DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603203.

Title of Experiment **Logic**	: **10. Verification and interpretation of Gates.**
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Register Number	: RA2011004010051
Date of Experiment	: 6th July 2021

Sl. No.	Marks Split up	Maximum marks (50)	Marks obtained
1	Pre Lab questions	5	
2	Preparation of observation	15	
3	Execution of experiment	15	
4	Calculation / Evaluation of Result	10	
5	Post Lab questions	5	
Total		**50**	

Staff Signature

PRE-LAB QUESTIONS

1. Name the different Logic Gates.

There are seven basic logic gates: AND, OR, XOR, NOT, NAND, NOR, and XNOR.

2. List out the IC names for the different logic Gates.

There are many IC with different logic gate arrangement, some of them are,

- 7400 Quad 2 input NAND Gate.
- 7402 quad 2 input NOR gate.
- 7404 Hex NOT gates.
- 7408 quad 2 input AND gate.
- 7432 quad 2 input OR gate.
- 7486 quad 2 input XOR gate.
- 747266 quad 2 input XNOR gate.
- 74133 single 13 input NAND gate.

3. What is the Boolean expression for a NOR gate?

The Boolean expression for a logic NOR gate is denoted by a plus sign, (+) with a line or Overline, (¯) over the expression to signify the NOT or logical negation of the NOR gate giving us the Boolean expression of: A+B = Q.

4. How does a NOR gate work?

A NOR gate is a logic gate that produces a high output only if all inputs are false and a low output otherwise. It is the inverse of an OR gate, it can have any number of input probes but only one output probe.

5. Expression for Ex-OR and Ex-NOR?

XOR is represented as A ⊕ B. The symbol of exclusive OR operation is represented by a plus ring surrounded by a circle ⊕.

The logical XNOR operation is represented by ⊙. That is a dot surrounded by a circle.

The expression of XNOR operation between variables A and B is represented as A ⊙ B.

Experiment No. 10 **Date :**	**Verification and interpretation of truth tables for AND, OR, NOT, NAND, NOR Exclusive OR (EX-OR), Exclusive NOR (EX-NOR) Gates.**

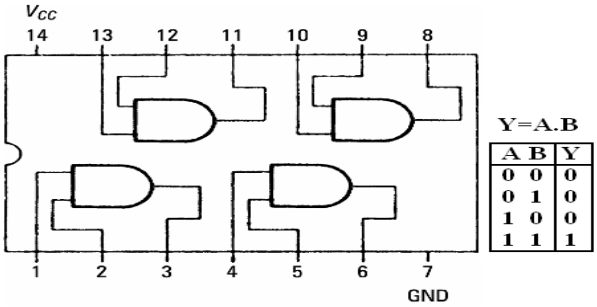
Aim: To verify the Boolean expression using logic gates.

Apparatus: Logic trainer kit, logic gates / ICs, wires.

Theory: Logic gates are electronic circuits which perform logical functions on one or more inputs to produce one output. There are seven logic gates. When all the input combinations of a logic gate are written in a series and their corresponding outputs written along them, then this input/ output combination is called **Truth Table**. The following logic gates and their working are explained.

i) AND Gate

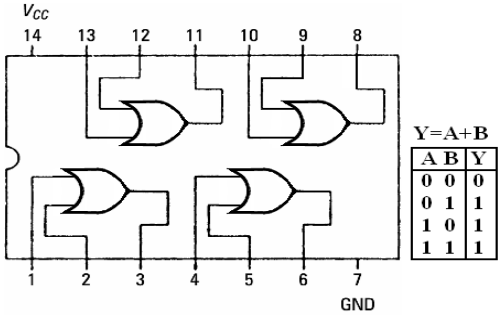
AND gate produces an output as 1, when all its inputs are 1; otherwise the output is 0. This gate can have minimum 2 inputs but output is always one. Its output is 0 when any input is 0.



IC 7408

ii) OR Gate

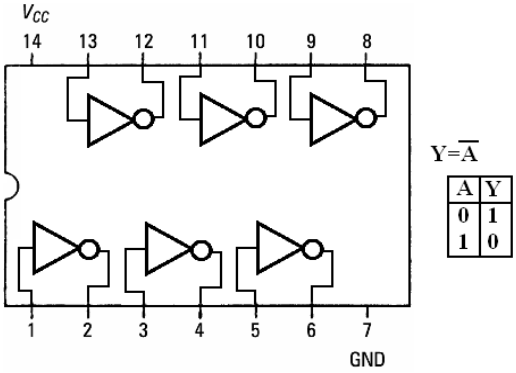
OR gate produces an output as 1, when any or all its inputs are 1; otherwise the output is 0. This gate can have minimum 2 inputs but output is always one. Its output is 0 when all input are 0.



IC 7432

iii) NOT Gate

NOT gate produces the complement of its input. This gate is also called an INVERTER. It always has one input and one output. Its output is 0 when input is 1 and output is 1 when input is 0.

