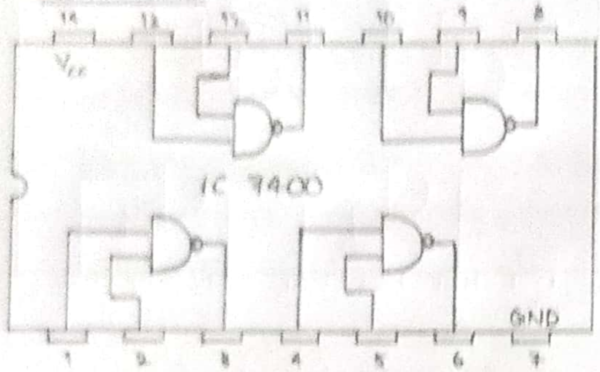
Pin Diagrams & Truth Tables

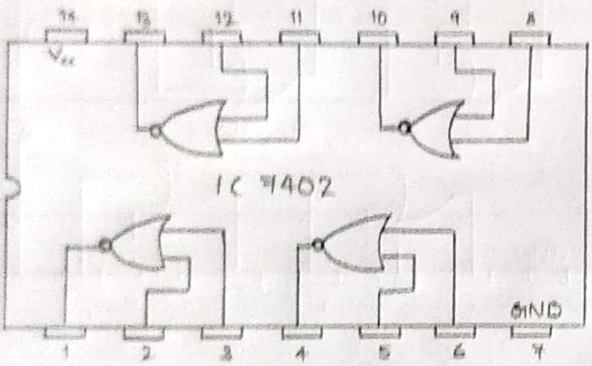
IC 7400



Quad 2 Input NAND Gate

Inputs		Output
A	B	
0	0	1
0	1	1
1	0	1
1	1	0

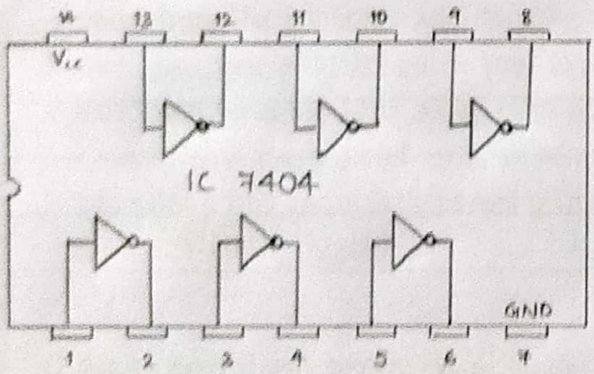
IC 7402



Quad 2 Input NOR Gate

Inputs		Output
A	B	
0	0	1
0	1	0
1	0	0
1	1	0

IC 7404



Hex Single Input NOT Gate

Input	Output
0	1
1	0

Date 28/1/19

Expt. No. 1 — BASIC GATES AND UNIVERSAL GATES — Page No. 3

Aim

1. To familiarize and verify the truth tables of basic gates and universal gates.
2. To implement basic gates using universal gates

Components Required

IC 7400, IC 7402, IC 7404, IC 7408, IC 7410, IC 7411, IC 7432, IC 7486 and connecting wires.

Theory

In electronics, a logic gate is an idealized or physically implemented device implementing a boolean function, i.e., it performs a logical operation on one or more binary inputs and produces a single binary output.
Logic gates are primarily implemented using diodes or transistors acting as electronic switches, but can also be constructed using vacuum tubes, electromagnetic relays, fluidic logic, pneumatic logic, optics, molecules or even mechanical elements.
Logic circuits include devices such as multiplexers, registers, arithmetic logic units and computer memory, all the way up through complete microprocessors, which may contain more than 100 million gates.

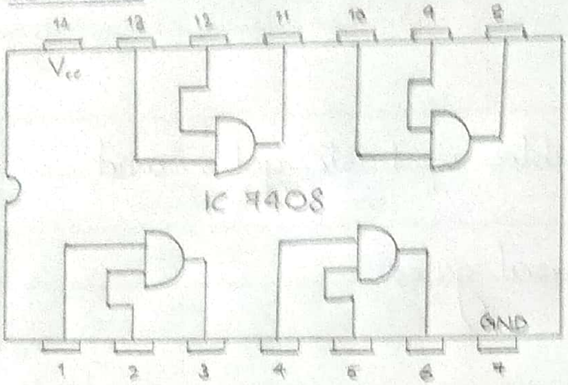
1. OR Gate

The output is high if any one of the inputs is high.
7432 is a logical 2 input OR gate IC.

