Identification of Various Active and Passive Electronic Components in a Given Circuit

Experiment No.: 06

Experiment Name:

Identification of Various Active and Passive Electronic Components in a Given Circuit

Objective:

To identify various active and passive electronic components in a given circuit.

Theory:

1. Active Components : An **active component** is an electronic component which supplies energy to a circuit.

Common examples of active components are:

- Voltage sources
- Current sources
- Generators (such as alternators and DC generators)
- All different types of transistors (such as bipolar junction transistors, MOSFETS, FETs, and JFET)
- Diodes (such as Zener diodes, photodiodes, Schottky diodes, and LEDs)

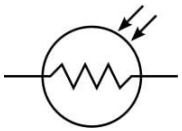
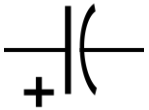
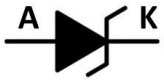
2. Passive Components: A **passive component** is an electronic component which can only receive energy, which it can either dissipate, absorb or store it in an electric field or a magnetic field. Passive elements do not need any form of electrical power to operate. As the name 'passive' suggests – passive devices do not provide gain or amplification. Passive components cannot amplify, oscillate, or generate an electrical signal.

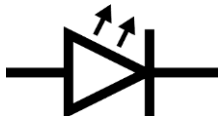
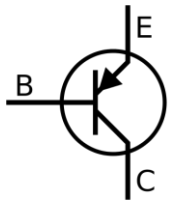
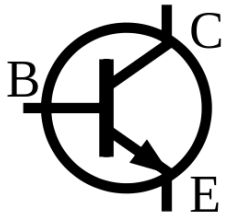
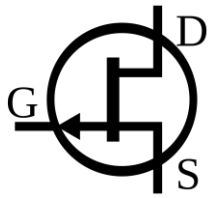
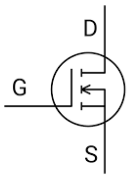
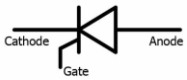
Common examples of passive components are:

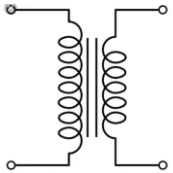
- Resistors
- Inductors
- Capacitors
- Transformers

Different Elements Identified:

Sl. No.	Name of the Elements	Figure of the Component	Symbol	Component Type	Function	Application	No. of Terminals
1.	Resistor			Passive	It resist the flow of current	Shunt, multiplier, current controller,	2

2.	**POT** (Potentiometer)			Passive	It works as a variable resistor	Control volume, brightness, colour	3
3.	**LDR** (Light Dependent Resistor)			Passive	It is used where there is a need to sense the presence and absence of light is necessary.	Alarm clocks, street lights, light intensity meters, burglar alarm circuits	2
4.	Inductor			Passive	It helps to store energy in the form of magnetic energy when electric current flows through it	Choking, blocking, attenuating, or filtering/smoothing high frequency noise in electrical circuits	2
5.	Polarised Capacitor			Passive	It passes AC and block DC	to filter power supplies in ac to dc rectifier circuit	2
6.	Non Polarised Capacitor			Passive	It has no implicit polarity – it can be connected either way in a circuit	used in circuits of coupling, decoupling, feedback, compensation, and oscillation	2
7.	PN Junction Diode			Passive	It is used to remove negative signals from AC current	Rectifier circuit, isolating signals from a supply, and mixing signals	2
8.	Zener Diode			Active	It can act as a steady output voltage for a load connected in parallel with it	Voltage regulation, as reference elements, surge suppressors, switching applications and clipper circuits	2

9.	**LED** (Light Emitting Diode)			Passive	It is a specialised type of diode as they have very similar electrical characteristics to a PN junction diode	Modern illumination, indicator, display	2
10.	PNP Transistor			Active	It helps to control current flow in heavy applications	Amplification circuits	3
11.	NPN Transistor			Active	It is used to amplify weak signals	Switching applications, amplification circuits	3
12.	**FET** (Field Effect Transistor)			Active	It is a <u>voltage</u> controlled device due to this it is used in operational amplifier as voltage variable resistors.	Input amplifiers in devices i.e. voltmeters, oscilloscopes, and other measuring devices	3
13.	**MOSFET** (Metal Oxide Semiconductor Field Effect Transistor)			Active	It has an insulated gate, whose voltage determines the conductivity of the device.	automotive electronics, particularly as switching devices in electronic control units, and as power converters in modern electric vehicles	3
14.	**SCR** (Silicon Controlled Rectifier)			Active	It is essentially a switch with no moving parts. It consists of a semiconductive path and what is called a bridge.	used in devices where the control of high power, possibly coupled with high voltage, is demanded	3

