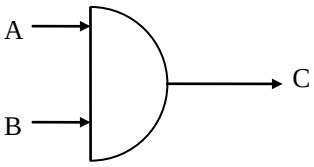
Logic Gates

1. Circuits that manipulate voltages and hence their representative binary values.
2. Logic gates are represented by
   - 2.1. Graphical symbol
   - 2.2. Logical equation
   - 2.3. Rule
   - 2.4. Operations described by a truth table
3. Truth table defines output obtained from all possible combinations of inputs.
4. Basic logic gates
   - 4.1. AND
   - 4.2. OR
   - 4.3. XOR (exclusive or)
   - 4.4. NOT
   - 4.5. NAND
   - 4.6. NOR
   - 4.7. NXOR

AND Gate :-

Graphical Symbol



Logic Equation C = A . B

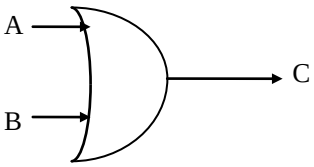
Rule The two inputs must be true (1) for the output to be true (1).

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate :-

Graphical Symbol



Logic Equation C = A + B

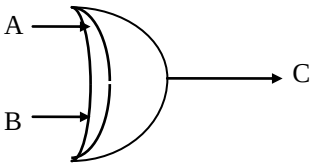
Rule At least one input must be true (1) for the output to be true (1).

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	0
0	1	1
1	0	1
1	1	1

XOR Gate (Exclusive OR) :-

Graphical Symbol



Logic Equation $C = A \oplus B$

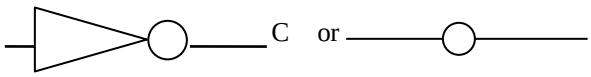
Rule One or the other input must be true (1) but not both for the output to be true (1).

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	0
0	1	1
1	0	1
1	1	0

NOT Gate :-

Graphical Symbol



Logic Equation $C = B^{-}$

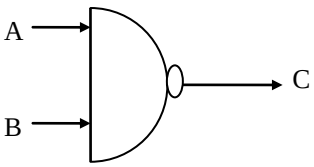
Rule Invert the output. i.e.. 1 changes to 0 & 0 changes to 1.

Truth Table

Inputs	**Output**
A	**C**
0	1
1	0

NAND Gate :-

Graphical Symbol



Logic Equation $C = (A \cdot B)'$ can also be written $C = \overline{(A \cdot B)}$

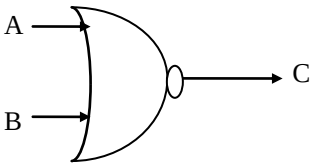
Rule Opposite to AND therefore if both input are true output is false(0) otherwise true(1)

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate :-

Graphical Symbol



Logic Equation C = (A + B)' can also be written C = $\overline{(A + B)}$

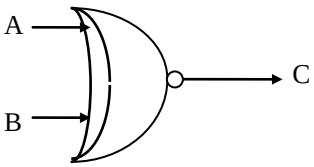
Rule Opposite to OR therefore if any input is true(1) the output is false(0).

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	1
0	1	0
1	0	0
1	1	0

NXOR Gate (Exclusive OR) :-

Graphical Symbol



Logic Equation C = (A $\oplus$ B)' can also be written C = $\overline{(A \quad B)}$

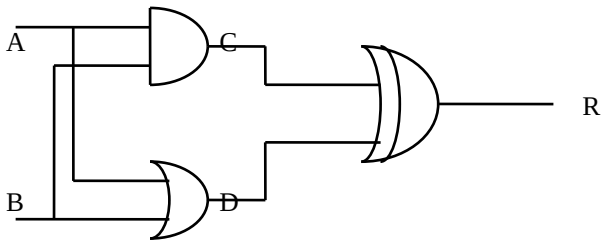
Rule Opposite to XOR - if both inputs are the same output is true(1) otherwise false(0)

Truth Table

Inputs		**Output**
A	**B**	**C**
0	0	1
0	1	0
1	0	0
1	1	1

Combinational Circuits

1. Circuit made up of a set of connected logic gates.
2. Used for generating...
   - 2.1. Binary control functions.
   - 2.2. Logic functions.
3. Described using a truth table.
   - 3.1. Consider every possible combination of inputs



Truth Table

Inputs		**Intermediary Logic**		**Output**
A	**B**	**C**	**D**	**R**
		A . B	**A + B**	**C ⊕ D**
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0