AKTU

GATEWAY CLASSES

Digital System Design

B.Tech. 3rd Sem

EC & Allied



Exam/Result Oriented Content

- ✓ Recorded Video Lectures
- ✓ Pdf Notes
- ✓ PYQs

DIGITAL SYSTEM DESIGN

UNIT 3 : Sequential logic design

Lec 5

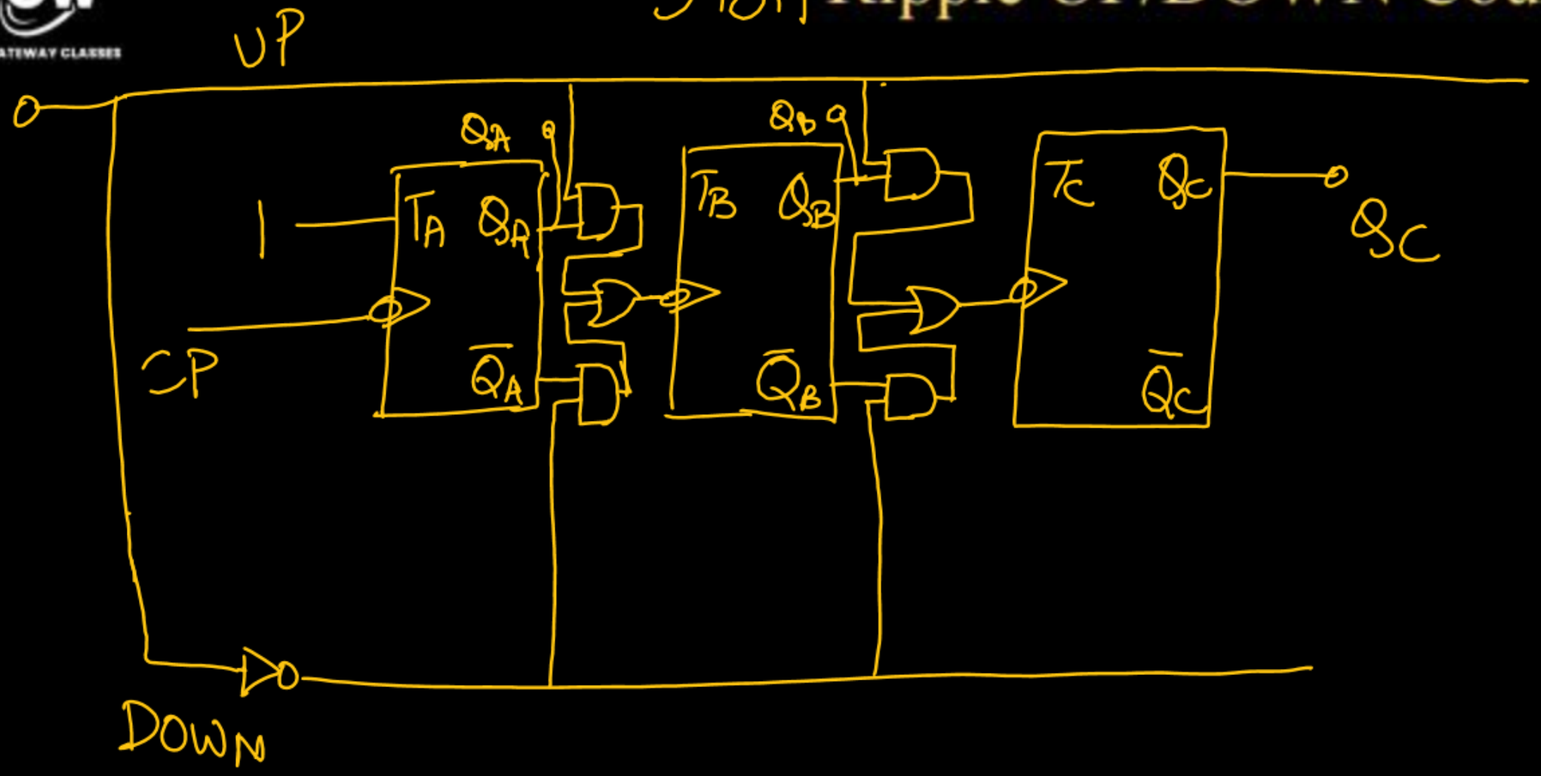
Today's Target

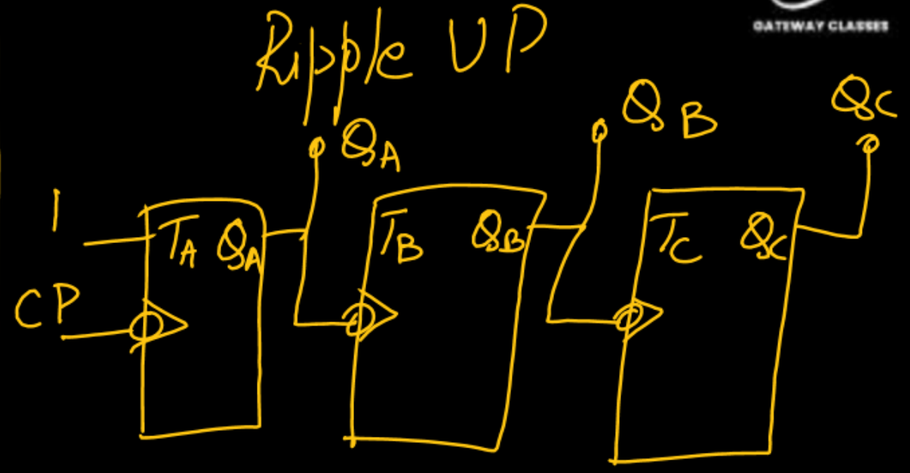
- Ripple UP/DOWN Counter
- Synchronous UP/DOWN Counters
- Excitation Tables & Truth Table of FFs
- MOD COUNTER
- University Questions

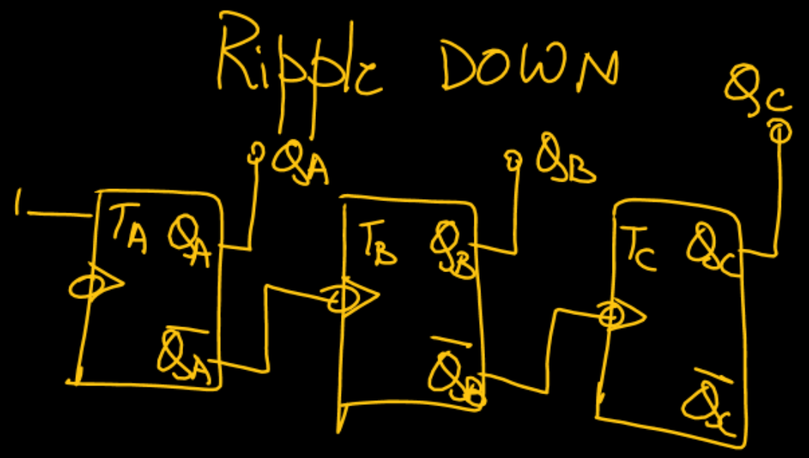
UNIVERSITY QUESTIONS

YEAR	QUESTIONS	MARKS
22-23	Design and draw State Diagram for a 2 bit up/down counter	2 Marks
22-23	Design a 3 bit up/down ripple counter	10 Marks
21-22	Design a mod 11 up ripple counter using T-FF	10 Marks
20-21	Design and implement a synchronous 3-bit up/down counter using JK flip-flops.	10 Marks
18-19	What is modulus of a counter?	2 Marks
18-19	Design a modulo-4 UP/DOWN counter using JK flip. flop. Design a ripple decade counter using JK flip	7 Marks