15.	Transformer			Passive	It is a static device which transfer electric power from one circuit to another without changing it's frequency.	To step up and step down the voltage and current	4 or 5 (in case of centre tapped transformer)

Results and Observations:
Resistors: R1 - 10kΩ, R2 - 220Ω, R3 - 1kΩ
Capacitors: C1 - 47µF, C2 - 10µF
Diodes: D1 - 1N4148, D2 - 1N4007
Transistors: Q1 - BC547, Q2 - BC557
Integrated Circuits: IC1 - LM358, IC2 - NE555
Voltage Regulator: VR1 - LM7805

Discussion: The aforesaid elements are identified successfully in a given circuit.

Measure the Value of a Given Resistor and to Confirm with Colour Code

Experiment No.: 07

Experiment Name:

Measure the Value of a Given Resistor and to Confirm with Colour Code.

Objective:

1. To measure the value of a given resistor
2. To confirm the value of that given resistor with colour code

Theory:

Colour	1st Colour Band	2nd Colour Band	3rd Colour Band (Multiplier)	4th Colour Band (Tolarance)
Black	**0**	**0**	**$\times 10^0$**	**–**
Brown	**1**	**1**	**$\times 10^1$**	**–**
Red	**2**	**2**	**$\times 10^2$**	**–**
Orange	**3**	**3**	**$\times 10^3$ (Kilo)**	**–**
Yellow	**4**	**4**	**$\times 10^4$**	**–**
Green	**5**	**5**	**$\times 10^5$**	**–**
Blue	**6**	**6**	**$\times 10^6$ (Mega)**	**–**
Violet	**7**	**7**	**$\times 10^7$**	**–**
Grey	**8**	**8**	**$\times 10^8$**	**–**
White	**9**	**9**	**$\times 10^9$ (Giga)**	**–**
Golden	**–**	**–**	**$\times 10^{-1}$ or 0.1**	**± 5%**
Silver	**–**	**–**	**$\times 10^{-2}$ or 0.01**	**± 10%**
No Colour (NC)	**–**	**–**	**–**	**± 20%**

Observation Table:

Sl. No.	1st Colour Band	2nd Colour Band	3rd Colour Band (Multiplier)	4th Colour Band (Tolarance)	Observed Value	Measured Value
1.	Brown	Black	Red	Golden	1 kΩ ±5%	1.01 kΩ
2.						
3.						
4.						
5.						

Apparatus Used:

Sl. No.	Name of the Apparatus	Quantity	Specification	Maker's Name
1.	Resistor	5	Carbon Component Resistor, ¼ Watt, Different value	
2.	Digital Multimeter	1	0-10 MΩ, 0-750 V, 0-10 A	METRAVI

Discussion:

The measured value of the resistor is almost same as observed value. We have used a tricks to remember the colour code chart, that is, "**B B ROY G**ood **B**oy **V**ery **G**ood **W**orker". Where, 1st **B** for Black, 2nd **B** for Brown, **R** for Red, **O** for Orange, **Y** for Yellow, 1st **G** for Green, 3rd **B** for Blue, **V** for Violet, 2nd **G** for Grey, and **W** for White.

In this lab, we successfully used a multimeter to measure the resistance of a given resistor and verified it with the color code markings. The process involved setting up the multimeter, connecting the resistor, and reading the resistance value displayed. By comparing the measured value with the expected value derived from the color code markings, we were able to confirm the accuracy of the resistor's value.

Test the PN junction Diodes using Digital Multimeter and find out their V-I characteristics in Forward Biased Circuit

Experiment No. :

Experiment Name :

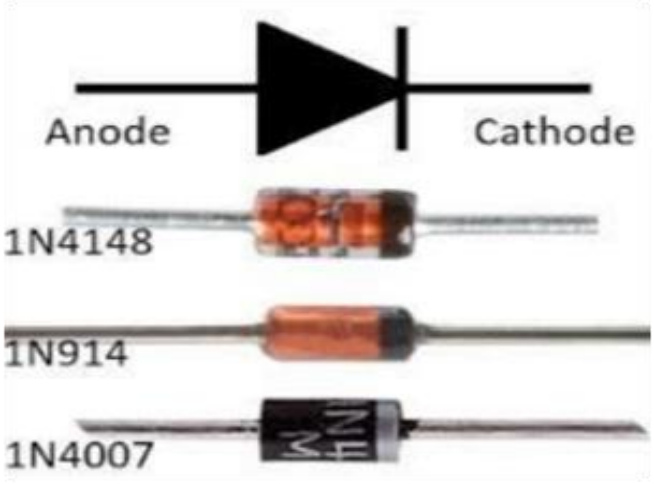
Test the PN junction Diodes using Digital Multimeter and find out their V-I characteristics in Forward Biased Circuit.

