

LOGIC GATES

- The logic gates are the main structural part of a digital system.
- Logic Gates are a block of hardware that produces signals of binary 1 or 0 when input logic requirements are satisfied.
- Each gate has a distinct graphic symbol, and its operation can be described by means of algebraic expressions.
- The seven basic logic gates includes: AND, OR, XOR, NOT, NAND, NOR, and XNOR.
- The relationship between the input-output binary variables for each gate can be represented in tabular form by a truth table.
- Each gate has one or two binary input variables designated by A and B and one binary output variable designated by x.

AND GATE:

The AND gate is an electronic circuit which gives a high output only if all its inputs are high. The AND operation is represented by a dot (.) sign.

AND Gate:



Α	В	
0	0	
0	1	
		1

1

1

Х

Ο

0 0

Truth Table:

Algebraic Function: x = AB

OR GATE:

The OR gate is an electronic circuit which gives a high output if one or more of its inputs are high. The operation performed by an OR gate is represented by a plus (+) sign.

OR Gate:



Truth Table:

Α	В	x
0	0	0
0	1	1
1	0	1
1	1	1

NOT GATE:

The NOT gate is an electronic circuit which produces an inverted version of the input at its output. It is also known as an **Inverter**.

NAND GATE:

The NOT-AND (NAND) gate which is equal to an AND gate followed by a NOT gate. The NAND gate gives a high output if any of the inputs are low. The NAND gate is represented by a AND gate with a small circle on the output. The small circle represents inversion.



NOR GATE:

The NOT-OR (NOR) gate which is equal to an OR gate followed by a NOT gate. The NOR gate gives a low output if any of the inputs are high. The NOR gate is represented by an OR gate with a small circle on the output. The small circle represents inversion.

NOR Gate:



Exclusive-OR/ XOR GATE:

The 'Exclusive-OR' gate is a circuit which will give a high output if one of its inputs is high but not both of them. The XOR operation is represented by an encircled plus sign.

XOR Gate:

Truth Table:



EXCLUSIVE-NOR/Equivalence GATE:

The 'Exclusive-NOR' gate is a circuit that does the inverse operation to the XOR gate. It will give a low output if one of its inputs is high but not both of them. The small circle represents inversion.



Answer the following questions:

1. Define Logic gates.

Ans: 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.

2. How many types of logic gates are there? Name them.

Ans: There are seven basic logic gates, which includes: AND, OR, XOR, NOT, NAND, NOR, and XNOR.

3. Write a short on AND gate.

Ans: The AND gate is an electronic circuit which gives a high output only if all its inputs are high. The AND operation is represented by a dot (.) sign. **AND Gate:**



Algebraic Function: x = AB

Α	В	x
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table:

4. Draw the truth table for OR gate.

Ans:

Α	В	x
0	0	0
0	1	1
1	0	1
1	1	1

5. Explain the XNOR gate briefly.

Ans: The 'Exclusive-NOR' gate is a circuit that does the inverse operation to the XOR gate. It will give a low output if one of its inputs is high but not both of them. The small circle represents inversion.



Truth Table:

в

0

1

0

1

х

0

1

1

0

А

0

0

1

1

6. Draw the symbol and truth table of XOR gate. Ans:







7. Draw the circuit diagram for the following :

a. X = A'B' + AB

XOR Gate:



b. Z = YX' + Y'X



c. Y = (A+B)'. C'.(C+D)

