Analog Electronics Lab (ECS481)

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- Subject - Analog Electronics
- 4th Semester Lab
- Code – ECS481

Experiment 1: Log and Antilog Amplifiers.

Title

Log and Antilog Amplifiers.

Objective

To study log and antilog amplifier.

Methodology

1. LOG AMPLIFIER
   - Connect the probes as mentioned below:
     L1-L3, L4-L7, L5-L7, L6-L9, L9-L10, L8-L12, L12-L11.
   - Set the input voltage to 1V.
   - See the voltage across the output terminal. Note the negative sign.
   - Increase the input voltage in the step of 1V up to 20V.
   - Plot the characteristics of input voltage and output voltage.

2. ANTILOG AMPLIFIER
   - Connect the probes as mentioned below:
     L1-L3, L4-L7, L5-L7, L6-L9, L9-L10, L8-L12, L12-L11.
   - See the voltage across the Resistor. Note the negative sign.
   - Increase the input voltage in the step of 50mV up to 250mV.
   - Plot the characteristics of input voltage and output voltage.
   - Reverse the polarity of the diode and see the effect for positive input voltage.

Circuit Diagram

Log Amplifier

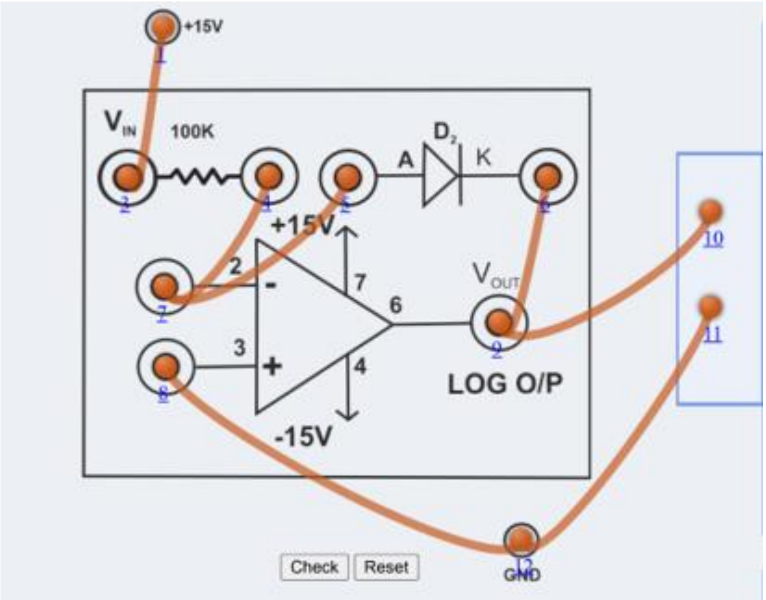


Figure 1: Log Amplifier Circuit Diagram

Antilog Amplifier

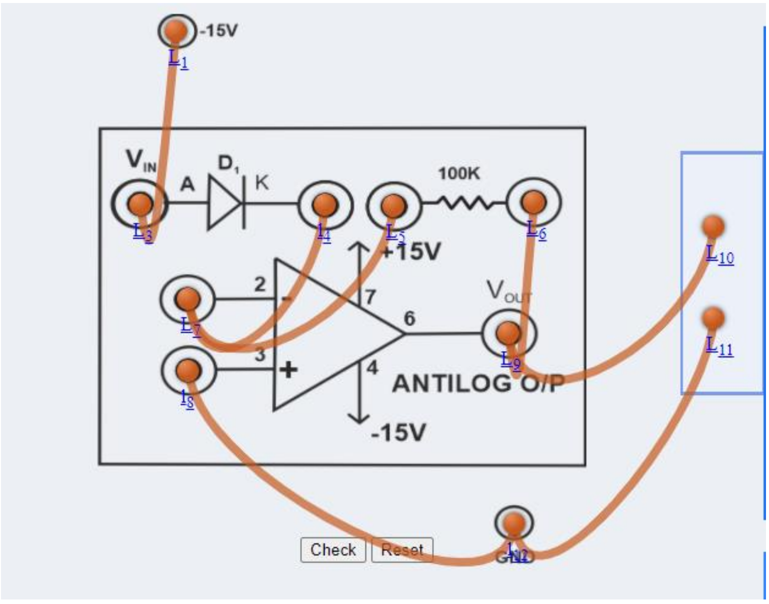


Figure 2: Antilog Amplifier Circuit Diagram

Results

1. Log Amplifier

Observation Table

SN.	I/P volatge (V_{In})	O/P volatge (V_{out})
1	14	12
2	15	12
3	16	12
4	17	12
5	18	12
6	19	12
7	20	12
8	21	12
9	22	12
10	23	12
11	24	12
12	25	12
13	26	12
14	27	12
15	28	12
16	29	12
17	30	12
18	31	12
19	32	12
20	33	12
21	34	12
22	35	12

If we plot the graph of Vin Vs Vout we find the amplifier produces an output that is proportional to the logarithm of the applied input. Hence our circuit serves the purpose.

