Digital Electronics LAB

By

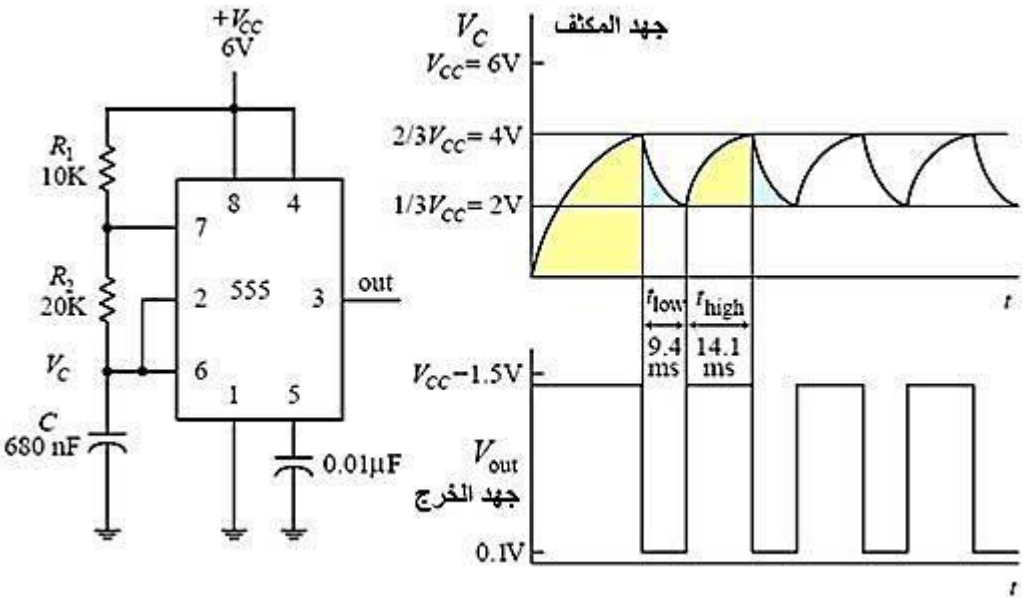
Lecture

Radhi Sehen Issa

2022-2023

Experiment No. – 1-

Determine the output frequency and duty cycle of the ٥٥٥ oscillator . Shown in figure by using Multisim



$$t_{low} = 0.693(20K)(680nF) = 9.6ms$$

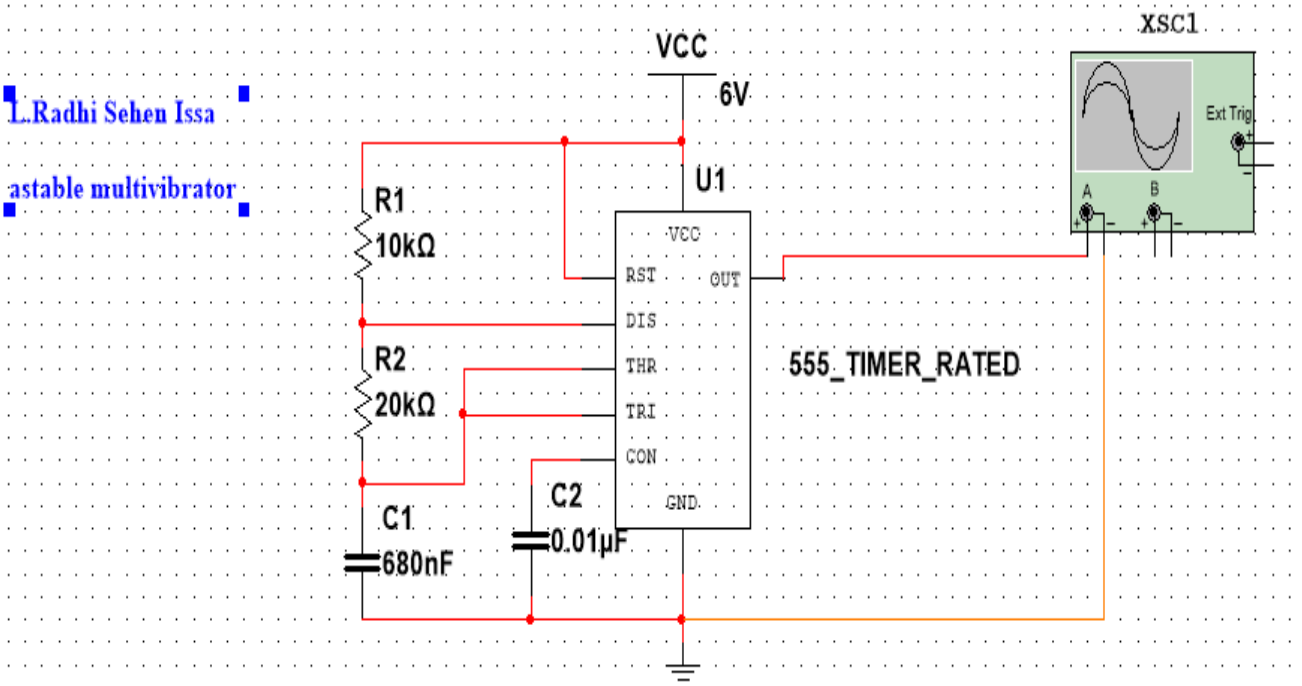
$$t_{high} = 0.693(10K + 20K)(680nF) = 14.1ms$$

