Practical No.5: Verify De-Morgan's Theorem (1 and 2).

I Practical Significance

De Morgan's theorems prove very useful for simplifying Boolean logic expressions because of the way they can 'break' an inversion, which could be the complement of a complex Boolean expression..This practical will enable the students to use De Morgan's theorem to simplify the complex function for the efficient hardware implementation.

II Industry/Employer Expected Outcome(s)

Students will be able to test the functionality of the digital circuits/system.

III Course Level Learning Outcome(s)

Apply Boolean laws to minimize complex Boolean function.

IV Laboratory Learning Outcome(s):

1. Build the logic circuit on breadboard to verify the De - Morgan's theorems.

V Relevant Affective Domain related outcome(s)

Identify PIN configuration of IC.
Handle the components and equipment carefully.
Follow all safety precautions.

VI Relevant Theoretical Background

De Morgan's theorem is used to simplify Boolean expressions and digital circuits.

De Morgan's first Theorem: It states that , the complement of the sum is equal to the product of their individual complements.

The theorem can be expressed by logic equation as

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

NOR gate = Bubbled AND gate

De Morgan's second Theorem: It states that , the complement of a product is equal to the sum of their individual complements.

The theorem can be expressed by logic equation as

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

NAND gate = Bubbled OR gate

VII Circuit diagram

a) Sample Circuit

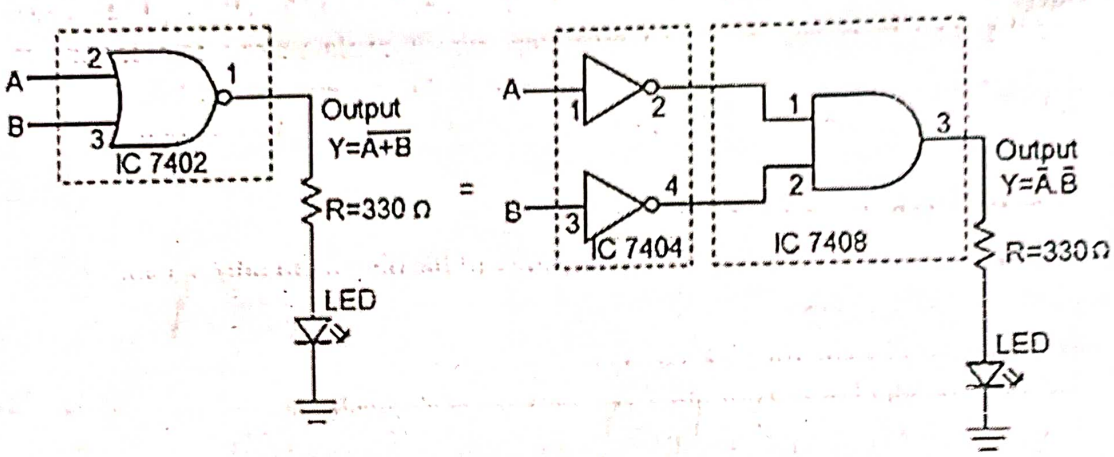


Fig 5.1: De Morgan's first theorem

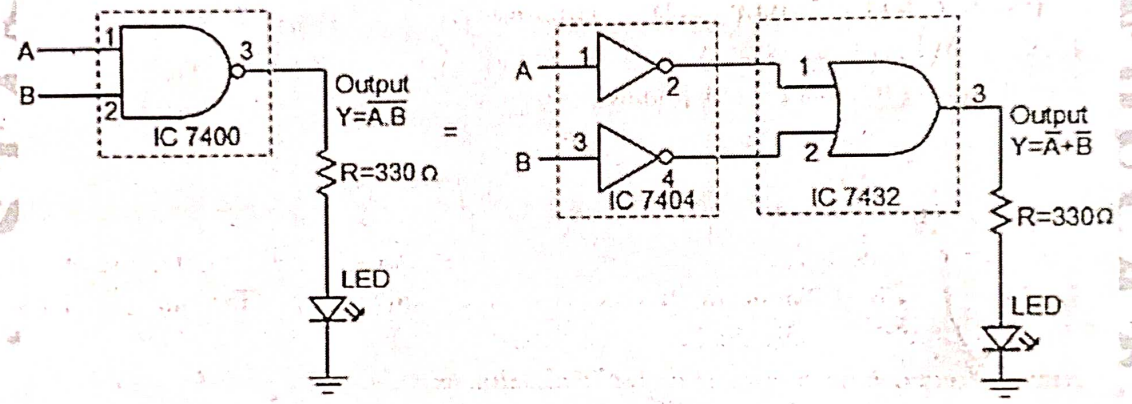
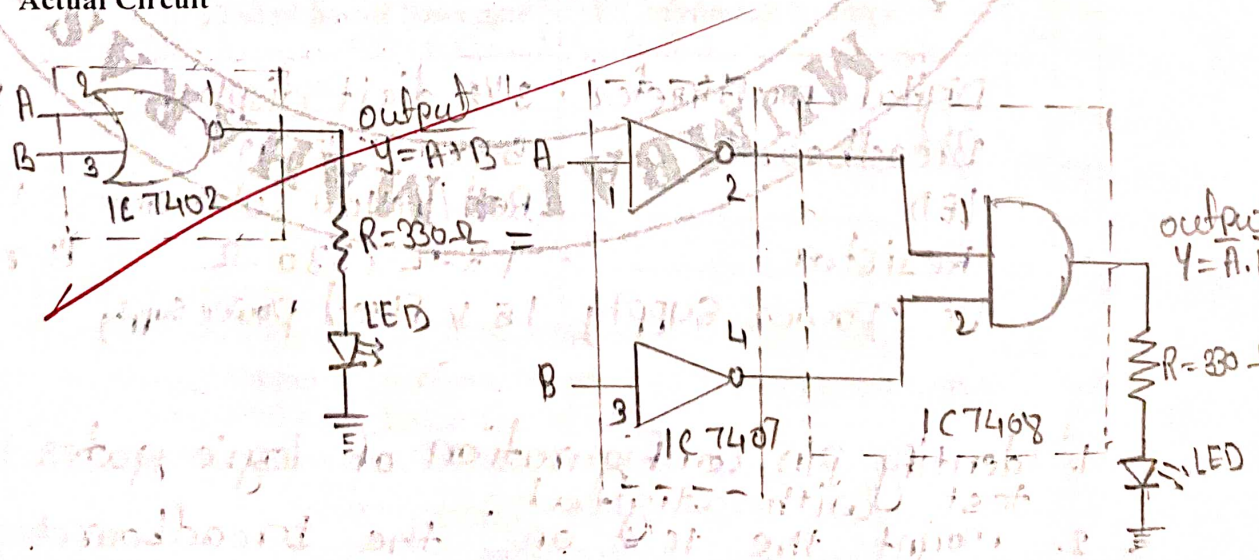


