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11434
GROUP-12

AND GATE

- A logic gate is a physical device that implements a Boolean function
- It performs a logical operation on one or more logic inputs and produces a single logic output.
- AND gate takes two inputs and gives output as low(0) whenever any of its input is low(0).
- The representation of AND function is C=A.B

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A	**B**	**C**
0	0	0
0	1	0
1	0	0
1	1	1

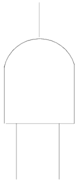

Figure: AND gate

OR GATE

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Truth Table for OR gate

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

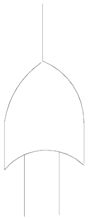

Figure: OR gate

NOT GATE

- NOT gate is different from previous two in the sense that it has 1 input instead of two.
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Truth Table for NOT gate

A	B
0	1
1	0

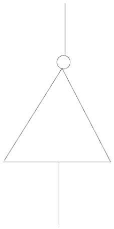

Figure: NOT gate

De-Morgan's Laws

The rules given by De-Morgan allow the expression of conjunctions and disjunctions purely in terms of each other via negation.Refer to slides 2, 5, and 8 before going further.

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Laws

The laws if laid in plain English are as follows:

1. The negation of a conjunction is the disjunction of the negations.
2. The negation of a disjunction is the conjunction of the negations.

Law 1

Theorem

The negation of a conjunction is the disjunction of the negations. Represented mathematically:

$$\overline{A + B} = \overline{A}.\overline{B} \tag{1}$$

$$\overline{A + B} = \overline{A}.\overline{B} \tag{2}$$

Proof using Truth Table

A	B	A+B	A'	B'	(A+B)'	A'.B'
0	0	0	1	1	1	1
0	1	1	1	0	0	0
1	0	1	0	1	0	0
1	1	1	0	0	0	0

Law 2

Theorem

The negation of a disjunction is the conjunction of the negations. Represented mathematically:

$$\overline{A.B} = \overline{A} + \overline{B} \tag{3}$$

$$\overline{A.B} = \overline{A} + \overline{B} \tag{4}$$

Proof using Truth Table

A	B	AB	A’	B’	AB’	A’+B’
0	0	0	1	1	1	1
1	0	0	0	1	1	1
0	1	0	1	0	1	1
1	1	1	0	0	0	0

Generalised De-Morgan's Laws

Equations 1 and 4 represent a special case.The law can be extended to more than two inputs following the definition itself.

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Laws

$$\overline{(A+B+C+D+E.....)} = \overline{A}.\overline{B}.\overline{C}.\overline{D}.\overline{E}..... \tag{5}$$

$$\overline{(A.B.C.D.E.....)} = \overline{A}+\overline{B}+\overline{C}+\overline{D}+\overline{E}..... \tag{6}$$