CS & IT

ENGINEERING



Sequential Circuit

Lecture No. 03



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TOPICS TO BE COVERED 01 SR, JK, D, T Flip Flop

02 PRACTICE

03 DISCUSSION

Q.

Which of the following will be correct for the given sequential circuit?

A
$$X Q(t)' + Y' Q(t)$$

$$\mathbf{B} \quad \mathbf{X} + \mathbf{Y}' \, \mathbf{Q}(\mathbf{t})$$

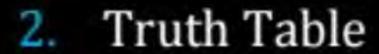
(-)	C	X Q(t)+Y'	Q(t)'
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X	Y	Q(t)	Q(t + 1)
0	×	0	0
0	1	0	1
1	0	1	0
×	1	1	1

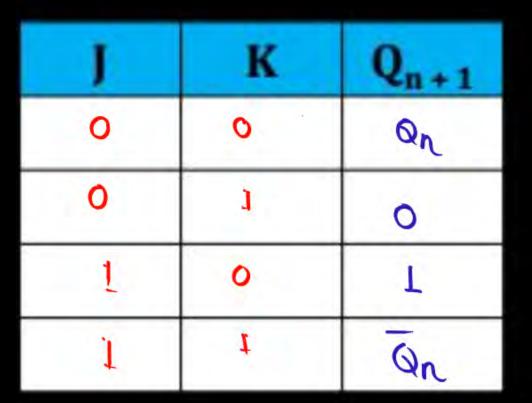


X	Y	Qn	Q _{n+1}
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

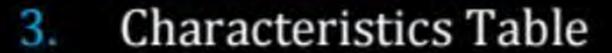
Symbol













I	K	Q _n	Q _{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



4. Characteristics Equation

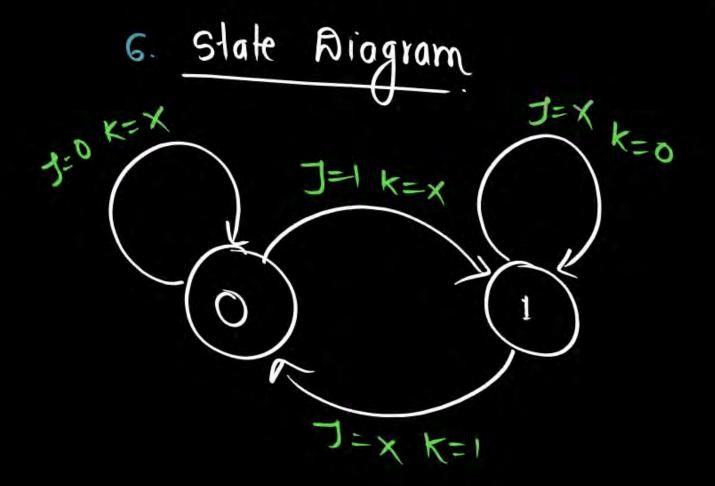
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$$Q_{n+1} = J\bar{q}_n + \bar{k} q_n$$