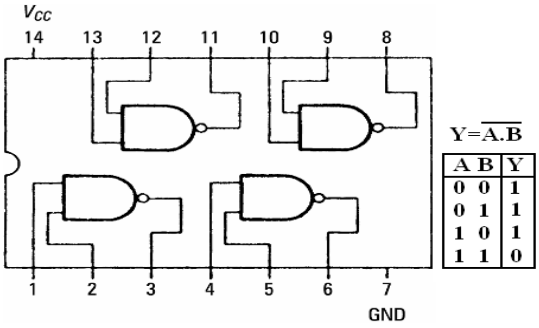


A	Y
0	1
1	0

IC 7404

iv) NAND Gate

NAND gate is actually a series of AND gate with NOT gate. If we connect the output of an AND gate to the input of a NOT gate, this combination will work as NOT-AND or NAND gate. Its output is 1 when any or all inputs are 0, otherwise output is 1.

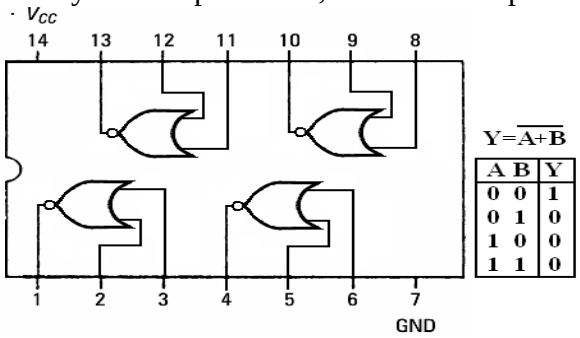


A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

IC 7400

v) NOR Gate

NOR gate is actually a series of OR gate with NOT gate. If we connect the output of an OR gate to the input of a NOT gate, this combination will work as NOT-OR or NOR gate. Its output is 0 when any or all inputs are 1, otherwise output is 1.

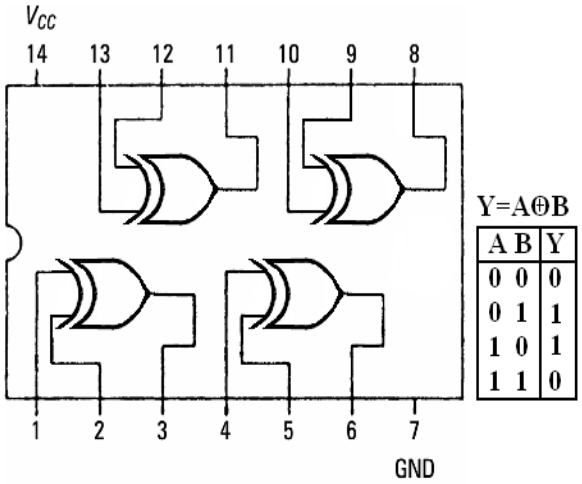


A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

IC 7402

vi) Exclusive OR (X-OR) Gate

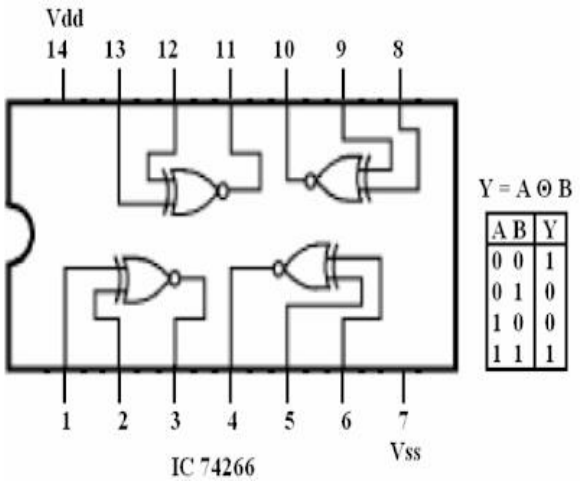
X-OR gate produces an output as 1, when number of 1's at its inputs is **odd**, otherwise output is 0. It has two inputs and one output.



IC 7486

vii) Exclusive NOR (X-NOR) Gate

X-NOR gate produces an output as 1, when number of 1's at its inputs is **not odd**, otherwise output is 0. It has two inputs and one output.



Procedure:

1. Connect the trainer kit to ac power supply.
2. Connect the inputs of any one logic gate to the logic sources and its output to the logic indicator.
3. Apply various input combinations and observe output for each one.
4. Verify the truth table for each input/ output combination.
5. Repeat the process for all other logic gates.
6. Switch off the ac power supply.

POST-LAB QUESTIONS

1. Name the universal Gates?

The NOR gate and NAND gate are universal logic gates.

2. Deduce the logic of AND gate using NAND and NOR?

AND USING NAND: Connect a NOT using NAND at the output of the NAND to invert it and get AND logic.
AND USING NOR: Connect two NOT using NORs at the inputs of NOR to get AND logic.

3. What is the symbol of NAND gate?

The logic NAND function is given by the Boolean expression $Y=A.\overline{B}$. Here A, B are the inputs and Y is the output.

4. How many NAND gates are required to make an OR gate?

Three NAND gates are required to make an OR gate.

5. How many NOR gates are required to implement a NAND gate?

Four NOR gates are required to implement a NAND gate.