Experiment 1

To verify the truth table for AND Gate

1.1 Apparatus

- Kit for realization of gates
- Connecting Leads

1.2 Theory

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 or can be written as AB A simple 2-input logic AND gate can be constructed using RTL (Resistor-Transistor-

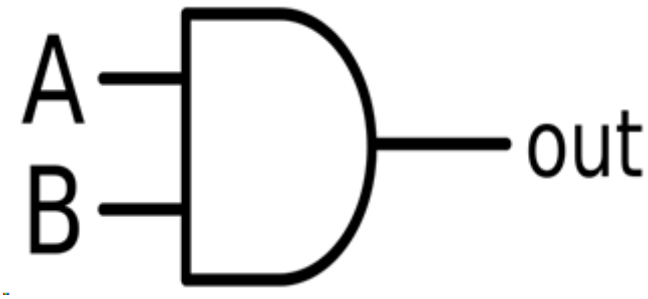


Figure 1.2.1: Symbol for AND gate

Logic) switches connected together as shown below with the inputs connected directly to the transistor bases. Both transistors must be saturated “ON” for an output at Q.

Input		Output
A	B	Y=A.B
0	0	0
0	1	0
1	0	0
1	1	1

Figure 1.2.2: Truth Table for AND gate

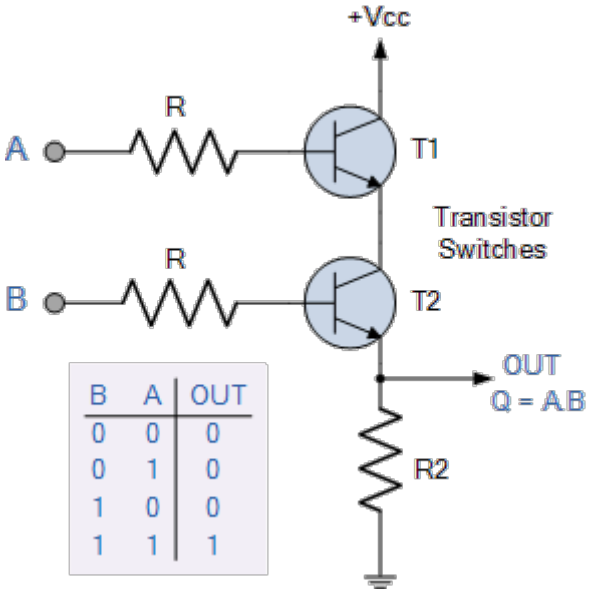


Figure 1.2.3: Circut for making AND gate

1.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A” and ”B”.
- The bulb does not glow if any one or both the switches (2 and 3) are OFF and glows only if both the switches (2 and 3) are ON.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.
- Click on ”Check” Button to verify your output.

- Click ”Print” if you want to get print out of Truth Table.

1.4 Observations

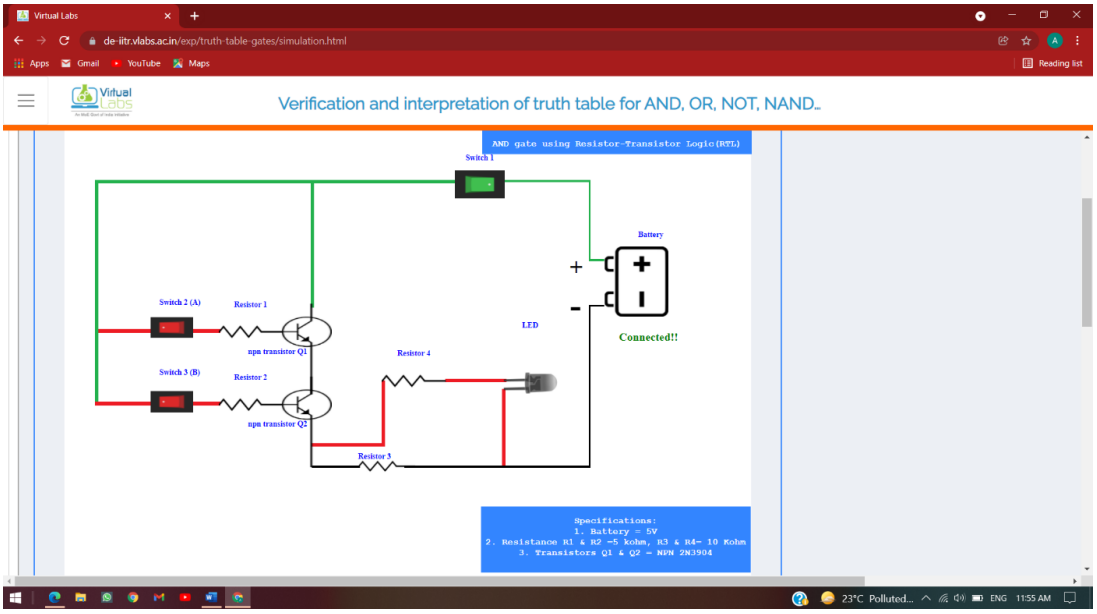
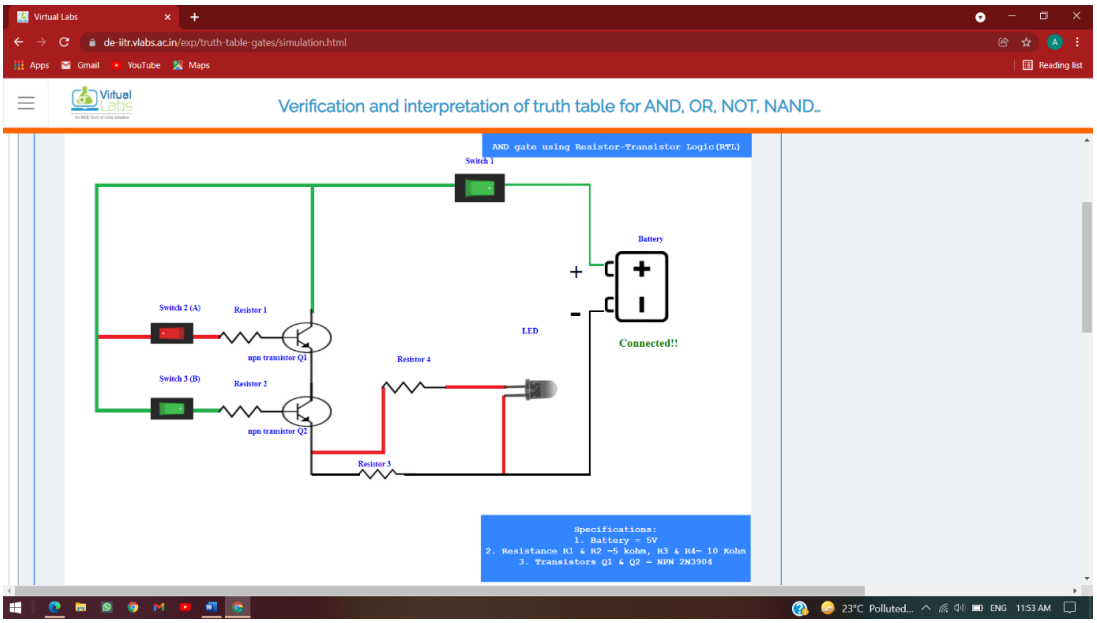


Figure 1.4.1



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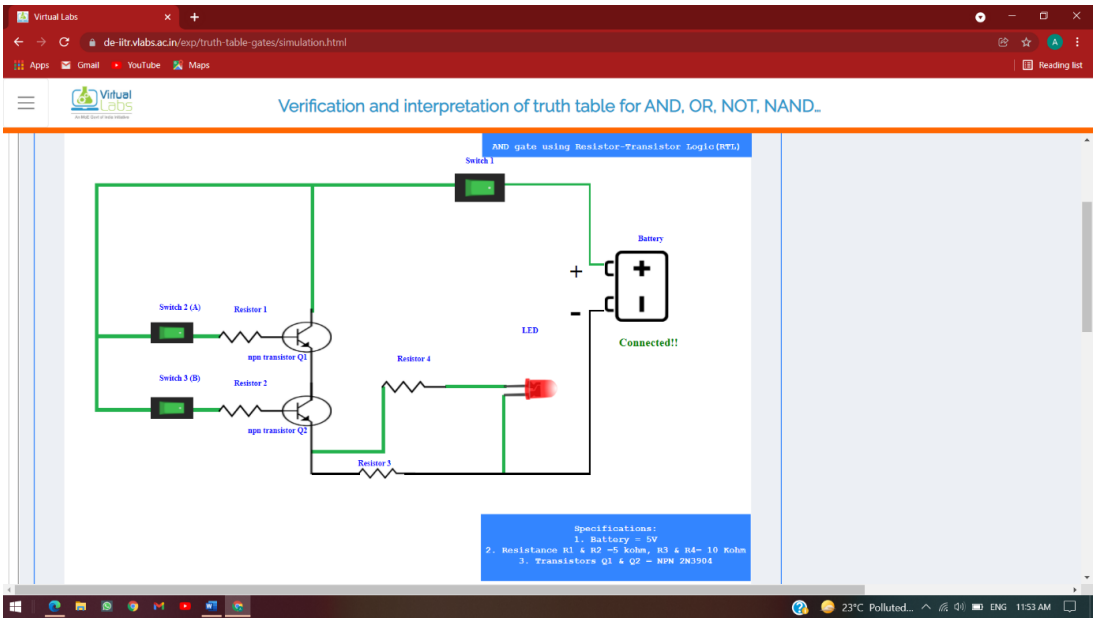


Figure 1.4.3

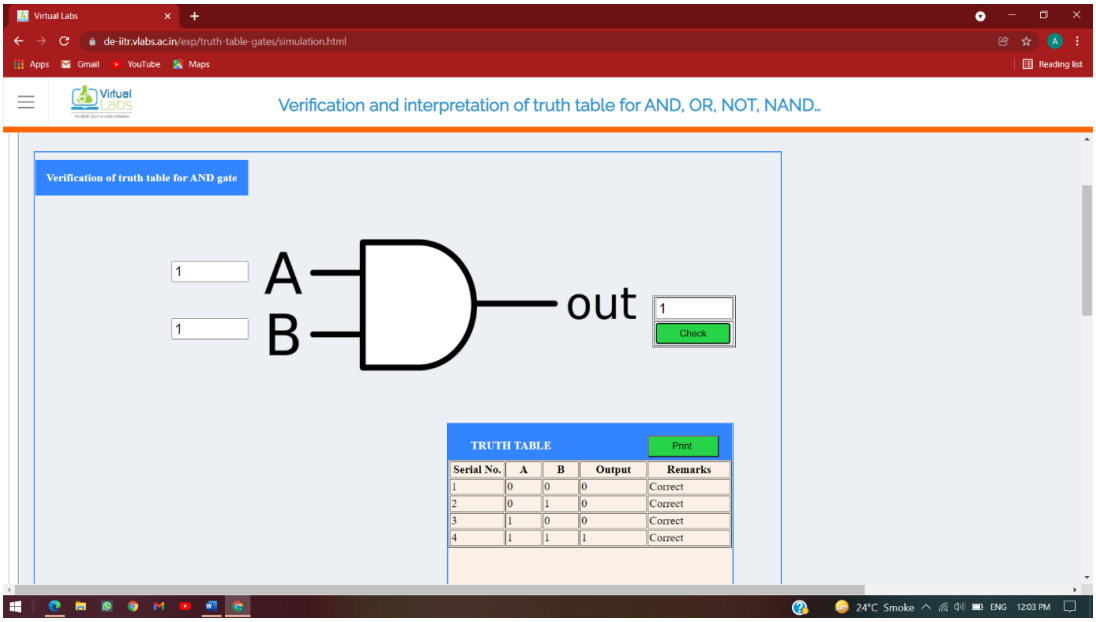


Figure 1.4.4

1.5 Conclusion

Thus we can conclude that if both inputs are high then only the output is high but if even one of the inputs is low the output is low.

