V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University
Re-accredited with 'A' Grade (3rd cycle) by NAAC
VIRUDHUNAGAR – 626 001 (TAMIL NADU)

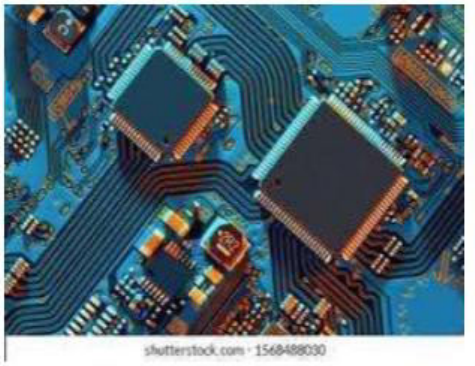
DIGITAL ELECTRONICS LAB MANUAL

under

DBT STAR COLLEGE SCHEME

DEPARTMENT OF BIOTECHNOLOGY

NEW DELHI



Prepared by

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DEPARTMENT OF PHYSICS

2020 - 2021

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DBT STAR COLLEGE SCHEME

Department of Biotechnology, Ministry of Science and Technology
Government of India, New Delhi

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FOREWORD

The Lab Manual on **"DIGITAL ELECTRONICS"** is prepared in accordance with the updated syllabus under DBT Star College Scheme sponsored by the Department of Biotechnology, Ministry of Science and Technology, MHRD, New Delhi to fulfil the needs of students. The handling of instruments and performing the experiments will enhance the practical knowledge of learnt concepts.

We thank the **Department of Biotechnology, The Ministry of Science and Technology, MHRD, New Delhi** for providing a good opportunity under Star College Scheme (No HRD11011/163/2020-HRD-DBT Dt. 24.08.2020). Under this scheme, we have purchased Muffle Furnace, Planck's constant by photoelectric effect apparatus, Spectrometer, Distillation Unit, Polarimeter, Dielectric Constant apparatus for solids and liquids, Solar Cell Characteristics kit, Calender and Barne's apparatus and Optical Fibre Communication Kit. This kind of support motivates the students for better understanding of physics concepts and creates interest on their core subject.

We hope this manual will definitely satisfy our student's need for knowledge to enhance their research attitude and motivate them to become a good physicist in future.

MEMBER SECRETARY/COORDINATOR **CHAIRMAN/PRINCIPAL**

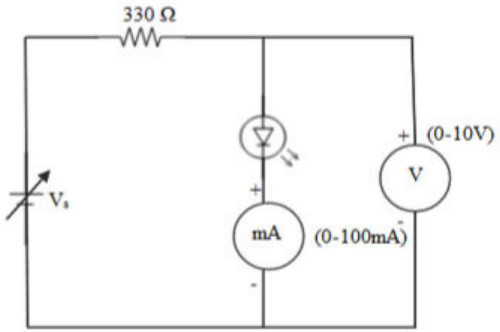
V.V.Vanniaperumal College for Women, Virudhunagar,Tamilnadu
VVVC/DBT-SCS/2020-2021/Physics /Lab Manual 1

LIST OF PRACTICALS

1A. LED CHARACTERISTICS

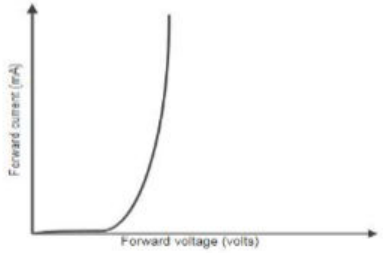
CIRCUIT DIAGRAM:

For LED characteristics:



R - 330 Ω resistance
mA - Milli ammeter
V - Voltmeter
V_s - Supply voltage

Model graph:



OBSERVATIONS:

Voltage (volt)	Current (mA)

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1A. LED CHARACTERISTICS

AIM:

To study the characteristics of LED and draw the VI characteristics graph.

APPARATUS REQUIRED:

LED, 330 Ω resistor, DC milliammeter, DC voltmeter, Power supply and connection wires.

PROCEDURE:

- Make the connections as shown in circuit diagram. Switch on the power supply.
- The voltage is set at 0 V and the current through the LED shown by milliammeter is recorded.
- For each setting of the voltage, corresponding current shown by the microammeter is noted. The observations are recorded in table.
- The graph is plotted, by taking forward voltage on the positive 'x' axis and forward current on the positive 'y' axis

PRECAUTIONS:

- Make sure that the connections are tight.
- Take care to apply suitable forward voltages across the LED so that suitable forward currents flow through the LED. Otherwise the LED may be damaged.

RESULT:

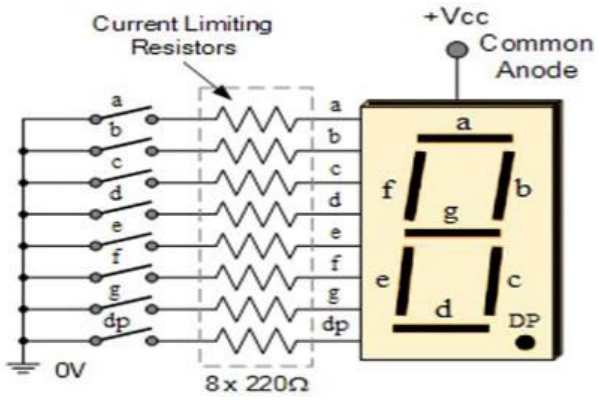
The characteristics of seven segment display are studied and VI characteristics graph of LED is drawn.

OUTCOME:

- Able to gain the knowledge about handling the equipments such as LED, milliammeter and voltmeter.
- Able to study the performance of LED for the application voltage.

1B. SEVEN SEGMENT DISPLAY

CIRCUIT DIAGRAM:



OBSERVATIONS:

Truth Table:

Display	A	B	c	d	E	f	G
0	ON	ON	ON	ON	ON	ON	OFF
1	OFF	ON	ON	OFF	OFF	OFF	OFF
2	ON	ON	OFF	ON	ON	OFF	ON
3	ON	ON	ON	ON	OFF	OFF	ON
4	OFF	ON	ON	OFF	OFF	ON	ON
5	ON	OFF	ON	ON	OFF	ON	ON
6	ON	OFF	ON	ON	ON	ON	ON
7	ON	ON	ON	OFF	OFF	OFF	OFF
8	ON	ON	ON	ON	ON	ON	ON
9	ON	ON	ON	ON	OFF	ON	ON

1B. SEVEN SEGMENT DISPLAY

AIM:

To study the characteristics of Seven Segment Display.

