University of Engineering and Technology Peshawar

Digital Logic Design (DLD)

LAB # 02

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Submitted by: **FAWAD ALI**

Registration No: **19PWCSE1845**

Semester: **3rd**

Class Section: **C**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: ______________

Submitted to:

Engr. Rehmat Ullah

DEPARTMENT OF COMPUTER SYSTEMS ENGINEERING

STUDY OF BASIC GATES

Objectives:

- To know about the logic gates.
- To know about the logical operation, logical symbol of the gates.
- Verify the truth table of logic gates when they use power supply then output shows in LED.
- Haw to use the ICs of the logic gates.

Equipment:

Dc power supply

Components:

ICs of the all gates

Breadboard

Wires

LEDs

DIP Switch

Theory:

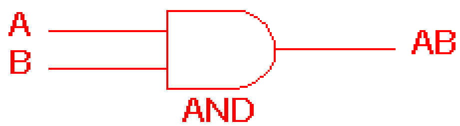
Introduction:

Digital circuits makeup the cornerstone of modern computational hardware. By representing binary digits (i.e. {0,1}) with voltage levels, digital circuits are able to process binary numbers electronically. Logic gates are the fundamental components within digital circuits so understanding their behavior is important. Therefore, the purpose of this experiment is to introduce you to gate behavior and logic interpretation as well as the basics of circuit wiring and troubleshooting. To do so, we will explore the function of several of the basic logic gates discussed.

Logic Gates:

Logic gates are the basic building blocks of any digital system. It is an electronic circuit having one or more than one input and only one output. The relationship between the input and the output is based on a certain logic. Based on this, logic gates are named as AND gate, OR gate, NOT gate etc.

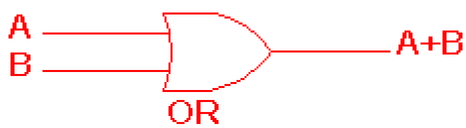
AND gate:



2 Input AND gate		
A	B	A.B
0	0	0
0	1	0
1	0	0
1	1	1

The AND gate is an electronic circuit that gives a high output (1) only if all its inputs are high. A dot (.) is used to show the AND operation i.e. A.B. Bear in mind that this dot is sometimes omitted i.e. AB

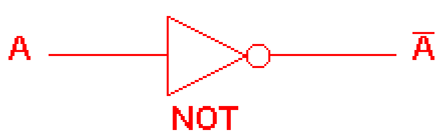
OR gate:



2 Input OR gate		
A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

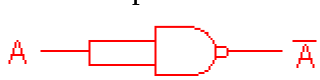
The OR gate is an electronic circuit that gives a high output (1) if one or more of its inputs are high. A plus (+) is used to show the OR operation.

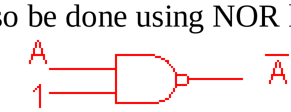
NOT gate:



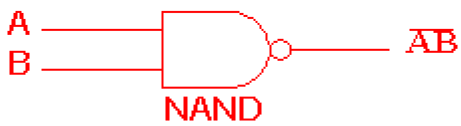
NOT gate	
A	$\overline{A}$
0	1
1	0

The NOT gate is an electronic circuit that produces an inverted version of the input at its output. It is also known as an inverter. If the input variable is A, the inverted output is known as NOT A. This is also shown as A', or A with a bar over the top, as shown at the outputs. The diagrams below show two ways that the NAND logic gate can be configured to produce a NOT gate. It can also be done using NOR logic gates in the same way.





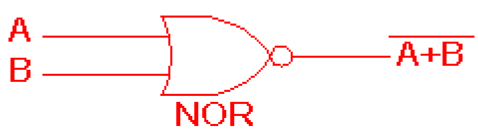
NAND gate:



2 Input NAND gate		
A	B	$\overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

This is a NOT-AND gate which is equal to an AND gate followed by a NOT gate. The outputs of all NAND gates are high if any of the inputs are low. The symbol is an AND gate with a small circle on the output. The small circle represents inversion.

