Electronics & Communication Engineering Department

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Delhi-NCR, Ghaziabad
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A+ NAAC GRADE

Computer Organization and Logic Design (COLD) Lab

(EC201P)

Lab Manual Presentations – Experiment Wise

By

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List of Experiments

S. No.	Experiment Name
1	Investigate logic behaviour of AND, OR, NOT, NAND, EX-OR, EX NOR Gates. Realization of Boolean Expressions using Gates and minimization using Karnaugh Map.
2	Design and verification of the truth tables of Half, Full adder.
3	Design and verification of truth table of decoder and multiplexer circuits.
4	Design and implement 1- bit magnitude comparator.
5	Verification of truth tables of SR, J-K, and D Flip-Flops.
6	Design and verify all types of Shift Registers.
7	Design and verify the 2-Bit Synchronous and Asynchronous Counter.
8	Design memory units (single bit RAM cell) and understand how it operates during read and write operation.

Experiment No.- 01

Investigate logic behaviour of AND, OR, NOT, NAND, EX-OR, EX NOR Gates. Realization of Boolean Expressions using Gates and minimization using Karnaugh Map

OBJECTIVE: Investigate logic behaviour of AND, OR, NOT, NAND, EX-OR, EX NOR Gates. Realization of Boolean Expressions using Gates and minimization using Karnaugh Map.

COMPONENTS REQUIRED: -

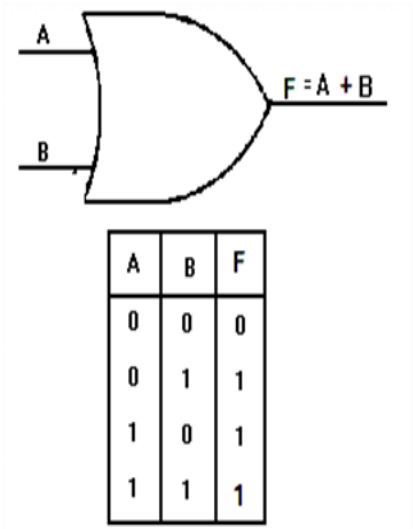
S. No.	Name of the Component	Specification
1	Bread board	
2	Connecting Wires	
3	NAND Gate	IC-7400
4	NOR Gate	IC-7402
5	NOT Gate	IC-7404
6	AND Gate	IC-7408
7	OR Gate	IC-7432
8	EX-OR Gate	IC-7486

THE OR GATE

The OR gate produces a HIGH output when any or all of the inputs is HIGH. The abbreviation for this gate is OR. When both inputs are LOW, the output is LOW. The operation function sign for the OR gate is +