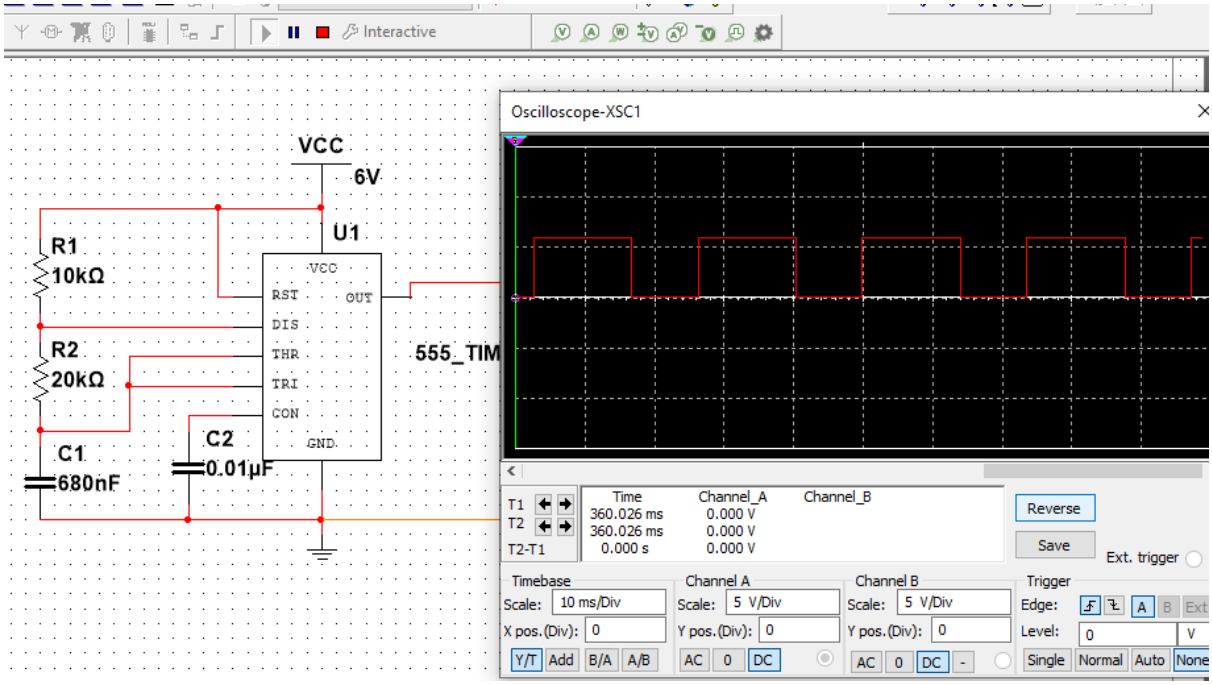
$$f = \frac{1}{9.6ms + 14.1ms} = 42Hz$$

$$\text{duty cycle} = \frac{14.1ms}{14.1ms + 9.6ms} = 0.6$$

L.Radhi Sehen Issa

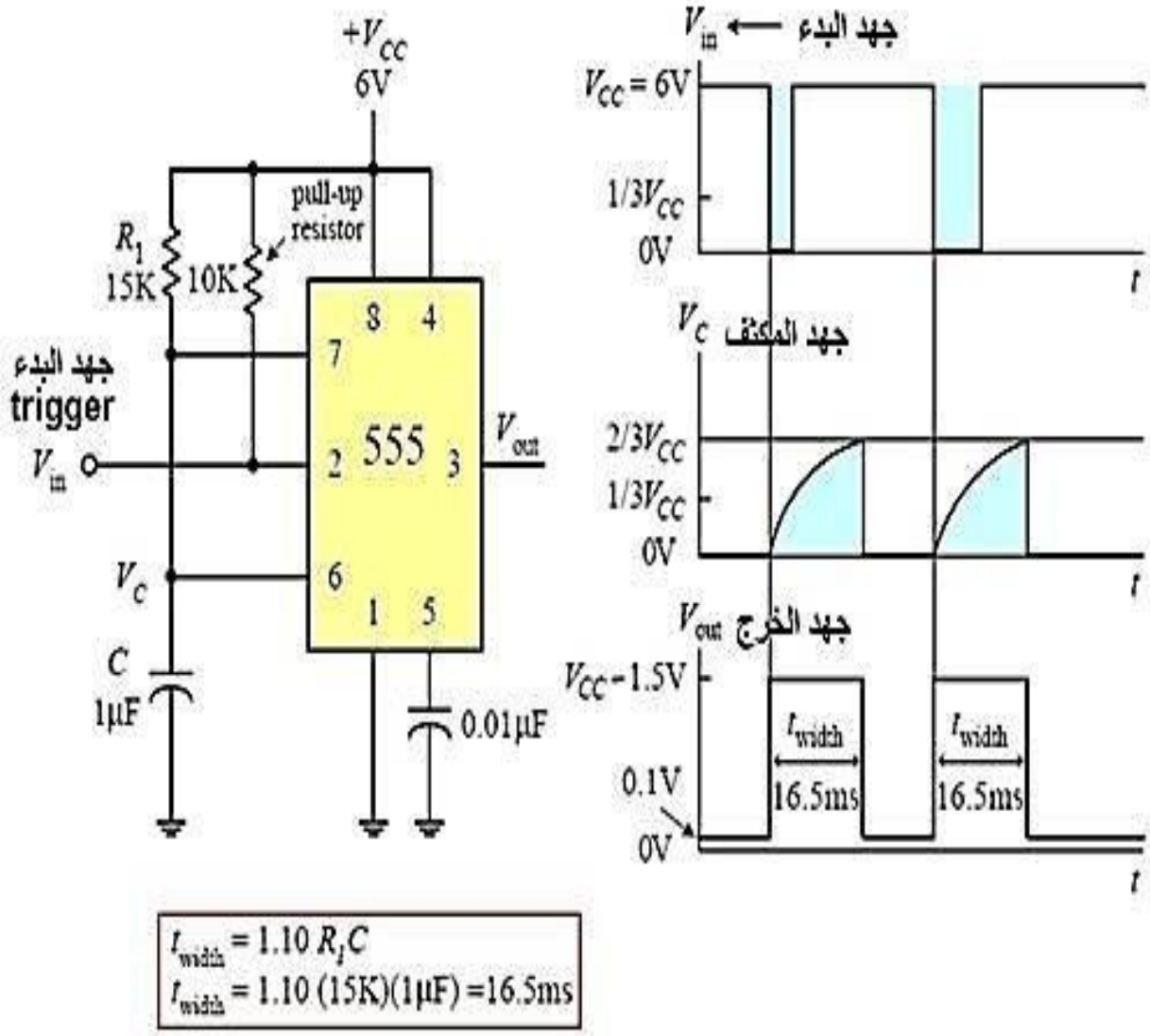
astable multivibrator



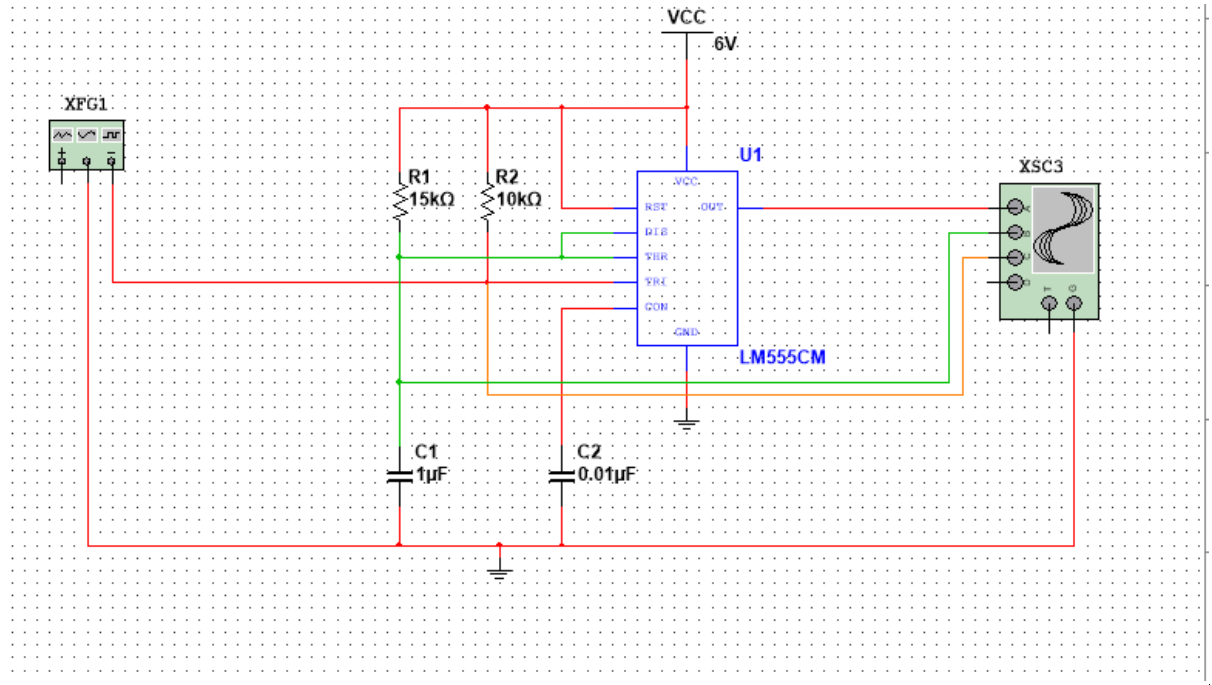


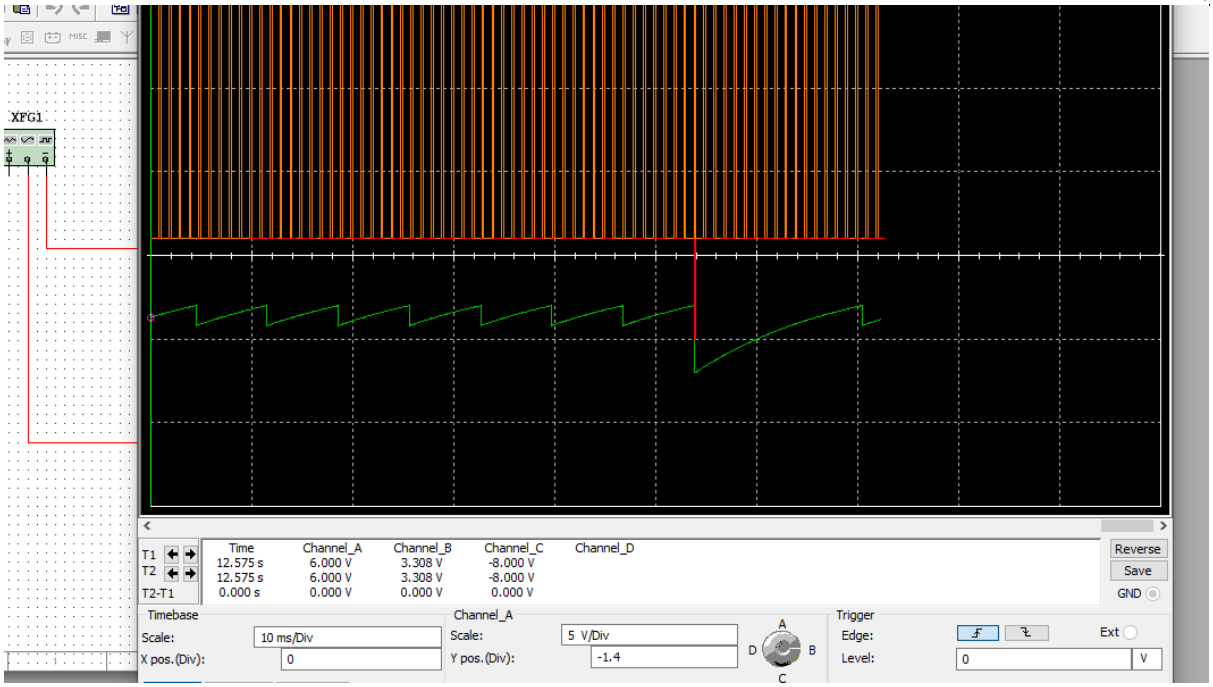
Experiment No. – 2-

Determine the output pulse width shown in figure below by using Multisim



$$t_{width} = 1.10\, R_1 C$$
$$t_{width} = 1.10\,(15K)(1\mu F) = 16.5ms$$

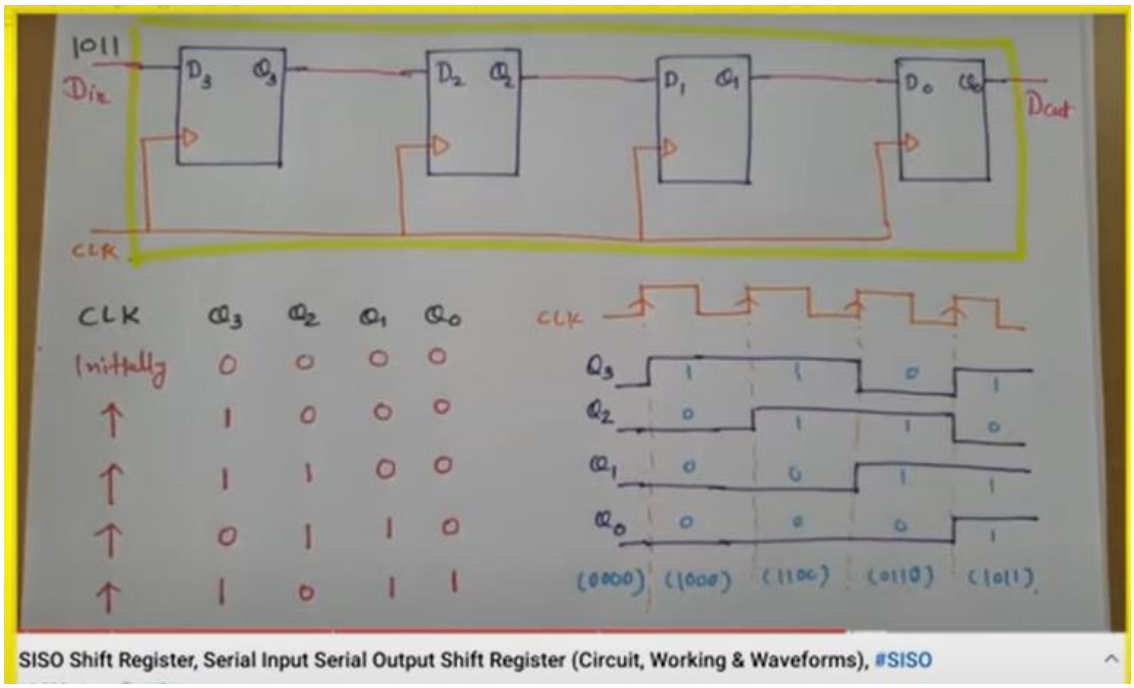

VCC
6V
XFG1
R1
15kΩ
R2
10kΩ
U1
XSC3
LM555CM
C1
1μF
C2
0.01μF

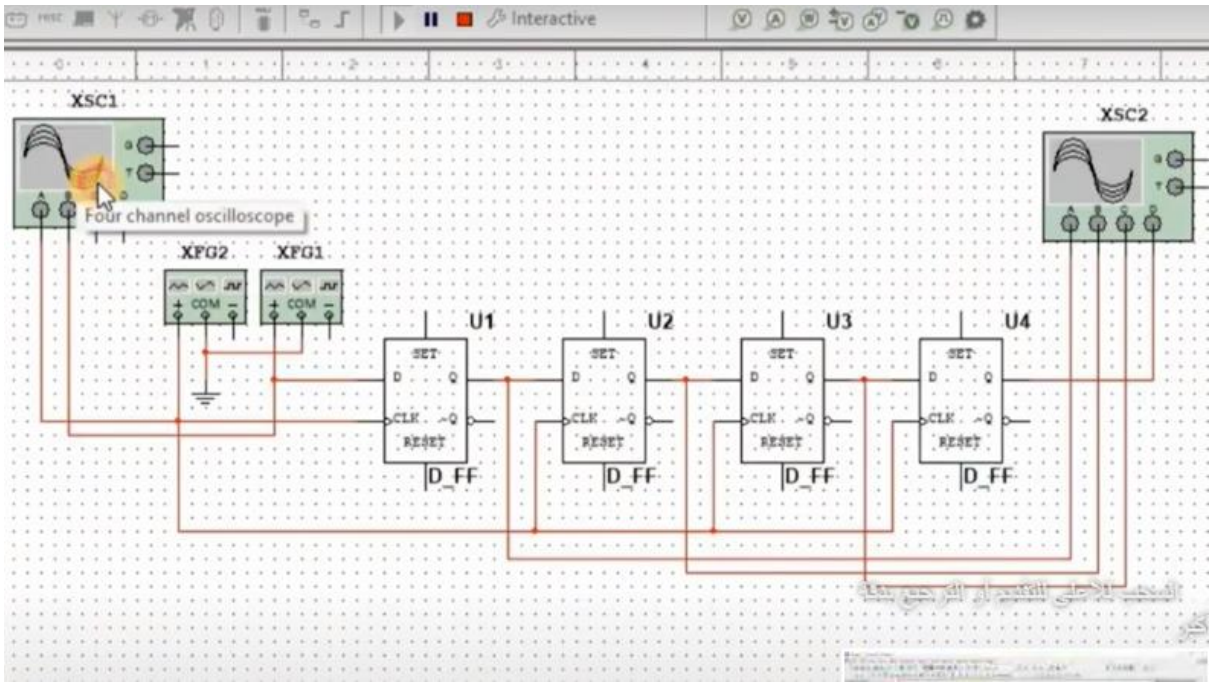