APPARATUS REQUIRED:

Seven segment display, 220Ω resistors -8, power supply and connection wires.

PROCEDURE:

- Make the connections as shown in circuit diagram. Switch on the power supply.
- In the common anode display, all the anode connections of the LED segments are joined together to logic "1".
- The individual segments are illuminated by applying a ground, logic "0" or "LOW" signal via a suitable current limiting resistor to the Cathode of the particular segment (a-g).
- Depending upon the decimal digit to be displayed, the particular set of LEDs is forward biased.
- For instance, to display the numerical digit 0, we will need to light up six of the LED segments corresponding to a, b, c, d, e and f. Thus the various digits from 0 through 9 can be displayed using a 7-segment display.

RESULT:

Thus the characteristics of Seven segment display was studied and its truth table is verified.

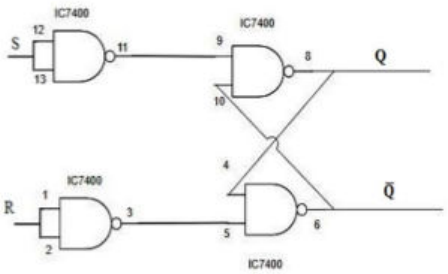
OUTCOME:

- Able to gain the knowledge about handling the equipments such as Seven segment display and bread board.
- Able to comprehend the performance of seven segment display and its ON and OFF conditions.

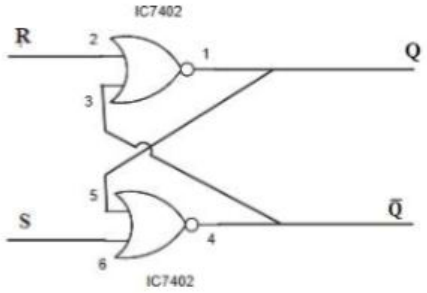
2. RS FLIP FLOP

CIRCUIT DIAGRAM:

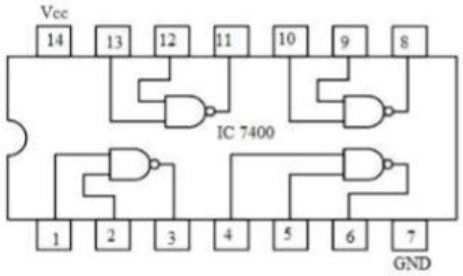
RS flip flop using NAND gate:



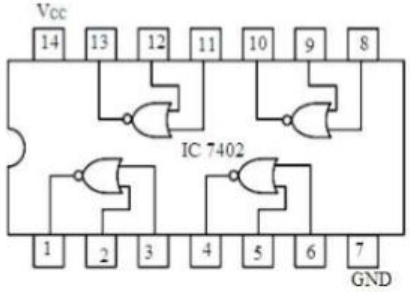
RS flip flop using NOR gate:



Pin configuration of IC 7400



Pin configuration of IC 7402



OBSERVATIONS:

Truth Table:

R	S	Q	$\bar{Q}$	State
0	0	-	-	Last state
0	1	1	0	Set
1	0	0	1	Reset
1	1	-	-	Forbidden

Verification Table:

R	S	Q	$\bar{Q}$	State
0	0			
0	5			
5	0			
5	5			

2. RS FLIP FLOP

AIM:

To construct RS flip flop using NAND and NOR gates and verify its truth table.

APPARATUS REQUIRED:

IC 7400, IC 7402, trainer board, 5V power supply, multimeter and connection wires.

PROCEDURE:

- Connections are made as per circuit diagram.
- Switch on the power supply.
- Observe the input and output according to the truth table.
- Verify the truth table for various combinations of inputs.
- Record the results in the table.

PRECAUTIONS:

- Make the connections according to the IC pin diagram.
- The connections should be tight.
- The Vcc and ground should be applied carefully at the specified pin only.

RESULT:

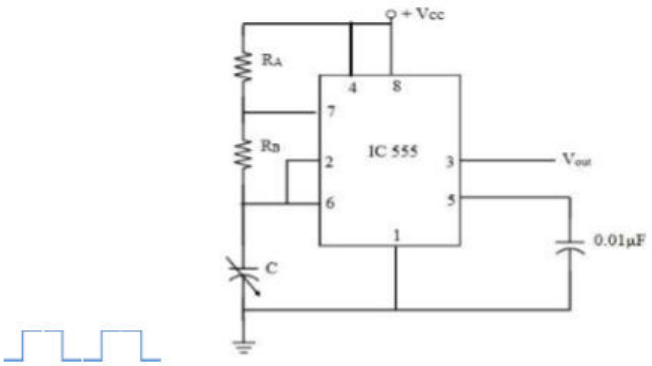
Thus the RS Flip Flop was constructed using NAND and NOR gate and its truth tables are verified.

OUTCOME:

- Able to gain knowledge about handling the equipments such as trainer board, multimeter and integrated chips.
- Able to study the performance of RS flip flop and it is set when the input at S terminal is high.

3. A STABLE MULTIVIBRATOR USING IC 555

CIRCUIT DIAGRAM:

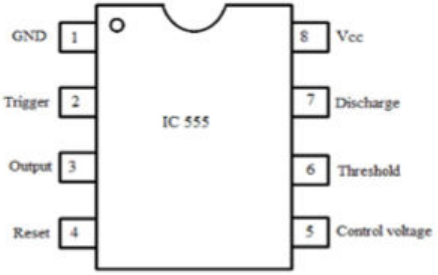


R_A= 10 KΩ resistor

R_B= 100 KΩ resistor

C is variable capacitor box in μF.

Pin configuration of IC 555



OBSERVATIONS:

Table 1. To measure the frequency of output waveform:

S.No.	R_a (KΩ)	R_b (KΩ)	C (μF)	Theoretical frequency (Hz) $f = \frac{1}{0.69(R_A + 2R_B)C}$	Experimental frequency (Hz)		
					λ	t	$f = \frac{1}{\lambda t}$
1	10	100					
2	10	100					
3	10	100					
4	10	100					
5	10	100					

3. A STABLE MULTIVIBRATOR USING IC 555

AIM:

To construct astable multivibrator using IC 555 and to calculate the frequency of the generated wave.

