* Digital Electronics and Logic Design (DELD) - Practical Number - 8

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Aim :-

Design and Realization : Flip-Flop Conversion.

Title :-

Flip-Flop Conversion.

Objective :-

To convert one flip-flop into another type of flip-flop :-

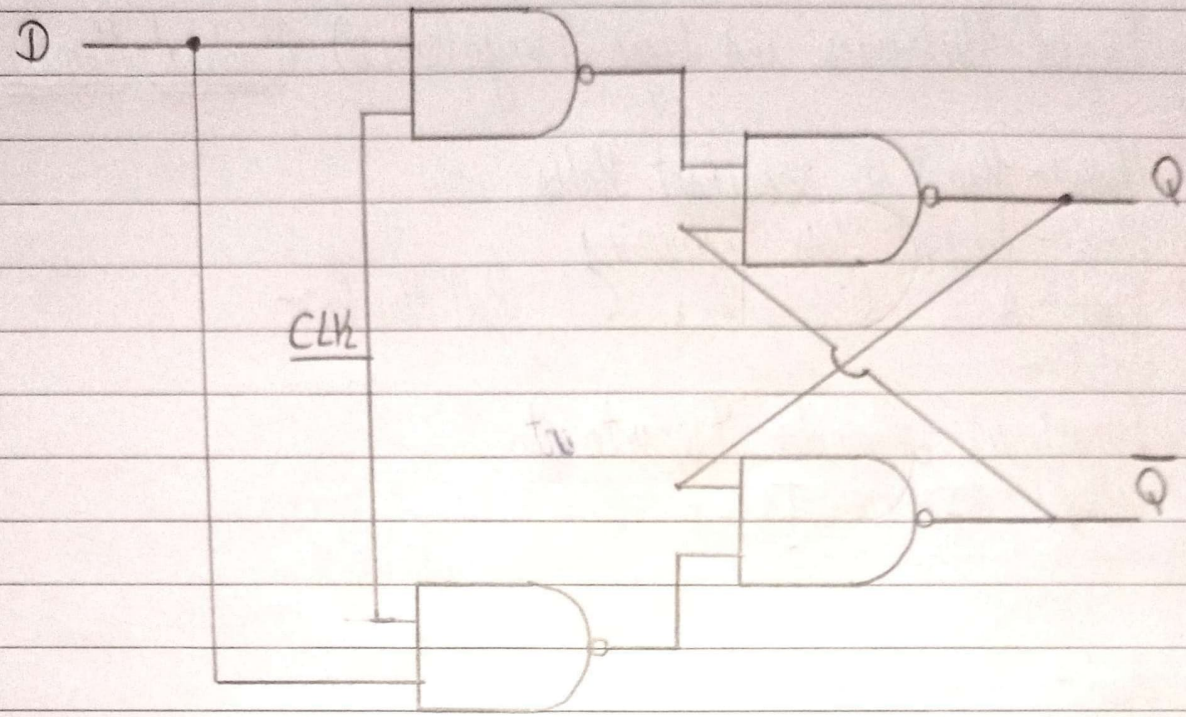
1. D-flip flop to T-flip flop.
2. JK-flip flop to D-flip flop.

Theory :-

D-Flip Flop -

It is a modified Set-Reset flip-flop with addition of an inverter to prevent the S and R input being at same logic level.

D-flip flop is by far the most important of clocked flip flop as it ensures that input S and R never equal at same time. It is constructed from a gated SR-flip flop with an inverter added between the S and R input to allow for a single D (input) Data.

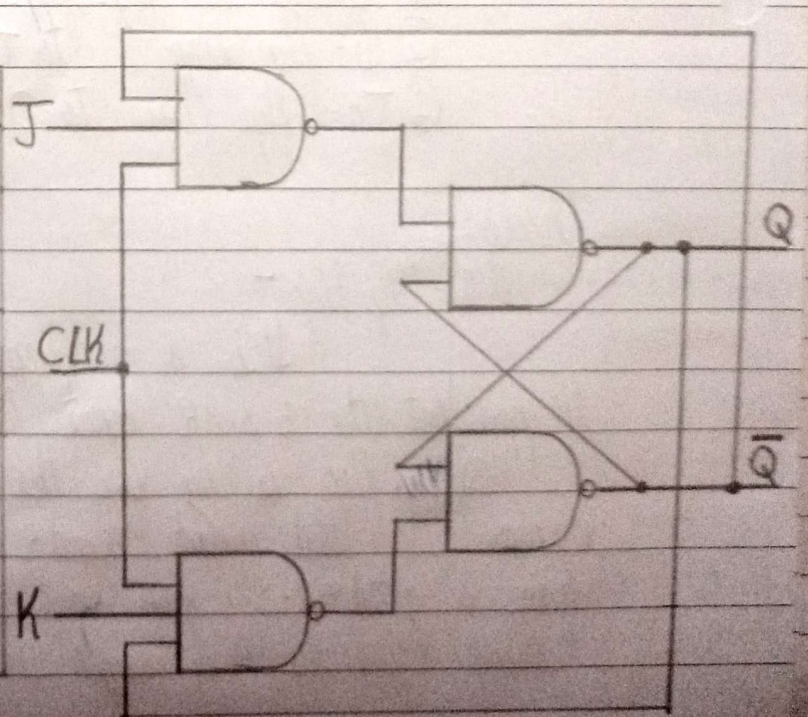


J-K Flip-Flop:-

JK flip flop is similar to SR flip flop but there is no change in state when J and K input are both Low. JK flip flop is considered to be a universal flip flop circuit.

