SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
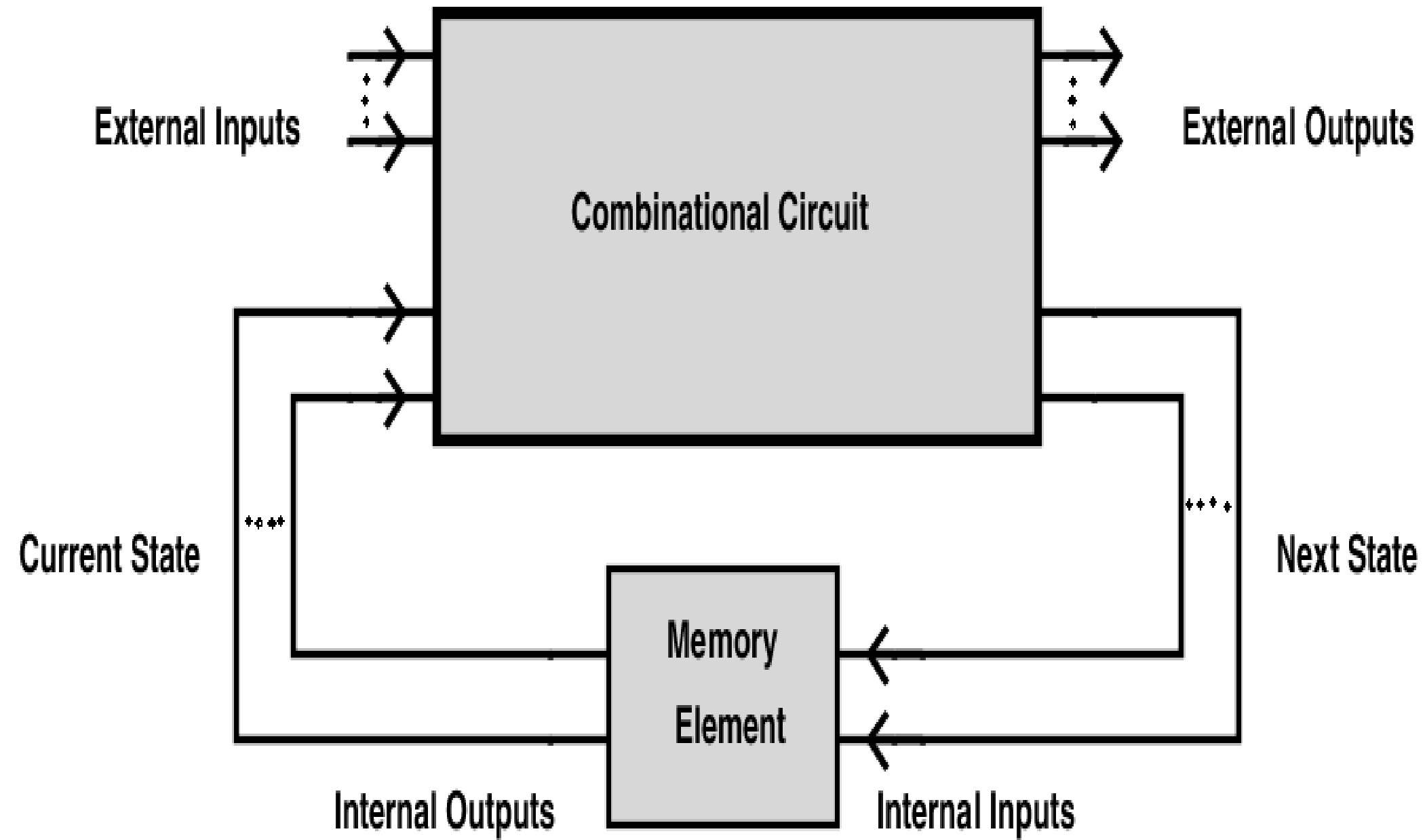
19ECB231 – DIGITAL ELECTRONICS