APPARATUS REQUIRED:

IC 555, 10 KΩ and 100 KΩ resistors, 0.01 μF capacitor, variable capacitance box, 5 V DC power supply, CRO and connecting wires.

FORMULA USED:

$$f = \frac{1}{0.69(R_A + 2R_B)C} \quad (Hz)$$

PROCEDURE:

- Make the connections as shown in circuit diagram.
- Switch on the power supply.
- Observe the waveforms at pin 3 of IC 555 on CRO.
- Measure wavelength λ of output wave for each value of capacitance in the variable capacitance box.
- Calculate the frequency of output wave using the formula.

RESULT:

Thus the A stable multivibrator was constructed using IC 555 and its frequencies are measured for various capacitance values and the corresponding output waveforms are traced out.

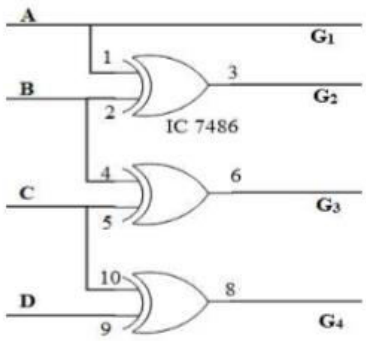
OUTCOME:

- Able to gain the knowledge about handling the equipments such as Cathode Ray Oscilloscope and integrated chips.
- Able to study the performance of Astable multivibrator and can study the output waveform.

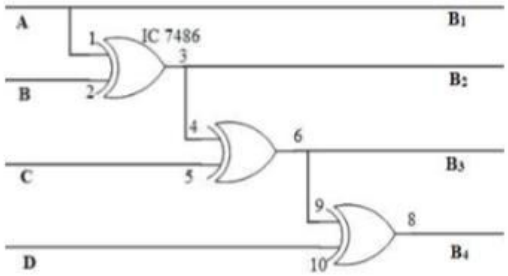
4. BINARY TO GRAY AND GRAY TO BINARY CONVERSION

CIRCUIT DIAGRAM:

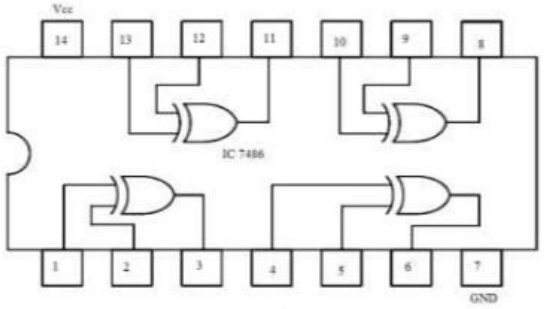
(i) Logic circuit for Binary to Gray converter



(ii) Logic circuit for Gray to Binary converter



(iii) Pin configuration of IC 7486



4. BINARY TO GRAY AND GRAY TO BINARY CONVERSION

AIM:

To construct binary to gray code converter, gray to binary code converter using EXOR gate and verify its truth table.

APPARATUS REQUIRED:

IC 7486, 5V power supply, bread board, multimeter and connection wires.

PROCEDURE:

- Make the connections as shown in circuit diagrams.
- Switch on the power supply.
- Pin 14 is connected to +Vcc and pin 7 to ground.
- In Binary to gray conversion, the inputs A, B, C, D are given at respective pins and outputs G0, G1, G2 and G3 are taken for all the sixteen combinations of inputs.
- In gray to binary conversion, the inputs A, B, C, D are given at respective pins and outputs B0, B1, B2 and B3 are taken for all the sixteen combinations of inputs.
- The values of outputs are verified with truth table.

CONVERSION PROCESS:

Binary to Gray conversion

Step1: Binary **1**101
Gray 1

Step 2: Binary **11**01
Gray 10

Step 3: Binary **110**1
Gray 101

Step 4: Binary 110**1**
Gray **1011** (Answer)

4. BINARY TO GRAY AND GRAY TO BINARY CONVERSION

OBSERVATIONS:

Truth Table for Binary to Gray Code Converter:

Input Binary code				Output Gray code			
A	**B**	**C**	**D**	**G_1**	**G_2**	**G_3**	**G_4**
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

Truth Table for Gray to Binary Code Converter:

Input Gray code				Output Binary code			
A	**B**	**C**	**D**	**B_1**	**B_2**	**B_3**	**B_4**
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
1	0	0	0	1	1	1	1
1	0	0	1	1	1	1	0
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	1	0	1	1
1	1	1	1	1	0	1	0

4. BINARY TO GRAY AND GRAY TO BINARY CONVERSION

CONVERSION PROCESS:

Gray to Binary conversion

Step1: Gray **1**101
Binary 1

Step 2: Gray 1**1**01
Binary 1**0**

Step 3: Gray 11**0**1
Binary 10**0**

Step 4: Gray 110**1**
Binary 100**1**

RESULT:

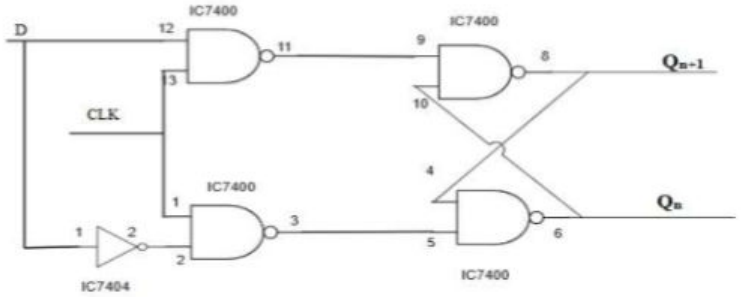
Thus the binary to gray code and gray to binary code converter constructed using EXOR gate and its truth tables are verified.

