Basic Electronic Circuits Lab (IEC-103)

Experiment-05

Objective

To build a square wave generator and triangular wave generator.

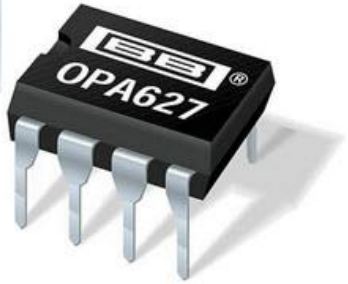
Components

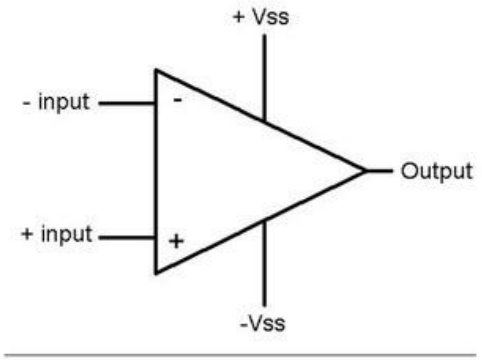
- **Op-amp ICS** (741)
- **Resistances** (10KΩ, 12KΩ, 20KΩ, and 47KΩ)
- **Capacitors** (0.1 μF **and** 0.01 μF)
- **Breadboard**
- **Connecting wires**

Equipment

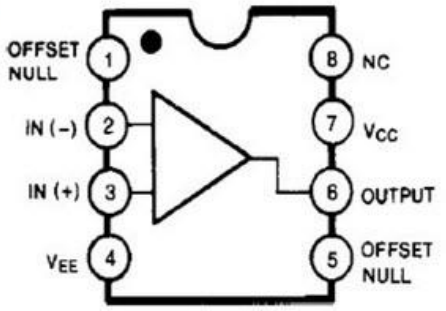
- **Regulated Power supplies ($\pm$ 12 V) to power up op-amp.**
- **CRO for voltage measurements.**

