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	: RA2011003010968
Date of Experiment	: 05-01-2021

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.

- 7400 Quad 2 input NAND gates.
- 7402 Quad 2 input NOR gates.
- 7404 Hex NOT gates (Inverters)
- 7408 Quad 2 input AND gates.
- 7432 Quad 2 input OR gates.
- 7486 Quad 2 input XOR gates.
- 747266 Quad 2 input XNOR gates.
- 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

4. How does a NOR gate work?

The NOR gate is a digital logic gate that implements logical NOR - it behaves according to the truth table to the right.

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

Ex-OR – Q = (A + B)

Ex-NOR - Q = A $\oplus$ B = (A.B) + (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.**

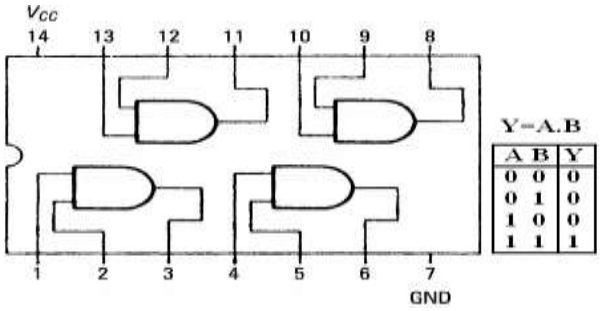
Aim: To verify the Boolean expression using logic gates.

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

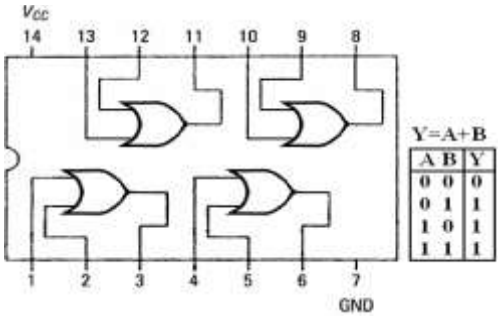
AND gate produces an output as 1, when all its inputs are 1; otherwise the output is 0. This gate can have minimum 2 inputs but output is always one. Its output is 0 when any input is 0.



IC 7408

ii) OR Gate

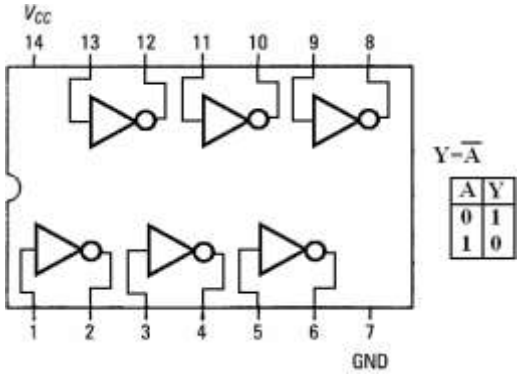
OR gate produces an output as 1, when any or all its inputs are 1; otherwise the output is 0. This gate can have minimum 2 inputs but output is always one. Its output is 0 when all input are 0.



IC 7432

iii) NOT Gate

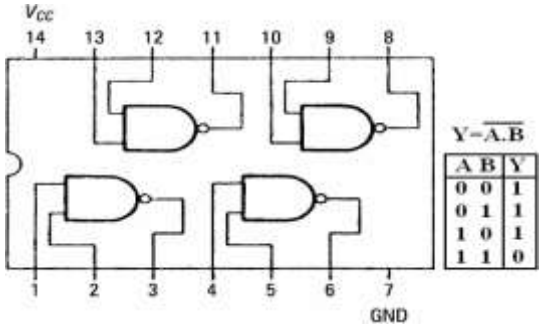
NOT gate produces the complement of its input. This gate is also called an INVERTER. It always has one input and one output. Its output is 0 when input is 1 and output is 1 when input is 0.