II YEAR/ III SEMESTER

UNIT 3 – SEQUENTIAL CIRCUITS

TOPIC 1 - LATCHES

10/12/2023

SEQUENTIAL CIRCUITS

SEQUENTIAL CIRCUITS

▪This sequential circuit contains a set of inputs and outputs

▪The outputs of sequential circuit depends not only on the combination of present inputs but also on the previous outputs

▪Previous output is nothing but the **present state**

▪Therefore, sequential circuits contain combinational circuits along with memory storage elements

▪Some sequential circuits may not contain combinational circuits, but only memory elements
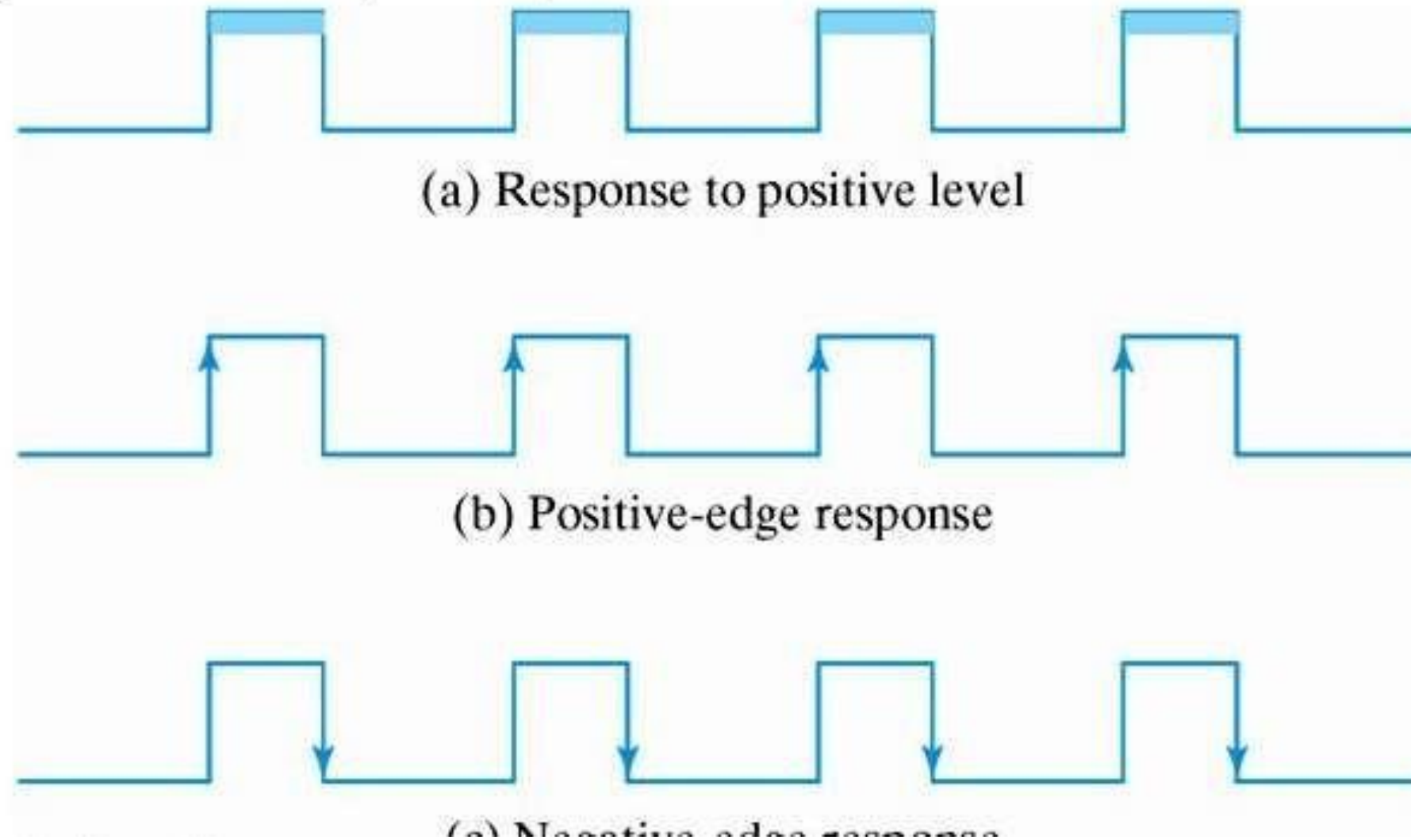
LATCH

