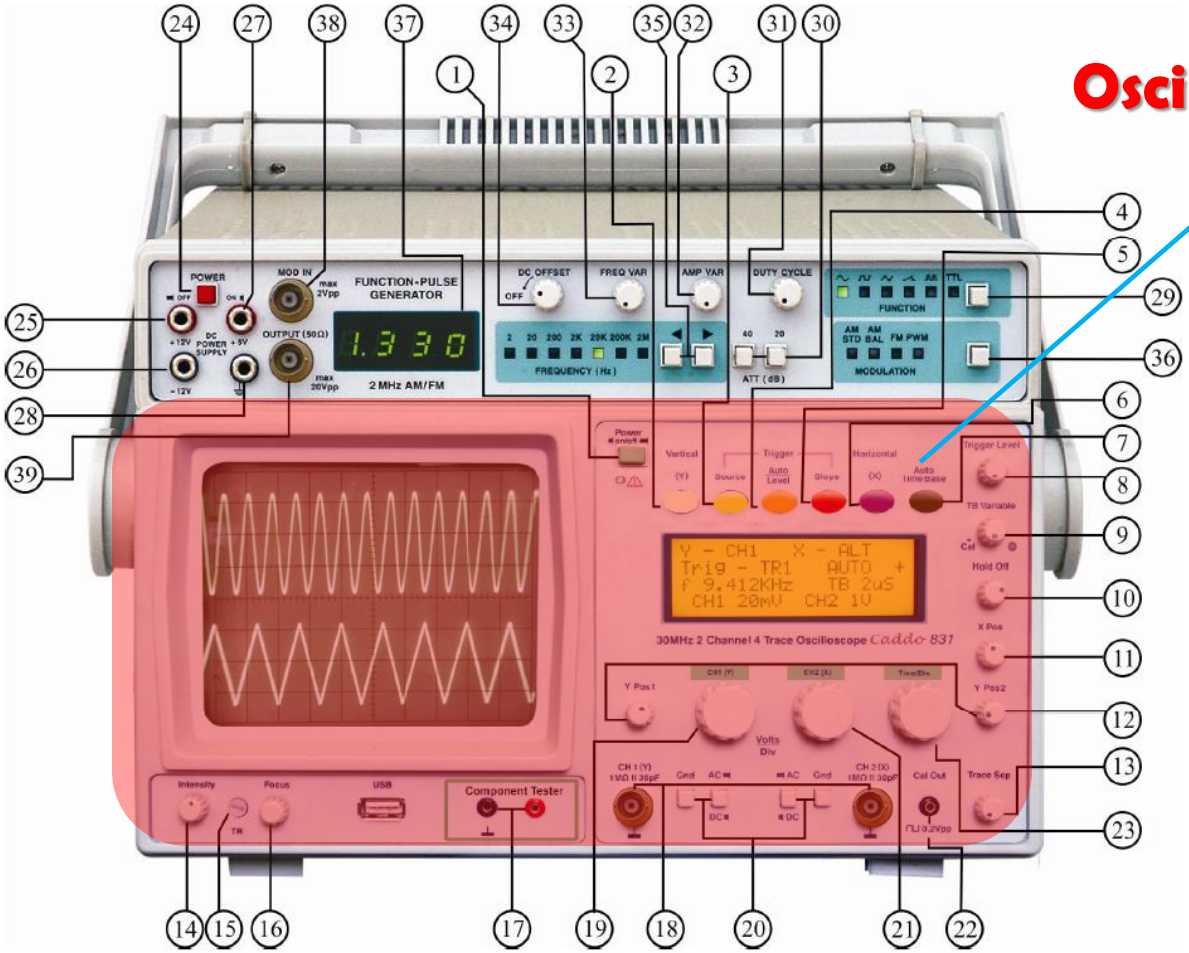
Power Supply (Fixed)



