Bangladesh University of Engineering and Technology

Dept. of Electrical and Electronic Engineering

EEE 303: Digital Electronics

Syllabus:

Introduction to number systems and codes. Analysis and synthesis of digital logic circuits: Basic logic functions, Boolean algebra, combinational logic design, minimization of combinational logic. MOSFET Digital circuits: NMOS inverter, CMOS inverter, CMOS logic circuits, Clocked CMOS logic circuits, transmission gates, sequential logic circuits,

Memories: classification and architecture, RAM memory cells, Read only memory, data converters, BJT digital circuits: ECL, TTL, STTL, BiCMOS, Design application A static ECL gate.

Modular combinational circuit design: pass transistor, pass gates, multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design.

Sequential circuits: different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: shift registers, counters and their applications. State Machine Design.

Asynchronous and synchronous sequential circuits.

Topics covered:

Text Book:
Fundamentals of Digital Logic with Verilog Design, 3rd ed, - Stephen Brown, Zvonko Vranesic.

Chapter 2: Introduction to Logic Circuits

2.1 Variables and Functions
2.2 Inversion
2.3 Truth Table
2.4 Logic Gates and Networks
    2.4.1 Analysis of a Logic Network
2.5 Boolean Algebra
    2.5.2 Notation and Terminology
    2.5.3 Precedence of Operations
2.6 Synthesis Using NAD, OR, and NOT Gates
    2.6.1 Sum-of-Products and Product-of-Sums Forms
2.7 NAND and NOR Logic Networks
2.8 Design Examples
    2.8.1 Three-Way Light Control
    2.8.2 Multiplexer Circuit
2.11 Minimization and Karnaugh Maps
2.12 Strategy for minimization
    2.12.1 Terminology
2.13 Minimization of Product-of-Sums Forms
2.14 Incompletely Specified Functions
2.15 Multiple-Output Circuits

Chapter 3: Number Representation and Arithmetic Circuits

Chapter 4: Combinational-Circuit Building Blocks

Chapter 5: Flip-Flops, Registers and Counters

5.10 Reset Synchronization
5.11 Other Types of Counters
    5.11.1 BCD Counter
    5.11.2 Ring Counter
    5.11.3 Johnson Counter
5.14 Design Example
    5.14.1 Reaction Timer

Chapter 6: Synchronous Sequential Circuits
6.1 Basic Design Steps
    6.1.1 State Diagram
    6.1.2 State Table
    6.1.3 State Assignment
    6.1.4 Choice of Flip-Flops and Derivation of Next State and Output Expressions
    6.1.5 Timing Diagram
    6.1.6 Summary of Design Steps
    Example 6.1
6.2 State Assignment Problem
    Example 6.2
    6.2.1 One Hot Encoding
    Example 6.3
6.3 Mealy State Model
    Example 6.4
6.10 Algorithmic State Machine Chart

Chapter 7: Digital System Design
7.1 Bus Structure
    7.1.1 Using Tri-State Drivers to Implement a Bus
    7.1.2 Using Multiplexers to Implement a Bus
7.2 Simple Processor

Appendix B: Implementation Technology
B.1 Transistor Switches
B.2 NMOS Logic Gates
B.3 CMOS Logic Gates
    B.3.1 Speed of Logic Gate Circuits
B.4 Negative Logic System
B.8.8 Transmission Gates
B.8.9-part (page-791) Drivers
B.8.10 Tri-state Drivers
B.9 Static Random Access Memory (SRAM)
    B.9.1 SRAM Blocks in PLDs

Text Book:
Integrated Electronics: Analog and Digital Circuits and Systems, 2nd ed, - Jacob Millman, Christos Halkias and Chetan D Parikh
17.19 Digital-to-Analog Converters
17.20 Analog-to-Digital Converter