XFG1
Time
Channel_A
Channel_B
Channel_C
Channel_D
T1
12.575 s
6.000 V
3.308 V
-8.000 V
T2
12.575 s
6.000 V
3.308 V
-8.000 V
T2-T1
0.000 s
0.000 V
0.000 V
0.000 V
Reverse
Save
GND
Timebase
Scale:
10 ms/Div
X pos.(Div):
0
Channel_A
Scale:
5 V/Div
Y pos.(Div):
-1.4
A
B
C
D
Trigger
Edge:
Ext
Level:
0
V

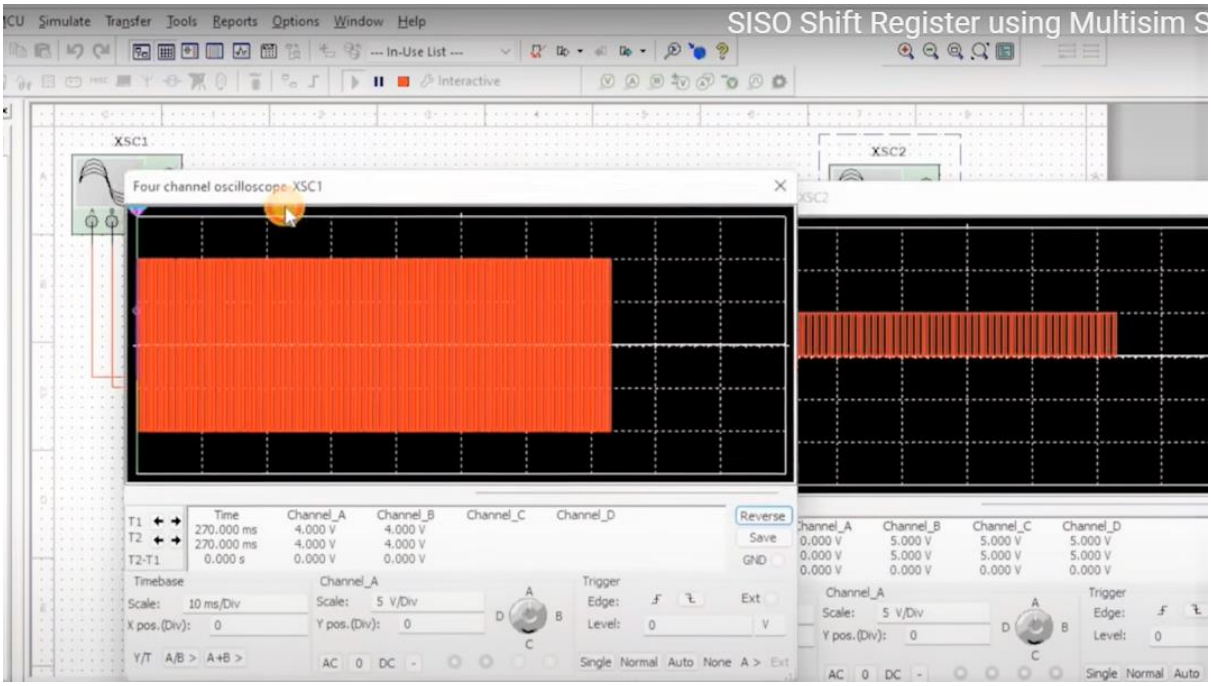
Experiment No. – 3-

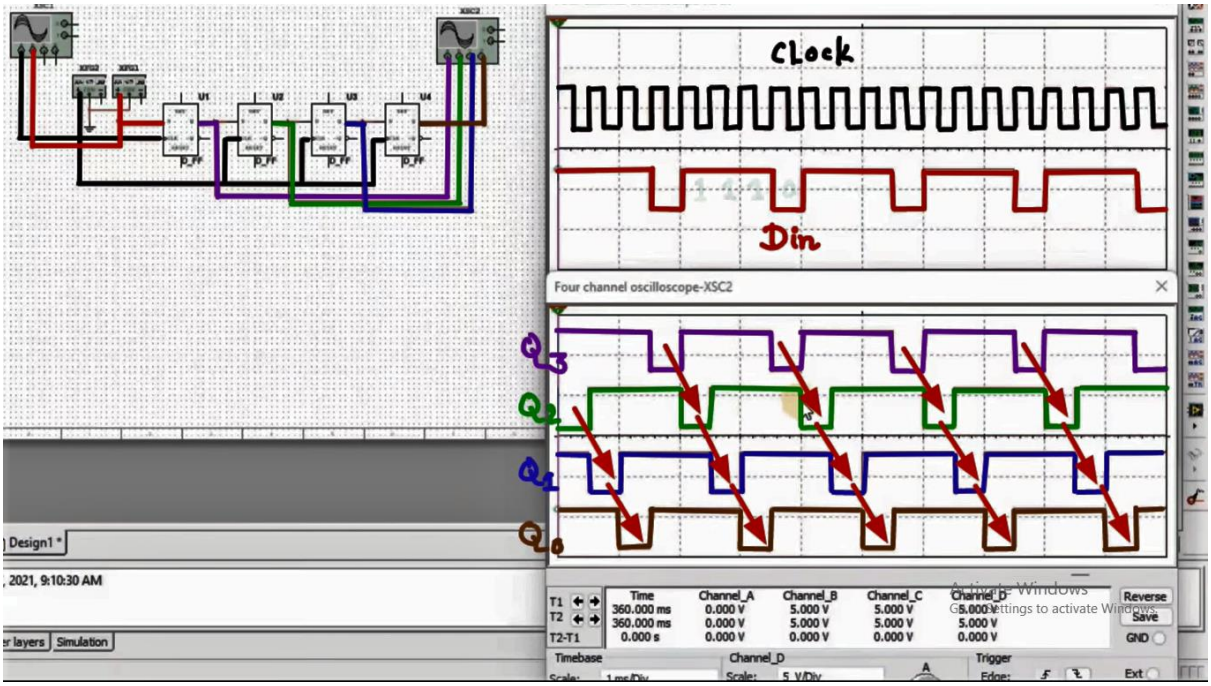
Shift Registers

Design a serial in/serial out shift register to shift 1011 to the right, draw circuit diagram and the timing waveforms for all outputs (use D flip-flops). By using Multisim





