- Converting a Flip-flop: -

1- Design A flip-flop from B flip-flop.

2- Convert B Flip-flop to A Flip-flop.

3- Using B Flip-flop to Design A Flip flop.

Note:- The third questions above are the same. (i.e. Designing A Flip-Flip using B flip-flop.

- There are 5 steps for flip-flop Conversions: —

1- Identify available and required flip-flop.

2- Make characteristic table for required flip-flop.

3- Make excitatation table for available flip-flop.

4- write boolean expression for available flip flop.

5- Draw the circuit.

Note:- We can summarized the (Excitation Tables) of all flip flops

Q_n	Q_{n+1}	S	R	D	T	J	K
0	0	0	X	0	0	0	X
0	1	1	0	1	1	1	X
1	0	0	1	0	1	X	1
1	1	X	0	1	0	X	0

- Flip-Flop Excitation tables -

Example:- Convert J-K F.F to T f.f:-

Solution:- Available F/F = JK F/F
Required F/F = T F/F

T	Q_n	Q_{n+1}	J	K
0	0	0	0	X
0	1	1	X	0
1	0	1	1	X
1	1	0	X	1

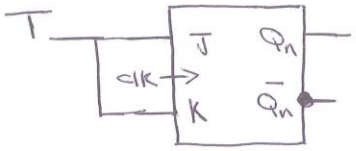
C/cs table for T f.f. | Excitation table for JK f.f

$J = T$

Q_n \ T	$\bar{T}$	T
$\bar{Q}_n$	0	1
Q_n	X	X

$K = T$

Q_n \ T	$\bar{T}$	T
$\bar{Q}_n$	X	X
Q_n	0	1



Example:- Convert RS F/F to D Latch

Solution:- Available F/F = RS F/F
Required F/F = D latch

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

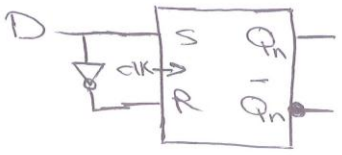
C/cs table for D f.f | Excitation table for SR F.F.

$S = D$

Q_n \ D	$\bar{D}$	D
$\bar{Q}_n$	0	1
Q_n	0	X

$R = \bar{D}$

Q_n \ D	$\bar{D}$	D
$\bar{Q}_n$	X	0
Q_n	1	0



Example:- Design T. f/f, using R.S f/f

Solution:- Available F/F = SR f/f

Required F/F = T f/f

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

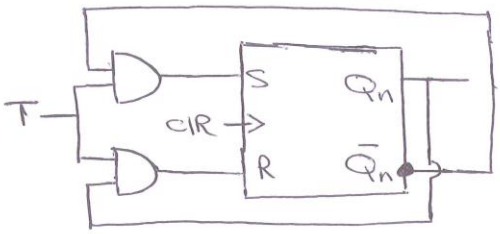
c/cs table & Excitation table for T f.f for SR f.f

Q_n \ T	$\bar{T}$	T
$\bar{Q}_n$	0	1
Q_n	X	D

$S = T\bar{Q}_n$

Q_n \ T	$\bar{T}$	T
$\bar{Q}_n$	X	0
Q_n	0	1

$R = TQ_n$



Example:- Using D f/f to design T. f/f

Solution:- Available F/F = D f/f

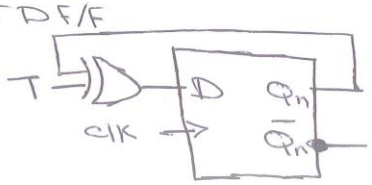
Required F/F = T f/f

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

c/cs table & Excitation table for T f/f for D F/F

Q_n \ T	$\bar{T}$	T
$\bar{Q}_n$	0	1
Q_n	1	0

$D = T\bar{Q}_n + \bar{T}Q_n$



Example:- Design J-K f/f, using T f/f

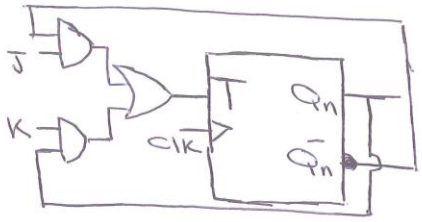
Solution:- Available F/F = T F/F

Required F/F = JK F/F

J	K	Q_n	Q_{n+1}	T
0	0	0	0	0
0	0	1	1	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	1
1	0	1	1	0
1	1	0	1	1
1	1	1	0	1

Q_n \ JK	$\bar{J}\bar{K}$	$\bar{J}K$	JK	$J\bar{K}$
$\bar{Q}_n$	0	0	1	1
Q_n	0	1	1	0

$T = \bar{J}\bar{Q}_n + KQ_n$



clks table & Excitation table for JK F/F for T f/f

H.W:-
1- JK to D flip-flop Conversion.
2- T flip-flop to D flip-flop Conversion.
3- SR flip-flop to JK flip-flop Conversion.
4- SR flip-flop to T flip-flop Conversion.
5- JK flip-flop to SR flip flop Conversion

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Difference between Synchronous and Asynchronous Sequential Circuits:-

Synchronous Seq. ckt.	Asynchronous Seq. ckt.
1- These circuits are easy to design.	1- These circuits are difficult to design.
2- A clocked flip-flops acts as memory element.	2- An unclocked flip-flops or time delay element is used as memory element.
3- They are slower.	3- Faster as clock is not present.
4- The status of memory element is affected only at the active edge of clock, if input is changed.	4- The status of memory element will change any time as soon as input is changed.