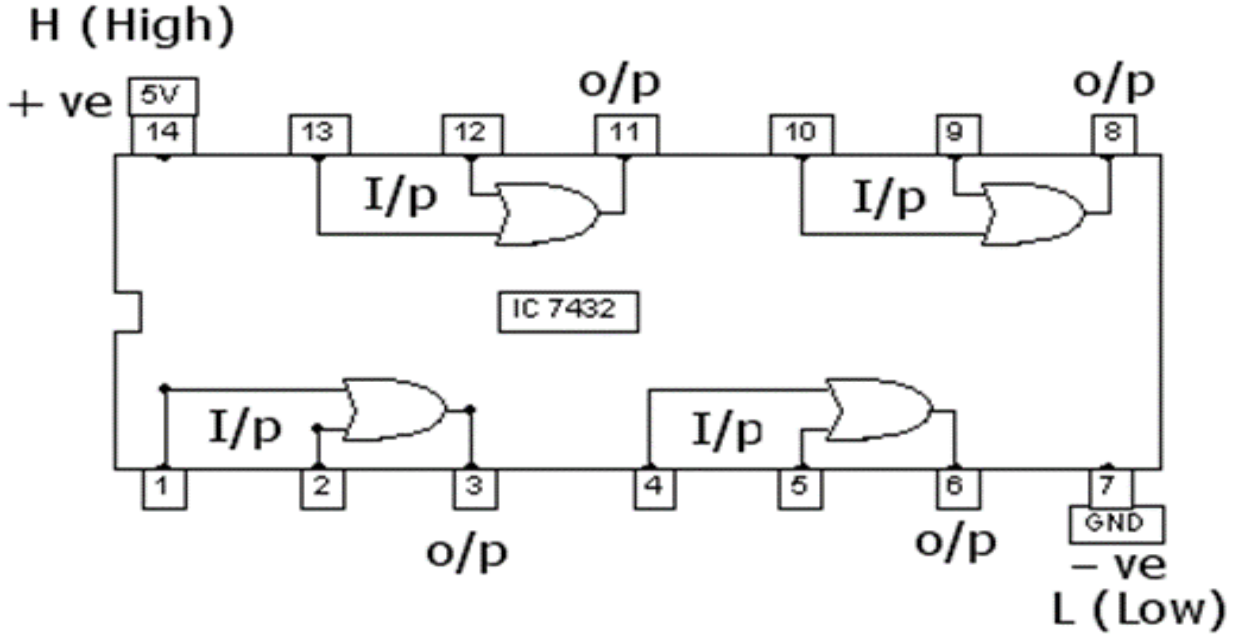
CIRCUIT DIAGRAM

The standard symbol for an OR gate is shown in figure below along with the associated Truth Table and pin diagram.



A	B	F
0	0	0
0	1	1
1	0	1
1	1	1

SYMBOL & TRUTH TABLE

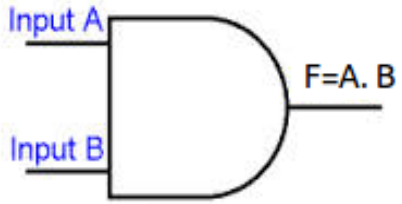


Pin Diagram of IC7432 (2-INPUT OR GATE)

THE AND GATE

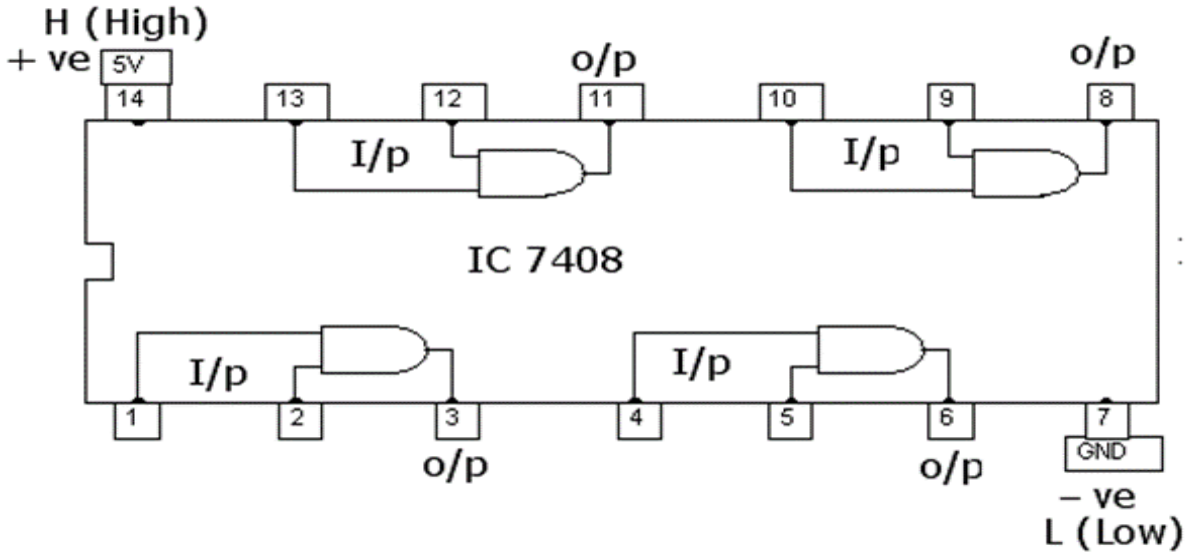
The AND gate produces a HIGH output when all of the inputs are HIGH. The abbreviation for this gate is AND and the operation is denoted by a dot (.). When any inputs are LOW, the output is LOW.

