SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++'(III Cycle) Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

23ECB201 – DIGITAL SYSTEMS DESIGN

II YEAR/ III SEMESTER

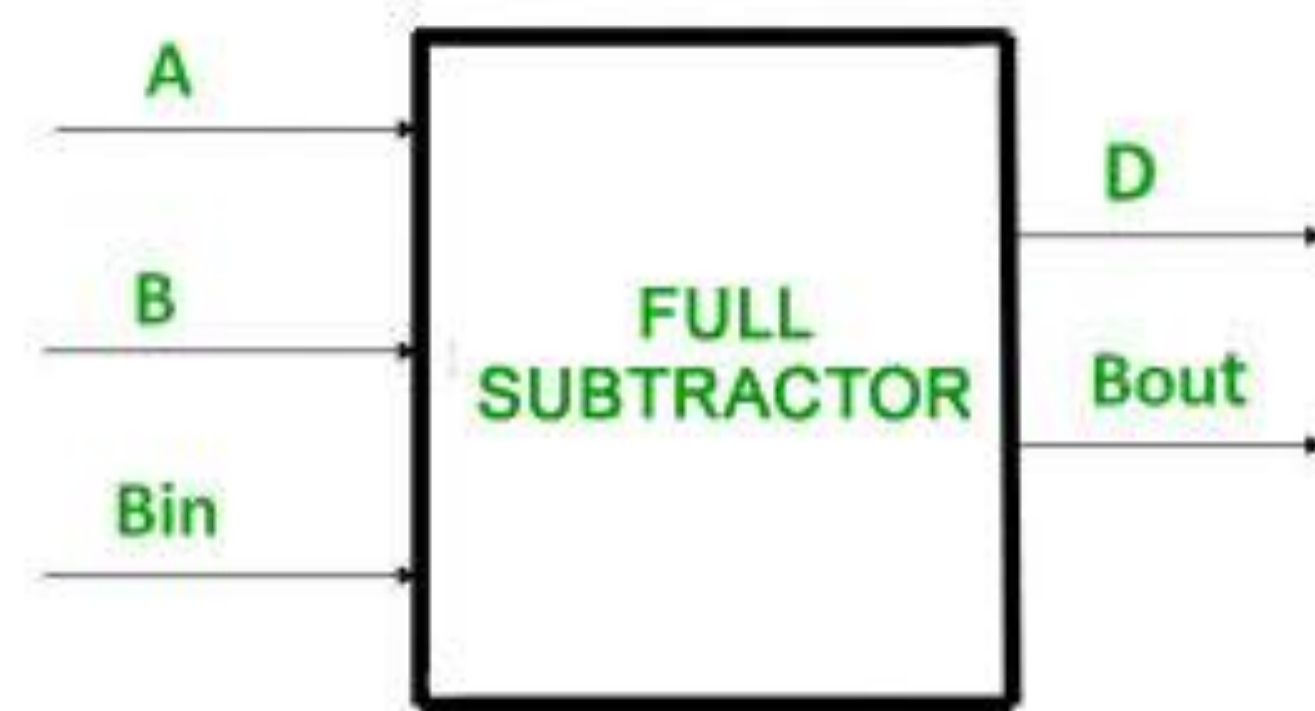## UNIT 2 – COMBINATIONAL CIRCUITS

TOPIC- FULL SUBTRACTOR

FULL SUBTRACTOR

• A full-subtractor is a combinational circuit that has three inputs A, B, bin and two outputs d and b.

• A is the minuend, B is subtrahend, bin is borrow produced by the previous stage, d is the difference output and b is the borrow output.

TRUTH TABLE

Inputs			Outputs	
A	B	Borrow$_{in}$	Diff	Borrow
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

LOGICAL EXPRESSION

For D

$$\begin{array}{c|c|c|c|c}
\diagdown & 00 & 01 & 11 & 10 \\
A \diagdown BB_{in} & & & & \\
\hline
0 & 0 & (1) & 0 & (1) \\
\hline
1 & (1) & 0 & (1) & 0 \\
\end{array}$$

For B_{out}

$$\begin{array}{c|c|c|c|c}
\diagdown & 00 & 01 & 11 & 10 \\
A \diagdown BB_{in} & & & & \\
\hline
0 & 0 & 1 & 1 & 1 \\
\hline
1 & 0 & 0 & 1 & 0 \\
\end{array}$$

$$D = \overline{A}\,\overline{B}\,B_{in} + \overline{A}\,B\,\overline{B}_{in} + A\,\overline{B}\,\overline{B}_{in} + A\,B\,B_{in}$$

$$= B_{in}\,(\overline{A}\,\overline{B} + AB) + \overline{B}_{in}\,(\overline{A}\,B + A\,\overline{B})$$