741 Op Amp IC

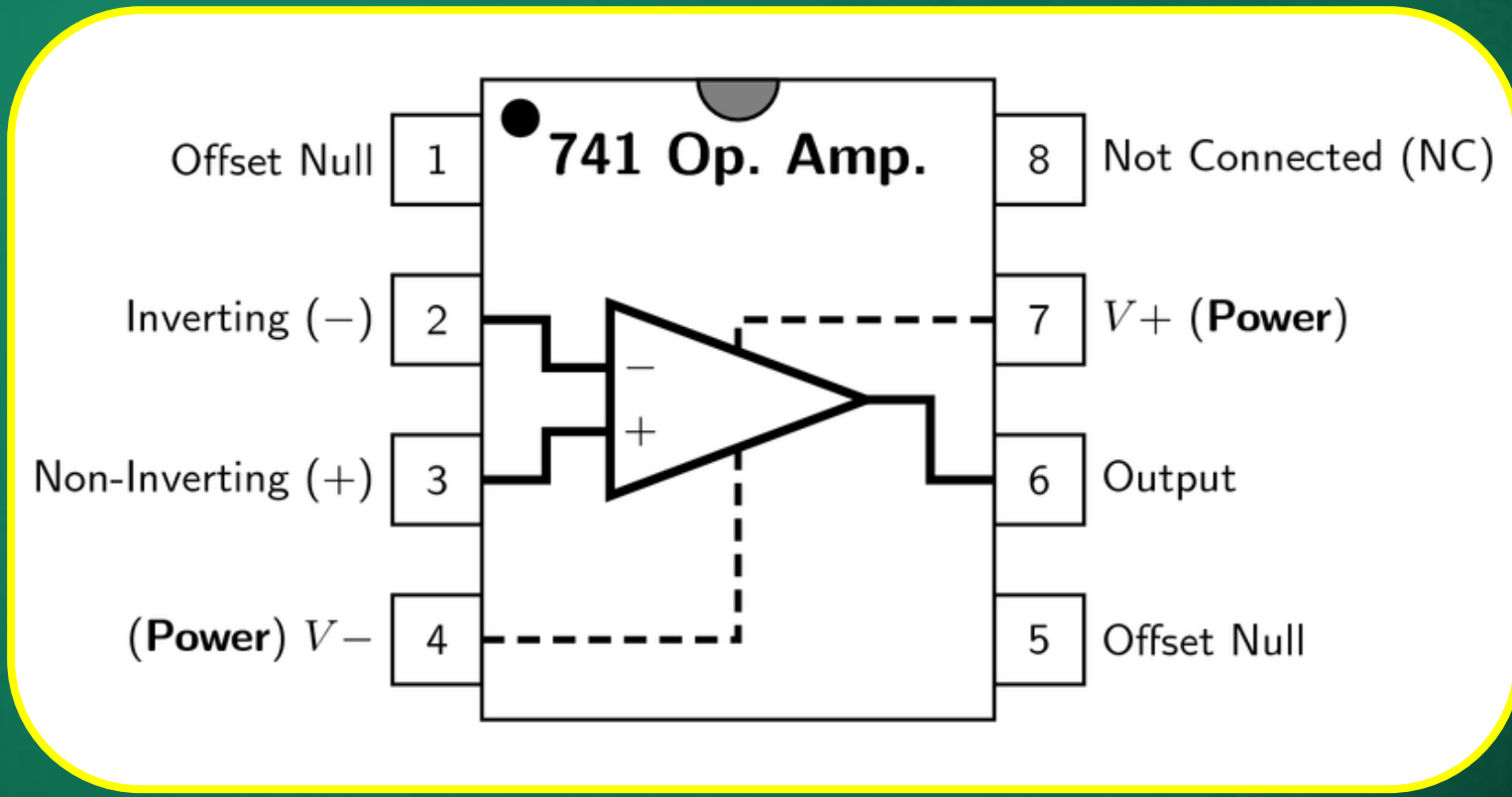




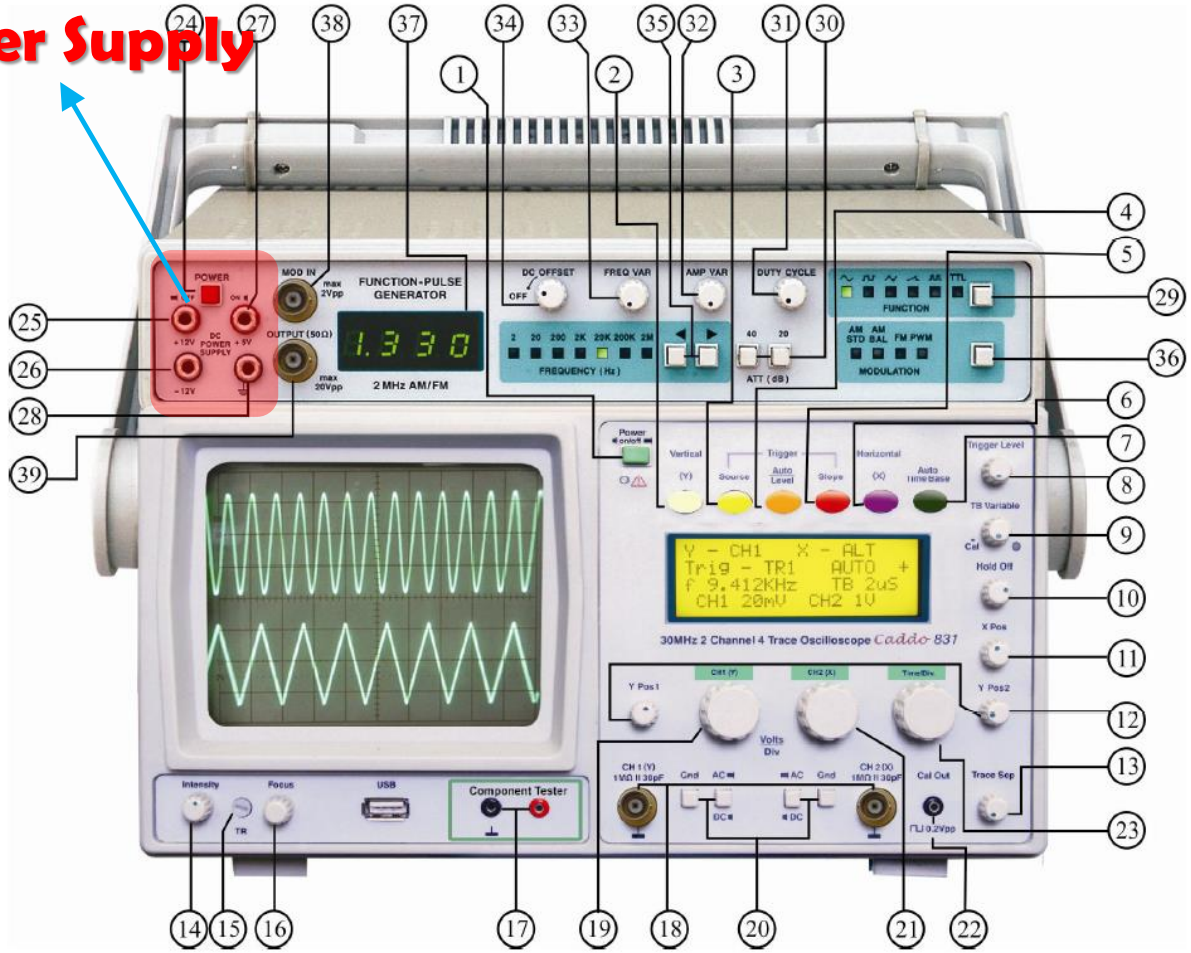