1.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 2

To verify truth table for OR gate

2.1 Apparatus

- Kit for realization of gates
- Connecting Leads

2.2 Theory

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. OR gate can be realized

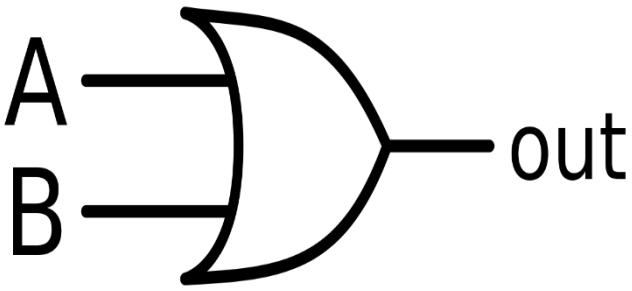


Figure 2.2.1: Symbol for OR gate

by DRL (Diode-Resistance-Logic) or by TTL (Transistor-Transistor-Logic). Presently, we will learn how to implement the OR gate using DRL (Diode-Resistance-Logic). To realise OR gate, we will use a diode at every input of the OR gate. The anode part of diode is connected with input while the cathode part is joined together and a resistor, connected with the cathode is grounded. In this case, we have taken two inputs which can be seen in the circuit below.

Input		Output
A	B	Y=A+B
0	0	0
0	1	1
1	0	1
1	1	1

Figure 2.2.2: Truth Table for OR gate

When both the inputs are at logic 0 or low state then the diodes D1 and D2 become reverse biased. Since the anode terminal of diode is at lower voltage level than the cathode terminal, so diode will act as open circuit so there is no voltage across resistor and hence output voltage is same as ground. When either of the diodes is at logic 1 or high state then the diode corresponding to that input is forward bias. Since this time anode is at high voltage than cathode therefore current will flow through forward biased diode and this current then appears on resistor causing high voltage at output terminal also. Hence at output we get high or logic 1 or +5V. So, if any or both inputs are high, the output will be high or "1".

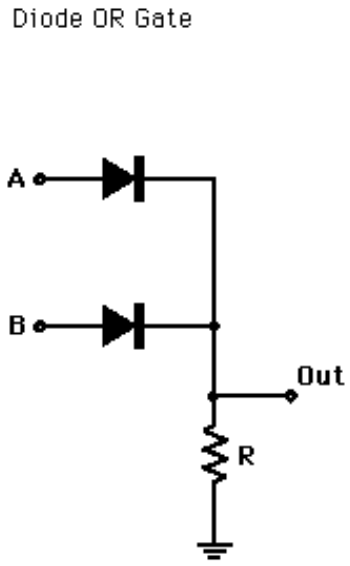


Figure 2.2.3: Circut for making OR gate

2.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.

- Press the switches for inputs ”A” and ”B”.
- The bulb glows if any one or both the switches are ON else it won’t glow.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.
- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

