PHYSICS PROJECT

ON

LOGIC GATE

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***CLASS:* XIIth** ***SECTION:* 'A1'**

***ROLL NO.:* 03**

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CERTIFICATE

THIS IS TO CERTIFY THAT THIS PROJECT IS THE BONAFIDE WORK OF **SAURAV KUMAR** OF CLASS **12TH 'A1'** AND HAS BEEN SUCCESSFULLY COMPLETED AND IS TAKEN TO BE AN ISSUE CONDUCTED BY THE C.B.S.E. IN THE SESSION 2015-2016.

- TEACHER’S SIGNATURE:
- EXTERNAL’S SIGNATURE:
- PRINCIPAL’S SIGNATURE:

ACKNOWLEDGEMENT

MERE WORDS WON'T BE ABLE TO EXPRESS MY GRATITUDE AND THANKFULNESS FOR THE VARIOUS PEOPLE WITHOUT WHOSE INVOLVEMENT THIS PROJECT COUNLDN'T HAVE BEEN COMPLETED SUCCESSFULLY.

FIRST OF ALL, I WOULD LIKE TO EXPRESS MY HEARTY GRATITUDE FOR **MISS ANUPAMA KAUSHAL**, MY PHYSICS TEACHER WITHOU T WHOSE SUPPORT AND GUIDANCE THIS VERY PROJECT COULDN'T HAVE BEEN POSSIBLE. I WOULD ALSO LIKE TO THANK MR. RAJU, OUR PHYSICS LAB ASSISTANT, WHO WAS ALWAYS THERE TO HELP US OUT OUR PROBLEMS.

LASTLY, I WOULD LIKE TO END UP THANKING ALL MY FRIENDS AND MY PARENTS TOO WITHOUT WHOSE CONTRIBUTION THE WORK ENTERED IN THIS FILE WOULDN'T BE A REALITY.

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AIM

TO DESIGN AN APPROPRIATE LOGIC GATE FOR A GIVEN TRUTH TABLE"

INTRODUCTION

A gate is defined as a digital circuit which follows some logical relationship between the input and output voltages. It is a digital circuit which either allows a signal to pass through as stop, it is called **a gate**.

The logic gates are building blocks at digital electronics. They are used in digital electronics to change on voltage level (input voltage) into another (output voltage) according to some logical statement relating them.

A logic gate may have one or more inputs, but it has only one output. The relationship between the possible values of input and output voltage is expressed in the form of a table called ***truth table or table of combinations***.

Truth table of a Logic Gates is a table that shows all the input and output possibilities for the logic gate.

George Boole in 1980 invented a different kind of algebra based on binary nature at the logic, this algebra of logic called *BOOLEAN ALGEBRA*. A logical statement can have only two values, such as

HIGH/LOW, ON/OFF, CLOSED/OPEN, YES/NO, RIGHT/WRONG, TRUE/FALSE, CONDUCTING/NON-CONDUCTING etc. The two values of logic statements one denoted by the binary number 1 and 0. The binary number 1 is used to denote the high value. The logical statements that logic gates follow are called ***Boolean expressions***

THEORY

Logic gates or logic gate is an entity in electronics and mathematics Boolean that turns one or more logic inputs to a logic output signal. Logic gate is mainly implemented electronically using diodes or transistors, but can also be built using the arrangement of components that utilize the properties of electromagnetic (relay), fluids, optical or even mechanical. Any Boolean algebra operation can be associated with inputs and outputs represent the statements of Boolean algebra. Although these circuits may be complex, they may all be constructed from three basic devices. We have three different types of logic gates .These are the AND gate, the OR gate and the NOT gate.

LOGIC STATES	
1	0
HIGH	LOW
+v	-v
ON	OFF
CLOSE	OPEN
RIGHT	WRONG
TRUE	FALSE
YES	NO

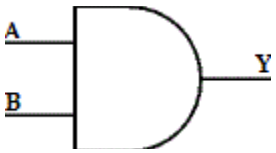
BASIC GATES

(a) THE OR GATE is a device that combines A with B to give Y as the result.
The OR gate has two or more inputs and one output. The logic gate of OR gate with A and B input and Y output is shown below:

In Boolean 

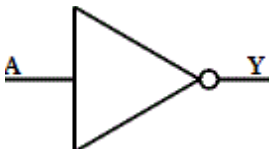
algebra, addition symbol (+) is referred as the OR. The Boolean expression:
A+B=Y, indicates Y equals A OR B.

