



Exp.No.9

## **SCHMITT TRIGGER using IC 741**

---

### **AIM:**

To design and construct a Schmitt trigger using IC741 Op-amp.

### **APPARATUS:**

1. Operational Amplifier mA 741 IC –1No
2. Resistors
3. Dual Power supply( 0-20V)
4. Multimeter
5. CRO and Probes
6. Function Signal Generator
7. Bread board
8. Connecting wires

### **THEORY:**

Schmitt trigger converts an irregular –shaped waveform to a square wave or pulse. This circuit is also known as squaring circuit.

The input voltage  $V_{in}$  triggers (changes the state of ) the output  $V_o$  every time it exceeds certain voltage levels called Upper threshold voltage,  $V_{UT}$  and Lower threshold voltage,  $V_{LT}$ . These threshold voltages are calculated as follows.

$$V_{UT} = (R_1/R_1+R_2) V_{sat} \quad \text{when } V_o = V_{sat}$$

$$V_{LT} = (R_1/R_1+R_2) (-V_{sat}) \quad \text{when } V_o = -V_{sat}$$

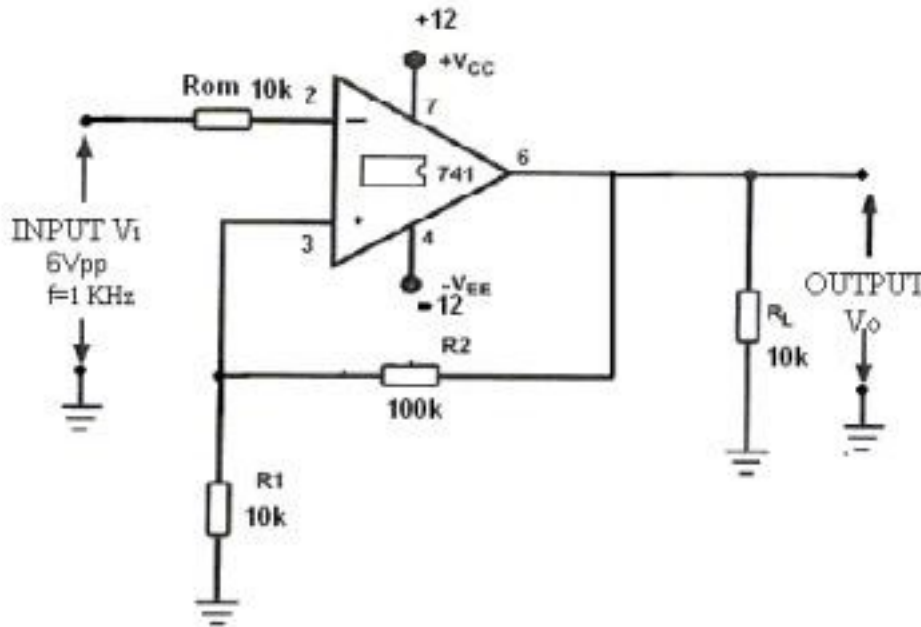
The hysteresis width is the difference between these two threshold voltages i.e.  $V_{UT} - V_{LT}$ .

The output of Schmitt trigger is a square wave when the input is sine wave or triangular wave, where as if the input is a saw tooth wave then the output is a pulse wave.





## CIRCUIT DIAGRAM:



## PROCEDURE:

1. Initially set  $+V_{cc} = 12$  volts and  $-V_{cc}$  to  $-12$  volts.
2. Measure all resistors that are used in the amplifier circuits using the multimeter and record these values
3. As shown in the circuit diagram connect the circuit for Schmitt Trigger on a breadboard.
4. Before turning any power on, double check the wiring to make sure that it is correct. Make sure that the power supply to the op-amp is correctly wired as not to apply the incorrect polarity to the op-amp.
5. Apply the input sine wave using function generator.
6. Connect the channel-1 of CRO at the input terminals and Channel-2 at the output terminals.
7. Observe the output square waveform corresponding to input sinusoidal signal.
8. Overlap both the input and output waves and note down voltages at positions on sine wave where output changes its state. These voltages denote the Upper



threshold voltage and the Lower threshold voltage (see EXPECTED WAVEFORMS below).

