



Experiment No. 8

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Semester: II
Subject Name: Digital Electronics

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Section/Group: 109-A
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1. Aim: Design traffic lights using D - flip flop and AND gate.

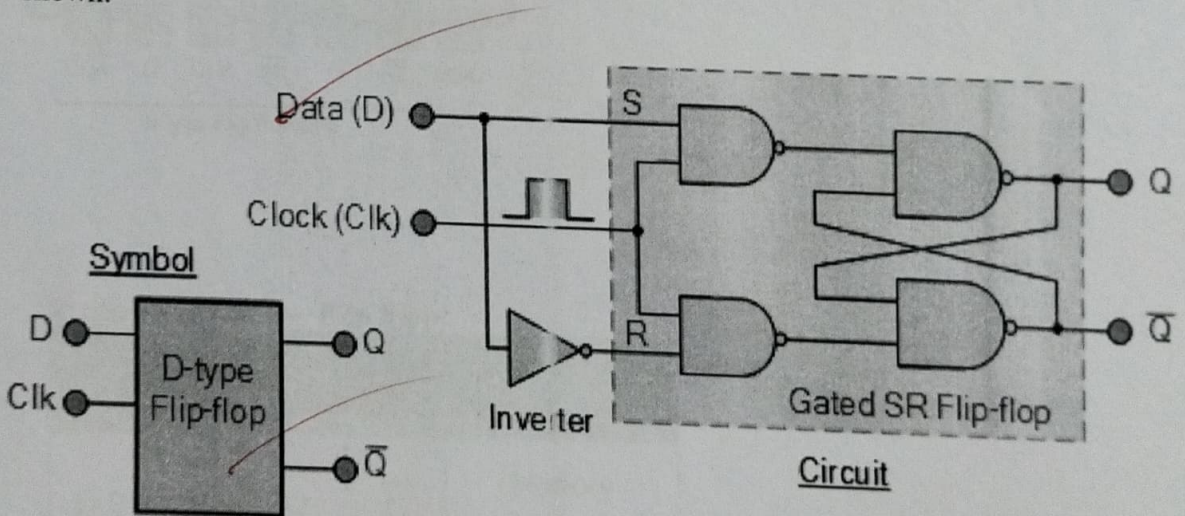
2. Requirements :

- i. **Software** : TinkerCad
- ii. **Hardware** : Breadboard, Connecting Wires, IC's - 7474, 7408. Power Supply, Function Generator, 220 ohm resistor, LED's.

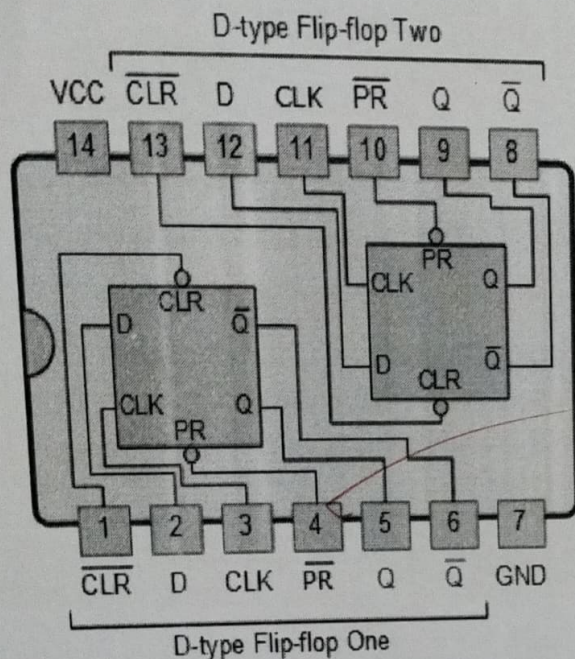
4. Simulation Results

D – Flip Flop : The **D Flip Flop** is by far the most important of all the clocked flip-flops. By adding an inverter (NOT gate) between the Set and Reset inputs, the S and R inputs become complements of each other ensuring that the two inputs S and R are never equal (0 or 1) to each other at the same time allowing us to control the toggle action of the flip-flop using one single D (Data) input.

Then this Data input, labelled “D” and is used in place of the “Set” signal, and the inverter is used to generate the complementary “Reset” input thereby making a level - sensitive D-type flip-flop from a level-sensitive SR-latch as now $S = D$ and $R = \text{not } D$ as shown.



