Date _____

Expt. No. 2 Page No. 4

Experiment - 2

AIM : Realization of logic functions with the help of universal NAND gate.

Apparatus :- Bread Board, NAND gate, wires.

Theory :-

NAND gate is actually a combination of two logic gates AND and NOT gate. It's output is compliment of AND gate. This gate can have minimum two inputs, output is always one. By using only NAND gate we can realise all logic functions AND, OR, NOR, XOR and XNOR. That is why this gate is known as universal gate.

NAND as NOT gate :-

NOT gate represent compliment of the input it can have only one input and join NAND input together, Now it will work as NOT gate

$$Y = (A \cdot A)'$$

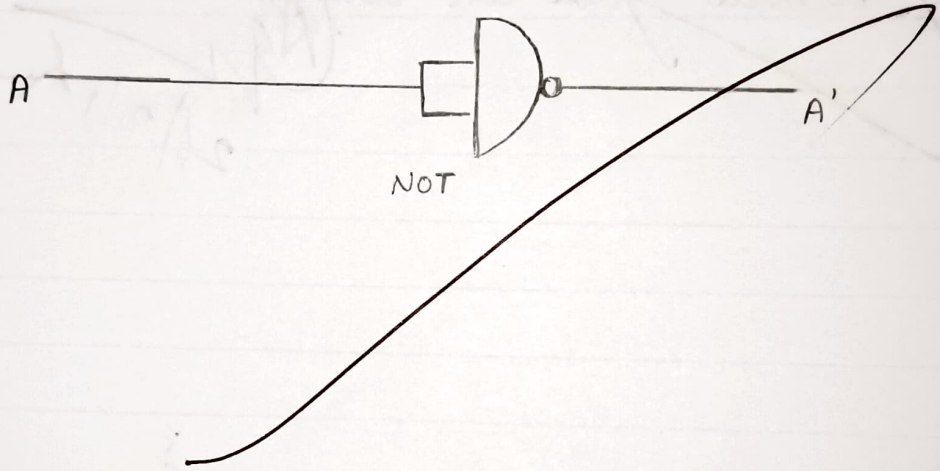
$$Y = A$$

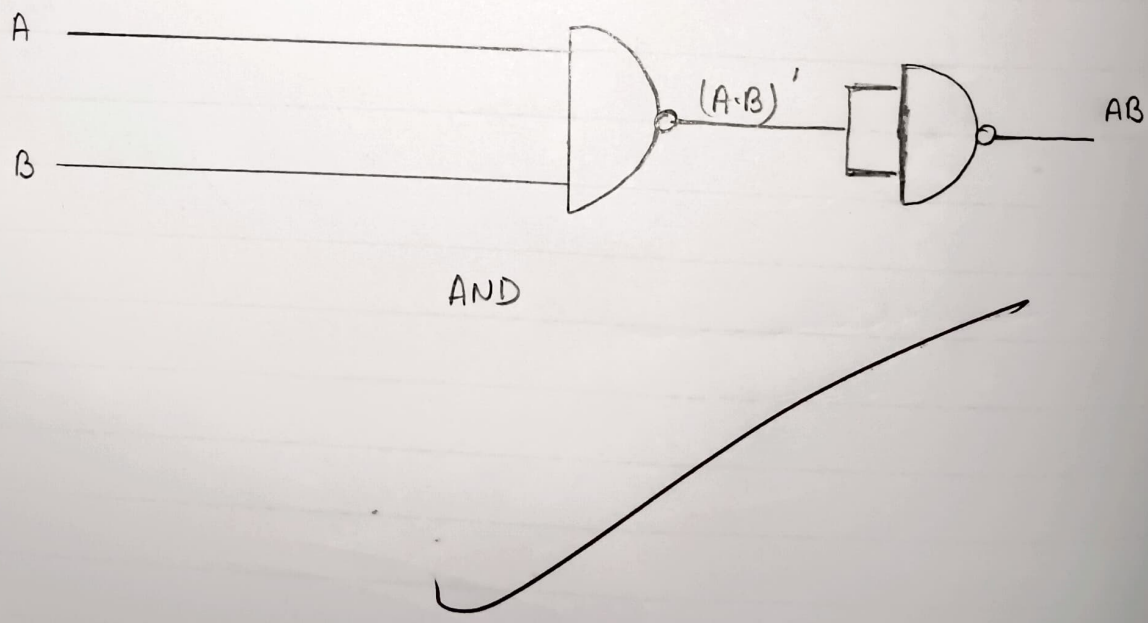
NAND as AND gate :-

NAND produces compliment of AND gate. So if the product of a NAND is inverted overall output will be AND gate.

$$Y = ((A \cdot B)')'$$

$$Y = A \cdot B$$


A
A'
NOT


A
B
(A·B)'
AB
AND

NAND gate as OR gate :-

From De Morgan's Theorem

$$(A \cdot B)' = A' + B'$$

$$(A' \cdot B')' = A'' + B''$$

$$\therefore = A + B$$

So give the inverted input to a NAND gate to obtain OR operation as output.