Graph Plot

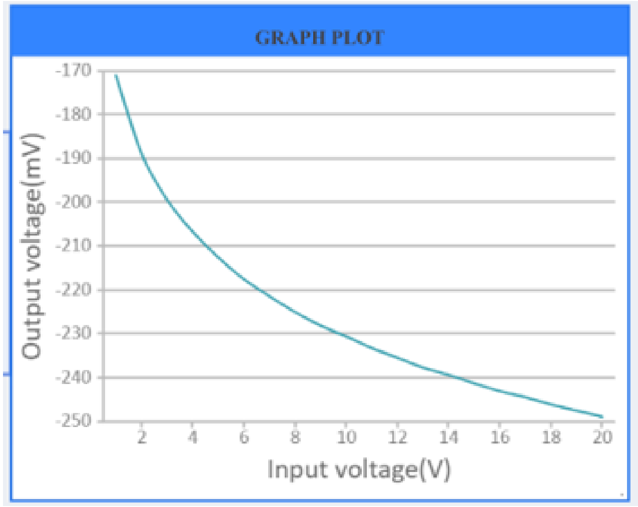


Figure 3: Graph of Vin Vs Vout for a log amplifier

2. Antilog Amplifier

Sl. No.	I/P voltage (V_{in})	O/P volatge (V_{out})
1	50	-0.01
2	100	-0.066
3	150	-0.448
4	200	-3.068
5	250	-20.99

Similarly, if we plot the graph of Vout Vs Vin we find that the amplifier produces an output that is proportional to the anti-logarithm of the applied input.

Graph Plot

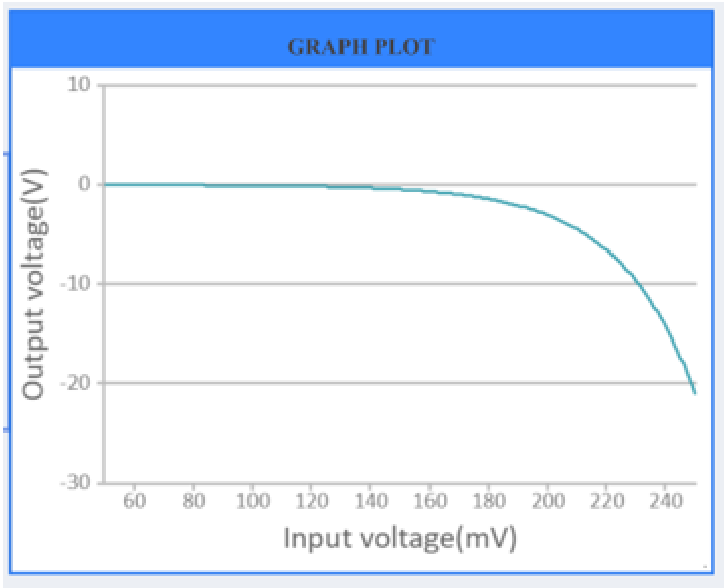


Figure 4: Graph of Vin Vs Vout for an antilog amplifier

Experiment 2: Voltage Comparator.

Title

Voltage Comparator

Objective

To analyse Voltage comparator

Methodology

1. Connect the probes and mentioned below:
   L3-L5, L6-L7, L2-L4, L8-L9, L10-L1
2. Click on the "check" button to check if the connections are right.
3. Once you make sure that the connections are right, you may vary the resistance and calculate the output voltage.
4. Click on the "Add to table" button to add the reading to the table.

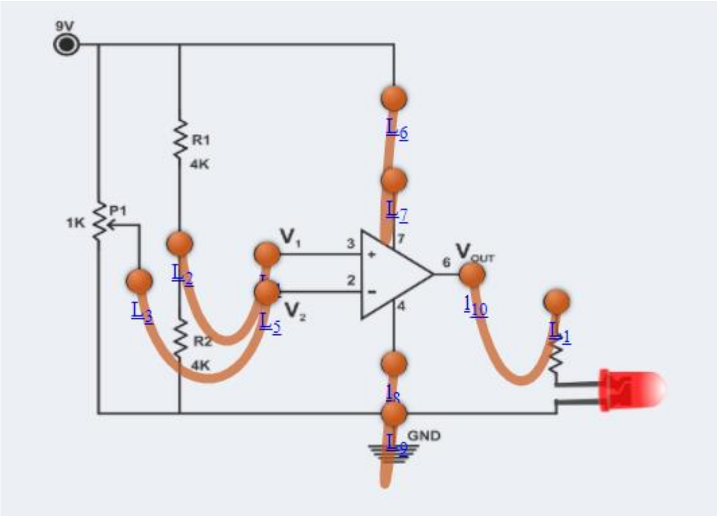
Results

Observation Table

SN.	Input Voltage (V_{in})	Reference Voltage (V_{Ref})	Output Voltage (V_{out})
1	0	4.5	Low
2	0.45	4.5	Low
3	0.9	4.5	Low
4	1.8	4.5	Low
5	2.25	4.5	Low