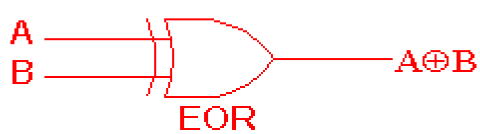
NOR gate:



2 Input NOR gate		
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

This is a NOT-OR gate which is equal to an OR gate followed by a NOT gate. The outputs of all NOR gates are low if any of the inputs are high. The symbol is an OR gate with a small circle on the output. The small circle represents inversion.

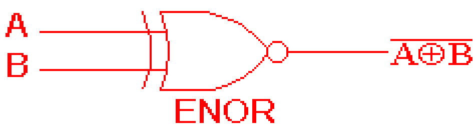
XOR gate:



2 Input EXOR gate		
A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

The 'Exclusive-OR' gate is a circuit which will give a high output if either, but not both, of its two inputs are high. An encircled plus sign ($\oplus$) is used to show the EOR operation.

XNOR gate:



2 Input EXNOR gate		
A	B	$\overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

The 'Exclusive-NOR' gate circuit does the opposite to the EOR gate. It will give a low output if either, but not both, of its two inputs are high. The symbol is an EXOR gate with a small circle on the output. The small circle represents inversion.

Ics 7400 series of logic Gates:

Logic gates are constructed from transistors, which are analog switches. These transistors can be forced to operate in two modes, namely ”ON” or ”OFF.” In doing so, we can abstractly think of electronic signals within a digital circuit as being either HIGH or LOW (i.e. ’1’ or ’0’). A digital gate takes as input one or more digital signals and outputs a digital signal as a result of a boolean operation. Figure 1 depicts the standard logic gate symbols and their associated boolean operation.

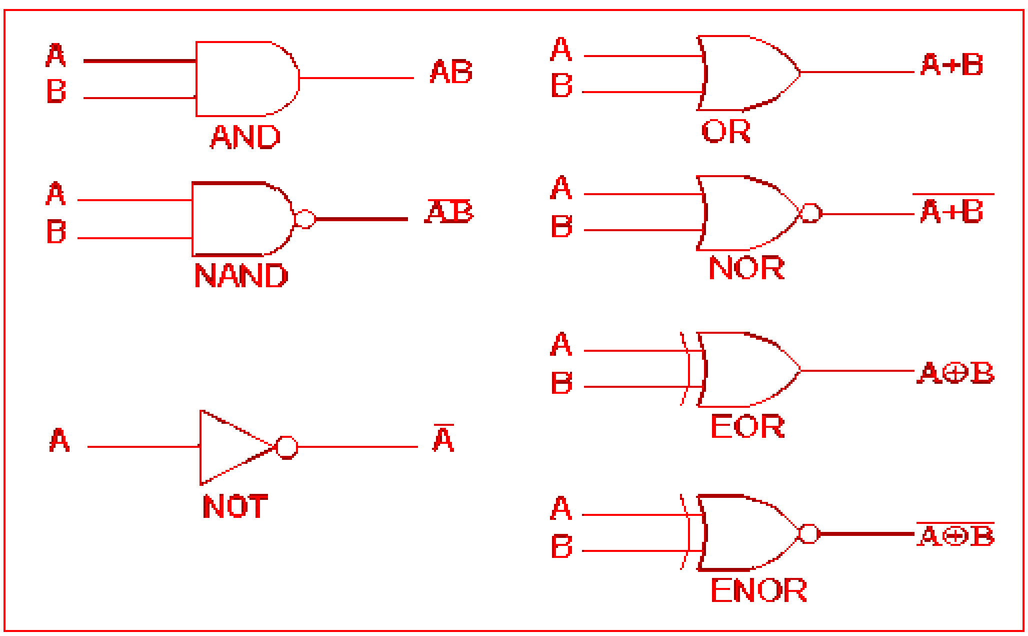


Figure 1: Logic Gates

The basic gates you will study in lecture are available in a series of Integrated Circuits (ICs) commonly referred to as the “7400” series. Within this series, there are various IC package types available; however, for bread-boarding digital circuits in the laboratory, we will use the Dual-Inline Package (DIP) type as shown