(b) THE AND GATE is a device that combines A with B to give Y as the result.
The AND gate has two or more inputs and one output. The logic gate of AND gate with A and B input and Y output is shown below:



In Boolean algebra, multiplication sign (either x or.) is referred as the AND. The Boolean expression:
A**.**B=Y, indicates Y equals A AND B.

(c)THE NOT GATE is a device that inverts the inputs. The NOT is a one input and one output. The logic gate of NOT gate with A and Y output is shown below:



In Boolean algebra, bar symbol (-) is referred as the NOT. The Boolean expression:
Ã =Y, indicates Y equals NOT A.

THE OR GATE

Aim:

TO DESIGN AND SIMULATE THE OR GATE CIRCUIT.

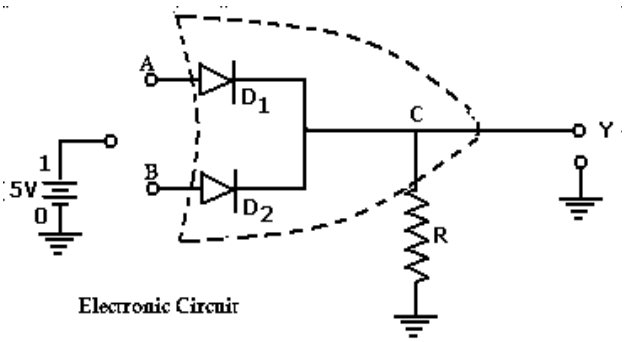
Components:

Two ideal p-n junction diode (D_1 and D_2).

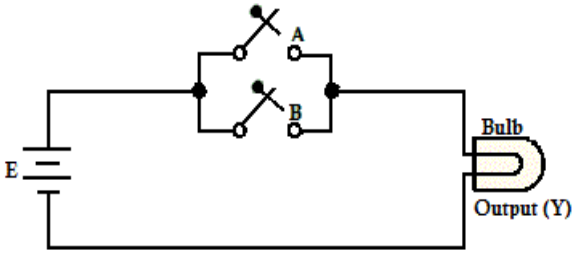
Theory and Construction:

An OR gate can be realize by the electronic circuit, making use of two diodes D_1 and D_2 as shown in the figure.

Here the negative terminal of the battery is grounded and corresponds to the 0 level, and the positive terminal of the battery (i.e. voltage 5V in the present case) corresponds to level 1. The output Y is voltage at C w.r.t. earth.



Electronic Circuit



Analogue Circuit

The following interference can be easily drawn from the working of electrical circuit is:

a) If switch A & B are open lamp do not glow (A=0, B=0), hence Y=0.

b) If Switch A open B closed then (A=0, B=1) Lamp glow, hence Y=1.

c) If switch A closed B open then (A=1, B=0) Lamp glow, hence Y=1.

d) If switch A & B are closed then (A=1, B=1) Lamp glow, hence Y=1.

Truth Table:

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

THE AND GATE

Aim:

TO DESIGN AND SIMULATE THE AND GATE CIRCUIT.

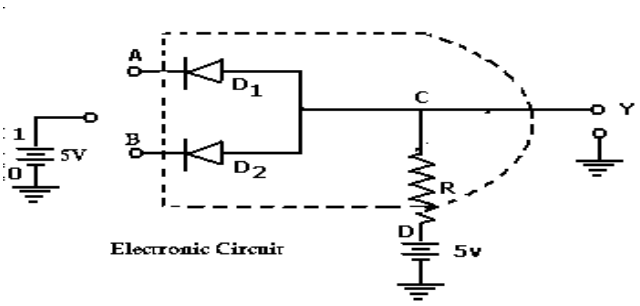
Components:

Two ideal p-n junction diode (D_1 and D_2), a resistance R.

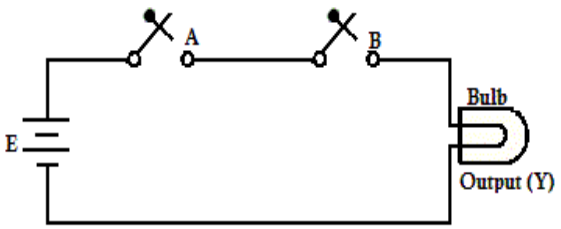
Theory and Construction:

An AND gate can be realize by the electronic circuit, making use of two diodes D_1 and D_2 as shown in the figure. The resistance R is connected to the positive terminal of a 5V battery permanently.

Here the negative terminal of the battery is grounded and corresponds to the 0 level, and the positive terminal of the battery (i.e. voltage 5V in the present case) corresponds to level 1. The output Y is voltage at C w.r.t. earth.