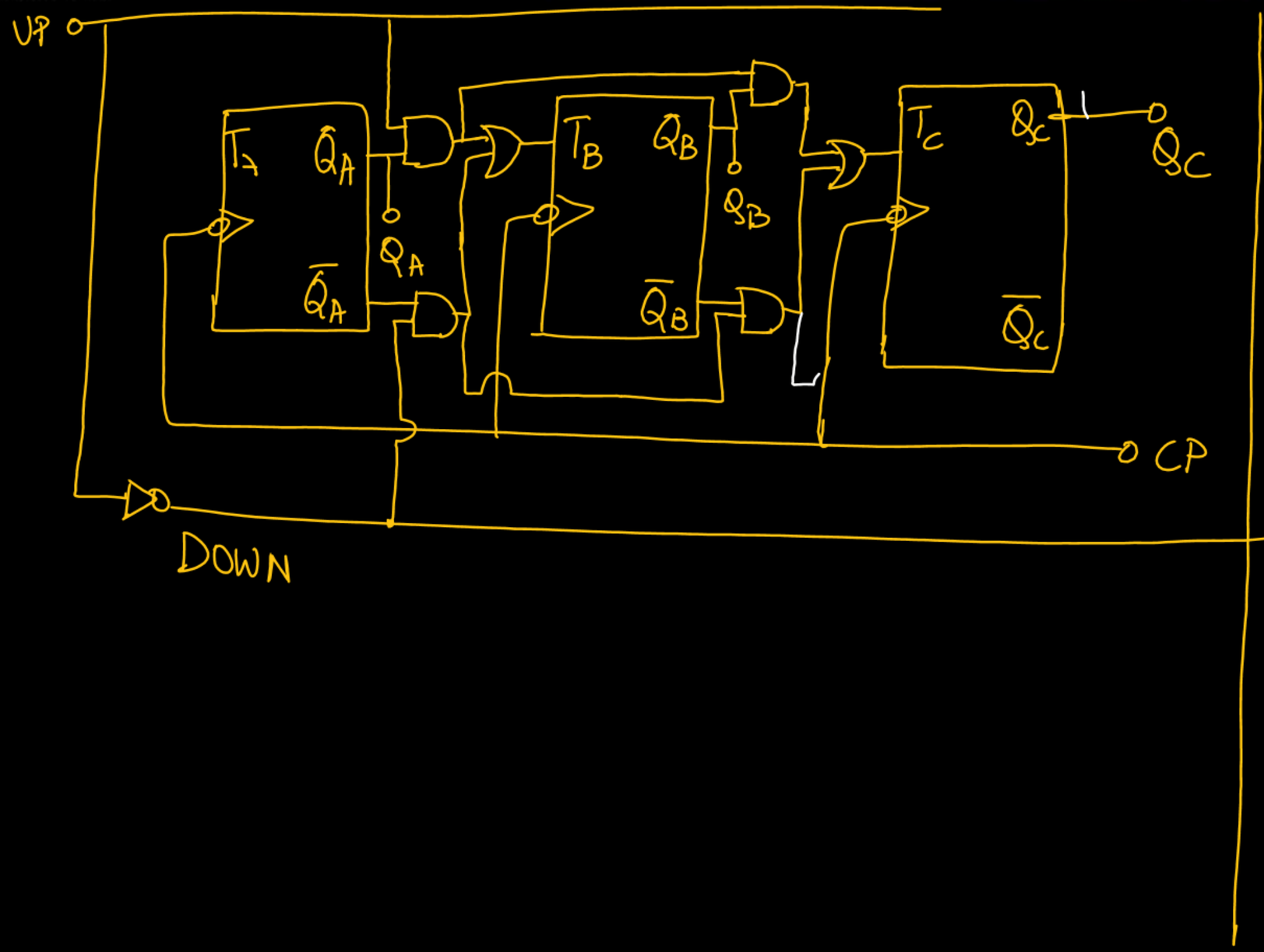
3 Bit Ripple UP/DOWN Counter



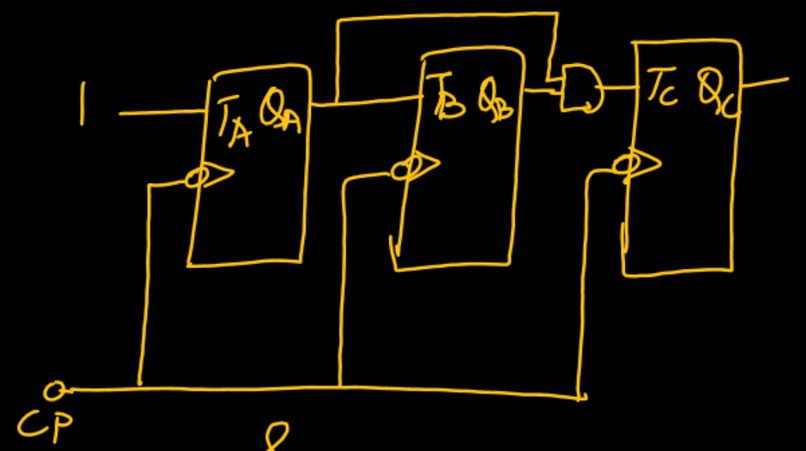




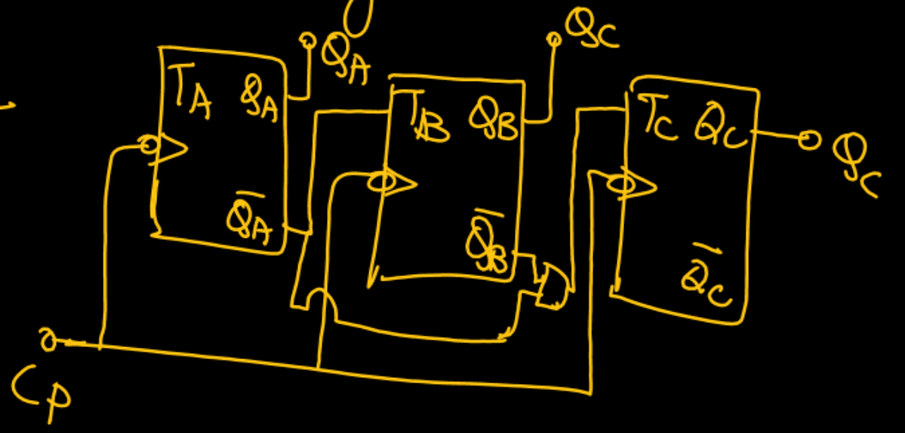
3 bit Synchronous UP/DOWN Counters



Sync. UP



Sync DOWN



Excitation Tables & Truth Table of FFs

SR FF Truth Table

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

SR FF Excitation Table

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

JK FF Truth Table

J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

JK FF Excitation Table

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

D FF Truth Table

D	Q_{n+1}
0	0
1	1

D FF Excitation Table

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

T FF Truth Table

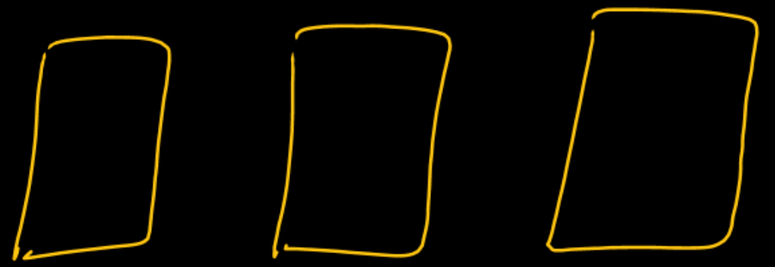
T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$