NAND as XOR gate :-

Output of a input XOR gate is shown by

$$Y = AB' + A'B$$

this can be achived with logic diagram as

Gate no.	Input	Output
1.	A, B	$(AB)'$
2.	A, $(AB)'$	$(A(AB)')'$
3.	$(AB)'$, B	$(B(AB)')'$
4.	$(A(A \cdot B)')' \cdot (B(A \cdot B)')'$	$A'B + AB'$

Now the output from gate no. 4 is overall output

$$Y = ((A(AB)')' + (B(A \cdot B)')')'$$

$$= (A(AB)'')'' + (B(AB)'')''$$

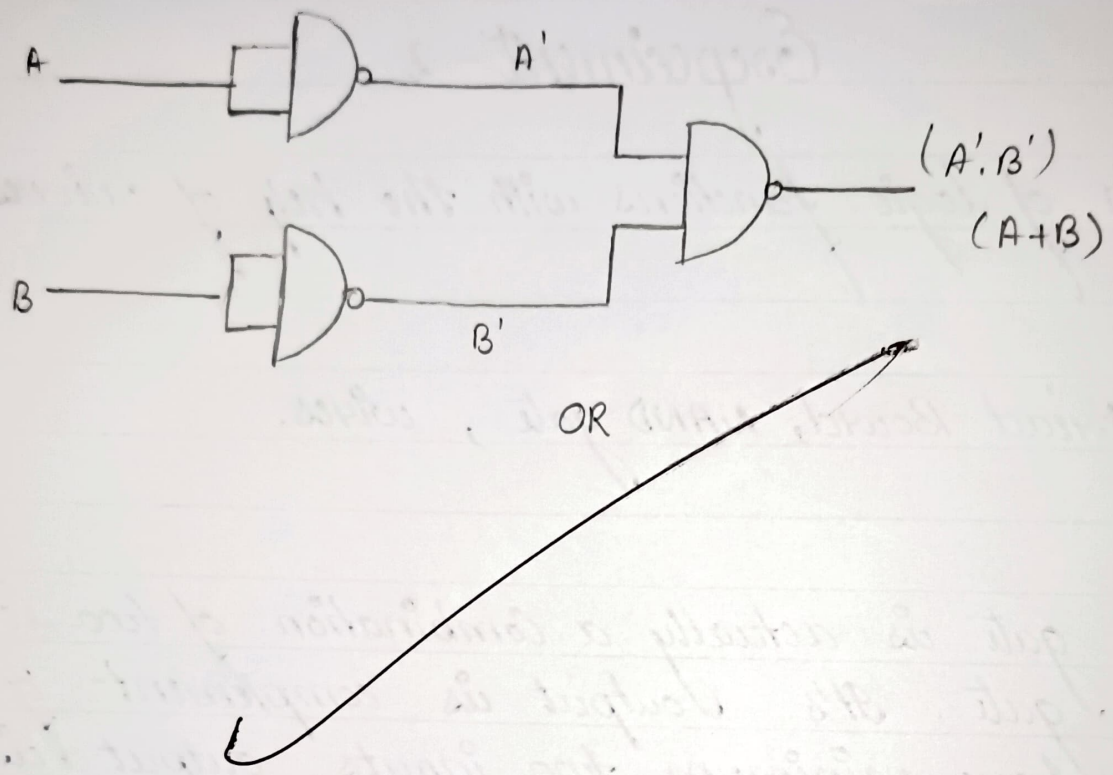
$$= (A(AB)') + (B(AB)')$$

$$= AA' + AB' + BA' + BB'$$

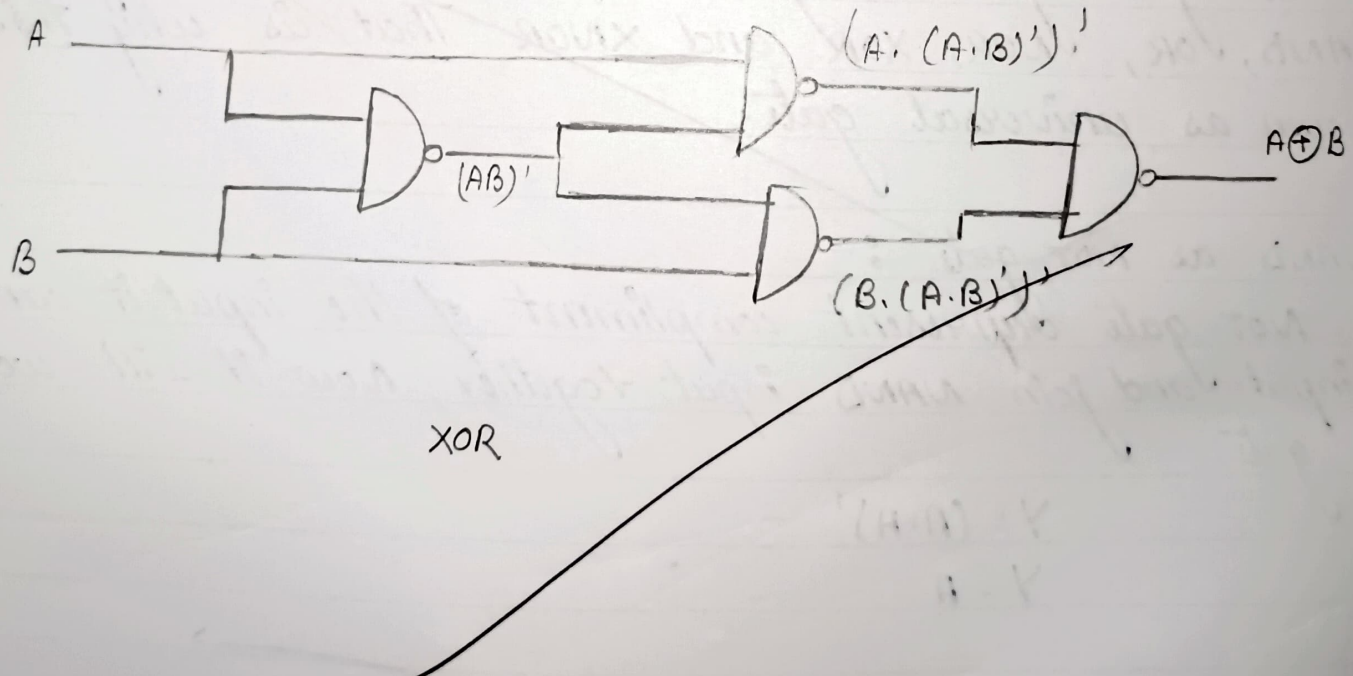