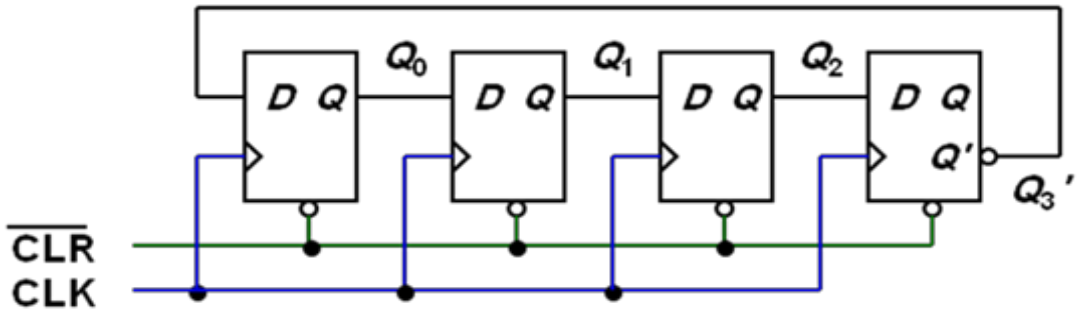

SISO Shift Register using Multisim S
Simulate
Transfer
Tools
Reports
Options
Window
Help
XSC1
XSC2
Four channel oscilloscope-XSC1
Time
Channel_A
Channel_B
Channel_C
Channel_D
Reverse
Save
Timebase
Trigger


CLock
Din
Four channel oscilloscope-XSC2
Q3
Q2
Q1
Q0
Design1 *
Simulation
Time
Channel_A
Channel_B
Channel_C
Channel_D
Reverse
Save
Timebase
Trigger

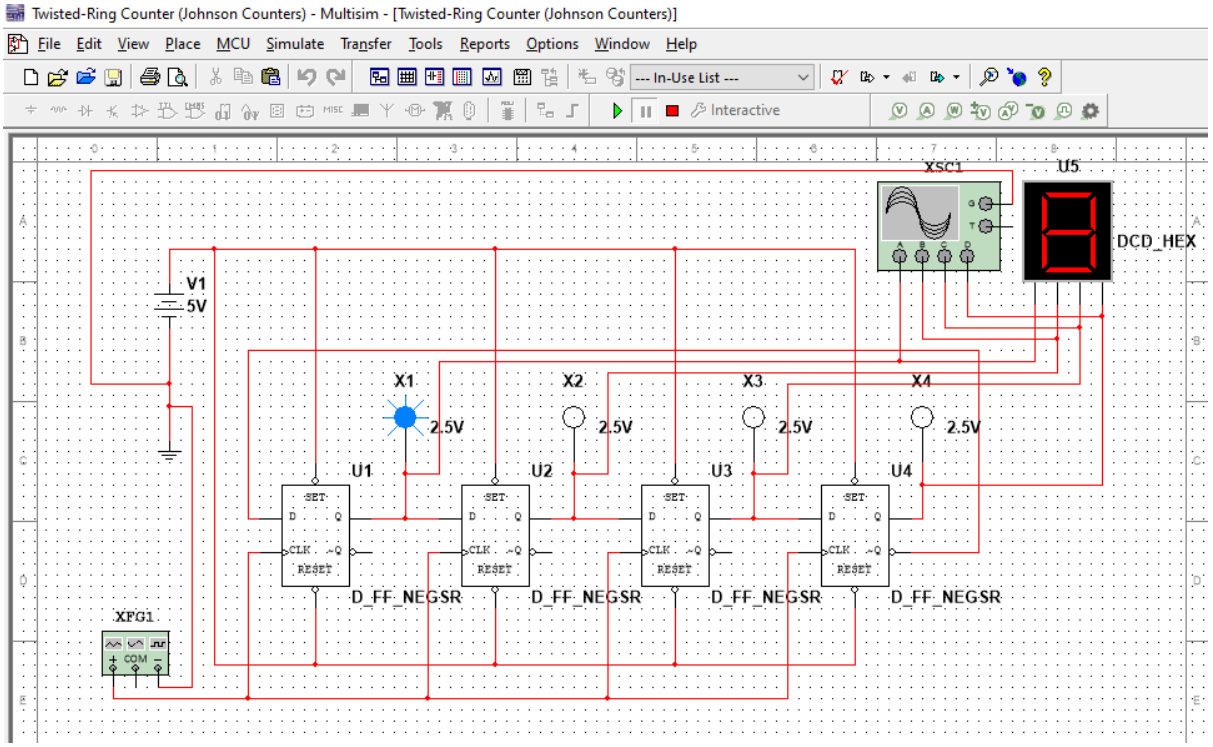
Experiment No. – 4-

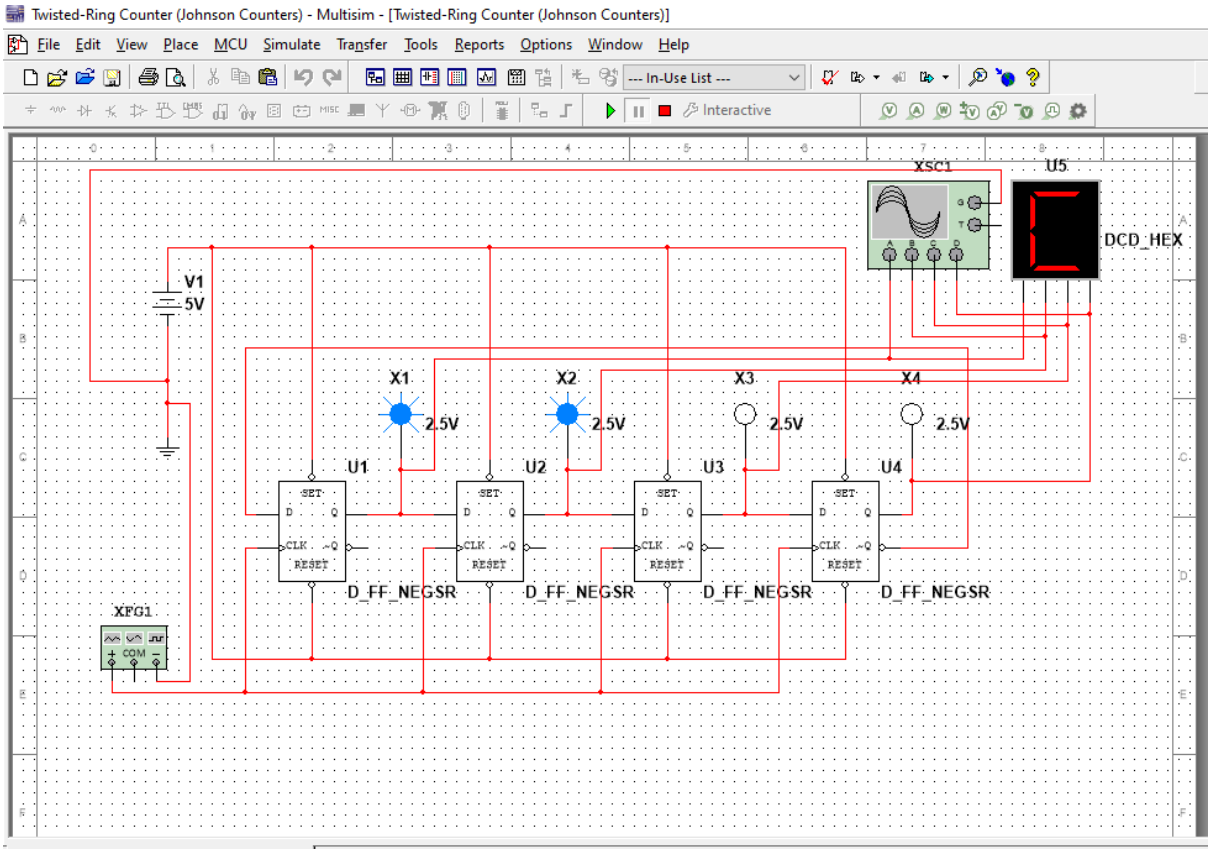
Twisted-Ring Counter (Johnson Counters)