Fig 5.2: De Morgan's second theorem

b) Actual Circuit



VIII Resources Required

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2
2	Digital IC Tester	Tests a wide range of Digital IC's such as 74 Series, 40/45 Series of CMOS IC's.	1
3	DC power supply	+5 V Fixed power supply	1
4	Breadboard	5.5cm X 17 cm	1
5	IC	7400, 7404,7432,7402,7408.	1 Each
6	LED	Red /Yellow color 5 mm	1
7	Connecting wires	Single strand 0.6 mm Teflon coating	As required
8	Resistor	1KΩ/330Ω	As required

IX Precautions to be followed

1) Check IC before use.
2) Set power supply to 5V (Variable DC Power Supply) before connecting.
3) Check all the connections as per circuit diagram

X Procedure

1. Identify pin configuration of logic gate IC's and test with digital IC Tester.
2. Mount the IC's on the breadboard
3. Make the connection as per fig 5.1for LHS as well as RHS side and give supply voltage to the relevant pin as per logic level.
4. Observe the LED (on or off) for each combination of input as per truth table
5. Verify the truth table
6. Repeat the process for figure 5.2.

XI Resources Used

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital multimeter	3 1/2 digit display	2
2	Breadboard	5.5cm X 17cm	1
3	LED	Red/yellow color 5mm	1
4	Resistor	1k-Ω / 330-Ω	As required
5	Dc Power Supply	15 V fixed power supply	1

XII Actual Procedure

1. Identify pin configuration of logic gates IC's & test with digital
2. mount the IC's on the breadboard,

XIII Observation:

Table 5.1: Observation Table: De Morgan's first theorem

Inputs		Outputs	
A	B	LHS= $\overline{A+B}$	RHS= $\overline{A}.\overline{B}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

Table 5.2: Observation Table: De Morgan's second theorem

Inputs		Outputs	
A	B	LHS= $\overline{A.B}$	RHS= $\overline{A}+\overline{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

XIV Result(s)

In this practical we learn about how to Verify Dc - morgan's theorem (1 and 2)

XV Interpretation of results

In this practical we observe the Dc - morgan's theorm to Perform boolean logic expressions by using Dc - morgan's theorem (1 & 2).

XVI Conclusion and recommendation

Hence we learnt how to Perform or Verify Dc - morgan's theorm (1 & 2).

XVII Practical related questions

Note: Below given are a few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List the IC numbers used in De Morgan's first theorem.
2. List the IC numbers used in De Morgan's second theorem.
3. Simplify the expression: $Y=\overline{\overline{(A+B)}[C\ (A+B)]}$

[Space for Answers]

1] ⟶
De morgan's first theorem can be made using

- 7400 (NAND gates)
- 7402 (NOR gates)

2] ⟶
De morgan's second theorem can be made using

- 7400 (NAND gates)
- 7402 (NOR gates)

De morgans second theorem is the dual of the first theorem & it can be implemented using the same IC numbers.

XVIII References/Suggestions for further reading

1. https://www.futurlec.com/74/IC7404.shtml
2. https://www.electroschematics.com/wp-content/uploads/2013/07/7408-datasheet.pdf
3. https://www.ti.com/lit/ds/symlink/sn5432.pdf?ts=1720330546912&ref_url=https%253A%252F%252Fwww.google.com%252F
4. https://www.futurlec.com/74/IC7400.shtml
5. https://www.futurlec.com/74/IC7402.shtml
6. https://www.youtube.com/watch?v=I8WdCozPTeQ

XIX Assessment Scheme

	Performance Indicators	Weightage
	Process Related : 15 Marks	**60 %**
1	Handling of the components	10%
2	identification of components	20%
3	Measuring value using suitable instrument	20%
4	working in teams	10%
	Product Related: 10 Marks	**40%**
5	Calculated theoretical values of given component	10%
6	Interpretation of result	05%
7	Conclusion	05%
8	Practical related questions	15%
9	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Marks Obtained			Dated signature of Teacher
Process related (15)	Product related (10)	Total (25)	
13	10	23	