IC 7404

iv) NAND Gate

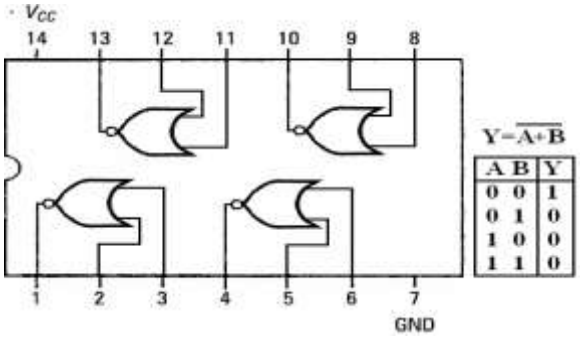
NAND gate is actually a series of AND gate with NOT gate. If we connect the output of an AND gate to the input of a NOT gate, this combination will work as NOT-AND or NAND gate. Its output is 1 when any or all inputs are 0, otherwise output is 1.



IC 7400

v) NOR Gate

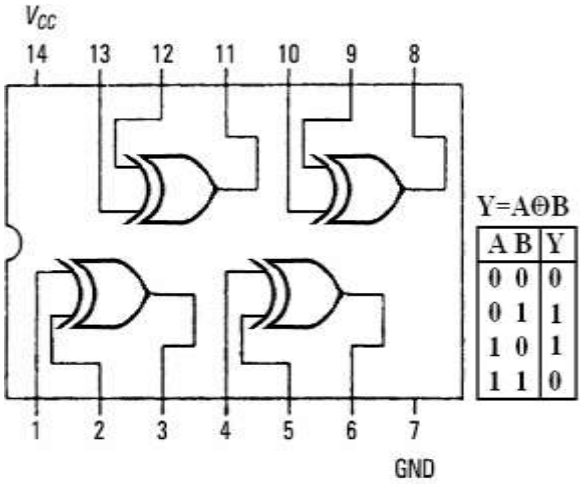
NOR gate is actually a series of OR gate with NOT gate. If we connect the output of an OR gate to the input of a NOT gate, this combination will work as NOT-OR or NOR gate. Its output is 0 when any or all inputs are 1, otherwise output is 1.



IC 7402

vi) Exclusive OR (X-OR) Gate

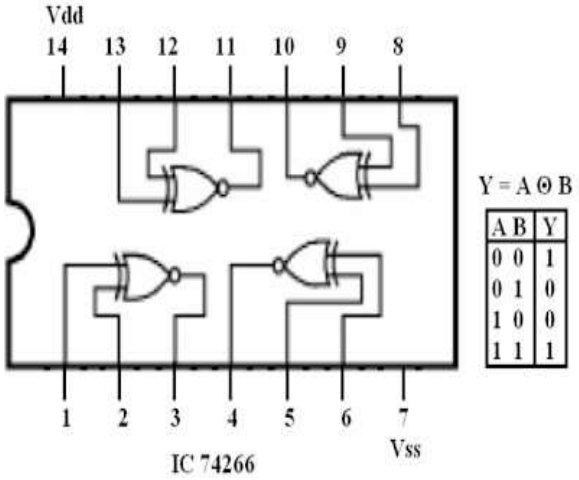
X-OR gate produces an output as 1, when number of 1's at its inputs is **odd**, otherwise output is 0. It has two inputs and one output.



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.