9. Verify that these practical threshold voltages are almost same as the theoretical threshold voltages calculated using formula.

10. Sketch the waveforms on graph paper by noting down the amplitude and the time period of the input  $V_{in}$  and the output  $V_o$ .

### TABULAR COLUMN:

S.No	Theoretical Values				Practical value	
	$R_1$	$R_2$	$V_{ut} = \frac{R_1}{R_1 + R_2} (+V_{sat})$	$V_{lt} = \frac{R_1}{R_1 + R_2} (-V_{sat})$	$V_{ut}$	$V_{lt}$
1						
2						
3						

### EXPECTED GRAPH:

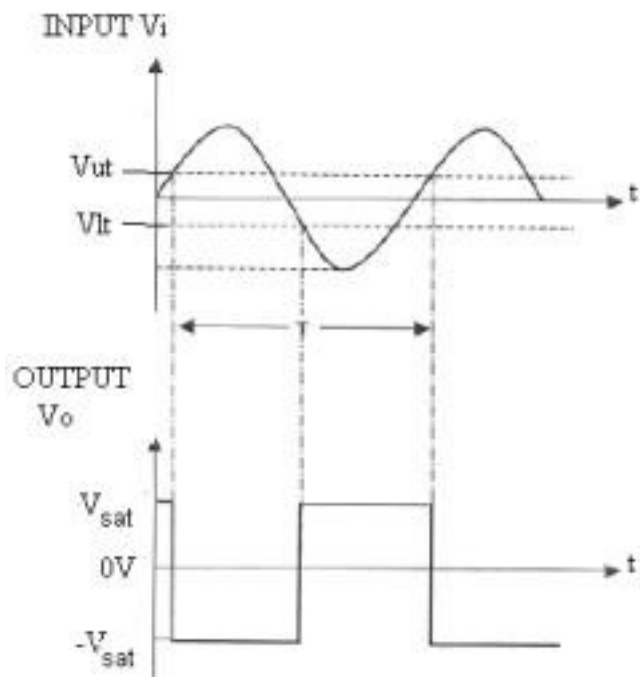
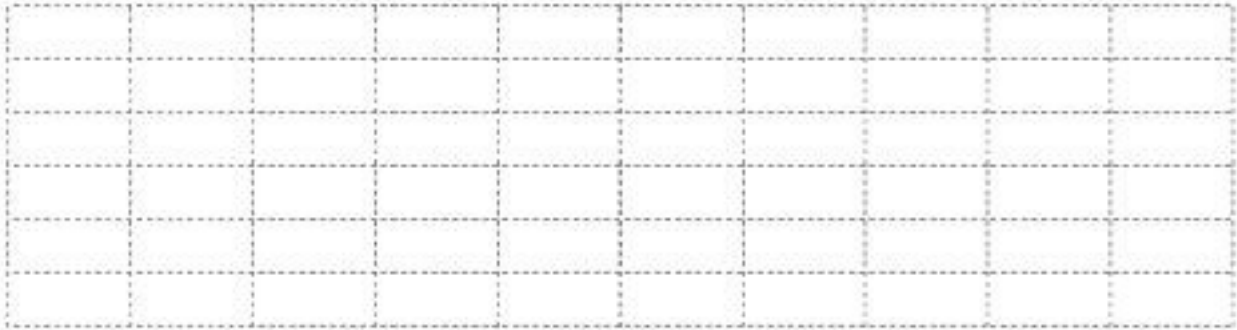


Figure shows that the output of the Schmitt trigger is a square wave when the input is a sinewave.



## WORKSHEET:

Input Waveform:



Output Waveform:



## RESULT:

Hence the output of Schmitt trigger using IC 741 Op-amp is observed.





