OP-AMP



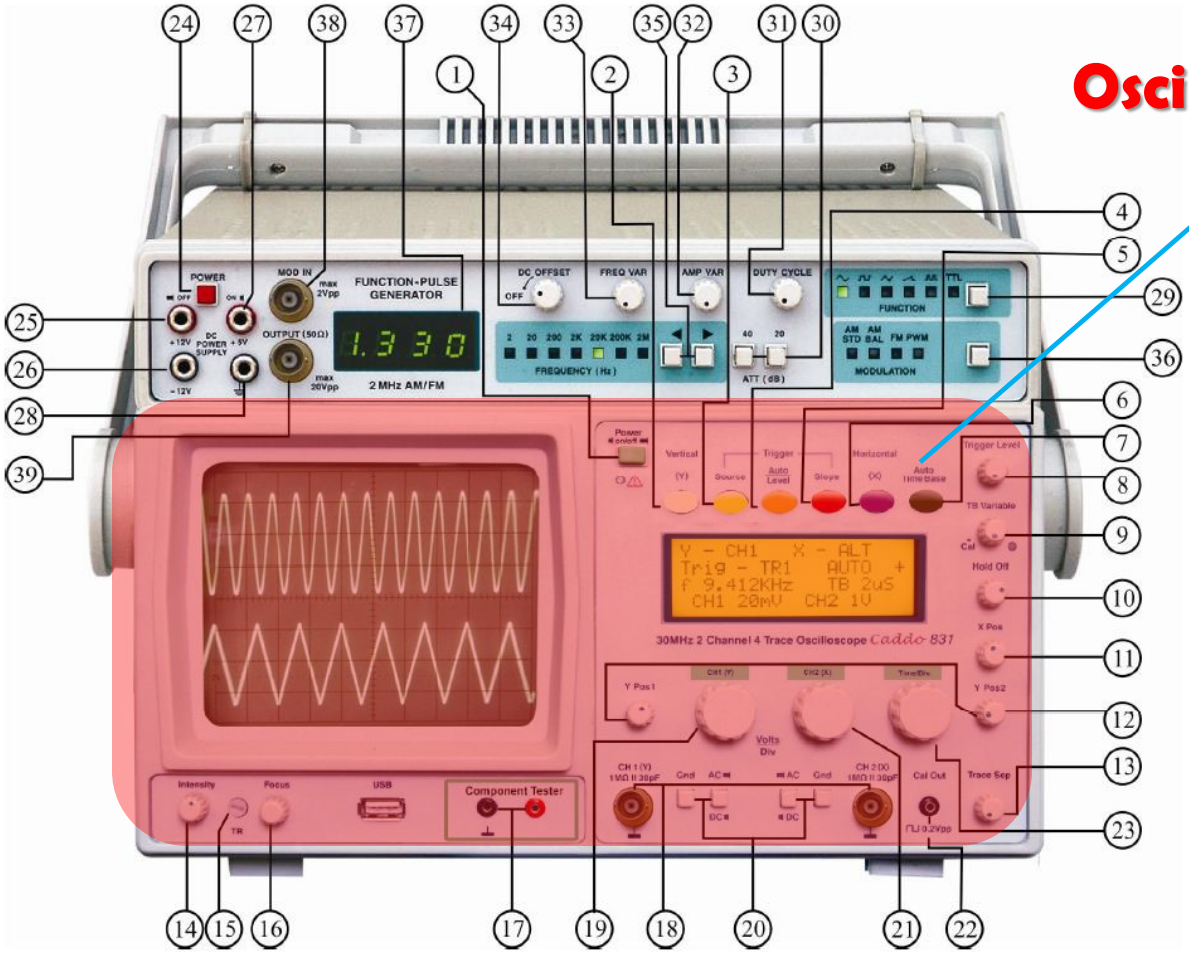
741 Op Amp IC (Pin Diagram)