CIRCUIT DIAGRAM: The standard symbol for an AND gate is shown in figure below along with the associated Truth Table and pin diagram.



A	B	F= A. B
0	0	0
0	1	0
1	0	0
1	1	1

Symbol and Truth Table

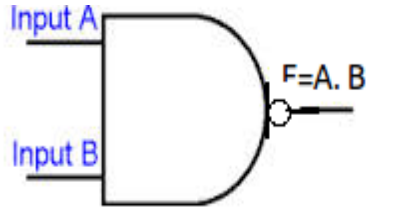


Pin diagram of IC 7408 (2-INPUT AND GATE)

THE NAND GATE

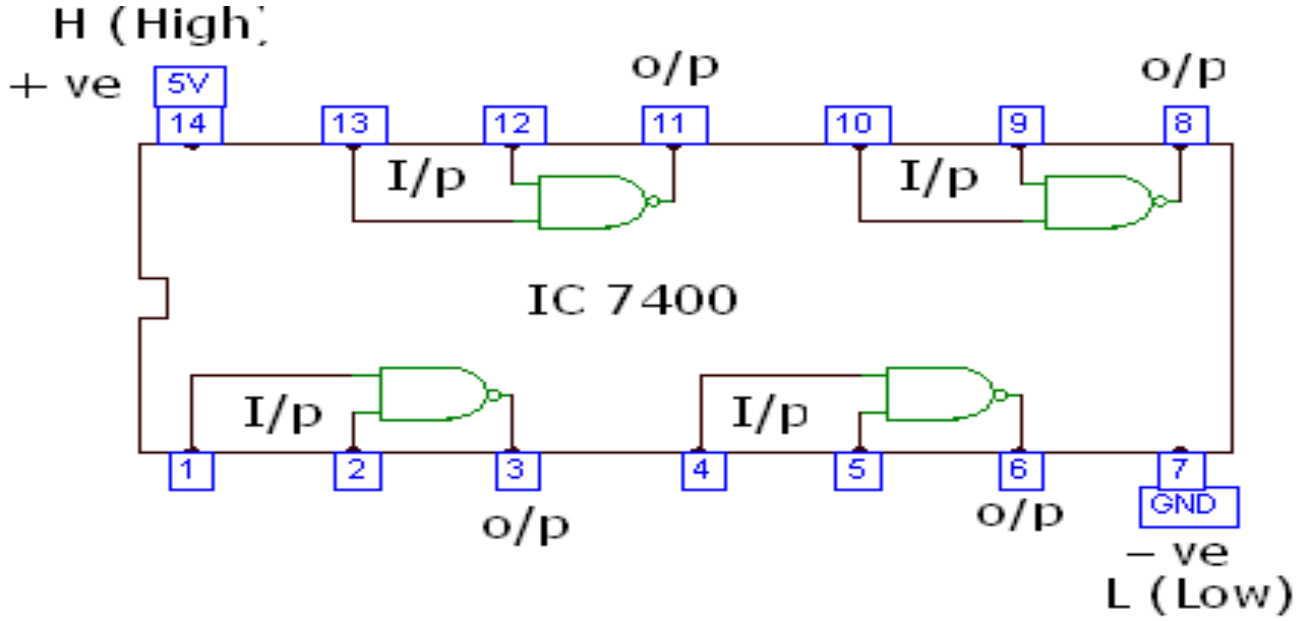
The NAND gate produces a LOW output when all of the inputs are HIGH. The abbreviation for this gate is NAND and is AND followed with NOT. When any inputs are LOW, the output is HIGH.