$$= 0 + AB' + BA' + 0$$

$$Y = AB' + BA'$$

Teacher's Signature



OR



XOR

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NAND gate as XNOR :-

XNOR gate is actually XOR gate followed by NOT gate. So give the output of XOR gate to a NOT gate so this give the output of XOR.

Overall output is that of an XNOR gate

$$Y = AB + A'B'$$

NAND gate as NOR :-

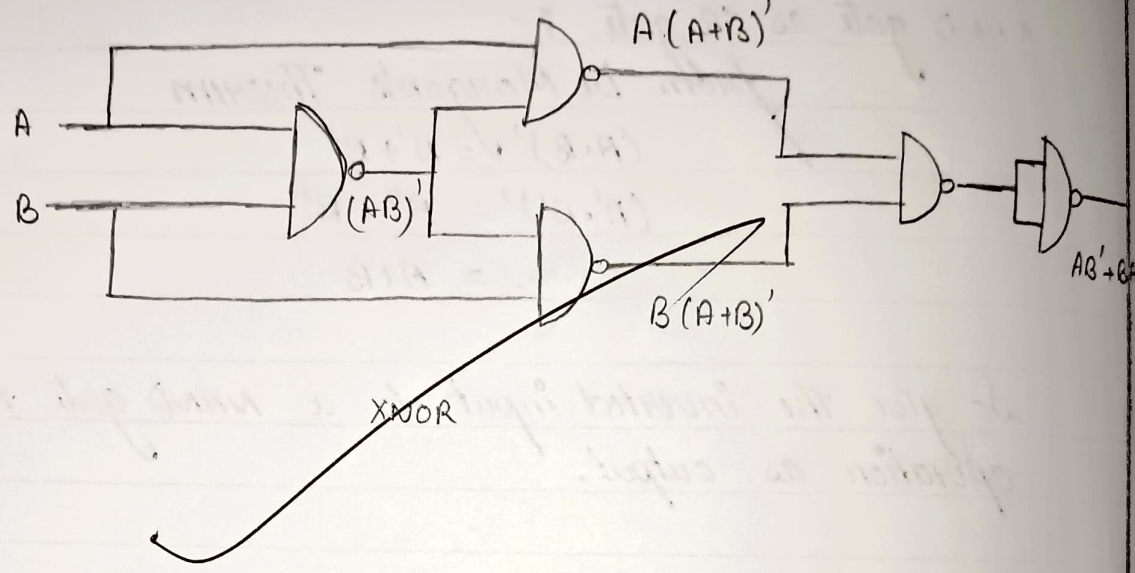
NOR gate is an OR gate followed by NOT gate So convert the output of OR gate to a NOT gate, overall output is that of a NOR gate

