



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35  
An Autonomous Institution**



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

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB231 DIGITAL ELECTRONICS**

II YEAR/ III SEMESTER

### **UNIT-IV DESIGN OF SEQUENTIAL CIRCUITS**

**Topic 9- Introduction to Hazards – Static and Dynamic**



**IDENTIFY THE TOPIC**



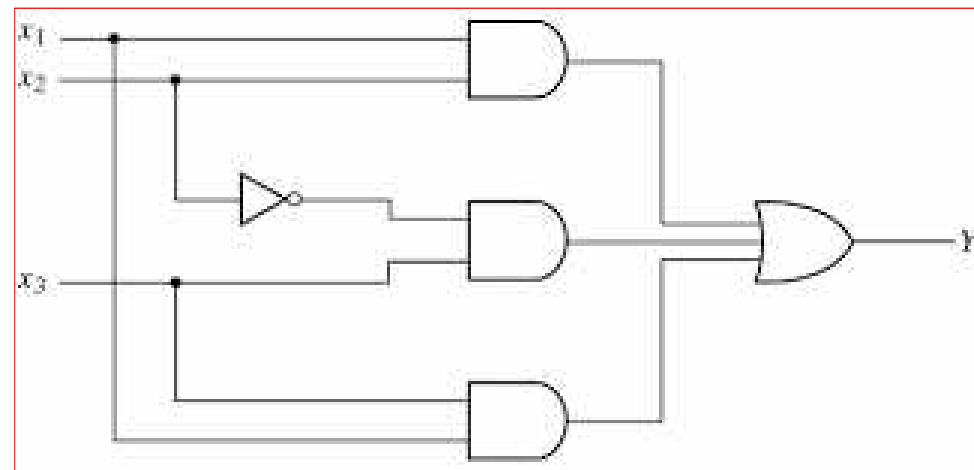


## Hazards



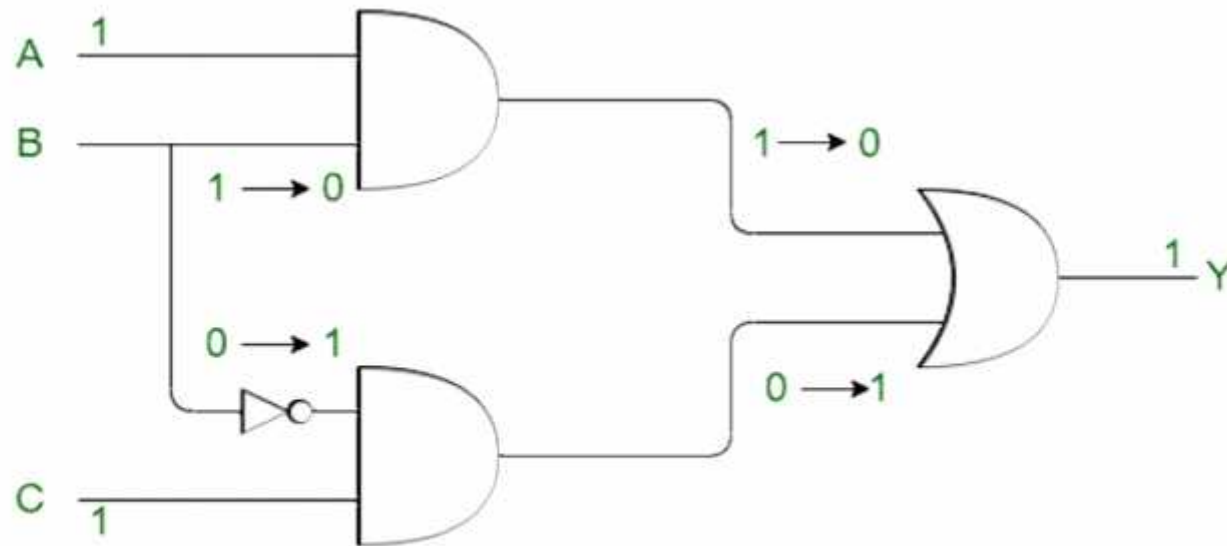
•The unwanted switching transient occur in a digital circuit is called hazard.