2.4 Observations

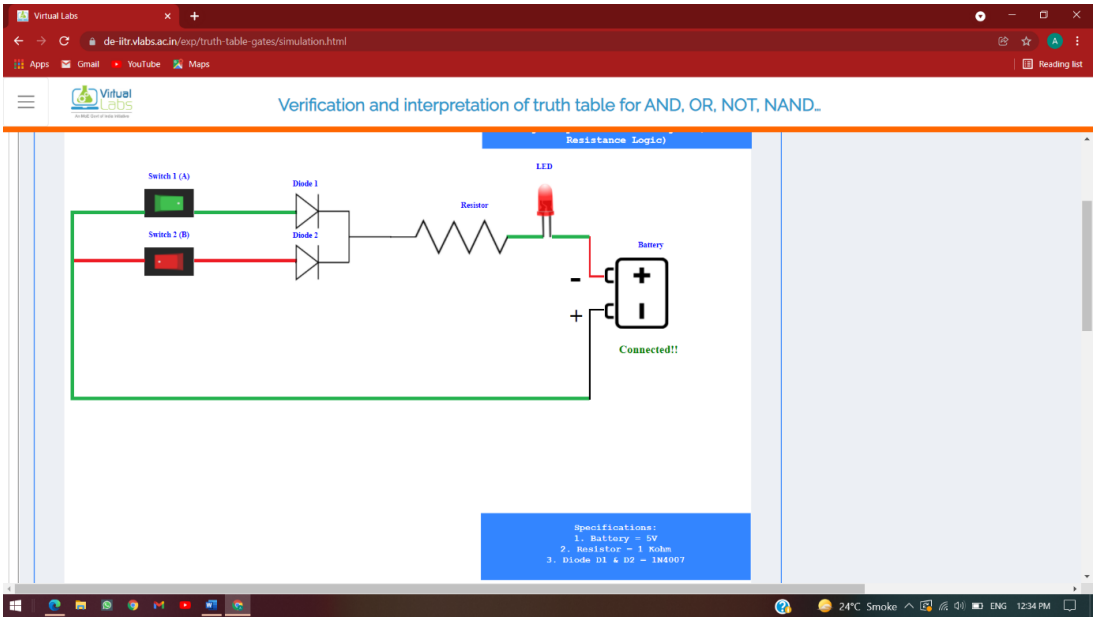


Figure 2.4.1

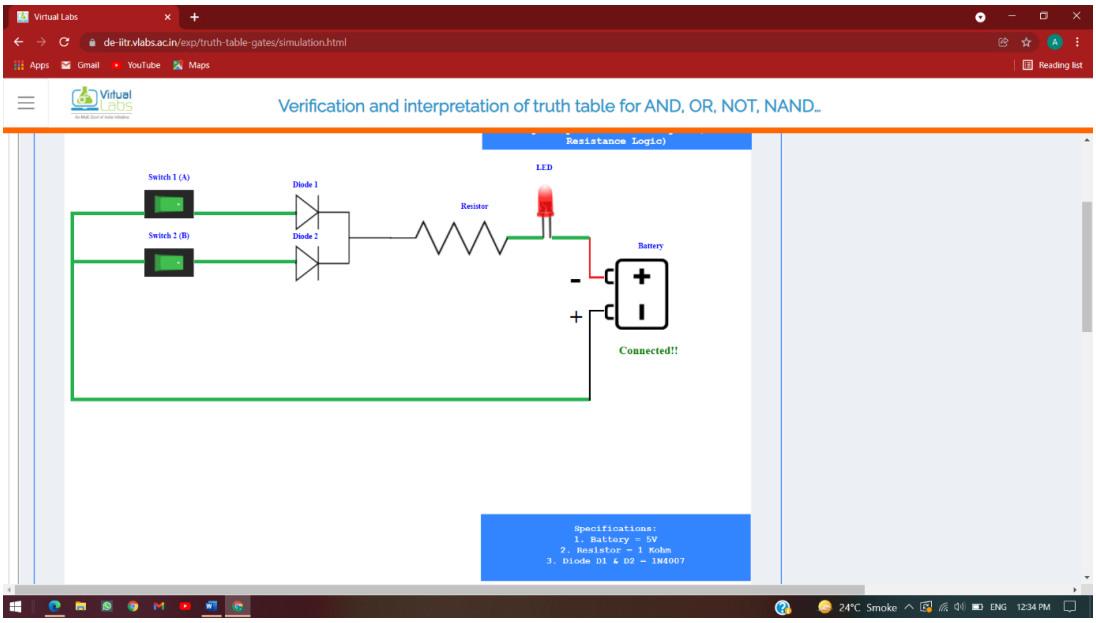


Figure 2.4.2

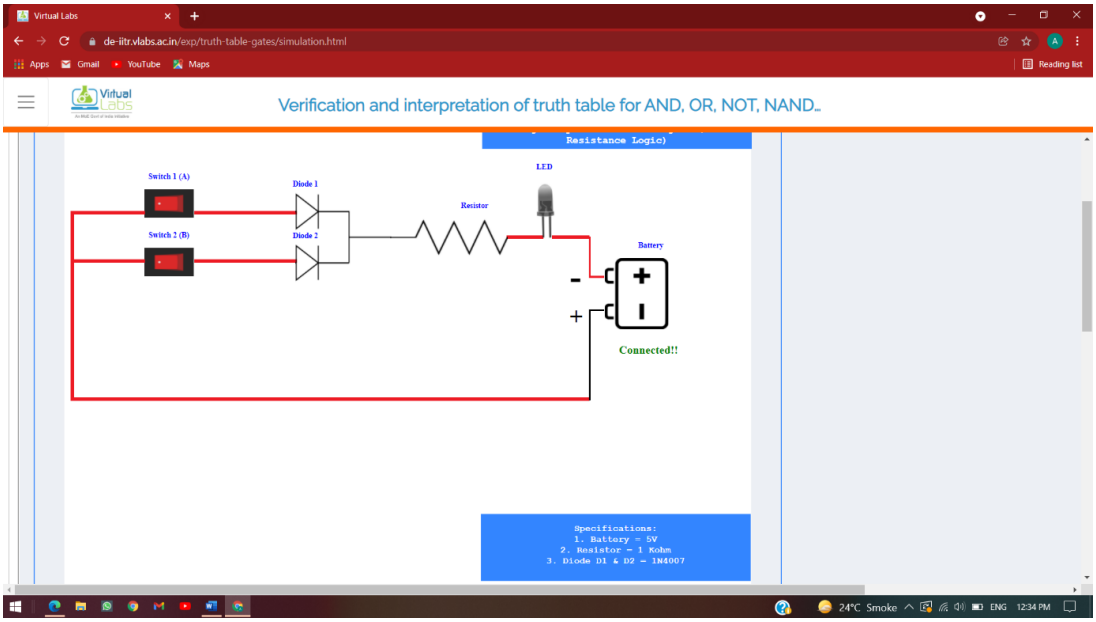
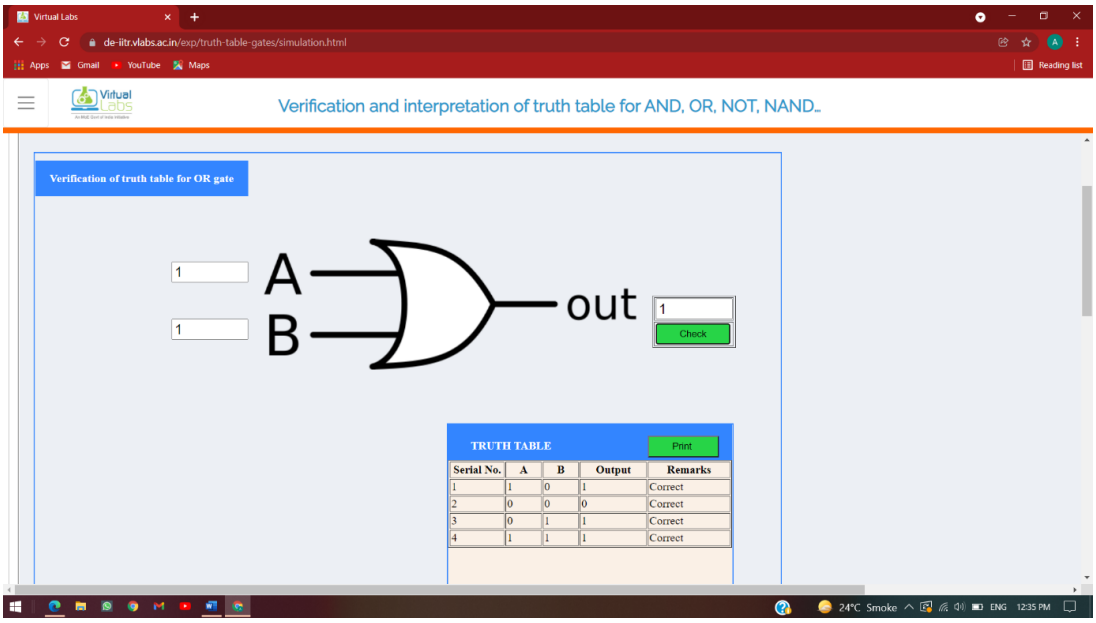


Figure 2.4.3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Reading list
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Verification and interpretation of truth table for AND, OR, NOT, NAND..
Verification of truth table for OR gate
1
1
A
B
out
1
Check
TRUTH TABLE
Print
Serial No. | A | B | Output | Remarks
1 | 1 | 0 | 1 | Correct
2 | 0 | 0 | 0 | Correct
3 | 0 | 1 | 1 | Correct
4 | 1 | 1 | 1 | Correct
24°C Smoke
ENG
12:35 PM

Figure 2.4.4

2.5 Conclusion

Thus we can see that when both inputs are low then only the output is low otherwise it is high when even one of the inputs is high.

2.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 3

To verify truth table for NOT gate

3.1 Apparatus

- Kit for realization of gates
- Connecting Leads

3.2 Theory

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. NOT gate can be realized through transistor.The input is connected

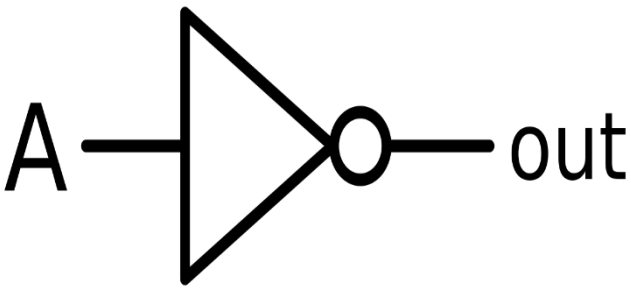


Figure 3.2.1: Symbol for NOT gate

through resistor R2 to the transistor's base. When no voltage is present on the input, the transistor turns off. When the transistor is off, no current flows through the collector-emitter path. Thus, current from the supply voltage (Vcc) flows through resistor R1 to the output. In this way, the circuit's output is high when its input is low.

Input	Output
A	Y
0	1
1	0

Figure 3.2.2: Truth Table for NOT gate

When voltage is present at the input, the transistor turns on, allowing current to flow through the collector-emitter circuit directly to ground. This ground path creates a shortcut that bypasses the output, which causes the output to go low.

In this way, the output is high when the input is low and low when the input is high.

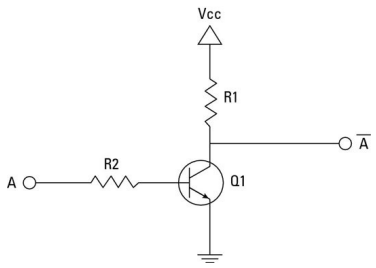


Figure 3.2.3: Circut for making NOT gate

3.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A”.
- Press the switch 2 for input ”A”.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A”.
- Enter the Boolean output for your corresponding inputs.

- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

3.4 Observations

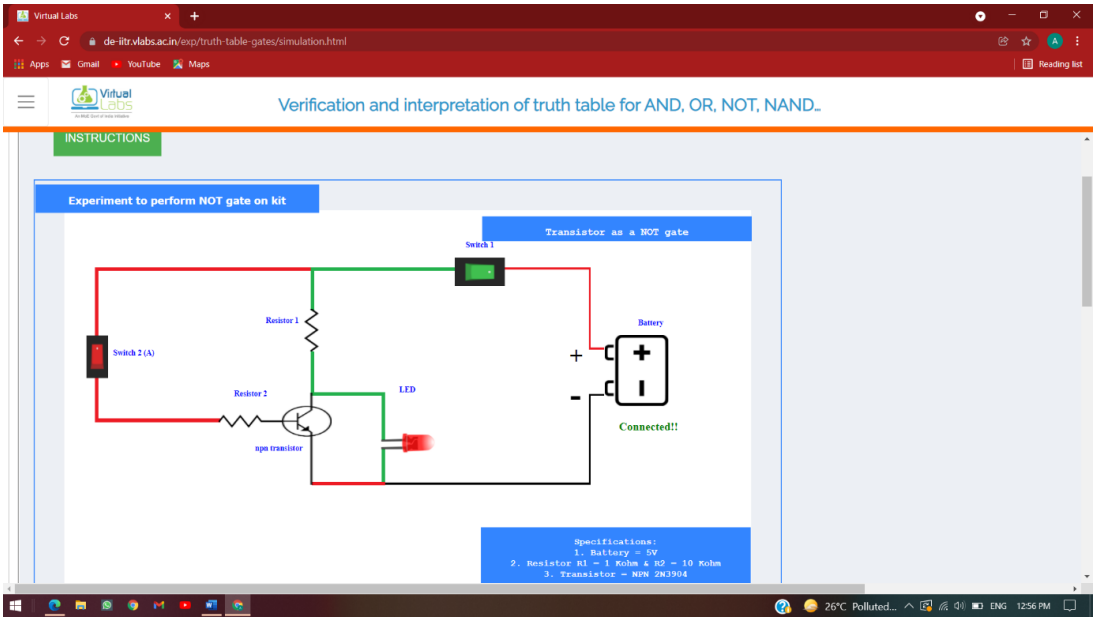


Figure 3.4.1

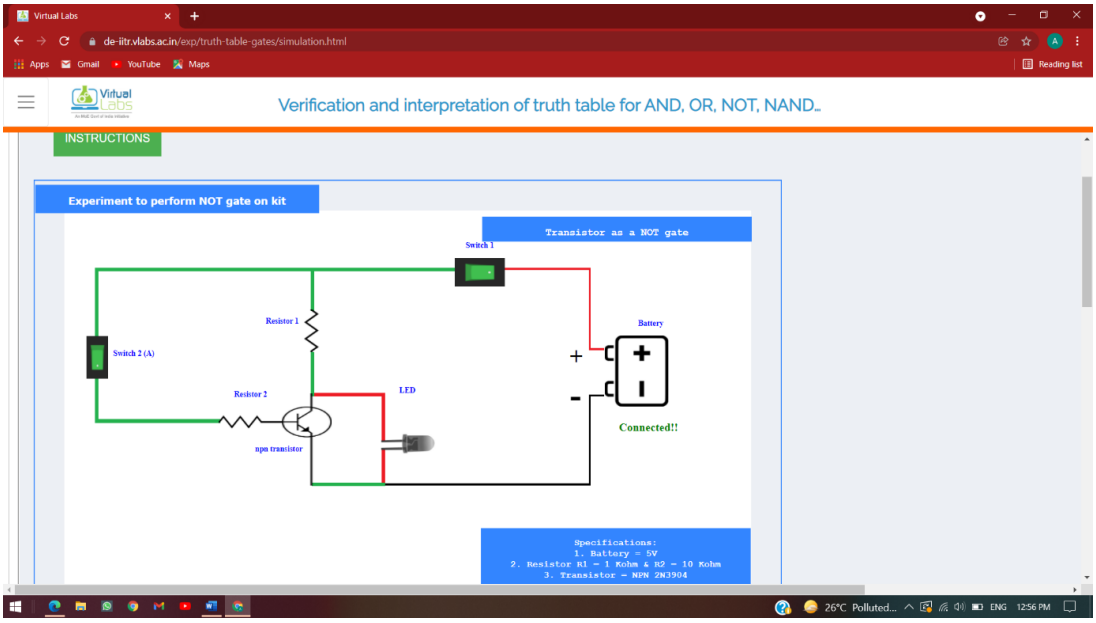


Figure 3.4.2

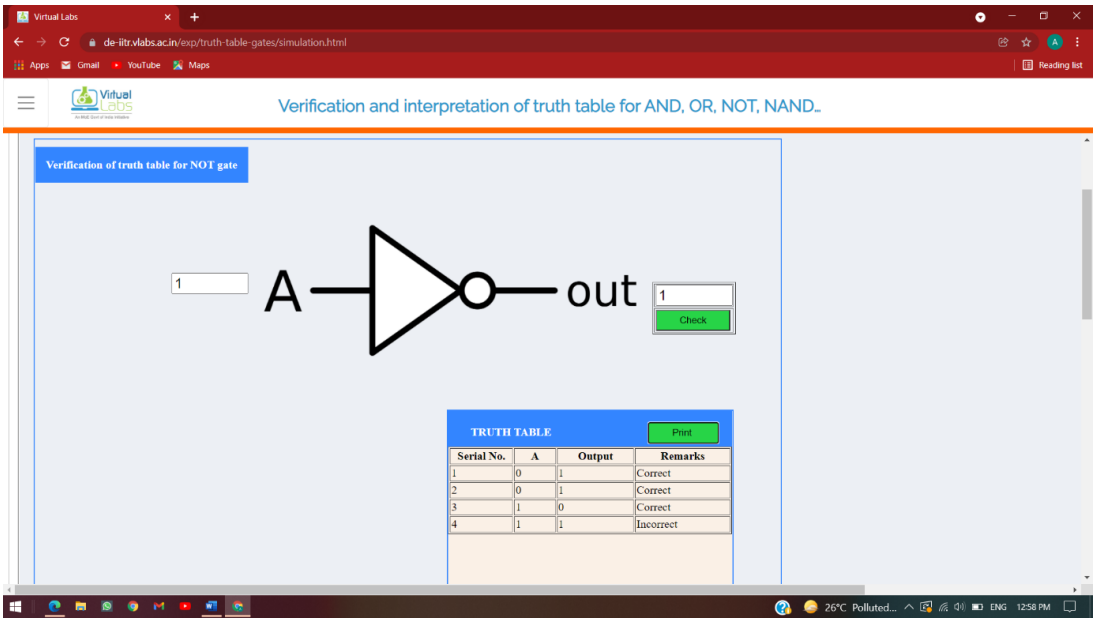


Figure 3.4.3

3.5 Conclusion

As seen above , NOT gate negates the value of input . If the input is low , the output is higher and vice versa.

3.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 4

To verify truth table for NAND gate

4.1 Apparatus

- Kit for realization of gates
- Connecting Leads

4.2 Theory

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.

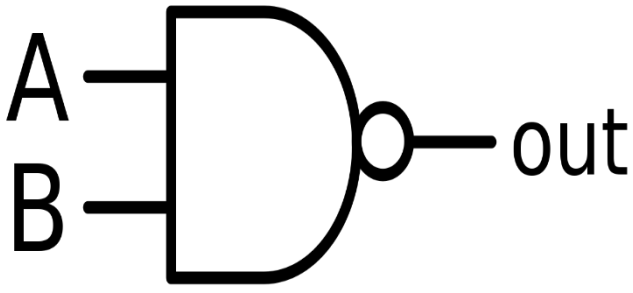


Figure 4.2.1: Symbol for NAND gate

A simple 2-input logic NAND gate can be constructed using RTL (Resistor-transistor-logic) switches connected together as shown below with the inputs connected directly to the transistor bases. Either transistor must be cut-off or "OFF" for an output at Q.

Input	Input	Output
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Figure 4.2.2: Truth Table for NAND gate

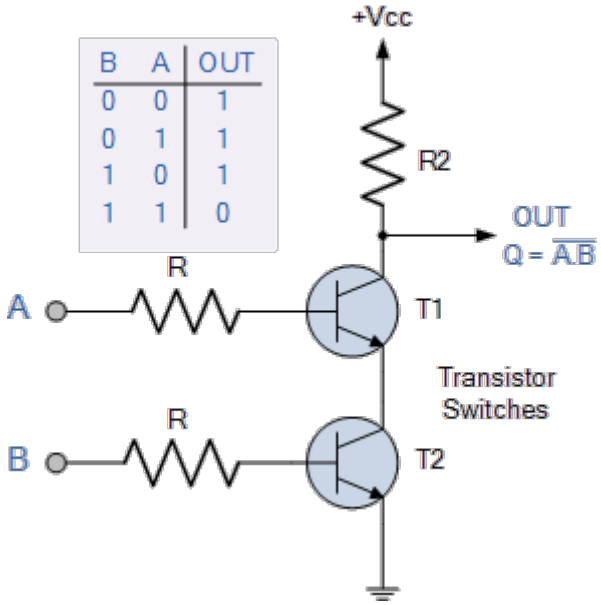


Figure 4.2.3: Circut for making NAND gate

4.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A” and ”B”.
- The bulb glows if any one or both the switches are OFF else it won’t glow.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.

- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

4.4 Observations

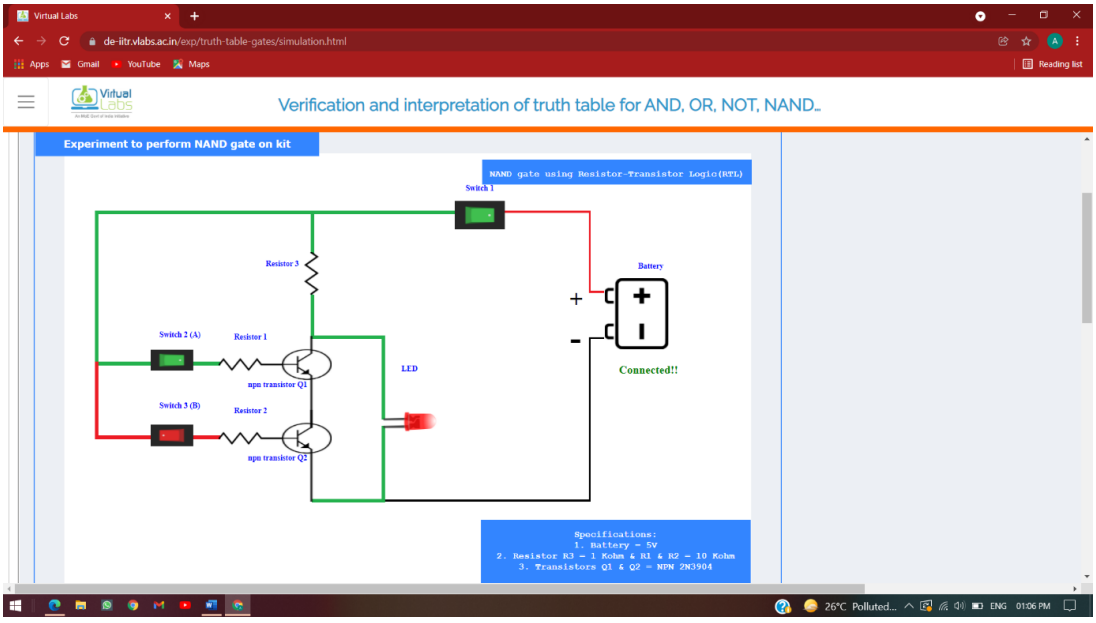


Figure 4.4.1

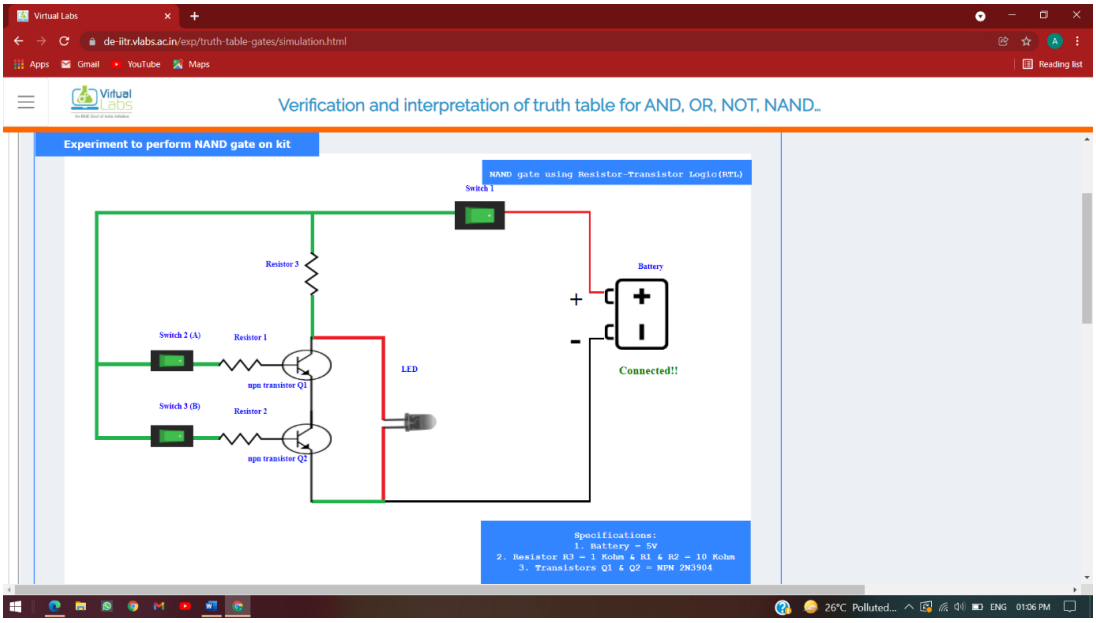


Figure 4.4.2

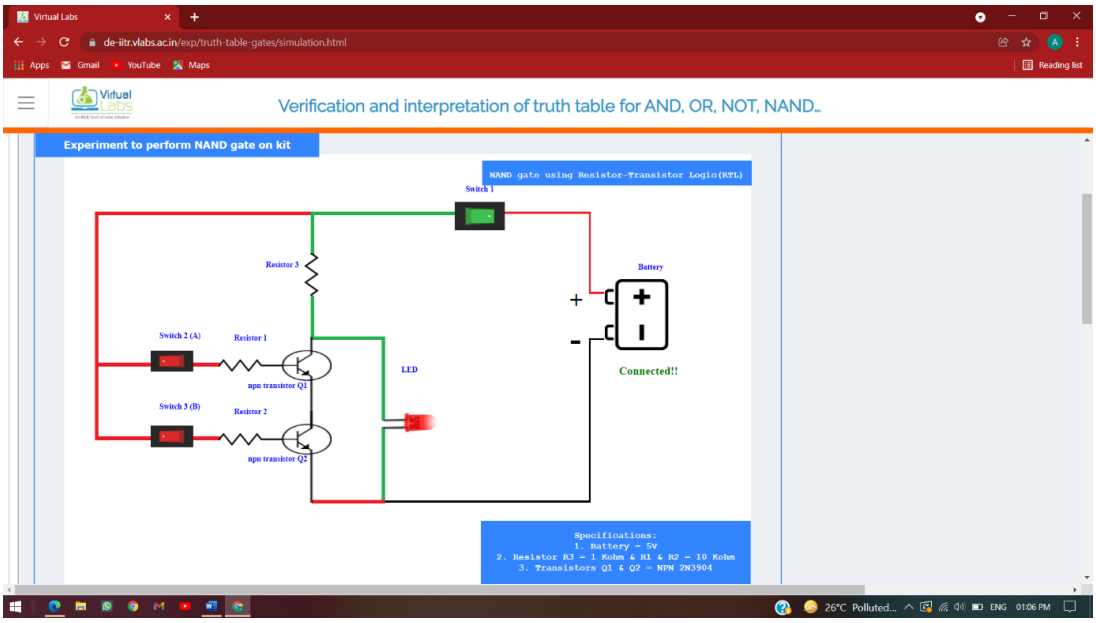


Figure 4.4.3

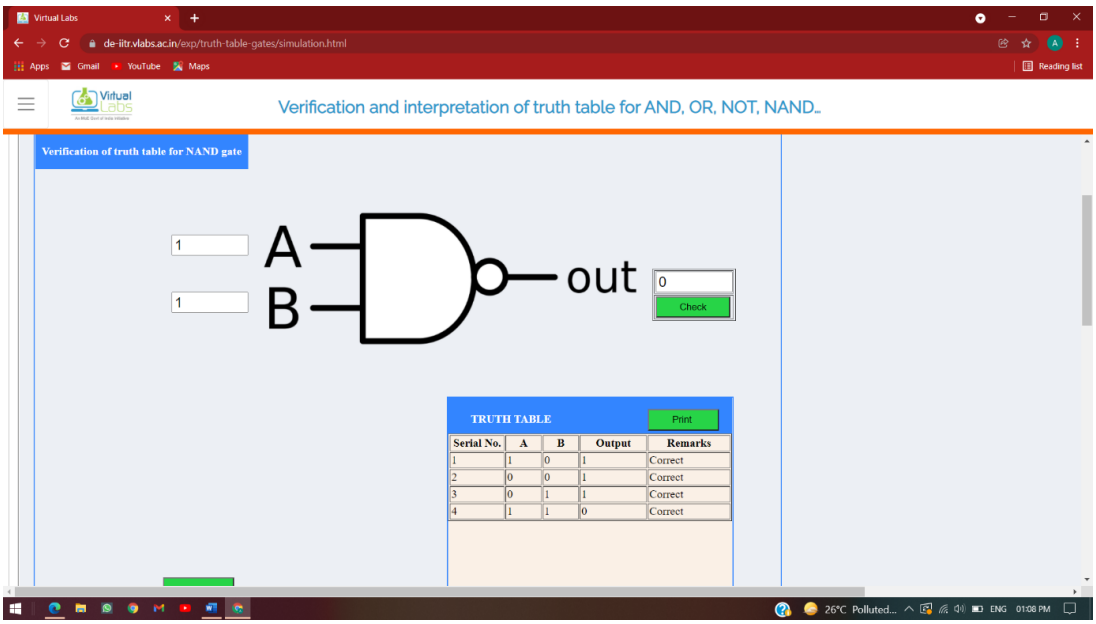


Figure 4.4.4

4.5 Conclusion

NAND gate basically negates the results of AND gate . The output is low when both the inputs are high and the output is high when even one of the input is low.

4.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 5

To verify the truth table for NOR gate

5.1 Apparatus

- Kit for realization of gates
- Connecting Leads

5.2 Theory

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.

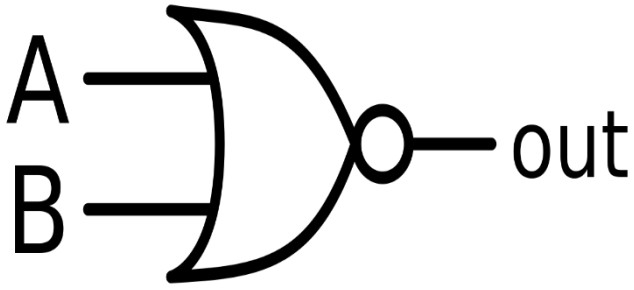


Figure 5.2.1: Symbol for NOR gate

A simple 2-input logic NOR gate can be constructed using RTL (Resistor-transistor-logic) switches connected together as shown below with the inputs connected directly to the transistor bases. Both transistors must be cut-off or “OFF” for an output at Q.

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

Figure 5.2.2: Truth Table for NOR gate

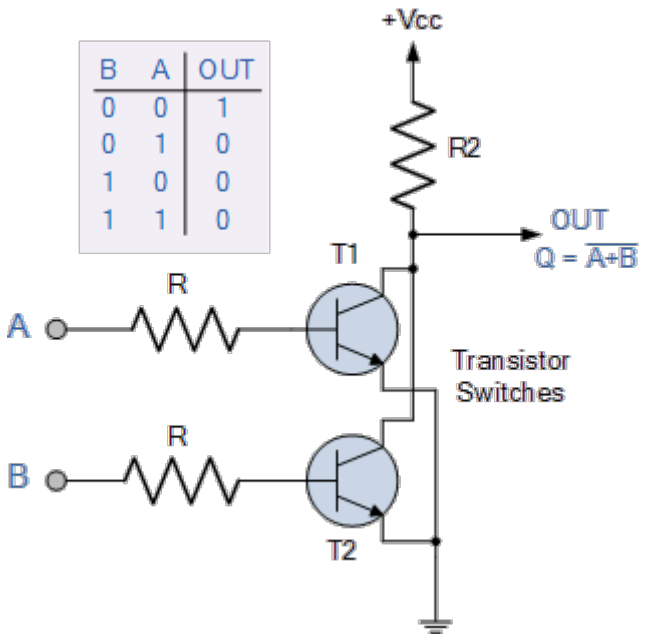


Figure 5.2.3: Circut for making NOR gate

5.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A” and ”B”.
- The bulb glows if both the switches are OFF else it won’t glow.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.
- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

