➢ <u>Gates</u>

- Logic gates are the basic building blocks of any digital system.
- It is an electronic circuit having one or more than one input and only one output. The relationship between the input and the output is based on certain logic.

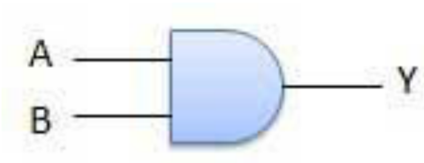
1. AND Gate

- A circuit which performs an AND operation is shown in figure. It has n input (n >= 2) and one output.

- The AND gate produces the AND logic function, that is, the output is 1 if input A and input B are both equal to 1; otherwise the output is 0. The algebraic symbol of the AND function is the same as the multiplication symbol

Y	=	A AND B AND C .... N
Y	=	A.B.C .... N
Y	=	ABC .... N

Logic diagram



Truth Table

Inputs		Output
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

2. OR Gate

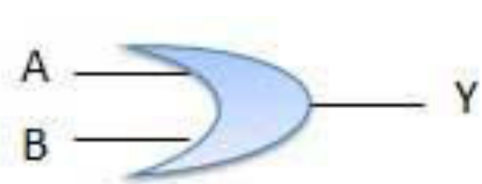
- A circuit which performs an OR operation is shown in figure. It has n input (n >= 2) and one output.

- The OR gate produces the inclusive-OR function; that is, the output is 1 if input A or input B or both inputs are 1; otherwise, the output is 0. The algebraic symbol of the OR function is +

Y = A OR B OR C .... N

$Y = A + B + C \ldots\ldots N$

Logic diagram



Truth Table

Inputs		Output
A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

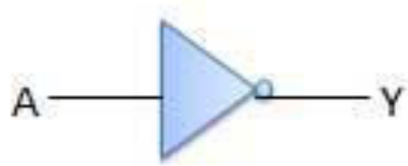
3. NOT Gate

- NOT gate is also known as Inverter. It has one input A and one output Y.
- The inverter circuit inverts the logic sense of a binary signal. It produces the NOT, or complement, function.
- The algebraic symbol used for the logic complement is a bar over the variable symbol.

Y = NOT A

$Y = \overline{A}$

Logic diagram



Truth Table

Inputs	Output
A	B
0	1
1	0

4. NAND Gate

- A NOT-AND operation is known as NAND operation. It has n input (n >= 2) and one output.
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- The NAND function is the complement of the AND function, as indicated by the graphic symbol, which consists of an AND graphic symbol followed by a small circle.
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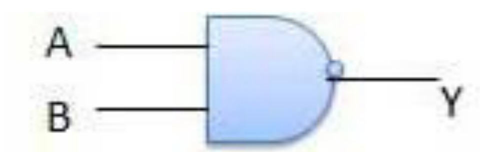
- The designation NAND is derived from the abbreviation of NOT-AND.

Y	=	A NOT AND B NOT AND C .... N
Y	=	A NAND B NAND C .... N

Logic diagram



Truth Table

Inputs		Output
A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

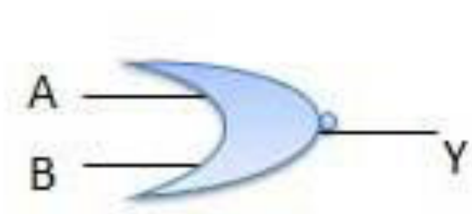
5. NOR Gate

- A NOT-OR operation is known as NOR operation. It has n input (n >= 2) and one output.

- The NOR gate is the complement of the OR gate and uses an OR graphic symbol followed by a small circle.

Y	=	A NOT OR B NOT OR C ……. N
Y	=	A NOR B NOR C ……. N

Logic diagram



Truth Table

Inputs		Output
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

6. XOR Gate

- XOR or Ex-OR gate is a special type of gate. It can be used in the half adder, full adder and subtractor. The exclusive-OR gate is abbreviated as EX-OR gate or sometime as X-OR gate. It has n input (n >= 2) and one output.
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- The exclusive-OR gate has a graphic symbol similar to the OR gate except for the additional curved line on the input side.
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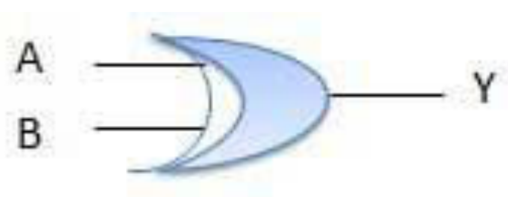
- The output of the gate is 1 if any input is 1 but excludes the combination when both inputs are 1.

$$Y = A \text{ XOR } B \text{ XOR } C \ldots\ldots\ N$$
$$Y = A \oplus B \oplus C \ldots\ldots\ N$$

$$Y = \overline{A}B + A\overline{B}$$

Logic diagram



Truth Table

Inputs		Output
A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

7. XNOR Gate

- XNOR gate is a special type of gate. It can be used in the half adder, full adder and subtractor. The exclusive-NOR gate is abbreviated as EX-NOR gate or sometime as X-NOR gate. It has n input (n >= 2) and one output.
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- The exclusive-NOR is the complement of the exclusive-OR, as indicated by the small circle in the graphic symbol.
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- The output of this gate is 1 only if both the inputs are equal to 1 or both inputs are equal to 0.
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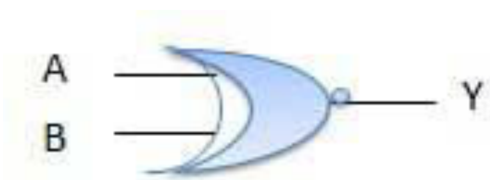
Y = A XOR B XOR C .... N

$Y = A \odot B \odot C .... N$

$Y = \overline{A}\,\overline{B} + AB$

Logic diagram



Truth Table

Inputs		Output
A	B	$A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1