- LATCH –building block of sequential circuits capable of storing one bit information
- It has 2 output states Q and Q Complement
- It is built from Logic gates
- Latches does not have Clock signal instead it have enable line
- Output changes only when enable input signal is applied
- Latch is level Triggered

A trigger

- The state of a latch or flip-flop is switched by a change of the control input

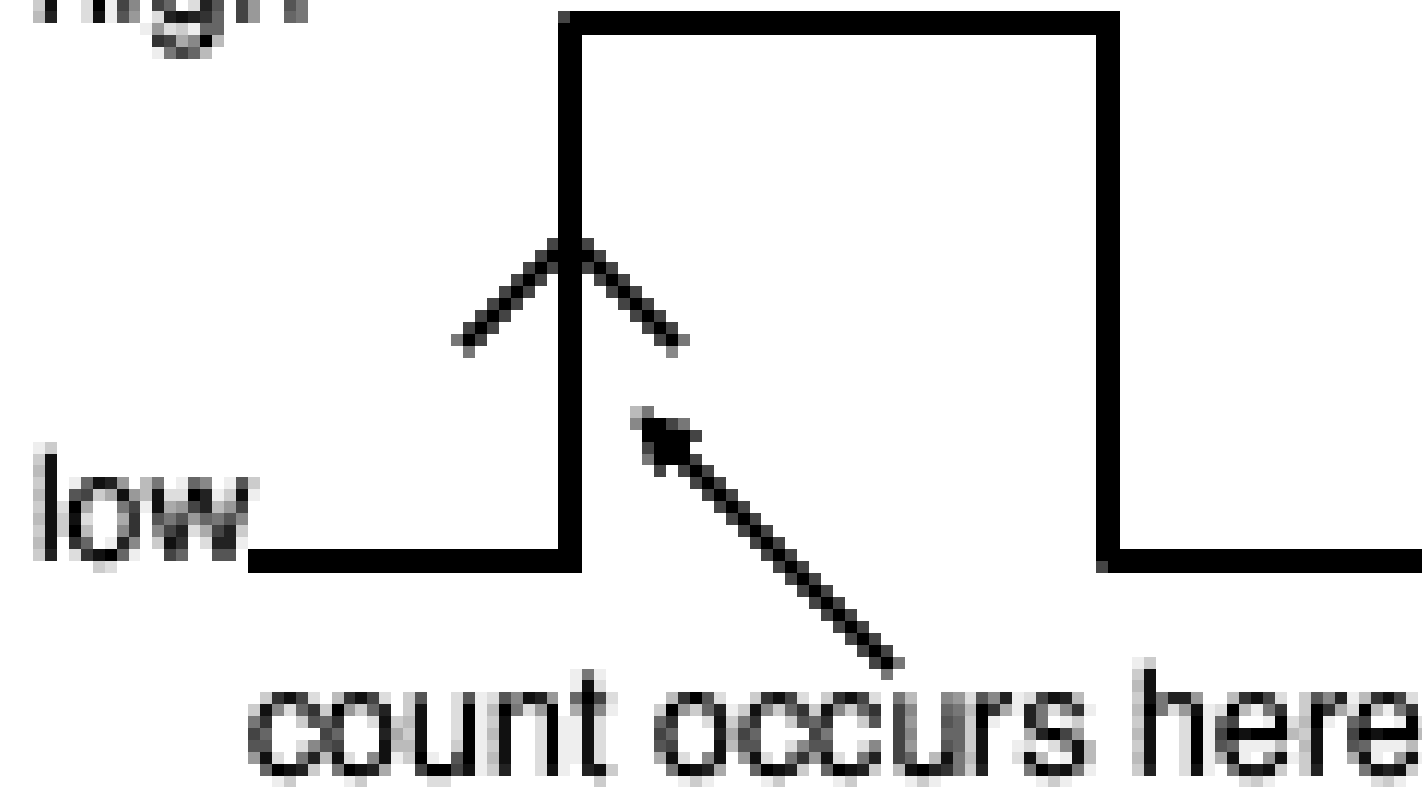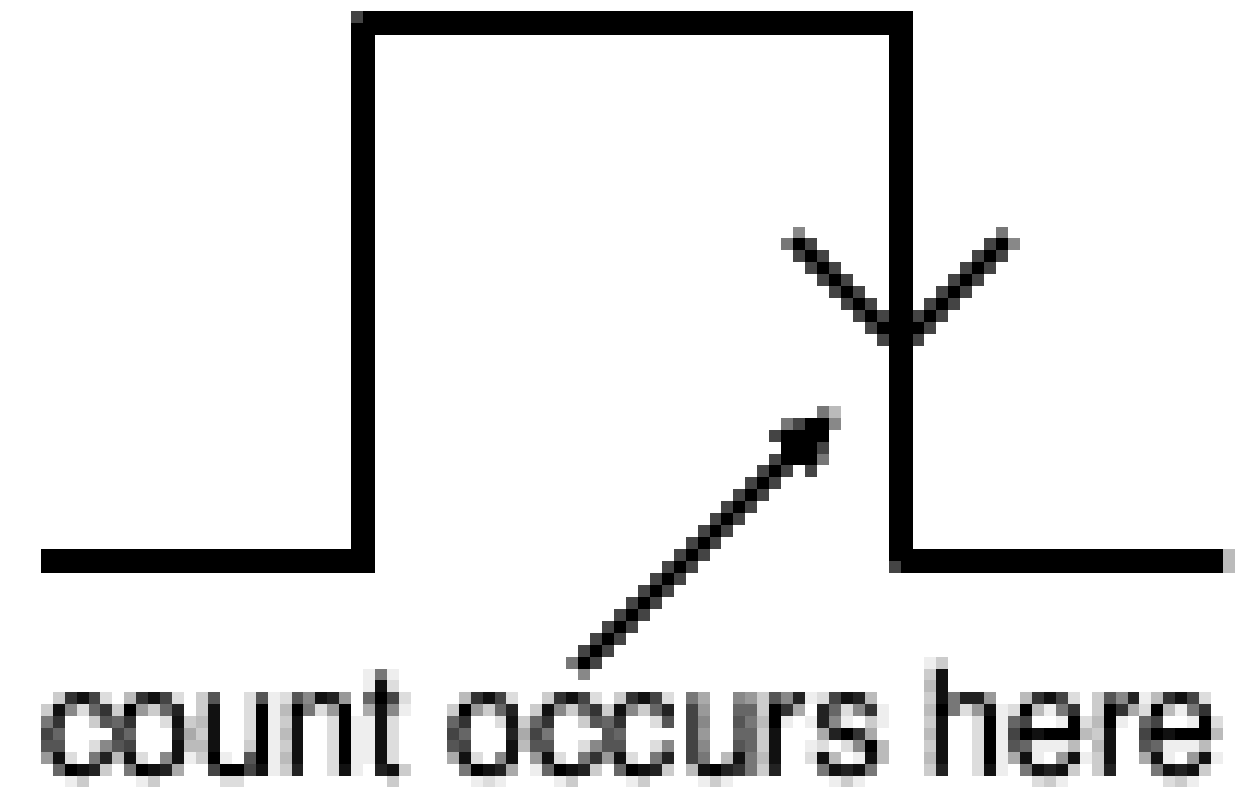- Level triggered – latches
- Edge triggered – flip-flops

(a) Response to positive level

(b) Positive-edge response

(c) Negative-edge response

. 5.8

Level Triggering	Edge Triggering

1. It is of two types
  – High level triggering
  – Low level triggering
	1. It is of two types :
	  – Positive edge triggering
	  – Negative edge triggering

2. The latch or flip-flop circuits which change their outputs only corresponding to active high or low levels are called as level triggered latches or flip-flops.	2. Those flip-flops which change their outputs only corresponding to the positive or negative edge of the clock input are called as edge triggered flip-flops.