CIRCUIT DIAGRAM: The standard symbol for an NAND gate is shown in figure below along with the associated Truth Table and pin diagram.



A	B	F=A. B
0	0	1
0	1	1
1	0	1
1	1	0

SYMBOL & TRUTH TABLE GATE)

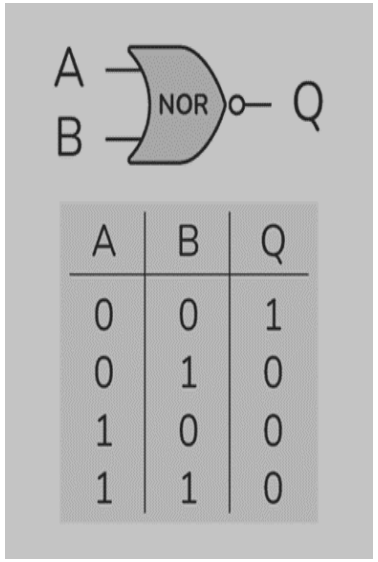


Pin Diagram of IC7400 (2-INPUT NAND)

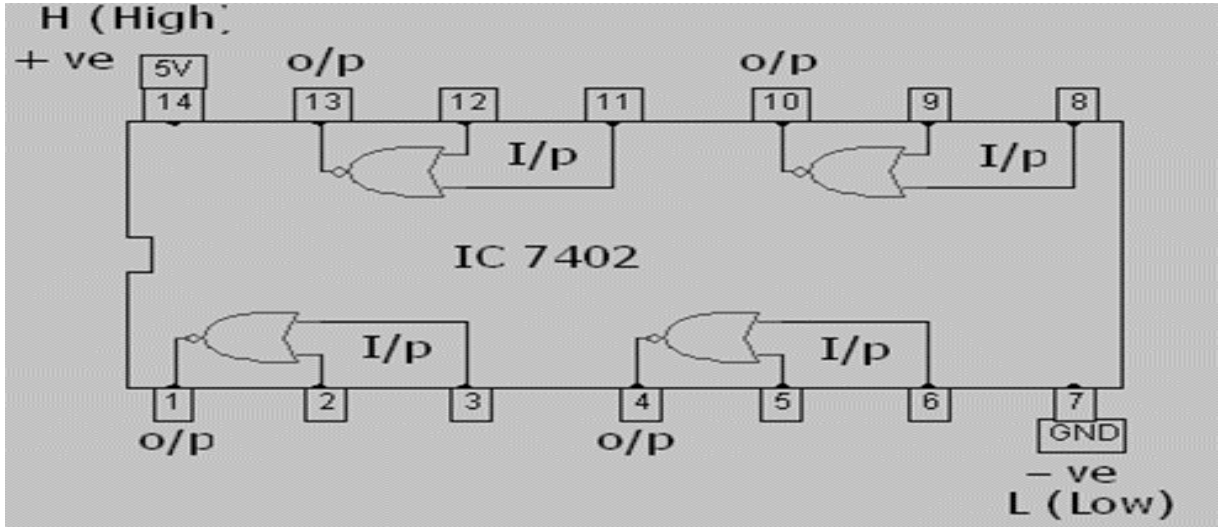
THE NOR GATE

The NOR gate produces a HIGH output when all of the inputs is LOW. When any or all its inputs are HIGH the output is LOW.

CIRCUIT DIAGRAM: The standard symbol for an NOR gate is shown in figure below along with the associated Truth Table and pin diagram. The operation function sign for the NOR gate is + inside a circle.



