



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

Experiment No. 2
Basic gates using universal gates.
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Date of Performance:
Date of Submission:



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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 -

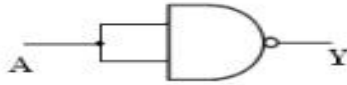


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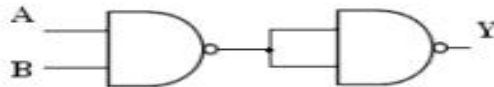
Implementation using NAND gate:

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



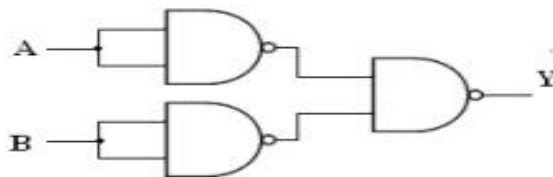
A	Y
0	1
1	0

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



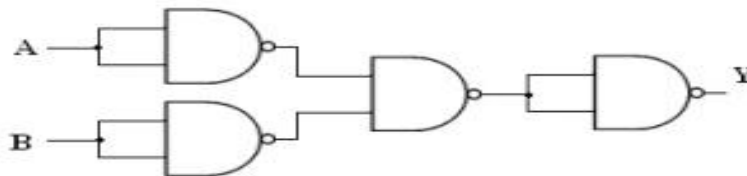
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



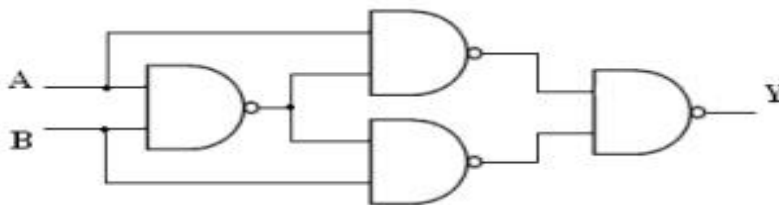
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

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



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

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



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



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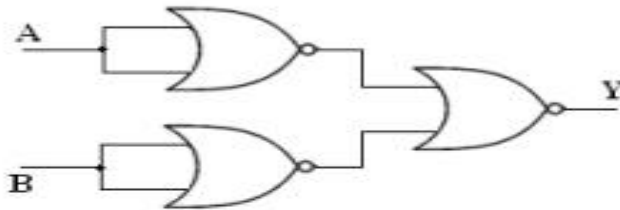
Implementation using NOR gate:

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



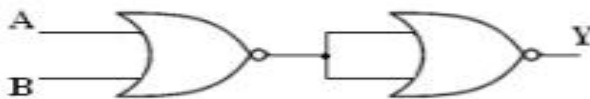
A	Y
0	1
1	0

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



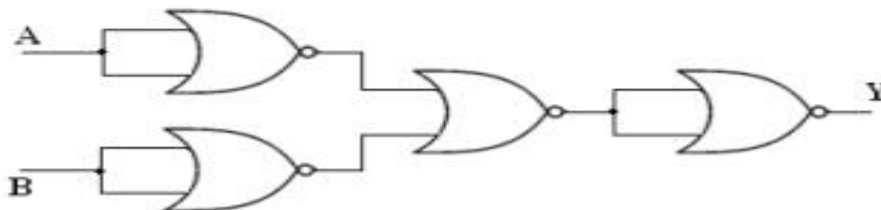
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



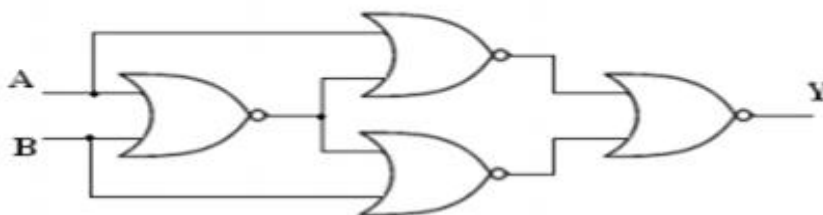
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(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:

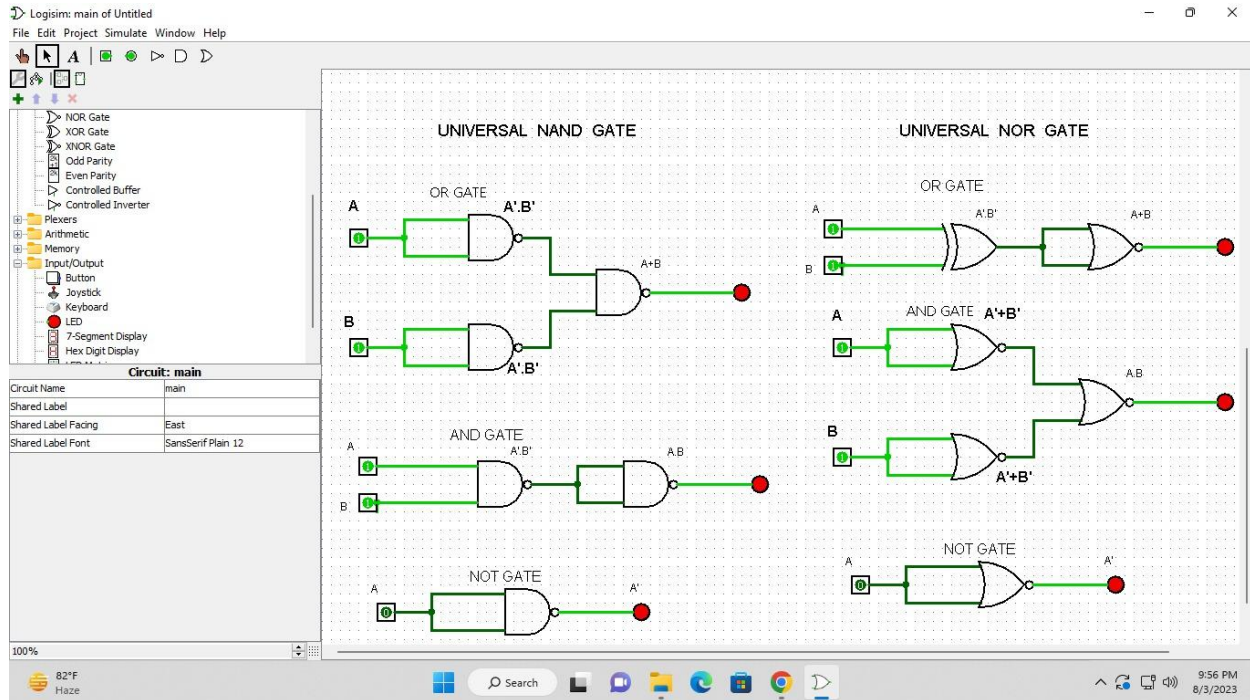
- Connections are made as per the circuit diagrams.
- By applying the inputs, the outputs are observed and the operations are verified with the help of truth table.



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Output:-



Conclusion –

Utilizing universal gates, such as NAND or NOR gates, offers a versatile approach to constructing complex digital circuits. By exclusively employing these gates, one can efficiently emulate all other logic gates, reducing component diversity and simplifying design. This cost-effective and versatile strategy is a fundamental concept in digital electronics.