$Y = A + B$

Teacher's Signature :

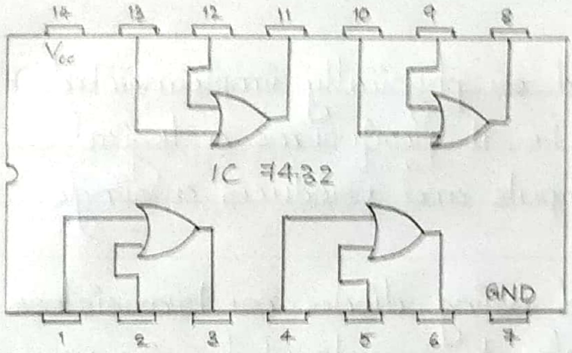
IC 7408



Inputs		Output
A	B	
0	0	0
0	1	0
1	0	0
1	1	1

Quad 2 Input AND Gate

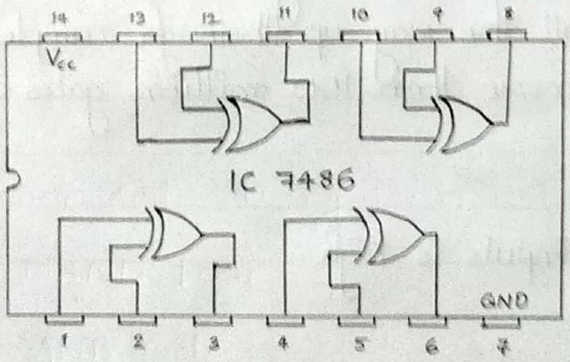
IC 7432



Inputs		Output
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

Quad 2 Input OR Gate

IC 7486



Inputs		Output
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

Quad 2 Input XOR Gate

2. NOT Gate

The gate acts like an inverter. The output is the complement of the input.
7404 is a single input NOT gate IC.

$Y = \overline{A}$

3. AND Gate

It gives a high output when all its inputs are high.
7408 is a logical 2 input AND gate IC

$Y = A \cdot B$

4. NOR Gate

This is a combination of OR and NOT gate.
7402 is a 2 input NOR gate IC.

$Y = \overline{A + B}$

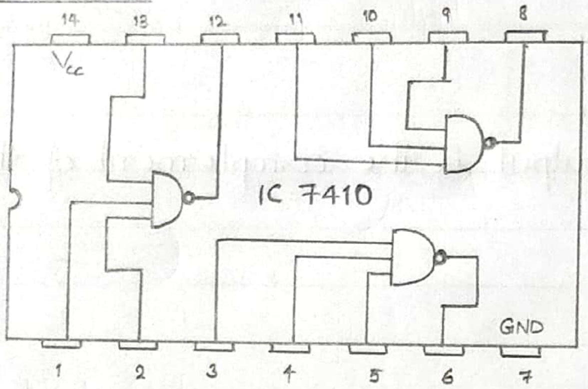
5. NAND Gate

7410 is a 3 input NAND gate IC.
7420 is a 4 input NAND gate IC.
7400 is a 4 input NAND gate IC.

$Y = \overline{A \cdot B}$

Teacher's Signature :

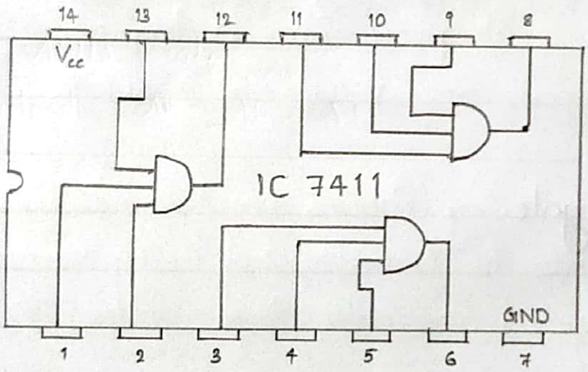
IC 7410



Triple 3 Input NAND Gate

Inputs			Output
A	B	C	
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

IC 7411



Triple 3 Input AND Gate

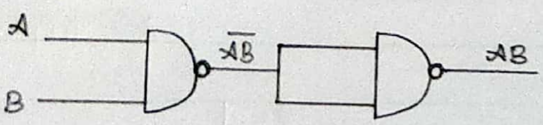
Inputs			Output
A	B	C	
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Basic Gates Using Universal Gates

NAND Logic

1. AND Gate

Output = $AB = \overline{\overline{AB}}$



A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

6. XOR Gate

The output is high if odd number of inputs is high.
7486 is an XOR gate IC.

$Y = A \oplus B$

Universal Gates

NOR gates alone or alternatively NAND gates alone can be used to reproduce the functions of all the other logic gates. Using these two gates, logic circuits of any complexity can be designed. Consequently, these two gates are called universal logic gates.