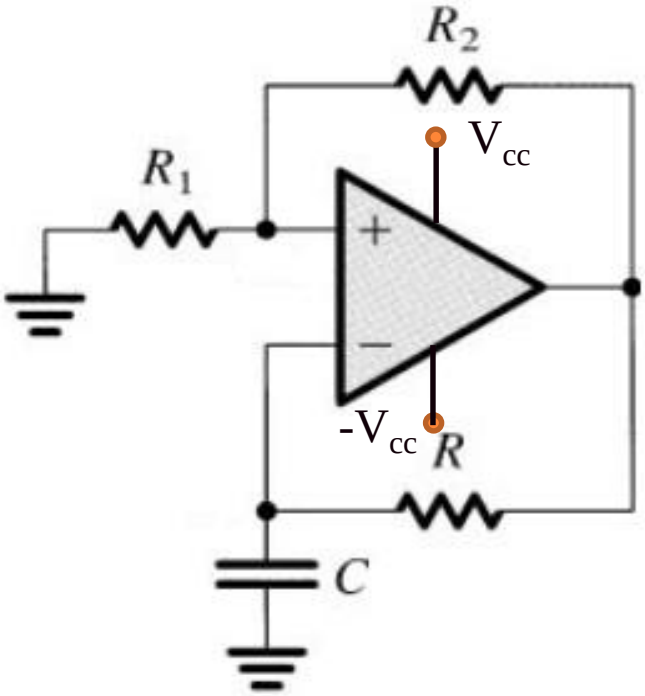
Power Supply (Fixed)



Oscilloscope



Square Wave Generator



$R_1 = R_2 = 10\ k\Omega$ and $R = 10\ k\Omega$ and $20\ k\Omega$, $C = 0.1\ \mu F$ and $0.01\ \mu F$

Square Wave Generator (T)

Time period of the oscillations

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$$T = 2RC \ln\left(\frac{1+\beta}{1-\beta}\right)$$