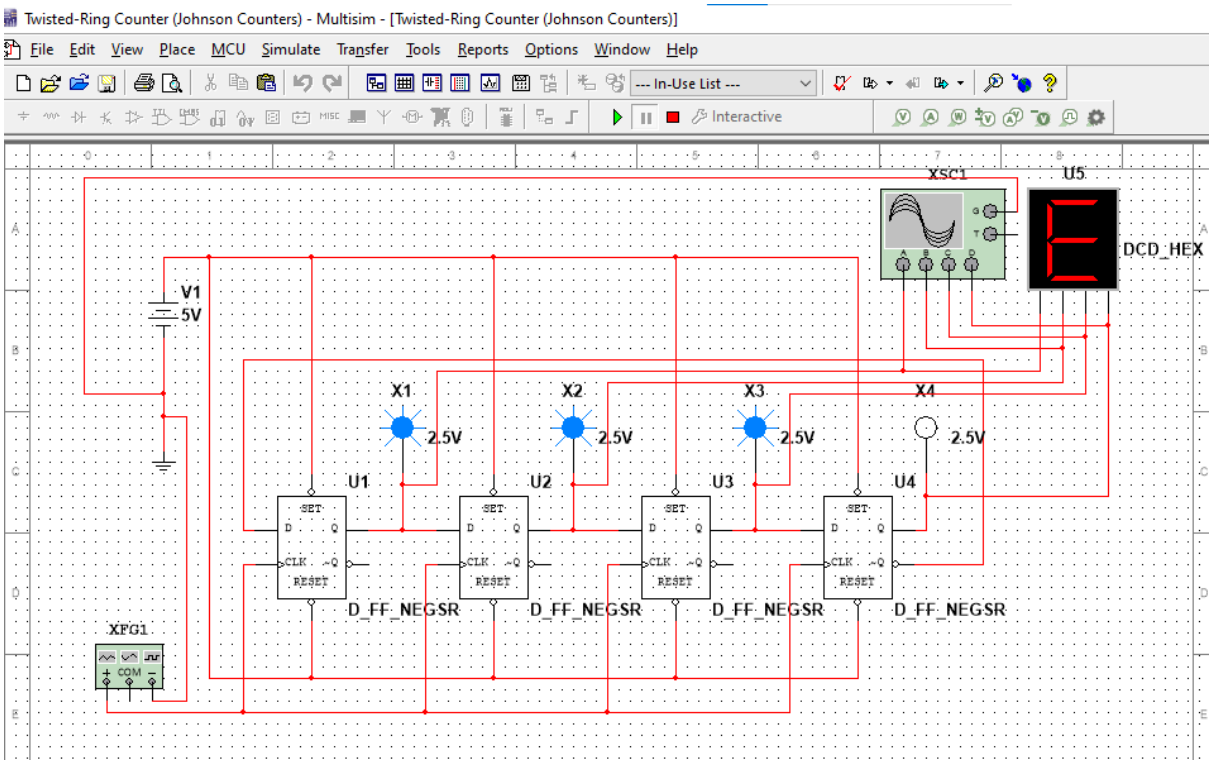
Implement the complete design for a 4-bit (MOD-8) Johnson counter :

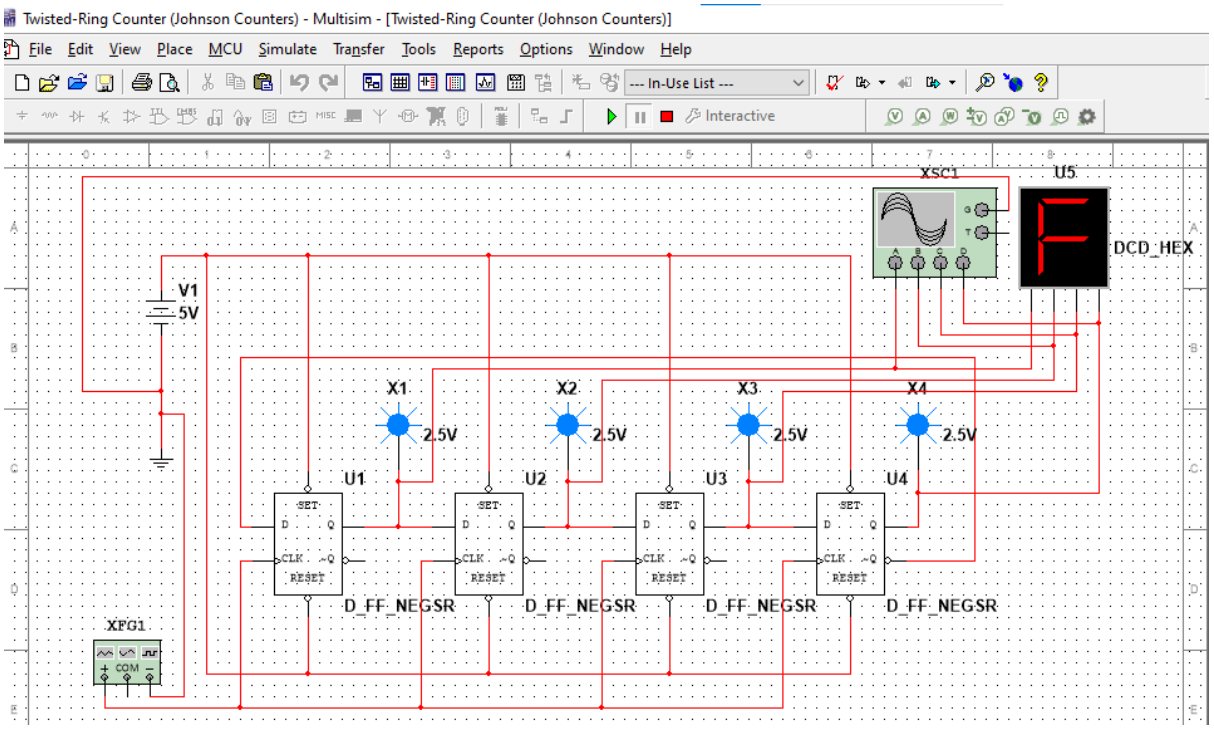


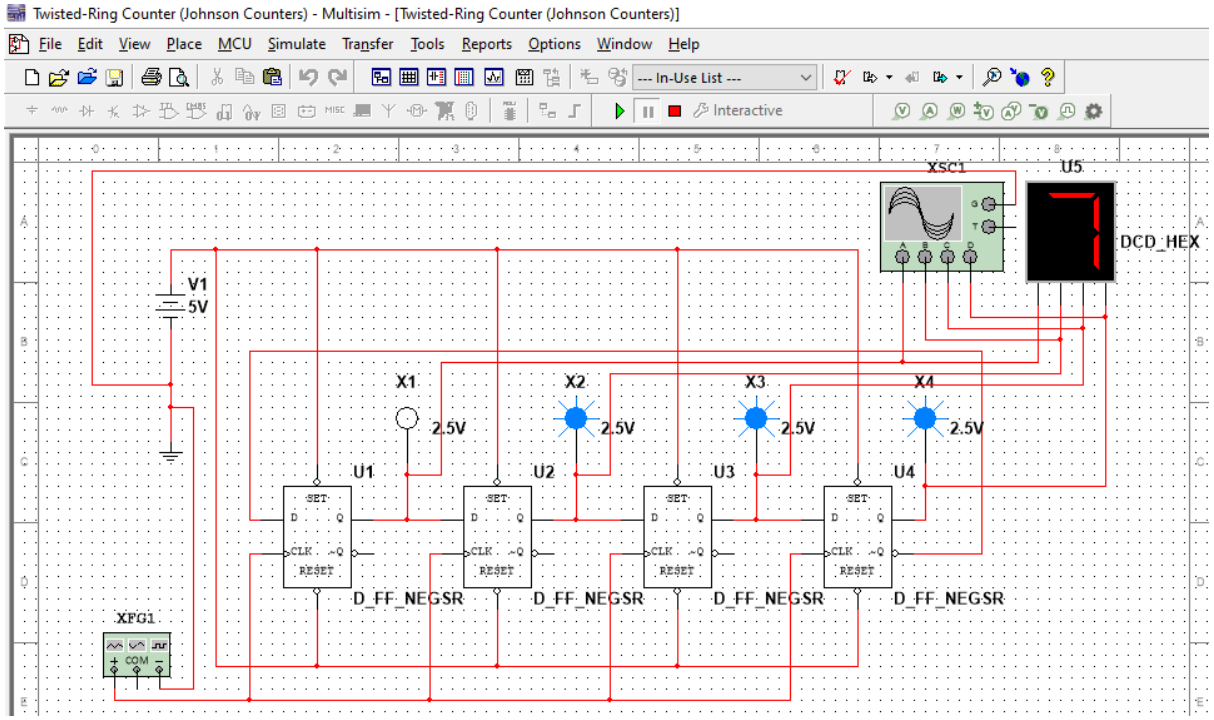
Clock	Q_0	Q_1	Q_2	Q_3
0	0	0	0	0
1	1	0	0	0
2	1	1	0	0
3	1	1	1	0
4	1	1	1	1
5	0	1	1	1
6	0	0	1	1
7	0	0	0	1