TYPES OF LATCH

1.SR Latch
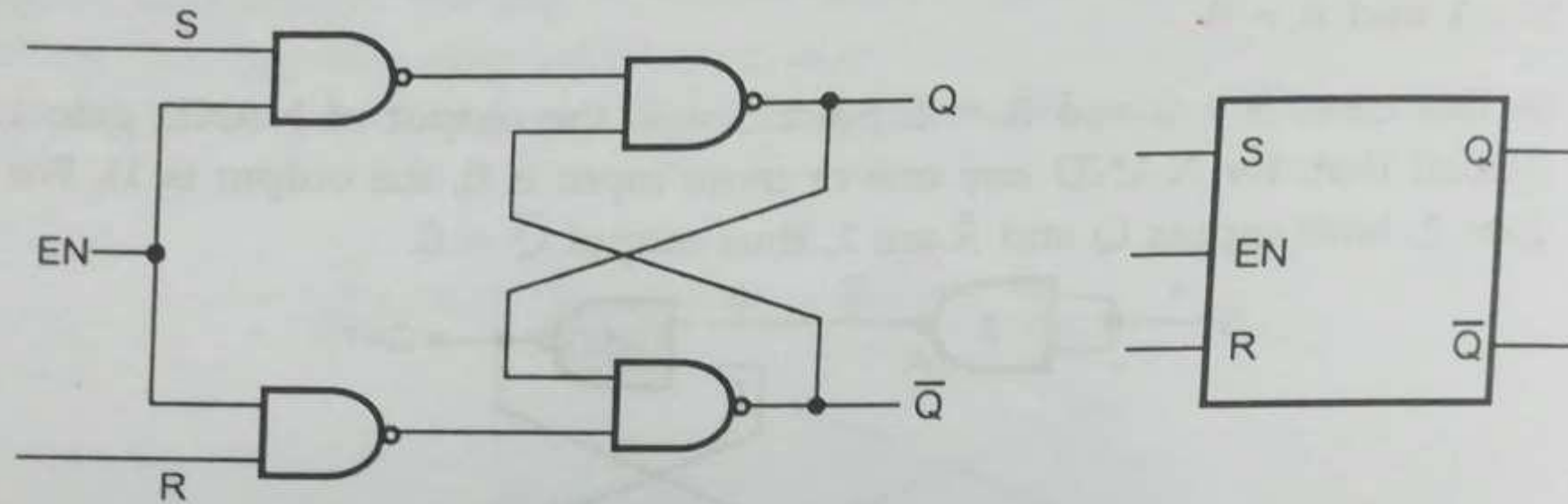
   R=Reset and S=Set

2.D Latch

   D means Delay

3.T Latch

   T means Toggle

4.JK Latch

SR LATCH

(a) SR latch with enable input using NAND gates

Fig. 6.7

(b) Logic symbol

EN	S	R	Q_n	Q_{n+1}	State
1	0	0	0	0	No change (NC)
1	0	0	1	1	
1	0	1	0	0	Reset
1	0	1	1	0	
1	1	0	0	1	Set
1	1	0	1	1	
1	1	1	0	X	Indeterminate
1	1	1	1	X	
0	X	X	0	0	No change (NC)
0	X	X	1	1	