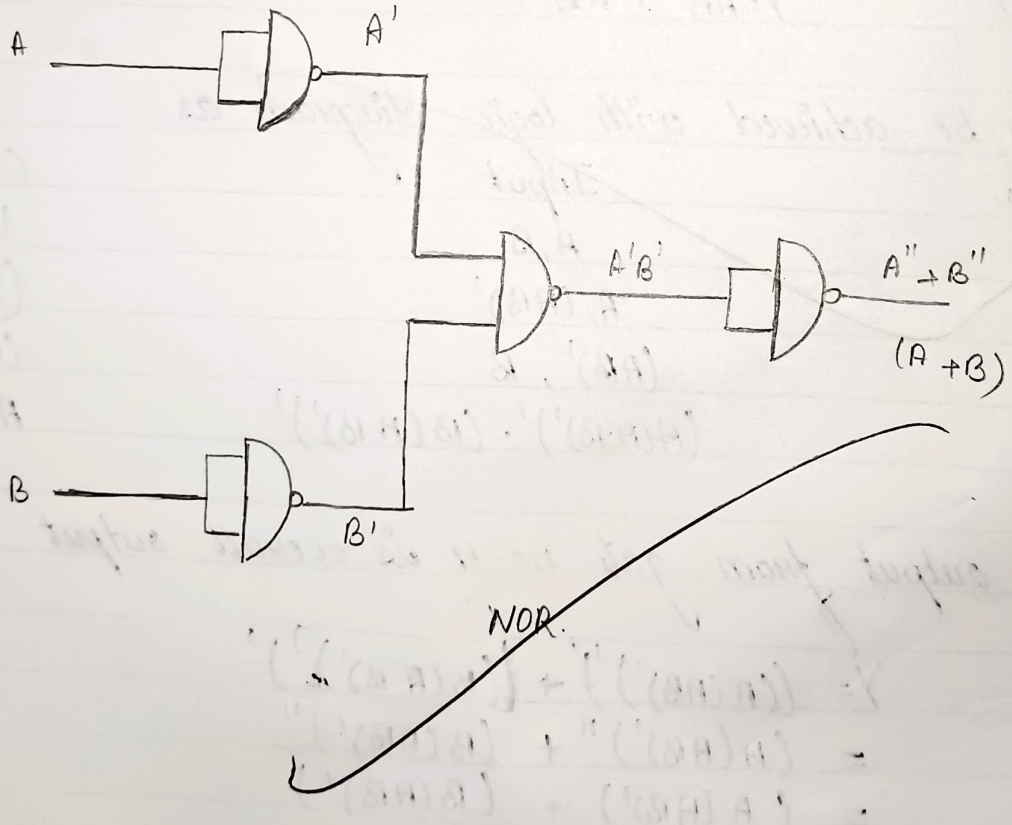
$$Y = (A+B)'$$

PROCEDURE :-

1) Convert the kit to AC power Supply
2) Connect the NAND gate for any of the logic gate
3) Convert the input of first Stage to logic Source and output to the last gate to logic indicator.
4) Apply various input combination and observe output.
5) Verify the truth table for each input/output.
6) Repeat the process for all logic function.
7) Switch off the A.C. power Supply.

26/8/19


A
B
(AB)'
A(A+B)'
B(A+B)'
AB'+B
XNOR


A
A'
B
B'
A'B'
A''+B''
(A+B)
NOR