OUTCOME:

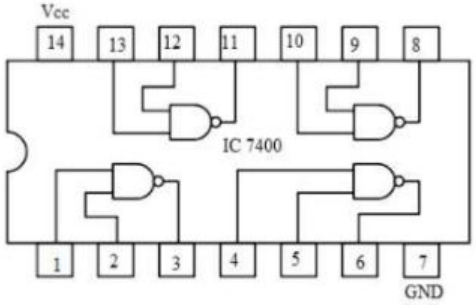
- Able to gain the knowledge about handling the equipments such as bread board, multimeter and integrated chips.
- Able to study the performance of Binary to Gray and Gray to binary converter.

5. D FLIP FLOP

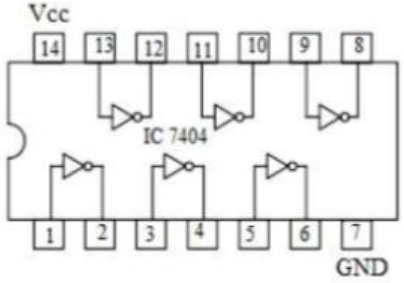
CIRCUIT DIAGRAM:



Pin configuration of IC 7400



Pin configuration of IC 7404



OBSERVATIONS:

Truth Table:

CLK	D	Q_{n+1}	Action
↑	0	0	Reset
↑	1	1	Set

Verification Table:

CLK	D	Q_{n+1}	Action
↑	0		
↑	5		

5. D FLIP FLOP

AIM:

To construct D flip flop using NAND gate and verify its truth table.

APPARATUS REQUIRED:

IC 7400, IC 7404 (NOT gate), trainer board, 5V power supply, multimeter and connection wires.

PROCEDURE:

- Connections are made as per circuit diagram.
- Switch on the power supply.
- Observe the input and output according to the truth table.
- Verify the truth table for various combinations of inputs.
- Record the results in the table.

PRECAUTIONS:

- Make the connections according to the IC pin diagram.
- The connections should be tight.
- The Vcc and ground should be applied carefully at the specified pin only.

RESULT:

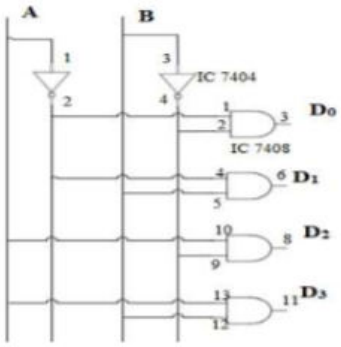
Thus, the D flip flop was constructed using NAND gate and its truth table was verified.

OUTCOME:

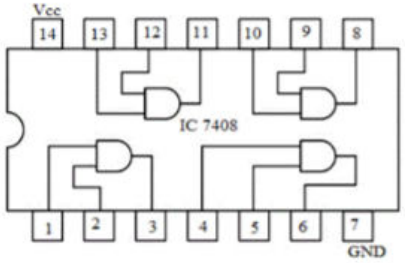
- Able to gain the knowledge about handling the equipments such as trainer board, multimeter and integrated chips.
- Able to study the performance of D flip flop and its set, reset conditions.

6. DECODERS- 2 TO 4 DECODER

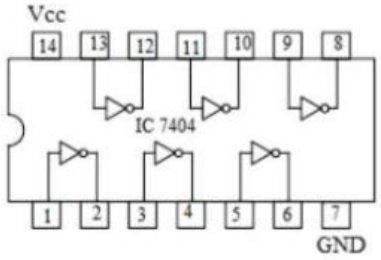
CIRCUIT DIAGRAM:



Pin configuration of IC 7408



Pin configuration of IC7404



OBSERVATIONS:

Truth Table:

Input		Output			
A	B	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

Verification Table:

Input		Output			
A	B	D_0	D_1	D_2	D_3
0	0				
0	5				
5	0				
5	5				

6. DECODERS - 2 TO 4 DECODER

AIM:

To construct 2 to 4 Decoder using IC 7404 and IC 7408 and verify its truth table.

APPARATUS REQUIRED:

IC 7404 (NOT gate), IC 7408 (AND gate), 5 V power supply, multimeter, trainer board and connection wires.

PROCEDURE:

- Connections are made as per circuit diagram.
- Apply Vcc and ground signal to every IC
- Switch on the power supply.
- Observe the input and output according to the truth table.
- Verify the truth table for various combinations of inputs.
- Record the results in the table.

PRECAUTIONS:

- Make the connections according to the IC pin diagram.
- The connections should be tight.
- The Vcc and ground should be applied carefully at the specified pin only.

RESULT:

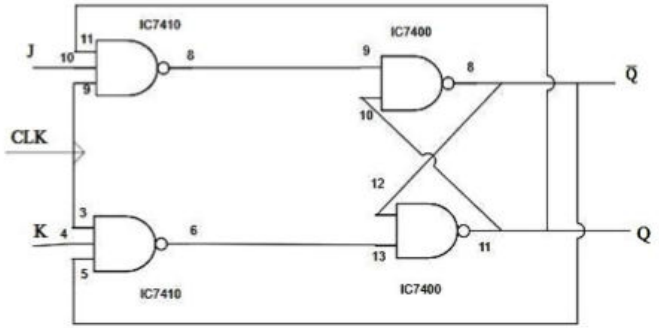
Thus the 2 to 4 Decoder was constructed using IC 7404 and IC 7408 and its truth table is verified.

OUTCOME:

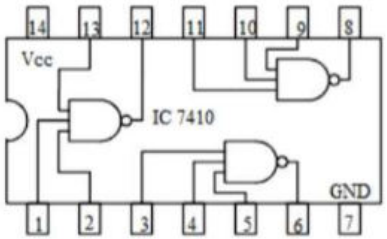
- Able to gain the knowledge about handling the equipments such as trainer board, multimeter and integrated chips.
- Able to study the performance of 2-4 decoder.

7. JK FLIP FLOP

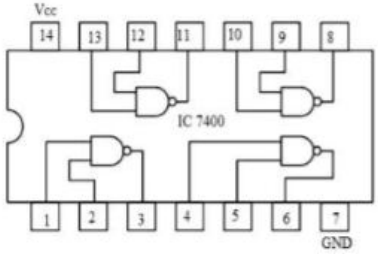
CIRCUIT DIAGRAM:



Pin configuration of IC 7410



Pin configuration of IC 7400



OBSERVATIONS:

Truth Table:

CLK	J	K	Q	$\bar{Q}$	Action
↑	0	0	-	-	Last state
↑	0	1	0	1	Reset
↑	1	0	1	0	Set
↑	1	1	-	-	Toggling

Verification Table:

CLK	J	K	Q	$\bar{Q}$	Action
↑	0	0			
↑	0	5			
↑	5	0			
↑	5	5			

7. JK FLIP FLOP

AIM:

To construct JK flip flop using IC 7410 and IC 7400 and verify its truth table.