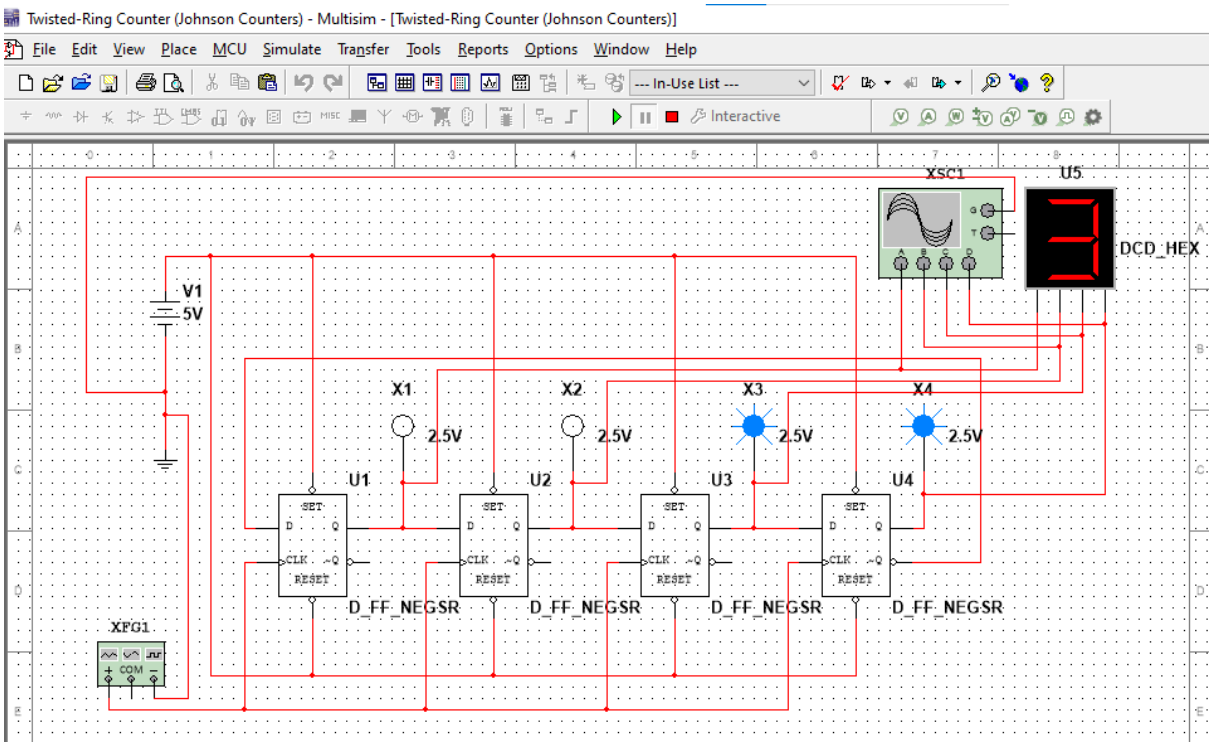

Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1

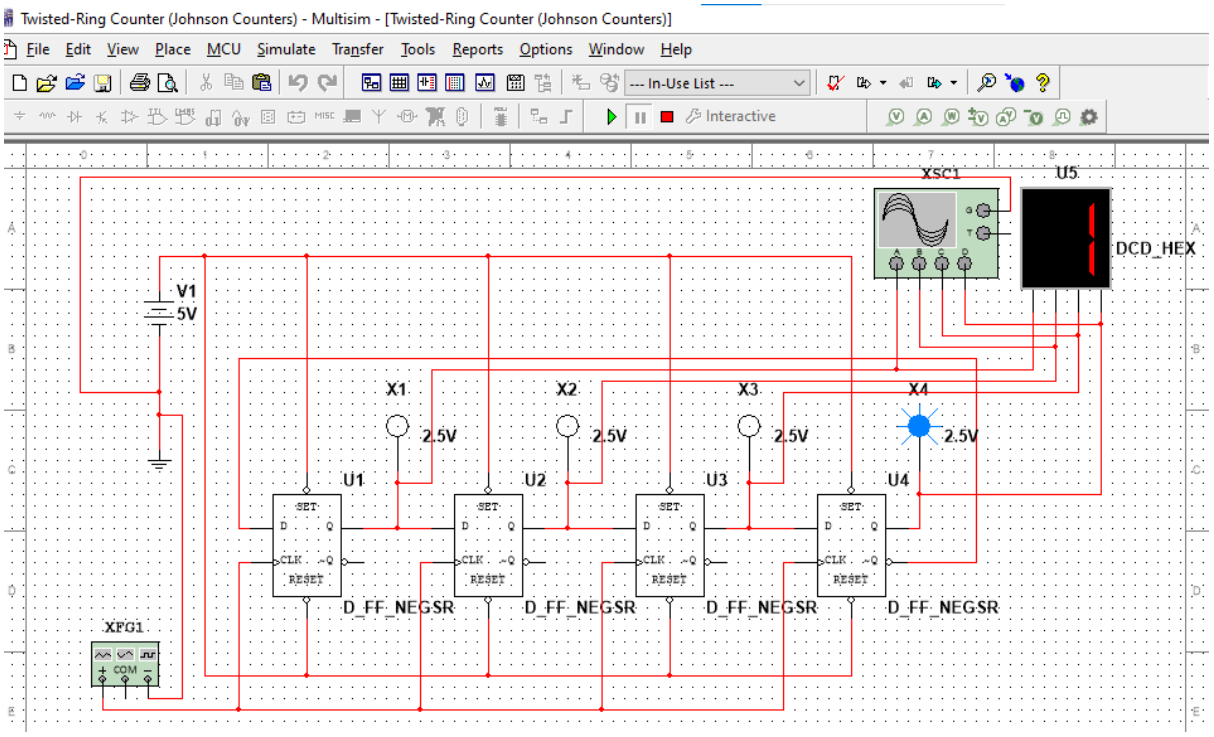

Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1

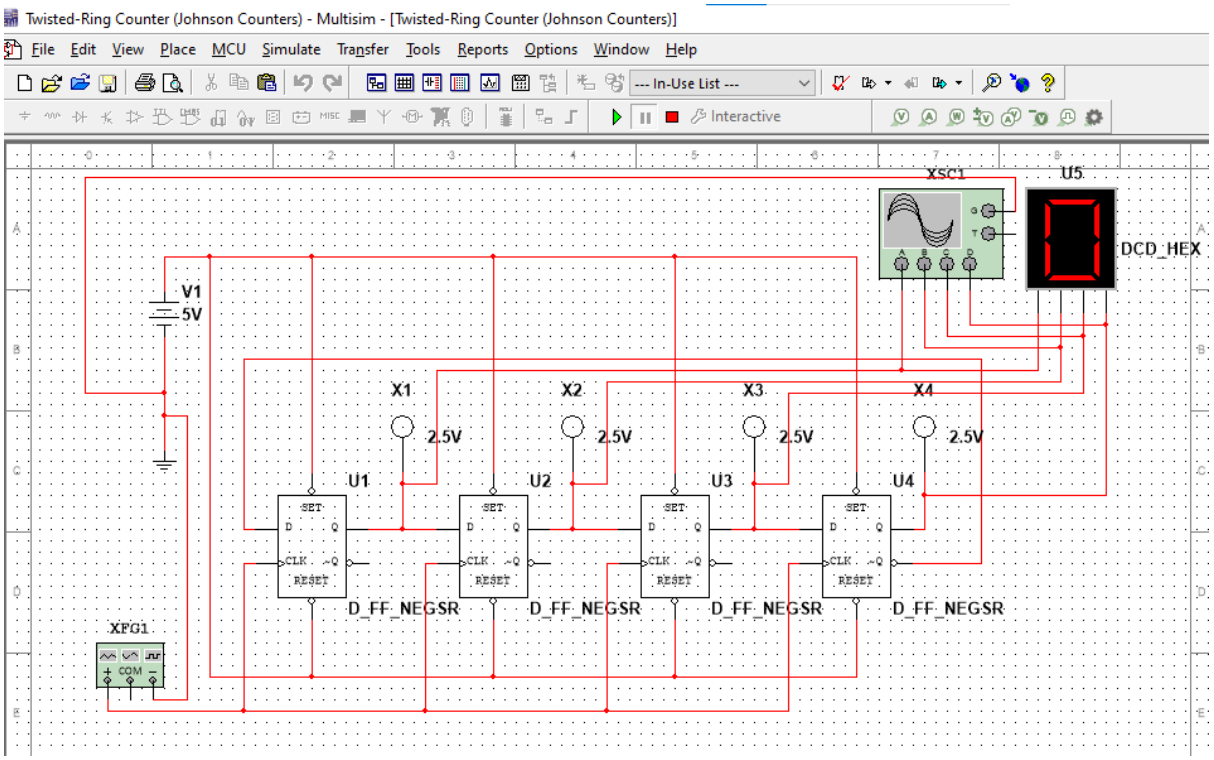

Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
~Q
RESET
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1
COM


Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
~Q
RESET
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1
COM


Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
RESET
D_FF_NEGSR
XFG1
COM


Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
RESET
D_FF_NEGSR
XFG1
COM

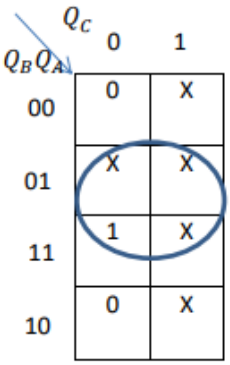

Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
~Q
RESET
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1
COM


Twisted-Ring Counter (Johnson Counters) - Multisim - [Twisted-Ring Counter (Johnson Counters)]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XSC1
U5
DCD_HEX
V1
5V
X1
X2
X3
X4
2.5V
2.5V
2.5V
2.5V
U1
U2
U3
U4
SET
D
Q
CLK
~Q
RESET
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
D_FF_NEGSR
XFG1
COM

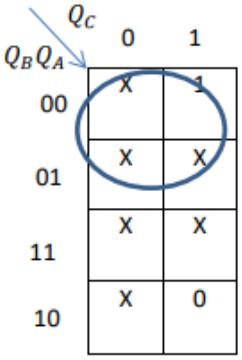
Experiment No. – 5-

Design an up-down counter using JK Flip-flop to count 0, 2, 3, 6, 4, 0....