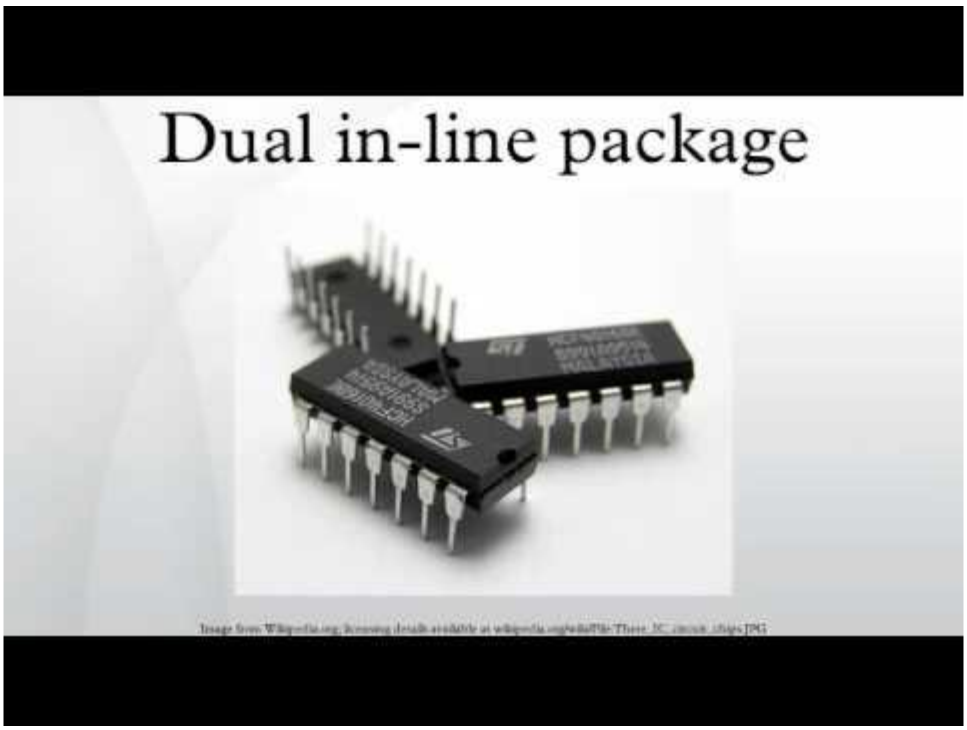


Figure 2: Dual-Inline Package

in Figure 2. As shown, the DIP features a black plastic package with pins on both sides, slightly resembling a flat caterpillar. Figure 3 shows the DIP pinout diagrams for the all gates.