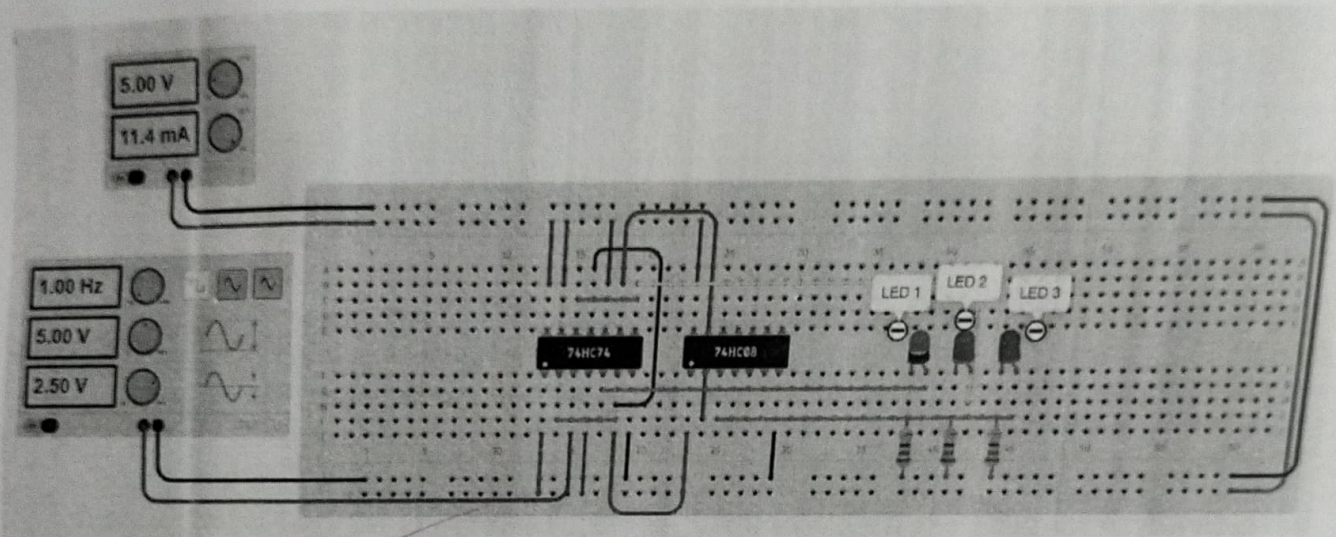
D – Flip Flop IC Diagram : -



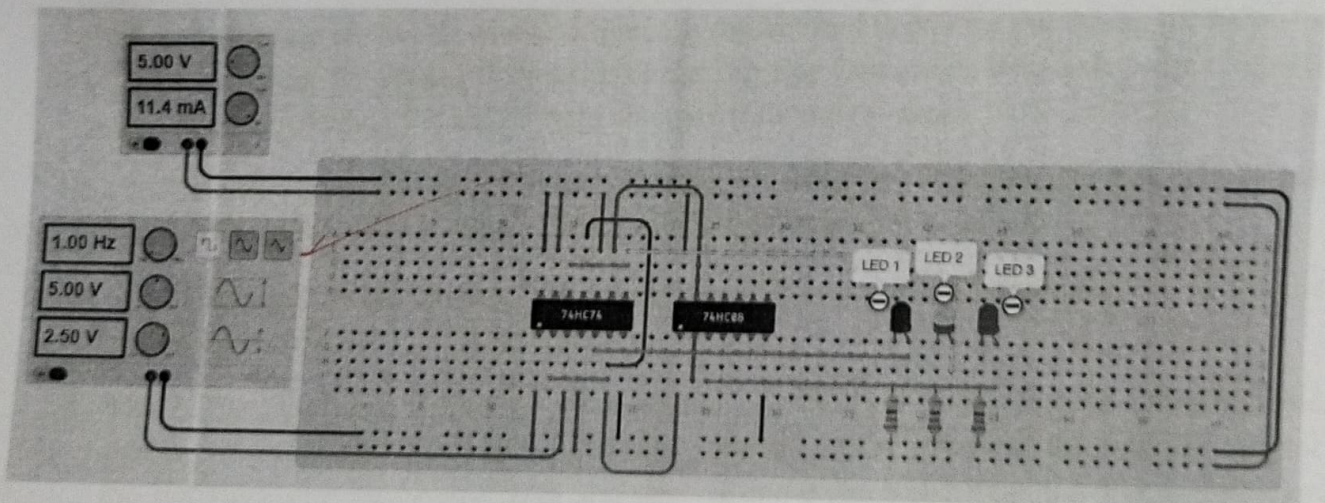
Truth Table for D – Flip Flop:

Clk	D	Q		Description
$\downarrow \gg 0$	X	Q	\bar{Q}	Memory no change
$\uparrow \gg 1$	0	0	1	Reset Q \gg 0
$\uparrow \gg 1$	1	1	0	Set Q \gg 1