Eg: Consider a logic circuit, which is expected to give a logic -1 output, momentarily becomes logic 0 because of finite propagation delays of various gates.





## Hazards in Combinational Logic Circuits



AND-OR Circuit containing Static Hazard



# Classification of Hazards

**Hazards are classified into three types:**

- 1. Static hazard**
  - a) Static -1 Hazard**
  - b) Static -0 hazard**
- 2. Dynamic Hazard**
- 3. Essential Hazard**



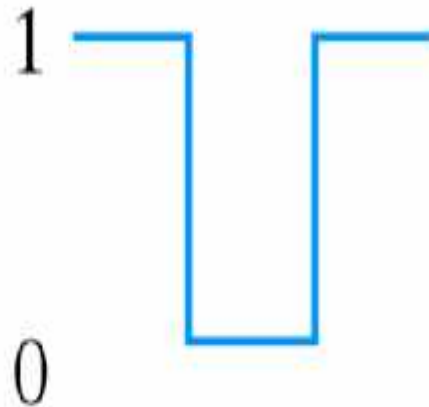
**Fig: Types of hazards**



## Static - 1 Hazard



In response to an input change and for some combination of propagation delays, a logic circuit may go to 0 when it should remain constant 1, this transient is called static-1 hazard

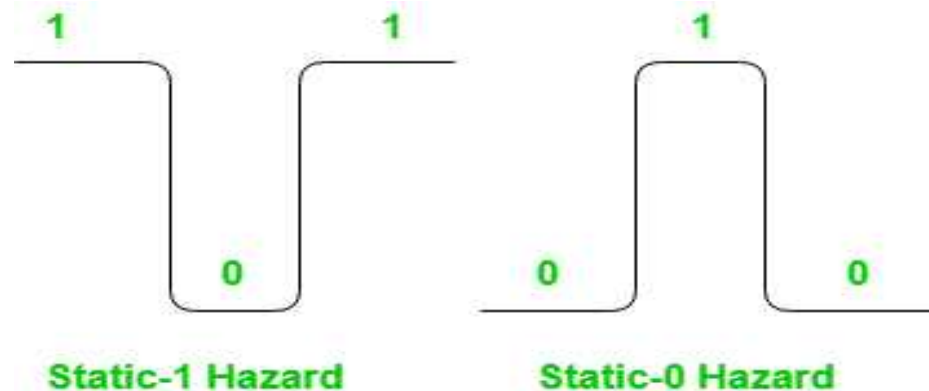




## Static -0 Hazard



In response to an input change and for some combination of propagation delays, a logic circuit may go to 1 when it should remain constant at 0, this transient is called Static-0 hazard

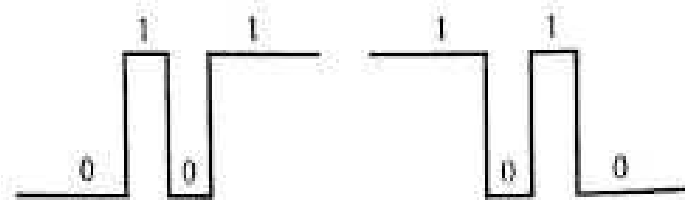




## Dynamic Hazard



When the output of logic circuit is changed from 0 to 1 and 1 to 0. These two outputs may change more number of times, this transient is called dynamic hazard.