5.4 Observations

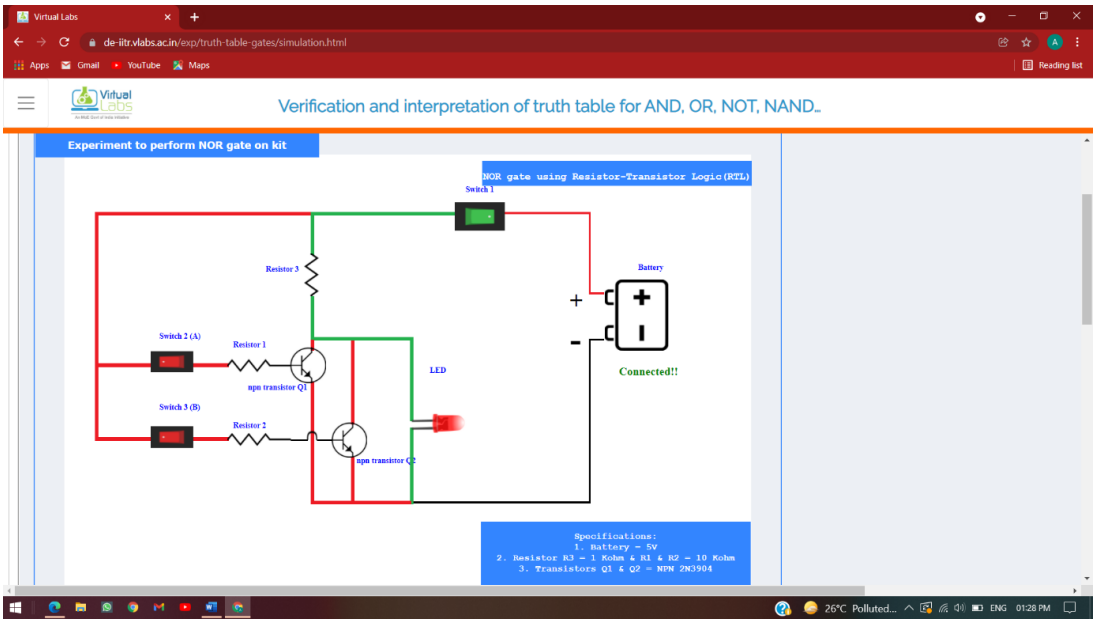


Figure 5.4.1

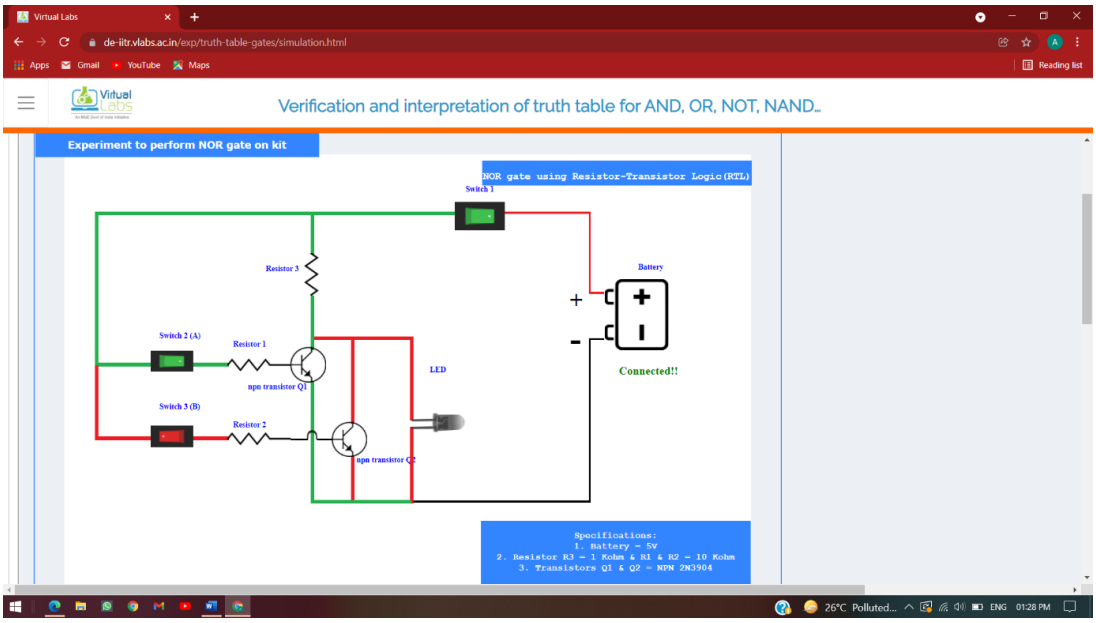


Figure 5.4.2

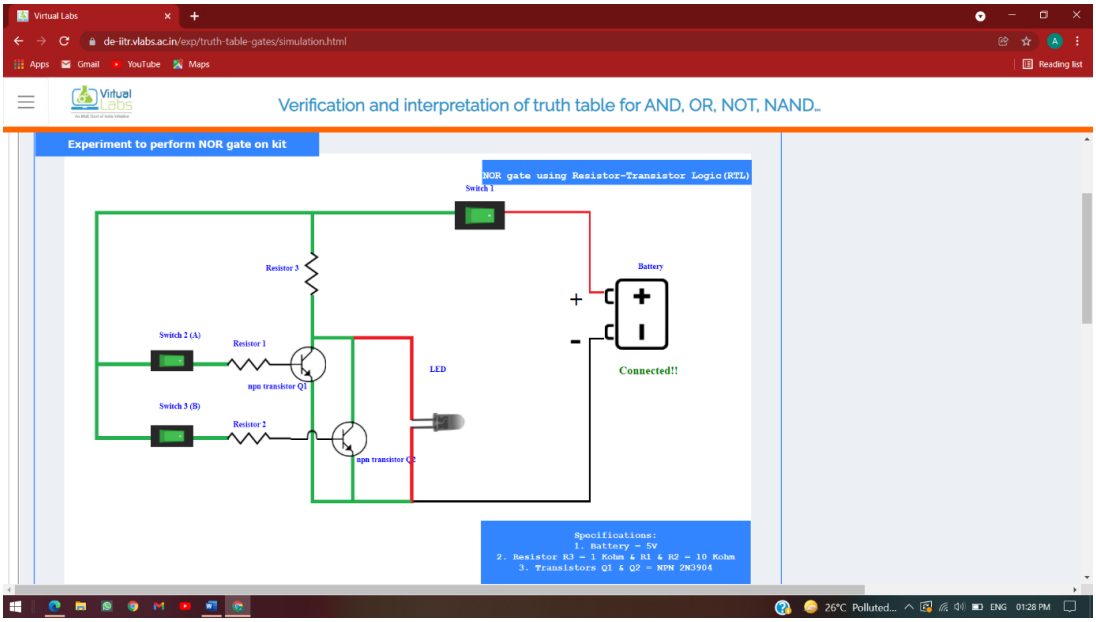
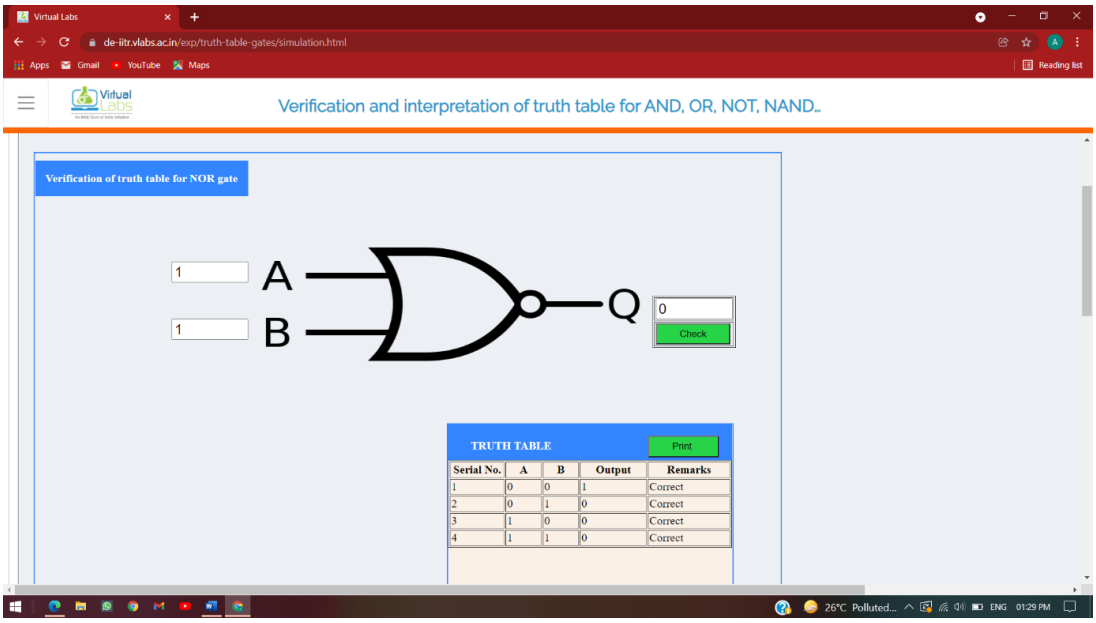


Figure 5.4.3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Verification and interpretation of truth table for AND, OR, NOT, NAND..
Verification of truth table for NOR gate
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Check
TRUTH TABLE
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Figure 5.4.4

5.5 Conclusion

NOR gate basically negates the results of OR gate . The output is low when both the inputs are high or when even one of the input is low. Iff both the inputs are low, we get a high output.

5.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 6

To verify truth table for XOR gate

6.1 Apparatus

- Kit for realization of gates
- Connecting Leads

6.2 Theory

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 Ex-OR operation.

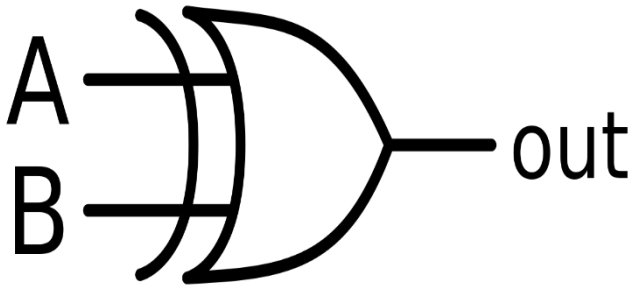

Figure 6.2.1: Symbol for XOR gate

Ex-OR gate is created from AND, NAND and OR gates.The output is high only when both the inputs are different.

A	B	A **XOR** B
0	0	0
0	1	1
1	0	1
1	1	0

Figure 6.2.2: Truth Table for XOR gate

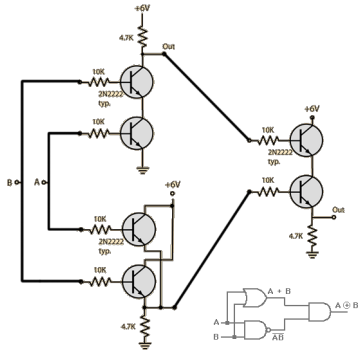

Figure 6.2.3: Circut for making XOR gate

6.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A” and ”B”.
- The bulb glows if one of the switches is ON and one of the switches is OFF else it won’t glow.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.
- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