Electronic Circuit



Analogue Circuit

The following conclusions can be easily drawn from the working of electrical circuit:

a) If both switches A&B are open (A=0, B=0) then lamp will not glow, hence Y=0.
b) If Switch A closed & B open (A=1, B=0) then Lamp will not glow, hence Y=0.
c) If switch A open & B closed (A=0, B=1) then Lamp will not glow, hence Y=0.
d) If switch A & B both closed (A=1, B=1) then Lamp will glow, hence Y=1.

Truth Table:

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

THE NOT GATE

Aim:

TO DESIGN AND SIMULATE THE NOT GATE CIRCUIT.

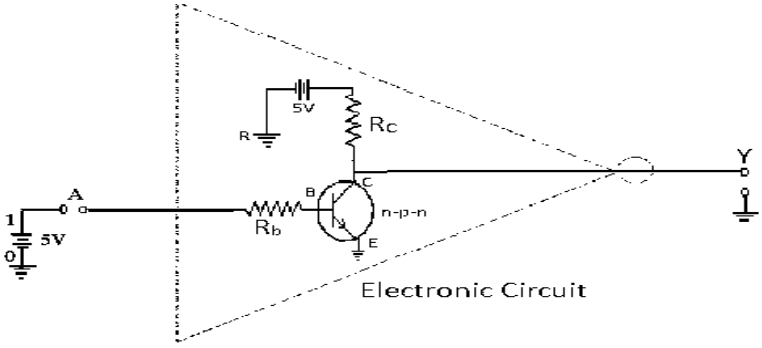
Components:

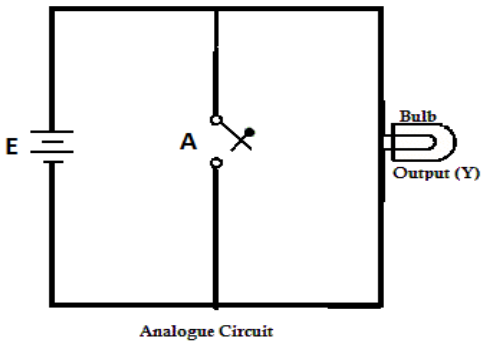
An ideal n-p-n transistor.

Theory and Construction:

A NOT gate cannot be realized by using diodes. However an electronic circuit of NOT gate can be realized by making use of n-p-n transistor as shown in the figure.

The base B of the transistor is connected to the input A through a resistance R_b and the emitter E is earthed. The collector is connected to 5V battery. The output Y is voltage at C w.r.t. earth.





The following conclusion can be easily drawn from the working of the electrical circuit:

a) If switch A is open (i.e. A=0), the lump will glow, hence Y=1.

b) If Switch A is closed (i.e. A=1), the lump will not glow, hence Y=0.

Truth Table:

Input A	Output Y
0	1
1	0

THE NOR GATE

Aim:

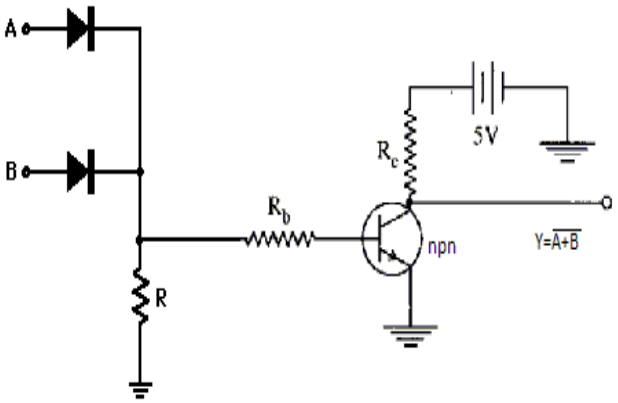
TO DESIGN AND SIMULATE THE NOR GATE CIRCUIT.

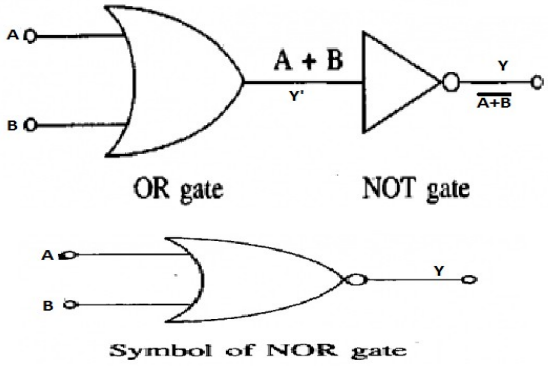
Components:

Two ideal p-n junction diode (D_1 and D_2), an ideal n-p-n transistor.