Table 6.2 Truth table for SR latch with enable input

SR LATCH

Characteristic Equation

S \ R Q$_n$	00	01	11	10
0	0	1	0	0
1	1	1	X	X

$$Q_{n+1} = S + \bar{R} Q_n .$$

SR LATCH

Excitation Table

Q_n	Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

D LATCH

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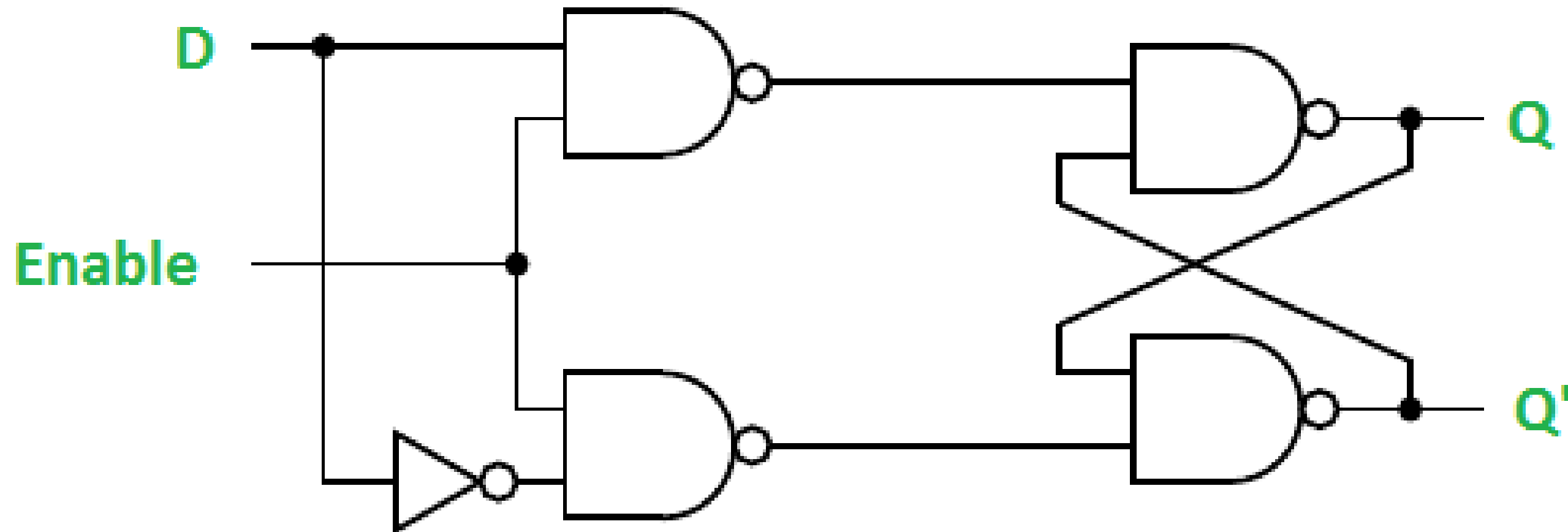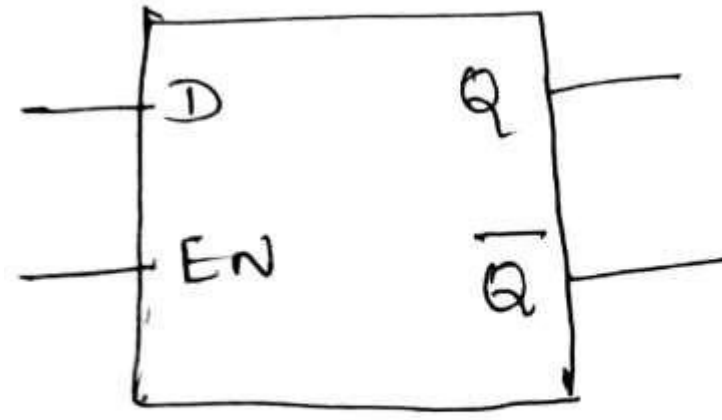
Logic Symbol

Truth Table

E	D	Q_n	Q_{n+1}
↑	0	0	0
↑	0	1	0
↑	1	0	1
↑	1	1	1
0	X	0	0
0	X	1	1

Characteristics Equation

D \ Qn

	0	1
0	0	0
1	1	1

$$Q_{n+1} = D$$

Excitation table

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

- The advantages of latches include the following.
- The designing of latches is very flexible when we compare with FFs (flip-flops)
- The latches utilize less power.

APPLICATIONS OF LATCHES

- The applications of latches include the following.

- Generally, latches are used to keep the conditions of the bits to encode binary numbers

- Latches are single bit storage elements which are widely used in computing as well as data storage.

ASSESSMENTS

1. What is Latch?
2. List the types of latches.
3. Difference between level trigger and edge triggering.

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THANK YOU

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