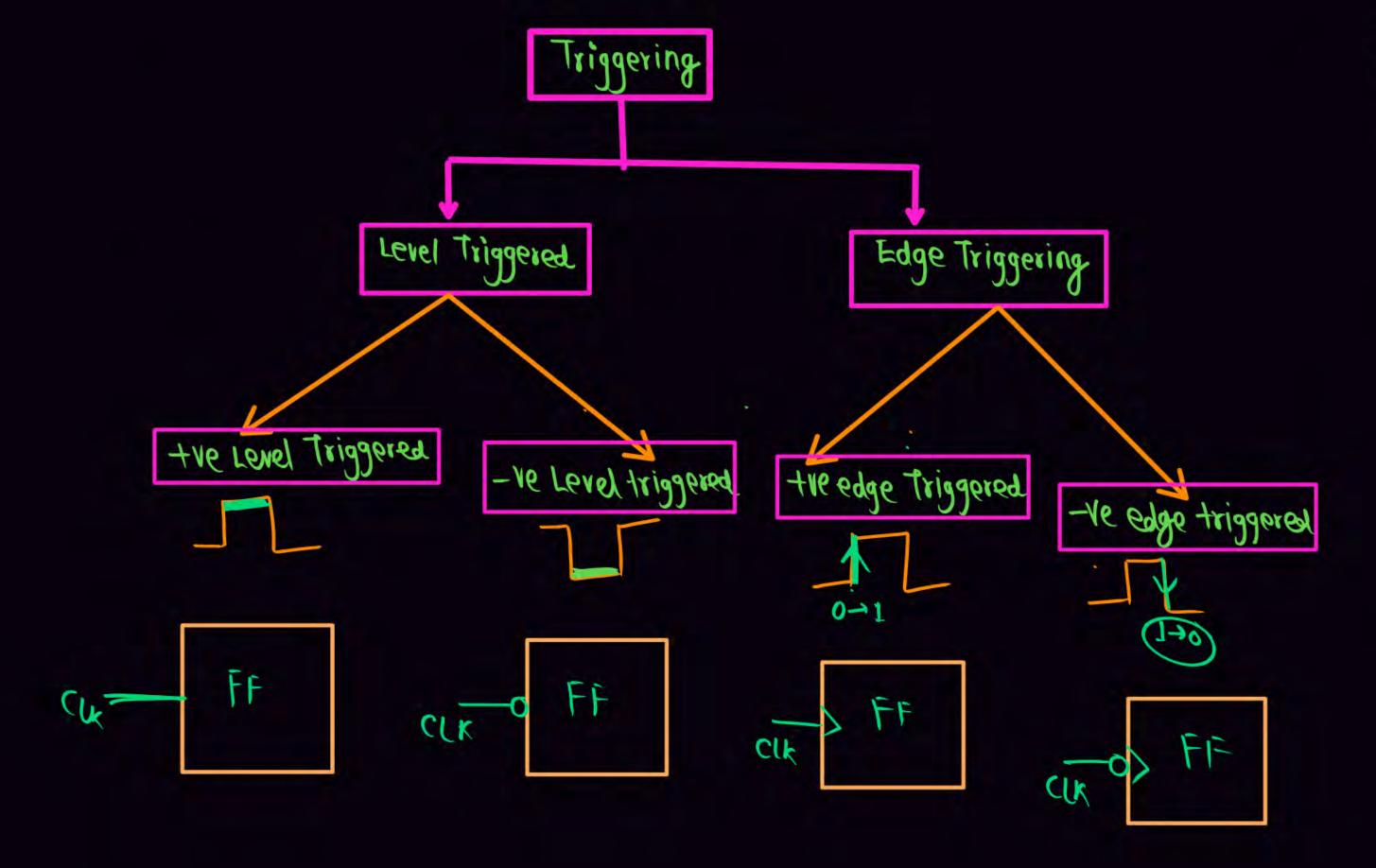


5. Characteristics Equation

Q _n	Q _{n+1}	J	K
0	0	0	×
0	7	1	×
1	0	×	1
1	1	×	0



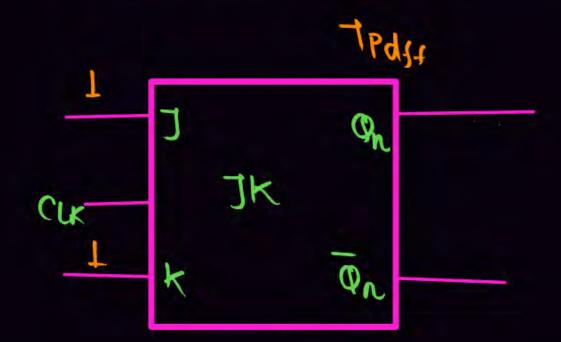






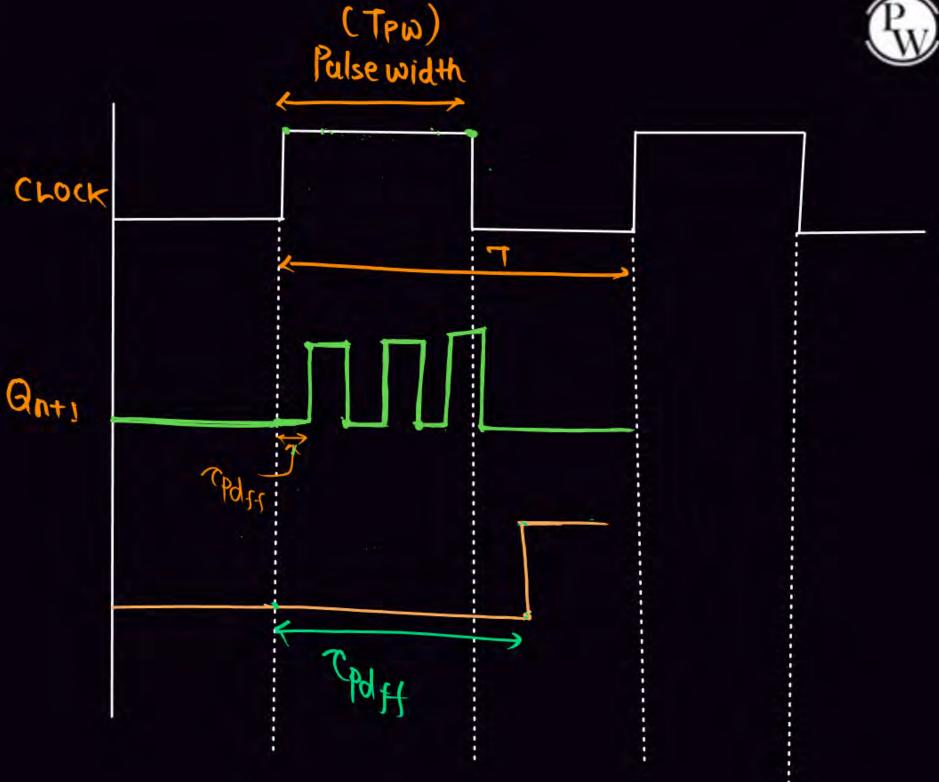
NOTE: Level triggered JK FF Suffers from the problem of RACE AROUND





To avoide the Race Around problem

3) By Moster slave FF.

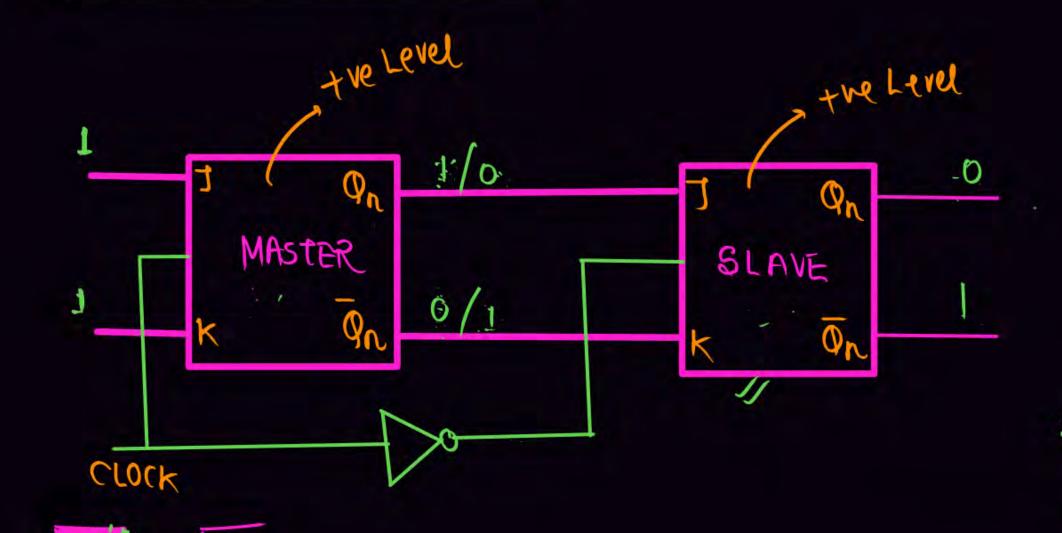




When J=K=1 is applied to the Level sensitive of JK FF, then with in the duration of pulse olp of the FF Toggle more than one times are called Race Around problem

MASTER SLAVE FF



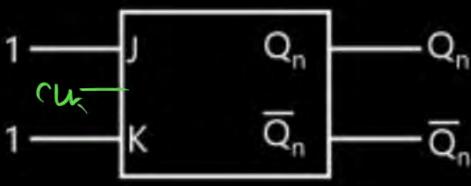


Moster V Moster X Slave X Slave V 1> Inverted clock is applied to the slave as compared to Master.

2) M-2 FF is use to Store single bit because O/p is taken only from Slave.



Note: J-K Flip-Flop suffer from the problem of race around.