Theory and Construction:

If we connect the output Y’ of OR gate to the input of a NOT gate the gate obtained is called NOR.
The output Y is voltage at C w.r.t. earth.





In Boolean expression, the NOR gate is expressed as Y=A+B, and is being read as ‘A OR B negated’. The following interference can be easily drawn from the working of electrical circuit is:

a) If Switch A & B open (A=0, B=0) then Lamp will glow, hence Y=1.
b) If Switch A closed & B open (A=1, B=0) then Lamp will not glow, hence Y=0.
c) If Switch A open & B close (A=0, B=1) then Lamp will not glow, hence Y=0.
d) If switch A & B are closed then (A=1, B=1) Lamp will not glow, hence Y=0.

Truth Table:

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

THE NAND GATE

Aim:

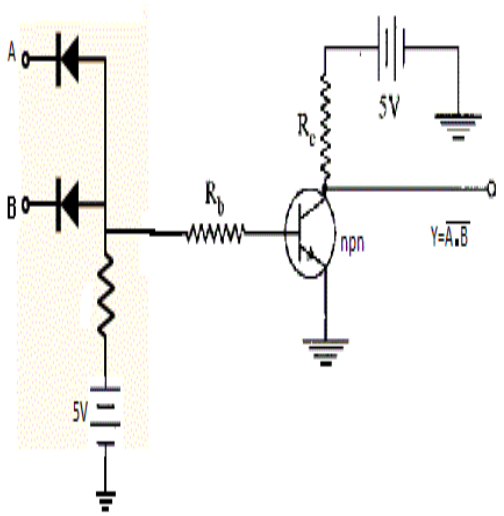
TO DESIGN AND SIMULATE THE NAND GATE CIRCUIT.

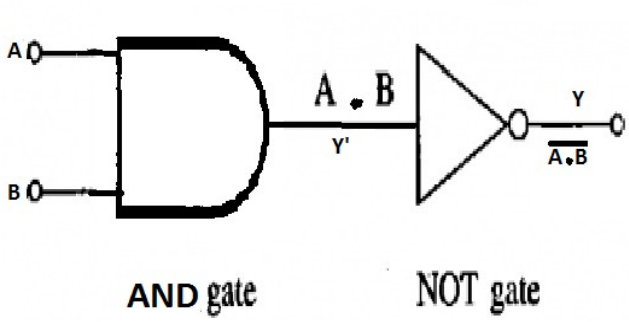
Components:

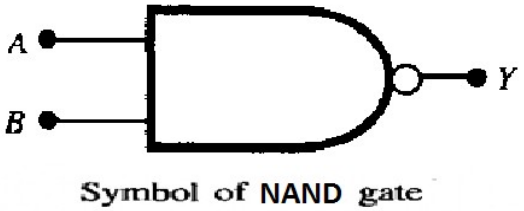
Two ideal p-n junction diode (D_1 and D_2), a resistance R, an ideal n-p-n transistor.

Theory and Construction:

If we connect the output Y' of AND gate to the input of a NOT gate the gate obtained is called NAND. The output Y is voltage C w.r.t.earth.







Symbol of NAND gate

In Boolean expression, the NAND gate is expressed as Y=A.B, and is being read as 'A AND B negated'. The following

interference can be easily drawn from the working of electrical circuit:

a) If Switch A & B open (A=0, B=0) then Lamp will glow, hence Y=1.

b) If Switch A open B closed then (A=0, B=1) Lamp glow, hence Y=1.

c) If switch A closed B open then (A=1, B=0) Lamp glow, hence Y=1.

d) If switch A & B are closed then (A=1, B=1) Lamp will not glow, hence Y=0.