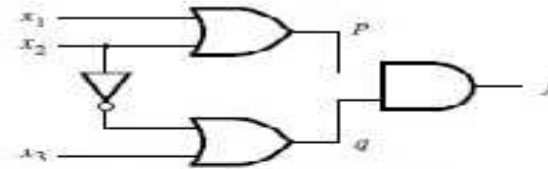


(c) Dynamic hazards





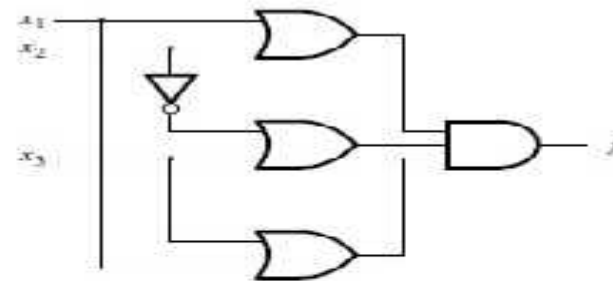
# Prevention of Hazards in Logic gates



(a) Circuit with a hazard

	$x_1, x_2$			
	00	01	11	10
$x_3$				
0	0	0	0	1
1	0	1	1	1

(b) Karnaugh map



(c) Hazard-free circuit

Figure 9.65 Static hazard in a POS circuit

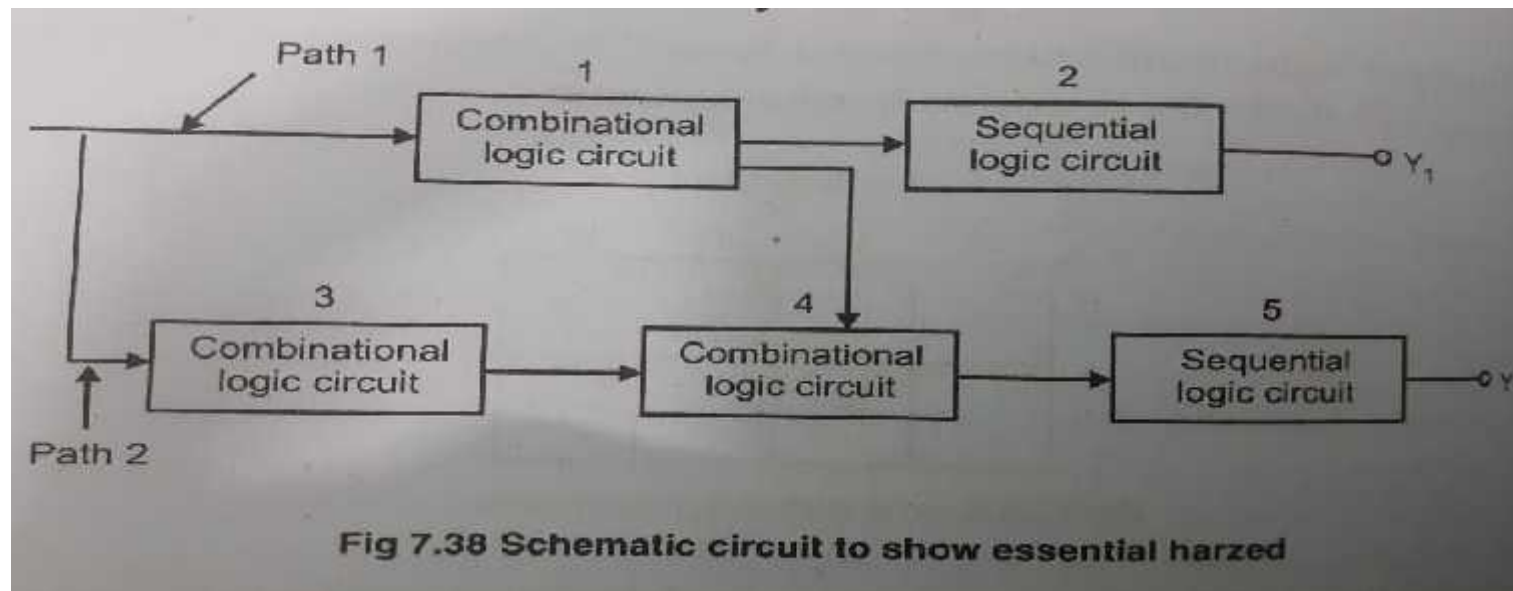
## 9.6.3 SIGNIFICANCE OF HAZARDS



## Essential Hazards



The static and dynamic hazards can occur in combinational as well as sequential logic circuits. Essential hazards occur in sequential circuits only





**THANK YOU**