Digital Fundamentals

Chapter 1

- Analog systems and digital systems
- Logic levels
  - High, Low and Unallowed
- Waveform characteristics
  - Period, frequency, duty cycle,…

Chapter 2

- Number systems
  - Decimal, binary, hexadecimal
  - Conversion between different number systems
- Signed numbers
  - 1's complement form
  - 2's complement form
- Floating-Point numbers
- Binary coded decimal (BCD)
  - 8421 code and BCD addition
- The Gray code

Chapter 3

- Fundamental logic gates
  - Inverter, AND gate, OR gate, NAND gate, NOR gate, Exclusive-OR gate and Exclusive-NOR gate
  - Corresponding symbols

Chapter 4

- Boolean operations and expressions
- Laws and rules of Boolean algebra
  - DeMorgan's theorems
- Expressions for a Logic Circuit
  - Boolean expression
  - Truth table
  - Logic diagram
  - Waveforms
- The Sum-of-Products (SOP) form
  - The standard SOP form
- Simplify a logic expression
  - By Boolean algebra
  - By the Karnaugh map

Chapter 5

- Basic combinational logic circuits
  - Boolean expressions and corresponding truth tables
  - Logic diagrams
  - waveforms

Chapter 6

- Basic adders, comparators, decoders, encoders, data selectors, demultiplexers
- Functional analysis on combinational logic
- Design combinational logic with given requirements
  - From truth table
  - Implement required logic with decoders, data selectors

Chapter 7

- S-R Latches, Gated S-R Latches
  - Basic operation
- Edge-Triggered Flip-flops, J-K Flip-flops
  - Basic operation
- Asynchronous and synchronous
- One-shots, 555 Timer

Chapter 8

- Asynchronous counter operation and synchronous counter operation
- Functional Analysis for a given counter
- Design a counter or a sequence generator with given requirements
  - Two methods
  - Procedures
  - State diagram

Chapter 9

- Basic functions for shift registers
  - Logic diagram
  - Serial and parallel
  - Time delay
  - Waveforms
  - Applications

Chapter 10

- Basic concepts
  - ROMs and RAMs
  - SRAM and DRAM
- Address of memory
- Memory expansion
  - Word-length expansion
  - Word-capacity expansion
- Simplified diagram of PLD

Chapter 11

- Procedure of converting an analog signal to digital signal

Chapter 12

- Basic concepts and parameters for IC technology
  - DC supply for TTL and CMOS
  - Logic levels
  - Noise immunity
  - Noise margin
  - Power dissipation
  - Propagation delay time
- CMOS circuits
  - Inverter, NAND gate, NOR gate
  - Concepts on open-drain gates and tristate gates.
- TTL circuits
  - Outputs of TTL circuits: Totem-Pole Outputs
  - Practical Considerations in the Use of TTL
  - OC gate and tristate gate

Verilog HDL

- Fundamentals of Verilog HDL
  - Structure of Verilog HDL module
  - Keypoints of Verilog module
  - Describe simple devices with Verilog HDL