Digital Circuits and Systems - Video course

1. Introduction

Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems; CAD tools.

2. Number Systems and Codes

Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.

3. Combinatorial Logic Systems

Definition and specification; Truth table; Basic logic operation and logic gates.

4. Boolean Algebra and Switching Functions

Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods; Synthesis of combinational logic circuits.

5. Logic families

Introduction to different logic families; Operational characteristics of BJT in saturation and cut-off regions; Operational characteristics of MOSFET as switch; TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation;Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product.

6. Combinational Logic Modules and their applications

Decoders, encoders, multiplexers, demultiplexers and their applications; Parity circuits and comparators; Arithmetic modules- adders, subtractors and ALU; Design examples.

7. Sequential Logic systems:

Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples

8. State machine design approach

Designing state machine using ASM charts; Designing state machine using state diagram; Design examples

9. Sequential logic modules and their applications

Multi-bit latches and registers, counters, shift register, application examples.

10. Memory

Read-only memory, read/write memory - SRAM and DRAM

11. Programmable Logic Devices:

PLAs, PALs and their applications; Sequential PLDs and their applications; State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs)

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