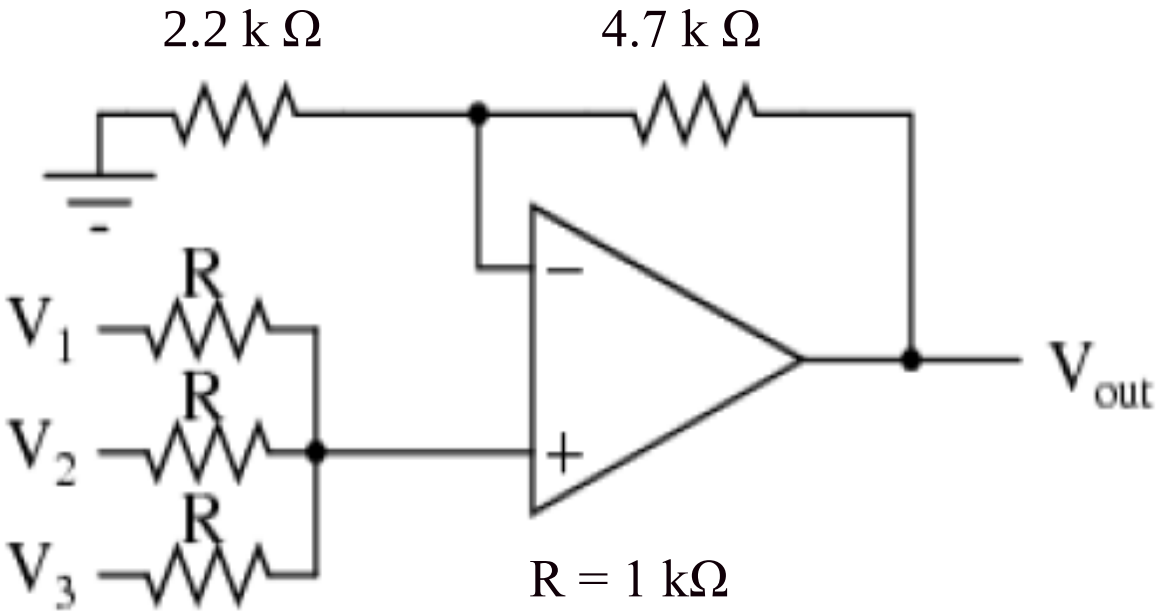
Signal Source



Oscilloscope



Summing Amplifier



Summing Amplifier

Output voltage due to source V_1 acting alone.

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$$V_{out1} = \left(1 + \frac{4.7}{2.2}\right)\left(\frac{0.5k}{1k + 0.5k}\right)V_1 \approx V_1$$

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Output voltage due to source V_2 acting alone.

$$V_{out2} = \left(1 + \frac{4.7}{2.2}\right)\left(\frac{0.5k}{1k + 0.5k}\right)V_2 \approx V_2$$

Summing Amplifier

Output voltage due to source V_1 acting alone.

$$V_{out1} = \left(1 + \frac{4.7}{2.2}\right)\left(\frac{0.5k}{1k + 0.5k}\right)V_1 \approx V_1$$

Output voltage due to source V_2 acting alone.

$$V_{out2} = \left(1 + \frac{4.7}{2.2}\right)\left(\frac{0.5k}{1k + 0.5k}\right)V_2 \approx V_2$$

Output voltage due to source V_3 acting alone.

$$V_{out3} = \left(1 + \frac{4.7}{2.2}\right)\left(\frac{0.5k}{1k + 0.5k}\right)V_3 \approx V_3$$

Summing Amplifier

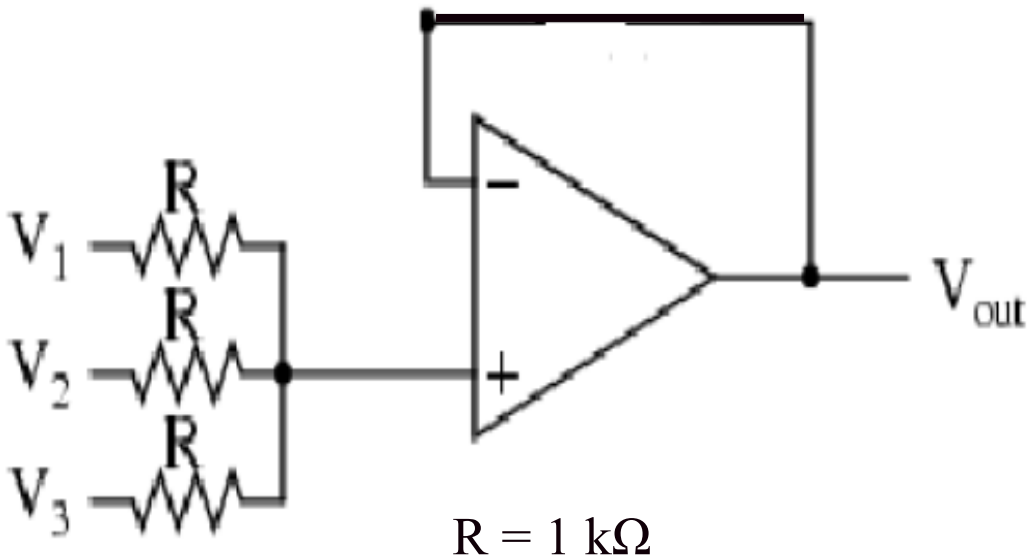
Output voltage due to all the sources (applying superposition principle)

