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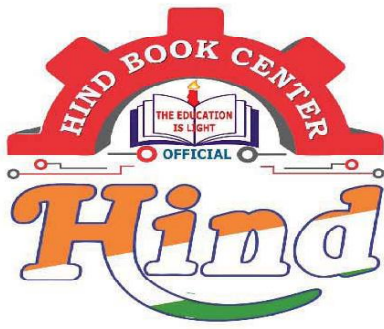### Toppers Handwritten Notes
Digital Logic
By- Sriniwas Sir

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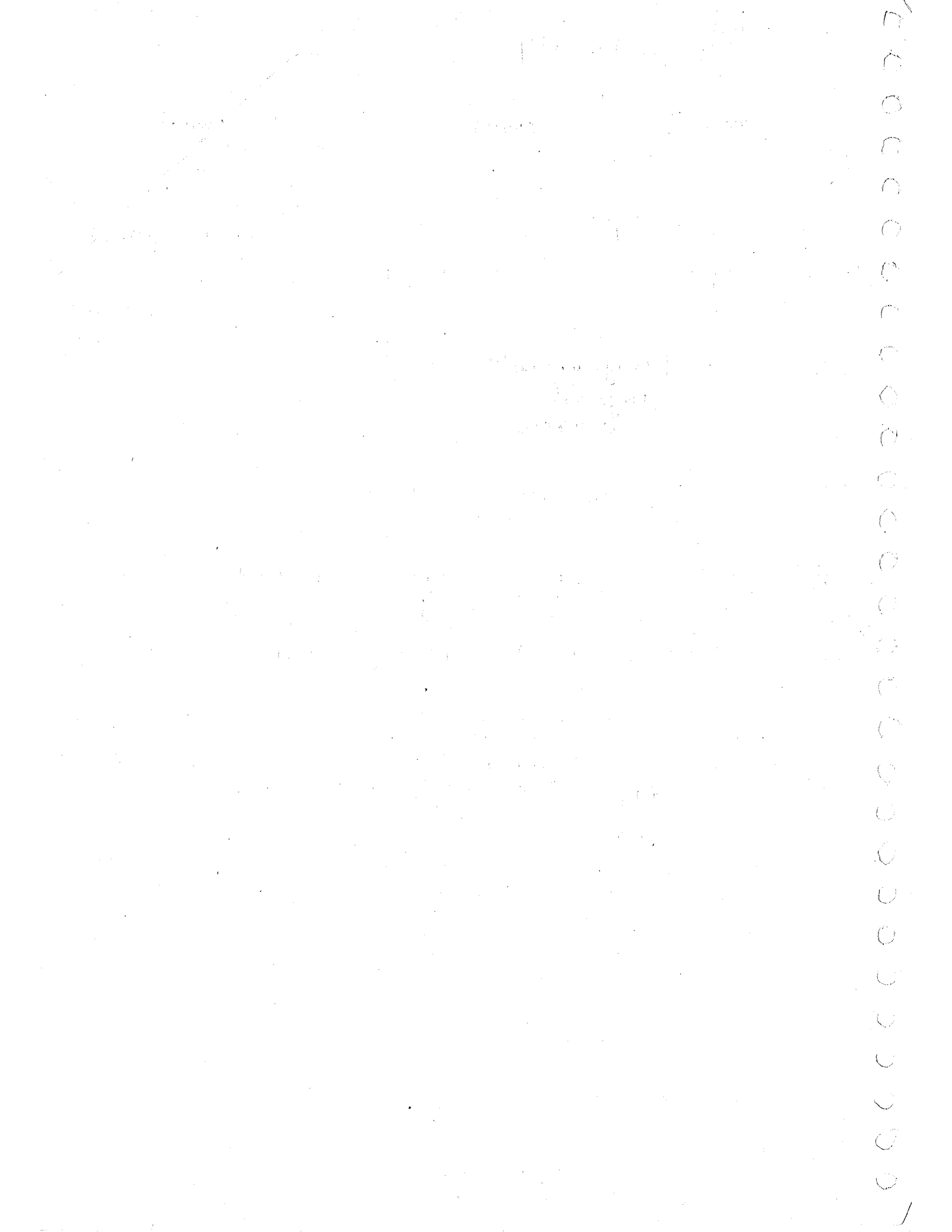
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Digital Logic Design

— Sri Nivas Sir.

Syllabus:

Text Book
Modern Digital Electronics
— RP Jain
TMH Publication.

SRINIVAS BETHI
9959750099

1). **Boolean Algebra**
   Boolean Variables
   Boolean operators
   Logic Gates
   B.A. properties
   Derived operators
   Universal Logic Gates
   Boolean function using Universal Logic Gates
   Simplification
   Self Dual functions etc.

2). **Number System**
   Conversion $(\quad)_{r_1} = (\quad)_{r_2}$
   $(r-1)$'s and r's
   Signed B. No. System etc.

3). **K-Map**
   Implicant
   Prime implicant
   Essential Prime implicant.

4). **Combinational Circuits**
   Code converters
   Arithmatic Circuits
   MUX, Decoder,
   Encoder, DeMUX etc.

5). **Sequential Circuits**
   Binary Latch
   Flip-flops
   Flip Flop Conversions
   $FF1 \longrightarrow FF2$
   $x_1 y_1 \longrightarrow x_2 y_2$
   Registers $\Rightarrow$ SISO, SIPO etc...