APPARATUS REQUIRED:

IC 7400, IC 7410, 5 V power supply, trainer board, multimeter and connection wires.

PROCEDURE:

- Connections are made as per circuit diagram.
- Switch on the power supply.
- Observe the input and output according to the truth table.
- Verify the truth table for various combinations of inputs.
- Record the results in the table.

PRECAUTIONS:

- Make the connections according to the IC pin diagram.
- The connections should be tight.
- The Vcc and ground should be applied carefully at the specified pin only.

RESULT:

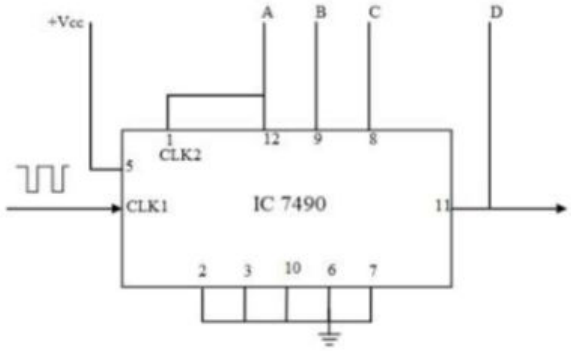
Thus the JK Flip Flop was constructed using NAND gate and IC 7476 and its truth table was verified.

OUTCOME:

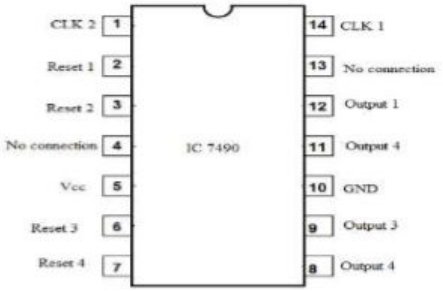
- Able to gain the knowledge about handling the equipments such as trainer board, multimeter and integrated chips.
- Able to study the performance of JK flip flop and it is get toggled when both inputs are high.

8. DECADE COUNTER

CIRCUIT DIAGRAM:



Pin configuration of IC7490



OBSERVATIONS:

Truth table:

Input pulses	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
0	0	0	0	0

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8. DECADE COUNTER

AIM:

To construct Decade Counter using IC 7490 and verify its truth table.

APPARATUS REQUIRED:

IC 7490, 5 V power supply, bread board, multimeter and connection wires

PROCEDURE:

- Assemble the circuit on bread board.
- Short pin 12 to 1.
- Give the clock signal manually or auto clock at pin 14.
- Apply Vcc and ground signal to the IC
- Switch on the power supply.
- Check the count sequence.
- Record the results in the table.

PRECAUTIONS:

- Make the connections according to the IC pin diagram.
- The connections should be tight.
- The Vcc and ground should be applied carefully at the specified pin only.

RESULT:

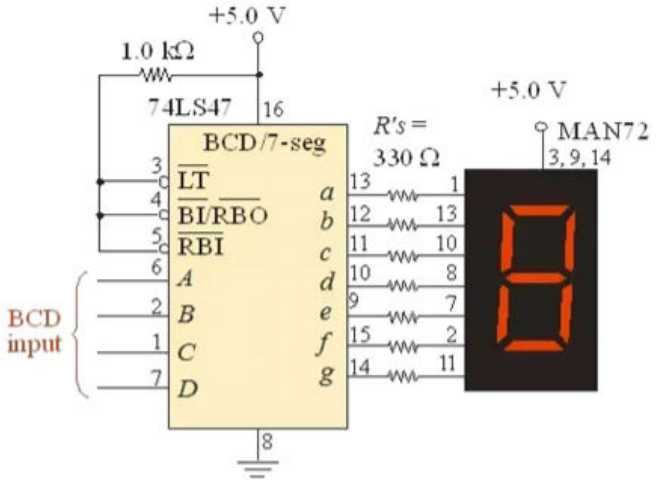
Thus, the Decade counter was constructed using IC7490 and its truth table was verified.

OUTCOME:

- Able to gain the knowledge about handling the equipments such as trainer board, multimeter and integrated chips.
- Able to study the performance of Decade counter.

9. BCD TO SEVEN SEGMENT DECODER

CIRCUIT DIAGRAM:



TRUTH TABLE

Decimal Digit	Input Lines				Output Lines						
	A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	0	1	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1

9. BCD TO SEVEN SEGMENT DECODER

AIM

To construct BCD to Seven Segment Decoder using IC 7447 and verify its truth table

APPARATUS REQUIRED

IC 7447, 150Ω resistor, +5V power Supply, KLS51H

PROCEDURE:

- Connect pins 3, 4, 5 and 16 of IC 7447 and pin 3 and 8 of KLS51H to +5V of the power supply and ground.
- Connect the pins 6, 2, 1 and 7 of IC 7447 to BCD inputs.
- Connect pins 13, 12, 11, 10, 9, 15 and 14 of IC 7447 to pins 1, 13, 10, 8, 7, 2 and 11 of KLS51H through the resistors.
- Vary the value of BCD inputs ABCD from 0000 to 1111 and observe the outputs in the seven segment display.
- The numbers from 0 to 9 will be displayed.

RESULT

Thus the BCD to Seven Segment Decoder is constructed and the output in the display is verified.

OUTCOME

- Able to gain the knowledge about handling of Seven segment display and IC 7447.
- Able to study the performance of BCD to seven segment display decoder.