6	2.7	4.5	Low
7	3.15	4.5	Low
8	3.6	4.5	Low
9	4.05	4.5	Low
10	4.5	4.5	High
11	4.95	4.5	High
12	5.4	4.5	High
13	5.85	4.5	High
14	6.3	4.5	High
15	6.75	4.5	High
16	7.2	4.5	High
17	7.65	4.5	High
18	8.1	4.5	High
19	8.55	4.5	High
20	9	4.5	High

Circuit Diagram



Thus, from the observation table we can see that the op-amp voltage comparator is a device whose output is dependent on the value of the input voltage, VIN with respect to some DC voltage level as the output is HIGH when the voltage on the non-inverting input is greater than the voltage on the inverting input, and LOW when the non-inverting input is less than the inverting input voltage. This condition is true regardless of whether the input signal is connected to the inverting or the non-inverting input of the comparator.

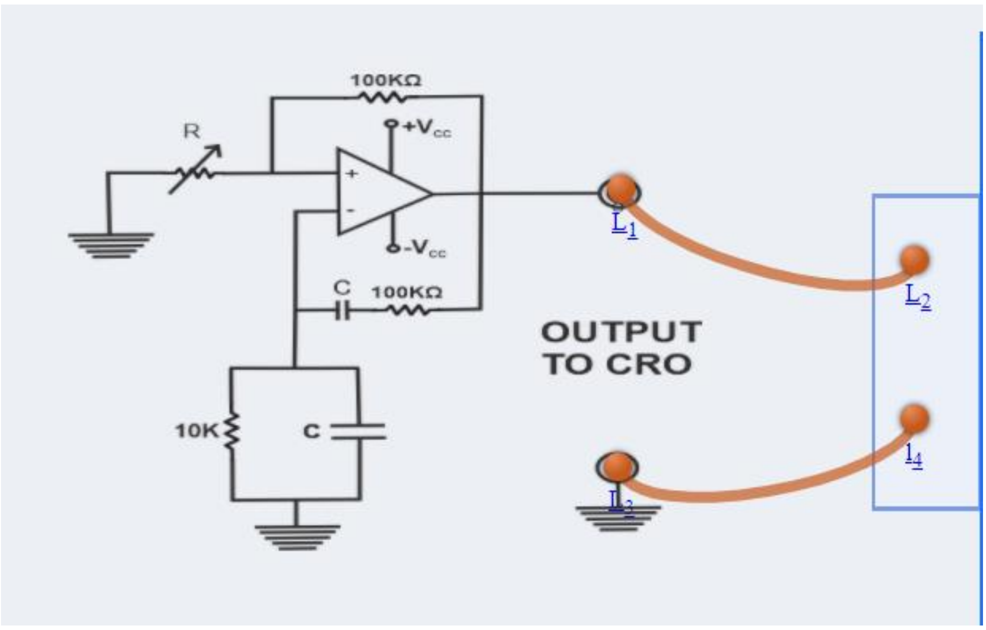
Experiment 3: Wein bridge oscillator using operational Amplifier.

Title
Wein bridge oscillator using operational Amplifier.

Objective
To analyze Wein bridge oscillator using operational Amplifier

Methodology
1. Connect the output terminals to the CRO. (L1-L2, L3-L4)
2. Click on the "check" button to check if the connections are right.
3. Once you make sure that the connections are right, you may vary the resistance and calculate the output frequency
4. Increase the resistance from 0.3KΩ to 300KΩ.
5. Click on the "Add to table" button to add the reading to the table.
6. Observe the waveform in the graph.

Circuit Diagram



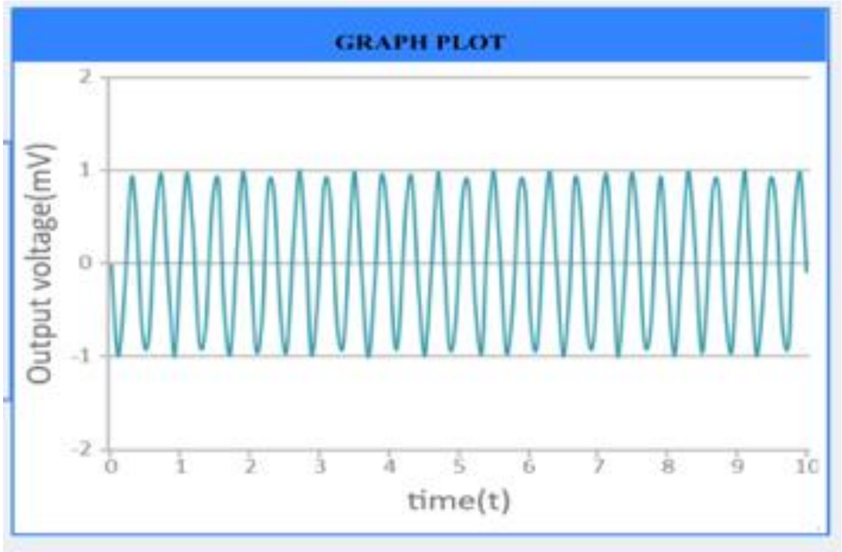
Results

Observation Table

SN.	Resistance (R)	Capacitance (C)	Frequency (KH_z)
1	0.3	0.01	53.079
2	49.7	0.01	0.32
3	50	0.01	0.318
4	100	0.01	0.159
5	150	0.01	0.106
6	200	0.01	0.08
7	250	0.01	0.064
8	300	0.01	0.053
9	10	0.01	1.592