6). **Counters**   a) Asynch.
                    b) Synch.

$$\boxed{\text{Boolean Algebra}} \longleftrightarrow \underline{\text{Chapter 1}}$$

$r = 2 \longleftarrow$ Binary.

~~Binary~~
Boolean Variables $\Rightarrow$ A, B, C ...
$\qquad\qquad\qquad\qquad a, b, c$ ...

Operators $\Rightarrow \underline{\text{OR, AND}}, \underline{\text{NOT}}$
$\qquad\qquad\quad\; \underset{\text{Binary}}{} \qquad \underset{\text{Unary}}{}$

$\underline{\text{OR Operator}} \rightarrow +, \cup, \vee$

$$Y = A + B = A \cup B = A \vee B$$

$$Y = A + B + C + \cdots$$

A	B	Y = A+B
0	0	0
0	1	1
1	0	1
1	1	1

A B C	Y = A+B+C
0 0 0	0
0 0 1	1
0 1 0	1
0 1 1	1
1 0 0	1
1 0 1	1
1 1 0	1
1 1 1	1

<u>Note</u>:• The result of OR operation is zero if and only if, all the variables are zero.

• OR Gate

$Y = A + B + C + \dots$
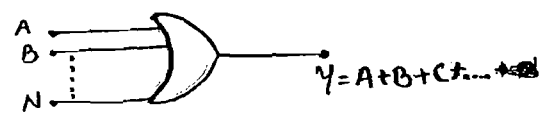
• No. of inputs in the logic gate is known as Fanin of the Logic gate.

for 2 Fanin of the OR Gate
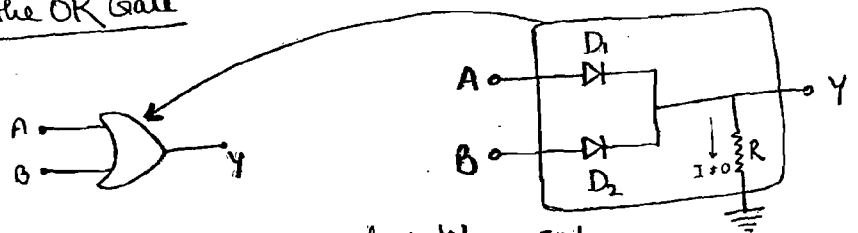
logic '1' $\Rightarrow +5V$
logic '0' $\Rightarrow 0V$

2

Truth Table is one consisting of all possible combination of the variables along with the result.

$$\text{for } n \Rightarrow 2^n \text{ Rows}$$

$$\text{values} \Rightarrow [0,1,2\ldots(2^n-1)]$$

AND OPERATOR : $\longrightarrow \cdot , \cap , \wedge$
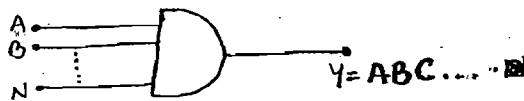
$$Y = A \cdot B = A \cap B = A \wedge B$$

$$Y = A \cdot B \cdot C \ldots$$

A	B	$Y = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

A	B	C	$Y = A \cdot B \cdot C$
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Note : • The result of AND operation is zero, if atleast one of the variable is zero.

• AND Gate

$$Y = ABC \ldots$$

	OR	AND
if $A = 0 \Rightarrow Y =$	B	0
if $A = 1 \Rightarrow Y =$	1	B
if $A = B = x \Rightarrow Y =$	x	x
if $A \neq B \Rightarrow Y =$	1	0
Enable input $\Rightarrow$	0	1
Disable input $\Rightarrow$	1	0

exp.
In OR Gate
$$Y = A + B + C$$
if $B = 0$, $Y = A + C$
if $B = 1$, $Y = 1$
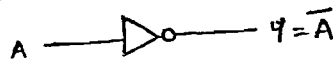
• Enable i/p is the one, it makes the device active.

Disable i/p is the one, it will make the device is to be inactive.

NOT Operator : '—', ' ' '

$$Y = \overline{A} = A'$$

A	Y = NOT A
0	1
1	0

Note : • NOT Gate

A ———▷o——— $Y = \overline{A}$

• NOT operator is also known as Inverter.

BOOLEAN ALGEBRA PROPERTIES :

1). $A + A + \ldots = A$

  $A \cdot A \cdot A \ldots = A$

2). $A + 0 = A$

  $A \cdot 1 = A$

3). $A + 1 = 1$

  $A \cdot 0 = 0$

4). $A \cdot \overline{A} = 0$

  $A + \overline{A} = 1$

5). $\overline{\overline{A}} = A$

6). $A + BC = (A+B)(A+C)$ → Distributivity.

  $A \cdot [B+C] = AB + AC$ → Dual of (6).

7). $A + \overline{A}B = A + B$

  $A[\overline{A} + B] = AB$

8). $\overline{A} + AB = \overline{A} + B$

  $\overline{A}[A+B] = \overline{A}B$

9). $A + AB = A$

  $A[A+B] = A$

•
Dual Operation	
Principle of Duality	→

  → OR ⟷ AND

  0 ⟷ 1.

Ques. $\overline{A} + B[C + \overline{D}(\overline{E} + F)]$

  Dual ⟹ $\overline{A}[B + C[\overline{D} + \overline{E}F]]$

•
Variable 'x' ⟹ 'x'
Literal 'x' ⟹ 'x' or '$\overline{x}$'

• There is No effect ~~on~~ ~~of~~ the dual operation on the Literal.