# SNS COLLEGE OF TECHNOLOGY

**(An Autonomous Institution)**

## Coimbatore-35

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**19ECB202 – LINEAR AND DIGITAL CIRCUITS**

**UNIT III – MINIMIZATION TECHNIQUES AND GATES**

**2 MARKS**

1. **State the fundamental postulates of Boolean algebra.** Answer:

The postulates of a mathematical system form the basic assumption from which it is possible to deduce the theorems, laws and properties of the system.

a. Closure: Closure with respect to the operator + : When two binary elements are operated by operator + the result is a unique binary element.
Closure: Closure with respect to the operator **.** (dot) : When two binary elements are operated by operator **.** (dot), the result is a unique binary element.

b. An identity element with respect to +, designated by 0: A + 0 = 0 + A = A
An identity element with respect to **.** (dot), designated by 1: A **.** 1 = 1 **.** A = A

c. Commutative with respect to + : A + B = B + A
Commutative with respect to **.** (dot) : A **.** B = B **.** A

d. Distributive property of **.** (dot) over + : A . (B + C) = (A **.** B) + (A **.** C)
Distributive property of + over **.** (dot) : A + (B . C) = (A + B) **.** (A + C)

e. Associative property of + : A + (B + C) = (A + B) + C Associative property of **.** : A **.** (B **.** C) = (A **.** B) **.** C

f. For every binary element, there exists complement element. For example, if A is an element, we have A‟ is a complement of A i.e., if A = 0, then A‟ = 1 and vice versa.

g. There exist at least two elements, say A and B in the set of binary elements such that A not equals B.

**2. List down the basic theorems of Boolean algebra.**

Answer:

| Theorems | (a) | (b) |
|---|---|---|
| Theorem 1 (Idempotency) | A + A = A | A . A = 1 |
| Theorem 2 | A + 1 = A | A . 0 = 0 |
| Theorem 3 (Involution) | (A‟)‟ = A | |
| Theorem 4 (Absorption) | A + AB = A | A ( A + B) = A |
| Theorem 5 | A + A‟B = A + B | A . (A‟ + B) = AB |
| Theorem 6 (Associative) | A (B + C) = (A + B) + C | A (BC) = (AB) C |

**3. State De-Morgan's Theorem.**

De Morgan suggested two theorems that form important part of Boolean algebra.

They are,

(1) The complement of a product is equal to the sum of the complements.
(AB)' = A' + B'

(2) The complement of a sum term is equal to the product of the complements. (A + B)' = A'B'

**4. Define the principle of duality theorem.**

Answer:

The principle of duality theorem says that, starting with a Boolean relation, another Boolean relation can be derived by using the following procedure:

a. Changing each OR sign to an AND sign

b. Changing each AND sign to an OR sign and

c. Complementing any 0 or 1 appearing in the expression.

5. **Simplify the given function: F = A'BC + A'B'C + ABC' + ABC** Answer:

F = A"BC + A"B"C + ABC" + ABC

= A"C (B + B") + AB (C" + C)

= A"C + AB

6. **Convert the given expression in standard SOP form: f (A, B, C) = AC + AB + BC** Answer:

Step 1: Finding missing literal in each product term
AC = Literal B is missing

AB = Literal C is missing BC
= Literal A is missing
Steps 2: AND product term with (missing literal + its complement) f
(A, B, C ) = AC (B + B") + AB (C + C") + BC (A + A")

Step 3: Expand the terms and reorder literals
f (A, B, C) = ABC + AB"C + ABC + ABC" + ABC + A"BC

Step 4: Omit repeated product terms (allowing only one time):
f (A, B, C) = ABC + AB"C + ABC + ABC" + ABC + A"BC Since A + A = A f
(A, B, C) = ABC + AB"C + ABC" + A"BC

**7. Define: Don't care conditions.** Answer:

In some logic circuits, certain input conditions never occur; therefore the corresponding output never appears. In such cases the output level is not defined, it can be either HIGH or LOW. These output levels are indicated by „X" or „d" in the truth tables and are called don"t care outputs or don"t care conditions or incompletely specified functions.

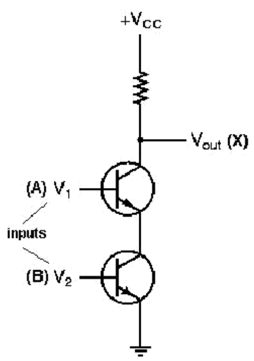
**8. Define logic gates.**

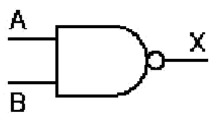
Answer:

Logic gates are the basic elements that make up a digital system. The electronic gate is a circuit that is able to operate on a number of binary inputs in order to perform a particular logical function. The types of gates available are the NOT, AND, OR, NAND, NOR, exclusive-OR, and exclusive-NOR.

**9. What are Universal gates? Give examples.**

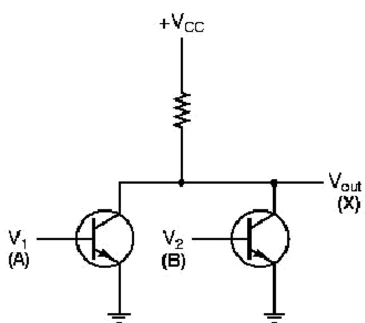
Answer:
The NAND and NOR gates are known as universal gates, since any logic function can be implemented using NAND and NOR gates.

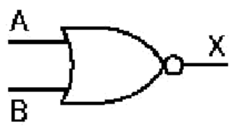



| A | B | X |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

(a) NAND Gate




| A | B | X |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

(b) NOR Gate

**10. Which gates are called as the universal gates? What are its advantages?**

The NAND and NOR gates are called as the universal gates. These gates are used to perform any type of logic application.