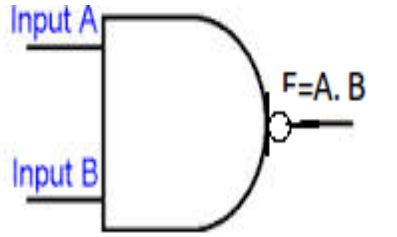
A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0



SYMBOL & TRUTH TABLE **Pin IC7402 (2-INPUT NOR GATE)**

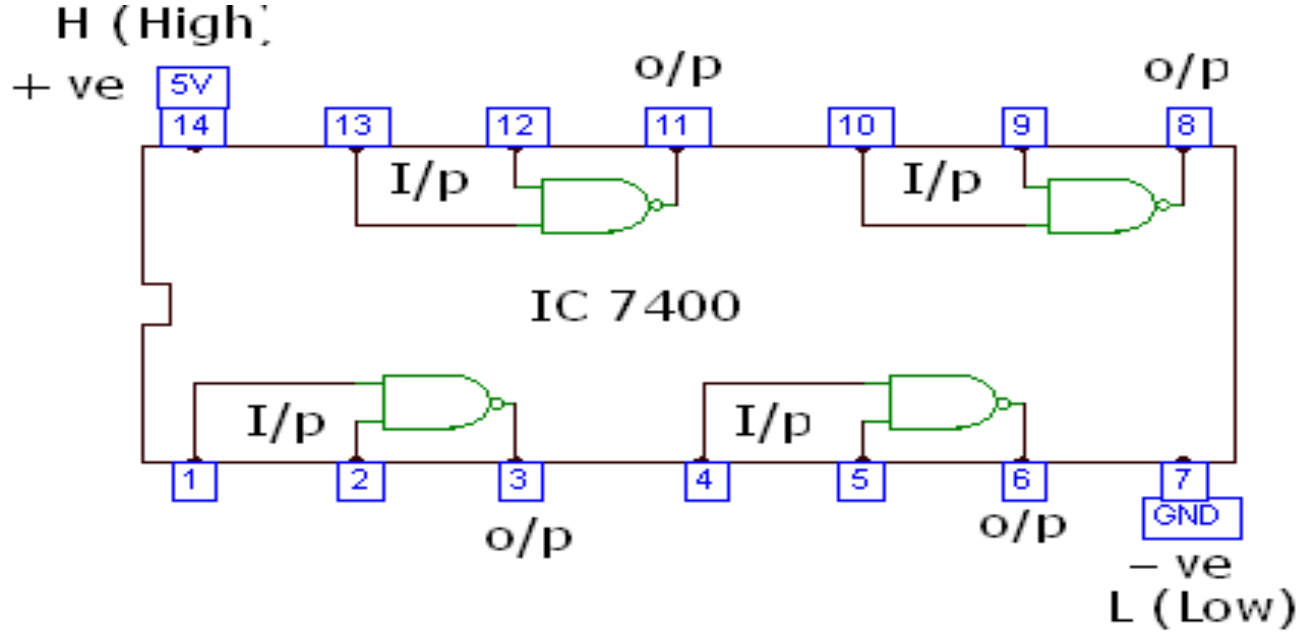
THE EXCLUSIVE OR GATE The exclusive OR gate is a modified OR gate that produces a HIGH output when only one of the inputs is HIGH. When both inputs are HIGH or when both inputs are LOW, the output is LOW.

CIRCUIT DIAGRAM: The standard symbol for an exclusive OR gate is shown in figure below along with the associated Truth Table and pin diagram.



