Lab 3: Full Adder

3.1 Aim

Design and verify the logic circuit Full adder using Half adder.

3.2 Objective:

- To understand the principle of binary addition.
- To understand full adder concept.
- Use truth table and Boolean Algebra theorems in simplifying a circuit design.
- To implement full adder circuit using logic gates.

3.3 Apparatus Required

- Prototyping board (breadboard)
- DC Power Supply 5V Battery
- Light Emitting Diode (LED)
- Digital ICs:
  - 7408 :Quad 2 input AND
  - 7486: Quad 2 input XOR
  - 7432 :Quad 2 input OR
- Connecting Wires

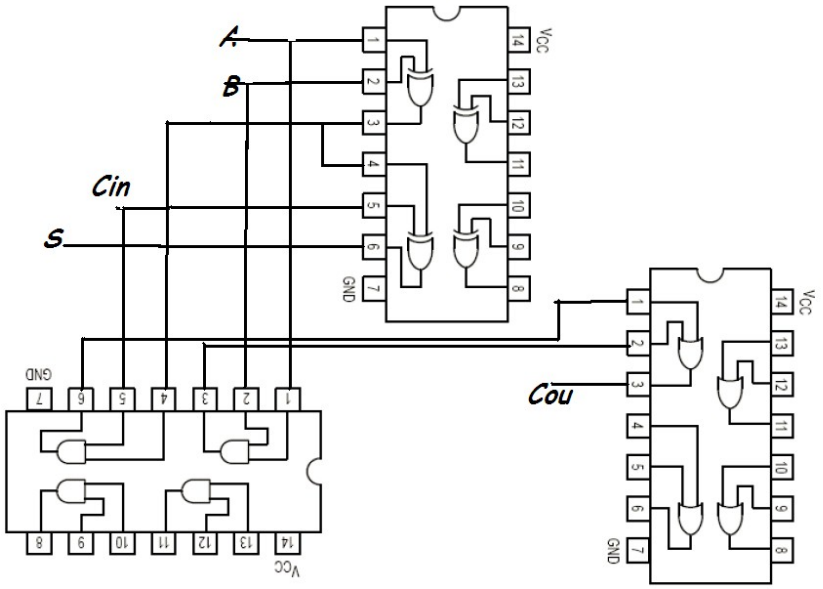

Figure 3.1: Pin diagram of Full adder

3.4 Pin Diagram

3.5 Theory

Full Adder: Full adder is a logical circuit that performs an addition operation on three binary digits. The full adder produces a sum and carry value, which are both binary digits. It can be combined with other full adders or work on its own.

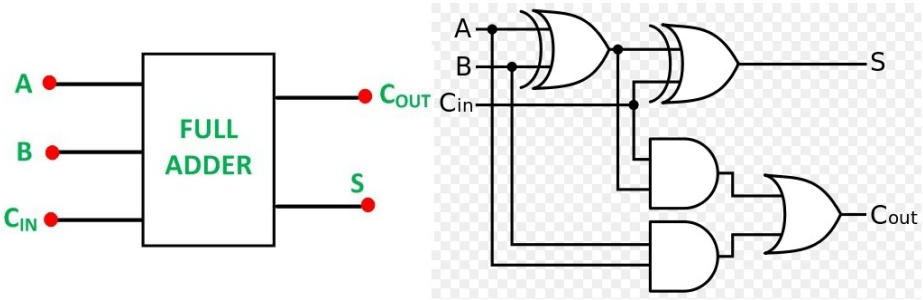

Figure 3.2: Logic circuit and block diagram of Full Adder

3.6 Procedure:

1. Collect the components necessary to accomplish this experiment.
2. Plug the IC chip into the breadboard.

Full adder truth table

$S = A \oplus B \oplus Cin$

$C = AB + Cin\ (A \oplus B)$

A	B	Carry-In	Sum	Carry-Out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Figure 3.3: Boolean Expression and Truth Table for Full Adder

3. Connect the supply voltage and ground lines to the chips. PIN7 = Ground and PIN14 = +5V.

4. According to the pin diagram of each IC mentioned above, make the connections according to circuit diagram.

5. Connect the inputs of the gate to the input switches of the LED.

6. Connect the output of the gate to the output LEDs.

7. Once all connections have been done, turn on the power switch of the breadboard

8. Operate the switches and fill in the truth table (Write "1" if LED is ON and "0" if LED is OFF Apply the various combination of inputs according to the truth table and observe the condition of Output LEDs.

3.7 Observation Table

Full adder: Input Variable: A ,B,Ci Output Variable: SUM(S), Carry(C_0) LED ON: RED Light: Logic 1 LED OFF: Green Light: Logic 0

Table 3.1: Add caption

Inputs			**Outputs**	
A	B	Ci	Sum (S)	Carry Âl′

3.8 Results And Analysis

Verified the truth table as follows.

Full Adder: Verified the truth table of Full Adder as S = 1 i.e LED which is connected to S terminal glows when inputs are A ,B ,Ci Verified the truth table of Full Adder as Co = 1 i.e LED which is connected to Co terminal glows when inputs are A ,B, Co

3.9 Conclusion:

1. To add two bits we require one XOR gate(IC 7486) to generate Sum and one AND (IC 7408) to generate carry. 2. To add three bits we require two half adders.