10A. MICROPROCESSOR - ADDITION

PROGRAM

Address	Opcode	Mnemonics
8100	21	LXI H, 8500H
8101	00	
8102	85	
8103	3E	MVI A, i/p
8104	20 (i/p)	
8105	06	MVI B, i/p
8106	44(i/p)	
8107	80	ADD B
8108	77	MOV M,A
8109	32	STA 8300
810A	00	
810B	83	
810C	76	HLT

OBSERVATION

Result Location	Inputs	Expected Output	Received Output
8300H	20H 44H	64H	64H

10A. MICROPROCESSOR - ADDITION

AIM

To add the given hexadecimal numbers using Microprocessor 8085

APPARATUS REQUIRED

Microprocessor 8085 kit, power supply

PROCEDURE

- Switch on the microprocessor 8085.
- Press Next.
- Press Next and type the program upto 76.
- Press Next.
- Press Reset.
- Press GO.
- Type Starting Address
- Press Execute.
- Press Reset.
- Press Result Memory Address.
- Press Next. (Answer will appear on the Screen)

RESULT

The given hexadecimal numbers are added using 8085 microprocessor and the output is verified.

OUTCOME

- Able to handle the microprocessor 8085 kit.
- Able to write the program for addition and verify the output.

10B. MICROPROCESSOR – SUBTRACTION

PROGRAM

Address	Opcode	Mnemonics
8000	3E	MVI A, i/p
8001	44(i/p)	
8002	06	MVI B, i/p
8003	20(i/p)	
8004	90	SUB B
8005	32	STA 8100H
8006	0D	
8007	81	
8008	76	HLT

OBSERVATION

Result Location	Inputs	Expected Output	Received Output
8100H	44H 20H	24H	24H

10B. MICROPROCESSOR - SUBTRACTION

AIM

To subtract the given hexadecimal numbers using Microprocessor 8085

APPARATUS REQUIRED

Microprocessor 8085 kit, power supply

PROCEDURE:

- Switch on the microprocessor 8085.
- Press Next.
- Press Next and type the program upto 76.
- Press Next.
- Press Reset.
- Press GO.
- Type Starting Address
- Press Execute.
- Press Reset.
- Press Result Memory Address.
- Press Next. (Answer will appear on the Screen)

RESULT

The given hexadecimal numbers are subtracted using 8085 microprocessor and the output is verified.

OUTCOME

- Able to handle the microprocessor 8085 kit.
- Able to write the program for subtraction and verify the output.

11. MICROPROCESSOR - DIVISION

PROGRAM

Address	Opcode	Mnemonics
8000	3E	MVI A, i/p
8001	90(i/p)	
8002	06	MVI B, i/p
8003	10(i/p)	
8004	0E	MVI C, 00
8005	00	SUB B
8006	90	ADD B
8007	0C	INR C
8008	D2	JNC 8006H
8009	06	
800A	80	
800B	0D	DCR C
800C	79	MOV A,C
800D	32	STA 8200H
800E	00	
800F	82	
8010	76	HLT

OBSERVATION

Result Location	Inputs	Expected Output	Received Output
8200H	90H 10H	09H	09H

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11. MICROPROCESSOR - DIVISION

AIM

To divide the given hexadecimal numbers using Microprocessor 8085.

APPARATUS REQUIRED

Microprocessor 8085 kit, power supply

PROCEDURE:

- Switch on the microprocessor 8085.
- Press Next.
- Press Next and type the program upto 76.
- Press Next.
- Press Reset.
- Press GO.
- Type Starting Address
- Press Execute.
- Press Reset.
- Press Result Memory Address.
- Press Next. (Answer will appear on the Screen)

RESULT

The given hexadecimal numbers are divided using 8085 microprocessor and the output is verified.

OUTCOME

- Able to handle the microprocessor 8085 kit.
- Able to write the program for division and verify the output.

12. MICROPROCESSOR - MULTIPLICATION

PROGRAM

Address	Opcode	Mnemonics
8000	3E	MVI A, 00H
8001	00	
8002	06	MVI B, i/p
8003	08(i/p)	
8004	0E	MVI C, i/p
8005	10(i/p)	STA 8100H
8006	80	ADD B
8007	0D	DCR C
8008	C2	JNZ 8006H
8009	06	
800A	80	
800B	32	STA 8100H
800C	00	
800D	81	
800E	76	HLT

OBSERVATION

Result Location	Inputs	Expected Output	Received Output
8100H	08H 10H	80H	80H

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12. MICROPROCESSOR - MULTIPLICATION

AIM

To multiply the given hexadecimal numbers using Microprocessor 8085.

APPARATUS REQUIRED

Microprocessor 8085 kit, power supply

PROCEDURE:

- Switch on the microprocessor 8085.
- Press Next.
- Press Next and type the program upto 76.
- Press Next.
- Press Reset.
- Press GO.
- Type Starting Address
- Press Execute.
- Press Reset.
- Press Result Memory Address.
- Press Next. (Answer will appear on the Screen)

RESULT

The given hexadecimal numbers are multiplied using 8085 microprocessor and the output is verified.

OUTCOME

- Able to handle the microprocessor 8085 kit.
- Able to write the program for multiplication and verify the output.

13. MICROPROCESSOR - BLOCK TRANSFER

PROGRAM

Address	Opcode	Mnemonics
8000	16	MVI C,05
8001	05	
8002	21	LXI H,8500
8003	00	
8004	85	
8005	11	LXI D, 8600
8006	00	
8007	86	
8008	7E	MOV A,M
8009	12	STAX D
800A	23	INX H
800B	13	INX D
800C	0D	DCR C
800D	C2	JNZ 8008
800E	08	
800F	80	
8010	76	HLT

OBSERVATION

Result Location	Inputs	Expected Output	Received Output
8600H	90H	90H	90H
	10H	10H	10H
	21H	21H	21H
	13H	13H	13H
	10H	10H	10H

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13. MICROPROCESSOR - BLOCK TRANSFER

AIM

To transfer the given data from one block to another block using Microprocessor 8085

APPARATUS REQUIRED

Microprocessor 8085 kit, power supply

PROCEDURE:

- Switch on the microprocessor 8085.
- Press Next.
- Press Next and type the program upto 76.
- Press Next.
- Press Reset.
- Press GO.
- Type Starting Address
- Press Execute.
- Press Reset.
- Press Result Memory Address.
- Press Next. (Answer will appear on the Screen)

RESULT

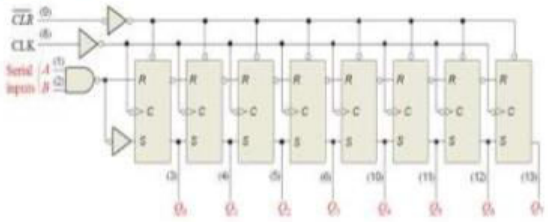
The data are transferred from one block to another block using 8085 microprocessor.

