INTEGRATED CIRCUITS LAB

MINIPROJECT REPORT

1. QUESTION

Design and fabricate a signal conditioning circuit to measure ac voltage and drive a relay according to the following requirements.

Design requirements: The circuit should be designed to measure (0-300)V, r.m.s, a.c voltage.

i. Use LV-25P voltage sensor to measure the voltage.

ii. Sensor output should be scaled down from (0-300)V to (0-1)V.

Sl. No.	*Parameter*	*Voltage level*
1.	Over voltage level	235V
2.	Under voltage level	180V

iii. If the input voltage is within the range of 180-235 load has to be connected to supply through relay.

iv. Under voltage and over voltage condition load has to be disconnected from the supply.

v. Self-power generation circuit for sensor and signal conditioning circuit (Input voltage variation is from 110V to 270V).

2. COMPONENTS USED

- IC741 - Opamp
- IC7404 - Inverter
- IC7408 – AND gate
- IC7474 – D flipflop
- IC555 – 555 timer
- BC547 – npn transistor
- Relay-5V
- Diode
- Capacitor-10uF,10nF
- Resistors-110kΩ ,15kΩ
- Battery-9V
- Potentiometer-10kΩ
- Connecting wires, LED's

3. THEORY

A window detector circuit, also called window comparator circuit or dual edge limit detector circuits is used to determine whether an unknown input is between two precise reference threshold voltages. It employs two comparators to detect over-voltage or under-voltage.

Each single comparator detects the common input voltage against one of two reference voltages, normally upper and lower limits. Outputs behind a logic gate like AND detect the input as in range of the so-called "window" between upper and lower reference.

Window detectors are used in industrial alarms, level sensor and controls, digital computers and production-line testing.

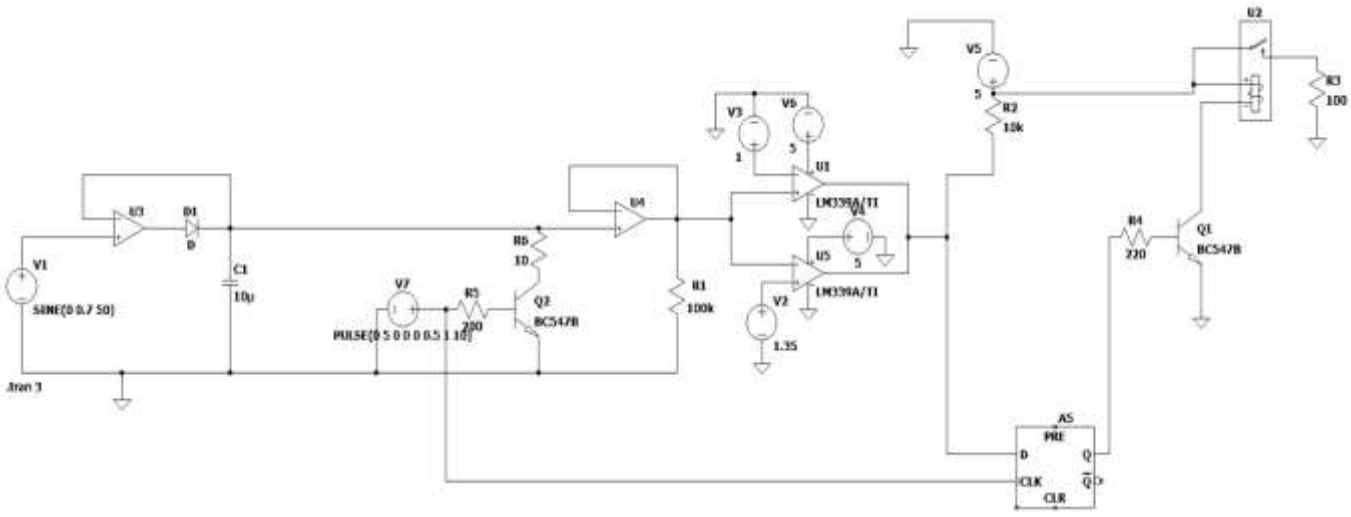
4. OPERATION

The circuit was assembles using above components, a transformer was used to scale down the input 0-300V rms to 0-1V. Peak detector was used with voltage follower to maintain the capacitor voltage. The capacitor was triggered after every second using a 555 timer to switch the transistor on for a small time.