Thus, we find the frequency of the oscillator varies with the variation in capacitance. It is inversely proportional to the capacitance. In other words, the frequency decreases with the increase in capacitance and vice versa. The variation in resistance has a similar effect on the frequency of the oscillator.

Output plots



Experiment 4: Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50mA.

Title

Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50mA.

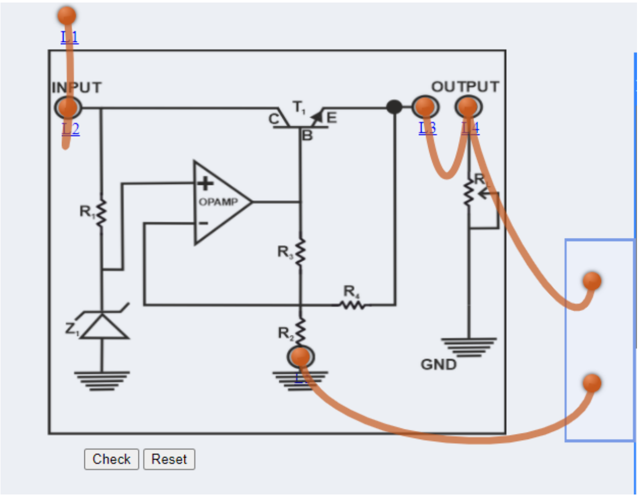
Objective

To study Voltage regulator using operational amplifier to produce output of 12V.

Methodology

1. Connect the probes and mentioned below:
   L1-L2, L3-L4, L4 & L5 to CRO knobs.
2. Click on the "check" button to check if the connections are right.
3. Once you make sure that the connections are right, you may vary the input voltage from 7.5V to 35V and calculate the output voltage.
4. Click on the "Add to table" button to add the readings to the table.

Circuit Diagram



Results

Observation Table

SN.	I/P volatge (V_{In})	O/P volatge (V_{out})
1	14	12
2	15	12
3	16	12
4	17	12
5	18	12
6	19	12
7	20	12
8	21	12
9	22	12
10	23	12
11	24	12
12	25	12
13	26	12
14	27	12
15	28	12
16	29	12
17	30	12
18	31	12
19	32	12
20	33	12
21	34	12
22	35	12

Thus, we see that provides a constant fixed output voltage regardless of a change in the load or input voltage.

Experiment 5: Voltage to current converter

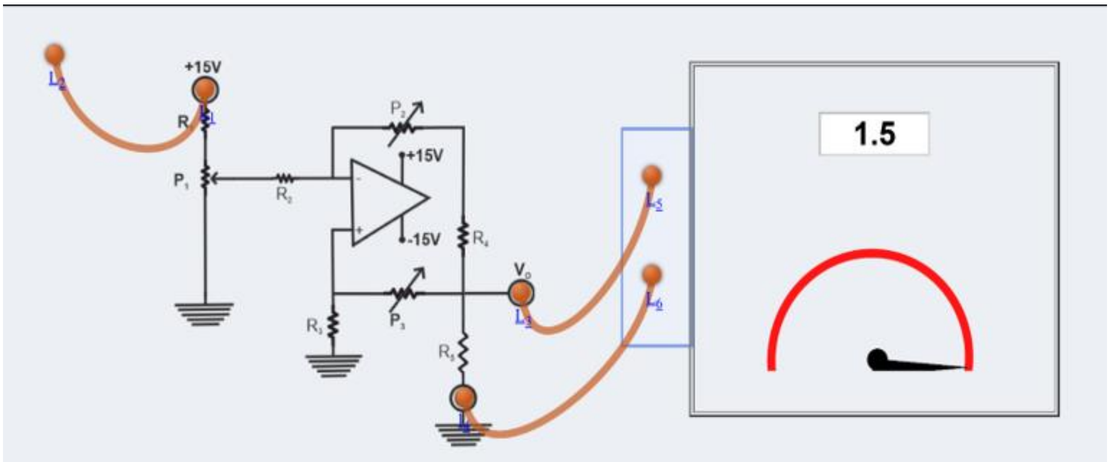
Title
Voltage to current converter

Objective
To study voltage to current converter.

Methodology

1. Connect the probes and mentioned below:
   L1-L2, L3-L5, L4-L6.
2. Click on the "check" button to check if the connections are right.
3. Once you make sure that the connections are right, you may vary the input voltage from 1V to 15V and calculate the output current by pressing the "Calculate" button.
4. Click on the "Add to table" button to add the reading to the table.
5. Observe the reading on the ammeter for each value of input voltage.