A	B	F=A. B
0	0	1
0	1	1
1	0	1
1	1	0

SYMBOL & TRUTH TABLE



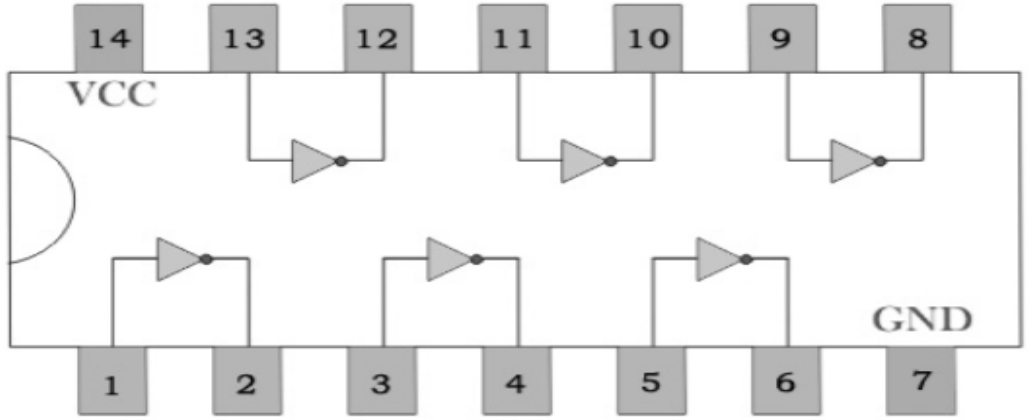
IC 7486 (2-INPUT XOR GATE)

THE NOT GATE (7404): The Simplest form of logic circuit is the INVERTER or NOT gate. It can have one input and one output terminal. It is defined as, whenever input is high then output is low and the vice-versa, or we can say that the inverter is a logic element whose output state is always opposite of its input state. Schematic Symbol is shown.

CIRCUIT DIAGRAM: The standard symbol for an NOT gate is shown in figure below along with the associated Truth Table and pin diagram.

A	Output
0	1
1	0

SYMBOL & TRUTH TABLE



IC 7486 (2-INPUT NOT GATE)

EXPERIMENT No- 1
(b)

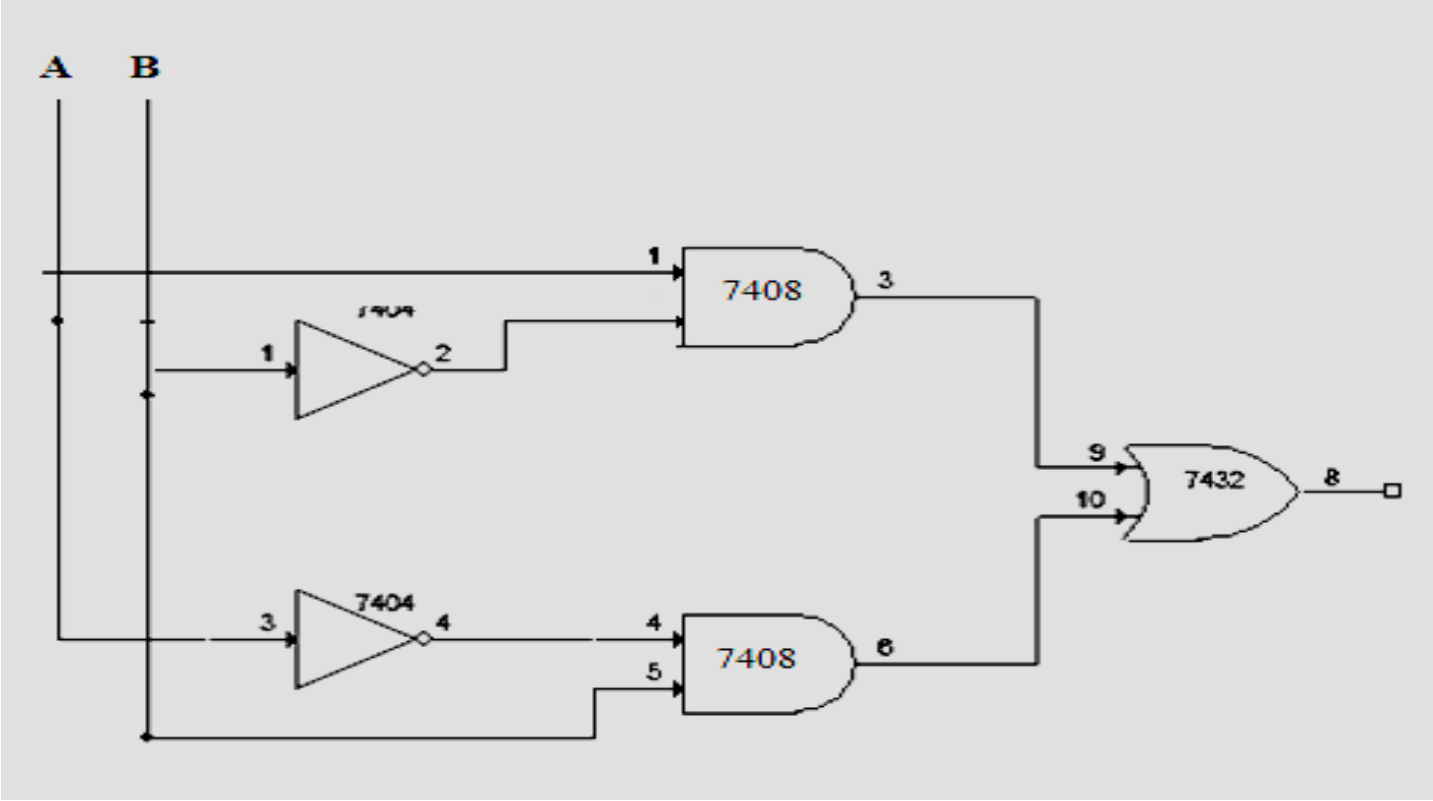
(a)Sum of product form (SOP) **(b) Product of sum form (POS)**