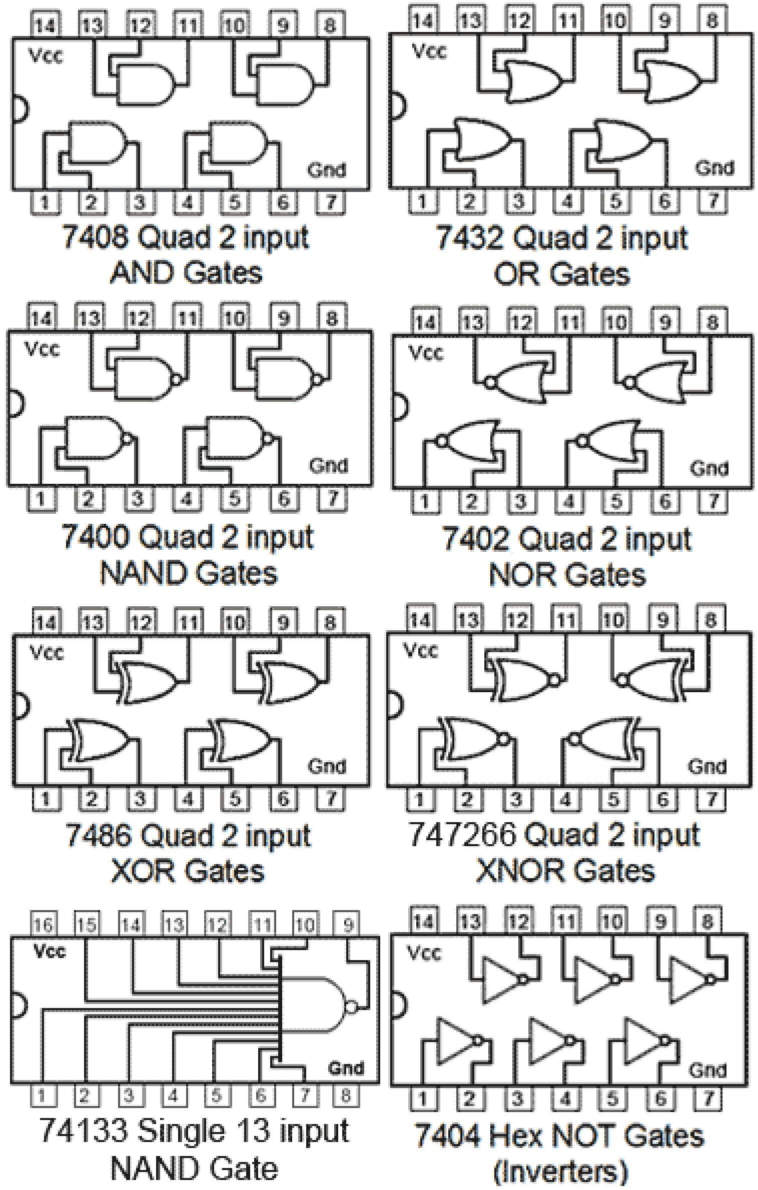


Figure 3: All gates Pinout Diagrams

DIP Switch:

DIP is short for Dual In-Line Package. They are designed to be mounted on printed circuit boards and are commonly used to customize the behavior of an electronic device for specific situations.

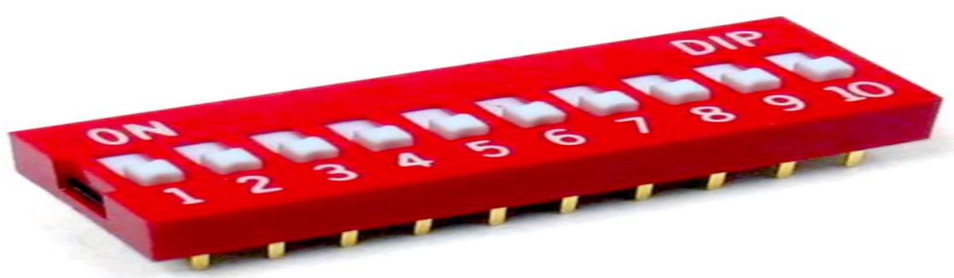
DIP switch refers to a set of electrical switches packaged in a small box or housing, which are arranged in a line or circle (rotary DIP). The function is to provide a range of electrical inputs to an electronic device based on the position of the individual switches within the line or circle.

DIP switches are an alternative to jumper blocks. Their main advantages are the ability to quickly change positions and the fact there are no parts to lose. In recent times DIP switches have lessened in popularity due to the rise of easily customizable software configurations.

However, they are still used for a variety of functions, especially within industrial equipment. They provide an inexpensive solution for circuit design, with the convenience of checking their configurations without the system being turned on.

Some common uses fo the DIP switch include:

- PC Expansion Cards
- Motherboards
- Arcade Game Machines
- Garage Door Openers
- Remote Controls



Procedure:

Note: Do not connect Power (RED) and Ground (Black) together. This will cause a short.

1. We set the power supply.
2. Put the ICs in breadboard which we know that the ICs have 14 pins. The 7^{th} number pin is connect to the ground or 0v and the 14^{th} number pins is Vcc connect to the 5v.
3. We show the figure 3 the input in output of the all ICs pinout diagram.
4. We can verify the above truth table so 0 is low voltage apply 0v in the 1 is high voltage apply 5 volt.
5. Give various combinations of inputs and note down the output with help of LED for all gates one by one.
6. Observe the output and verify the truth tables for all gate.

We can see the below image to set the ICs in breadboard in can verify by LEDs.

Observation and Calculation:

We apply zero volt in 0 and 5 volt apply in 1 to check the output by LED. When the LED is on the output in 1 and the LED is off the output is 0.