IC 74266

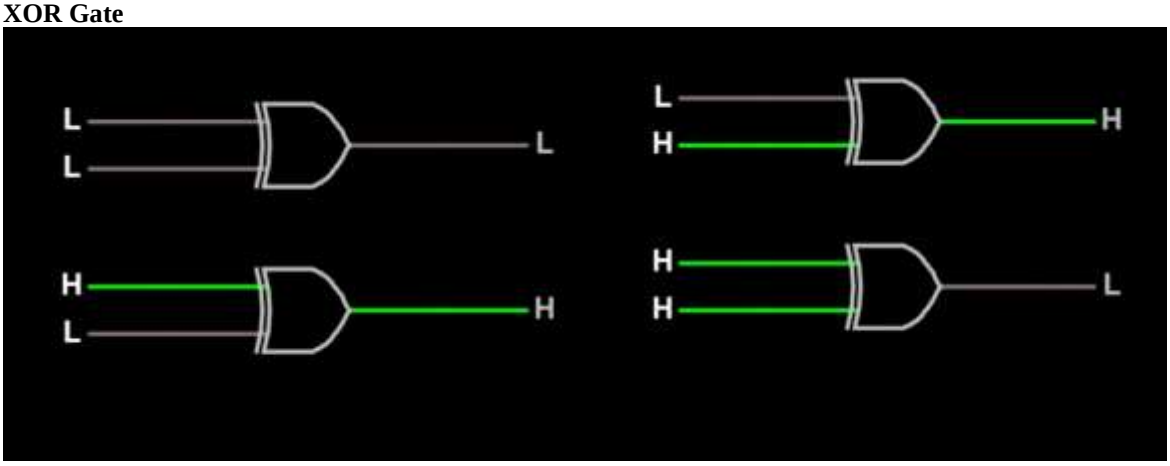
Procedure:

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.

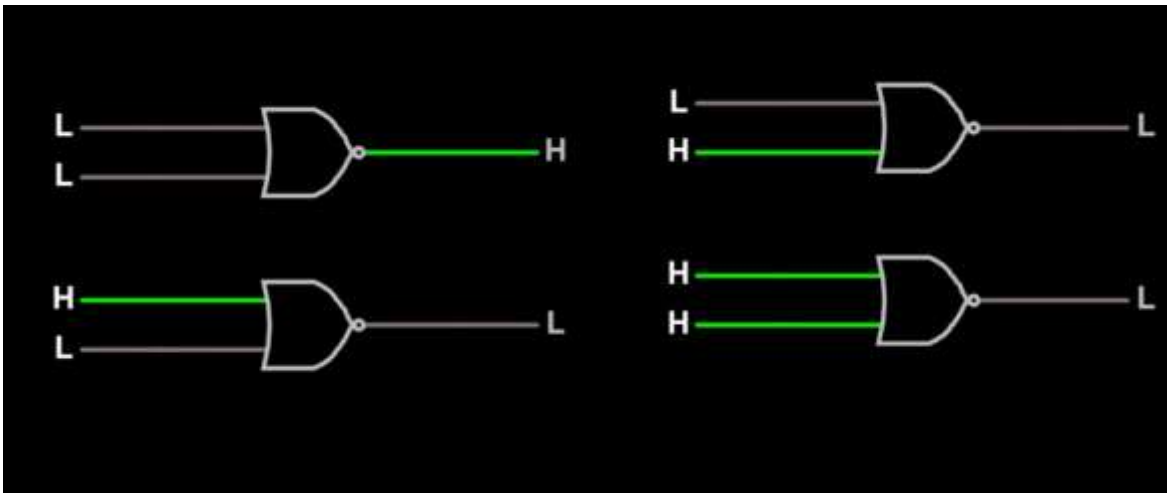
Circuit Diagram:

OR Gate

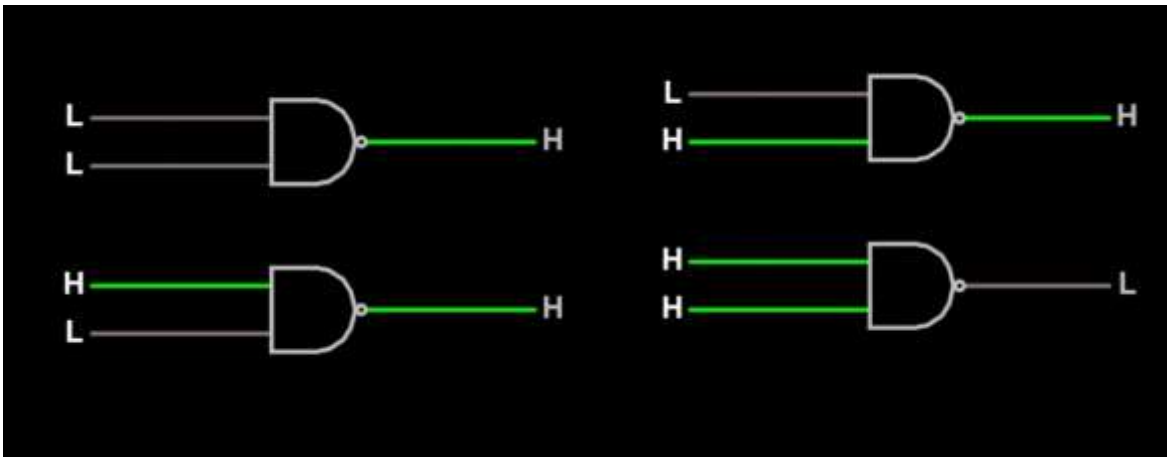
XOR Gate



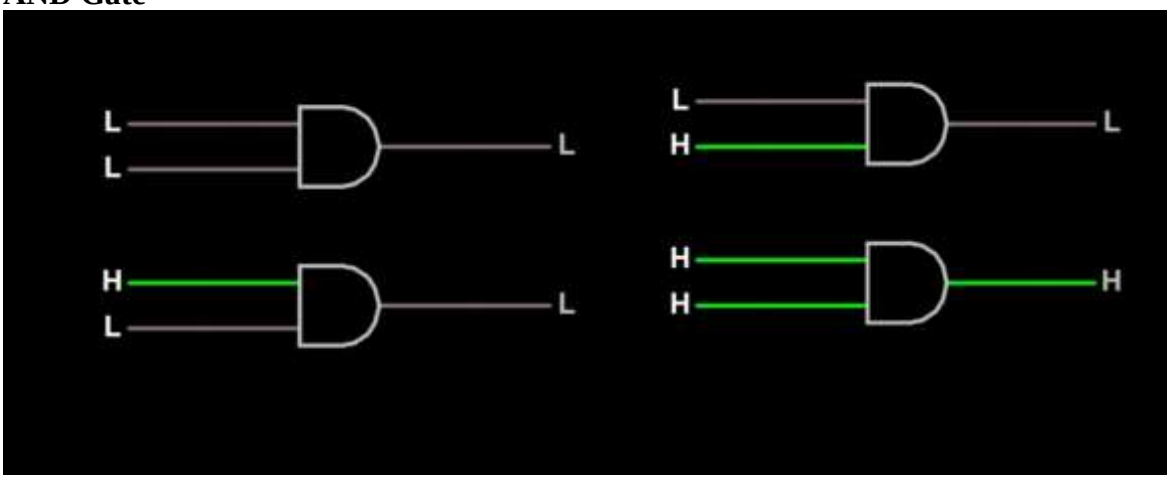
NOR Gate



NAND Gate



AND Gate



POST-LAB QUESTIONS

1. Name the universal Gates?

A universal gate is a gate which can implement any Boolean function without need to use any other gate type.

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

i) AND Gate: The output state of a digital logic AND gate only returns "LOW" again when ANY of its inputs are at a logic level "0". In other words for a logic AND gate, any LOW input will give a LOW output.

ii) NAND Gate: The NAND (Not – AND) gate has an output that is normally at logic level "1" and only goes "LOW" to logic level "0" when ALL of its inputs are at logic level "1". The Logic NAND Gate is the reverse or "Complementary" form of the AND gate.

iii) NOR Gate: The inclusive NOR (Not-OR) gate has an output that is normally at logic level "1" and only goes "LOW" to logic level "0" when ANY of its inputs are at logic level "1". The Logic NOR Gate is the reverse or "Complementary" form of the inclusive OR gate.

3. What is the symbol of NAND gate?

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