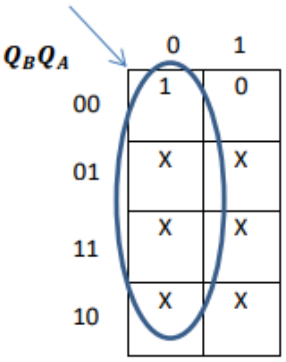
P.S			N.S			Flip-flop					
Q_C	Q_B	Q_A	Q_C^+	Q_B^+	Q_A^+	J_C	K_C	J_B	K_B	J_A	K_A
0	0	0	0	1	0	0	X	1	X	0	X
0	0	0	-	-	-	X	X	X	X	X	X
0	1	1	0	1	1	0	X	X	0	1	X
0	1	1	1	1	0	1	X	X	0	X	1
1	0	0	0	0	0	X	1	0	X	0	X
1	0	0	-	-	-	X	X	X	X	X	X
1	1	1	1	0	0	X	0	X	1	0	X
1	1	1	-	-	-	X	X	X	X	X	X



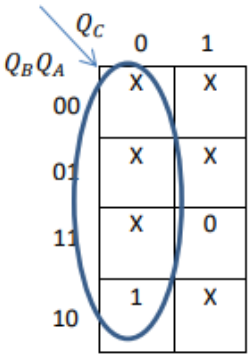
$J_C = Q_A$



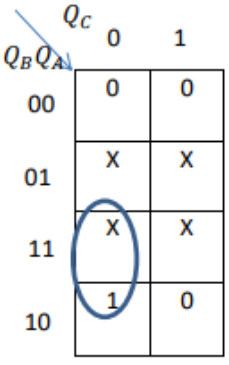
$K_C = \overline{Q_B}$



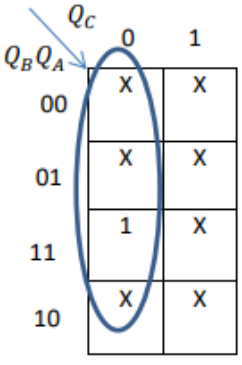
$J_B = \overline{Q_C}$



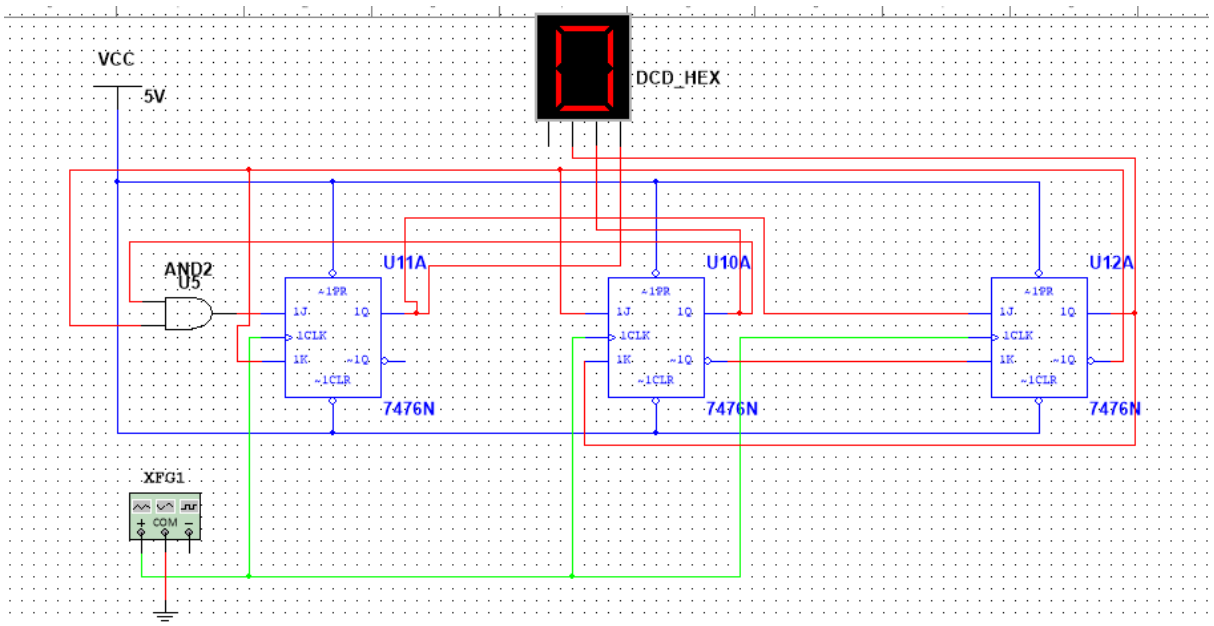
$K_B = Q_C$

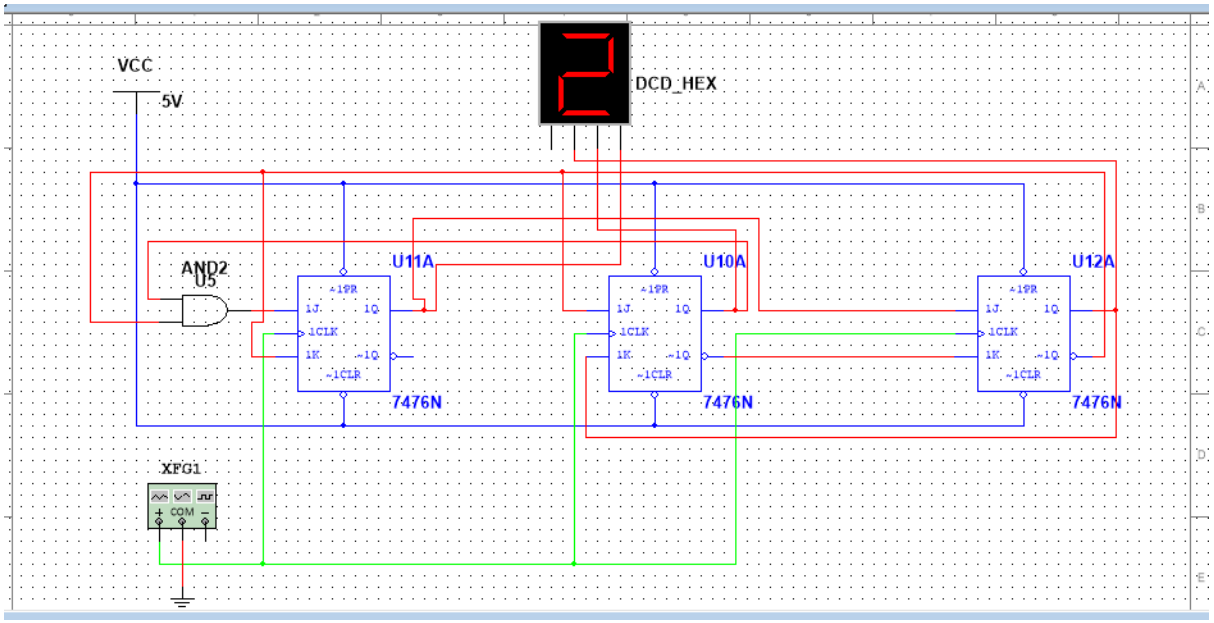


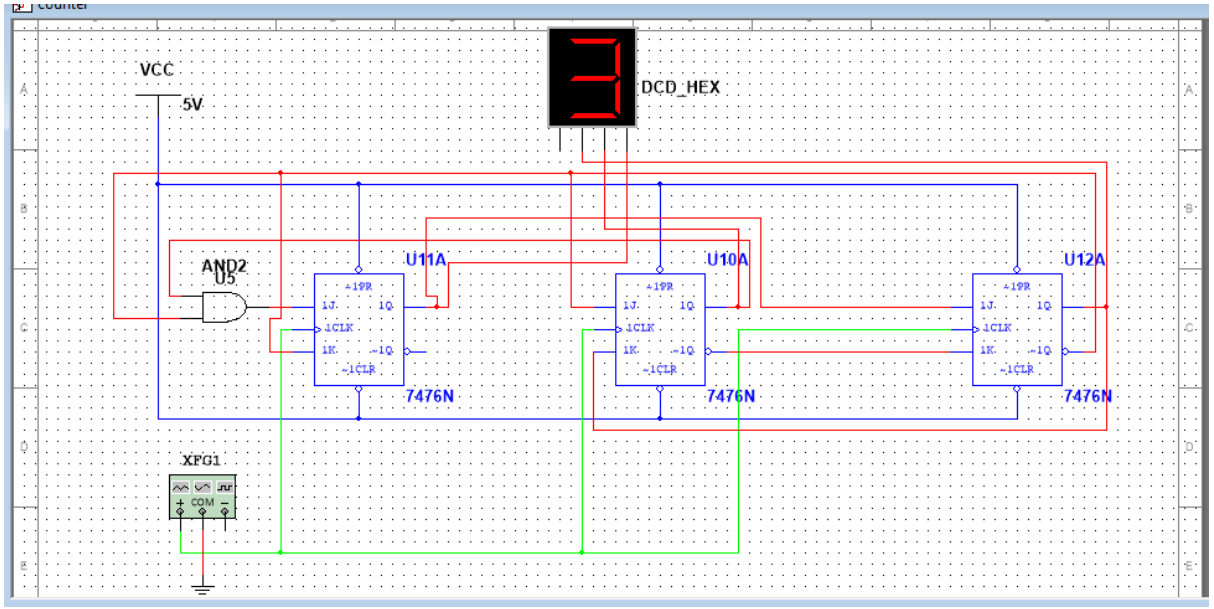
$J_A = \overline{Q_C}Q_B$

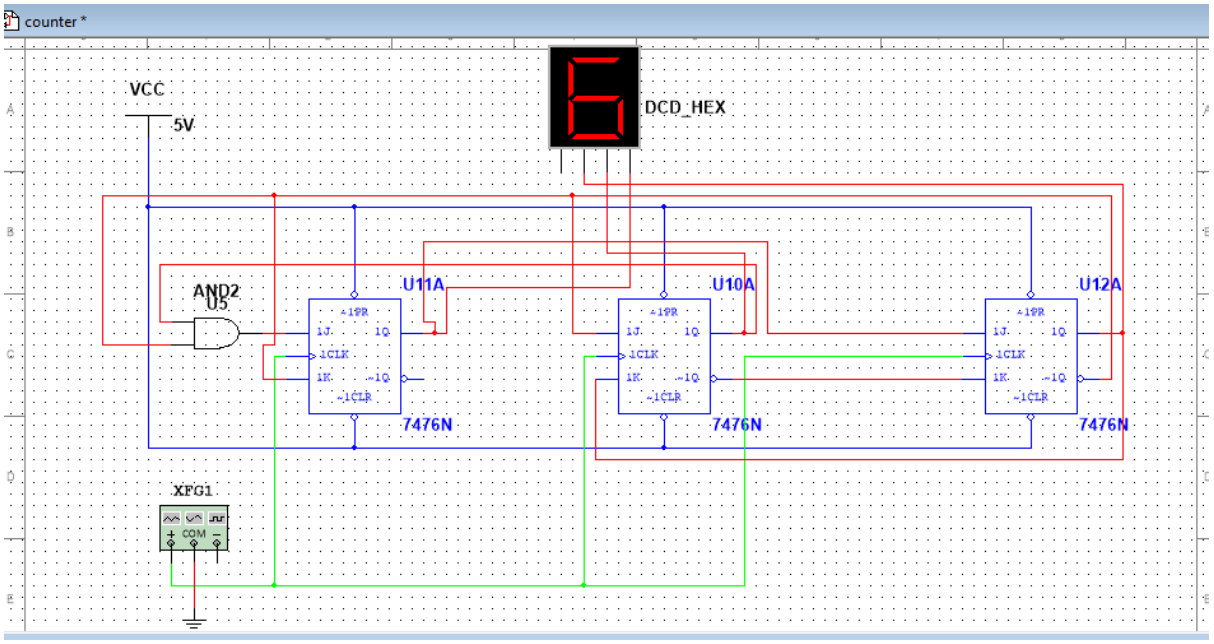


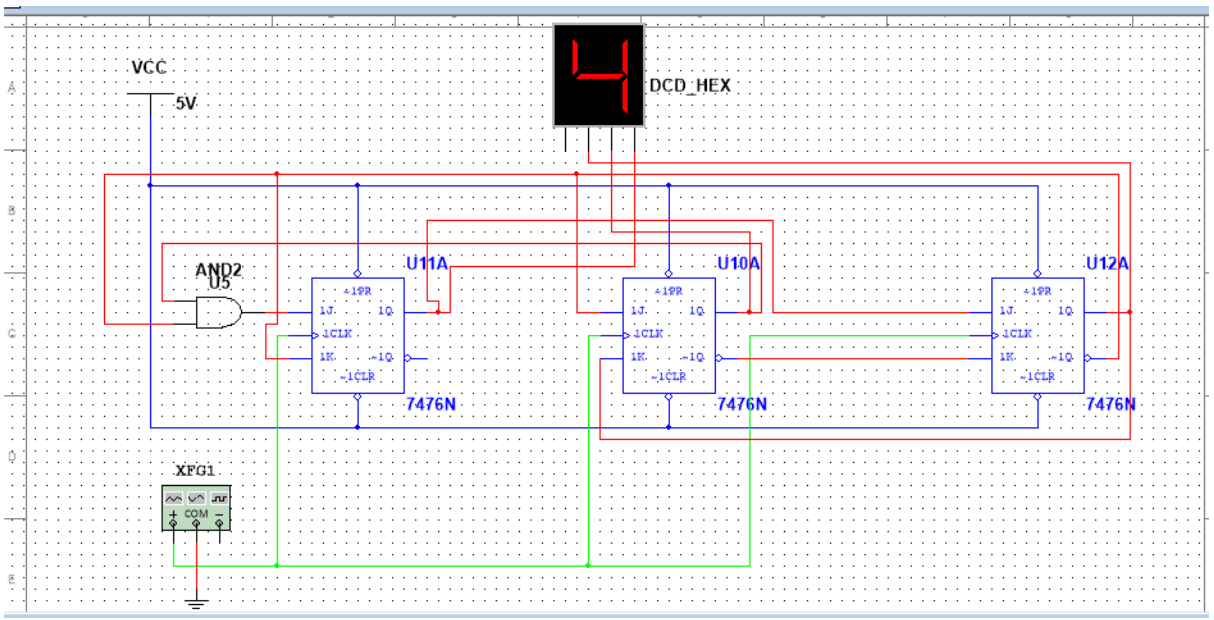
$K_A = \overline{Q_C}$


VCC
5V
DCD_HEX
AND2
U5
U11A
U10A
U12A