Table 1: Truth Table for AND Gate (7408)

Input		Output
x	y	Z = x.y
0	0	0
0	1	0
1	0	0
1	1	1

Table 2: Truth Table for OR Gate (7432)

Input		Output
x	y	Z = x+y
0	0	0
0	1	1
1	0	1
1	1	1

Table 3: Truth Table for XOR Gate (7486)

Input		Output
x	y	Z = xy
0	0	0
0	1	1
1	0	1
1	1	0

Table 4: Truth Table for NAND Gate (7400)

Input		Output
x	y	$Z = \overline{x}.\overline{y}$
0	0	1
0	1	1
1	0	1
1	1	0

Table 5: Truth Table for NOR Gate (7402)

Input		Output
x	y	$Z = \overline{x}+\overline{y}$
0	0	1
0	1	0
1	0	0
1	1	0

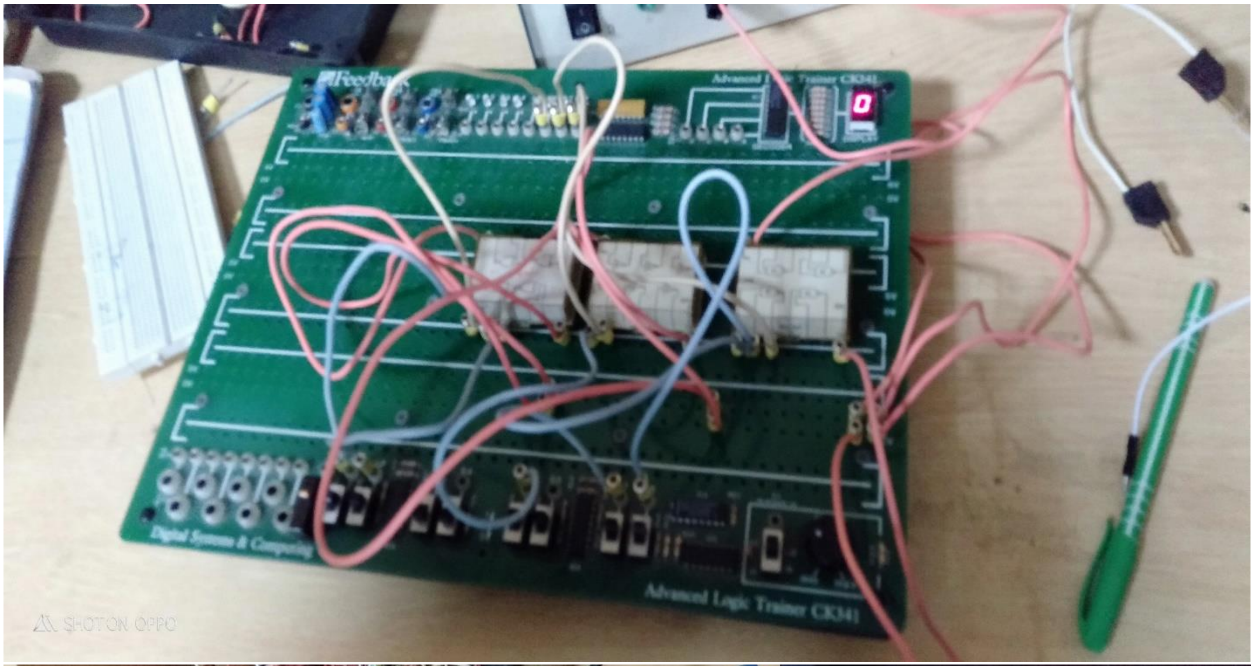
Table 6: Truth Table for XNOR (747266)