Objective :

- To test the PN junction diode using digital multimeter.
- To find out the V-I characteristics in Forword Biased Circuit.

Theory :

A diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other. A diode vacuum tube or thermionic diode is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate.



If +ve terminal of the input supply is connected to anode (P-side) and –ve terminal of the input supply is connected to cathode (N- side) then diode is said to be forward biased. In this condition the height of the potential barrier at the junction is lowered by an amount equal to given forward biasing voltage. Both the holes from p-side and electrons from n-side cross the junction simultaneously and constitute a forward current (injected minority current – due to holes crossing the junction and entering N-side of the diode, due to electrons crossing the junction and entering P-side of the diode). Assuming current flowing through the diode to be very large, the diode can be approximated as short-circuited switch.

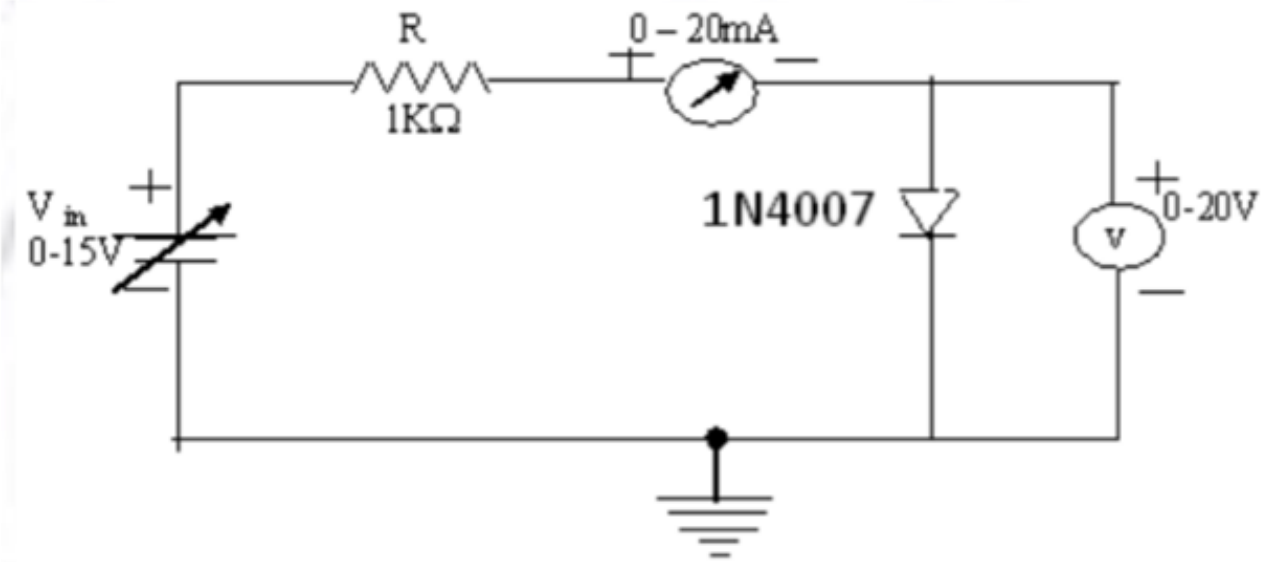
A multimeter's Diode Test mode produces a small voltage between test leads. The multimeter then displays the voltage drop when the test leads are connected across a diode when forward-biased.

Diode test analysis

- A good forward-biased diode displays a voltage drop ranging from 0.5 to 0.8 volts for the most commonly used silicon diodes. Some germanium diodes have a voltage drop ranging from 0.2 to 0.3 V.
- The multimeter displays OL when a good diode is reverse-biased. The OL reading indicates the diode is functioning as an open switch.

