UNIT – 5(COUNTER)

→Counter is a digital device used to count the number of clock pulses & it can also be used as "frequency divider".

→ Counter can count the clock pulses in two ways

   (1) Up counter :- it counts in increasing order Ex:- 0 , 1 , 2 , 3 , 4 ,----------to N

                 Ex:- example of up counter may be EVM machine which is counting the number of people participating in election.

   (2) Down counter:- it counts in decreasing order. Ex:- N , N-1 , N-2 , N-3 ,---------to 0

                   Ex:- Example of down counter may be "rocket launcher".

       rocket launcher counts from N to 0 to lunch the rocket.

→ Q. What is the "State of counter"?

Ans:- Present count value of the counter is called "state of counter".

      Suppose a counter is holding the value 5 at present then "state of counter" = 5 .

→ counter contains set of flip-flop . it means to make n-bit counter , we need n flip flop and total number of states for n-bits counter = 2^N .

$$\text{Each state frequency} = \frac{\text{Total frequency}}{2^N}$$

→counter can be divided into two types

   (1) Synchronous counter

   (2) Asynchronous counter

** Asynchronous counter:-

→ Asynchronous counter refers to states that doesn't have fixed time relationship with each other.

It means suppose we have 2 bit Asynchronous counter then there will be 2^N states like state 1 , 2 , 3 & 4 . there will be no time relationship means 1st state may occur in 2 minutes ,2nd state may occur in 4 minutes , 3rd state may occur 10 minutes & so on.

FFI = flip flop 1
FF2 = flip flop 2
FF3 = Flip flop 3
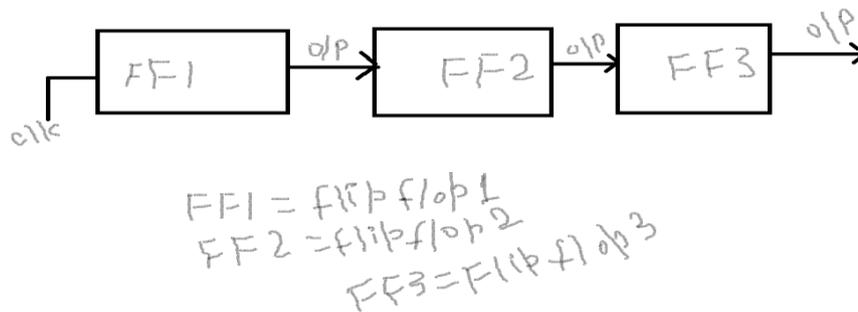
→ In Asynchronous counter , each flip flop doesn't get a common clock pulse . it means each flip flop is getting different clock pulse.

→ Suppose there is 3 bit Asynchronous counter . there will be 3 flip flops. Clock pulse is applied to 1st flip flop . output of 1st flip flop will be consider as clock pulse for 2nd flip flop and output of 2nd flip flop will be consider as clock pulse for 3rd flip flop.

Here according to above discussion we see that each flip flop is getting different clock pulse.

→ In most of the counter we use JK or T flip flop to design counter. JK & T flip flop there is "toggle state" when we apply high input(ie 1).This "toggle" is used to design counter.

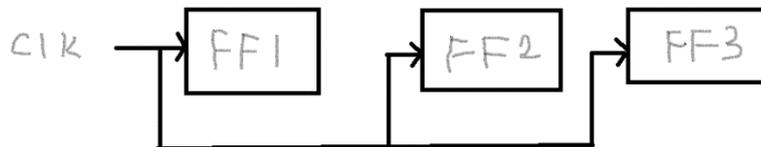→speed is slow because clock pulse propagates from one flip flop to other one by one.

→ Example of Asynchronous counter is "Ripper Counter".

** Ripper Counter:-

https://youtu.be/eiIV28LSQnM-------------> view this video.

synchronous counter:-

→ In synchronous counter , a common clock pulse is each & every flip flop.

→ All flip flops get the clock pulse simultaneously/at a time.

→ Speed is high because all flip flops generates output at a time because all flip flops are getting clock pulse at a time.

→ https://youtu.be/Pvty_1r-tl8   ---→ Circuit diagram

** Diffrence between Asynchronous counter & synchronous counter

S no	Asynchronous counter	synchronous counter
1.	Low cost	More cost
2.	Speed is slow	Speed is more
3.	Different clock pulse is applied	Same clock pulse is applied
4.	Difficult to design	Easy to design

** Decade counter:-   https://youtu.be/n_cKhWdMhOk

Application of Decade counter:-

(1) counts the token at bank token counter.

(2) counts the product automatically in industry.

(3)digital clocks

(4)digital clock watch

(5)for setting timer for water supply.