7476N
7476N
7476N
XFG1
COM


VCC
5V
DCD_HEX
AND2
U5
U11A
U10A
U12A
7476N
7476N
7476N
XFG1
COM


VCC
5V
DCD_HEX
AND2
U5
U11A
U10A
U12A
7476N
7476N
7476N
XFG1
COM

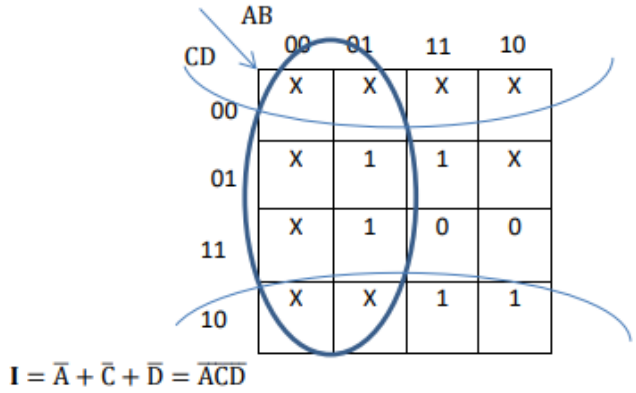

counter *
VCC
5V
DCD_HEX
AND2
U5
U11A
U10A
U12A
7476N
7476N
7476N
XFG1
COM


VCC
5V
DCD_HEX
AND2
U5
U11A
U10A
U12A
7476N
7476N
7476N
XFG1
COM

Experiment No. – 6-

Design a sequence generator to generate the sequence 1011110

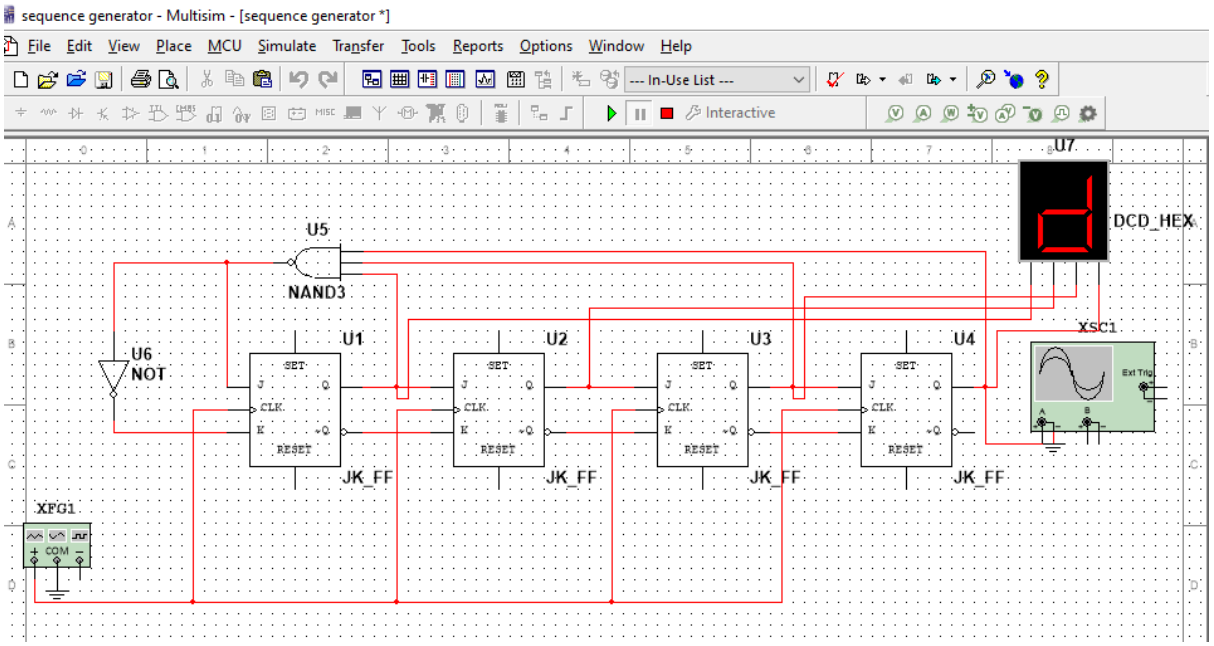
D	C	B	A	I
1	1	0	1	0
1	0	1	0	1
0	1	0	1	1
1	0	1	1	1
0	1	1	1	1
1	1	1	1	0
1	1	1	0	1



$$I = \bar{A} + \bar{C} + \bar{D} = \overline{ACD}$$

حيث تظهر الارقام بالتسلسل

d, A,5,B,7,F,E


sequence generator - Multisim - [sequence generator *]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
U7
DCD_HEX
U5
NAND3
U6
NOT
U1
U2
U3
U4
JK_FF
XSC1
XFG1
COM