



Experiment No. 4
Study of flip flop IC
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**Aim -** Study of flip flop IC

**Objective -**

1. To familiarize students with the operation of various types of flip-flops, including RS, JK, D, and T flip-flops.
2. To verify the truth tables for each type of flip-flop through practical circuit implementations.
3. To explore the role of flip-flops in memory storage and sequential logic circuits.

**Components required -**

1. ICs:
  - 7474 (Dual D Flip-flop)
  - 7476 (Dual JK Flip-flop)
  - 7400 (Quad 2-input NAND gate)
  - 7402 (Quad 2-input NOR gate)
  - 7404 (Hex Inverter)
  - 7408 (Quad 2-input AND gate)
  - 7432 (Quad 2-input OR gate)
  - 7486 (Quad 2-input XOR gate)
2. Breadboard
3. Connecting wires
4. Digital IC Tester
5. Clock Pulse Generator or Manual Switch for Clock Input
6. Power Supply (5V)



# Vidyavardhini's College of Engineering and Technology

## Department of Artificial Intelligence & Data Science

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### Theory -

Flip-flops are bistable devices that can store one bit of data. They have two stable states and can be used to store state information. The main types of flip-flops include:

#### 1. RS Flip-flop

1. Inputs: Set (S) and Reset (R)
2. Outputs: Q and Q' (complement of Q)
3. Operation:
  - When  $S = 1$  and  $R = 0$ ,  $Q = 1$  (Set state).
  - When  $S = 0$  and  $R = 1$ ,  $Q = 0$  (Reset state).
  - When  $S = 0$  and  $R = 0$ , Q remains unchanged.
  - $S = 1$  and  $R = 1$  is an invalid state.

#### 2. D Flip-flop

1. Input: Data (D)
2. Output: Q
3. Operation: Captures the value of D at the rising edge of the clock. The output Q follows the input D only at the clock transition.

#### 3. JK Flip-flop

1. Inputs: J and K
2. Outputs: Q and Q'
3. Operation:
  - $J = 1, K = 0$ : Set ( $Q = 1$ ).
  - $J = 0, K = 1$ : Reset ( $Q = 0$ ).
  - $J = 1, K = 1$ : Toggle the output.
  - $J = 0, K = 0$ : No change.

#### 4. T Flip-flop

1. Input: Toggle (T)
2. Output: Q
3. Operation: Toggles the output state on each clock pulse when  $T = 1$ ; holds the previous state when  $T = 0$ .



## Applications of Flip-flops

Flip-flops are used in various digital applications, including:

- Memory storage elements (registers)
- Frequency dividers
- Counters
- Shift registers
- State machines

## Conclusion -

The experiment successfully demonstrates the functionality of various flip-flops, including RS, JK, D, and T types. The outputs observed during the experiments matched the expected results based on the truth tables. This practical experience enhances the understanding of flip-flops as essential components in digital circuits, particularly in memory storage and sequential logic applications. By implementing these circuits, students gain hands-on experience with digital electronics, preparing them for more complex systems involving memory and data storage. The knowledge acquired will be beneficial for future studies in digital systems and electronics design.