- A bad (opened) diode does not allow current to flow in either direction. A multimeter will display OL in both directions when the diode is opened.
- A shorted diode has the same voltage drop reading (approximately 0.4 V) in both directions

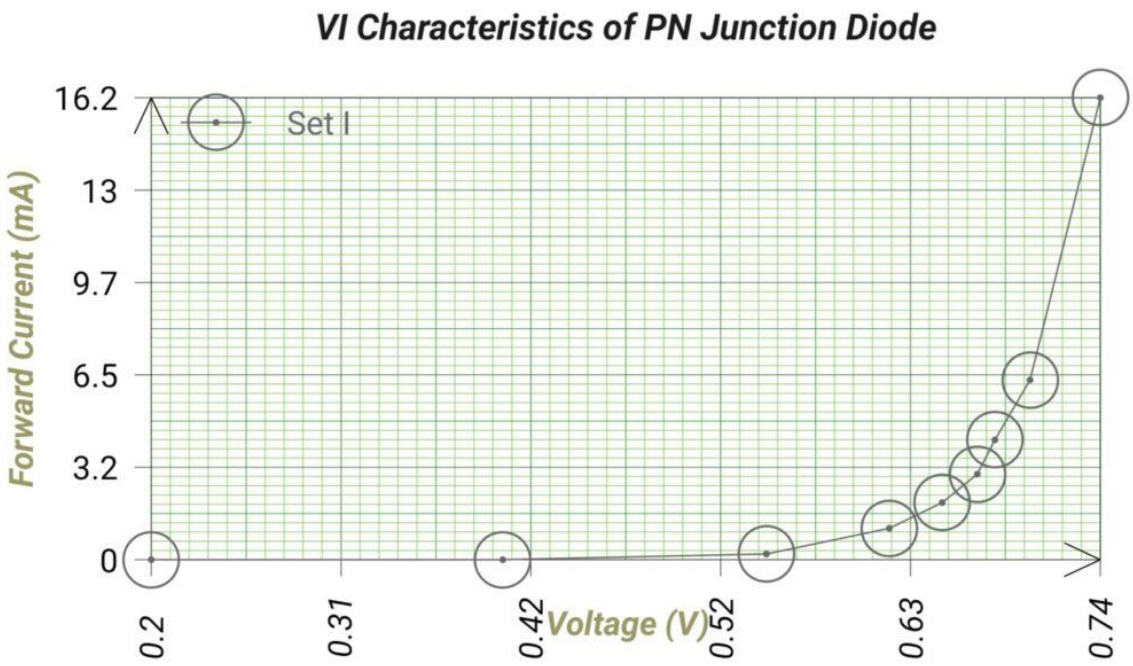
Circuit Diagram:



Observation Table:

Sl.No.	Forward Voltage across the Diode (V)	Forward Current through the Diode (mA)
1.	**0.20**	**0**
2.	**0.40**	**0**
3.	0.55	0.2
4.	**0.62**	**1.1**
5.	**0.65**	**2.0**
6.	0.67	3.0
7.	0.68	4.2
8.	0.70	6.3
9.	0.74	16.2

Graph:



Apparatus Used:

Sl. No.	Name of the Apparatus	Quantity	Specification	Maker's Name
1.	Diode & Zener Diode Characteristics Trainer Kit	1	Diode 1N4007	M.E.W.
2.	Digital Multimeter	1	0-10 MΩ, 0-750 V, 0-10 A	METRAVI

Remarks:

The forward characteristics of the pn junction diode is plotted on graph and the knee voltage is found out. The forward voltage is measured using digital multimeter.

Identification of 3 terminal of a Transistor and to calculate Gain in CE Mode

Experiment No:

Experiment Name:

Identification of 3 terminal of a Transistor and to calculate Gain in CE Mode

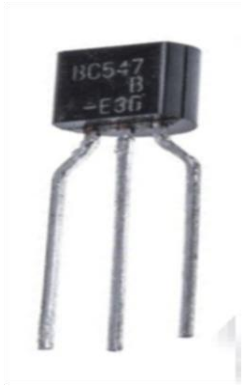
Theory:

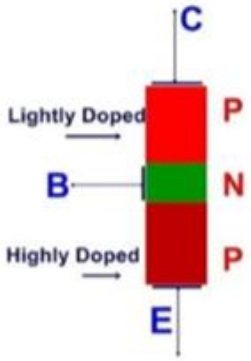
A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

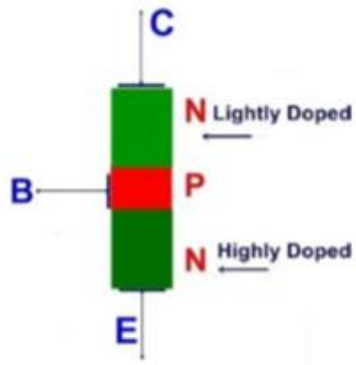
An NPN transistor is a semiconductor device with three distinct areas: a P-region sandwiched between two N-regions.

