Sub-Group: A-7
Experiment 5: Study of 555 Timer IC

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1 Aim:

Study of 555 Timer IC as Astable multivibrator with different frequency.

2 Theory:

Pin Functions:

1. **Trigger Input:** When it is less than $V_S/3$ it makes the output high V_S. It monitors the discharging of timing capacitor in astable circuit.
2. **Threshold Input:** When it is greater than $2V_S/3$, it makes the output low (0 V). But this only happens if the trigger input is more than $V_S/3$. If the trigger input is low then it forces the output to be high. This input monitors the charging of time capacitor in astable and monostable circuit.
3. **Reset Input:** When it is less than 0.7 V, it makes the output low(0 V), overriding other inputs. When it is unnecessary it should be connected to the source voltage.
4. **Control Input:** If there is a need to change the threshold voltage which is normally set to $2V_S/3$, usually this is connected to 0 V with a very low capacitor of 0.01 μF to avoid electrical noise.
5. **Discharge Pin:**

2.1 555/ 556 Astable Circuit:

Time period (T) of the square wave is the time for one complete cycle. And frequency (f) of the wave is no. of complete cycles per second.

$$T = 0.7(R_1 + 2R_2)C_1$$
$$f = \frac{1.4}{(R_1 + 2R_2)C_1}$$

Time period can be split into two part, when the output is high, **mark time** (T_m) and when the output is low, **space time** (T_s).

$$\begin{aligned} T_m &= 0.7(R_1 + R_2)C_1 \\ T_s &= 0.7R_2C_1 \end{aligned} .$$

3 Data and Analysis

Table 1: Experimental and Theoretical Time Constants

C_1(µF)	R_1	R_2	f_{theo}(kHz)	T_m(µs)	T_s(ps)	T(ps)	f_{expt}(kHz)	Error(%)
0.001	1	10	6.667×10^{1}	9.5	8.5	1.8×10^{1}	5.556×10^{1}	16.67
0.001	10	100	6.667	8.4×10^{1}	7.4×10^{1}	1.58×10^{2}	6.329	5.06
0.001	100	1000	6.667×10^{-1}	7.8×10^{2}	7.0×10^{2}	1.480×10^{3}	6.757×10^{-1}	1.35
0.01	1	10	6.667	7.6×10^{1}	7.0×10^{1}	1.46×10^{2}	6.849	2.74
0.01	10	100	6.667×10^{-1}	8.2×10^{2}	7.8×10^{2}	1.600×10^{3}	6.250×10^{-1}	6.25
0.01	100	1000	6.667×10^{-2}	8.4×10^{3}	7.6×10^{3}	1.600×10^{4}	6.250×10^{-2}	6.25
0.1	1	10	6.667×10^{-1}	6.4×10^{2}	6.0×10^{2}	1.280×10^{3}	7.813×10^{-1}	17.19
0.1	10	100	6.667×10^{-2}	7.2×10^{3}	6.8×10^{3}	1.400×10^{4}	7.143×10^{-2}	7.14
0.1	100	1000	6.667×10^{-3}	7.4×10^{4}	7.0×10^{4}	1.440×10^{5}	6.944×10^{-3}	4.16
1	1	10	6.667×10^{-2}	7.0×10^{3}	6.4×10^{3}	1.340×10^{4}	7.463×10^{-2}	11.94
1	10	100	6.667×10^{-3}	7.2×10^{4}	6.6×10^{4}	1.380×10^{5}	7.246×10^{-3}	8.69
1	100	1000	6.667×10^{-4}	7.0×10^{5}	6.4×10^{5}	1.340×10^{6}	7.463×10^{-4}	11.90
10	1	10	6.667×10^{-3}	7.4×10^{4}	6.8×10^{4}	1.420×10^{5}	7.042×10^{-3}	5.63
10	10	100	6.667×10^{-4}	8.0×10^{5}	7.2×10^{5}	1.520×10^{5}	6.579×10^{-4}	1.30
10	100	1000	6.667×10^{-5}	7.5×10^{6}	6.0×10^{6}	1.350×10^{7}	7.407×10^{-5}	11.00