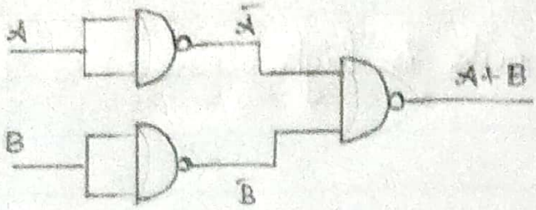
Procedure

1. Place the IC on the bread board.
2. Connect V_{cc} and ground (GND) to their respective pins.
3. Provide input from switch.
4. Connect the output of LED and verify the operation as per the truth table obtained.
5. Repeat these steps for different ICs taken.

Teacher's Signature :

2. OR Gate

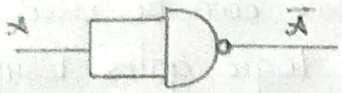
$A+B = \overline{\overline{A+B}} = \overline{\bar{A}\cdot\bar{B}} = \text{Output}$



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

3. NOT Gate

$\text{Output} = \bar{A}$

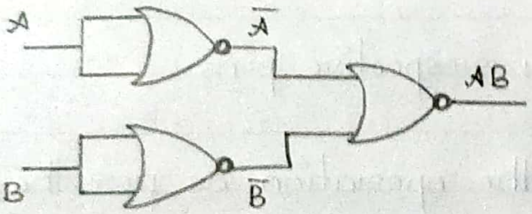


A	Output
0	1
1	0

NOR Logic

1. AND Gate

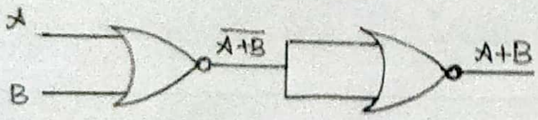
$\text{Output} = AB = \overline{\overline{AB}} = \overline{\bar{A}+\bar{B}}$



A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

2. OR Gate

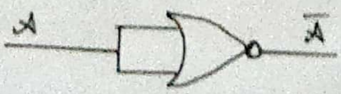
$\text{Output} = A+B = \overline{\overline{A+B}}$



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

3. NOT Gate

$\text{Output} = \bar{A}$



A	Output
0	1
1	0

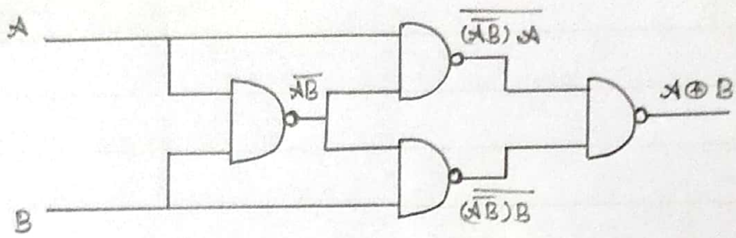
Scanned by CamScanner

XOR Gates Using Universal Gates

NAND Logic

$$Output = A \oplus B = A\bar{B} + \bar{A}B = \overline{\overline{A\bar{B} + \bar{A}B}} = \overline{\overline{(A\bar{B})} \cdot \overline{(\bar{A}B)}}$$

$$= \overline{\overline{(\overline{AB})A} \cdot \overline{(\overline{AB})B}}$$



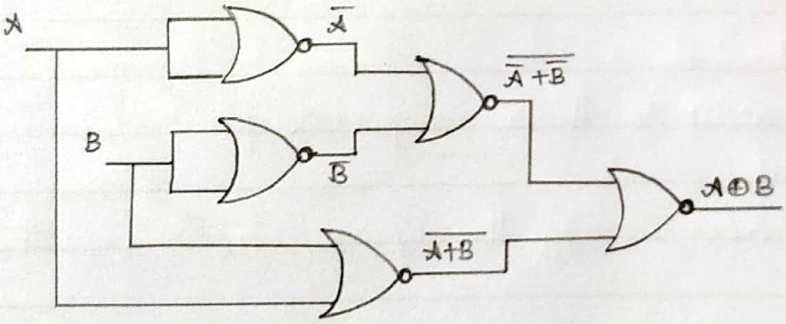
A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

NOR Logic

$$Output = A \oplus B = A\bar{B} + \bar{A}B = (A\bar{A} + A\bar{B}) + (\bar{A}B + B\bar{B})$$

$$= (\bar{A} + \bar{B})(A + B) = (\overline{AB})(\overline{\bar{A}\bar{B}}) = \overline{AB + \bar{A}\bar{B}}$$

$$= \overline{\overline{\overline{(A+A)} + \overline{(B+B)}} + \overline{(A+B)}}$$



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

Date 28/1/19

Expt. No. 1

Page No. 11

Result

1. Familiarized with and verified the truth tables of basic gates and universal gates.
2. Implemented basic gates using universal gates.

Teacher's Signature :