$$V_{out} = V_1 + V_2 + V_3$$

Observations

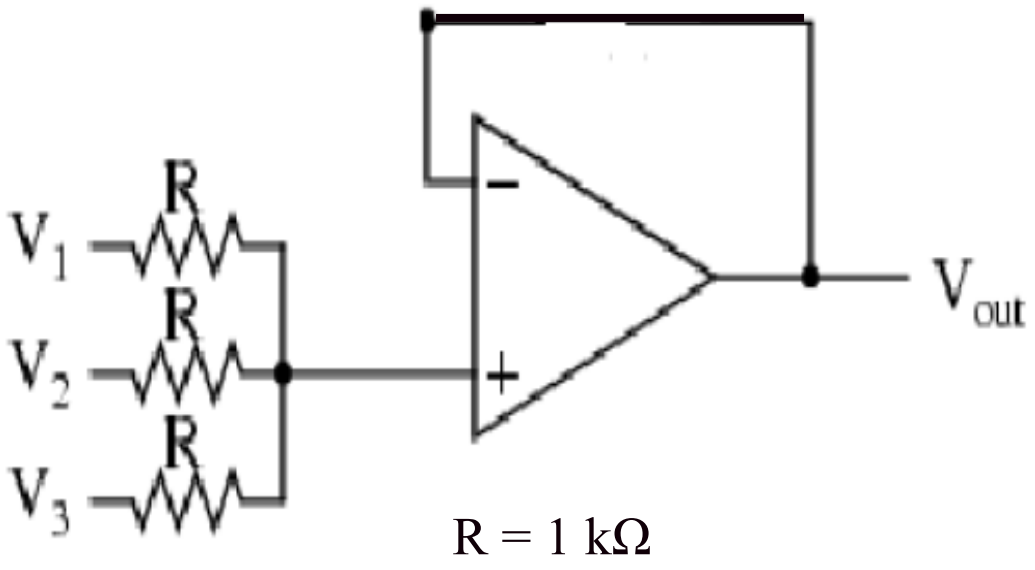
S. No	V_1	V_2	V_3	V_{out}
1	0	0	0	
2	1 V (peak)	0	0	
3	0	1 V (peak)	0	
4	0	0	1 V (peak)	
5	1 V (peak)	1 V (peak)	0	
6	1 V (peak)	0	1 V (peak)	
7	0	1 V (peak)	1 V (peak)	
8	1 V (peak)	1 V (peak)	1 V (peak)	