Circuit Diagram



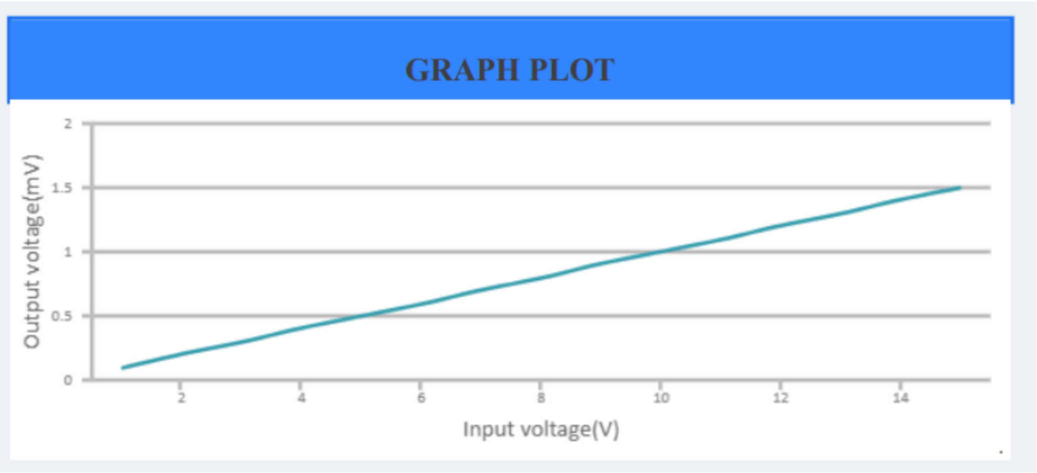
Results

Observation Table

Sl. No.	Input Voltage (V)	Resistance (KΩ)	Output Current (mA)
1	1	10	0.1
2	2	10	0.2
3	3	10	0.3
4	4	10	0.4
5	5	10	0.5
6	6	10	0.6
7	7	10	0.7
8	8	10	0.8
9	9	10	0.9
10	10	10	1
11	11	10	1.1
12	12	10	1.2
13	13	10	1.3
14	14	10	1.4
15	15	10	1.5

We find that the graph between input and output voltage comes out to be linear

Graph Plot



Experiment 6: Function generator using operational amplifier (sine, triangular & square wave)

Title

Function generator using operational amplifier (sine, triangular & square wave).

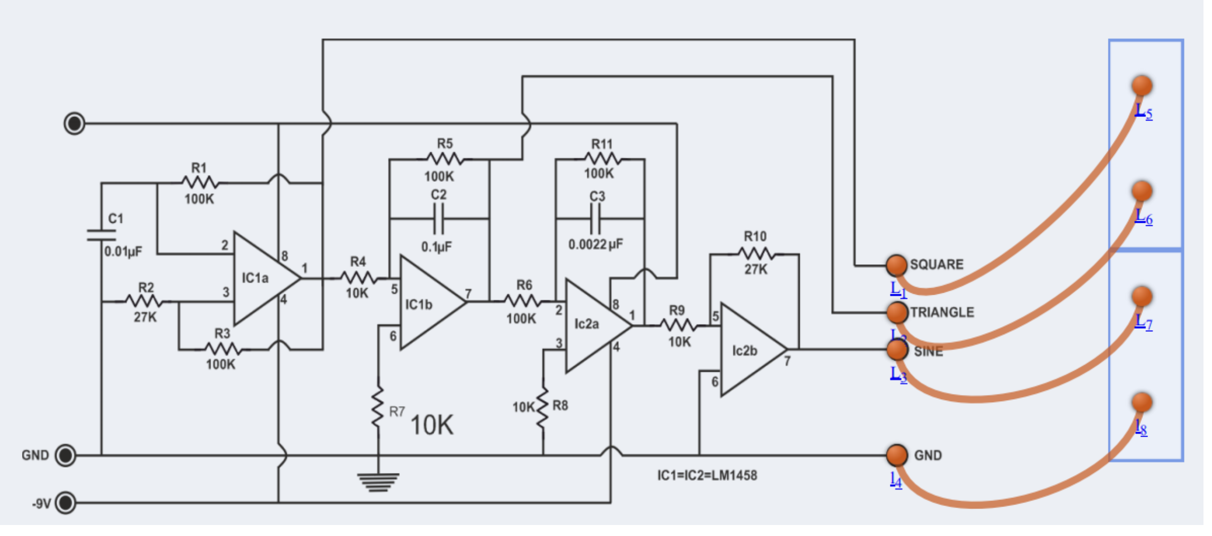
Objective

To analyse Function generator using operational amplifier (sine, triangular and square wave).

Methodology

1. Connect L4 with L8.
2. For square wave, connect L1 with L5.
3. For triangular wave, connect L2 with L6.
4. For sine wave, connect L3 with L7.
5. Click on "check" button to observe the waveforms.