T FF Excitation Table

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

MOD COUNTER

MODULUS COUNTER



MOD 5 → 101

0 1 2 3 4

MOD 11 → 1011

0 - - - - 10

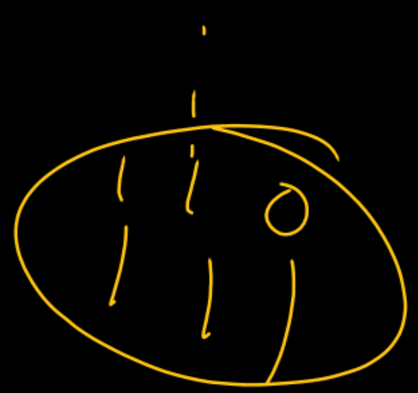
DECADE

0 - - - 9 → 1010

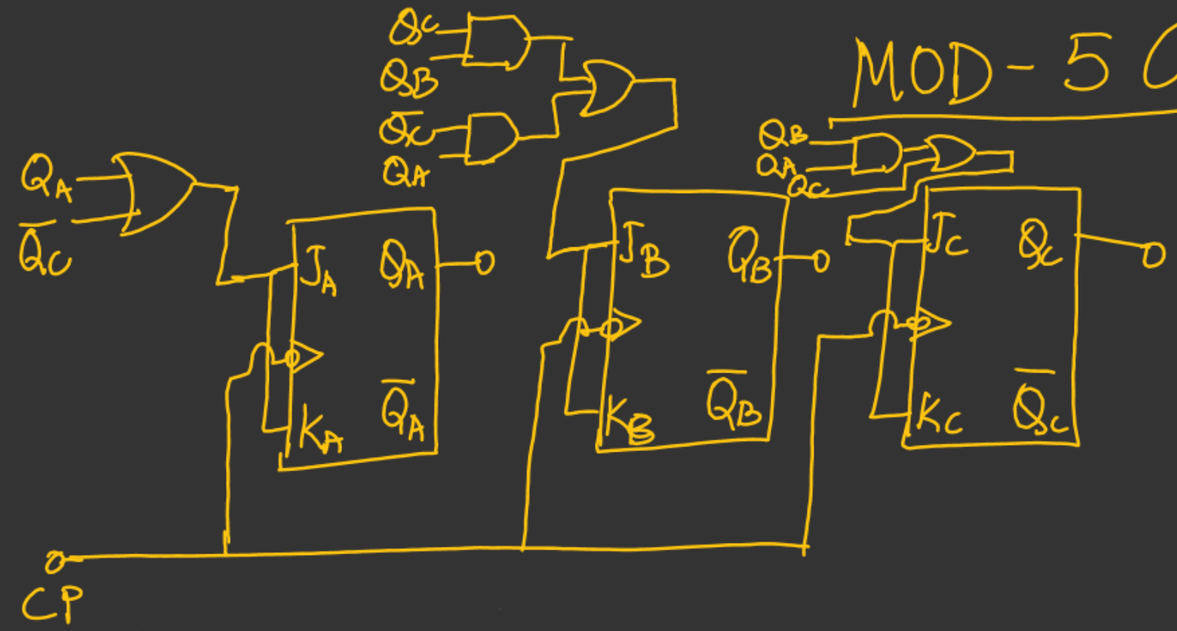
MOD 4

0 1 2 3

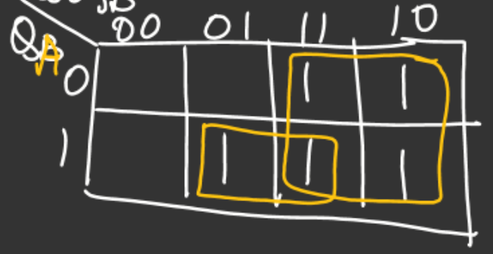
11



MOD - 5 Counter



for T_C



$$T_C = Q_C + Q_B Q_A$$

for T_B