6.4 Observations

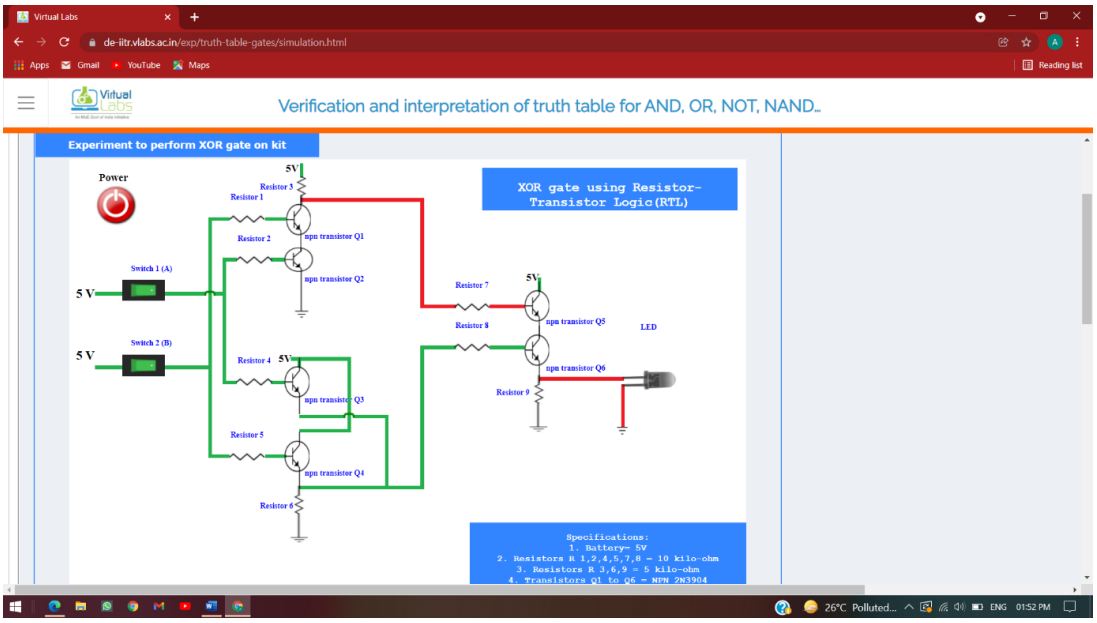

Figure 6.4.1

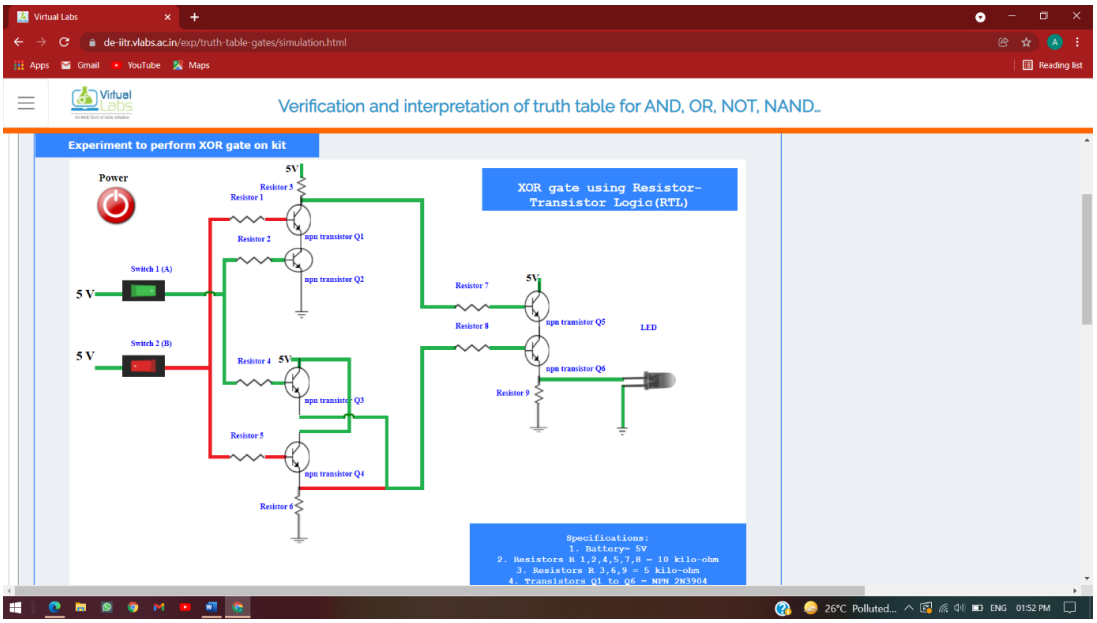

Figure 6.4.2

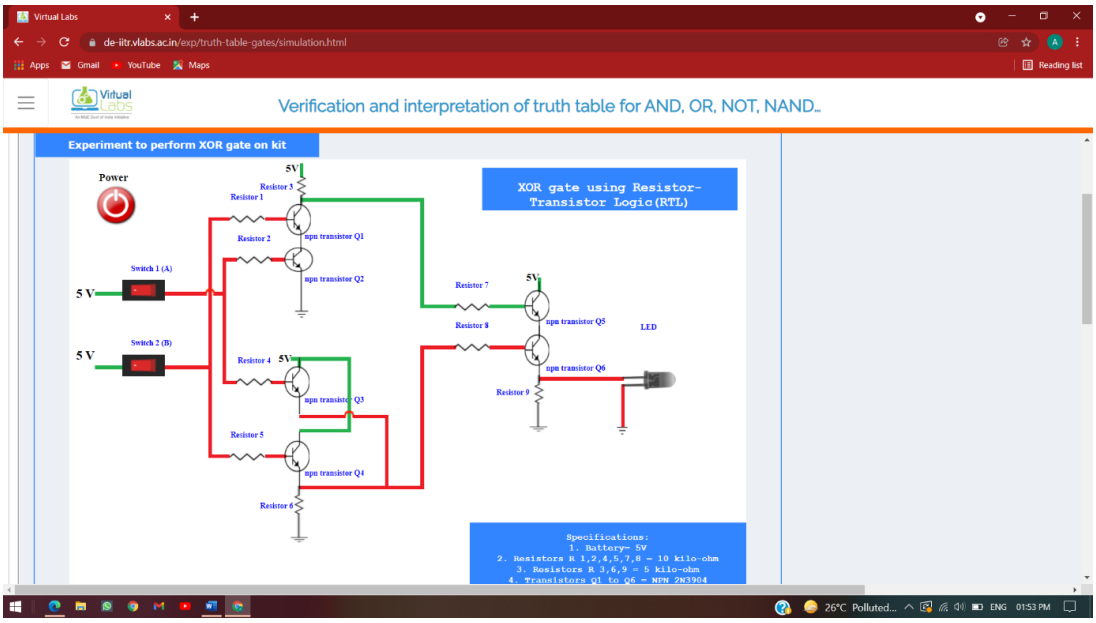

Figure 6.4.3

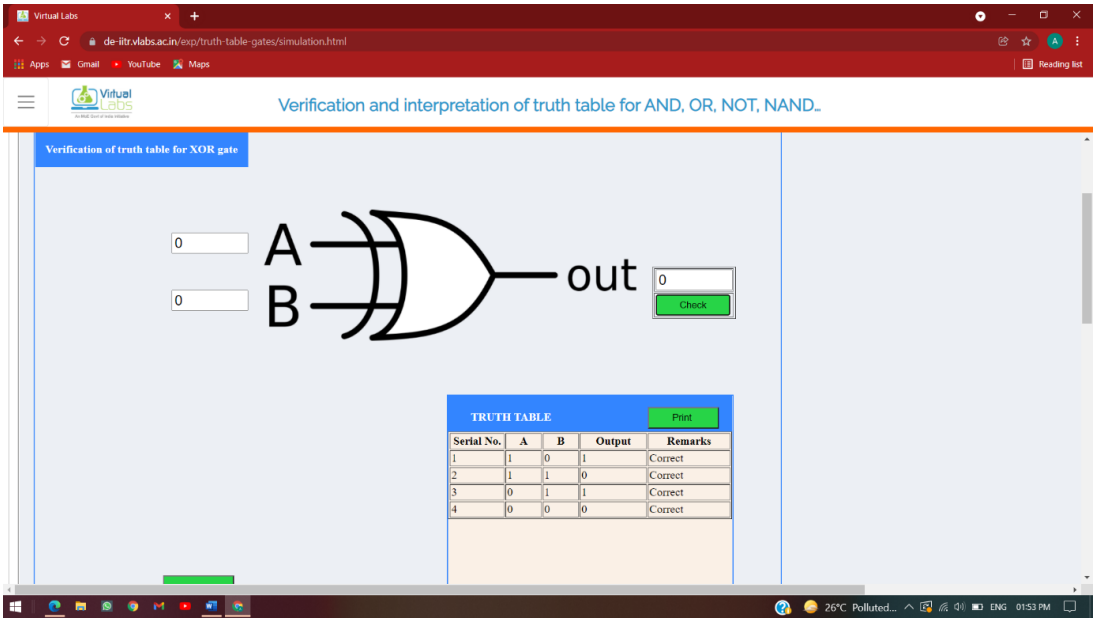

Figure 6.4.4

6.5 Conclusion

XOR gate basically is a special version of OR gate which gives a low even when both the inputs of OR gate are high.

6.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.

Experiment 7

To verify truth table of XNOR gate

7.1 Apparatus

- Kit for realization of gates
- Connecting Leads

7.2 Theory

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

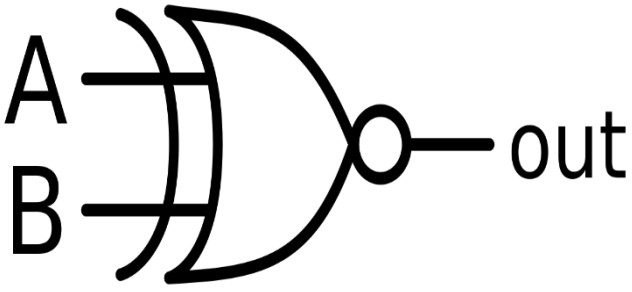

Figure 7.2.1: Symbol for XNOR gate

Ex-NOR gate is created from AND, NOT and OR gates.The output is high only when both the inputs are same.

XNOR Truth Table		
A	**B**	**Q**
0	0	1
0	1	0
1	0	0
1	1	1

Figure 7.2.2: Truth Table for XNOR gate

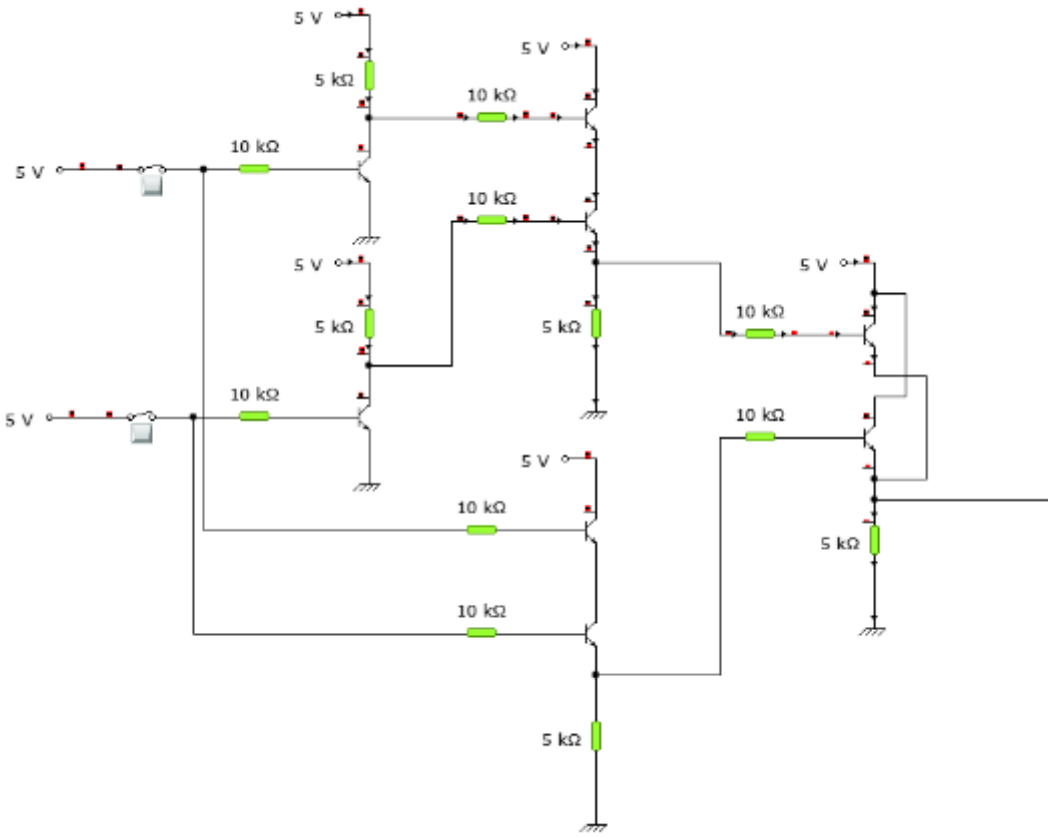

Figure 7.2.3: Circut for making XNOR gate

7.3 Procedure

Simulator 1

- Connect the supply(+5V) to the circuit.
- Press the switches for inputs ”A” and ”B”.
- The bulb glows if both the switches are ON or if both the switches are OFF else it won’t glow.
- Repeat step-2 and step-3 for all state of inputs.