Averaging Amplifier



$R = 1\ k\Omega$

Averaging Amplifier

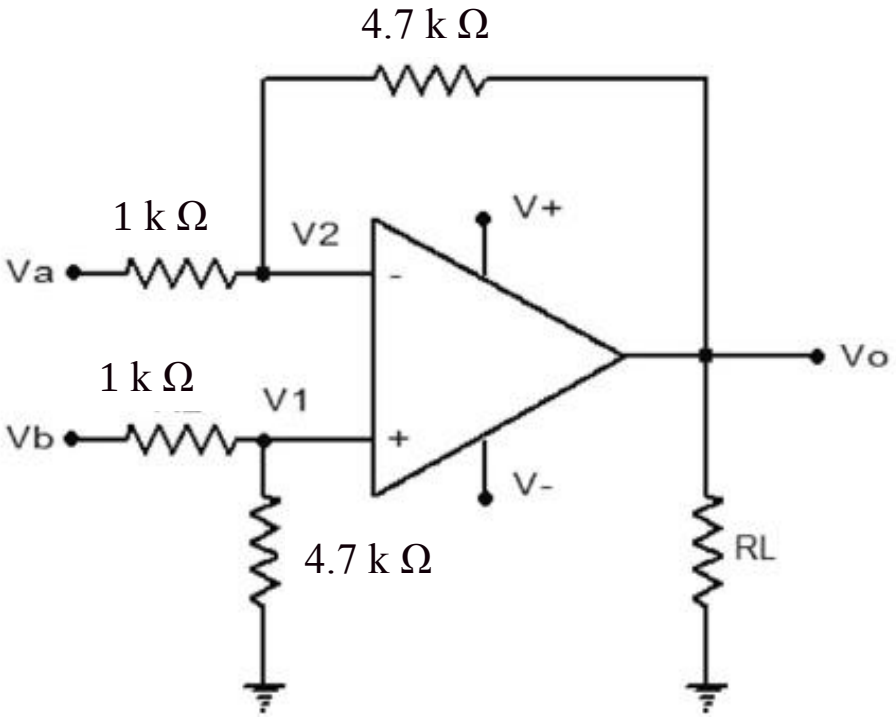


$$V_{out} = \frac{V_1 + V_2 + V_3}{3}$$

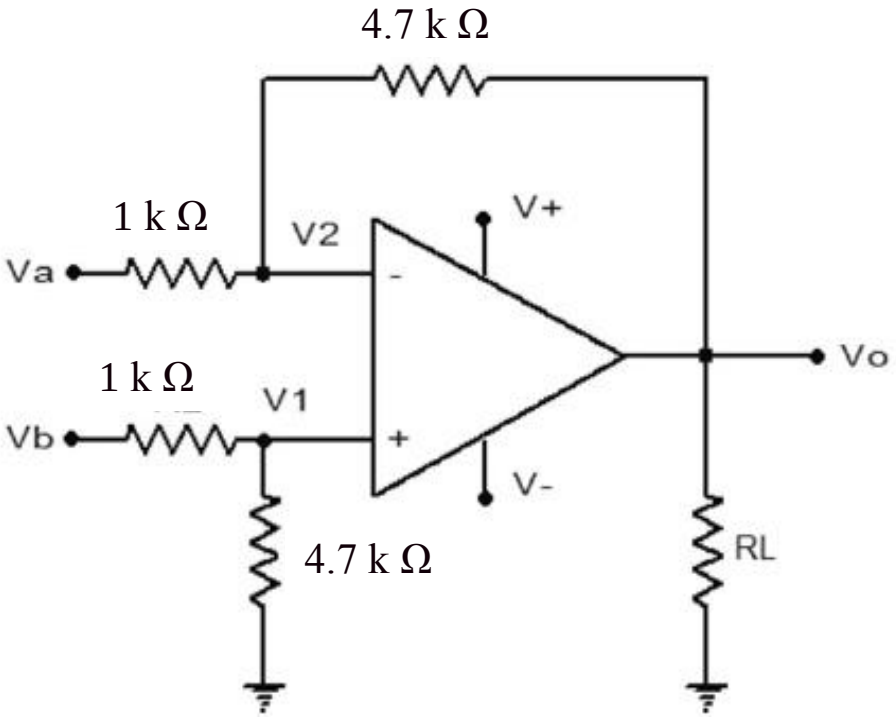
Observations

S. No	V_1	V_2	V_3	V_{out}
1	0	0	0	
2	1 V (peak)	0	0	
3	0	1 V (peak)	0	
4	0	0	1 V (peak)	
5	1 V (peak)	1 V (peak)	0	
6	1 V (peak)	0	1 V (peak)	
7	0	1 V (peak)	1 V (peak)	
8	1 V (peak)	1 V (peak)	1 V (peak)	

Difference Amplifier



Difference Amplifier



$$V_o = 4.7(V_b - V_a)$$

Observations

S. No	V_a	V_b	V_o
1	0	0	
2	1 V (peak)	0	
3	0	1 V (peak)	
4	1 V (peak)	1 V (peak)	