Truth Table:

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

THE XOR GATE

Aim:

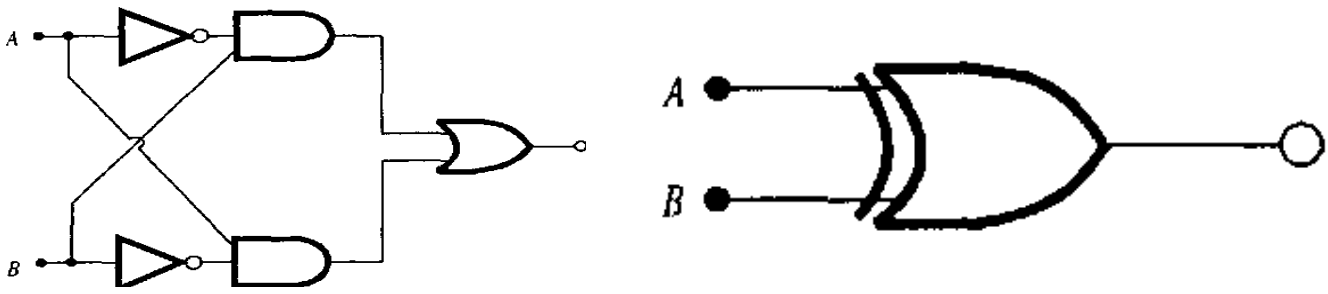
TO DESIGN AND SIMULATE THE EX OR GATE CIRCUIT.

Components:

Two AND gate, an OR gate, two NOT gate.

Theory and Construction:

The operation XOR checks for the exclusivity in the value of the two signals A and B. It means if A and B are not identical (i.e. if A=0 and B=1 or vice versa), the output Y=1, and if both are identical, then the output Y=0. This operation is also called exclusive OR gate, designated EXOR.



In Boolean expression, the EX OR gate is expressed as

$$Y=A.\bar{B} + \bar{A}.B = A \oplus B$$

The following interference can be easily drawn from the working of electrical circuit:

a) If both switches A&B are open (A=0, B=0) then lamp will not glow, hence Y=0.
b) If Switch A open B closed then (A=0, B=1) Lamp glow, hence Y=1.
c) If switch A closed B open then (A=1, B=0) Lamp glow, hence Y=1.
d) If switch A & B are closed then (A=1, B=1) Lamp will not glow, hence Y=0.

Truth Table:

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

THE XNOR GATE

Aim:

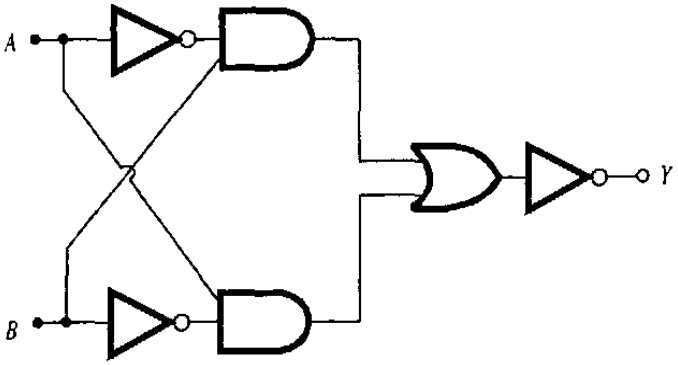
TO DESIGN AND SIMULATE THE EX NOR GATE CIRCUIT.

Components:

Two AND gates, an OR gates, three NOT gates._

Theory and Construction:

The operation XNOR checks for the exclusivity in the value of the two signals A and B. It means if A and B are not identical (i.e. if A=0 and B=1 or vice versa), the output Y=0, and if both are identical, then the output Y=1. This operation is also called exclusive NOR gate, designated XNOR.



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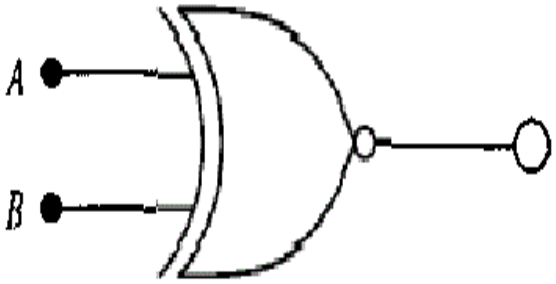

Boolean expression, the XNOR gate is expressed as

$$Y=A.B + \overline{A}.\overline{B} = \overline{A \oplus B}$$

The following interference can be easily drawn from the working of electrical circuit:

a) If Switch A & B open (A=0, B=0) then Lamp will glow, hence Y=1.

b) If Switch A closed & B open (A=1, B=0) then Lamp will not glow, hence Y=0.

c) If Switch A open & B close (A=0, B=1) then Lamp will not glow, hence Y=0.

d) If switch A & B both closed (A=1, B=1) then Lamp will glow, hence Y=1.

Truth Table:

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

BIBLIOGRAPHY

I would like to acknowledge the following sources through which I obtained vital information which contributed in the completion of this project:

I. slideshare.com
II. wikipedia.org
III. icbse.co.in
IV. scribd.com