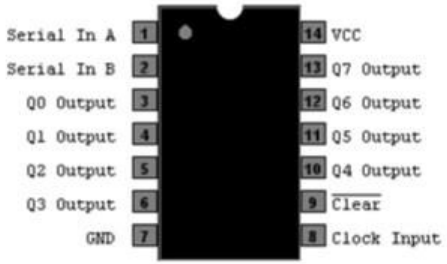
OUTCOME

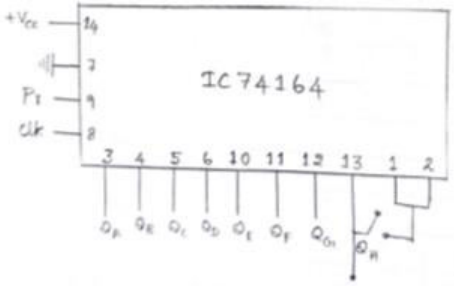
- Able to handle the microprocessor 8085 kit.
- Able to write the program for block transfer and verify the output.

14. RING COUNTER

CIRCUIT DIAGRAM:







OBSERVATION:

Clock Pulse	Flip Flop outputs							
	Q_A	Q_B	Q_C	Q_D	Q_E	Q_F	Q_G	Q_H
1	1	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0
4	0	0	0	1	0	0	0	0
5	0	0	0	0	1	0	0	0
6	0	0	0	0	0	1	0	0
7	0	0	0	0	0	0	1	0
8	0	0	0	0	0	0	0	1

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14. RING COUNTER

AIM

To construct Ring Counter using IC 74164 and verify its truth table

APPARATUS REQUIRED

IC 74164, IC trainer and connecting wires.

PROCEDURE:

- Connect pin 8 to the clock signal.
- Connect pin 9 to the clear signal.
- Connect the pins 1, 2 and 13.
- Connect the pins 3, 4, 5, 6, 10, 11, 12 and 13 to the outputs Q_A, Q_B, Q_C, Q_D, Q_E, Q_F, Q_G and Q_H.
- Connect the pins 14 and 7 to Vcc and ground.
- Switch on the power supply.
- Apply the data 1 for the first flip flop and 0 to the remaining flip flops
- Observe the output and verify the truth table by applying the clock pulse.

RESULT

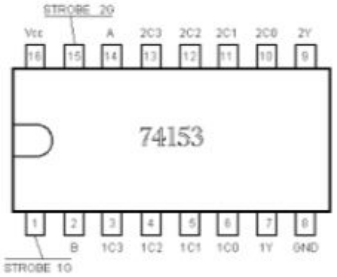
Thus the ring counter using IC 74164 is constructed and its truth table is verified.

OUTCOME

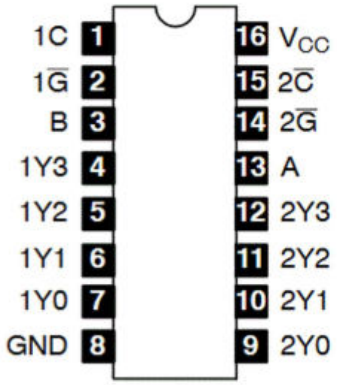
- Able to gain the knowledge about handling of IC 74164.
- Able to study the performance of ring counter.

15. MULTIPLEXER AND DEMULTIPLEXER

CIRCUIT DIAGRAM:



4 – 1 Multiplexer



1 - 4 Demultiplexer

OBSERVATION

4 – 1 MULTIPLEXER

Input			Output
STR	A_1	A_0	
0	0	0	D_0
0	0	1	D_1
0	1	0	D_2
0	1	1	D_3

1 - 4 DEMULTIPLEXER

Selection input		Ga	Da	Selection output			
S_1	S_0			Y_3	Y_2	Y_1	Y_0
0	0	0	1	1	1	1	0
0	1	0	1	1	1	0	1
1	0	0	1	1	0	1	1
1	1	0	1	0	1	1	1

15. MULTIPLEXER AND DEMULTIPLEXER

AIM

To construct multiplexer and demultiplexer using ICs and verify its truth table

APPARATUS REQUIRED

IC 74153, IC 74155, +5V power supply and connecting wires.

PROCEDURE:

4 – 1 MULTIPLEXER

- Connect pin 1 to the STR signal which should be low.
- Connect pin 14 and pin 2 to A_0 and A_1 inputs.
- Connect pin 3, 4, 5 and 6 to the outputs D_3, D_2, D_1 and D_0.
- Apply Vcc and ground signal to pin 16 and pin 8.
- Switch on the power supply.
- Change the values of input as per the truth table and note down the output readings.
- Record the results in the table.
- The Vcc and ground should be applied carefully at the specified pin only.

1 - 4 DEMULTIPLEXER

- Connect pin 3 and pin 13 to the S0 and S1 signals.
- Connect pin 1 and pin 2 to Da and Ga inputs.
- Connect pin 4, 5, 6 and 7 to the outputs Y_3, Y_2, Y_1 and Y_0.
- Apply Vcc and ground signal to pin 16 and pin 8.
- Switch on the power supply.
- Change the values of input as per the truth table and note down the output readings.
- Record the results in the table.

RESULT

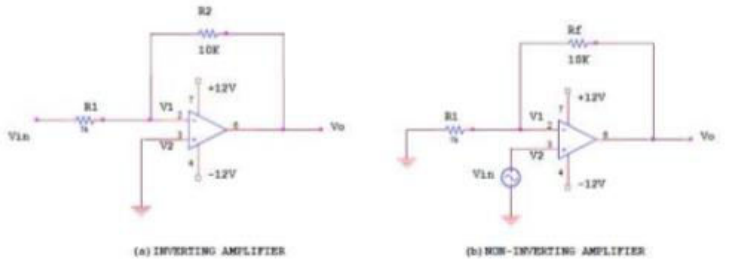
Thus the 4-1 multiplexer is constructed using IC 74153 and the 1-4 demultiplexer is constructed using IC 74155 and their operation is studied.

