EXPERIMENT NO: 7

AIM: To study the waveform of Schmitt Trigger circuit & Precision Rectifier using 741 OP-AMP IC.

THEORY:

Schmitt Trigger circuit: It converts an irregular shaped waveform to a square wave or pulse. Here, the input voltage triggers the output voltage every time it exceeds certain voltage levels called the upper threshold voltage V_{UTP} and lower threshold voltage V_{LTP} as shown in Figure 1. Further as shown in Figure 2, the input voltage is applied to the inverting input. Because the feedback voltage is aiding the input voltage, the feedback is positive. A comparator using positive feedback is usually called a Schmitt Trigger. Schmitt Trigger is used as a squaring circuit, in digital circuitry, amplitude comparator, etc.

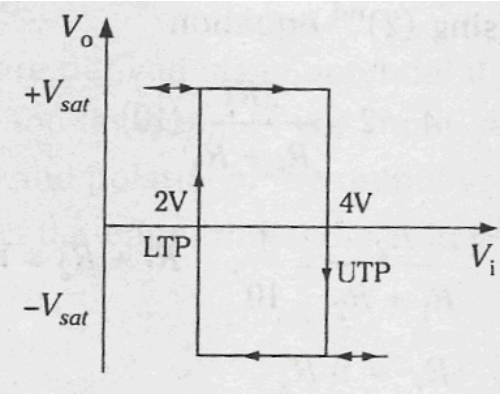

Figure 7.1: Hysteresis curve

Precision rectifier: It uses op amp based circuits whereas ordinary rectifiers use simple diodes. The advantages of precision rectifier are that there is no diode voltage drop (usually 0.7) between input and output and it has the ability to rectify very small voltages which is very much smaller than the diode forward voltage of diode.

As shown in Figure 3, when the input is greater than zero, D1 is off, and D2 is on, so the output is zero because the other end of R2 is connected to the virtual ground and there is no current through R2. When the input is less than zero, D1 is on, and D2 is off, so the output is like the input with an amplification of –R2/R1.

This circuit has the benefit that the op-amp never goes into saturation, but its output must change by two diode voltage drops (about 1.2 V) each time the input signal crosses zero. Hence, the slew rate of the operational amplifier and its frequency response (gain–bandwidth product) will limit high-frequency performance, especially for low signal levels, although an error of less than 1% at 100 kHz is possible.

CIRCUIT DIAGRAM:

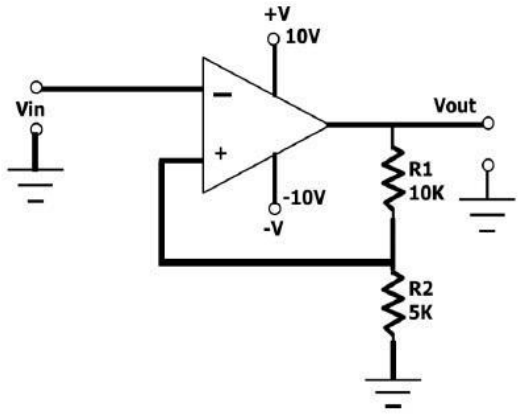

Figure 7.2: Circuit Diagram of Schmitt trigger circuit

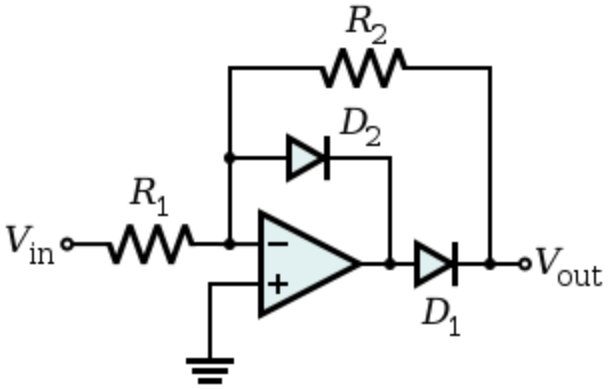

Figure 7.3: Circuit diagram of Precision rectifier

WAVEFORMS

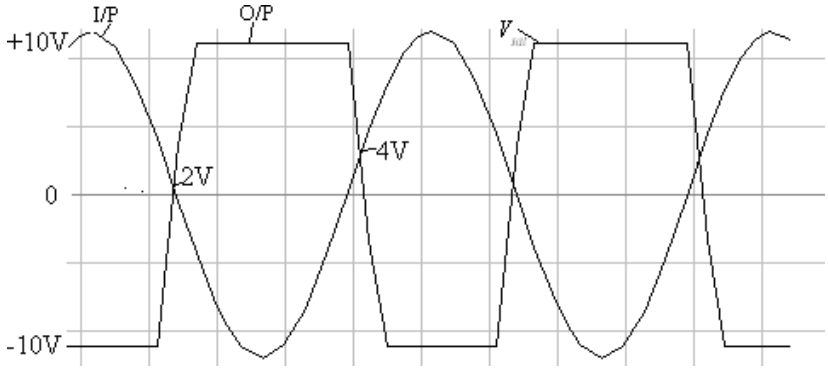

Figure 7.4: Transient Analysis of Schmitt Trigger

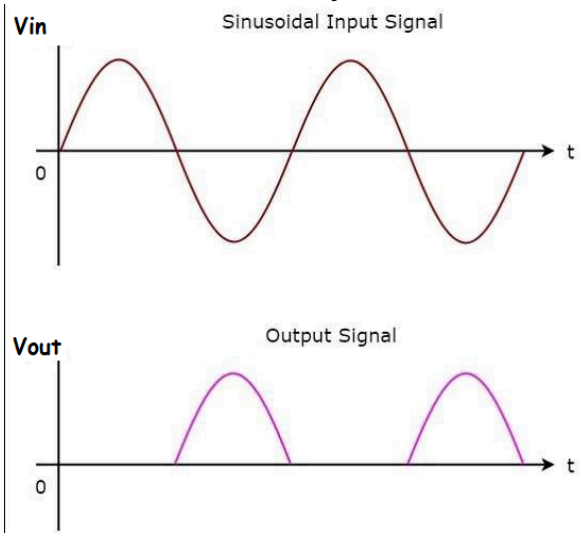

Figure 7.5: Transient Analysis of Precision Rectifier

ANALYSIS:

Transients Analysis of Schmitt Trigger circuit

Run to time: 40 ms, step size: 0.1 ms

Observation:

For Schmitt Trigger circuit

- Practical value of UTP = Volts
- Practical value of LTP = Volts

CONCLUSION