$$T_B = Q_C Q_B + \bar{Q}_C Q_A$$

for T_A

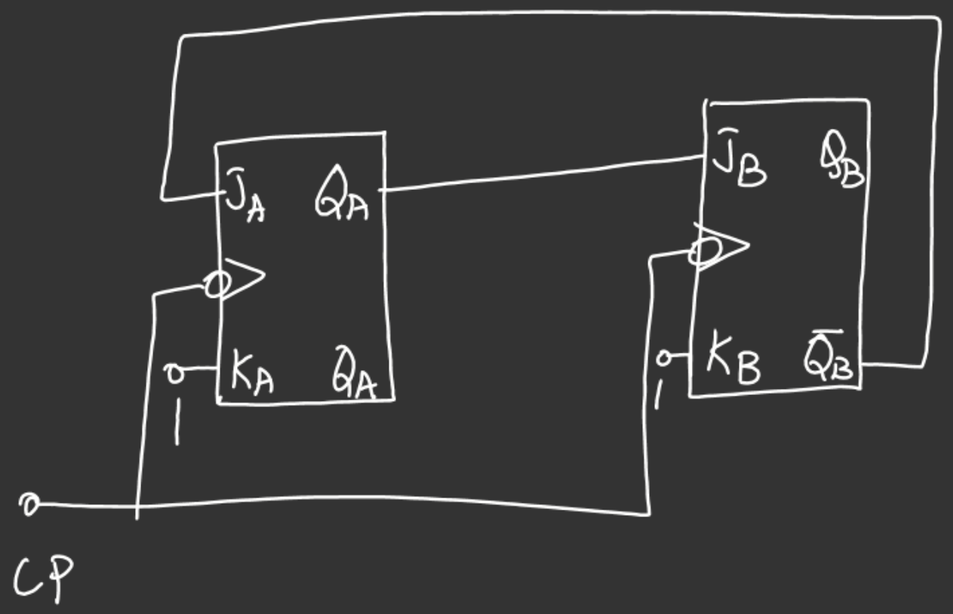


$$T_A = Q_A + \bar{Q}_C$$

State Table

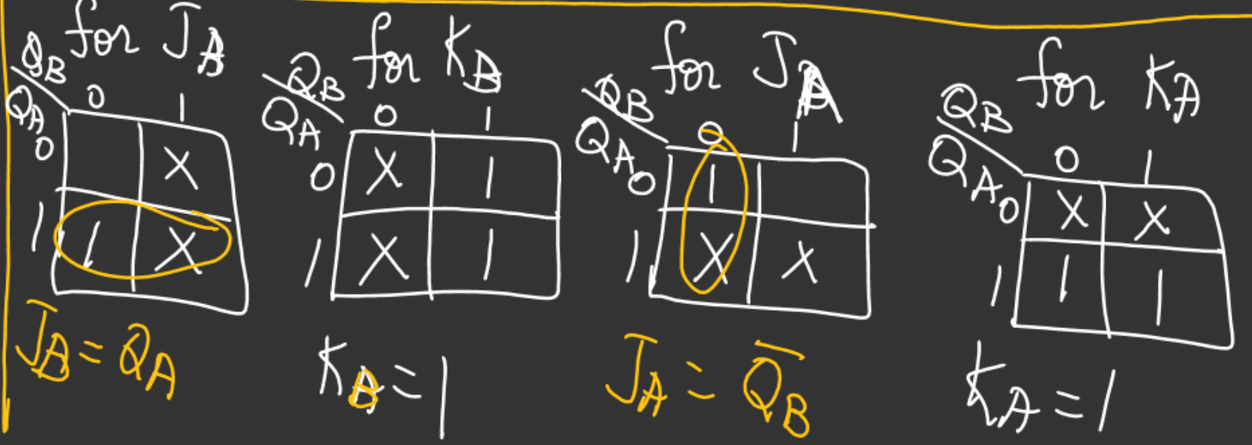
Present state			Next state					
Q_C	Q_B	Q_A	Q_{C+1}	Q_{B+1}	Q_{A+1}	T_C	T_B	T_A
0	0	0	0	0	1	0	0	1
0	0	1	0	1	0	0	1	1
0	1	0	0	1	1	0	0	1
0	1	1	1	0	0	1	1	1
1	0	0	0	0	0	1	0	0
1	0	1	0	0	0	1	0	1
1	1	0	0	0	0	1	1	0
1	1	1	0	0	0	1	1	1