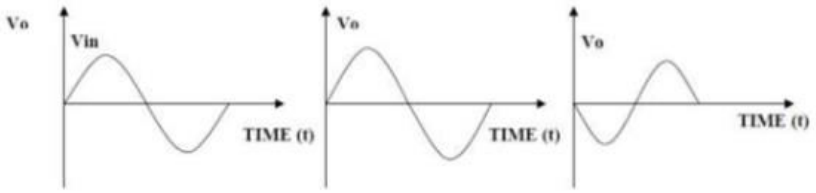
OUTCOME

- Able to gain the knowledge about handling of IC 74153 and IC 74155.
- Able to study the performance of 4-1 multiplexer and 1-4 demultiplexer.

16. INVERTING AND NON-INVERTING AMPLIFIER

CIRCUIT DIAGRAM:





16. INVERTING AND NON-INVERTING AMPLIFIER

AIM

To construct inverting and noninverting amplifier using op-amp and verify its operation.

APPARATUS REQUIRED

IC 741, 1 KΩ and 10 KΩ resistors, 12 V Dual power supply, connecting wires and voltmeter.

PROCEDURE:

INVERTING AMPLIFIER

- Connect 1 KΩ and 10 KΩ resistors in series and the point of joining of the two resistors is connected to the pin 2 of IC 741.
- The other end of 1 KΩ and and 0V of power supply are connected to ground and other end of 10 KΩ is connected to the pin 6 of IC 741.
- Apply 12V and -12V to the pins 7 and 4.
- Pin 3 is connected to Vin.
- Pin 6 is connected to the CRO.
- Switch on the power supply.
- Feed the input from function generator and output to the CRO.
- Draw the input and output waveforms.

NON - INVERTING AMPLIFIER

- Connect 1 KΩ and 10 KΩ resistors in series and the point of joining of the two resistors is connected to the pin 2 of IC 741.
- The other end of 1 KΩ is connected to Vin other end of 10 KΩ is connected to the pin 6 of IC 741.
- Apply 12V and -12V to the pins 7 and 4.
- Pin 3 and 0V of power supply is connected to the ground.
- Pin 6 is connected to the CRO.
- Switch on the power supply.
- Feed the input from function generator and output to the CRO.
- Draw the input and output waveforms.

RESULT

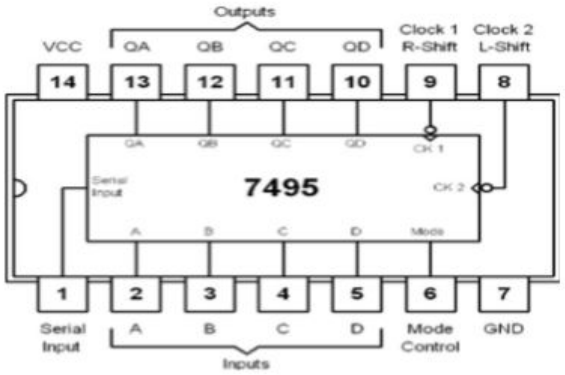
The inverting and non-inverting amplifiers are constructed and the input and output waveforms are traced.

OUTCOME

- Able to gain the knowledge about handling of IC 741.
- Able to study the performance of inverting and non-inverting amplifiers.

17. SHIFT REGISTER

CIRCUIT DIAGRAM:



OBSERVATION

SERIAL – IN – PARALLEL – OUT SHIFT REGISTER

Input = 0 Mode = 0

Serial input	After four clock pulse			
	Q_A	Q_B	Q_C	Q_D
0	0	0	0	0

Input = 1 Mode = 0

Serial input	After four clock pulse			
	Q_A	Q_B	Q_C	Q_D
1	1	1	1	1

17. SHIFT REGISTER

AIM

To construct (i) serial – in parallel – out shift register and (ii) parallel – in parallel – out shift register using IC 7495 and verify their operation.

APPARATUS REQUIRED

IC 7495, IC trainer and connecting wires.

PROCEDURE:

SERIAL – IN – PARALLEL – OUT SHIFT REGISTER

- Connect pin 1 to the serial input.
- Connect pin 6 to Mode Control (low)
- Connect pin 8 and pin 9 to the clock signal.
- Connect pins 10, 11, 12 and 13 to the outputs Q_D, Q_C, Q_B, and Q_A.
- Connect pins 14 and 7 to ground.
- Switch on the power supply.
- Apply the data at serial input
- Apply one clock pulse at clock and observe the data at Q_A.
- Apply the next data at serial input.
- Apply one clock pulse at clock , observe that the data on Q_A will shift to Q_B and the new data applied will appear at Q_A.
- Repeat steps 2 and 3 till all the 4 bits data are entered one by one into the shift register.

17. SHIFT REGISTER

OBSERVATION

PARALLEL – IN – PARALLEL – OUT SHIFT REGISTER

Mode = 1

Parallel Input				Parallel Output			
A	B	C	D	Q_A	Q_B	Q_C	Q_D
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	0
0	1	0	1	0	1	0	1
0	1	1	0	0	1	1	0
0	1	1	1	0	1	1	1
1	0	0	0	1	0	0	0
1	0	0	1	1	0	0	1
1	0	1	0	1	0	1	0
1	0	1	1	1	0	1	1
1	1	0	0	1	1	0	0
1	1	0	1	1	1	0	1
1	1	1	0	1	1	1	0
1	1	1	1	1	1	1	1

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17. SHIFT REGISTER

PROCEDURE:

PARALLEL – IN – PARALLEL – OUT SHIFT REGISTER

- Connect pins 2, 3, 4 and 5 to the parallel inputs A, B. C and D.
- Connect pin 6 to Mode Control (High)
- Connect pin 8 and pin 9 to the clock signal.
- Connect pins 10, 11, 12 and 13 to the outputs Q_D, Q_C, Q_B, and Q_A.
- Connect pins 14 and 7 to ground.
- Switch on the power supply.
- Apply the four bit data at A, B. C and D.
- Apply one clock pulse at clock.
- The four bit at A, B. C and D appears at Q_A, Q_B, Q_C and Q_D respectively.

RESULT

The serial – in parallel – out shift register and parallel – in parallel – out shift register are constructed using IC 7495 and their operation is verified.

OUTCOME

- Able to gain the knowledge about handling of IC 7495.
- Able to study the performance of serial – in parallel – out shift register and parallel – in parallel – out shift register.