E-content of MSc Semester II Electronics – Unit 4

LOGIC GATES

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Logic Gates

Logic gate is a digital circuit that is able to operate on a number of binary inputs in order to perform a particular logic function

→ A logic gate can have one or more inputs but only one output

Basic logic gates

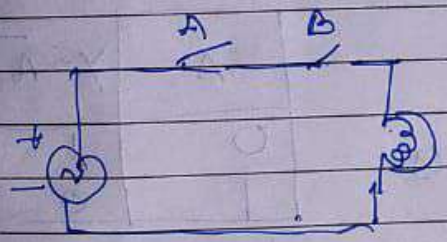
1 - High-ON
0 - low-off

1. AND Gate
2. OR "
3. NOT Gate

AND Gate - An AND gate is a logic circuit which consists of two or more inputs and one output.

Truth table

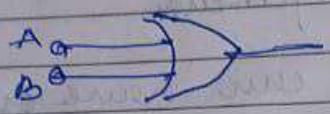
A	B	Y = AB
0	0	0
0	1	0
1	0	0
1	1	1

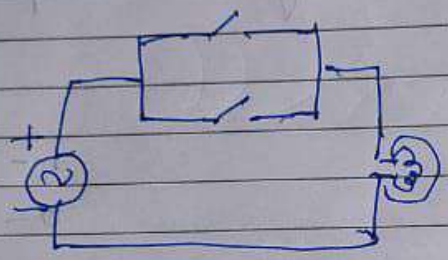


The output of AND gate becomes 1 if and only if all inputs are 1

OR Gate

An OR Gate is a logic circuit which consist of two or more input & one output



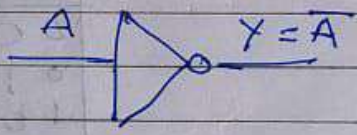


A B	Y = A + B
0 0	0
0 1	1
1 0	1
1 1	1

Output of OR Gate will be 1 if any input is 1

NOT Gate

NOT Gate is a logic circuit which consist of one input and one output

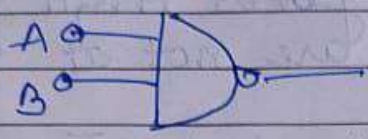


A	Y = $\bar{A}$
0	1
1	0

The NOT Gate produces complement of input signal i.e if input is 1 output will be and vice versa

NAND Gate

NAND gate is a combination of AND gate followed by a NOT gate



The NAND Gate produces High output when any one of the input is low

A	B	$Y = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate

NOR gate is the combination of OR gate followed by NOT gate

→ The output of NOR gate is low if any of the input is ~~High~~ HIGH

A	B	$Y = \overline{(A+B)}$
0	0	1
0	1	0
1	0	0
1	1	0

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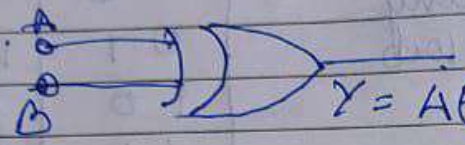
Ex - OR or XOR Gate

The Exclusive - OR operation is widely used in digital circuit

The XOR gate gives HIGH output when the inputs are not at equal logic level

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



→ when both inputs are same output will be zero or low

A	B	Y = A⊕B
0	0	0
0	1	1
1	0	1
1	1	0

Ex - NOR Gate

The exclusive NOR gate performs the same function as an XOR gate followed by a NOT gate

$$\overline{A \oplus B} = \bar{A} \cdot \bar{B} + AB$$

A	B	$Y = A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1

→ The output of X-NOR gate is 1 when both inputs are same

→ Or we can say output is 1 when even no. of inputs are 0