EXPERIMENT NO. 1

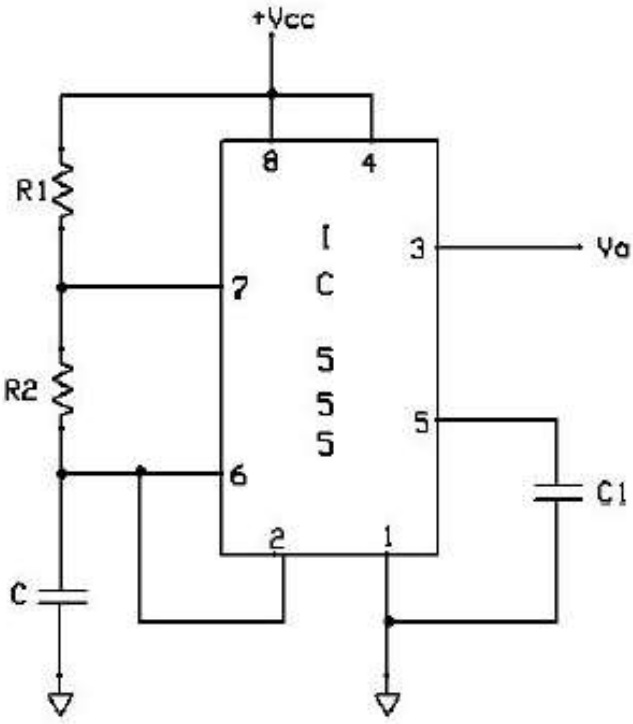
TITLE: Study of Astable Multivibrator using 555 timer

OBJECTIVE: To design and study Astable Multivibrator using 555 timer.

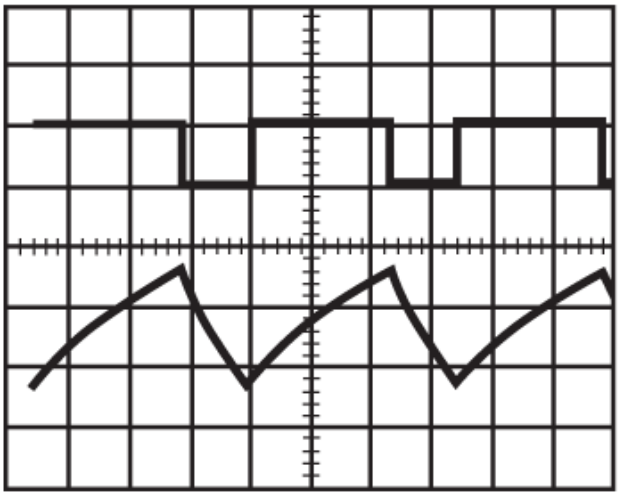
THEORY: When IC555, a combination of linear comparator and digital flip-flops is to be configured as an astable multivibrator, both the trigger and threshold inputs (pin 2, 6) to the two comparators are connected together and to a capacitor. The capacitor charges towards the supply voltage through 2 resistors R_1 and R_2. The discharge pin 7 connected to the internal transistor is connected to the junctions of those two resistors. When Power is first applied to the circuit, the capacitor will unchanged therefore both trigger and the threshold inputs will be near zero volts. This also turns of transistor T_1.

This allows the capacitor to begin charging through R_1 and R_2. As soon as the charge on the capacitor reaches 2/3 of the supply voltage, the upper comparator will trigger causing the flip-flop to reset, which causes the output to switch low. The effect of T1 conducting causes resistor R_2 to be connected across the external capacitor. Resistor R_2 is effected connected to ground through internal transistor T_1. The result of output is a continuous stream of rectangular pulses**.**

CIRCUIT DIAGRAM:



Pin Diagram of 555 timer IC (Values: R1=494kΩ, R2=496kΩ, C=2.29µF, C1=0.0129µF)



Output Voltage and Capacitor Voltage

APPARATUS:

Sl. No.	Instruments/Apparatus	Maker's Name	Specification	Quantity
1	IC 555	-	-	1
2	Resistors	-	494kΩ, 496kΩ, 1kΩ	3
3	Capacitors	-	12.9nF, 2.29µF	2
4	Bread Board	-	-	1
5	DC Power Supply	Hi-Watt	9V	2
6	LED	-	-	1
7	Oscilloscope	Rigol	-	1
8	Connecting wires	-	-	7

OBSERVATIONS:

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Experiment -01

Study of Astable Multivibrator using 555 timer.

Observation Table:

Experimental		Calculated		% Error	
T_{ON}(s)	T_{OFF}(s)	T_{ON}(s)	T_{OFF}(s)	T_{ON}	T_{OFF}
1.58	0.79	1.57	0.78	0.64%	1.28%

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R_1 = 494KΩ, R_2 = 496KΩ

C_1 = 12.9 nF, C = 2.29 µF

V_{cc} = 8.3V

Calculations:

$T_{ON} = 0.693 \times (R_1 + R_2) \times C_1 = 1.57s$

$T_{OFF} = 0.693 \times R_2 \times C_1 = 0.78s$

T_{ON} % error $= \left| \frac{1.58 - 1.57}{1.57} \right| \times 100\% = 0.64\%$

T_{OFF} % error $= \left| \frac{0.78 - 0.79}{0.78} \right| \times 100\% = 1.28\%$

RESULTS AND CONCLUSIONS:

The error from the above experimental values for Ton that is 0.64% and that for Toff is 1.24%. This shows that the formula used for theoretical calculations works satisfactorily.

The frequency and duty cycle of the output can be adjusted by varying the values of the resistors and capacitors connected to the timer. This makes the 555 timer astable multivibrator versatile for applications such as clock pulses, light flashing circuits, and tone generation.