

# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

## DEPARTMENT OF PHYSICS



### LAB MANUAL

## HALF AND FULL SUBTRACTOR

**AIM:** - Implementation of half subtractor and Full subtractor using logic gates.

### **APPARATUS REQUIRED**

1. IC 7486, IC 7432, IC 7408, IC 7404, IC 7400.
2. BreadBoard.

### **THEORY:**

**HALF SUBTRACTOR:** Subtracting a single-bit binary value B from another A (i.e. A -B) produces a difference bit D and a borrow out bit B-out. This operation is called half subtraction and the circuit to realize it is called a half subtractor. The Boolean functions describing the half Subtractor are:

$$D = A \oplus B$$

$$B_r = \bar{A} B$$

**FULL SUBTRACTOR:** Subtracting two single-bit binary values, B, C<sub>in</sub> from a single-bit value A produces a difference bit D and a borrow out B<sub>r</sub> bit. This is called full subtraction. The Boolean functions describing the full-subtractor are:

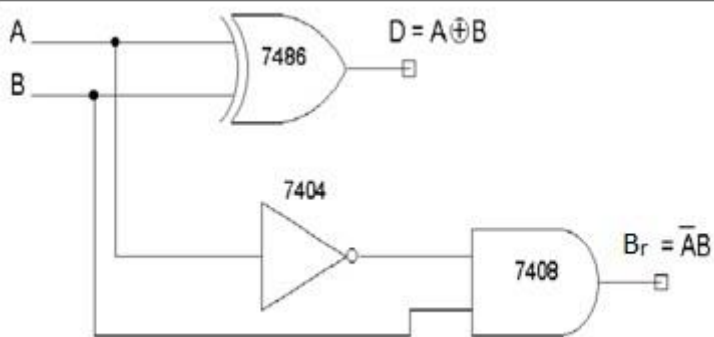
$$D = (x \oplus y) \oplus B_{in}$$

$$B_r = \bar{A}B + \bar{A} (B_{in}) + B (B_{in})$$

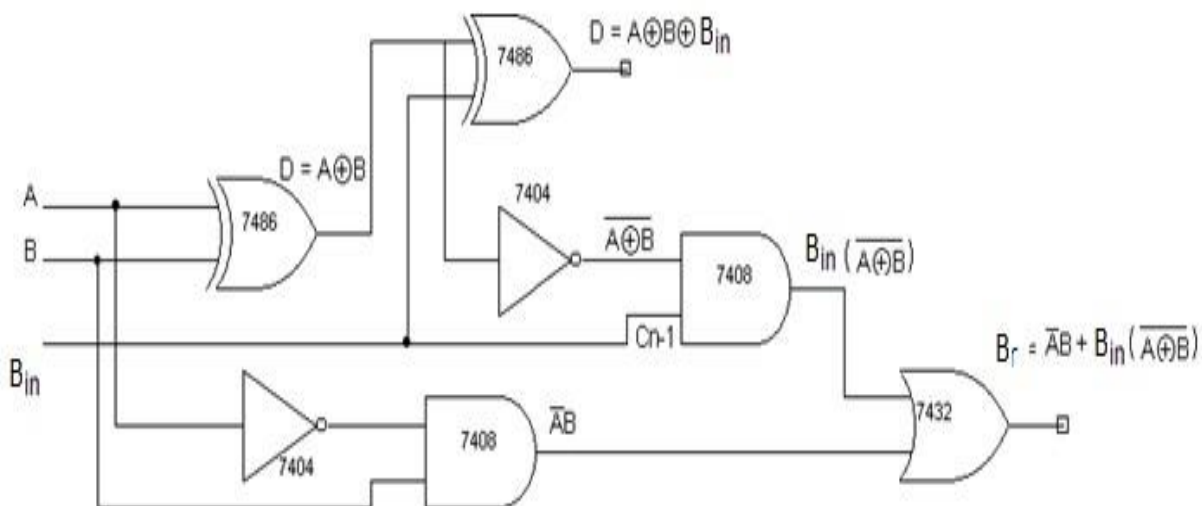
## Procedure: -

1. Verify the gates.
2. Make the connections as per the circuit diagram.
3. Switch on VCC and apply various combinations of input according to the truth table.
4. Note down the output readings for half and full subtractor difference and borrow bit for different combinations of inputs.

### Using X – OR and Basic Gates (a)Half Subtractor



### Full Subtractor



Half Subtractor			
A	B	D	B <sub>r</sub>
0	0		
0	1		
1	0		
1	1		

Full Subtractor				
A	B	B <sub>in</sub>	D	B <sub>r</sub>
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

**Conclusion: -**

**Half subtractor and full subtractor are constructed and their truth tables are Verified.**