Simulator 2

- Enter the Boolean input ”A” and ”B”.
- Enter the Boolean output for your corresponding inputs.
- Click on ”Check” Button to verify your output.
- Click ”Print” if you want to get print out of Truth Table.

7.4 Observations

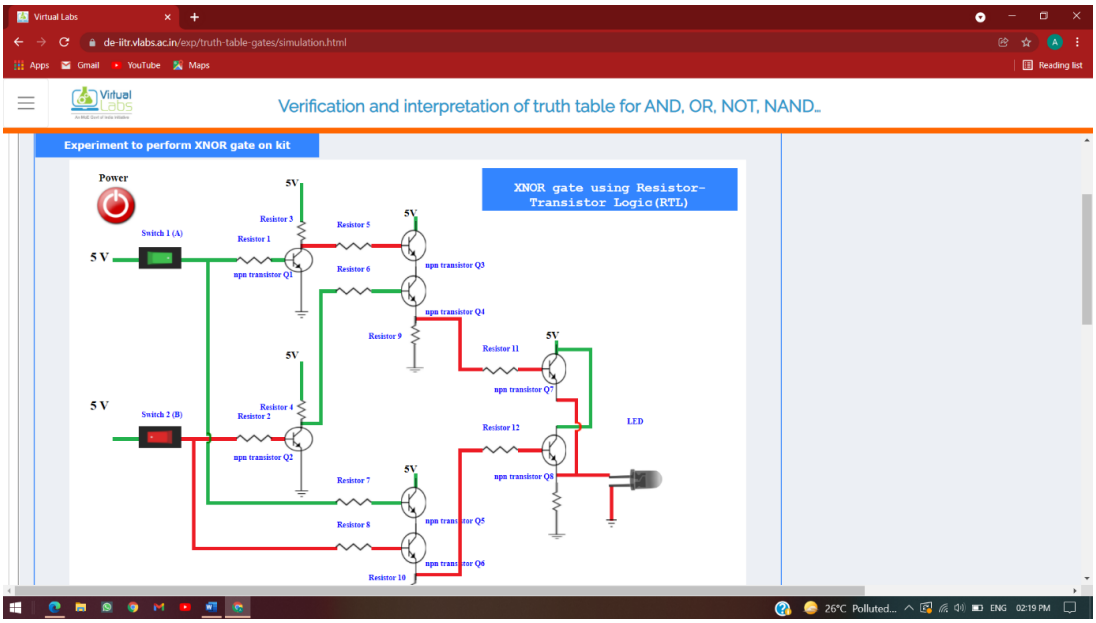

Figure 7.4.1

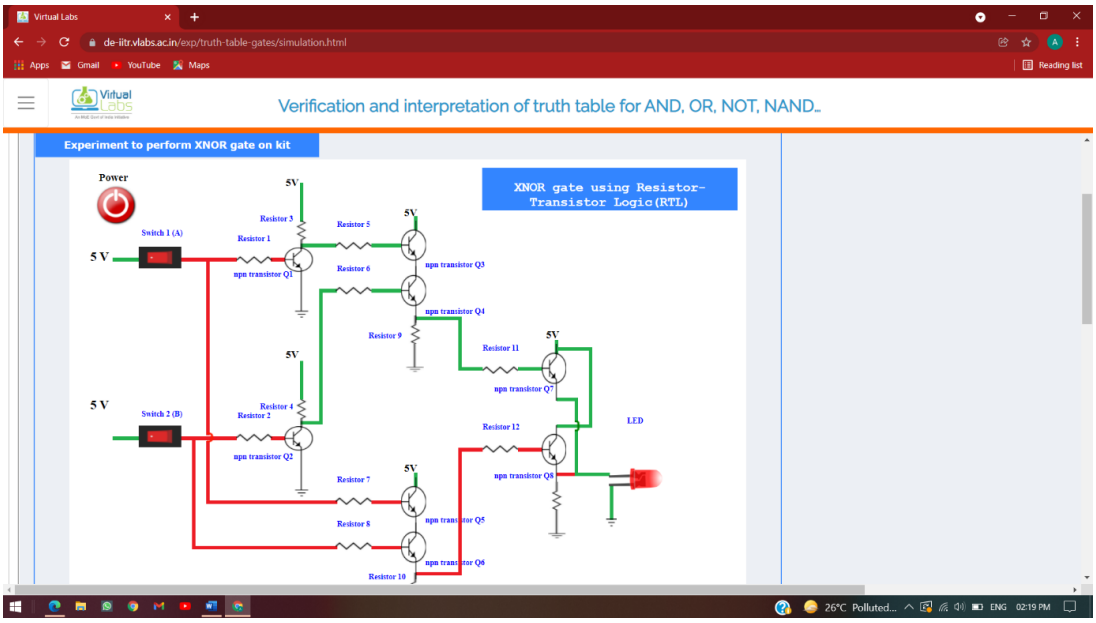

Figure 7.4.2

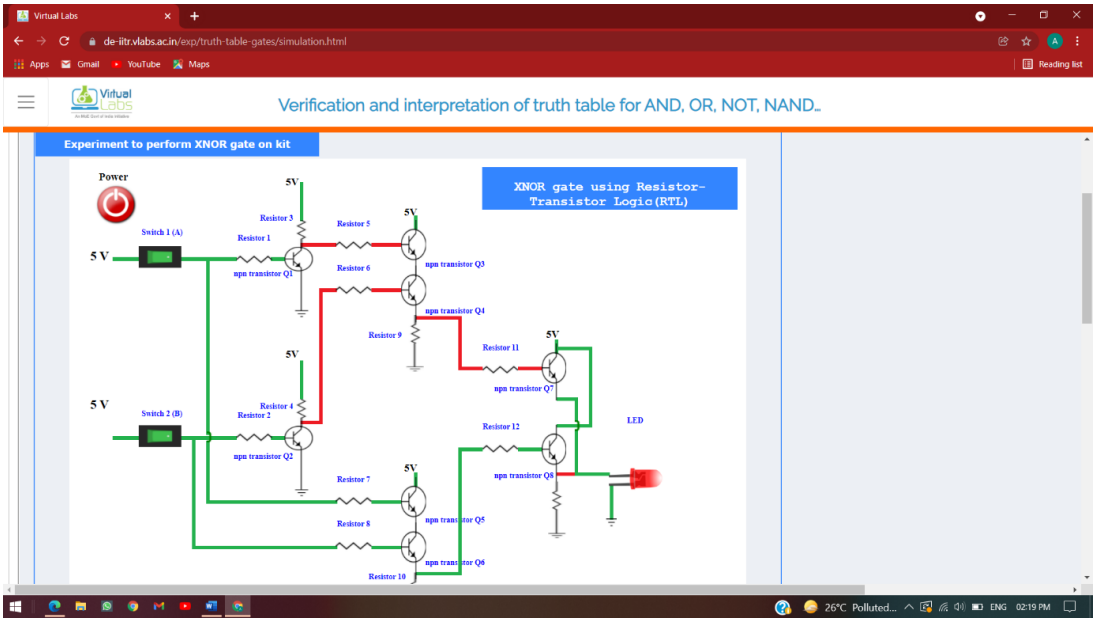

Figure 7.4.3

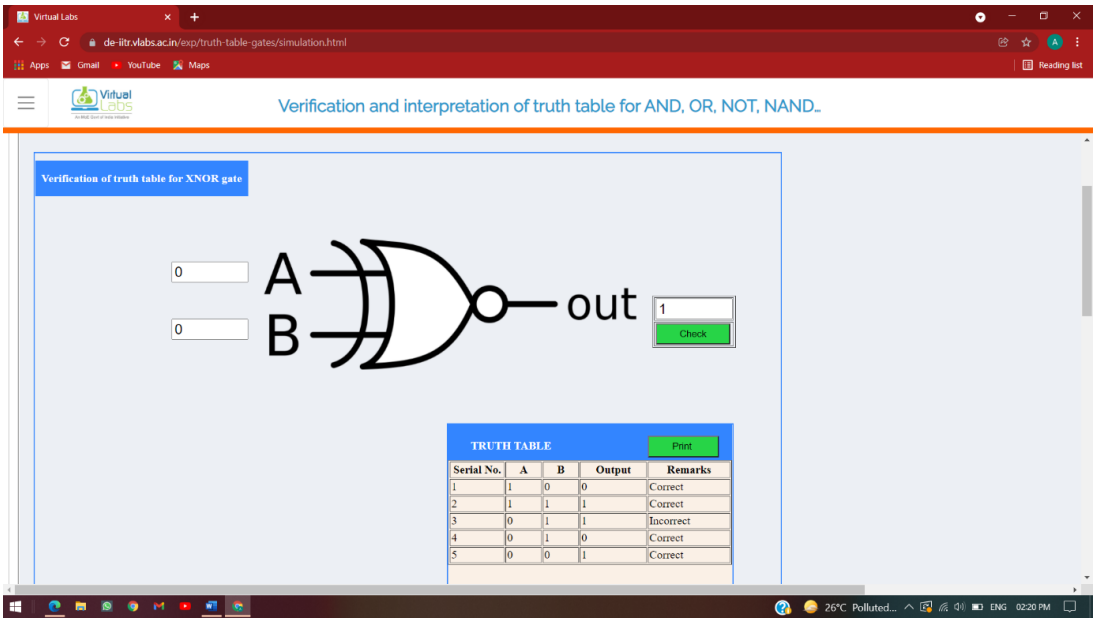
Virtual Labs
de-iitr.vlabs.ac.in/exp/truth-table-gates/simulation.html
Apps
Gmail
YouTube
Maps
Reading list
Virtual Labs
Verification and interpretation of truth table for AND, OR, NOT, NAND..
Verification of truth table for XNOR gate
0
0
A
B
out
1
Check
TRUTH TABLE
Print
Serial No. | A | B | Output | Remarks
1 | 1 | 0 | 0 | Correct
2 | 1 | 1 | 1 | Correct
3 | 0 | 1 | 1 | Incorrect
4 | 0 | 1 | 0 | Correct
5 | 0 | 0 | 1 | Correct
26°C Polluted...
ENG
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Figure 7.4.4

7.5 Conclusion

XNOR gate basically negates the XOR gate. It gives high output only when both the inputs are same else it gives low output.

7.6 Precautions

1. Make the connections when power supply is OFF.
2. Ensure that the connections are tight.
3. Change the status of inputs only when power supply is OFF.