The sum of product form expression contains two or more AND terms which are OR together. Each AND term (product term) consists of one or more variables appearing either in complemented or in un-complemented form.

- **Sum of product form (SOP)**

CIRCUIT DIAGRAM:

S=AB'+A'B

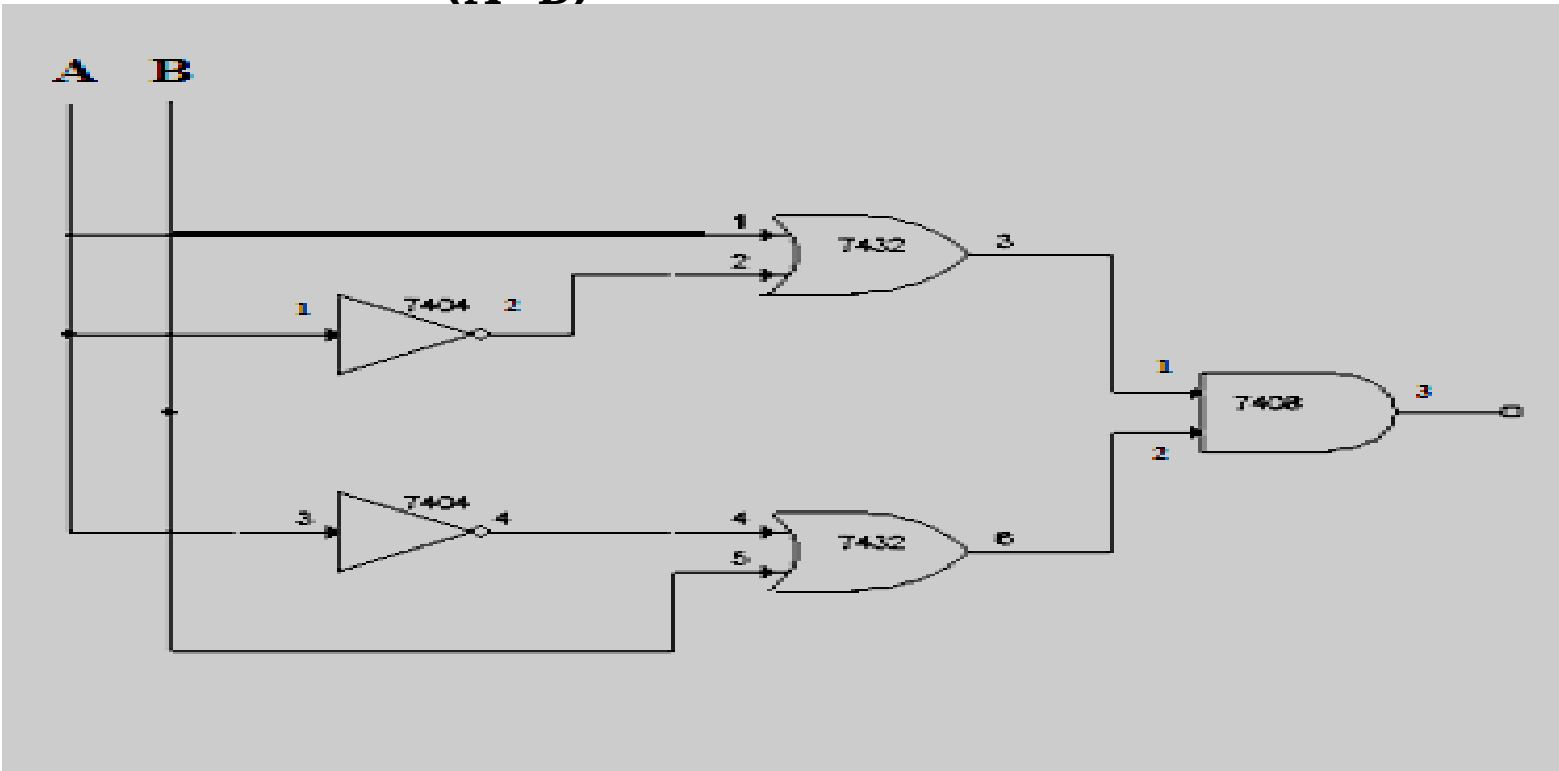


EXPERIMENT No- 1
(b)

- **PRODUCT OF SUM FORM (POS)**

CIRCUIT DIAGRAM:

For example: **S= (A+B').(A'+B)**



TRUTH TABLE OF SOP

.

Inputs		Outputs		
A	B	A B’	A’ B	F=AB’+A’B
0	0	0	0	0
0	1	0	1	1
1	0	1	0	1
1	1	0	0	0

TRUTHTABLE OF POS

Input		Outputs		
A	B	(A+B’)	(A’+B)	F=(A+B’) (A’+B)
0	0	1	1	1
0	1	0	1	0
1	0	1	0	0
1	1	1	1	1

RESULTS: Boolean Expressions using Gates are verified.

PRECAUTIONS:

- All Connections should be according to circuit diagram.
- Reading should be taken carefully.
- Switch off Power supply after completing the Experiment.

FUTURE APPLICATIONS:

- Advanced Control Systems:
- Artificial Intelligence and Machine Learning:
- Quantum Computing
- Internet of Things (IoT)
- Advanced Memory Systems

VIVA VOCE QUESTIONS & ANSWERS

[as per the placement requirement by technical core company]

Q1. Explain logic gates.

Ans:A logic gate is a basic digital circuit that performs a logical operation on one or more binary inputs and produces a single binary output (0 or 1).

Q2. Write the name of the basic logic gates.

Ans: AND, OR, NOT

Q3. Explain universal gates

Ans:NAND and NOR are universal gates because you can implement any logic gate using only NAND or only NOR gates.

Q4. Determine the output of an AND gate if all inputs are high (1).

Ans: 1

Q5. Write the Boolean expression for an OR gate with inputs A and B .

Ans: Y = A + B

VIVA VOCE QUESTIONS & ANSWERS
[as per the placement requirement by technical core company]

Q6. Determine the output of an XOR gate when both inputs are the same.
Ans: 0

Q7. Write the Boolean expression for XOR gate.
Ans: Y= xy' + x'y

Q8. Write the Boolean expression for a NOR gate.
Ans: If A and B are inputs then Y= (A+B)' is output.

Q9. The output of a logic gate is "1" when all its inputs are at logic "0". The gate is either
Ans: A NOR or an EX-NOR gate

Q10. If we take both input same in NOR or an EX-NOR gate then we get
Ans: NOT

Thanks