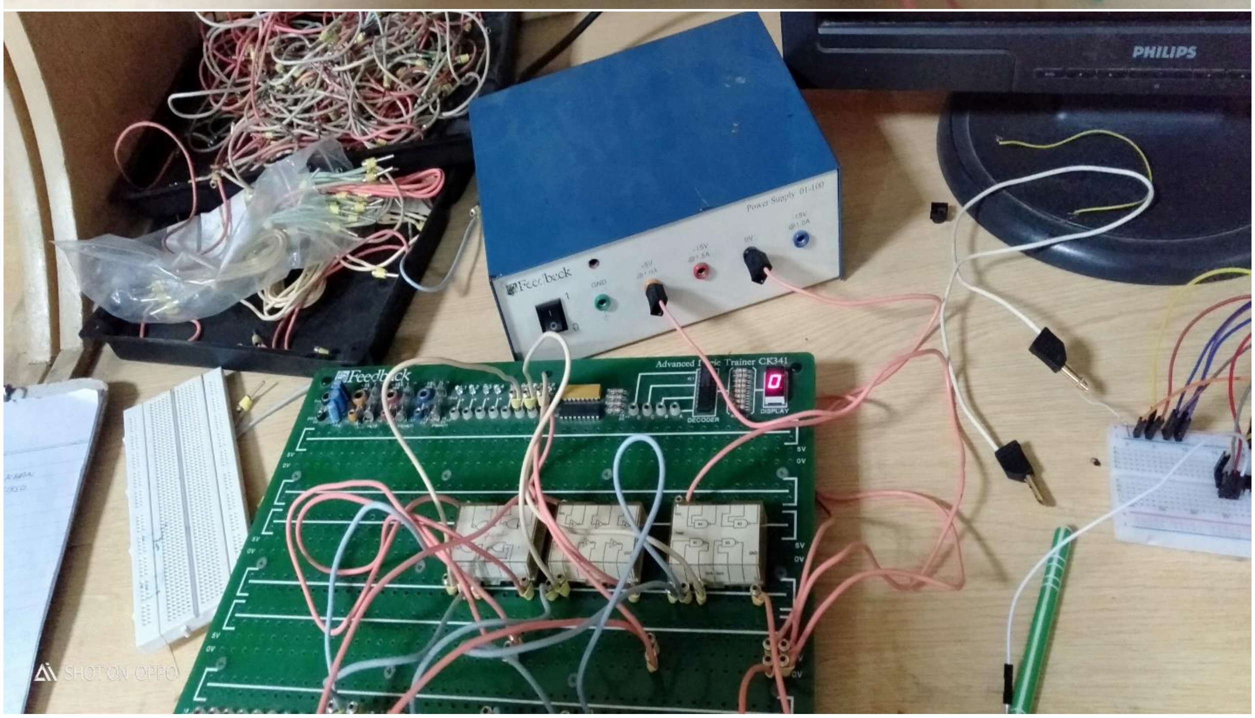
Input		Output
x	y	$Z = \overline{xy}$
0	0	1
0	1	0
1	0	0
1	1	1

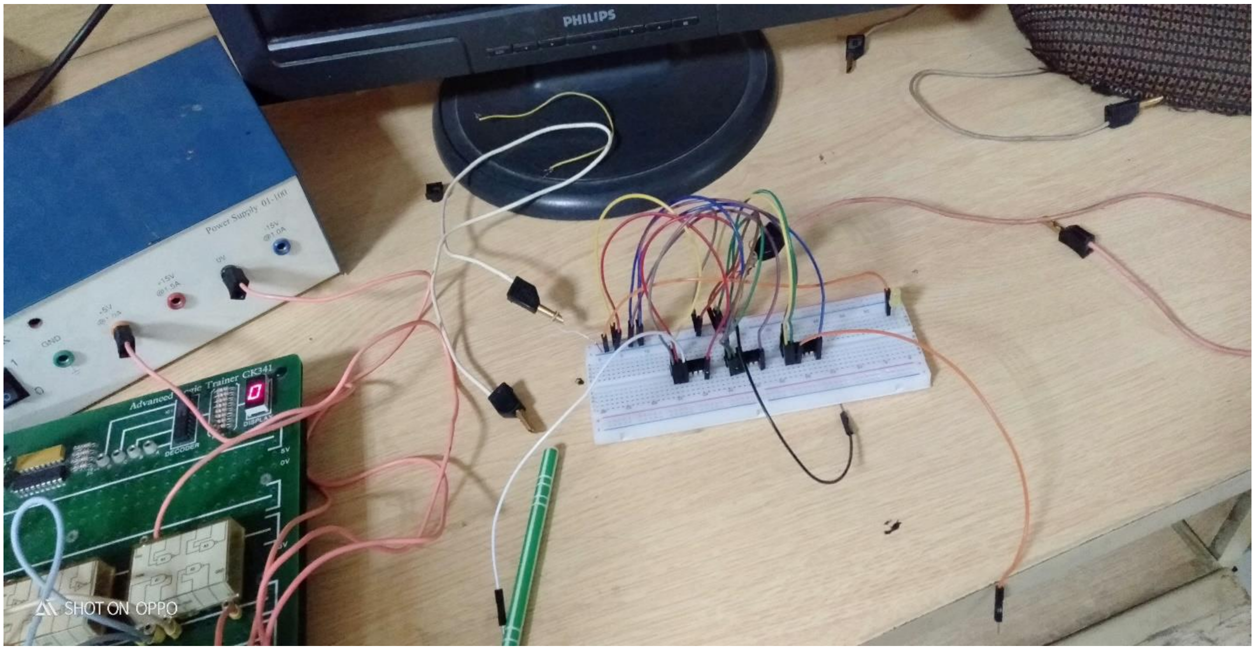
Table 7: Truth Table for NOT Gate (7404)