JK flip flop has no invalid or forbidden input states of the SR latch even when S and R are high.

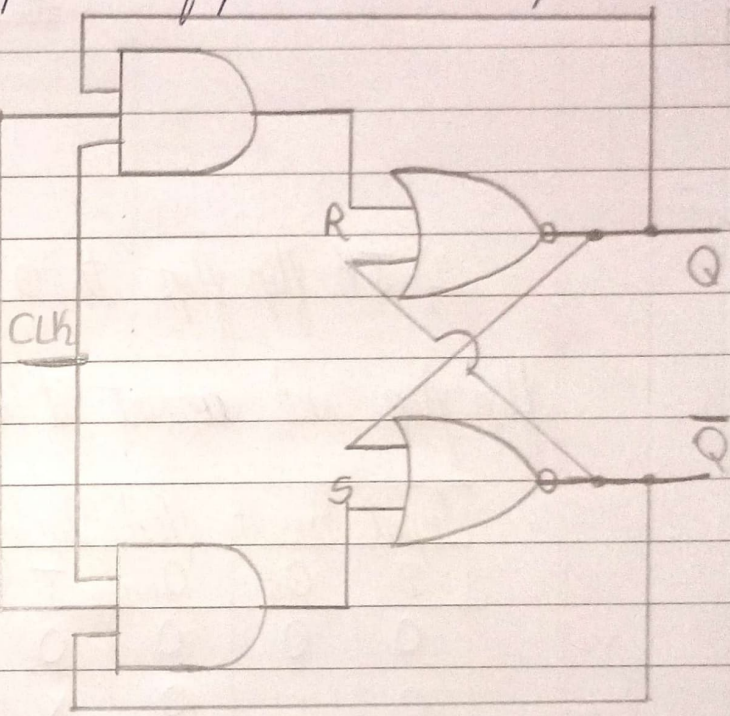
Clock	Input		Output		Description
	J	K	Q	$\overline{Q}$	
x	0	0	1	0	Memory NC
x	0	0	0	1	
↓	0	1	1	0	Reset
x	0	1	0	1	
↓	1	0	0	1	Set
x	1	0	1	0	
↓	1	1	0	1	Toggle
↓	1	1	1	0	



T- Flip Flop:-

To avoid the intermediate state occurence in SR flip flop, T flip flop is used. This flip flop work as toggle switch. The next output state is changed with the complement of present state output. This is called toggling.

	Previous		Next	
T	Q	$\bar{Q}$	Q	$\bar{Q}$
0	0	1	0	1
0	1	0	1	0
1	0	1	1	0
1	1	0	0	1



* Conversion:-

1) D flip flop to T flip flop:-

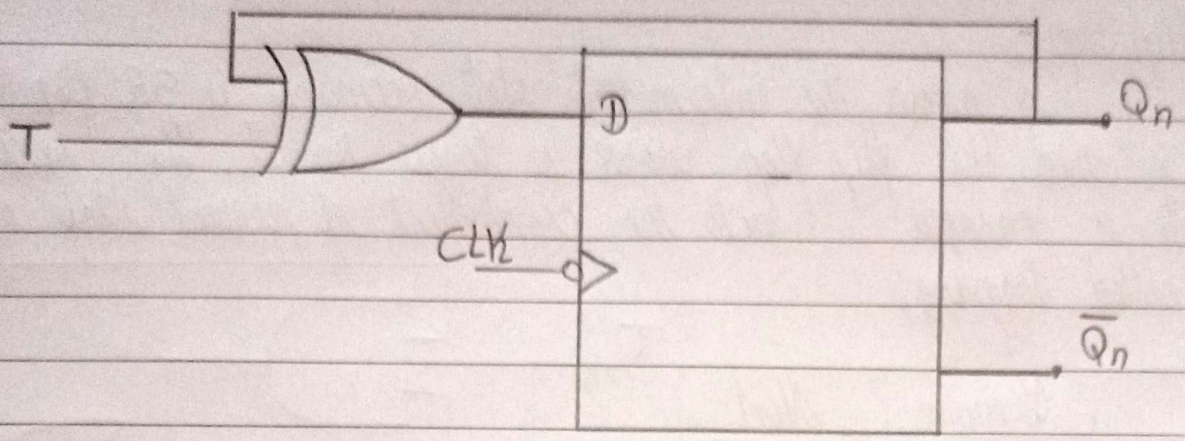
Compare the truth table of both D and T flip flop and make excitation table.

Input	Present S	Next S	FF input
T	Q_n	Q_{n+1}	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

Using K-map for D.

