Aim of the Experiment: To study the half adder operation using universal gates.

Apparatus used:
1) NAND/NOR gate IC's.
2) Power supply.
3) LED.
4) Connecting wires.

Theory:

A logic circuit for the addition of two one bit binary digits (A & B), producing a sum (S) and a carry (C) is referred to as a half-adder. The logic symbol for a half adder is as shown in Fig. 1.

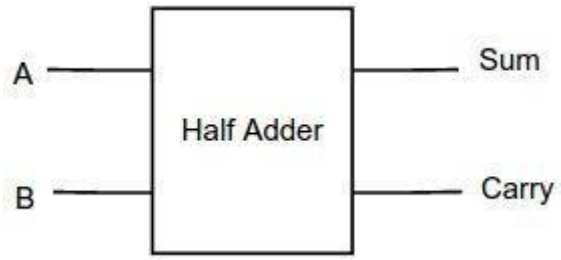

Fig.1. Logic symbol for half adder

Here A and B are two inputs and Sum and Carry are the two outputs.

The half adder operates in accordance with the following truth table-

Input		Output	
A	B	S (Sum)	C (Carry)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

The logic equation for a half adder is given by the following equations-

$$S = \overline{A}B + A\overline{B} = A \oplus B$$
$$C = AB$$

The basic logic circuit of a half adder is as shown in Fig. 2.

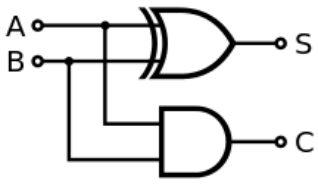

Fig. 2.: Logic circuit for a half adder

The realization of half adder by using NAND gates and NOR gates are as shown in the figure 3 and 4 respectively.

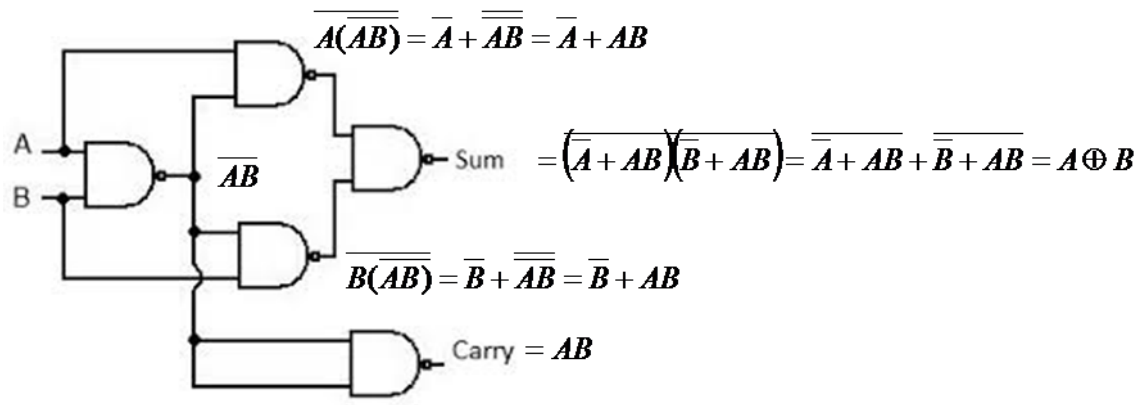

Fig. 3.: Logic circuit for a half adder by using NAND gates.

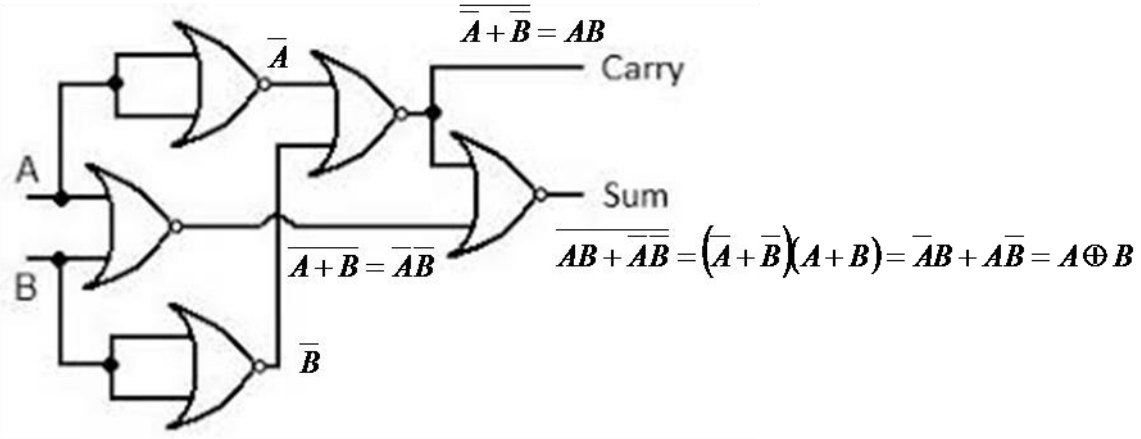

Fig. 3.: Logic circuit for a half adder by using NOR gates.

Observation:

Input		Output			
A	B	S (Sum) ON/OFF	Corresponding Binary value (1/0)	C (Carry) ON/OFF	Corresponding Binary value (1/0)
0	0				
0	1				
1	0				
1	1				

Result:

Observation table is compared with the truth table of half adder and it verifies the truth table.

Precautions:

1) Power supply of the kit should be checked and all the connections should be done properly.

2) The NAND/NOR gate IC's should be properly pinned in the mounting board and handled carefully.