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where

$$\beta = \frac{R_1}{R_1 + R_2}$$

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where

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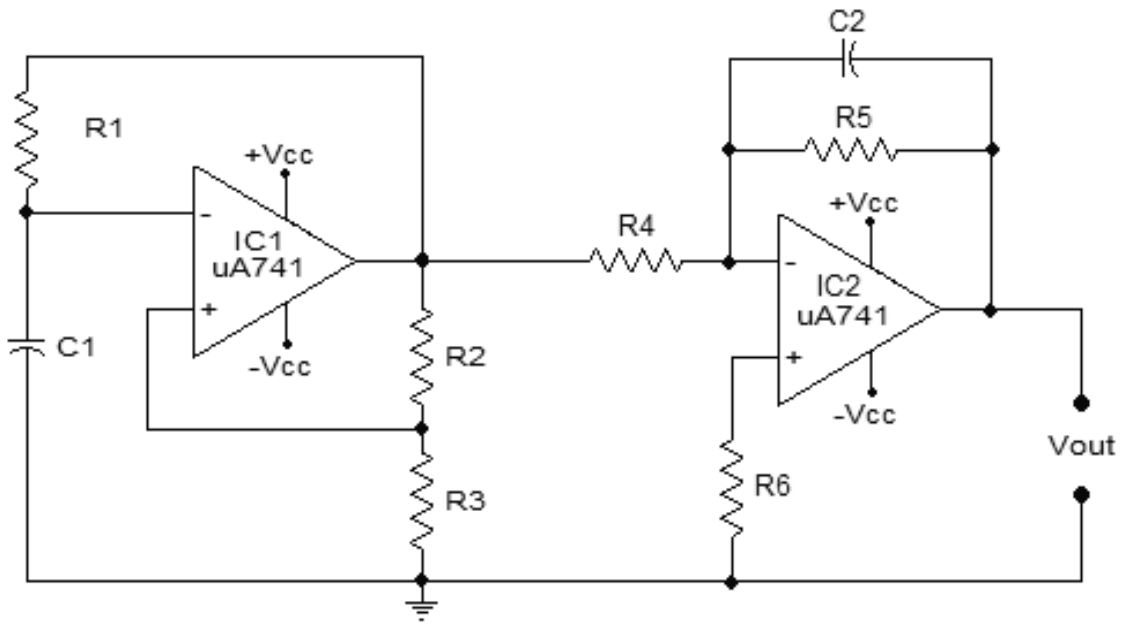
If $R_1 = R_2$ **then** $\beta = 0.5$**.**

Observations

$$T\,(\text{theoretical}) = 2RC\,ln\left(\frac{1+0.5}{1-0.5}\right) = 2RC\,ln\,(3) = 2.197RC$$

Sr. No.	R_1	R_2	β	R	C	T (theoretical)	T (measured)
1	10 K	10 K	0.5	10 K	0.1 μF		
2	10 K	10 K	0.5	10 K	0.01 μF		
3	10 K	10 K	0.5	20 K	0.1 μF		

Triangular Wave Generator



$R_1 = R_2 = R_3 = 10\ k\Omega$ and $R_4 = 10\ k\Omega$, $12\ k\Omega$ and $20\ k\Omega$, $R_5 = 47\ k\Omega$,

$C_1 = C_2 = 0.1\ \mu F$

Triangular Wave Generator (T)

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Time period of the oscillations

$$T = 2RC \ln\left(\frac{1+\beta}{1-\beta}\right)$$

where

$$\beta = \frac{R_3}{R_2 + R_3}$$

If $R_2 = R_3$ **then** $\beta = 0.5$**.**

Triangular Wave Generator (T)

Time period of the oscillations

$$T = 2RC \ln\left(\frac{1+\beta}{1-\beta}\right)$$

where

$$\beta = \frac{R_3}{R_2 + R_3}$$

If $R_2 = R_3$ then $\beta = 0.5$.

$$\text{slope} = \pm \frac{V_{sat}}{R_4 C_2}$$

Observations

$$\text{slope (theoretical)} = \pm \frac{V_{sat}}{R_4 C_2}$$

Sr. No.	R_1	R_2	R_3	R_4	R_5	C_1	C_2	Slope (Theoretical)	Slope (Measured)	T (The.)	T (Meas.)
1	10 K	10 K	10 K	10 K	47 K	0.1 µF	0.1 µF				
2	10 K	10 K	10 K	12 K	47 K	0.1 µF	0.1 µF				
3	10 K	10 K	10 K	20 K	47 K	0.1 µF	0.1 µF				