Experiment No. 2
Basic gates using universal gates.
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Roll Number: **41**
Date of Performance: **31/7/24**
Date of Submission:

Aim - To realize the gates using universal gates.

Objective -

1) To study the realization of basic gates using universal gates.
2) Understanding how to construct any combinational logic function using NAND or NOR gates only.

Theory -

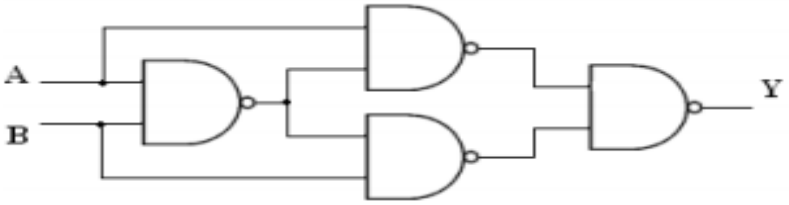
AND, OR, NOT are called basic gates as their logical operation cannot be simplified further. NAND and NOR are called universal gates as using only NAND or only NOR, any logic function can be implemented.

Components required -

1. IC's 7400(NAND) 7402(NOR)
2. Bread Board.
3. Connecting wires.

Circuit Diagram -

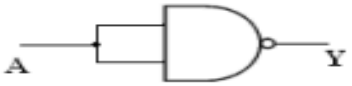
(e) Ex-OR gate: $Y = A \oplus B$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

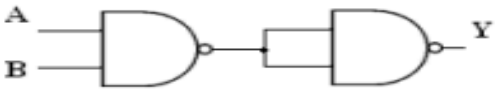
Implementation using NAND gate:

(a) NOT gate: $Y = A'$



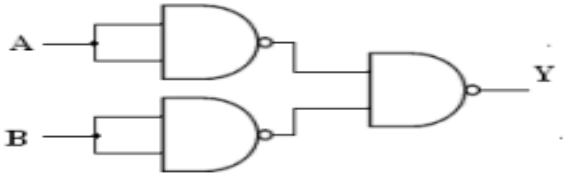
A	Y
0	1
1	0

(b) AND gate: $Y = A \cdot B$



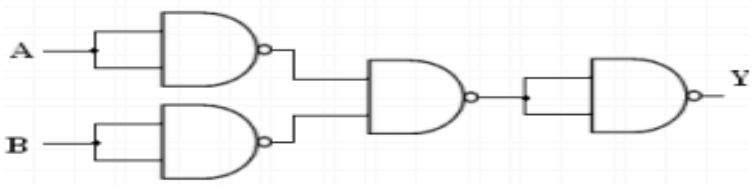
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(c) OR gate: $Y = A + B$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(d) NOR gate: $Y = (A + B)'$



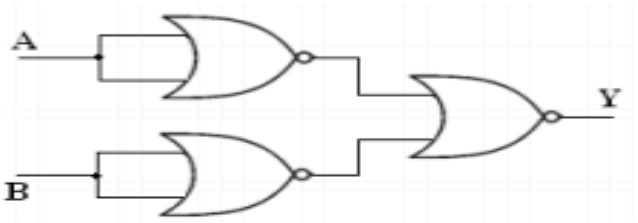
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Implementation using NOR gate:

(a) NOT gate: $Y = A'$

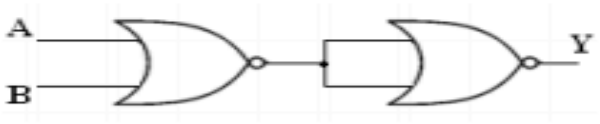
A	Y
0	1
1	0

(b) AND gate: $Y = A \cdot B$



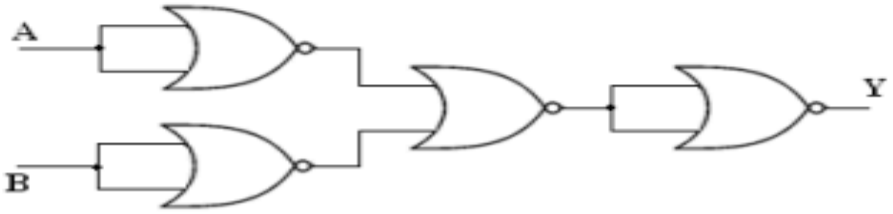
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(c) OR gate: $Y = A + B$



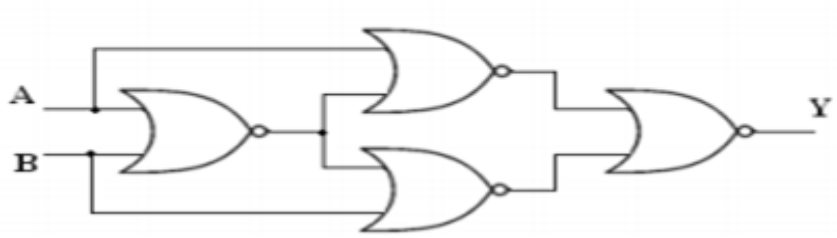
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(d) NAND gate: $Y = (AB)'$



A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(e) Ex-NOR gate: $Y = A \odot B = (A \oplus B)'$



A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

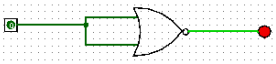
Procedure:

a) Connections are made as per the circuit diagrams.

