Concept of Registers

- Registers are groups of flip-flops used to store binary data
  - Each flip-flop stores one bit
  - Used for temporary storage in digital systems
  - Common in CPUs and memory units

Types of Registers

- SISO – Serial In Serial Out
  - SIPO – Serial In Parallel Out
  - PISO – Parallel In Serial Out
  - PIPO – Parallel In Parallel Out

Shift Registers

- Data shifts left or right on clock pulse
  - Can be serial or parallel
  - Used in data transfer and storage
  - Common in communication systems

Applications of Registers

- Data storage
  - Data transfer
  - Arithmetic operations
  - Signal processing

Counter Basics

- Counters count clock pulses
  - Sequence of binary states
  - Used in timing circuits
  - Common in digital clocks

Ripple vs Synchronous Counters

- Ripple: clock flows through flip-flops one by one
  - Slower due to delay
  - Synchronous: all flip-flops triggered together
  - Faster and more reliable

Up/Down Counters

- Up counter counts forward
  - Down counter counts backward
  - Controlled using input signal
  - Used in elevators and timers

Mod-N Counters

- Counts up to specific number N
  - Resets after reaching N
  - Example: Mod-10 counts 0 to 9
  - Used in digital clocks

Mod-10 Counter Design Example

- Uses flip-flops connected in sequence
  - Counts from 0000 to 1001
  - Resets when reaching 1010
  - Demonstrates Mod-N principle

Summary

- Registers store binary data
  - Shift registers move data
  - Counters count clock pulses
  - Mod-N controls count range
  - Essential in digital systems