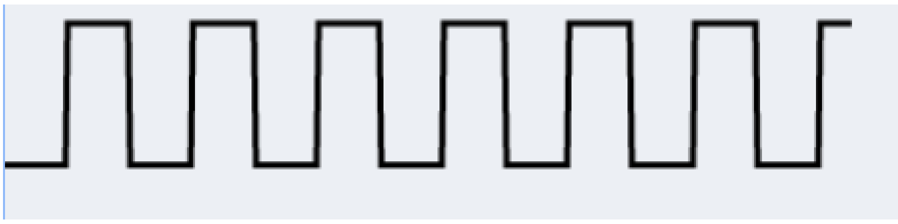
Circuit Diagram



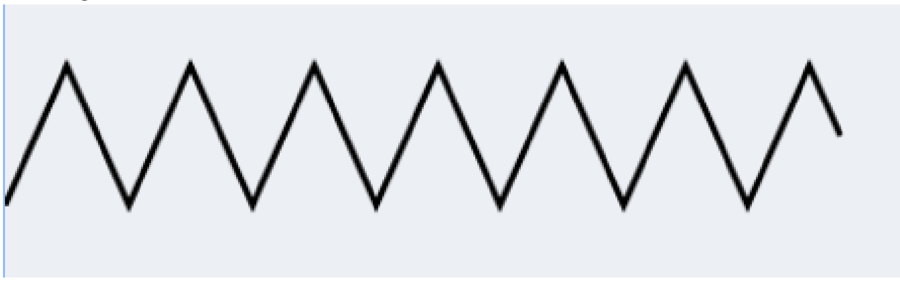
Results

We see the following function plots

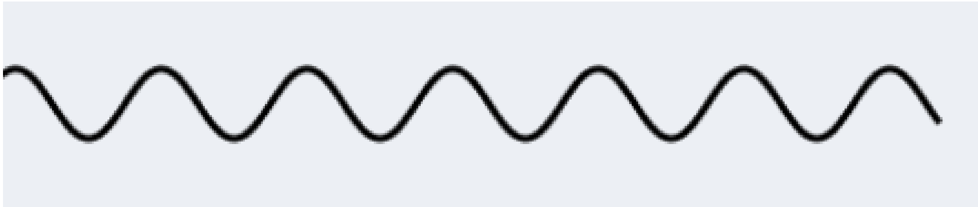
1. Square Wave



2. Triangular Wave



3. Sine Wave



Experiment 7: Astable and monostable multivibrator using IC 555.

Title

Astable and monostable multivibrator using IC 555.

Objective

To study astable and monostable multivibrator using IC 555.

Methodology

1) ASTABLE MULTIVIBRATOR

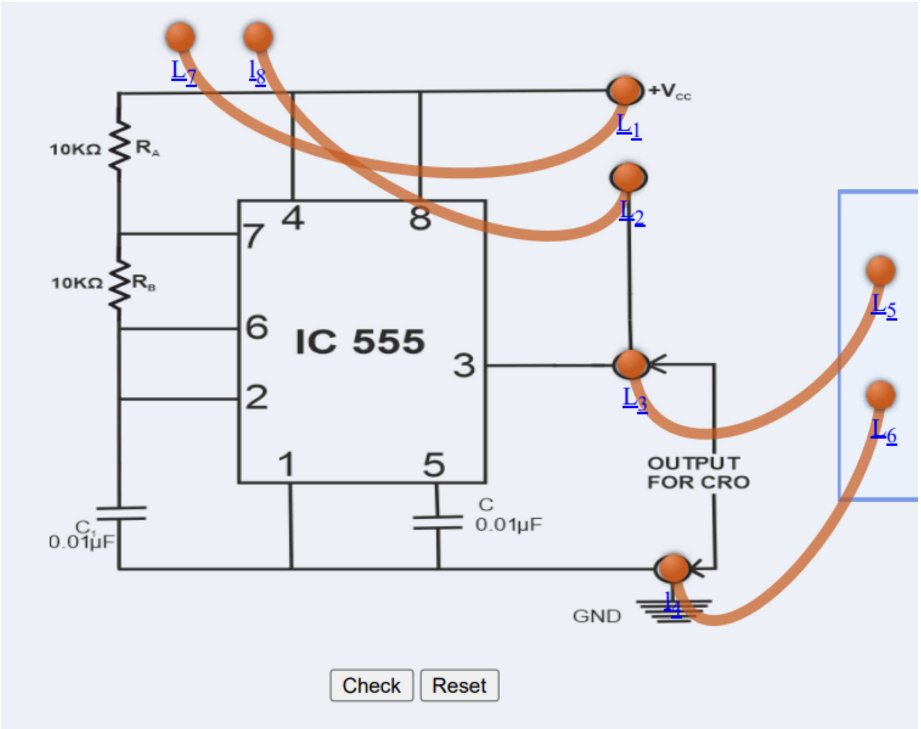
Step-1) Connect the Supply to input terminals.
Step-2) Connect output terminals to the CRO input.
Step-3) Press the "check" button to check whether the connections are correct or not.
step-4) Vary the resistance using the slider after making sure the connections are correct. Press the calculate button to determine the pulse width(τ_P).
Step-5) Observe the capacitor and output characteristics for each value of pulse width.
Step-6) Press "Add to table" to add the quantities to the table.
Step-7) Repeat steps 4-6 for different values of resistance.
Step-8) Press the reset button whenever you want to refresh your simulator.