MOD-3 Counter using JK-FF



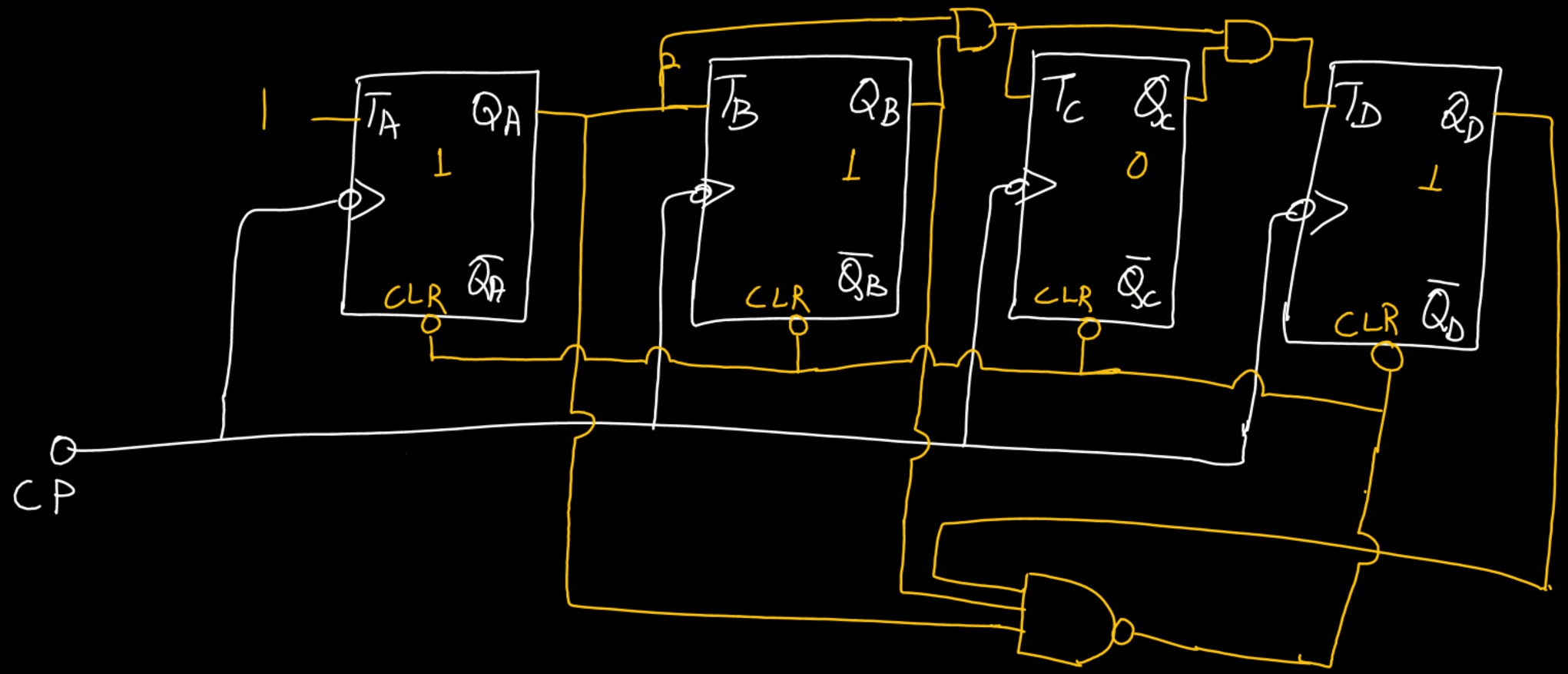
State Table

Present State		Next State		I/Ps			
Q_B	Q_A	Q_{B+1}	Q_{A+1}	J_B	K_B	J_A	K_A
0	0	0	1	0	X	1	X
0	1	1	0	1	X	X	1
1	0	0	0	X	1	0	X
1	1	0	0	X	1	X	1



Other Way of MOD Counter

MOD - 11



GATEWAY CLASSES

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All Subjects

Link in Description

Thank You