Experiment - 2

* Aim :- Realization of all basic gates using NAND gate.

* Apparatus :- Bread board, NAND gate (IC-7400), wires.

* Theory :- A NAND gate is formed by an AND gate followed by a NOT gate. The output of AND gate becomes the input of NOT gate and the output of NOT gate becomes final output.
A NAND is one of the two universal gate. It is called a universal gate because any other gate can be verified with help of NAND gate.

$$NOT \quad gate :- \quad Y = (AA)' = A'$$
$$AND \quad gate :- \quad Y = (\overline{\overline{A} + \overline{B}}) = A \cdot B$$
$$OR \quad gate :- \quad Y = (\overline{\overline{A} \cdot \overline{B}}) = A + B$$
$$NOR \quad gate :- \quad Y = \overline{A + B}$$

* Procedure:-
1. Connect the transistor to the power.
2. Connect one NAND gate for any of one logic function realized.
3. Connect the input of first gate to logic source and output of last gate to logic indicator.
4. Apply logics and various inputs and observe output for each one.
5. Verify the truth table for each input combinations
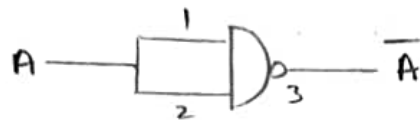6. Repeat the process for all basic logic functions.
7. switch off the power supply.

* Result :- We implemented and unified logic gates → AND, OR, NOR,
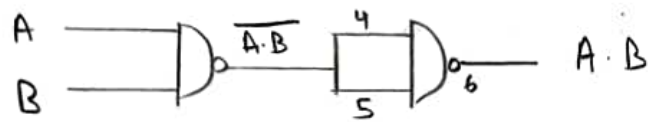
Teacher's Signature _____

EX-NOR, NOT gates using NAND gate.

* <u>Discussion</u> :- NAND gate is known as universal gate. since any of the basic gates or any boolean expression can be derived from them. Further practical apps include burglar alarm, freezer warning, bu bruzzer, automatic watering system etc.
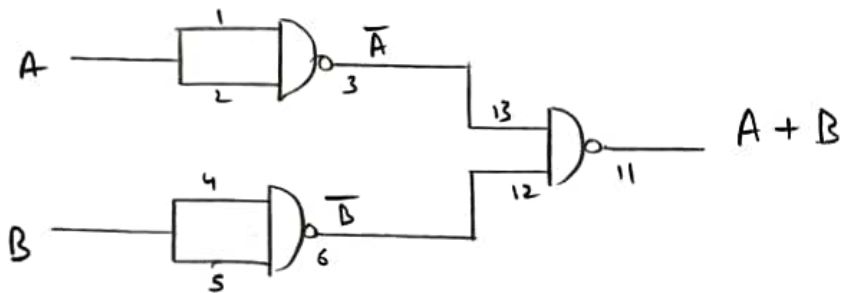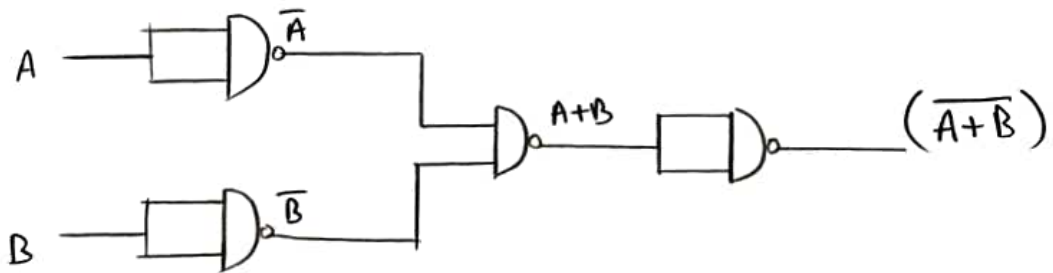
★ NOT gate :-

A ———[1]D₂○₃— $\overline{A}$

★ AND Gate :-

A ———D○ $\overline{A \cdot B}$ ———[4 / 5]D₆○— $A \cdot B$
B

★ OR Gate :-

A ———[1 / 2]D₃○— $\overline{A}$ ———13—
                                         [ ]D○₁₁— $A + B$
B ———[4 / 5]D₆○— $\overline{B}$ ———12—

★ NOR gate :-

A ———[ ]D○ $\overline{A}$ ———
                              [ ]D○ $A + B$ ———[ ]D○— $(\overline{A + B})$
B ———[ ]D○ $\overline{B}$ ———

✶ XOR gate :-

A
4
5
$\overline{A \cdot (\overline{A \cdot B})}$
6
1
$\overline{A \cdot B}$
2
3
10
9
8
$A \oplus B$
12
11
13
$\overline{B \cdot (\overline{A \cdot B})}$
B

✶ XNOR gate :-

A
$\overline{A(\overline{A \cdot B})}$
$(\overline{A \cdot B})$
$A \oplus B$
$\overline{A \oplus B}$
B
$\overline{B \cdot (\overline{A \cdot B})}$