2) MONOSTABLE MULTIVIBRATOR

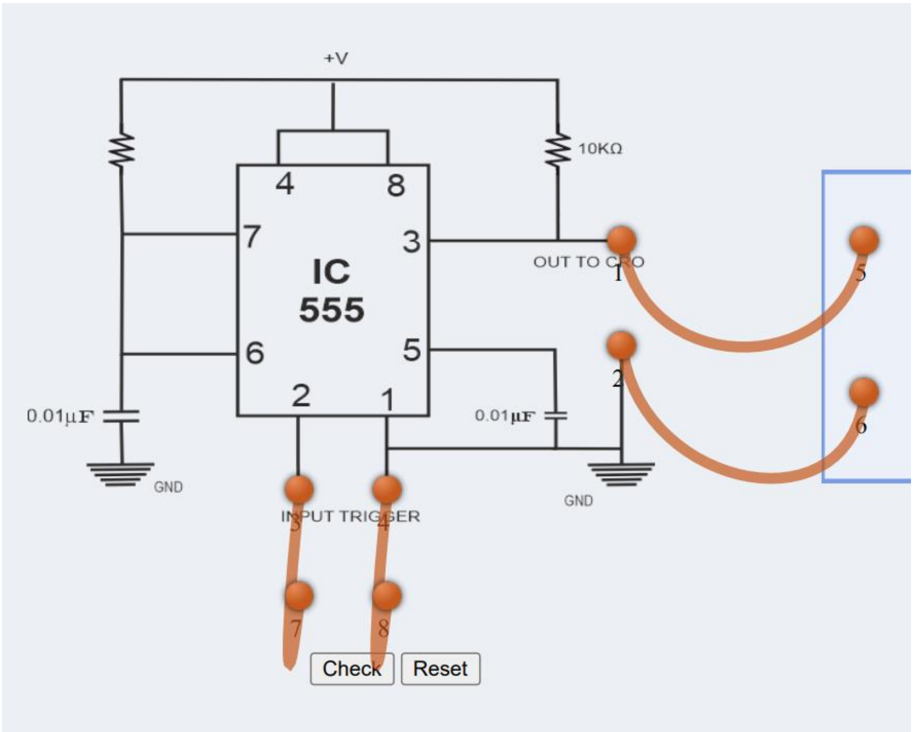
Step-1) Connect the Supply to input terminals.
Step-2) Connect output terminals to the CRO input.
Step-3) Press the "check" button to check whether the connections are correct or not.
Step-4) Vary the resistance using the slider after making sure the connections are correct. Press the calculate button to determine the time constant(τ).
Step-5) Observe the capacitor and output characteristics for each value of pulse width.
Step-6) Press "Add to table" to add the quantities to the table.
Step-7) Repeat steps 4-6 for different values of resistance.
Step-8) Press the reset button whenever you want to refresh your simulator.

Circuit Diagram

Astable Vibrator



Monostable Vibrator



Results

Astable Vibrator

Observation Table

Sl. No.	Resistance (R_A)	Resistance (R_B)	Capacitance (C)	Pulse Width (tp)	Time Constant (T)	Duty Cycle (%)	Freq (F)
1	1	3.9	0.1	0.338	0.607	55.68	1.65
2	1.5	3.9	0.1	0.373	0.642	58.06	1.56
3	2.1	3.9	0.1	0.414	0.683	60.61	1.46
4	2.6	3.9	0.1	0.448	0.718	62.5	1.39
5	2.9	3.9	0.1	0.469	0.738	63.55	1.35
6	3.2	3.9	0.1	0.49	0.759	64.55	1.32
7	3.5	3.9	0.1	0.511	0.78	65.49	1.28
8	3.9	3.9	0.1	0.538	0.807	66.67	1.24