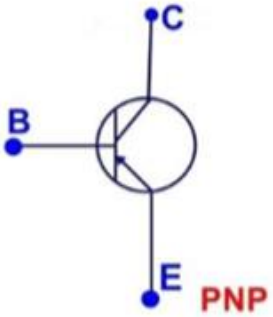
An PNP transistor is a semiconductor device with three distinct areas: an N-region sandwiched between two P-regions.

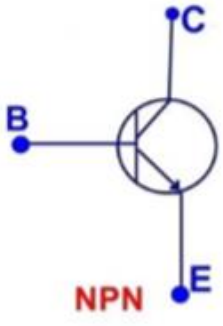
Observation:

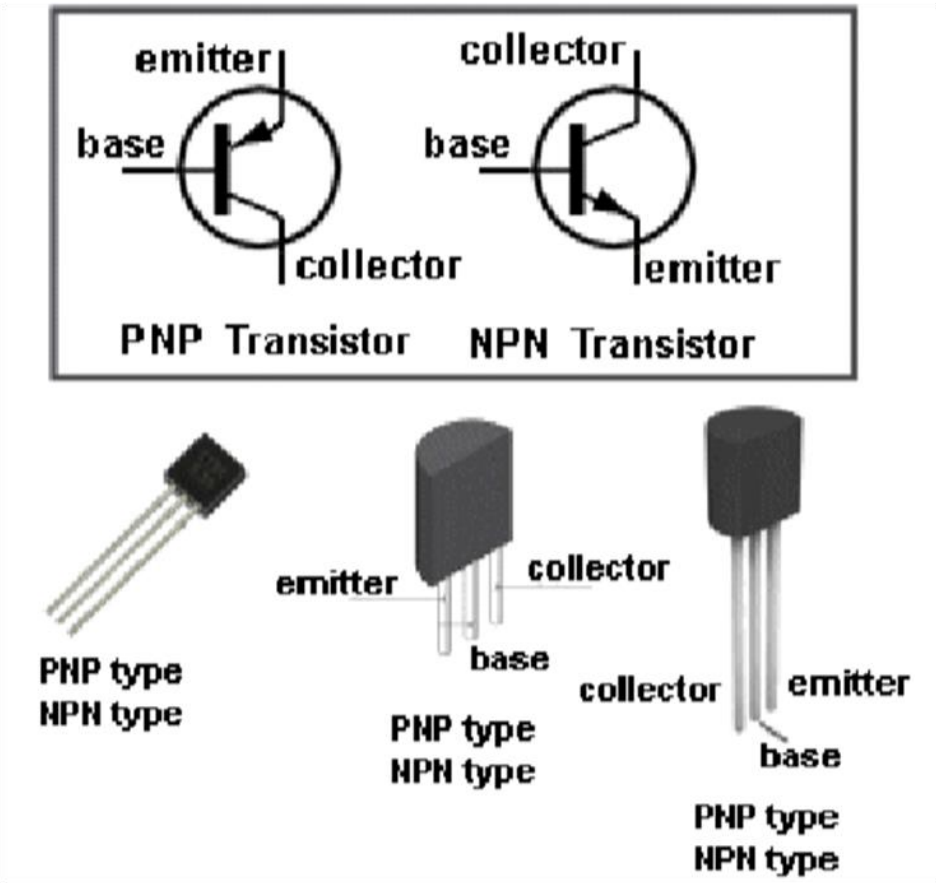












Current Gain = Collector current / Base current

Apparatus Used:

Sl. No.	Name of the Apparatus	Quantity	Specification	Maker's Name
1.	Transistor	1	BC547	
2.	Digital Multimeter	1	0-10 MΩ, 0-750 V, 0-10 A	Haoyue DT830D

Discussion: In this lab, we successfully identified the three terminals of a transistor using a digital multimeter. By testing the diode junctions and analyzing the voltage drop readings, we were able to determine the base, emitter, and collector terminals.