T \ Q_n	0	1
0	0	1
1	1	0

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



2) JK flip flop to D flip flop.-

Compare the truth table of both flip flop and convert it into excitation table.

Input D	Present Q_n	Next Q_{n+1}	Flip Flop Input J	K
0	0	0	0	X
0	1	0	X	1
1	0	1	1	X
1	1	1	X	0

Using K map for expression of JK.

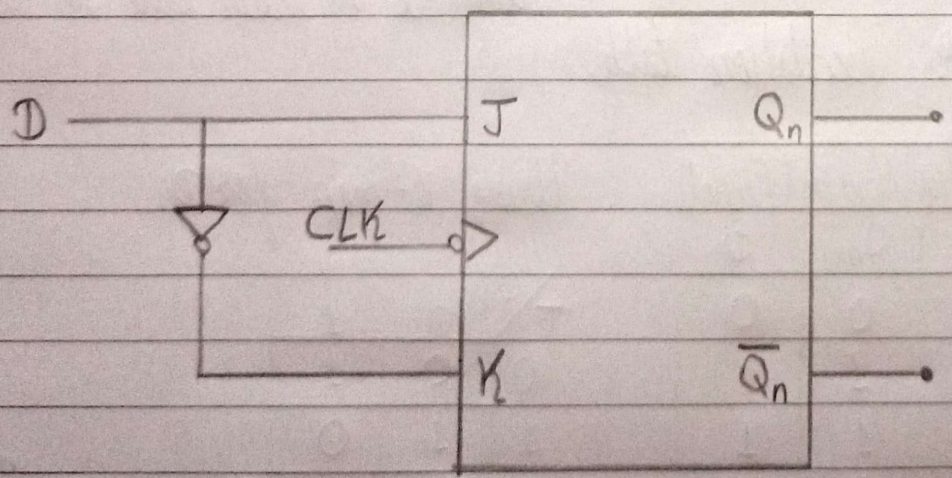
for J

D \ Q_n	0	1
0	0	X
1	1	X

for K

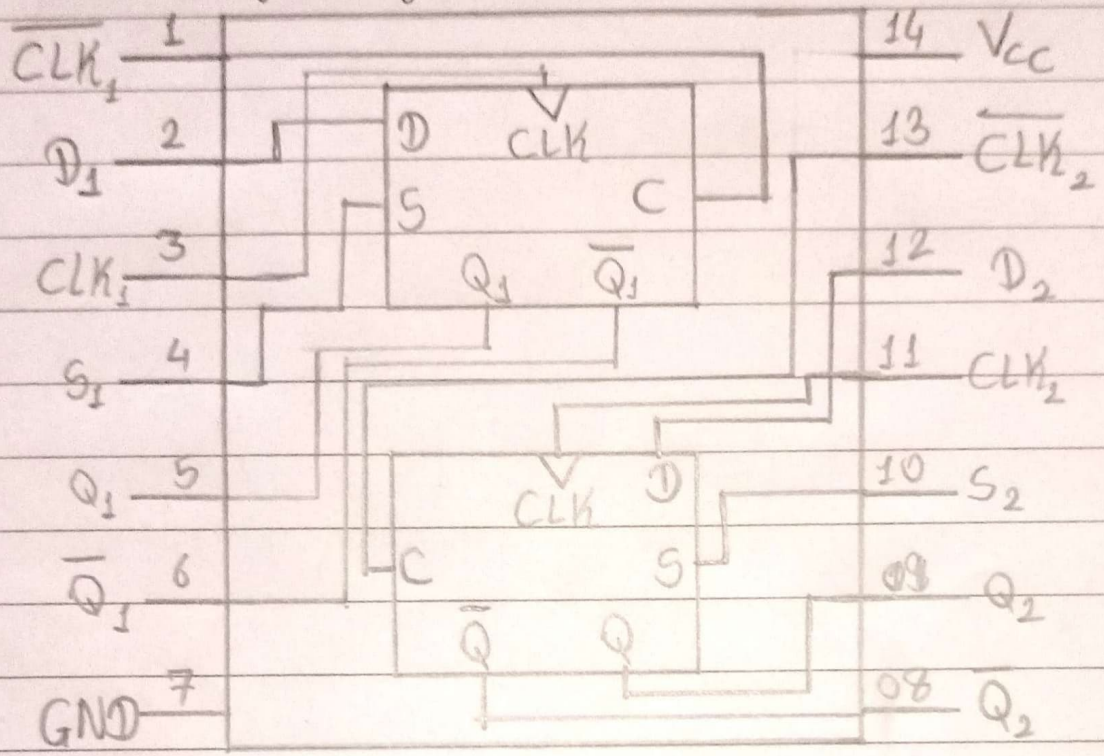
D \ Q_n	0	1
0	X	1
1	X	0

$J = D$ $\quad K = \overline{D}$



IC's Used -

① Dual Positive Edge trigered IC 7474 (D flip flop) -



Conclusion:-

Hence, we have successfully converted the flip flop from one type to another type.