Graph Plot

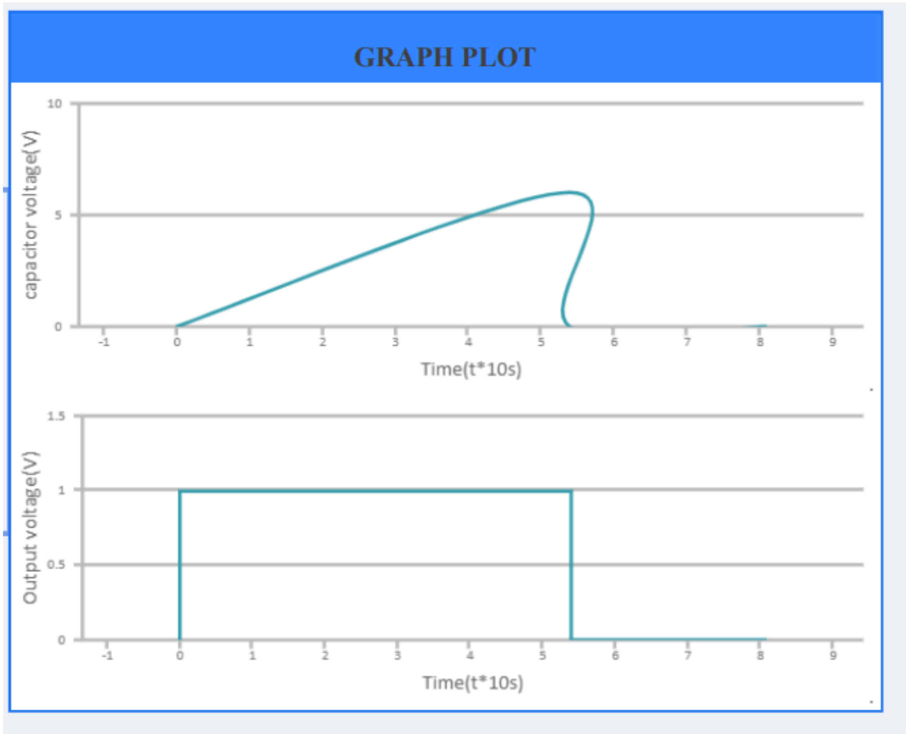


Figure 5: Graph plots for Astable Circuit

Monostable Vibrator

Observation Table

Sl. No.	Resistance (R)	Capacitance (C)	Time Constant (t)
1	1	0.01	0.011
2	3.5	0.01	0.039
3	6	0.01	0.066
4	9	0.01	0.099
5	12.5	0.01	0.138
6	15	0.01	0.165
7	17.5	0.01	0.193
8	20	0.01	0.22

Graph Plot

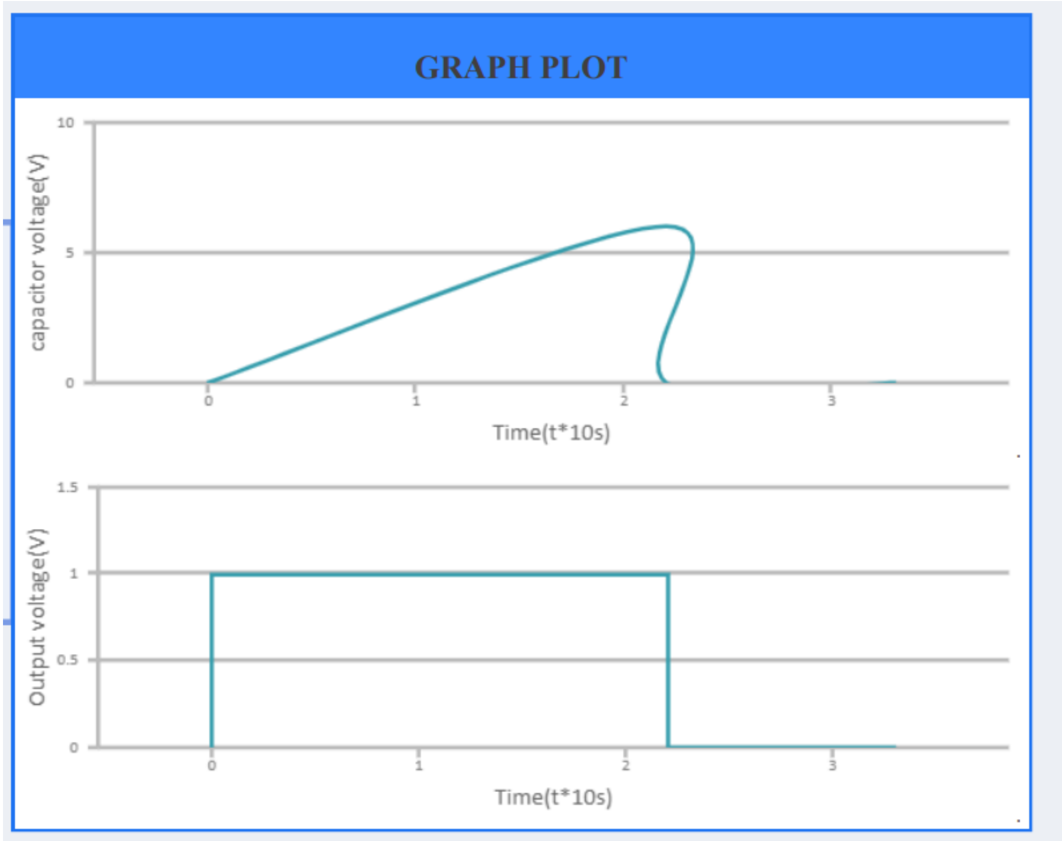


Figure 6: Graph Plot for Monostable Circuit