The output of the voltage follower is the peak detected which is then provided to a window comparator whose output is given to a D flipflop triggered using same clock as that of transistor, thus retaining the same value of the input for one second. The output will vary according to the range of higher cut-off and lower cut-off voltage which is used to drive the relay.

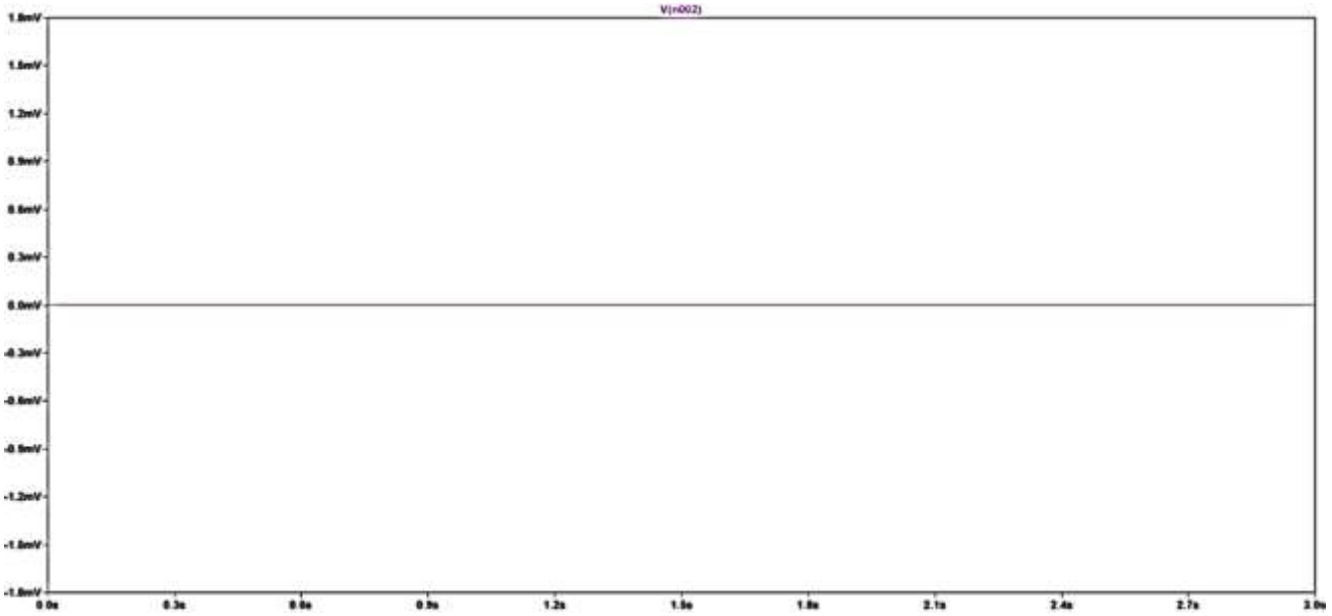
5. SIMULATION STUDIES

Simulation Diagram



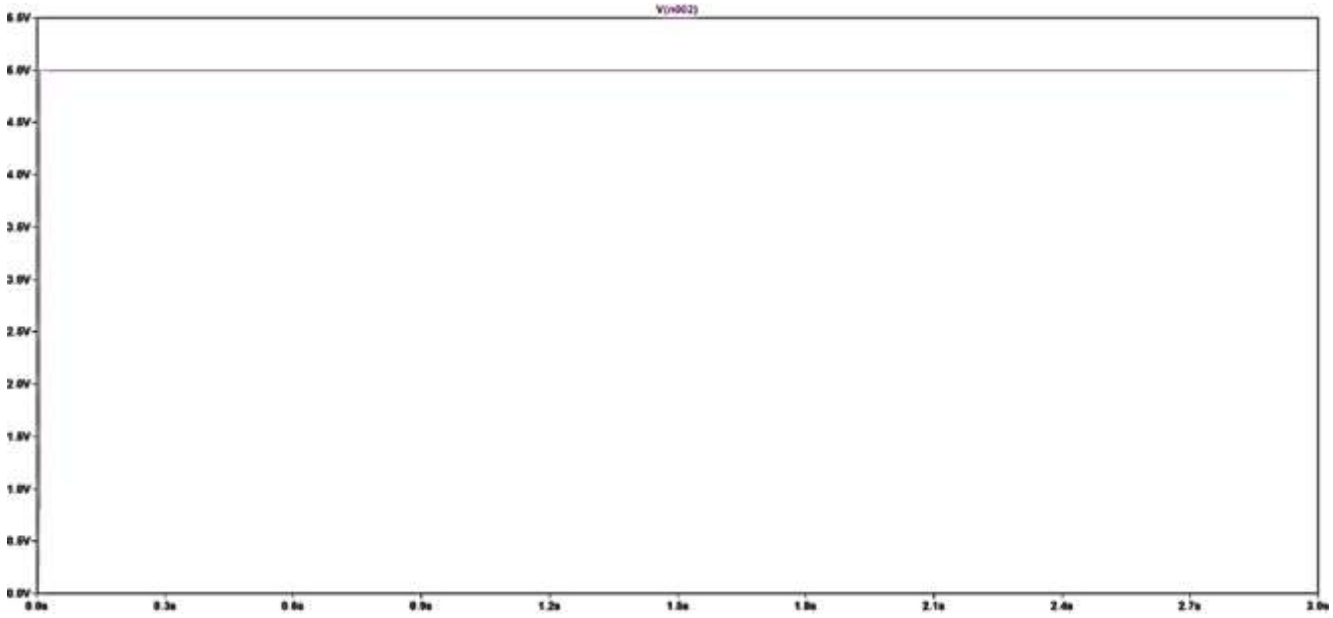
Simulation Results

(i) When input voltage is less than lower cutoff voltage (V<Vl):



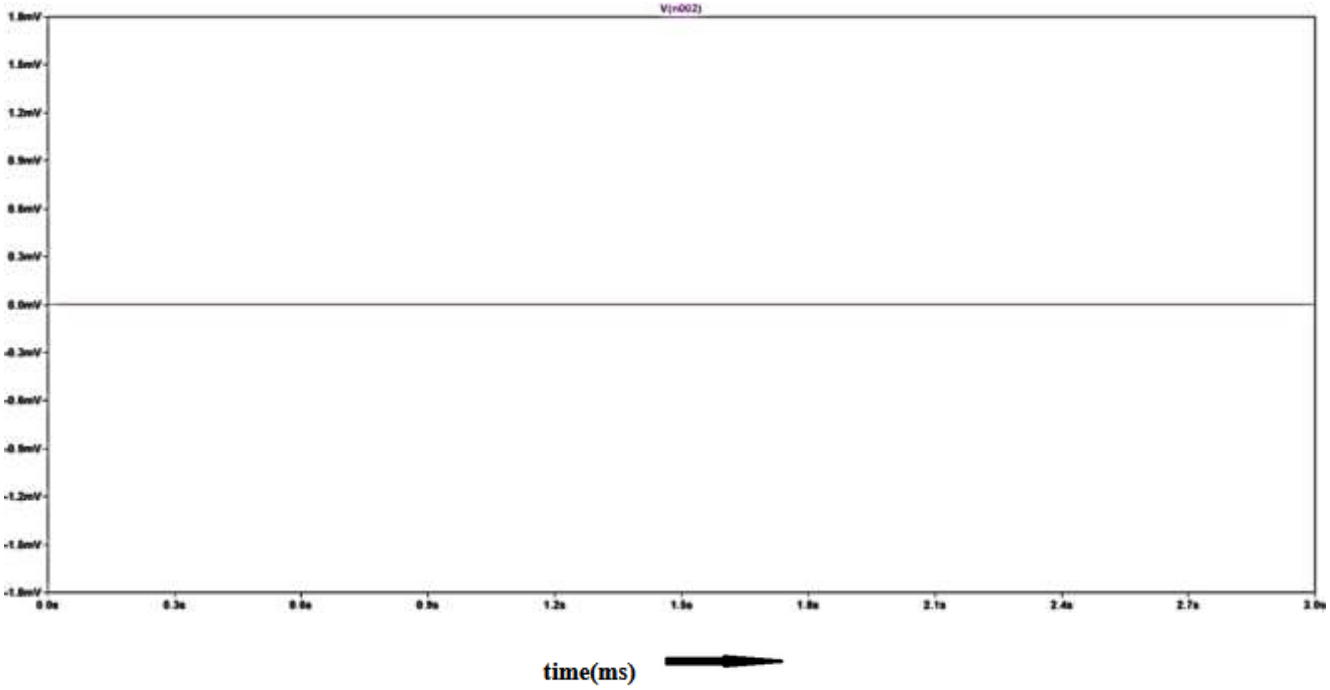
time(ms)