Transistors are essential components in amplification and switching circuits, and correctly identifying their terminals is crucial for their proper utilization. Understanding the terminal configuration allows us to correctly connect the transistor in circuits and ensure the desired functionality.

Realization of Truth Table of Different Logic Gates and Verification of De Morgan's Theorem

Introduction: Logic gates are fundamental building blocks of digital circuits that perform logical operations on one or more binary inputs to produce a binary output. They are based on Boolean algebra and play a crucial role in digital systems. De Morgan's theorem is an important principle in Boolean algebra that provides a relationship between the logical complement of a compound expression and its individual terms. In this lab, we will realize the truth tables of different logic gates and verify De Morgan's theorem using logic gates.
Objective: The objective of this lab is to demonstrate the realization of truth tables for different logic gates and verify De Morgan's theorem using logic gates.

COMPONENTS REQUIRED:

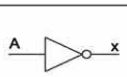
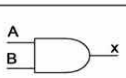
- Logic gate ICs (e.g., AND, OR, NOT)(IC 7400, IC 7408, IC 7432, IC 7406, IC 7402, IC 7404, IC 7486)
- Breadboard
- Connecting wires
- LEDs
- Resistors (if required)

Procedure:

1. Set up the circuit: a. Select the logic gates you want to work with (e.g., AND, OR, NOT). b. Place the logic gate ICs onto the breadboard, ensuring correct pin connections. c. Connect power and ground connections to the respective pins of the ICs. d. Connect the input terminals of the logic gates to the desired binary inputs (0s and 1s) using switches or jumper wires. e. Connect the output terminals of the logic gates to LEDs or output indicators through appropriate current-limiting resistors.
2. Realize the truth tables of logic gates: a. Assign binary values (0 or 1) to the inputs of each logic gate and note down the combinations. b. Activate the circuit by applying power. c. Observe the output states of the logic gates corresponding to each input combination. d. Record the output states in a truth table format.
3. Verify De Morgan's theorem: a. Choose a compound logical expression involving multiple inputs and their logical operators (AND, OR, NOT). b. Simplify the expression using De Morgan's theorem by applying the appropriate transformations. c. Implement the original expression and its De Morgan's transformed expression using logic gates. d. Compare the output states of both implementations for all input combinations. e. Confirm whether the output states match, thus verifying De Morgan's theorem.
4. Repeat for different logic gates and expressions: a. Perform steps 2 and 3 with other logic gates (e.g., OR, NOT) to realize their truth tables and verify De Morgan's theorem for compound expressions involving those gates. b. Record the results and observations for each gate and expression.

Results and Observations:

Logic Gates

Name	NOT	AND	NAND	OR	NOR	XOR	XNOR
Alg. Expr.	$\overline{A}$	AB	$\overline{AB}$	$A+B$	$\overline{A+B}$	$A \oplus B$	$\overline{A \oplus B}$
Symbol							

Truth Table

A	X
0	**1**
1	**0**

B	A	X
0	0	**0**
0	1	**0**
1	0	**0**
1	1	**1**

B	A	X
0	0	**1**
0	1	**1**
1	0	**1**
1	1	**0**

B	A	X
0	0	**0**
0	1	**1**
1	0	**1**
1	1	**1**

B	A	X
0	0	**1**
0	1	**0**
1	0	**0**
1	1	**0**

B	A	X
0	0	**0**
0	1	**1**
1	0	**1**
1	1	**0**

B	A	X
0	0	**1**
0	1	**0**
1	0	**0**
1	1	**1**

Inputs (A, B) | Original Output (X) |De Morgan's theorem verification

Discussion: In this lab, we successfully realized the truth tables for different logic gates and verified De Morgan's theorem using logic gates. By implementing the logic gates on a breadboard and observing the output states corresponding to different input combinations, we were able to construct the truth tables.

Furthermore, we applied De Morgan's theorem to simplify compound logical expressions involving multiple inputs and their logical operators. By comparing the output states of the original expression and its De Morgan's transformed expression, we confirmed that the output states matched for all input combinations, thus verifying De Morgan's theorem.

Understanding the truth tables of logic gates and De Morgan's theorem is crucial for designing and analyzing complex digital circuits. These concepts form the foundation of digital logic design and are essential for various applications, including digital arithmetic, sequential circuits, and computer architecture.