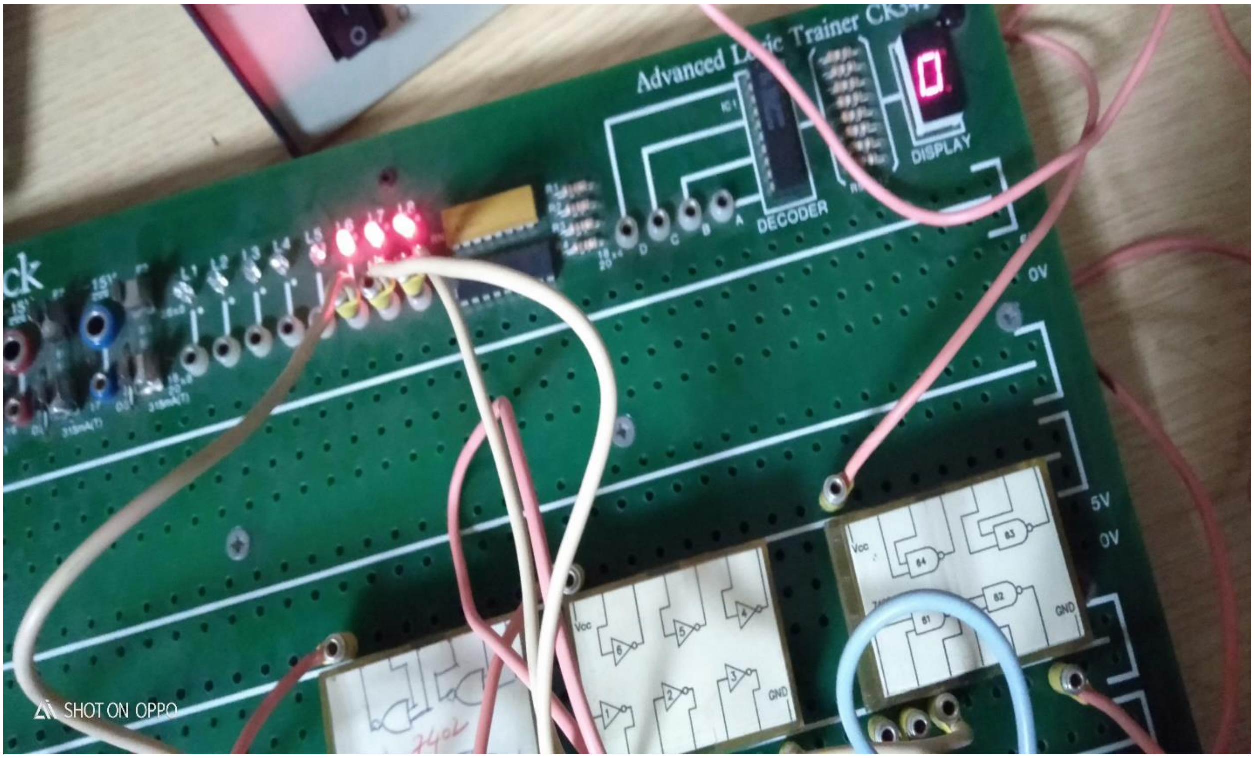
Input	Output
x	$\overline{x}$
0	1
1	0

The image shot on the time of experiment in the lab:









CONCLUSION:

Thus all basic gates are studied. When we shows the above all truth tables in all image to verify the truth tables.