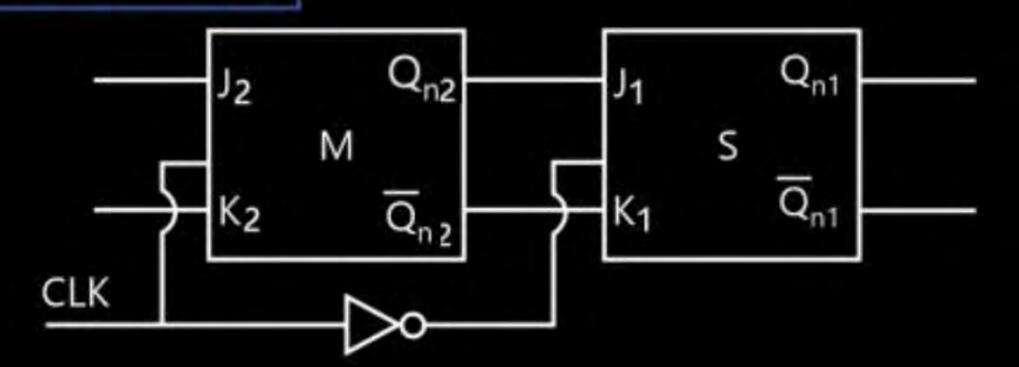
To avoid Race around problem:

i.
$$T_{pw} < \tau_{pd} < T_{CLK}$$

Master slave FF

MASTER-SLAVE FF





- In master-slave FF inverted CLK is given to master and slave.
- Master-slave FF is used to store single bit because output is taken only from the slave.
- iii. By the operation it seems that master is level triggered whereas slave is negative edged triggered.

D FLIP-FLOP

(Bola FF)



- (i) It is known as Delay FF or Transparent FF.
- (ii) In the D FF what ever the input is applied it will directly come to the output along with the clock.
- Symbol

Figure 1: D Flip Flop

	D	Q _{n+1}
Truth Table	0	0
	1	1

Table 1: Truth Table of D Flip Flop

D FLIP-FLOP

3. Characteristics Table

D	Qn	Q _{n+1}
0	0	0
0	1	0
1	0	L
1	1	1

4. Characteristics Equation

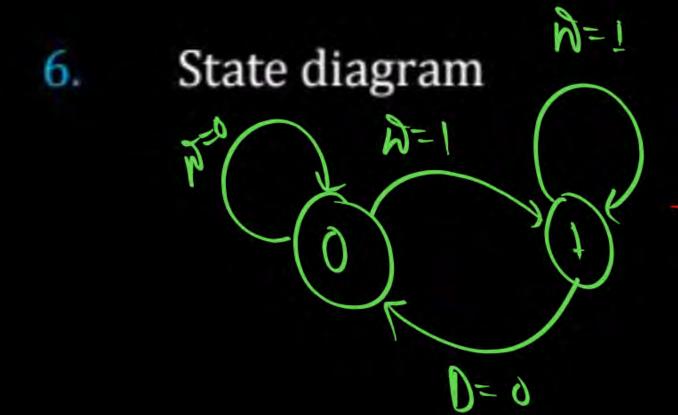
$$Q_{n+1} = B$$

Table 2: Characteristic Table of D Flip Flop



D FLIP-FLOP

Excitation table



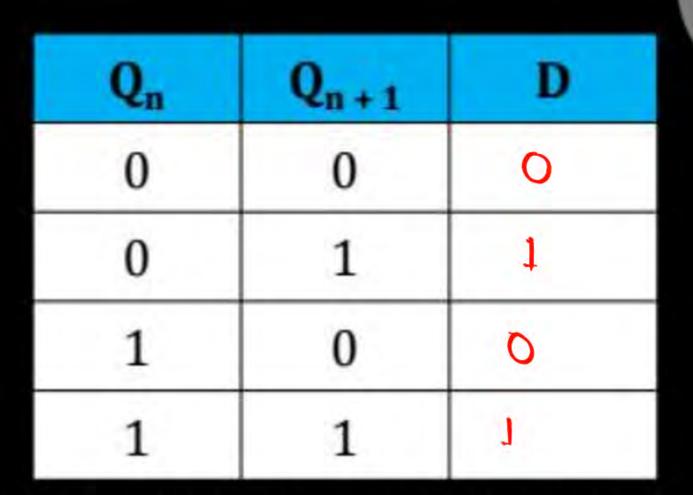


Table 3: Excitation Table of D Flip Flop





Thank you

Soldiers!

