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| **Course Name:** | **Digital Design Laboratory** | **Semester:** | **III** |
| **Date of Performance:** | **01 / 10 / 2024** | **Batch No:** | **C3** |
| **Faculty Name:** | **Bharathi Narayan** | **Roll No:** | **16010123217** |
| **Faculty Sign & Date:** |  | **Grade/Marks:** | **\_\_\_/25** |

**Experiment No: 6**

**Title: Shift Register**

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| **Aim and Objective of the Experiment:** |
| To implement the SISO, SIPO, PISO, PIPO shift register using **Universal IC 74194** |

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| **COs to be achieved:** |
| **CO3**: Design synchronous and asynchronous sequential circuits. |

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| **Tools used:** |
| Trainer kits |

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| **Theory:** |
| A register is capable of shifting its binary information in one or both directions is known as shift register. The logical configuration of shift register consist of a D-Flip flop cascaded with output of one flip flop connected to input of next flip flop. All flip flops receive common clock pulses which causes the shift in the output of the flip flop.The simplest possible shift register is one that uses only flip flop. The output of a given flip flop is connected to the input of next flip flop of the register. Each clock pulse shifts the content of register one bit position to right.  The basic types of shift registers are   * Serial In - Serial Out * Serial In - Parallel Out * Parallel In - Serial Out * Parallel In - Parallel Out * Bidirectional shift registers.   **Pin diagram of IC 74194 and Function table**  IMG_256  IMG_256  **Circuit diagram: Serial left shift**    Truth Table   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **clk** | **A** | **B** | **C** | **D** | | **0** | **0** | **0** | **0** | **0** | | **1** | **1** | **0** | **0** | **0** | | **1** | **1** | **1** | **0** | **0** | | **1** | **1** | **1** | **1** | **0** | | **1** | **1** | **1** | **1** | **1** |   **Circuit diagram: Serial right shift**    **Truth Table**  IMG_256  **Circuit diagram: Parallel in Parallel out**  IMG_256  **Truth Table** |

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| **Implementation Details** |
| **Procedure**   1. Locate IC 74196 on Digital trainer kit 2. Apply various inputs to appropriate pins as per the mode of operation with reference to the pin configuration of the IC. 3. Connect a pulsar switch to the clock input. 4. Verify the respective truth tables for different modes with reference to the truth table given in the data sheet of IC 74194. |
| **Post Lab Subjective/Objective type Questions:** |
| 1. What is a universal shift register?   Ans. A universal shift register is a digital circuit or device that can perform various types of shift operations on binary data. It is called "universal" because it can be configured to perform different types of shifting, such as serial-in, serial-out (SISO), serial-in, parallel-out (SIPO), parallel-in, serial-out (PISO), and parallel-in, parallel-out (PIPO) shifting.  Here are the common types of shift operations that a universal shift register can perform:  1. Serial-In, Serial-Out (SISO): In this mode, data is shifted serially from the input to the output one bit at a time.  2. Serial-In, Parallel-Out (SIPO): In this mode, data is shifted serially into the register, and then all bits are available in parallel at the output.  3. Parallel-In, Serial-Out (PISO): In this mode, data is loaded in parallel into the register and then shifted out serially, one bit at a time.  4. Parallel-In, Parallel-Out (PIPO): In this mode, data is both loaded and read out in parallel, maintaining the parallel format.   1. Prepare a truth table for 3 bit SISO left shift with data 011 along with clock pulse   Ans. A 3-bit Serial-In, Serial-Out (SISO) left shift register with clock pulses can be represented in a truth table as follows. Let's assume "D2," "D1," and "D0" represent the data bits, and "CLK" represents the clock input. The arrows (->) represent the direction of shifting.   | **CLK** | **D2 (MSB)** | **D1** | **D0 (LSB)** | **Q2 (Output)** | **Q1** | **Q0** | | --- | --- | --- | --- | --- | --- | --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 |     In this truth table, the data bits D2, D1, and D0 are initially set to 0, and the clock input "CLK" alternates between 0 and 1. With each clock pulse (rising or falling edge, depending on the specific implementation), the data bits are shifted to the left (towards the lower significance) one position at a time. Since the initial data is all zeros, the output Q2, Q1, and Q0 remain 0 throughout the shifting process. The arrow "->" indicates the direction of the shift. The leftmost bit is the most significant bit (MSB), and the rightmost bit is the least significant bit (LSB).  You can continue the truth table with additional clock pulses if you want to see the full shift operation.   1. Can a shift register be used as a counter? Give any one application.   Ans. Yes, a shift register can be used as a counter in certain applications. One such application is in controlling LED displays. By connecting a shift register to a microcontroller or other control circuitry and shifting in binary values, you can use the shift register to count and display numbers on a series of LEDs. Each shift operation effectively counts up or down, allowing for dynamic numeric displays in devices like digital clocks, calculators, or scoreboards.   1. How many clock pulses are required to enter a byte of data serially into an 8-bit shift register?   Ans. To enter a byte of data serially into an 8-bit shift register, you would need 8 clock pulses. Each clock pulse would shift one bit of the data into the shift register, and after 8 clock pulses, all 8 bits of the byte would be loaded into the shift register, with the first bit entering on the first clock pulse and the last bit on the eighth clock pulse. |

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| **Conclusion:** |
| We learned implementation of the SISO, SIPO, PISO, PIPO shift register usingUniversal IC 74194 |

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| **Signature of faculty in-charge with Date:** |