$$= B_{in}\,(A \odot B) + \overline{B}_{in}\,(A \oplus B)$$

$$= B_{in}\,(\overline{A \oplus B}) + \overline{B}_{in}\,(A \oplus B)$$

$$= B_{in} \oplus (A \oplus B)$$

$$B_{out} = \overline{A}B_{in} + \overline{A}B + BB_{in}$$

IMPLEMENTATION
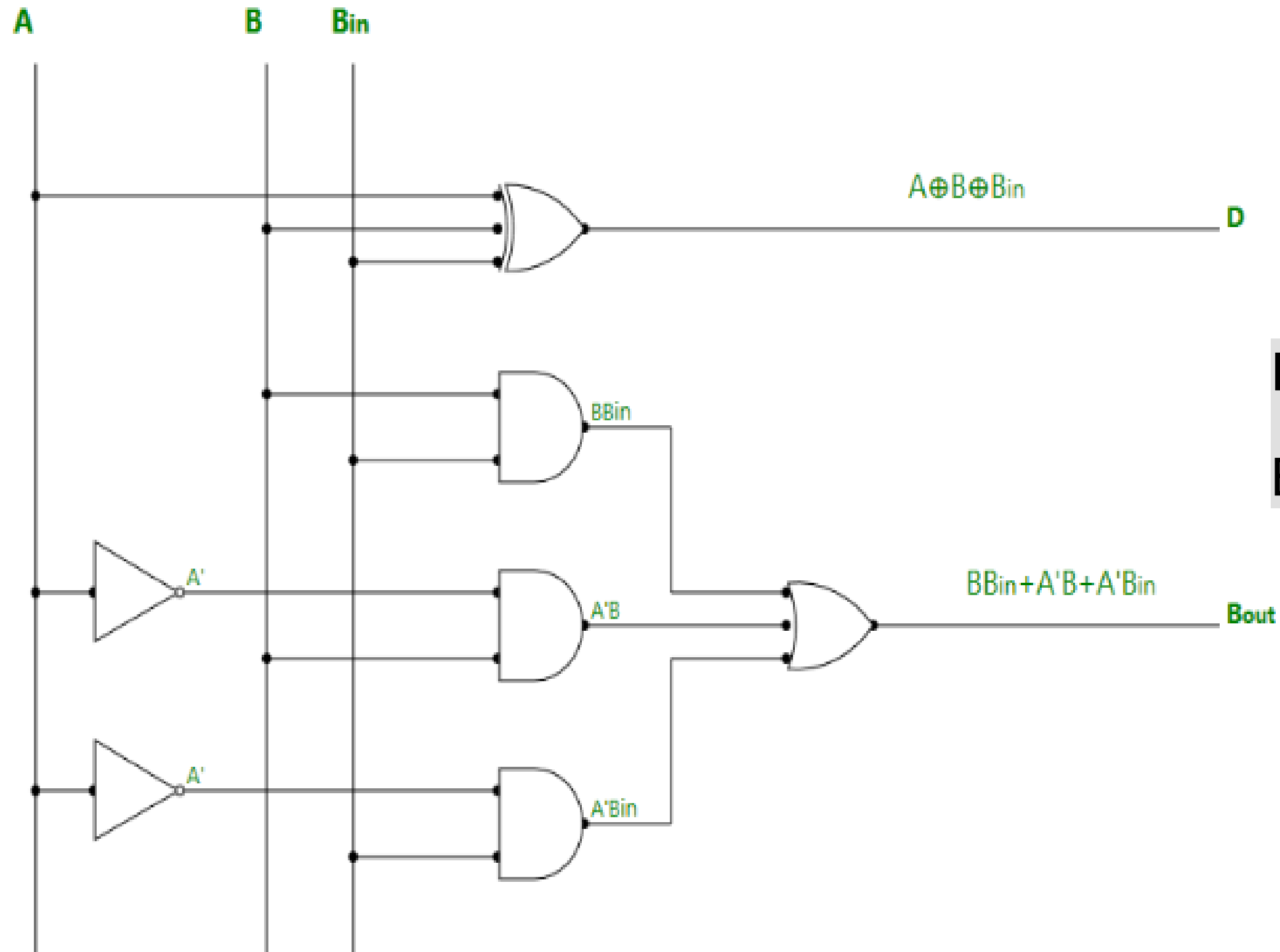
$$D = A \text{ xor } B \text{ xor } B_{in}$$

$$B_{out} = BB_{in} + A'B + A'B_{in}$$

APPLICATIONS OF FULL SUBTRACTOR

1.Arithmetic circuits

2.Microcontrollers

3.Timers and Program Counters

4.Processors

5. DSP

6. ALUs

ADVANTAGES

- The designing of subtractor is very simple as well as implement
- Power deduction within DSP (digital signal processing)
- Computational tasks can be carried out at high speed.

DISADVANTAGES

- The speed of the subtractor is limited by the longest delay through the circuit.

ASSESSMENT QUESTIONS

1. Full subtractor is used to perform subtraction of _____
a) 2 bits
b) 3 bits
c) 4 bits
d) 8 bits

2. The full subtractor can be implemented using _____
a) Two XOR and an OR gates
b) Two half subtractors and an OR gate
c) Two multiplexers and an AND gate
d) Two comparators and an AND gate

3. What does minuend and subtrahend denotes in a subtractor?
a) Their corresponding bits of input
b) Its outputs
c) Its inputs
d) Borrow bits

THANK YOU