

## Assignment No. 2.

Title :- Ripple Counter.

Problem Statement :- Design of Ripple Counter using suitable Flip-flops.

Hardware and Software requirements :-

Theory :-

- What is Counter?

The digital circuit used for counting pulses is known as counter. It is a sequential circuit.

Counter is the most widely used application of flip-flops. It is a group of flip-flops with a clock signal applied. Counters count the no. of pulses. Therefore, with some modifications we can use them for measuring frequency or time period.

- Type of Counters.

Counters are basically of two types :-

1. Asynchronous or ripple counter:

For these counter the external clock signal is applied to one flip-flop and then the output of preceding flip-flop is connected to the clock of next flip-flop.

## 2. Synchronous counters :

In synchronous counter, all the flip-flops receive external clock pulse is applied to all the flip-flops simultaneously.

Ring counter and Johnson counter are examples of Synchronous counter.

Design :-

### 1. 3-bit Asynchronous Up Counter :-

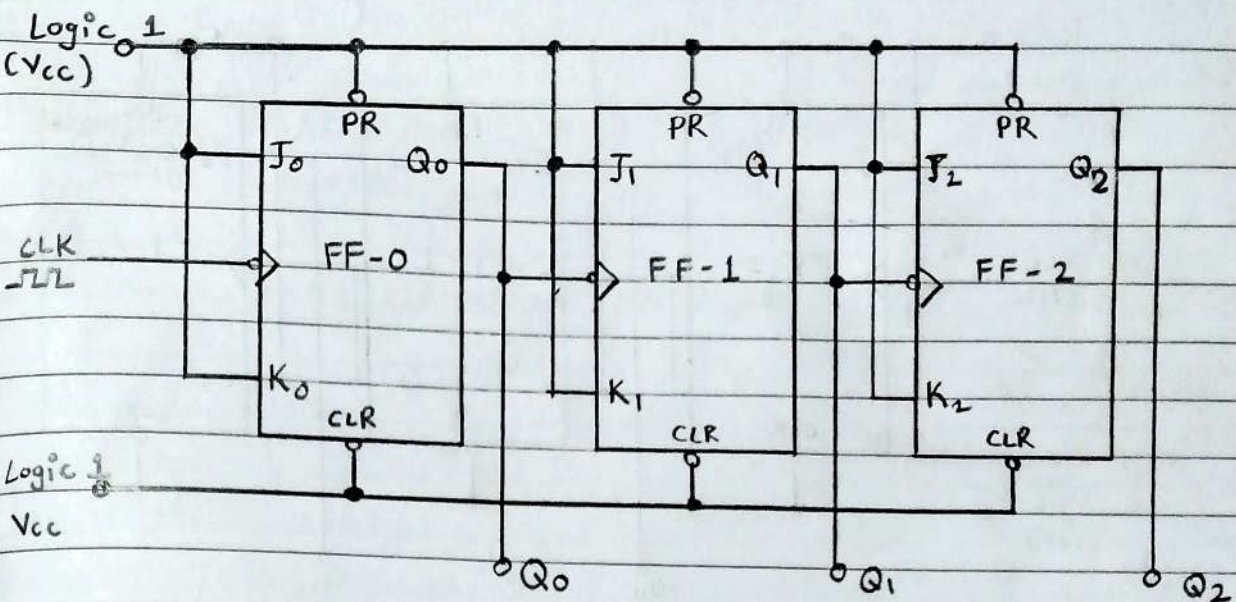
- Truth Table :-

CLK	Flip-flop o/p's			State	Decimal equivalent
	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>0</sub>		
Initially	0	0	0	1	0
↓ (1 <sup>st</sup> )	0	0	1	2	1
↓ (2 <sup>nd</sup> )	0	1	0	3	2
↓ (3 <sup>rd</sup> )	0	1	1	4	3
↓ (4 <sup>th</sup> )	1	0	0	5	4
↓ (5 <sup>th</sup> )	1	0	1	6	5
↓ (6 <sup>th</sup> )	1	1	0	7	6
↓ (7 <sup>th</sup> )	1	1	1	8	7
↓ (8 <sup>th</sup> )	0	0	0	1	0