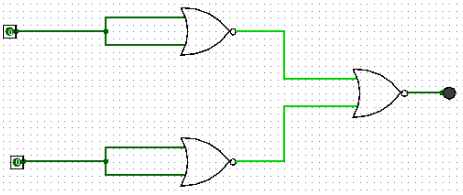
b) By applying the inputs, the outputs are observed and the operations are verified with the help of truth table.

B) IMPLEMENTATION USING NOR GATE

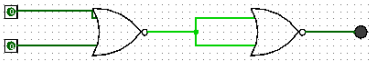
A) NOT GATE



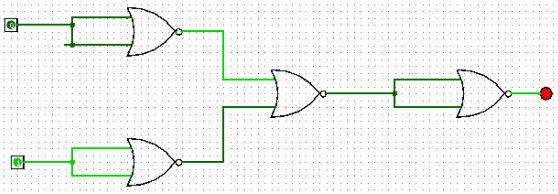
B) AND GATE



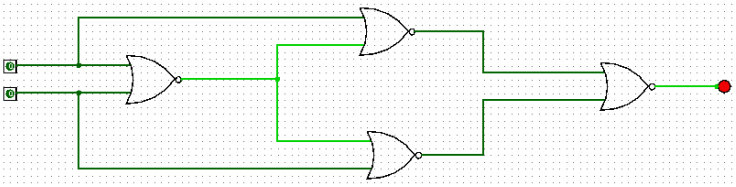
C) OR GATE

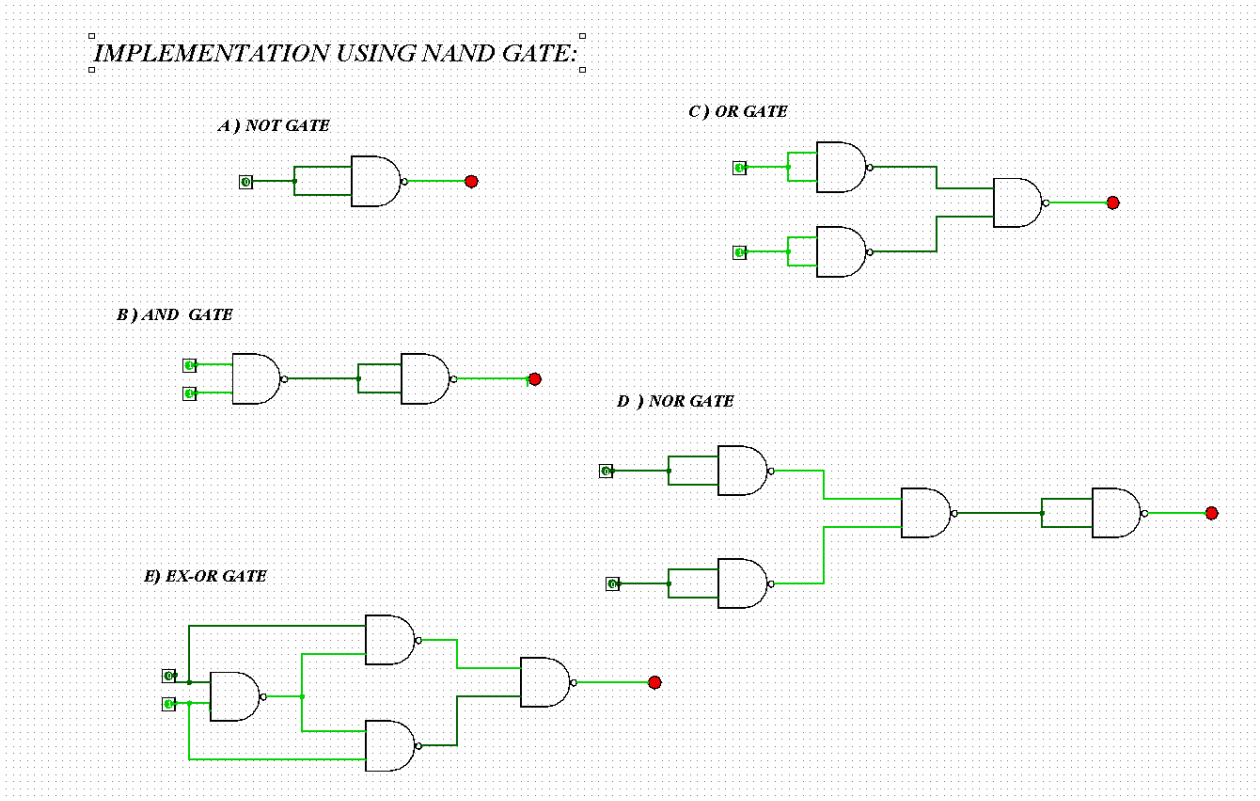


D) NAND GATE



E) EX-NOR GATE





Conclusion -

The experiment successfully demonstrates the realization of basic logic gates using universal gates (NAND and NOR). By constructing AND, OR, and NOT gates with these universal gates, we confirm their versatility and the principle that any combinational logic function can be implemented using just NAND or NOR gates. This exercise enhances understanding of digital logic design and the fundamental relationships between different types of logic gates.