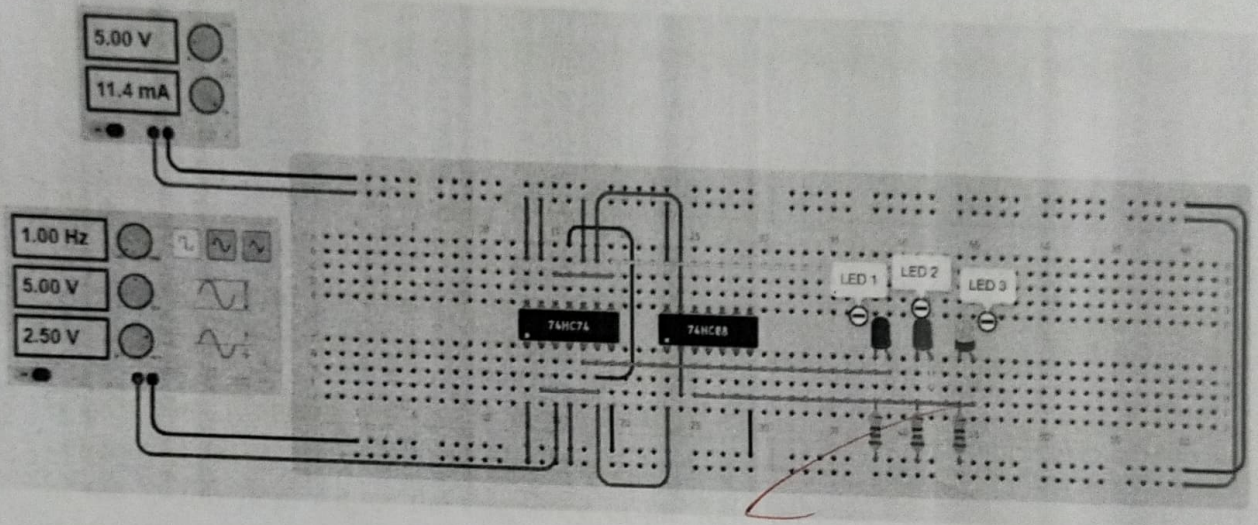
(i.) When LED 1 (Red Light) is ON



(ii.) When LED 2 (Yellow Light) is ON



(iii.) When LED 3 (Green Light) is ON



5. Observations : Here are some observations written for the above circuit :

1. The D-flip flop and AND gate combination can be used to control the timing of the traffic light sequence. By setting the values of the flip flop input and AND gate output signals, we can control when the traffic light changes from red to green.
2. The function generator can be used to generate a clock signal for the flip flop. This clock signal determines the rate at which the traffic light sequence changes.
3. By adjusting the frequency of the clock signal, we can control the speed at which the traffic light changes.
4. The D-flip flop and AND gate combination can be used to implement a simple state machine that controls the traffic light. The state machine consists of three states: one for the red light, one for yellow light and one for the green light. The flip flop input signal determines which state the state machine is in, and the AND gate output signal controls when the state machine transitions from one state to the other.

5. By observing the output of the traffic light, we can verify that the D-flip flop and AND gate combination is working as expected. For example, we can observe that the traffic light changes from red to green when the input signal to the flip flop changes from low to high.
6. **Troubleshooting:**
1. **Check the circuit connections:** Verify that all components are connected properly and according to the circuit diagram. Check for any loose or disconnected wires.
 2. **Check the function generator settings:** Make sure that the function generator is generating the correct waveform and frequency, and that it is connected to the clock input of the D-flip flop. Adjust the frequency of the function generator to match the desired timing of the traffic light sequence.
 3. **Check the D-flip flop:** Verify that the D-flip flop is functioning properly by checking its input and output signals. Ensure that the flip flop is connected properly and its output is connected to the input of the AND gate.
 4. **Check the AND gate:** Verify that the AND gate is functioning properly by checking its input and output signals. Ensure that the gate is connected properly and its output is connected to the control signal of the traffic light.
 5. **Test the system:** Connect the power supply and function generator to the circuit and test the system by observing the output of the traffic light. Adjust the settings of the function generator as needed to achieve the desired timing of the traffic light sequence.
7. **Result:** We have successfully Designed Traffic Light using D – Flip Flop and AND Gate.

Learning outcomes (What I have learnt):

1. **Understanding of digital logic:** We will learn how digital circuits work, and how to design them using logic gates, such as the 3-to-8 decoder.
2. **Familiarity with D – Flip Flop:** We will develop a deeper understanding of the D – Flip Flop and how it can be used to practical application such as Traffic Lights.
3. **Circuit design skills:** You will learn how to design a circuit using a combination of logic gates and how to choose the appropriate components to achieve the desired functionality.

Evaluation Grid:

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Worksheet completion including writing learning objectives/Outcomes.(To be submitted at the end of the day).	10	12
2.	Viva	08	8
3.	Student Engagement in Simulation/Demonstration/Performance and Controls/Pre-Lab Questions.	10	10
	Signature of Faculty (with Date):	Total Marks Obtained: 28	