Number of states :-

$$2^n = 2^3 = 8.$$

Circuit Diagram :-



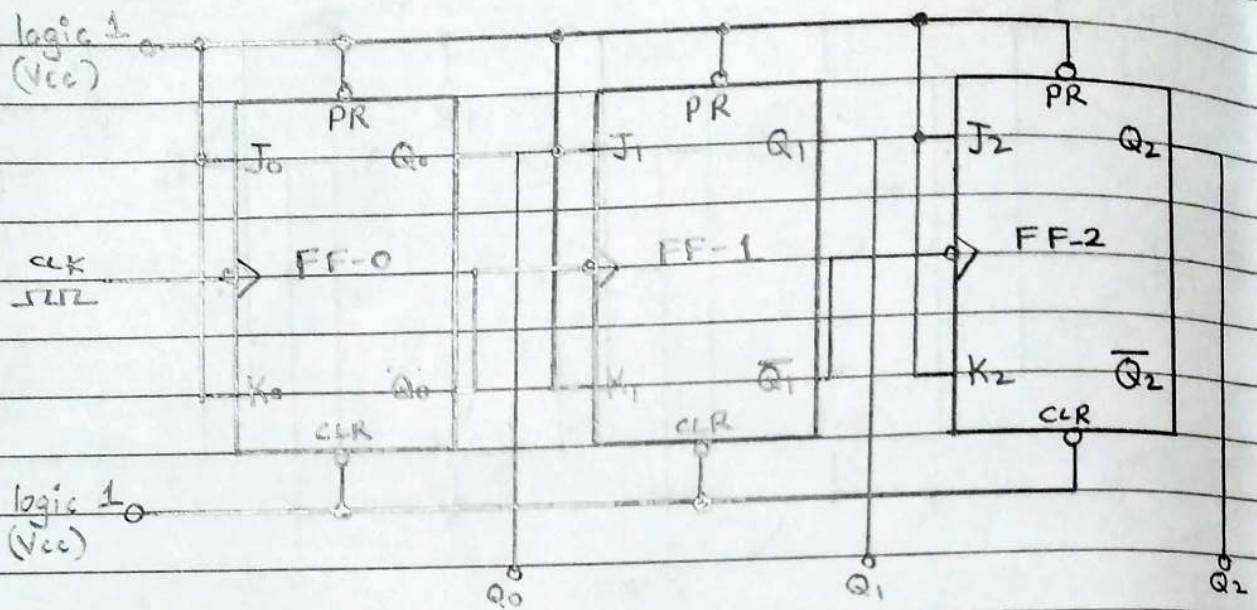
3-bit Asynchronous Down Counter :-

Truth table :-

CLK	Flip-flop o/p's			Decimal count
	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>0</sub>	
Initially	0	0	0	0
↓ (1 <sup>st</sup> )	1	1	1	7
↓ (2 <sup>nd</sup> )	1	1	0	6
↓ (3 <sup>rd</sup> )	1	0	1	5
↓ (4 <sup>th</sup> )	1	0	0	4
↓ (5 <sup>th</sup> )	0	1	1	3
↓ (6 <sup>th</sup> )	0	1	0	2
↓ (7 <sup>th</sup> )	0	0	1	1
↓ (8 <sup>th</sup> )	0	0	0	0

~ Repeats

- Circuit diagram :-



- Applications of Counters :-

1. In digital clocks.
2. In frequency counters.
3. In time measurement.
4. In digital voltmeters.
5. In the counter type A/D converters.
6. In the digital triangular wave generators.
7. In the frequency divider circuits.

Conclusion :- Hence, ripple counter studied.