(ii) When input voltage is within the range (Vl<V<Vh) :

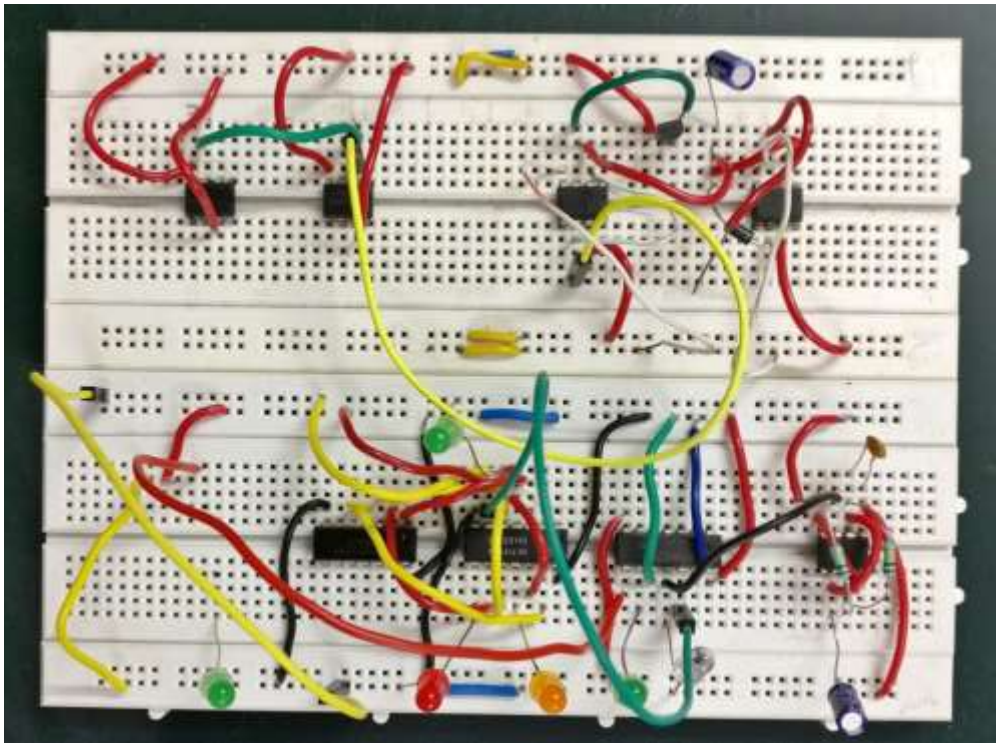


time(ms)

(ii) When input voltage is greater than higher cutoff voltage (V>Vh):



6. Hardware model



7. Result

A signal conditioning circuit that measures the AC voltage is designed and fabricated. It drives the relay based on the conditions given. The load is connected to the supply through the relay only when the voltage is in the permissible range i.e., between 180 V and 235 V. In cases of under voltage and over voltage the load is disconnected.

When the voltage from the source is in the permissible range i.e., between 180 V and 235 V, a **green** LED glows indicating that the voltage is **in range**. When the voltage is less than 180 V, a **yellow** LED glows indicating **under voltage.** When the voltage is above 235 V, a re LED glows indicating **over voltage**.